A TAXONOMIC REVISION OF TAXA IN STYRAX SERIES CYRTA (STYRACACEAE) WITH VALVATE COROLLS

Gary Li  
Department of Botany  
California Academy of Sciences  
55 Music Concourse Drive  
San Francisco, California 94118, U.S.A.

Peter W. Fritsch  
Botanical Research Institute of Texas  
1700 University Drive  
Fort Worth, Texas 76107, U.S.A.  
pfritsch@brit.org

ABSTRACT

Several taxonomic treatments of Styrax (Styracaceae) exist in regional floras of Asia, but the Asian species of the genus have not been comprehensively revised since 1907. A treatment of the Asian taxa of S. series Cyrtta with imbricate floral aestivation was accomplished in 2003. To complete the taxonomic revision of S. series Cyrtta, we conducted a taxonomic revision of the species of the series with valvate aestivation of the corolla lobes. Our revision comprises 11 species with a combined distribution from eastern India through southern China and Malesia, Melanesia, and Micronesia, although the group is absent from the Philippines. We resurrected S. bracteolatus, S. rubifolius, and S. warburgii as species to be recognized, and we corrected the misapplication of S. finlaysonianus, previously used for a species in S. series Benzoin. Styrax finlaysonianus and S. warburgii are segregated from the broader concept of S. agrestis recognized in prior treatments. The circumscriptions of the heretofore poorly delimited species S. confusus, S. faberi, and S. fortunei are clarified and their possible introgressants discussed. We observed unique combinations of characters in some problematic specimens whose taxonomic status remains unresolved because only single specimens with either flowers or fruits were available; at least some of these may represent undescribed species. Lectotypes are designated for Cyrtta agrestis, S. argyi, S. bracteolatus, S. calvscens, S. casearifolius, S. confusus var. microphyllus, S. dasyanthus, S. dasyanthus var. cinerascens, S. faberi, S. finlaysonianus, S. formosanus, S. fortunei, S. fukienensis, S. henryi, S. henryi var. microcalyx, S. iopilus, S. philadelphoides, S. rostratus, S. rubifolius, S. serrulatus var. agrestis, and S. virgatus. A neotype is designated for S. warburgii. Keys, descriptions, distribution maps, and conservation assessments are provided for all species. Styrax agrestis, S. bracteolatus, and S. rubifolius are rare endemics of conservation concern, with highly restricted distributions.

Key Words: Asia, Styracaceae, Styrax, taxonomy

RESUMEN


INTRODUCTION

Styrax L. (Styracaceae) is a genus of about 140 species of trees and shrubs distributed in the Mediterranean region, eastern Asia (broadly considered here as encompassing South, East, and Southeast Asia through Melanesia and Micronesia), and the Americas (Fritsch 2015). This range is typical of many other genera of plants distributed among the refugia of Tertiary mixed-mesophytic forests in the Northern Hemisphere.
except that 

*Styrax* also has a large Neotropical component extending south to the southern Andes, northern Argentina, and Uruguay (Fritsch 1999, 2001). *Styrax* is the largest of the 12 genera comprising the Styracaceae. Characters that distinguish *Styrax* from the other genera in the family include a high (vs. low) attachment of the staminal tube on the corolla, the presence (vs. absence) of placent al obturators, bitegmic (vs. unitegmic) ovules, and a thick (vs. thin) seed coat. The combination of the following characters serves to further disting uish *Styrax* from other genera of the Styracaceae: absence of bud scales, presence of pseudoterminal fertile shoots, non-articulated pedicels, a short hypanthium, glossy trichomes that are circular in cross-section on the staminal filaments, a 3-carpellate ovary, presence of mesocarp, and a seed-to-carpel ratio ≤ 1 (Fritsch et al. 2001; Fritsch 2004). Like the other genera in the family, *Styrax* has a vestiture of stell ate trichomes (sometimes modified into peltate scales or simple trichomes), generally twice the number of stamens as corolla lobes, and introrsely dehiscent anthers with a large, linear connective (Fritsch et al. 2001; Fritsch 2004).

In the last worldwide monograph of the genus, Perkins (1907) divided *Styrax* into two sections, *Styrax* and *Foveolaria* (Ruiz & Pav.) Perkins, based on the number of ovules in the gynoecium. *Styrax* section *Styrax* was further divided into two series, *Styrax* and *Valvatae* (Gürke) Perkins, on the basis of imbricate and valvate corolla aestivation, respectively. Despite using the latter for infrageneric classification, Perkins recognized that there were certain species in *S.* series *Valvatae* with subvalvate aestivation, an apparently intermediate state between valvate and imbricate aestivation wherein the corolla lobes are contiguous but oblique in cross section. On this basis, Steenis (1932), in a revision of the Malesian species of *Styrax*, disregarded corolla aestivation, instead combining together several different species of imbricate and subvalvate *Styrax* into *S.* serrulatus Roxb., a strictly subvalvate species in our view.

Fritsch (1999) conducted a morphological phylogenetic analysis of *Styrax* and on this basis recircu mscribed the infrageneric classification of the genus. *Styrax* section *Styrax* (about 33 species) was recircumscribed to include all the deciduous species. This was supported by the presence of young shoots with scattered stalked stellate trichomes distinct from the rest of the vestiture (vs. without stalked trichomes unless accompanied by a dense tomentum of the same type of vestiture) and membranaceous (vs. subcoriaceous) corolla lobes. *Styrax* section *Valvatae* Gürke (about 97 species) was recircumscribed to include species with valvate (vs. imbricate or subvalvate) corolla aestivation, the evergreen (vs. deciduous) condition, straight (vs. convex) sides of the corolla in bud, and concave (vs. planar) staminal filaments. Within section *Styrax*, *S.* series *Styrax* (three species) is supported by strictly pseudoterminal (vs. pseudoterminal and lateral) inflorescences, and *S.* series *Cyrt* (Lour.) PW. Fritsch (about 30 species) is supported by glandular-serrate (vs. entire) laminar margins. Fritsch’s reclassification of *Styrax* reflected Perkins’s recognition of the difference between the truly valvate species of *Styrax*, all in *S.* section *Valvatae*, and the subvalvate species of *Styrax*, now under *S.* series *Cyrt*. A molecular phylogenetic analysis (Fritsch 2001) corroborates this infrageneric classification.

The taxonomy of the species in *Styrax* series *Cyrt* had been poorly understood because a comprehensive study of specimens was lacking. Although several regional floristic treatments of *Styrax* in eastern Asia were produced (Steenis 1932, 1949; Croft 1981; Svengsuksa & Vidal 1992; Hwang & Grimes 1996; Li 1998), they generally did not appear to incorporate specimens from outside their geographic range of interest and sometimes did not include the study of types from herbaria for which access to specimens is difficult, in such cases often leading to misapplication of the names regarding the specimens included in the treatments. Part of *S.* series *Cyrt* has been recently revised by Huang et al. (2003). This revision encompasses 17 eastern Asian species of *Cyrt*, all with imbricate corolla aestivation, along with a key that includes all 21 species of the series with imbricate corolla aestivation, (i.e., including the four in North America, treated taxonomically in more depth in Fritsch 1997, 2009). Although imbricate vs. valvate aestivation has been shown to poorly reflect monophyly in *S.* series *Cyrt* (Fritsch 2001), corolla aestivation is, without exception, species-specific in that series. As such, even if not indicating monophyly, corolla aestivation served as a means of providing a practical limit to the scope of Huang et al.’s (2003) treatment.

Still to be revised taxonomically were the remaining species in *Styrax* series *Cyrt*, i.e., those with valvate corolla aestivation, henceforth referred to as the valvate members of *S.* series *Cyrt*. From our preliminary
investigation, such a treatment is needed, as based on apparent problems such as the synonymization of *S. rubifolius* Guillaumin under *S. dasyanthus* Perkins in the treatment of the genus in the *Flora of China* (Hwang & Grimes 1996), the omission of *S. bracteolatus* Guillaumin from that treatment, and the misapplication of names in the treatment of *Styrax* in the *Flore du Cambodge, du Laos, et du Viêtnam* (Svengsuksa & Vidal 1992). A related problem lies in the lack of study concerning species variation across the borders of different areas covered by floristic treatments, typically those separating countries. Here we provide a taxonomic revision of the remaining valvate species of *S. series Cyrta* to complement the work of Huang et al. (2003). In combination, these treatments complete the taxonomic revision of the series.

**GEOGRAPHIC DISTRIBUTION**

A more general discussion of *Styrax* series *Cyrta* and the imbricate members of the group, as well as a discussion of the differences between *S. series Cyrta* and *S.* ser. *Benzoin* PW. Fritsch, the other series of *Styrax* in eastern Asia, is included in the treatment of the imbricate members of *S. series Cyrta* by Huang et al. (2003).

The valvate members of *Styrax* series *Cyrta* occur exclusively in eastern Asia, ranging from Jiangsu, China, south to the Solomon Islands and from Orissa, India, east to Kosrae, Micronesia. Most of the species in this group overlap geographically with at least one other species in the group; the two exceptions are *S. warburgii* Perkins, distributed throughout Indonesia to the Solomon Islands, and *S. serrulatus*, which extends from the eastern region of the Indian subcontinent through the border of Myanmar and China, to northern Laos and Thailand. *Styrax finlaysonianus* Wall. ex G. Don is also notably disjunct between Hainan, China, northern Vietnam, and central Vietnam, and similarly, *S. agrestis* (Lour.) G. Don is disjunct between northern Vietnam and central Vietnam. The most common and widespread species in the group, in more or less relative order, are *S. serrulatus*, *S. fortunei* Hance, *S. faberi* Perkins, *S. confusus* Hemsl., and *S. warburgii*. Species that can be considered narrowly distributed endemics are *S. agrestis*, *S. bracteolatus*, *S. rubifolius*, and *S. wuyuanensis* S.M. Hwang, which together account for 36% of the species in the group (Table 1).

**MORPHOLOGY AND TAXONOMIC CHARACTERS**

Below we discuss the principal diagnostic characters used in the systematics of the species of *Styrax* series *Cyrta* with valvate corolla lobes.

**Habit**

All species included in this treatment are deciduous shrubs or trees. The tree species are all <20 m tall. *Styrax wuyuanensis* is only known as a shrub, and *S. agrestis* is only known as a tree. All other species in this treatment can be shrubs or trees.

**Leaves**

Leaves are generally alternate except for the two most proximal leaves on each shoot. Two general patterns of phyllotaxis occur. One has the leaves consistently alternate (*Styrax agrestis*, *S. finlaysonianus*, *S. serrulatus*, and *S. warburgii*), whereas the other has the two most proximal leaves of each shoot from an axillary bud opposite or subopposite (the rest of the species). This feature is more or less consistent within species. Petiolar length can vary within and among species, although it can be a useful diagnostic character in some species. *Styrax faberi* has some of the shortest petioles among the valvate members of *S. series Cyrta*, and the leaves can even be subsessile. Generally, *S. agrestis*, *S. finlaysonianus*, *S. serrulatus*, and *S. warburgii* have longer petioles than the other species, but considerable overlap can occur. The margins of the laminae are almost always serrulate or serrate, with each tooth tipped by a gland. The only exception occurs in *Styrax finlaysonianus*, which usually has subentire leaves. Rarely, there will be two or three weak to strong lobes on a single leaf of an individual, but this is only consistent in *S. bracteolatus*. The size and shape of the leaves vary within most species. *Styrax formosanus* Matsum. and *S. wuyuanensis* have consistently rhombic leaves. The tertiary veins in most species are generally reticulate, although in *S. serrulatus* and *S. warburgii* they are consistently parallel and perpendicular to the secondary veins.
## Table 1. Distribution, richness, and endemism of the species of *Styrax* series *Cyrta* with valvate corolla aestivation, by country. * = endemic.

<table>
<thead>
<tr>
<th>Country</th>
<th>No. species/no. endemics</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>1/0</td>
<td><em>S. serrulatus</em></td>
</tr>
<tr>
<td>Bhutan</td>
<td>1/0</td>
<td><em>S. serrulatus</em></td>
</tr>
<tr>
<td>China</td>
<td>9/7</td>
<td><em>S. bracteolatus</em>, <em>S. confusus</em>, <em>S. faberi</em>, <em>S. finlaysonianus</em>, <em>S. formosanus</em>, <em>S. fortunei</em>, <em>S. rubifolius</em>, <em>S. serrulatus</em>, <em>S. wuyuanensis</em></td>
</tr>
<tr>
<td>India</td>
<td>1/0</td>
<td><em>S. serrulatus</em></td>
</tr>
<tr>
<td>Indonesia</td>
<td>1/0</td>
<td><em>S. warburgii</em></td>
</tr>
<tr>
<td>Laos</td>
<td>1/0</td>
<td><em>S. serrulatus</em></td>
</tr>
<tr>
<td>Micronesia</td>
<td>1/0</td>
<td><em>S. warburgii</em></td>
</tr>
<tr>
<td>Myanmar</td>
<td>1/0</td>
<td><em>S. serrulatus</em></td>
</tr>
<tr>
<td>Nepal</td>
<td>1/0</td>
<td><em>S. warburgii</em></td>
</tr>
<tr>
<td>Palau</td>
<td>1/0</td>
<td><em>S. warburgii</em></td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>1/0</td>
<td><em>S. warburgii</em></td>
</tr>
<tr>
<td>Solomon Islands</td>
<td>1/0</td>
<td><em>S. warburgii</em></td>
</tr>
<tr>
<td>Thailand</td>
<td>1/0</td>
<td><em>S. serrulatus</em></td>
</tr>
<tr>
<td>Vietnam</td>
<td>2/1</td>
<td><em>S. agrestis</em>, <em>S. finlaysonianus</em></td>
</tr>
</tbody>
</table>

### Vestiture

Different types of trichomes and the density of trichomes can be useful characters in identifying some species, but in other species they can exhibit high variation (Fritsch 1996, 1997, 2004). Some general trends in laminar pubescence can be observed within the species of this group. In most leaves, the midvein and the area around it tend to have the densest amount of pubescence, as well as the largest trichomes. Many specimens also have domatia formed by large trichomes in the axils of the secondary veins, especially proximal ones. Within most species, the density and branch length of trichomes on the abaxial surface of leaves vary more or less continuously, without clear gaps and with no discernable geographical pattern. *Styrax fortunei* is the only species that can have the abaxial surface of the leaves completely covered by trichomes, but it can also have leaves that are only sparsely covered with trichomes. *Styrax formosanus* var. *hirtus* S.M. Hwang is distinguished by the ubiquitous simple trichomes that cover the plant.

Pubescence on the petiole can be a useful diagnostic character for several species. Short-armed, spider mite-like trichomes on the abaxial surface of the petiole near the junction of the petiole and the lamina are usually present in *Styrax agrestis*, *S. finlaysonianus*, *S. serrulatus*, and *S. warburgii*, whereas trichomes of this sort are not usually present in the other valvate members of *S. series Cyrta*. In combination with other characters, they can be used to distinguish these four species from the rest of the group.

Pubescence on reproductive parts can vary in location, color, and density and can be used as a diagnostic character in several species. Features of calyx trichomes can be used to identify species, i.e., color (e.g., *S. faberi*), density, and location (e.g., *S. formosanus*). *Styrax wuyuanensis* is unique among the species of the group in the nearly complete lack of trichomes on the calyx. Presence of trichomes on the seeds can be used as a diagnostic character for some species as well (*S. agrestis*, *S. finlaysonianus*, and *S. warburgii*).

### Inflorescences

All inflorescences of the valvate members of *Styrax series Cyrta* are produced pseudoterminal and laterally on the shoots of the current growing season. Occasionally, only pseudoterminal inflorescences are produced on a fertile shoot in some specimens, but lateral inflorescences can always occur on other shoots. Pseudoterminal inflorescences are racemose or paniculate with the exception of *S. bracteolatus*, which has solitary or rarely two-flowered inflorescences. Many species have racemose inflorescences that have some pairs of flowers with pedicels originating from a common point arising from a very short shoot off the rachis, making such inflorescences subpaniculate; nonetheless, for simplicity we refer to these as racemose. Lateral inflorescences are 1- or 2-flowered or racemose except for *S. fortunei*, which can have panicles. Lateral inflorescences are always
shorter and less floriferous than pseudoterminal inflorescences and occur in the axils of leaves below the pseudoterminal inflorescence. The range in the number of flowers per inflorescence is usually relatively consistent within species apart from *S. fortunei*, which can have substantially lower numbers of flowers in the inflorescence than is typical. As such, the lower end of the range of flowers per inflorescence of *S. fortunei* overlaps that of *S. confusus* and of *S. faberi*. It is still a generally useful character for this group, however, especially when used in conjunction with other characters.

**Flowers**

All flowers are bisexual and actinomorphic with a short hypanthium adnate to the basal third or less of the ovary wall. Flower length (ranging from 0.7–2.2 cm) is generally not a useful diagnostic character apart from separating *Styrax confusus* from *S. fortunei* in conjunction with other characters. Pedicel length (ranging from 3–22 mm) is not a useful diagnostic character for which to delimit species. *Styrax* has a calyx with the sepals fused and reduced to teeth. Except in *S. wuyuanensis*, which is notably subglabrous, the species in the study group have a calyx with the abaxial surface completely covered by stellate trichomes, with trichome density occasionally becoming less dense towards the margin (apex), in which case the less dense part can appear in dried specimens as a marginal green to brown band. Variation in the pubescence on the abaxial surface of the calyx is a useful diagnostic character, e.g., presence (vs. absence) of reddish brown trichomes (*S. faberi*) and the width of the band formed by the pubescence on the calyx becoming sparser towards the margin (*S. formosanus*). The margin of the calyx can be undulate or toothed. Calyces of *S. bracteolatus* can have notably longer teeth (up to 3 mm long) than those of other species, along with notably deep sinuses that can reach to near the base of the calyx.

The species have a gamopetalous corolla that is white or rarely light yellow and is always completely covered with stellate pubescence on its adaxial surface. Occasionally in *Styrax finlaysonianus* and *S. warburgii* this pubescence becomes sparser towards the tube. Pubescence on the adaxial surface of the lobes is usually limited to the apex and margins but can occasionally occur throughout. The tube of the corolla is always shorter than the lobes, ranging from 1.2–6.9 mm.

The stamens are adnate to the corolla tube proximally and free distally, their number being generally limited to the apex and margins but can occasionally occur throughout. The tube of the corolla is always shorter than the lobes, ranging from 1.2–6.9 mm.

The species have a gamopetalous corolla that is white or rarely light yellow and is always completely covered with stellate pubescence on its adaxial surface. Occasionally in *Styrax finlaysonianus* and *S. warburgii* this pubescence becomes sparser towards the tube. Pubescence on the adaxial surface of the lobes is usually limited to the apex and margins but can occasionally occur throughout. The tube of the corolla is always shorter than the lobes, ranging from 1.2–6.9 mm.

The style is filiform and 0.7–1.9 cm in length. It is densely pubescent with stellate trichomes basally and glabrous otherwise except rarely extending to half the length of the style in *S. agrestis*.

**Fruits**

The fruit in the valvate members of *Styrax* series *Cyrtta* is dry—nut-like when indehiscent, or capsular when dehiscent (usually by three valves), and typically with one seed but occasionally with two or three. The mature fruit is important for reliable species identification in this group of *Styrax*. Ideally, when collecting specimens of *Styrax*, mature flowers or fruits should be obtained and the tree or shrub tagged for a return trip to obtain the other. The fruit shape in the study group is usually narrowly ellipsoid, subglobose, ellipsoid, or ovoid. The apex can be rounded, pointed (e.g., *S. serrulatus*), thick-rostrate (*S. finlaysonianus*), or narrowly rostrate (*S. agrestis, S. formosanus, and S. warburgii*). Fruits range from 0.6–4 cm long and 0.5–2.5 cm wide. The outer surface of the pericarp is completely covered by yellowish brown or grayish stellate trichomes. The inner surface is usually smooth or rugose but is notably reticulate-pitted in *S. rubifolius*. The inner surface of the pericarp is also
usually glabrous but is sparsely to densely stellate pubescent in *S. agrestis*, *S. finlaysonianus*, *S. serrulatus*, and *S. warburgii*. These four species are also the only species with fruits that are nut-like, being dry and indehiscent. *Styrax serrulatus* can also have dehiscent single-seeded capsules that dehisce by three valves, like the other valvate members of *S*. series *Cyrtia*. The thickness of the pericarp wall is also a key diagnostic character, with the walls of *S. confusus* and *S. finlaysonianus* uniquely thicker (> 0.6 mm) than those of the other species. This character is also key in differentiating *S. agrestis* from *S. warburgii*.

**Seeds**

The seeds are ellipsoid, ovoid, or obovoid, ranging from tan to dark brown and with smooth to longitudinally fissured or rugose testa. *Styrax rubifolius* has strongly tuberculate seeds. The seed coats of *S. agrestis*, *S. finlaysonianus*, and *S. warburgii* are also consistently pubescent with at least sparse stellate trichomes.

**Chromosome Numbers**

The only species in our revision for which a chromosome number is documented is *Styrax serrulatus* (*n* = 8; Mehra & Bawa 1969; Mehra 1976). From this count and other counts for species of *Styrax*, the base number of *Styrax* is inferred to be *x* = 8 (Fritsch 2001).

**ECOLOGY AND ECONOMIC IMPORTANCE**

From the data on the labels of specimens, the range of elevation among all species of the valvate group of *Styrax* series *Cyrtia* is 0–2450 m. Most species in the group occur at ≥ ca. 1500 m except *S. rubifolius* and *S. wuyuanensis*. The range of *S. rubifolius* is 800–1500 m whereas that of *S. wuyuanensis* is 450–540 m, although this narrow range may be a sampling artifact based on the few collections of this rare species with elevation data. Because the few specimens of *S. agrestis* and *S. bracteolatus* that we examined lack elevation data, we have no hard evidence of elevation ranges for these species. Most species occur in a wide variety of mesic habitats, including forests, thickets, mountain slopes, roadsides, riversides, and successional areas.

Huang et al. (2003) discuss pollination and breeding systems for *Styrax* in general. Few data exist on fruit dispersal of *Styrax* in our group. After the fruit wall has detached, the seeds of the riparian species *S. faberi* remain attached to the calyx by the hilum. The seeds, which would otherwise sink, can thus be transported in water by the floating infructescence (P. Fritsch, pers. obs.). The retention of the seed on the calyx after fruit dehiscence occurs in other dehiscent members of the study group, including *S. confusus*, *S. formosanus*, *S. fortunei*, and *S. rubifolius*. The retention of the seed may also occur in *S. wuyuanensis*, although we did not see it on the specimens we examined, perhaps because of the low number of collections available.

One of the major economic products derived from *Styrax* is benzoin, also referred to as gum benjamin, a balsamic resin exuded from the bark and wood tissues after the cambium is injured. The resin is composed mainly of coniferyl cinnamate, cinnamyl cinnamate (styracin), and coniferyl benzoate, as well as minor traces of fragrant benzaldehyde, vanillin, and styrene. It is used as a flavoring agent and a fragrance fixative, as well as in medicine as an antiseptic and expectorant. The best known source of benzoin is *S. benzoin*, a species in *S*. series *Benzoin*, but several species in *S*. series *Cyrtia* are also known to produce benzoin, such as *S. subpaniculatus* and *S. tonkinensis*. Of the species in our group, *S. serrulatus* is known to produce benzoin, but it is regarded as lower quality than the resin produced by other species of *Styrax* (Burkill 1966; Langenheim 2003).

Similar to several species in the imbricate group of *Styrax* series *Cyrtia*, the oil extracted from seeds of *S. confusus*, *S. faberi*, and *S. fortunei* is used as a soap and a machine lubricant. The seed oil from *S. fortunei* can also be used to produce lacquer and that from *S. confusus* for making printing ink (Hwang 1987a; Liu 1991). Recent research has also been undertaken to investigate the use of *S. confusus* seed oil for biodiesel synthesis, because of its widespread distribution and the high oil content of the seeds (up to 50%; Wang et al. 2015). The wood from *S. serrulatus* can be used for construction materials, furniture, and tools (Yin 1990), and has potential value as a fuel, having high calorific value and producing a low amount of ash (Bhatt et al. 2016). The wood of *S. confusus* and *S. fortunei* can also be used for tools (Liu 1989; Ding & Wang 1997). The leaves of *S. fortunei* are used in traditional Chinese herbal medicine as a cough suppressant and expectorant (Liu 1991). Although
species of S. series Cyrta from eastern Asia have horticultural value as ornamental plants, the most important belong to the imbricate group of the series (S. japonicus and S. obassia). Several valvate species in S. series Cyrta are, however, occasionally used in horticulture, including S. confusus, S. formosanus, and S. fortunei (Yang 1984; Ding & Wang 1997; Lobdell 2013).

Most species of Styrax in eastern Asia are primary hosts to gall-forming aphids of the family Hormaphididae (tribe Cerataphidini), including probably all the species in the study group. Further discussion on the galls commonly occurring on the species of S. series Cyrta is included in Huang et al. (2003).

MATERIALS AND METHODS

Nearly 1900 specimens from 30 herbaria (A, AAU, BM, BO, BRIT, C, CAS, DS, E, F1, G, GH, HBG, HHBG, IBK, IBSC, K, KUN, KYO, L, LBG, MO, NAS, P, PE, TAI, TI, US, and W) were examined for this study. We followed the materials and methods laid out in the treatment of the imbricate members of Styrax series Cyrta (Huang et al. 2003), with the following modifications. All descriptions were derived from the examination of herbarium specimens except for S. wuyuanensis, which was described with a combination of herbarium specimens and the original description due to the lack of material available to us for study. In addition to measurements of leaves taken from fertile branches, an upward range for leaves from sterile branches was recorded. Observations and measurements were made either manually or observed digitally through the use of a Zeiss AxioCam ICC5 microscope camera attached to a dissecting microscope (maximum magnification = 100x) and measured with ZEN 2012 Blue Edition (Zeiss). For specimens that we examined only via digital images, we gained access to them through various online resources. Many important specimens of our study group are stored in European herbaria, and images are available from JSTOR (https://plants.jstor.org/) or the online database of the herbarium; of particular note for our study are the online databases for G (http://www.ville-ge.ch/musinfo/bd/cjb/chg/index.php?lang=en), K (http://apps.kew.org/herbcat/gotoHomePage.do), and P (https://science.mnhn.fr/institution/mnhn/collection/p/item/search), where we found many critical type specimens. Other important specimens stored in Chinese herbaria were accessed via images stored on the Chinese Virtual Herbarium (http://www.cvh.ac.cn). For these digital images, we used ImageJ (Schneider et al. 2012) to measure macroscopic characters.

The points in the distribution maps are based on the specimens cited in this revision (see Taxonomic Treatment and Appendix 2). For collections in which geographic coordinates are not indicated on specimen labels (most collections), we estimated coordinates based on the locality information from the labels and placed these estimates within brackets in the specimens cited sections of species entries. Estimates were derived from a variety of published maps, atlases, and gazetteers, especially Google Maps. Mapped localities were resolved at least to the second-level administrative divisions of each country whenever possible. Geographic information provided on labels, especially from older specimens, is often insufficient for a reasonable estimation of locality; in such cases, the collection was not mapped. When locality information was not specified within a particular geographical division [e.g., xian (Chinese county)], we provide coordinates for that division as provided by Google Maps, or else leave it unestimated as to coordinates. Oftentimes, the locality names are outdated and not in current use; we put the assumed current name of the locality in brackets after the verbatim names. Chinese political boundaries are those used in the Flora of China series. A Specify (Specify Collections Consortium) database of all collection information used in this revision, including geographic coordinates linked to geographic information system software (ArcView, ESRI, Inc.), is available from the authors upon request. Appendix 3 provides an alphabetical listing of species in the Taxonomic Treatment, including synonyms and excluded names.

Each species entry includes a preliminary conservation assessment. All assessments are based on the IUCN conservation ratings system (IUCN Standards and Petitions Subcommittee 2017). As part of the assessment, the extent of occurrence (EOO) and area of occurrence (AOO) were estimated with the georeferenced database of collections in GeoCAT, an online geospatial analysis tool (Bachman et al. 2011).
TAXONOMIC TREATMENT

For descriptions of Styrax and S. series CyRTa, refer to Huang et al. (2003).

KEY TO SPECIES OF THE VALVATE GROUP OF STYRAX SERIES CYRTA

1. Calyx and pedicel subglabrous __________________________________________________________________ 11. S. wuyuanensis
   1. Calyx and pedicel completely covered by stellate trichomes, occasionally becoming less dense towards calyx margin
   2. Calyx subtended by single large deltoid or oblong bracteole; corolla lobe apex often bifurcated; calyx often divided
      nearly to base by at least one sinus per calyx; inflorescence 1- or 2-flowered; at least one leaf blade on each individ-
      ual bilobed ____________________________________________________________________________ 2. S. bracteolatus
   2. Calyx not subtended by bracteoles or occasionally subtended by a small linear bracteole; corolla lobe apex acute;
      calyx with shallow sinuses between teeth; inflorescence usually more than 2-flowered; leaves without lobes (rarely
      bilobed).
   3. Seed and interior surface of pericarp with stellate trichomes; fruit apex rostrate and leaves obovate, elliptic, or
      lanceolate.
   4. Pericarp wall > 0.6 mm thick; fruit obliquely ovoid to obliquely ellipsoid; fruit width usually > half the length;
      corolla subcoriaceous; calyx 5–6(–7) × 5–6 mm; leaves entire to weakly serrulate towards apex ___________ 5. S. finlaysonianus
   4. Pericarp wall < 0.35 mm thick; fruit obliquely and narrowly ellipsoid; fruit width usually < half the length;
      calyx chartaceous; calyx 3–5 × 3–5 mm; leaves serrulate.
   5. Pericarp wall 0.23–0.35 mm thick (Borneo, Indonesia to Solomon Islands, Micronesia) _________________ 10. S. warburgii
   5. Pericarp wall 0.09–0.13 mm thick (Vietnam) ____________________________ 1. S. agrestis
   3. Seed and interior surface of pericarp without stellate trichomes; fruit apex usually pointed to rounded OR if fruit
      rostrate, leaves rhomboid
   6. Seed strongly tuberculate; interior of pericarp wall reticulately pitted; rachis proximally chestnut brown and
      glabrous, distally completely covered with stellate trichomes ___________________________________________________________________ 8. S. rubifolius
   6. Seed smooth to rugose; interior of pericarp wall smooth to slightly rugose; rachis sparsely to completely covered
      with stellate trichomes throughout
   7. Calyx abaxially with trichomes becoming less dense within 1–2 mm of margin; leaves usually rhomboid; fruit
      usually rostrate ___________________________________________________________ 6. S. formosanus
   7. Calyx abaxially with trichomes evenly dense across whole surface or becoming less dense within 1 mm of
      margin; leaves ovate, ellipsoid, lanceolate, or obovate; fruit pointed to rounded
   8. Calyx abaxially with long-armed reddish brown trichomes overtopping grayish yellow or rarely yellow
      basal pubescence; flowers per pseudoterminal inflorescence (1–3–5–11). __________________________ 4. S. faberi
   8. Calyx abaxially without long-armed reddish brown trichomes, basal pubescence usually yellow or golden
      yellow; flowers per pseudoterminal inflorescence usually 5 or more
   9. Two most proximal leaves on each shoot alternate; fruit indehiscent or dehiscent, ellipsoid; petiole with
      short-armed trichomes on abaxial surface near junction of blade and petiole (eastern Nepal and India
      through border region of Myanmar and Yunnan, China to northern Laos and Thailand) ____________ 9. S. serrulatus
   9. Two most proximal leaves on each shoot subopposite or opposite; fruit always dehiscent, usually not
      ellipsoid OR if fruit ellipsoid, petiole without short-armed trichomes on abaxial surface near junction of
      blade and petiole (eastern Yunnan and Sichuan to Zhejiang)
   10. Fruit wall ≤ 0.5 mm thick; corolla subcoriaceous; mature leaves subcoriaceous; pseudoterminal inflo-
       rescence racemose; flowers per pseudoterminal inflorescence (4–)5–11–12 (coastal southeastern China from Guangxi
       to Jiangsu and further inland to Jiangxi) ________________________________________________ 3. S. confusus
   10. Fruit wall ≥ 0.5 mm thick; corolla chartaceous; mature leaves usually chartaceous; occasionally sub-
       coriaceous; pseudoterminal inflorescence usually paniculate; flowers per inflorescence (5–12 or more
       (inland China from eastern Yunnan and Sichuan to Jiangsu and Zhejiang) __________________________ 7. S. fortunei

   TYPE: VIETNAM. Cochinchina, J. de Loureiro s.n. (LECTOTYPE, designated by Svengsuksa & Vidal (1992): BM!— photograph at A!).

Trees to 10 m tall. Young branchlets yellowish brown, nearly glabrous to densely pubescent with yellow
stellate trichomes; older branchlets brown, subglabrous. Petiole 3–6(–8) mm long, with tightly appressed
stellate trichomes on abaxial surface, trichome arms up to 0.06–0.12 mm long. Two most proximal leaves
on each shoot alternate. Lamina of fertile shoots 3.7–6.9(–8) × 1.8–3.5 cm, those of sterile shoots to 10.5 × 4.2 cm,
1.7–2.7 x as long as wide, chartaceous, elliptic to elliptic-lanceolate; abaxial surface grayish green to greenish
brown when dry, with sparse yellow stellate trichomes, trichome arms up to 0.09–0.27 mm long, pubescence
scattered on whole surface, trichomes usually denser and larger in axes of midvein and secondary veins;
adaxial surface dark brown when dry, nearly glabrous or with very sparse yellow stellate trichomes, trichome
This document is intended for digital-device reading only.
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
arms up to 0.07–0.13 mm long, pubescence mostly along midvein and rarely elsewhere; base acute, occasionally rounded; margin serrulate; apex short-acuminate to acute, rarely shallowly 2- or 3-lobed; secondary veins 4 to 6 on each side of midvein, abaxially prominent, adaxially plane or sunken, tertiary veins reticulate, abaxially prominent, adaxially plane. Fertile shoots 4.5–7.4(–10.6) cm long, 2- to 3-leaved. Lateral inflorescences racemose, 1–2.2 cm long, 1- or 2-flowered; pseudoterminal inflorescences racemose, with well-spaced nodes; 2.2–3.8 cm long, 3- to 9-flowered, rachis completely covered with yellowish brown stellate trichomes. Pedicel 3–6 mm long, completely covered with short-armed yellow appressed stellate trichomes and scattered long-armed yellowish brown erect stellate trichomes; bracteoles 0.6–3.8 mm long, linear or subulate, positioned at base of pedicels, rarely at middle. Flowers 1.2–1.9 cm long. Calyx 4–5 × 3–5 mm, cupuliform; abaxial surface slightly striate and completely covered with short-armed yellow appressed stellate trichomes and scattered long-armed yellowish brown trichomes, occasionally trichomes becoming less dense towards calyx margin, trichome arms up to 0.16–0.3 mm long; adaxial surface yellowish brown to brown with 2- or 3-armed trichomes along margin; margin rarely undulate or with 5 evenly distributed defined teeth 0.5–1(–1.5) mm long; marginal teeth deltoid or obtuse, contiguous, densely pubescent on both surfaces. Corolla 0.8–1.4 cm long, white, tube 1.9–3.3 mm long, abaxial surface proximally glabrous and distally scattered with stellate trichomes, lobes 5, 8.4–10.4 × 2.5–2.9(–3.9) mm, chartaceous, oblong to lanceolate, apex acute, abaxially completely covered with pale yellow appressed stellate trichomes, adaxially glabrous except margins. Stamens 10; filaments 2.3–3.4 mm long, flexuous, of equal width throughout, proximal half dense with stellate trichomes, distal half glabrous; anthers (3.2–)3.8–5.1 mm long, wider than distal portion of filament, with sparse yellow stellate trichomes, connective with sparse yellow stellate trichomes. Style 0.7–1.3 cm long, proximally dense with stellate trichomes, rarely extending to midpoint of style, distally glabrous; stigma 0.2–0.5 mm wide, punctiform or capitate. Fruiting calyx 5 × 3–5 mm, funnelform. Fruit 1.7–2.1 × 0.7–0.9 cm, indehiscent, oblique-ellipsoid, apex rostrate or rarely stoutly rostrate, rostrum up to 8 mm long; pericarp dry, 0.09–0.16 mm thick, outside smooth, with dense yellowish brown appressed stellate trichomes, inside densely pubescent with stellate trichomes, smooth. Seeds brown, obliquely narrow-ellipsoid, slightly grooved, with dense stellate trichomes.

Illustrations.—Guillaumin 1933:981, fig. 113 (4–5) (as S. annamensis); Svengsuksa & Vidal 1992:173, pl. 31 (4) (as S. annamensis).

Phenology.—Flowering: February–April, June–September. Fruiting: April, May, July.

Distribution.—Laos (Xiangkhoang) and Vietnam (Bac Kan, Ha Noi, Phu Tho, Quang Tri, Thai Nguyen, Thua Thien-Hue, and Vinh Phuc); Fig. 1.

Vernacular names.—Cay cau cau (Vietnam; Loureiro 1790); cay don tran (Vietnam, Tinh Thua Thien-Hue; Bauche 34); cay ton trau (Vietnam; Guillaumin 1924); cut sat (Vietnam; Guillaumin 1924); do:k huy pha (Laos; Svengsuksa & Vidal 1992); do:k fa:w (Laos, Louangphrabang; Svengsuksa and Vidal 1992); ph’ungx fa:w (Laos, Xiangkhoang; Svengsuksa & Vidal 1992).

Conservation assessment.—Styrax agrestis is known to us from 11 geographic localities in northern and central Vietnam. The EOO is 39,955 km² and AOO is 44 km². Only one of the known collections appears to be from a protected area, Ba Vi National Park. The most recent collection was made in 1940 from Thuang An, Huyen Phong Dien by Bauche. The distribution of the species is split between two regions. Eight of the localities are in northern Vietnam around Hanoi, one of the most heavily developed regions in Vietnam, and six of the eight localities in that region have been greatly altered by urban development. The other three localities are in central Vietnam near Hue, where much urban development has occurred as well. We therefore propose these two regions that are under a common threat in their respective areas as two locations. In conjunction with the two subpopulations not currently under threat, we propose four locations in total for this species and classify it as Endangered (EN): B2ab(iii).

Discussion.—The names Styrax annamensis, S. finlaysonianus, S. subcrenatus Hand.-Mazz., and S. warburgii are all involved in the confused taxonomic history of S. agrestis; together we refer to this collection of names as the S. agrestis complex. Styrax agrestis was originally published as Cyorta agrestis by Loureiro (1790). Don
FIG. 1. Geographic distribution of Styrax agrestis, S. bracteolatus, and S. faberi.

(1837) did not recognize more than one genus in his concept of the Styracaceae and moved C. agrestis into Styrax. In the same publication, he validly published S. finlaysonianus, a name in Wallich’s (1828) catalogue, basing his description on a specimen with only flowers and maturing flower buds. Perkins (1907) distinguished the Malesian species S. warburgii from the Indochinese species S. agrestis by the sparse stellate pubescence on the abaxial surface of the leaf (vs. the glabrous leaf of S. agrestis) and a purported difference in the number of leaf veins. Perkins also recognized S. finlaysonianus. Although she apparently did not see any fruit of the species, she grouped it with species that have fruit without a rostrum in her key. Apparently not having seen the type of S. agrestis, Guillaumin (1924) misapplied the name S. agrestis to several large-fruited specimens with subentire leaves that we recognize as S. finlaysonianus. Instead, he published a new species, S. annamensis, based on several flowering specimens. Handel-Mazzetti (1931) published S. subcrenatus in an article describing several other species new to China. He likely did not compare the material he examined for describing S. subcrenatus with any material from Indochina, and instead compared S. subcrenatus to S. confusus. Steenis (1932) only treated Malesian specimens, but did examine S. agrestis from Vietnam. Discerning no difference in fruit morphology (or other characters), van Steenis considered S. warburgii and S. agrestis to be a single species. Svengsuksa & Vidal (1992) treated species from Cambodia, Laos, and Vietnam. They extensively examined specimens of both S. agrestis and S. finlaysonianus, recognizing clear differences between the two species. However, apparently because they lacked access to the type specimens of these species, they misapplied the names: following Guillaumin, they applied S. agrestis to the large-fruited species S. finlaysonianus sensu our revision, and S. annamensis to the narrowly ellipsoid-fruited species that we recognize as S.
agrestis. They also applied *S. finlaysonianus* to a species in *S. series Benzoin*. Perhaps because they did not examine Malesian material for their flora, they did not assess the Malesian species *S. warburgii*. Hwang & Grimes (1996), treating only the material with these names from China (specifically, only from Hainan), apparently did not examine the material from Vietnam or Malesia in detail, and so they applied the name *S. agrestis* to the Chinese material; they also included *S. subcrenatus* as a synonym under this name.

From our comprehensive assessment of the species involved with the taxonomic history of *Styrax agrestis*, we distinguish three species within this complex. *Styrax agrestis* occurs in northern and central Vietnam, *S. finlaysonianus* has a range that mostly overlaps that of *S. agrestis* in Vietnam and China (Hainan), and *S. warburgii* is distributed from Borneo east to the Solomon Islands with outliers in Palau and Micronesia. All three species of the complex along with *S. serrulatus* can be distinguished from the other species in the study group by their generally short-armed trichomes on the abaxial surface of the petiole, especially apparent on the junction of the petiole and blade. Also, in these four species the two most proximal leaves on each shoot are alternate (vs. opposite or subopposite).

*Styrax agrestis* can be distinguished from *S. finlaysonianus* by the size and shape of the fruit, having strongly thin-rostrate obliquely narrow-ellipsoid (vs. thick-rostrate ovoid) fruits that are mostly 0.9 cm wide (vs. usually > 1 cm). *Styrax agrestis* can also be distinguished from *S. finlaysonianus* by consistently serrulate laminar margins (vs. usually subentire) and thin corolla lobes (vs. thick).

*Styrax agrestis* is more difficult to distinguish from *S. warburgii*. The two species share a similar fruit shape but *S. agrestis* has a thinner fruit wall (0.09–0.13 mm) than *S. warburgii* (0.23–0.35 mm). Although this character works well to separate the species, only three fruiting specimens of *S. agrestis* were available to us for examination; more collections will be needed to test the distinctness of the two species. The large geographical distance between the ranges of the two entities, however, lends ancillary support for two species rather than one (Figs. 1, 8).

The type specimen of *Styrax annamensis* has thin corolla lobes and serrulate leaves, like the type of *S. agrestis*, and is similar to *S. agrestis* in all other respects. We therefore synonymize *S. annamensis* and *S. agrestis*.

On initial examination, the collections A.C. d'Alleizette s.n. [L69998] and E. Poilane 18971 and 19080 resemble *Styrax agrestis*. However, these specimens differ from this species in several key characters. Unlike *S. agrestis*, they have paniculate pseudoterminal inflorescences (vs. racemose). Also, the pseudoterminal and lateral inflorescences are much longer and have many more flowers than is typical for *S. agrestis*. They also have thick subcoriaceous leaves with entire margins, vs. the chartaceous serrulate leaves of *S. agrestis*. These specimens potentially represent an undescribed species of *S. series Cyrta*. Because we lack fruiting specimens with these characters, however, we have refrained from describing a distinct species. We have excluded them from the description of *S. agrestis*.

The collection A.F.G. Kerr 20830 seems to represent an intermediate between *Styrax agrestis* and *S. finlaysonianus* in the size and shape of the fruit. The fruit is narrower and the rostrum longer than in typical *S. finlaysonianus*, but the fruit is larger and wider and the rostrum thicker than in typical *S. agrestis*. Most of the fruits on the specimen are immature. We opened one of the few fruits that appear close to maturity to examine the seeds and found that they are atypical of any in the study group. In this group of *Styrax*, usually only one ovule per ovary matures into a seed, or rarely two or even three ovules will mature. This fruit has three seeds that are maturing and the seeds are also oddly shaped, being triangular prisms with tapering ends, as opposed to the ovoid, obvoid, or ellipsoid seeds of most members of this group. It is possible that the odd shape is due to the drying and pressing process. We have excluded this specimen from the *S. agrestis* description.

W.T. Tsang 27113 and T. Chen & P. Fritsch 9704109 are atypical specimens related to the *Styrax agrestis* complex but do not fit any of the species in this group; they appear to combine features of *S. serrulatus* and *S. finlaysonianus*. Like *S. serrulatus*, they have dehiscent ellipsoid fruits with smooth seeds. However, the leaves are entire and the seeds are stellate pubescent, like *S. finlaysonianus*. These specimens likely represent an undescribed species. The material we have is limited to fruiting material with only sterile leaves, and there is only
one inflorescence on the A specimen of W.T. Tsang 27113, which is incomplete. Flowering material and more collections in general of Styrax with this morphology will be needed before further considering the taxonomic status of these specimens.

Svensguloka & Vidal (1992) cite J. de Loureiro s.n. as the holotype of Styrax agrestis. In the protologue of Cyrt a agrestis, however, Loureiro does not cite any specimens. Because of this, the term holotype would be incorrect, and we are recognizing the citation in the Flore du Cambodge, du Laos, et du Viêt nam as a lectotype designation.

Additional specimens examined. VIETNAM. Bac Kan: [Huyen Bach Thong], Phu Thong Hoa [-Phu Thong], [22.333°N, 105.9°E], Sep 1919 (fl), P.A. Eberhardt 4715 (K). Ha Noi: Ninh Thai, in the woods of the hill Muuo Lang, [21.028°N, 105.85°E], 17 Mar 1890 (fl), H.-F. Bon 4303 (P[2]). Huyen Ba Vi, Village of [Bip!], at the western base of Mont Bavi, [21.958°N, 105.366°E], 31 Mar 1887 (fl), B. Balansa 4337 (P[2]).


2. Styrax bracteolatus Guill. in Bull. Soc. Bot. France 70:883. 1924 [as S. “bracteolata”] (Fig. 2). Type: CHINA. YUNNAN: Shuifu Xian, Tchen long chan [= Cheng Feng Shan], [28.410°N, 104.233°E], 17 May 1901, F. Ducloux 2137 (LECTOTYPE, designated here: P [barcode 00219502]).

Shrubs or small trees. Young branchlets light brown, with sparse or evenly distributed yellowish brown or rusty red stellate trichomes; older branchlets chestnut brown or brown, glabrous or with sparse stellate trichomes. Petiole 3–5 mm long. Two most proximal leaves on each shoot alternate or subopposite. Lamina of fertile shoots 6.2–10.5 × 2.8–4 cm, those of sterile shoots to 16.3 × 7.6 cm, 2.1–2.6 × as long as wide, chartaceous, oblong-elliptic to lanceolate, sometimes leaves subtending inflorescence highly reduced and asymmetrical; abaxial surface grayish brown, with sparse yellow or reddish brown stellate trichomes, trichome arms up to 0.2–0.4 mm long, pubescence on veins, occasionally on whole surface; adaxial surface brown, with sparse yellow or rusty red simple or 2- or 3-armed trichomes, trichome arms up to 0.2–0.4 mm long, pubescence on veins, occasionally on whole surface; adaxial surface brown, with sparse yellow or rusty red simple or 2- or 3-armed trichomes, trichome arms up to 0.1–0.3 mm long, pubescence along midvein and rarely on proximal secondary veins; base cuneate, rarely rounded; margin subentire to serrulate; apex acuminate, rarely acute, occasionally bifurcate; secondary veins 8 to 12 on each side of midvein, abaxially prominent, adaxially prominent, tertiary veins reticulate, abaxially prominent, adaxially prominent. Fertile shoots 3.7–5.9(–13.7) cm long, 3– to 6-leaved, branchlets often slightly flattened. Inflorescences solitary, rarely two-flowered, 1.5–2.1 cm long. Flowers subsessile to pedicellate; pedicel 5–7 mm long, with dense erect stellate trichomes with reddish brown centers and yellowish arms; bracteoles 3.6–7.2 mm long, deltoid or oblong, brown or yellow, subtending calyx. Flowers 1.2–1.5 cm long. Calyx 3–4 × 5–8 mm, cupuliform, often divided nearly to base; abaxially with dense yellowish appressed stellate trichomes, trichome arms up to 0.3–0.4 mm long; adaxially glabrous except margins; margin with 5 well defined unevenly distributed teeth 1.2–3 mm long; marginal teeth deltoid, contiguous, adaxially densely pubescent, adaxially pubescent. Corolla 0.95–1.35 cm long, white, tube 1.2–1.4 mm long, abaxial surface proximally glabrous and distally covered with stellate trichomes, lobes (3 to)5(or 11), 8.1–12.1 × 2.5–4.1 mm, chartaceous, oblong, apex acute or slightly bifurcated to bifurcated, abaxially dense with pale yellow appressed stellate trichomes, adaxially glabrous except margins. Stamens (6 to)10(or 17); filaments 1.7–3.5 mm long, slightly flexuous at middle, of equal width throughout, proximally dense with stellate trichomes, distally glabrous; anthers 4.7–5.9 mm long, wider than distal portion of filament, with sparse yellow stellate trichomes; connective with sparse yellow stellate trichomes. Style 0.7–1.1 cm long, glabrous, with stellate trichomes at base; stigma about 0.3 mm wide, capitate or punciform. Fruit unknown.

Illustrations.—None previously published.

Phenology.—Flowering: May, June. Fruiting: unknown.

Distribution.—China (Yunnan). Fig. 1.

Habitat.—In forests.

This document is intended for digital-device reading only.

Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
Vernacular names.—Jú-bào-yè-mo-li (China, Yunnan; Ming 1983).

Conservation assessment.—Styrax bracteolatus is only known to us from only two localities in China, both in Yunnan. Because we only know of two localities, we cannot calculate an EOO for this species. None of the known subpopulations appear to be in a protected area. The last known collection of this species was made in 1908 by A.C. d’Alleizette. Without additional data on the species, we are unable to further assess the conservation status of S. bracteolatus, and assign a status of Data Deficient (DD).
Discussion.—Styrax bracteolatus is endemic to Yunnan and can easily be distinguished from the other members of S. series Cytra with valvate corolla aestivation by the presence of a large deltoid bracteole subtending the calyx. The 1- or 2-flowered inflorescences distinguish it from both S. fortunei and S. rubifolius, whose distributions overlap the distribution of S. bracteolatus. The species has been rarely collected throughout its range and is only known from sterile and flowering collections.

Styrax bracteolatus was synonymized with S. roseus Dunn (= S. hookeri C.B. Clarke) in the Flora Reipublicae Popularis Sinicae (Hwang 1987b). However, it clearly has valvate aestivation, vs. the imbricate aestivation of S. hookeri. Styrax bracteolatus does not appear anywhere in the treatment of Styrax in the Flora of China.

In the protologue of Styrax bracteolatus, two collections (syntypes) are cited by Guillamin (1924): F. Ducloix 2137 and J.M. Delavay s.n. We designated F. Ducloix 2137 as the lectotype over J.M. Delavay s.n. because F. Ducloix 2137 has flowering material, whereas J.M. Delavay s.n. does not, and F. Ducloix 2137 is better preserved, with stems that have the leaves less crowded vs. J.M. Delavay s.n., allowing the petioles and alternate leaf arrangement to be seen.

Additional specimens examined. CHINA. Yunnan: reg. de Yunnan Fou [=Kunming Shi], [25.067°N, 102.683°E], Jun 1908 (fl), J.M. Delavay s.n. has flowering material, whereas F. Ducloix 2137 does not, and J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designated J.M. Delavay s.n. as the lectotype over F. Ducloix 2137. We designed...
trichomes; bracteoles 0.9–5+ mm long, linear or subulate, at base or on basal half of pedicel, rarely at base of calyx. Flowers (1.3–)1.5–1.9–(2.2) cm long. Calyx 5–8(–10) × 4–7 mm, cupuliform; abaxially completely covered with short-armed yellow appressed stellate trichomes and scattered to dense long-armed golden yellow stellate trichomes, with trichomes occasionally becoming less dense within 1 mm of calyx margin, margin brown and scarios, arms of trichomes to 0.26–0.79(–0.9) mm long; adaxially yellowish brown to brown with stellate trichomes growing denser towards margins; margin glandular with 5 to 7 evenly distributed teeth 0.6–1.6 mm long; marginal teeth deltoid to lanceolate, not contiguous, pubescent on both surfaces. Corolla 1.2–1.6 cm long, white or rarely light yellow, tube 2.3–3.7 mm long, abaxial surface proximally glabrous and distally covered with stellate trichomes, lobes 5(6 or) 8–13 × 2–3.1(–4.1) mm, subcoriaceous, lanceolate or oblong, apex acute, abaxially completely covered with yellow appressed stellate trichomes, adaxially glabrous except apex and margins, rarely sparse with 2- or 3- armed trichomes, denser at apex. Stamens 9 or 10; filaments 3–4.7 mm long, straight, of equal width throughout, proximally dense with stellate trichomes, distally glabrous; anthers 4.2–7.2 mm long, wider than distal portion of filament, with sparse yellow stellate trichomes; connective with dense yellow stellate trichomes. Style 1.2–1.9 cm long, glabrous, with stellate trichomes at base; stigma 0.3–0.6 mm wide, punctiform or capitate. Fruiting calyx 4–8(–9) × 7–11(–13) mm, funnelform to salverform. Fruit 0.8–1.6 × 0.7–1.3 cm, dehiscent, ovoid to subglobose, apex pointed to slightly rostrate; pericarp dry, 0.7–1.64 mm thick, outside smooth to slightly rugose, with dense yellowish erect long-armed stellate trichomes, inside glabrous, smooth. Seeds light brown, ovoid to obovoid, slightly rugose with shallow longitudinal grooves and deep longitudinal fissures, glabrous.


Distribution.—China (Anhui, Fujian, Guangdong, Guangxi, Hong Kong, Hunan, Jiangsu, Jiangxi, Shanghai, and Zhejiang); Fig. 3.

Habitat.—In mixed forests and thickets, on hillside slopes and summits, along streams and roadsides, on sandy or clay soils; 20–1750 m.

Vernacular names.—Baihualong (China, Hunan; L.B. Luo 998); hai-shan-long (China, Anhui; Liu 1991); chan shue (China, Guangdong; W.T. Tsang 28688); gou-gan-chai (China, Hong Kong; Xia & Deng 2007); hua-li-sai-shan-mei (China; Hwang & Grimes 1996); huazanshu (China, Guangdong; F.A. McClure 133); hung lat kai shue [hong-la-ji-shu] (China, Guangdong; W.T. Tsang 20485); meng-gu-zu (China, Guangdong; Hwang 1987a); sai-shan-mei (China; Hwang & Grimes 1996); tsat shing tsz shue [qi-xing-zi-shu] (China, Guangdong; W.T. Tsang 21385); wenzushu (China, Guangdong; F.A. McClure 78); wu-wen-zi (China, Guangdong; Hwang 1987a).

Conservation assessment.—Styrax confusus is one of three of the common and widespread Chinese endemic species in S. series Cyrta with valvate corolla aestivation. Collections have been made from > 180 geographic localities in a broad area (EOO = ca. 798,805 km²) covering eastern and southeastern China. There appears to be a significant amount of suitable habitat for S. confusus throughout its distribution and the species is also locally abundant in some areas (notes on some specimens remark on its common occurrence, e.g., R.C. Ching 3053). This species also occurs in several protected areas in parts of its geographic range. We therefore categorize this species as Least Concern (LC).

Discussion.—The range of Styrax confusus almost completely overlaps that of S. faberi. Styrax confusus can be distinguished from S. faberi by its usually thicker leaves, buds, corolla lobes, pedicels, and fruit walls. Also, the pseudotaler terminal inflorescences of S. confusus can have more flowers than S. faberi, with S. confusus usually having 5 to 11 flowers per inflorescence, vs. 3 to 5 in S. faberi. Moreover, S. confusus usually has yellow or golden yellow trichomes overtopping the basal pubescence of the calyx, in contrast with the reddish brown trichomes of S. faberi.

The range of Styrax confusus also overlaps with that of S. fortunei, mostly in eastern China. These two
species can sometimes be difficult to distinguish, especially without mature fruits, but can be reliably distinguished with mature fruits because *S. confusus* has much thicker fruit walls than *S. fortunei*. *Styrax confusus* also has thicker flower buds, corolla lobes, and pedicels. The two species can also be distinguished by the structure and number of flowers of the pseudoterminal inflorescences. *Styrax confusus* has racemes with 4 to 12 flowers per inflorescence, whereas *S. fortunei* always has panicles, usually with > 11 flowers per inflorescence. Also, the flowers of *S. confusus* are usually > 1.5 cm long (vs. usually < 1.4 cm).

*Styrax confusus* var. *superbus* was distinguished from *S. confusus* by having larger flowers than is typical for the species, and more strongly serrate leaves. From our inspection of *S. confusus*, flower size is not strongly correlated with the degree of serration of the leaves. Leaves ranging from serrulate to serrate appear throughout the range of *S. confusus* without any discernable geographical pattern. Furthermore, although the specimens of *S. confusus* with the largest flowers appear to come from around Shaoguan City, Guangdong, specimens with smaller flowers have been collected from that area as well. On this basis, we consider these differences to represent taxonomically trivial variation within the species.

Although *Styrax confusus* usually has fruits with thick fruit walls, the collection B.Z. Xiao 3712, from Mt. Mangshan along the border of Hunan and Guangdong, China, is atypical in its very thin, rugose fruit walls. However, the specimen has far too many fruits per infructescence to be *S. faberi* or *S. formosanus*, the other two species that occur near the collection locality. The specimen may represent an undescribed species. More collections from Mt. Mangshan, especially those with flowers, could help confirm this.

The collection C.S. Ye 621 is atypical for *Styrax confusus* in its unusually dense pubescence on the leaves of...
the fertile shoot. The fertile shoot is also unusually long and possesses many more leaves than is typical. The specimen was difficult to identify because it is only in flower bud. However, the pubescence on the leaf matches that of C.S. Ye 581, a fruiting specimen of S. confusus collected nearby. The sterile leaves on this specimen are densely pubescent like the fertile leaves of C.S. Ye 621. Because of the odd structure of the fertile shoot of C.S. Ye 621 and the dense pubescence on the leaves, we suspect that the shoot was somehow abnormally converted from sterile to fertile.

Two flowering specimens (W.R. Carles s.n. [E105545] and W. Hancock 28) appear to represent intermediates between Styrax confusus and S. fortunei, having corolla lobes too thick and flowers too few per pseudoterminal inflorescence for S. fortunei, but flowers too small for S. confusus. Based on the thickness of the corolla lobes, we have assigned them to S. confusus.

In the protologue of Styrax philadelphoides, two collections (syntypes) are cited by Perkins (1907): O. Warburg 6634 and R. Fortune A32. We designated R. Fortune A32 as the lectotype, for several reasons. Much of the material Perkins examined was located at B and destroyed during World War II; we presume that both O. Warburg 6634 and R. Fortune A32 at B were destroyed then. Although we have been able to find a photograph of the destroyed syntype and a duplicate of O. Warburg 6634 stored at A, R. Fortune A32 is more widely distributed, with many duplicates stored in various herbaria, as well as a flower fragment and photograph of the B specimen stored at A. Three extant sheets of R. Fortune A32 bear Perkins’s annotation label, with two stored at G and one stored at P. Of these three sheets, we were able to examine only P597864 in person. Furthermore, this specimen is the only one that has a label bearing the exact collection data of the specimen. For these reasons, we have chosen the P597864 sheet of R. Fortune A32 as the lectotype of S. philadelphoides.

In the protologue of Styrax fukienensis, Smith & Jeffrey (1916) cite J. de La Touche 149 as original material but do not state clearly in which herbarium the specimen is deposited. As discussed by McNeill (2014), the definition of original material includes duplicates, even if they were not explicitly examined by the authors, and thus duplicates must be considered syntypes if there is no clear indication of the herbarium in which the type is deposited. We designated the E duplicate of J. de La Touche 149 as the lectotype because this is the herbarium of Smith. Furthermore, someone has written on the E duplicate that the specimen was a type of S. fukienensis, unlike on the K duplicate.

Additional specimens examined. CHINA. Anhui: Chien Shan Hsien [=Qianshan Qu], Tien Chu Shan [=Tianzhu Shan], [31.062°N, 116.188°E], 900 m, 24 Jun 1936 (fl), C.S. Fan & Y.Y. Li 219 (A, L); Huangshan Shi, Huangshan, South Anhui, [30.125°N, 118.167°E], 2000 ft, 20 Jul 1925 (fr), R.C. Ching 3033 (A); Huangshan Shi, ChushiHilin to Tzekwangsze, [29.717°N, 118.283°E], 7 Aug 1933 (fr), T.N. Liu & P.C. Tsong 2277 (KUN[2]). Qimen Xian, Cha-awan Forest Farm [=Chawan Cun?], [29.666°N, 117.347°E], 400 m, 7 Jul 1993 (fr), X.Y. Dong 93510 (CAS); Wangshan [=Huangshan Shi], locality unknown, [30.125°N, 118.167°E], year 1973 (fr), K.S. Chow 147 (A, AAU); Xuanzhou Qu, Xixi Zhen, Baijian Shan, [30.659°N, 118.812°E], 350 m, 17 May 2006 (fr), M.D. Liu & H.M. Lin Lin 60133 (KUN). Fujian: Changting Xian, E of Wani Cun, [25.584°N, 116.064°E], 130 m, 12 Sep 1938 (fr), Anonymous 3636 (KUN); Changting Xian, locality unknown, [25.683°N, 116.333°E], 12 Sep 1938 (fr), Botanical Resource Investigation Team 84627 (KUN); Foochow [=Fuzhou Shi], locality unknown, [26.070°N, 119.306°E], 11 Apr 1928 (fl), H.H. Chung 8423 (A); Hok-Chiang [=Fuyang Shi], Ling-Sok Temple [=Linshi Temple?] and vicinity, [25.607°N, 119.356°E], 21 May 1927 (fr), S.G. Tang 15016 (A); Hok-Chiang [=Fuying Shi], Ling-Sok Temple [=Linshi Temple?], Ching Ka Ni [=Qingxiu Xiang], [25.607°N, 119.356°E], 25 May 1927 (fr), S.G. Tang 15113 (A); Jiale Xian, Longxi Shan, outer hills, [26.551°N, 117.277°E], 370–520 m, 26 Jun 1991 (fr), Longxi Mt. Expd. 1648 (CAS); Jiale Xian, Longxi Shan, Yujiaping, [26.52°N, 117.306°E], 770–890 m, 17 Jun 1991 (fr), Longxi Mt. Expd. 1435 (CAS); Jiale Xian, Longxi Shan, Yujiaping, [26.52°N, 117.306°E], 780–900 m, 15 Sep 1991 (fr), Longxi Mt. Expd. 2046 (CAS); Jinian Qu, Kuliang [=Guling Xiang], [26.086°N, 119.403°E], 10 Jul 1927 (fr), H.H. Chung 6416 (A); Longhai Shi, White Cloud Hill [=Baiyunyuan], [24.449°N, 117.731°E], 26 Mar 1923 (fl), H.H. Chung 1111 (A); Nanping Xian, Daling and Dangbluping, Shudou Shan, [24.65°N, 117.3°E], 620 m, 16 Apr 1932 (fr), Xiamen Collection Team 1307 (KUN); Nanping Shi, 3800 kan, [26.65°N, 118.183°E], 300 m, 15 Apr 1993 (fr), G.S. He 5115 (MO); Nanping Shi, 3800 kan, [26.65°N, 118.183°E], 300 m, 8 Jun 1993 (fr), G.S. He 5254 (MO); Ninghua Xian, locality unknown, [26.333°N, 116.6°E], 18 Aug 1938 (fr), Botanical Resource Investigation Team 226 (KUN[2]); Pinghe Xian, Jufeng Shan, [24.247°N, 117.018°E], 600 m, 22 Aug 1993 (fr), G.S. He 6427 (MO); Pinghe Xian, Jufeng Shan, [24.247°N, 117.018°E], 500 m, 22 Aug 1993 (fr), G.S. He 6460 (MO); Pinghe Xian, Jufeng Shan, [24.247°N, 117.018°E], 500 m, 22 Aug 1993 (fr), G.S. He 6460 (MO); Sanyuan Qu, Shennou [Cun?], [26.162°N, 117.54°E], 7 Jun 1978 (fr), G.L. Cai 254 (KUN); Sha Xian, Yanfeng Liukeng, [24.45°N, 117.8°E], 16 Aug 1958 (st), Botanical Resource Investigation Team 15784 (KUN); Shi Xian, locality unknown, [26.45°N, 117.8°E], 16 Apr 1932 (fl), D.S. Wang 395 (KUN); Songxi Xian, Yenping, Cha-ping [=Chaping], [27.473°N, 118.825°E], 730 m, 30 Jul 1924 (st), H.H. Chung 2827 (A); Taining Xian, Xinquao Gongshe, [27.042°N, 117.107°E], 1400 m, 17 Jun 1978 (fr), G.L. Cai 501 (KUN); Taining Xian, Yangkouzi, [26.817°N, 117.038°E], 24 Apr 1931 (fl), Y.L. Liu 194 (KUN); Taining Xian, locality unknown, [26.817°N, 117.038°E], 17 Jul 1959 (fl), J. He 2699 (KUN); Wuyishan Shi, Aotou, [27.723°N, 118.092°E], 26 Aug 1984 (fr), H.Y. Zou 2020.
unknown, [24.167°N, 113.417°E], 31 Jul 1929 (fr), W.K. Wang 2883 (A); [Yuancheng Qu], Kwai Shan [=Gui Shan], Tsing-loong Village [Jingaojiang Cun], [23.688°N, 114.997°E], 1–12 Apr 1938 (fr), W.T. Tsang 28688 (CAS, P); [Zengcheng Qu], Longtou Shan [=Longtou Cun], Lu Village and Yeung Uk Village [Yangwu Cun], Lingnan, [23.183°N, 113.621°E], 26 Jun 1924 (fr), K.P. To et al. 12589 (BM, P); Zijn Xian, Huantang Xian, Lianhua Shan, [23.534°N, 114.699°E], 480 m, 29 Jun 1938 (fr), Z. Wei Zefi 120812 (KUN); locality unknown, 26 Mar 1923 (fr), N.K. Chun 40805 (CAS). Guanguo: Chun Yuen, 18 Jan 1937 (fr), T.S. Tsong 81993 (A); Damiaoshan [=Rongshui Miaoxiu Zizhixian], near Zhonghau [Cun], [23.247°N, 110.039°E], 28 Apr 1955 (fl), S.Q. Chen 8789 (KUN); Hing On District, [Xian-gan Xian], Wah Kong [=Huangji Xiang], [25.769°N, 110.477°E], 29 Aug 1937 (fr), T.S. Tsong 83651 (A); Jinxiu [=Jinxiu Yaozu Zizhixian], Yao Shan [=Dayao Shan], [23.977°N, 110.117°E], 6 Oct 1936 (fr), C.M. Wang 39999 (A); [Jinxiu Yaozu Zizhixian], Dayao Shan, [Jinwang] to Luomen, [23.979°N, 110.117°E], 900 m, 22 Apr 1964 (fr), F.N. Wei 638 (MO); Jinxiu Yaozu Zizhixian, Dayao Shan, Jinxiu Lao Shan, [23.97°N, 110.117°E], 1200 m, 4 Jun 1938 (fr), Y.K. Li 40033 (MO); Jinxiu Yaozu Zizhixian, Guzhenwuzi Shan, [24.117°N, 110.183°E], 900 m, 17 May 1964 (fr), F.N. Wei 884 (MO); Lingchuan Xian, Pin-wu Village [=Yangwu Cun], in vicinity, Ta-lung [=Dalington], [25.322°N, 110.244°E], 21–30 Jul 1937 (fr), W.T. Tsang 29384 (A); Lipu Xian, Park Commune [Pulu Xiang], [25.331°N, 110.234°E], 22 Jul 1979 (fr), Q.H. Lu 121 (MO); Shuen-yuen, 12 May 1936 (fr), T.S. Tsong 81545 (A); Yanshan District, Yanshan Botany Research Institute [CAS Guilin], back mountain, [25.083°N, 110.298°E], 310 m, 4 Jun 1983 (fr), D.D. Tao 83073 (KUN); Yuansheng [=Rongxian], Ta Tseh Tsuen, [22.867°N, 110.539°E], 320 m, 4 Aug 1933 (fr), A.N. Stewart & H.C. Cheo 748 (A, P).
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.


This document is intended for digital-device reading only.
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
appressed stellate trichomes and scattered long-armed reddish brown stellate trichomes; bracteoles 0.7–2.8
(–5.1) mm long, linear or subulate, at base of pedicel or on pedicel, occasionally on calyx. Flowers 0.7–2 cm
long. Calyx (2–)4–7 × 3–7 mm, cupuliform to funnelform; abaxially completely covered with short-armed
grayish yellow or rarely yellow appressed stellate trichomes and scattered long-armed reddish brown stellate
trichomes, with trichomes usually becoming less dense within 1 mm of calyx margin, margin brown and
scarious, arms of trichomes to 0.1–0.74 mm long; adaxially brown with dense 2- or 3-armed trichomes at mar-
gins; margin glandular with 5 to 8 evenly distributed teeth 0.4–1.8 mm long; marginal teeth lanceolate, rarely
deloid, not contiguous, pubescent on both surfaces. Corolla 0.9–1.7 cm long, white, tube (1.3–)2.3–4.4 mm
long, abaxial surface proximally glabrous and distally covered with stellate trichomes, lobes 5 (or 6), 6.7–14.6 ×
1.4–3(–4.5) mm, chartaceous, lanceolate, apex acute, abaxially completely covered with pale yellow appressed
stellate trichomes, adaxially glabrous except apex. Stamens (9 or)10; filaments 2.6–5.6 mm long, straight, wid-
est at base, proximally dense with stellate trichomes, distally glabrous; anthers 3.4–6.7 mm long, wider than
distal portion of filament, with sparse yellow stellate trichomes; connective with sparse or rarely dense yellow
stellate trichomes. Style 1.1–1.7 cm long, glabrous, with stellate trichomes at base; stigma 0.2–0.5 mm wide,
punctiform. Fruiting calyx 3–6 × 5–10 mm, funnelform to salverform. Fruit 0.6–1.1 × 0.5–1.2 cm, dehiscent by
three valves at base, ovoid to subglobose, apex pointed to rounded; pericarp dry, 0.13–0.55(–1.25) mm thick,
outside slightly rugose to rugose, rarely smooth, with dense grayish brown appressed stellate trichomes, inside
rugose, smooth, occasionally rugose. Seeds light brown, ovoid, slightly rugose to rugose, rarely smooth, with
shallow longitudinal grooves and deep longitudinal fissures, glabrous.

Illustrations.—Hayata 1912:121, pl. 22 (as S. “matsumureana”); Hou 1956:475, fig. 260; Liu 1962:1041, pl.
866; Tai & Pan 1981:430, fig. 167 (paniculate inflorescences with too many flowers for S. faberi; possibly S.
fortunei); Yang 1984:546, fig. 233 (paniculate inflorescences with too many flowers for S. faberi; possibly S.
fortunei); Hwang 1987a:392, fig. 426; Hwang 1987b:120, pl. 41 (6–12); Zheng 1989:95, fig. 5:127; Liu 1989:356,
fig. 289 (fruited branch has too many fruits per infructescence); Wu & Raven 2000:210, fig. 210 (7–13); Fu

Phenology.—Flowering: March–June, August–October. Fruiting: January, April–December.

Distribution.—China (Anhui, Fujian, Guangdong, Guangxi, Guizhou, Hainan, Hubei, Hunan, Jiangsu,
Jiangxi, Macau, Taiwan, and Zhejiang); Fig. 1.

Habitat.—In mixed forests and thickets, on hillside slopes, along streams and roadsides, on dry, sandy or
clay soils; 60–1420 m.

Vernacular names.—Bai-hua-long (China; Hwang & Grimes 1996); bai-long-tiao (China, Guangdong;
Hwang 1987a); bao-jing-bai-hua-long (China; Hwang & Grimes 1996); ch’at ki k’eung [cha-ji-qiang] (China,
Guangdong; K.P. To 12200); i uen to [er-wan-tao] (China, Jiangxi; S.K. Lau 3994); kau nai ch’ai [gou-nai-chai]
(China, Guangdong; K.P. To 12200); mai tap kong (China, Guangdong; S.Y. Lau 20132); mian-zi-shu (China,
Guangdong; Hwang 1987a); miao-li-bai-hua-long (China; Hwang & Grimes 1996); sao-zhou-shu (China,
Guangdong; Hwang 1987a); tai-wan-ye-mo-li (China, Taiwan; Li 1978); takasago-egonoki (China, Taiwan;
Kanehira 1936); xiao-ye-sai-shan-mei (China; Hwang & Grimes 1996).

Conservation assessment.—Styrax faberi is one of three Chinese endemic species in Styrax series Cytra
with valvate corolla aestivation that are common and widespread. It occurs throughout eastern and southeastern
China, becoming rarer in western China. There are also small populations in northwestern Taiwan and on
Hainan Island. Collections have been made from > 150 geographic localities in a broad area, with an EOO of
ca. 1,458,704 km². Even if the EOO were to be reduced to account for the areas where S. faberi has not been
collected, the geographic distribution would remain large. There appears to be a significant amount of suitable
habitat for S. faberi throughout its distribution and the species is also locally abundant in some areas (notes on
some specimens remark on its common occurrence, e.g., R.C. Ching 2670). This species also occurs in several
protected areas in parts of its geographic range. We therefore categorize this species as Least Concern (LC).

Discussion.—Styrax faberi can usually be identified by the presence of reddish brown trichomes overtop-
ing the gray basal pubescence of the calyx; such trichomes are usually not present in other Styrax species in
the group. Other characters that separate *S. faberi* from other members of the group include the shorter petiole, which can be so short that the leaf is subsessile, and the globose to ovoid dehiscent fruit. The geographic range of *S. faberi* almost completely overlaps that of *S. confusus*. *Styrax faberi* can be distinguished from *S. confusus* by the much thinner leaves, buds, corolla lobes, pedicels, and fruit walls. Also, *S. faberi* has 3 to 5 flowers per pseudoterminal inflorescence, vs. usually 5 to 11 in *S. confusus*. The northern range of *S. faberi* also overlaps the southern range of *S. fortunei*. In addition to the distinctive trichomes on the calyx, *S. faberi* can be distinguished from *S. fortunei* by the racemes with 3 to 5 flowers per inflorescence (vs. panicles with usually with > 11 flowers per inflorescence) and never > 3 flowers in each lateral inflorescence (vs. often >> 3).

The Taiwanese populations of *Styrax faberi* have long been treated as either a species or variety. Originally the taxon was published by Matsumura (1901) as *S. rugosus var. formosanus*. Perkins (1907) recognized that this taxon did not have the long calyx teeth, imbricate aestivation, and rugose leaves of *S. rugosus* Kurz and so raised it to the species level as *S. matsumuraei*. Liu (1972) moved it back to the varietal level, but as a variety of *S. formosanus*. It is not clear why this was done, because Liu did not justify this taxonomic change. *Styrax faberi* and *S. formosanus* on Taiwan can be easily differentiated by the fruit, which is not rostrate in *S. faberi* and rostrate in all Taiwanese specimens of *S. formosanus*, and the leaf shape, which is elliptic to orbicular in *S. faberi* and rhombic in *S. formosanus*. Hwang (1980) recognized the similarity between the taxon and *S. faberi*, and considered it a variety of *S. faberi*, publishing it as *S. faberi var. matsumuraei*. However, because the epithet *formosanus* was still available at the varietal level, *S. faberi var. matsumuraei* is an illegitimate name, an error later corrected by Hwang (1994). Hwang distinguished *S. faberi var. formosanus* from the nominate variety by its orbicular leaves (vs. elliptic to obovate). Although the Taiwan specimens of *S. faberi* tend to have more orbicular leaves, orbicular leaves also occasionally appear in mainland specimens of *S. faberi*. Because of this, we subsume *S. faberi var. formosanus* under *S. faberi*.

*Styrax confusus var. microphyllus* was distinguished from *S. confusus* in the *Flora of China* by its smaller calyx (Hwang & Grimes 1996). However, upon inspection of the type, we did not find any characters to justify varietal status under *S. confusus*. The leaves and corolla lobes are much thinner than are typical for *S. confusus*. It is, however, similar to *S. faberi*, most notably in its reddish brown trichomes on the calyx that overtops the basal pubescence. The only difference between *S. faberi* and *S. confusus var. microphyllus* is the basal pubescence of the calyx, which is usually gray in *S. faberi* and yellow in *S. confusus var. microphyllus*. On this basis, we subsume *S. confusus var. microphyllus* under *S. faberi*.

*Styrax argyi* was synonymized with *S. dasyanthus* (= *S. fortunei*) in the *Flora of China*, possibly on the presence of a single pseudoterminal infructescence with 11 fruits on the K isolecotype (Hwang & Grimes 1996). However, this appears to be an anomaly, because all other pseudoterminal inflorescences on the type have 3 to 5 flowers per inflorescence, in line with *S. faberi*, and far too few flowers for *S. fortunei*. Reddish brown trichomes are also present on the calyx, although not as distinctly as in most specimens of *S. faberi*. Because of these characters, we synonymize *S. argyi* with *S. faberi*.

*Styrax faberi var. amplexifolius* was differentiated by Hwang (1980) from the nominate variety by the auriculate and amplexicaul base of the leaf. Hwang & Grimes (1996) state that this variety is endemic to Dongkou Xian, Hunan. However, we examined specimens representing a continuous range of variation between petiolate plants and amplexicaul plants throughout the distribution of *S. faberi*, without any geographical pattern to the variation. Because of this, we subsume *S. faberi var. amplexifolius* under *S. faberi*.

Although *Styrax faberi* usually has thin fruit walls, two specimens exhibit walls that are relatively thick (H.H. Chung 2067 and Yao 9221). These specimens have far too few fruits per infructescence to be *S. confusus*, and possess the reddish brown trichomes on the calyx, like *S. faberi*. These may represent introgressants with *S. confusus*.

The flowering specimen G.Z. Li 13155 is typical of *Styrax faberi* in its few-flowered inflorescences and small flowers. However, it is atypical in its mostly solitary inflorescences on each branchlet, which is not the case in typical *S. faberi*. The leaves and calyces are also much smaller than is typical for *S. faberi*. The specimen most closely resembles *S. americanus* with its small pinched calyx, narrow acute corolla lobes, and thin new
branchlets. The locality of the specimen is “Yanshan, Guilin, Guangxi”, but the label is not specific as to whether the specimen was collected in Yanshan County or specifically Yanshan Botanical Garden in Yanshan County. Thus this could be a cultivated specimen of S. americanus from the botanical garden. Alternatively, it could be a collection of an undescribed species. Given the uncertainty, we excluded this specimen from our treatment. Collecting a fruiting specimen from this area would help to determine the status of the plant.

In the protologue of Styrax faberi, four collections (syntypes) are cited by Perkins (1907): J.-M. Callery 236, E.F.L. Faber s.n., H.F. Hance 13738, and M.E. Wichura 1663. We designated H.F. Hance 13738 as the lectotype, for the following reasons. Much of the material Perkins examined was located at B and destroyed during World War II; we presume that E.F.L. Faber s.n. and M.E. Wichura 1663 were destroyed then. Although J.-M. Callery 236 and H.F. Hance 13738 both have extant specimens housed at P with Perkins’s annotation attached, H.F. Hance 13738 has more extant duplicates than J.-M. Callery 236. H.F. Hance 13738 is composed of two collections: one of flowering material collected in March 1870 from Baiyun Mountain, Guangzhou, and the other of fruiting material collected in September 1866 from Feilai Temple in Qingcheng District, Qingyuan City, Guangdong. Perkins cites the flowering collection from Baiyun Mountain in the protologue, so we have lectotypified on that collection (and the fruiting collection, being collected on a different date and thus regarded as a separate collection, is not considered type material). Of the six sheets comprising the flowering collection of H.F. Hance 13738, we chose P550872 as the lectotype over the other sheets because it is the only one that possesses Perkins’s annotation.

In the protologue of Styrax confusus var. microphyllus, two collections (syntypes) are cited by Perkins (1907): E.F.L. Faber s.n. and A. Henry 3450. Much of the material Perkins examined was located at B and destroyed during World War II; we presume that both E.F.L. Faber s.n. and A. Henry 3450 at B were destroyed then. We have not been able to find any extant material of E.F.L. Faber s.n., so we have designated A. Henry 3450 as the lectotype. Other than a photograph and fragment of the destroyed holotype at A, we have seen four extant specimens of A. Henry 3450. The P specimen with accession number P552366 does not resemble the other specimens in this collection; it instead appears to be an atypical specimen of S. fortunei with smaller calyces and abaxial laminar surfaces completely covered by stellate trichomes. This specimen should not be considered part of the type collection. Of the three remaining extant specimens, we were able to see two in person. Of these, we designate the P specimen with accession number P552367 as the lectotype because it matches attached detailed illustrations of the floral parts.

In the protologue of Styrax argyi, Léveillé (1912) cited C. d’Argy s.n. as the type, but two sheets of this specimen are housed at E, where Léveillé’s original herbarium is housed. Although both sheets have both flower buds and fruiting branches, collection dates, which would clarify whether the specimens are from one or more separate gatherings, are not provided. We designated E105262 as the lectotype over the other sheet because it possesses what is presumably Léveillé’s original label.

Diels (1926) clearly indicates H.H. Hu 861 as the holotype of Styrax iopilinus in the protologue. However, much of the material Diels examined was located at B and destroyed during World War II; we presume that the specimen of H.H. Hu 861 at B was destroyed then. All that remains of the B holotype specimen is a photograph of the holotype stored at A. We have designated the duplicate specimen of H.H. Hu 861, also stored at A, as the lectotype, because it is the only duplicate we were able to find and examine.

Additional specimens examined. CHINA. Anhui: Chien Shan Hsien [=Qianshan Qu], Tien Chu Shan [=Tianzhu Shan], [31.062°N, 116.188°E], 200 m, 13 Jun 1936 (fr), C. S. Fan & Y.Y. Li 78 (A, L); [Qingyang Xian], Chu Hwa Shan [=Jiuhua Shan], [30.482°N, 117.804°E], 2 May 1925 (fr), R.C. Ching 2670 (A); Fujian: central Fukien [=Fujian], Apr–Jun 1905 (fr), S.T. Dunn 2809 (A), [Changting Xian], Guilong Shan, [25.606°N, 119.356°E], 21 Jul 1958 (fr), C.S. Fan & Y.Y. Li 78; [Jiangbei Xian], Ling-Soik Temple [=Linshi Temple?], 200 m, 13 Jun 1936 (fr), J.-M. Callery 236; Hok-Chiang [=Fuqing Shi], Ling-Soik Temple [=Linshi Temple?] and vicinity, [25.606°N, 119.356°E], 21 May 1927 (fr), S.G. Tang 13194; Hok-Chiang [=Fuqing Shi], Ling-Soik Temple [=Linshi Temple?] and vicinity, [25.606°N, 119.356°E], 27 May 1927 (fr), S.G. Tang 15148 (A); Ingkoh Hsien [=Yongtai Xian], Taishan[n] [=Taishan], [25.887°N, 119.093°E], 18 Apr 1924 (fr), H.H. Chung 2622 (A, K); Ingkoh [=Yongtai Xian], Fang-Quang-Yen [=Fangguang Yan], [25.887°N, 119.093°E], 10 May 1928 (fr), H.H. Chung 7976 (A); Ingkoh [=Yongtai Xian], Huong-guong Nang [=Fangguang Yan], Temple near Gak-liang [=Geling], [25.892°N, 119.093°E], 19 Mar 1927 (fr), S.G. Tang 13194 (A), Ingkoh [=Yongtai Xian], Huong-guong Nang [=Fangguang Yan], Temple near Gak-liang [=Geling], [25.892°N, 119.093°E], 4 Oct 1927 (fr), S.G. Tang 16502 (A); Ingkoh [=Yongtai Xian], locality unknown, [25.9°N, 118.933°E], 11 May 1928 (fr), H.H. Chung 7696 (A);
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

This document is intended for digital-device reading only.

Li and Fritsch, Taxonomic revision of Styrax series Cyrta
Zhao 339
Y.C. Lin 204
G.S. He 4446 (MO); locality
Apr 1931 (fr), Y.C. Lin 204 (KUN), Ying-tak District [=Yingde Shi], Canton or Hainan, (fl), W.R. Carles s.n. (E), Canton [=Guangzhou Shi], locality unknown, [23.133°N, 114°E], 6 May 1928 (fr), K’tung 78 5888 (BM); 
[=Baiyun Mountain], [23.187°N, 113.295°E], 19 Mar 1887 (fl), B.C. Henry 13738 (BM); Canton [=Guangzhou Shi], locality unknown, [23.133°N, 113.267°E], 30 May 1875 (fr), S.Q. Chen 7184 (CAS); [Boluo Xian], Luo-fu Shan, [23.3°N, 114°E], 26 Apr 1978 (fr), Z.Y. Li 468 (BM); 
[=Xinfeng Xian], Ngok Shing Shan [=Yuecheng Shan], Sai-lin-shan Village [=Xilianshan Cun], [24.097°N, 114.246°E], 1–16 Apr 1938 (fl), X.W. Wang 141 (BM); Shixing Xian, locality unknown, [24.843°N, 114.144°E], 30 May 1958 (fr), Z.Y. Li 468 (BM); Port back to village, 25 Aug 1931 (fl), Y. Tsang 570 (KUN); 
[San-ning City [=Taishan], [22.25°N, 112.783°E], May 1875 (fr), C. Wang 42518 (KUN, MO); [Renhua Xian], Danxia Shan summit, [25.032°N, 113.745°E], 29 Apr 1940 (fr), J.L. Zuo 21642 (KUN), Nanxiong Xian, Baishun Xiang [=Baishun Zhen], Dongdi She, Shiquanli, [25.259°N, 114.068°E], 25 Apr 1938 (fr), C.O. Levine 3154 (A); [Yingde Shi], Wentang Shan, Peikeng, [24.342°N, 113.671°E], 25 Aug 1931 (fr), Z.B. Liu 339 (KUN); 
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

This document is intended for digital-device reading only.

Li and Fritsch, Taxonomic revision of Styrax series Cyrta
Zhao 339
Y.C. Lin 204
G.S. He 4446 (MO); locality
Apr 1931 (fr), Y.C. Lin 204 (KUN), Ying-tak District [=Yingde Shi], Canton or Hainan, (fl), W.R. Carles s.n. (E), Canton [=Guangzhou Shi], locality unknown, [23.133°N, 114°E], 6 May 1928 (fr), K’tung 78 5888 (BM); 
[=Baiyun Mountain], [23.187°N, 113.295°E], 19 Mar 1887 (fl), B.C. Henry 13738 (BM); Canton [=Guangzhou Shi], locality unknown, [23.133°N, 113.267°E], 30 May 1875 (fr), S.Q. Chen 7184 (CAS); [Boluo Xian], Luo-fu Shan, [23.3°N, 114°E], 26 Apr 1978 (fr), Z.Y. Li 468 (BM); 
[=Xinfeng Xian], Ngok Shing Shan [=Yuecheng Shan], Sai-lin-shan Village [=Xilianshan Cun], [24.097°N, 114.246°E], 1–16 Apr 1938 (fl), X.W. Wang 141 (BM); Shixing Xian, locality unknown, [24.843°N, 114.144°E], 30 May 1958 (fr), Z.Y. Li 468 (BM); Port back to village, 25 Aug 1931 (fl), Y. Tsang 570 (KUN); 
[San-ning City [=Taishan], [22.25°N, 112.783°E], May 1875 (fr), C. Wang 42518 (KUN, MO); [Renhua Xian], Danxia Shan summit, [25.032°N, 113.745°E], 29 Apr 1940 (fr), J.L. Zuo 21642 (KUN), Nanxiong Xian, Baishun Xiang [=Baishun Zhen], Dongdi She, Shiquanli, [25.259°N, 114.068°E], 25 Apr 1938 (fr), C.O. Levine 3154 (A); [Yingde Shi], Wentang Shan, Peikeng, [24.342°N, 113.671°E], 25 Aug 1931 (fr), Z.B. Liu 339 (KUN); 
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

This document is intended for digital-device reading only.

Li and Fritsch, Taxonomic revision of Styrax series Cyrta
Zhao 339
Y.C. Lin 204
G.S. He 4446 (MO); locality
Apr 1931 (fr), Y.C. Lin 204 (KUN), Ying-tak District [=Yingde Shi], Canton or Hainan, (fl), W.R. Carles s.n. (E), Canton [=Guangzhou Shi], locality unknown, [23.133°N, 114°E], 6 May 1928 (fr), K’tung 78 5888 (BM); 
[=Baiyun Mountain], [23.187°N, 113.295°E], 19 Mar 1887 (fl), B.C. Henry 13738 (BM); Canton [=Guangzhou Shi], locality unknown, [23.133°N, 113.267°E], 30 May 1875 (fr), S.Q. Chen 7184 (CAS); [Boluo Xian], Luo-fu Shan, [23.3°N, 114°E], 26 Apr 1978 (fr), Z.Y. Li 468 (BM); 
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

604 Journal of the Botanical Research Institute of Texas 12(2)

Hainan: prope oppidum Tsching Dschen [=near town of Qingzhen], [26.55°N, 106.467°E], 1200 m, 26 Jun 1917 (fr), H.F. Handel-Mazzetti 10457

Hunan: (GH); Ichang [=Yichang Shi], locality unknown, [30.717°N, 111.283°E], Sep 1886 (fl), (K); Ichang [=Yichang Shi], locality unknown, A. Henry 1155

Jiangsu: E-shing [=Xingyi Shi], locality unknown, [31.217°N, 119.698°E], 21 Jun 1942 (fr), C.W. Cheng et al. 4825

Yunnan: Sinning Hsien [=Xinning Xian], Ma-Ling-Tung [=Malin Zizhixian, Daxi Xiang, Limu Cun, Guanchong], 24°46’59.1”N, 111°54’4.6”E, 524 m, 2 Aug 2007 (fr), S.Q. Zhong A6020587 (KUN); Dong'an Xian, Mt. Shunhuangshan, [26.365°N, 111.015°E], 270 m, 25 Apr 2004 (fr), J.K. Liu 470

Hubei: Hefeng Xian, Xima Gongshe, Baiguo Ping, Sunjia Ping, [30.108°N, 110.217°E], 8 May 1939 (fr), H.J. Li 322 (KUN)

Hunan: Changning Hsien [=Changning Shi], I-Chia-Ao, [26.351°N, 112.417°E], 220 m, 23 Jun 1935 (fr), C.F. Liang 31682

Hunan: An Yüan Hsien [=Anyuan Qu], locality unknown, [25.246°N, 115.371°E], 7 Jan 1921 (fr), F.N. Wei 154

Yunnan: Sinning Hsien [=Xinning Xian], Ma-Ling-Tung [=Malin Zizhixian, Daxi Xiang, Limu Cun, Guanchong], 24°46’59.1”N, 111°54’4.6”E, 524 m, 2 Aug 2007 (fr), S.Q. Zhong A60311 (P); Pingnan Xian, Yao Shan, [23.55°N, 110.383°E], 300 ft, 16 Apr 1936 (fr), C. Wang 39012 (A); Pingnan Xian, locality unknown, [23.55°N, 110.383°E], 22 May 1936 (fr), C. Wang 38253 (MO); Yixing Shi, Yueya Shan [prope oppudium Tsingchen Shi], prope oppudium Tsingchen Shi, [26.55°N, 110.667°E], 1200 m, 20 Jun 1917 (fr), H.F. Handel-Mazzetti 10457 (E).
Li and Fritsch, Taxonomic revision of Styrax series Cyrta

Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

Zhejiang:

- Anhui Shi, Tongchuan Qian, [27.42°N, 119.3°E], 200 m, 13 Jul 1958 (fr), S.S. Lai et al. 3245 (KUN).
- Zhejiang: [Xihu Qu], Xiaohe Shan, [30.203°N, 120.031°E], 26 Jun 1959 (fl), S.Y. Zhang 5881 (CAS).
- Hang Chow [=Hangzhou Shi], locality unknown, [30.25°N, 120.167°E], Jun 1922 (fr), J. de La Touche s.n. (E).
- Xinzhu Wangkaoliao [=Dadu Shan Wanggaoliao], 24°9'3"N, 120°34'51"E, 235 m, 29 Oct 2007 (fl/fr), S.Y. Chang 30251 (CAS).
- Shanghai Shi, Xuying Zhen, [31.573°N, 121.297°E], 600 m, 31 Aug 1965 (fl), S.S. Lai et al. 4861 (KUN).
- Yongxiu Xian, Yunshan, [27.79°N, 118.383°E], 250 m, 2 Aug 1963 (fr), M.X. Nie et al. 6803 (KUN).
- Xunwu Xian, Guizhumao Forestry Center, [24.93°N, 115.533°E], 650 m, 10 May 1958 (fr), C.H. Hu B1875 (KUN).


Shrubs or trees to 12(–15) m tall. Young branchlets yellowish, scattered with yellow stellate trichomes; older branchlets dark brown, glabrous. Petiole 7–17 mm long, with tightly appressed stellate trichomes on abaxial surface, trichome arms up to 0.05–0.14 mm long. Two [as proximal leaves on each shoot alternate. Lamina of fertile shoots 4.9–12.5 × 2.6–5.5 cm, those of sterile shoots to 17.4 × 8.6 cm, 1.5–2.5(–2.9) × as long as wide, subcoriaceous, obovate to elliptic, occasionally narrowly elliptic, rarely ovate; abaxial surface yellowish green when dry, with sparse yellow stellate trichomes, trichome arms up to 0.06–0.3 mm long, pubescence dense in axils of midvein and secondary veins and sparse on whole surface, with largest trichomes along midvein; adaxial surface brown to brownish green when dry, nearly glabrous or with very sparse yellow stellate trichomes, trichome arms up to 0.05–0.23 mm long, pubescence situated along midvein and rarely on proximal secondary veins; base cuneate to broadly cuneate, occasionally slightly oblique; margin entire to weakly serrulate or crenate towards apex; apex acute, occasionally slightly acuminate, occasionally slightly oblique, rarely emarginate; secondary veins 5 to 7 on each side of midvein, abaxially prominent, adaxially plane or sunken, tertiary veins reticulate, abaxially prominent, adaxially plane. Fertile shoots 7.5–15.5(–18.6) cm long, 2–4-leaved. Lateral inflorescences racemose, 1.5–3.1 cm long, 1–5-flowered; pseudoterminal inflorescences racemose, rarely subpaniculate, with well-spaced nodes, 3.6–7.6 cm long, 4–10–(to 14-)flowered, rachis yellow, completely covered with stellate trichomes. Pedicel (5–)7–14(–18) mm long, with dense short-armed yellow appressed stellate trichomes and scattered long-armed yellowish brown erect stellate trichomes; bracteoles 1.8–4.3 mm long, linear or subulate, positioned on basal half of pedicels. Flowers 1.6–2.1 cm long. Calyx 5–6(–7) × 5–6 mm, cupuliform, rarely funnelform; abaxially faintly striate with dense short-armed yellow appressed trichomes and scattered long-armed yellowish brown erect stellate trichomes, usually with trichomes becoming less dense towards calyx margin, trichome arms up to 0.12–0.28(–0.4) mm long; adaxially brown with scattered 2- or 3-ranked trichomes; margin with 5(or 6) evenly distributed teeth 0.2–0.8 mm long; marginal teeth deltoid or obtuse, contiguous, densely pubescent on both surfaces. Corolla 1.2–1.9 cm long, white, tube (1.5–)3.3–6.9 mm long, abaxial surface proximally glabrous and distally with stellate trichomes, lobes 5(or 6), 8.6–14.4 × 2.7–3.4(–4.5) mm, subcoriaceous, oblong to lanceolate, apex acute, abaxially completely covered with pale yellow appressed stellate trichomes, occasionally becoming sparser towards tube, adaxially glabrous except margins or with sparse 2- or 3-ranked trichomes. Stamens 10(or 11); filaments 2–5.3 mm long, flexuose, widest at middle, proximally dense with stellate trichomes, distally glabrous; anthers 4.2–7.4 mm long, wider than distal portion of filament, with sparse yellow stellate trichomes; connective with yellow stellate trichomes. Style 1.3–1.6 cm long, proximally dense with white stellate trichomes, distally glabrous; stigma 0.2–0.5 mm wide, pectiform. Fruiting calyx 4–8 × 6–13 mm, funnelform, rarely cupuliform. Fruit 1.4–4 × 0.6–2.5 cm, indehiscent or rarely showing signs of partial dehiscence at base of fruit (dried material), oblique-ovoid to oblique-ellipsoid, rarely ovoid to ellipsoid, apex pointed to rostrate, rostrum up to 10 mm long, rarely obtuse; pericarp dry, 0.6–2 mm thick, outside smooth to rugose, with dense yellowish brown appressed stellate trichomes, inside rugose, with scattered stellate trichomes. Seeds light brown to brown, ovoid, rugose, with stellate trichomes.

Illustrations.—Guillaumin 1933:981, fig. 113 (1–3) (as S. agrestis); Anonymous 1974:340, fig. 4633 (as S. agrestis); Chen 1974:182, fig. 652; Hwange 1987a:390, fig. 424 (as S. agrestis); Hwang 1987b:114, pl. 39 (1–6) (as S. agrestis); Svengsuksa & Vidal 1992:173, pl. 31 (7–9) (as S. agrestis var. agrestis); Wu & Raven 2000:208, fig. 208 (1–6) (as S. agrestis).

Distribution.—China (Hainan) and Vietnam (Da Nang, Ha Noi, Lao Cai, Ninh Binh, Quang Nam, Quang Tri, Thua Thien-Hue, and Vinh Phuc); Fig. 4.

Habitat.—In a variety of forests, growing on poor schistose, sandy, or granitic soils; 90–1500 m.

Vernacular names.—Cay lim (Vietnam; Guillaumin 1924); cay lo nghe (Vietnam, Thua Thien-Hue; E. Poilane 27691); cay ne (Vietnam, Ha Son Binh; Svengsuksa & Vidal 1992); cay o rep (Vietnam, Da Nang; E. Poilane 1588); chi-nian (China, Hainan; Chen 1974); deng dao (Vietnam, Ha Son Binh; Svengsuksa & Vidal 1992); dök kaux (Laos, Xiangkhoang; Svengsuksa & Vidal 1992); hui-guo-an-xi-xiang (China; Hwang & Grimes 1996); nan-yue-ye-mo-li (China; Anonymous 1974); o rep (Vietnam, Quang Nam-Da Nang; Svengsuksa & Vidal 1992); po loi co (Vietnam, Binh Tri Thien; Svengsuksa & Vidal 1992); tat rung (Vietnam, Quang Nam-Da Nang; Svengsuksa & Vidal 1992); van tac (Vietnam, Binh Tri Thien; Svengsuksa & Vidal 1992).

Conservation assessment.—Styrax finlaysonianus occurs in northern and central Vietnam and the southern side of Hainan, China. Collections have been made from > 20 geographic localities in a broad area, with an EOO of ca. 202,510 km². Even if the EOO were to be reduced to take into account areas in which S. finlaysonianus has not been collected, the geographic distribution would remain large. There appears to be a significant amount of suitable habitat for S. finlaysonianus throughout its distribution. This species also occurs in several protected areas in parts of its geographic range. We therefore categorize this species as Least Concern (LC).

Discussion.—Styrax finlaysonianus is the only member of the valvate species of S. series Cyrtia with subentire to entire leaves. The fruits are also distinctly larger than any others in this group, attaining a size of as
much as 4 × 2.5 cm (vs. at most, 2 × 1.3 cm). Its range overlaps that of *S. agrestis* but it can be distinguished from this species by its larger ovoid fruits with walls usually >0.6 mm thick (vs. smaller, narrow-ellipsoid, and fruit walls <0.2 mm thick). *Styrax finlaysonianus* also usually has subentire leaves (vs. serrulate). Further differences between the two species and their shared taxonomic history are discussed under *S. agrestis*.

The distinctive thick-rostrate ovoid fruit of *Styrax finlaysonianus* readily distinguishes it from *S. faberi*, which also occurs rarely on Hainan but which has a smaller globose or ellipsoid fruit that lacks a rostrum. The seed of *S. finlaysonianus* is also densely stellate pubescent, vs. the glabrous seeds of *S. faberi*. Furthermore, the petiole of *S. finlaysonianus* is longer than that of *S. faberi* (>7 mm vs. <5 mm). *Styrax finlaysonianus* can rarely have fruit that resembles *S. serrulatus* in shape but can be distinguished from this species by its rugose, stellate-pubescent seeds (vs. smooth and glabrous). Furthermore, the fruit of *S. finlaysonianus* is indehiscent, whereas that of *S. serrulatus* can be dehiscent or indehiscent.

The name *Styrax finlaysonianus* was originally coined by Wallich (1828) in his catalogue of herbarium specimens that he distributed on behalf of the British East India Company. Lacking any descriptive information in the catalogue, the name was validly published by Don (1837). The description was slightly inaccurate, however, because the specimen is not notably canescent on the abaxial side of the leaves. The fruit is an important feature for the taxonomy of this species, but the type lacks fruiting material. This resulted in a vague protologue description that was easy to misinterpret. Perhaps because they did not have access to type material, Svengusksa & Vidal (1992) misapplied the name to a species in *S. series Benzoin*, apparently based purely on the description of Don. From our inspection of the type material, it is clear that the type is a specimen from *S. series Cytra*: it has chartaceous leaves that are not likely to be evergreen. Furthermore, the type has stamens with pubescence only covering the proximal half of the filament, vs. later collections under this name that have pubescence covering the whole filament. The *S. series Benzoin* specimens considered to be *S. finlaysonianus sensu* Svengusksa & Vidal (1992) should be re-evaluated for its species status because they appear to have a uniquely shaped fruit versus others in the series, which may warrant the recognition of a distinct species.

The locality for the type of *Styrax finlaysonianus* was indicated neither on the sheet nor in Wallich's catalogue. Don's (1837) protologue only mentions that the species is a “native of the East Indies.” Clarke (1882) cites the type as probably from Cambodia, but provides no clarification as to why it was thought to be from there; Perkins (1907) and Svengusksa & Vidal (1992) repeated Clarke's claim. Wallich's list indicates that the specimen originated from the personal herbarium of George Finlayson, a Scottish botanist who collected in Southeast Asia, specifically from Siam (Thailand) to Hue, Vietnam (Finlayson 1826). Thus, Finlayson collected in the vicinity where other specimens of this species were gathered, suggesting that the type was collected from there.

*Styrax subcrenatus* was described by Handel-Mazzetti (1931) from a specimen collected in Hainan. Handel-Mazzetti compared the species to *S. confusus*, likely noticing the similarly thick corolla lobes and leaves. However, *S. subcrenatus* has subentire leaves, like *S. finlaysonianus* and unlike any other species in the study group. On this basis, we synonymize *S. subcrenatus* and *S. finlaysonianus*.

Fruits of *Styrax finlaysonianus* are generally the largest within the study group (generally >2 cm long and >1 cm wide). Of this species also have thick pericarp walls (generally >1 mm) that are generally smooth. The seeds of *S. finlaysonianus* are often densely covered with stellate trichomes. There are, however, a number of specimens of *S. finlaysonianus* with mature fruits that are smaller and have thinner, rugose pericarp walls. Oftentimes, the seeds in these fruits have stellate trichomes that are very sparsely distributed, requiring some effort to locate. Although most of these specimens occur in Central Vietnam in or around Bach Ma National Park (e.g. *N.T. Cuong et al. HN-NY 401*, *D.S. Penneys et al. 2138*, *E. Poilane 27649* and *27691*), there are also specimens from outside of this region that possess combinations of these characters, including the only fruiting specimen we examined in depth from North Vietnam (*F. Fleury 37821*), as well as a number of other specimens from Hainan (e.g. *H. Fung 2264*, *T. Tuyama et al. 81149*). Two recent collections from Bach Ma National Park (*N.T. Cuong et al. HN-NY 401* and *D.S. Penneys et al. 2138*) have similarly small rugose fruit with relatively thin walls, whereas a third recent collection from the park (*Hai et al. HN-NY 942*), also in mature
fruit, has much larger smooth fruit with much thicker walls, suggesting that two taxonomic entities may currently reside within our concept of *S. finlaysonianus*. We cannot detect any other differences among the specimens, although the leaves of the two rugose-fruited specimens appear to be slightly smaller, and we lack sufficient data to confidently resolve this problem. Of particular help would be field investigation in Bach Ma National Park to observe and collect more fruiting specimens, as well as to tag the plants and return to collect them in flower. Chromosome counts of the two morphs might also uncover a higher ploidy level in the larger-fruited specimens.

The flowering collection Q.F. Liang 14 has short-armed trichomes on the petiole and entire leaves, as in *Styrax finlaysonianus*, but the flowers are atypically small and the corolla lobes atypically thin for the species. The locality on the specimen label is “Institute of Forestry,” which may be in Guangdong because the specimen label originates from the South China Botanical Garden. If so, then the specimen is an outlier geographically from the rest of *S. finlaysonianus*. The collection is also similar to *S. faberi* in its reddish brown trichomes over-topping the basal pubescence of the calyx, small flowers, and few flowers per inflorescence. However, the alternate leaves at the base of each shoot, short-armed trichomes on the petiole, and entire leaf margins all serve to exclude it from this species. This specimen may represent an undescribed species, but without a more accurate locality it will be difficult to conduct a field search for other plants that resemble it. We have excluded this specimen from our species descriptions.

Svensuksa & Vidal (1992) cite Wallich 4403 as the holotype of *Styrax finlaysonianus*. However, in the protologue of *S. finlaysonianus*, Don does not cite in which herbarium the specimen was deposited. As we have discussed under the discussion of the typology *S. Fukienensis* (= *S. confusus*), the term holotype would be incorrect, and we are recognizing it as a lectotype designation.


VIETNAM. Da Nang: [Huyen Hoa Vang], 15 km de Mt. Bana [=Ba Na Hills], [15.996°N, 107.994°E], 20 May 1941 (fr), J. Vidal 8194 (P), [Huyen Hoa Vang], BNa Hills, [15.996°N, 107.994°E], 200 m, 11 Jul 1923 (fr), E. Poilane 7073 (A, P), [Huyen Hoa Vang], Ba Na Hills, [15.996°N, 107.994°E], 9 Mar 1939 (fr), E. Poilane 29308 (P[2]); [Huyen Hoa Vang], Bana, [15.996°N, 107.994°E], 14 Jun 1920 (fr), E. Poilane
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

6. Styrax formosanus Matsum., Bot. Mag. (Tokyo) 15:75. 1901 [as S. "formosanum"]. Type: CHINA. TAIWAN: [Taichung Shi], Touskeikusa [= Dongshi Qu], [24.238°N, 120.828°E], Mar 1896, A. Tasko 81A (LECTOTYPE, designated here: T1!).


Shrubs or trees to 8 m tall. Young branchlets grayish green to brown, with dense yellow to brown stellate trichomes, rarely with scattered erect longer simple or 2- or 3-armed trichomes; older branchlets brown, glabrous. Petiole 3–7 mm long, with dense to occasionally scattered appressed or erect yellow stellate trichomes, rarely with scattered erect longer simple or 2- or 3-armed trichomes, trichomes or trichome arms to 0.06–0.29 (–1.1) mm long. Two most proximal leaves on each shoot subopposite, rarely alternate. Lamina of fertile shoots 2.3–6.3 × 1.1–2.7 cm, those of sterile shoots to 9 × 4.7 cm, 1.6–3.2 × as long as wide, chartaceous, rhombic to narrow-rhombic, occasionally obovate; abaxial surface green to greenish brown when dry, with yellow stellate trichomes, rarely with sparse reddish brown stellate trichomes or scattered longer simple or 2- or 3-armed trichomes, trichomes or trichome arms to 0.13–0.5 (–0.79) mm long, pubescence scattered on whole surface, trichomes denser and larger in axils of midvein and secondary veins; adaxial surface dark green to brown when dry, with yellow stellate trichomes, rarely with scattered longer simple or 2- or 3-armed trichomes, trichomes or trichome arms to 0.05–0.37 (–0.47) mm long, pubescence mostly along veins, occasionally scattered over whole surface; base cuneate to acute; margin serrulate to serrate, occasionally with some teeth much larger than others; apex short-acuminate to acute, occasionally acuminate, rarely rounded or emarginate; secondary veins 3 to 5 on each side of midvein, abaxially prominent, adaxially plane, tertiary veins reticulate, abaxially prominent, adaxially plane. Fertile shoots 2.6–7.4 cm long, 2- to 4-leaved. Lateral inflorescences racemose, 1.2–3.3 cm long, 1- or 2-flowered; pseudoterminal inflorescences racemose, with well-spaced nodes, 1.5–5 cm long, (1- to)3- to 6-flowered, rachis brown, very dense with yellow stellate trichomes, rarely with scattered erect longer simple or 2- or 3-armed trichomes. Pedicel 7–18 (–22) mm long.
completely covered with short-armed yellow appressed stellate trichomes and scattered long-armed yellow stellate trichomes, rarely with scattered erect longer simple or 2- or 3-armed trichomes; bracteoles 0.7–3.2 mm long, linear or subulate, positioned in middle of pedicels, rarely at base. Flowers 0.7–2.1 cm long. Calyx 3–5 × 4–5–(6) mm, cupuliform to funnelform; abaxially completely covered with short-armed yellow appressed stellate trichomes and scattered long-armed yellow stellate trichomes, rarely with scattered simple or 2- or 3-armed trichomes, with trichomes becoming less dense within 1–2 mm of calyx margin, margin brown and scarious, arms of trichomes to (0.11–)0.28–0.84(–0.95) mm long; adaxially yellowish brown to brown with scattered 2- or 3-armed trichomes; margin with 4 to 7 unevenly distributed teeth with unevenly deep sinuses, or occasionally evenly distributed teeth 0.3–0.9 mm long; marginal teeth deltoid to lanceolate, not contiguous, pubescent on both surfaces. Corolla (0.7–)1.1–1.8 cm long, white, tube 1.5–2.6 mm long, abaxial surface proximally glabrous and distally covered with stellate trichomes, lobes 4 or 5, (5.3–)8.6–15.5 × 2–4.2 mm, chartaceous, oblong to lanceolate, apex acute, abaxially completely covered with pale yellow appressed stellate trichomes, adaxially with pale yellow stellate pubescence, denser at apex. Stamens 8 to 10; filaments 2.9–6.3 mm long, straight, widest at base, proximally dense with stellate trichomes, distally glabrous; anthers 2.9–6.4 mm long, wider than distal portion of filament, with sparse to rarely dense yellow stellate trichomes; connective with sparse yellow stellate trichomes. Style 1.1–1.9 cm long, glabrous, with stellate trichomes at base; stigma 0.2–0.5 mm wide, punctiform, rarely capitate. Fruit calyx 3–4(–5) × 5–8 mm, funnelform to salverform. Fruit 0.7–1.2 × 0.5–0.8 cm, dehiscent by three valves at base, rarely at apex, ovoid to ellipsoid, apex pointed to rostrate to 5 mm, very rarely rounded; pericarp dry, 0.12–0.47 mm thick, outside slightly rugose, with dense grayish brown appressed stellate trichomes, inside glabrous, occasionally with sparse stellate trichomes at apex, smooth. Seeds tan to brown, ovoid, smooth with shallow longitudinal grooves and deep longitudinal fissures, glabrous.

**KEY TO THE VARIETIES OF STYRAX FORMOSANUS**

6a. Long simple or 2- or 3-armed trichomes absent on young branchlets, leaf surfaces, petioles, rachises, pedicels, and calyces; petiole trichome length 0.06–0.29 mm

6a. var. formosanus

6b. Long simple or 2- or 3-armed trichomes present, scattered on young branchlets, leaf surfaces, petioles, rachises, pedicels, and calyces; petiole trichome length 0.61–1.1 mm

6b. var. hirtus

**6a. Styrax formosanus var. formosanus**

Young branchlets grayish green to brown, with dense yellow to brown stellate trichomes. Petiole with dense to occasionally scattered appressed or erect yellow stellate pubescence, trichome arms to 0.06–0.29 mm long. Lamina abaxial surface green to greenish brown when dry, with yellow stellate trichomes, rarely with sparse reddish brown stellate trichomes, trichome arms to 0.13–0.5 mm long, pubescence scattered on whole surface, trichomes denser and larger in axils of midvein and secondary veins; adaxial surface dark green to brown when dry, with yellow stellate trichomes, trichome arms to 0.05–0.37 mm long, pubescence mostly along veins, occasionally scattered over whole surface. Rachis brown, very dense with yellow stellate trichomes. Pedicel completely covered with short-armed yellow appressed stellate trichomes and scattered long-armed yellow stellate trichomes. Calyx abaxially completely covered with short-armed yellow appressed stellate trichomes and scattered long-armed yellow stellate trichomes, arms of trichomes to (0.11–)0.28–0.84 mm long.

**Illustrations.**—Hayata 1912:120, pl. 21; Hayata 1915:121, fig. 41; Kanehira 1936:605, fig. 562; Liu 1962:1039, pl. 864; Li 1963:752, fig. 602; Li 1978:110, pl. 993; Hwang 1987b:120, pl. 41 (1–5); Liu 1989:355, fig. 288; Li 1998:98, pl. 41; Wu & Raven 2000:210, fig. 210 (1–6). **Phenology.**—Flowering: January–May, October–November. Fruiting: April–October. **Distribution.**—China (Fujian, Guangdong, Jiangxi, Taiwan, and Zhejiang); Fig. 5. **Habitat.**—In broadleaf and mixed forests, on hillside slopes, in exposed sites and roadsides; 0–2350 m. **Vernacular names.**—Fen-qi-hu-ye-mo-li (China, Taiwan; Li 1978); funkiko-egonoki (China, Taiwan; Mori 1935); henrii-egonoki (China, Taiwan; Sasaki 1928); hioh-e-peh (China, Taiwan; Sasaki 1928); kazu-yun (China, Taiwan; Sasaki 1928); kazimu (China, Taiwan; Sasaki 1928); o-koe-bu (China, Taiwan; Sasaki 1928); kosyun-egonoki (China, Taiwan; Sasaki 1928); o-phe-kiu-kiong (China, Taiwan; Sasaki 1928).
Conservation assessment.—*Styrax formosanus* var. *formosanus* occurs commonly throughout Taiwan and rarely on mainland China (from Zhejiang southwest to Guangxi). Collections have been made from > 70 geographic localities in a broad area, with an EOO of ca. 391,522 km². Even if the EOO were to be reduced to take into account areas in which *S. formosanus* var. *formosanus* has not been collected, the geographic distribution would remain large. There appears to be a significant amount of suitable habitat for *S. formosanus* var. *formosanus* throughout its distribution and it is also locally abundant in some areas (notes on some specimens remark on its common occurrence, e.g., Y.C. Kao & S.H. Lai 292). This species also occurs in several protected areas in parts of its geographic range. We therefore categorize this variety as Least Concern (LC).

Additional specimens examined. **China.** Fujian: Jiangle Xian, Longxishan, 117.27°E, 700–1000 m, 11 Jun 1991 (fr), Longxi Mt. Exped. 1301 (CAS). Guangdong: Lianshan Zhanzhu Yaozhou, Zizhixian, Daxu Shan, Guannen Ling, [24.9°N, 112.07°E], 850 m, 3 Jun 1958 (fr), P.X. Tan 518283 (KUN). Jiangxi: Anyuan Qu, Duijiang Xiang, Huang Di, [25.33°N, 115.45°E], 600 m, 17 Jun 1958 (fr), C.M. Hu 2708 (KUN); Anyuan Qu, Duijiang Xiang, Huang Di, [25.33°N, 115.45°E], 600 m, 17 Jun 1958 (fr), C.M. Hu 2709 (KUN); Huichang Xian, Shiba Xiang, Chutou Keng, [25.46°N, 115.74°E], 19 Jun 1958 (fr), Anonymous 2845 (KUN); Jinggangshan Shi, Heng Keng, [26.59°N, 113.92°E], 1200 m, 13 Jul 1965 (fr), S.S. Lai et al. 4434 (KUN); Nanfeng Xian, Shan Qu (Yi Qu), [27.22°N, 116.36°E], 4 May 1958 (fr), M.X. Nie & S.S. Lai 2449 (KUN). **Taiwan:** Hsichu [Xinzhu Xian], Hu-Kou [Xiang], [24.9°N, 121.0°E], 4 Apr 1985 (fr), M.T. Kao 10075 (MO); Hsinchu Hsien [Xinzhu Xian], Chienhsih Hsiang [Jianshi Xiang], Yuanyanghu Natural Preserved Area, along the trail of the lake, 24°34′16″N, 121°24′37″E, 1670 m, 8 May 1995 (fr), H.Y. Shen et al. 741 (MO), Hualien Hsien.
Li and Fritsch, Taxonomic revision of Styrax series Cyrta 613

Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
Shan], [23.171°N, 121.552°E], 19 Jun 1984 (fr), S.C. Chen 65 (L); Taipei City [=Taipei Shi], Chushingshan [=Qixing Shan], [25.171°N, 121.552°E], 17 Jun 1984 (fr), S.C. Chen & E.L. Kuo 75 (MO); Taipei City [=Taipei Shi], Mt. Yangmings, [25.167°N, 121.364°E], 19 Jul 1985 (fr), T.C. Huang 9713 (TAI); Taipei Hsien [=Xinbei Shi], Hsichih Town [=Xihih], hiking trail between Changtzuotoushan [=Jiangzuo Shan] and Changtzuotoushan [=Jiangziao Shan], 23°31′, 121°43′34″E, 630 m, 3 Mar 1998 (fr), Y.C. Kao & S.H. Lai 292 (CAS); Taipei Hsien [=Xinbei Shi], Kungliao Hsiang [=Gongliang Xiang], Laolanshan: hiking trail near Kunglankung [=Gonglankong], 23°05′34″N, 121°57′37″E, 300 m, 19 Mar 1998 (fr), Y.C. Kao & S.H. Lai 337 (CAS); Taipei Hsien [=Xinbei Shi], Sanhsia [=Sanxia District], Manyueyuotian [=Manyueyu], 18450 ft, 24 Jul 1999 (fr), Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.


Young branchlets brown, scattered with yellowish brown stellate trichomes and erect longer simple or 2- or 3-armed trichomes. Petiole with scattered appressed yellow stellate pubescence and erect longer simple or 2- or 3-armed trichomes, trichome or trichome arms to 0.61–1.1 mm long. Lamina abaxial surface light brown when dry, with yellow stellate trichomes and scattered longer simple or 2- or 3-armed trichomes, trichome or trichome arms to 0.53–0.79 mm long, pubescence scattered on whole surface, trichomes larger along veins; adaxial surface brown when dry, with yellow stellate trichomes and scattered longer simple or 2- or 3-armed trichomes, trichome or trichome arms to 0.27–0.47 mm long, pubescence scattered over whole surface, trichomes denser along midvein. Rachis brown, very dense with brown stellate trichomes and scattered with erect longer simple or 2- or 3-armed trichomes. Pedicel completely covered with short-armed yellow appressed stellate trichomes and scattered longer simple or 2- or 3-armed trichomes, arms of trichomes to 0.4–0.95 mm long.

Illustrations.—Zheng 1989:92, fig. 5-122; Liu 1991:69, fig. 1774.

Phenology.—Fruiting: June, August, September.

Distribution.—China (Guangxi, Hunan, and Zhejiang); Fig. 5.

Habitat.—On mountain slopes, along roadsides; 800 m.

Vernacular names.—Chang-rou-mao-an-xi-xiang (China; Hwang & Grimes 1996).
Conservation assessment.—Styrax formosanus var. hirtus is only known from four localities in mainland China: one in Guangxi, one in Hunan, and two in Zhejiang. The EOO is 48,791 km² and AOO is 16 km². All the known collections of this variety were collected in 1959. Although one of the subpopulations appears to occur in a protected area, the Dayaoshan National Nature Reserve, the other three appear to occur in areas that have been heavily altered by deforestation. From satellite imagery in Google Maps, two of the localities are in areas where much land has been converted for agriculture or urban development, whereas the third locality appears to be completely deforested. Therefore, in conjunction with the subpopulation in the protected Dayaoshan National Nature Reserve, we propose four locations for this variety. This variety is noted to be rare in some areas (some specimens have remarks on its rarity, e.g., Q. H. Lu 4103). We therefore categorize this variety as Endangered (EN): B2ab(iii).


Discussion.—Styrax formosanus occurs commonly throughout Taiwan and rarely on mainland China (from Zhejiang southwest to Guangxi). It can be distinguished from other sympatric species of S. series Cyrtta with valvate corolla aestivation by the presence of a wide band at the margin of the calyx formed by the basal stellate pubescence progressively becoming sparser towards the margin. Although this band is present inconsistently in other species, it is not as conspicuously wide as in S. formosanus. Styrax formosanus can be further distinguished from other sympatric species of Styrax in the group in its consistently rhombic leaves. This character only appears in S. formosanus and S. wayuanensis, and the two can be differentiated by the stellate-pubescent calyx and pedicels in S. formosanus (vs. subglabrous in S. wayuanensis). See S. faberi for additional comments.

We examined flowers on several specimens of Styrax formosanus in which some of the lobes strongly overlap in bud (R.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). Perkins (1907) mentioned the presence of flowers with some subinduplicate-valvate lobes in both the evergreen and deciduous species of her S. series Valvatae, and Steenis (1932) observed some flowers with slightly imbricate lobes but apparently not the strongly imbricate lobes seen here. All specimens of S. formosanus that we examined with such partially imbricate flowers are from Taibei, Yilan, and Nantou counties in northeastern Taiwan, near the distribution of S. japonicus Siebold & Zucc. in Hualian County in the eastern part of the island. Styrax formosanus and S. japonicus are recovered as each other’s closest relatives in the molecular phylogenetic study of Fritsch (2001). Thus, introgression with S. japonicus may be responsible for the partially imbricate flowers in S. formosanus in these regions.

In the protologue of Styrax formosanus, Matsumura (1901) cited the two collections (syntypes) A. Tashiro 81A and Hiroaka s.n. We designated the TI specimen of A. Tashiro 81 as the lectotype because that was the only specimen we were able to locate and examine.

In the protologue of Styrax henryi, Perkins (1907) cited two collections (syntypes), A. Henry 394 and O. Warburg 10740. Much of the material Perkins examined was located at B and destroyed during World War II; we presume that O. Warburg 10740 was destroyed then. We designated the A specimen of A. Henry 394 as the lectotype because that was the only specimen we were able to locate and examine. The holotype of S. henryi var. microcalyx housed at B is presumably destroyed as well, although we have examined fragments and a photograph of this specimen at A. We designated the E specimen of A. Henry 2063 as the lectotype because we have examined that specimen, and it has more material than either the A or P specimens.

Mori (1935) cites B. Hayata s.n. as the type of Styrax funkikensis and indicates that the collection was stored at the Herbarium of the Department of Forestry of the Government Research Institute Taihoku, Formosa. This was an institution from the period of Japanese rule on Taiwan, and we were unable to find any information on what happened to the collection after the war. It could have been moved back to Japan, or integrated with collections left on Taiwan. We were able to find a digital image of a collection of B. Hayata s.n. labeled as a type at the website of TAI. It is not clear if this is the original material examined by Mori, so we refer to it as a probable holotype. The digital image of the specimen is a fragment inside a packet that was not opened.
during imaging, so we could not examine it. Li (1963) synonymized the name with S. formosanus in the Woody Flora of Taiwan, so we assume here that he was correct in doing so and follow his treatment, with the caveat that the type will need thorough examination to confirm this.

Styrax formosanus var. hirtus appears to be distinct in having scattered simple or 2- to 3-armed trichomes over both surfaces of the leaves, the petioles, the pedicels, and the calyces, unlike S. formosanus from Taiwan. All specimens determined to this variety occur only on the mainland. However, the material of this variety available to us was limited to two fruiting specimens from a single collection (S.Y. Chang/Zhang 6395). Although digital images of several other fruiting specimens (Q.H. Lu 4013 and P.X. Tan 61270) with this name are in the Chinese Virtual Herbarium, the resolution of the images was not high enough for us to clearly discern if they also possess the long trichomes diagnostic for the variety. As such, we decided to retain the current taxonomy but stress that more study is needed to assess the status of the varieties of S. formosanus.

We observed two other specimens (S.Y. Chang/Zhang 5076 and Longxishan Exp. 1301) of putative Styrax formosanus from the mainland that differ from those on Taiwan in having much shorter stellate trichomes on the calyx. Although images of specimens identified as S. formosanus from the mainland are in the Chinese Virtual Herbarium, the resolution is not high enough for study of the calyx trichomes. Several other mainland specimens (Anonymous 2845, C.M. Hu 2708, S.S. Lai et al. 4434, Longxishan Exp. 1301, and P.X. Tan 58283), including the specimen of S. formosanus var. hirtus that we were able to examine (S.Y. Chang/Zhang 6395), have atypical fruits in that they lack a rostrum, unlike the specimens from Taiwan. We also lack any flowering specimens of S. formosanus from the mainland to compare to flowering material from Taiwan, again highlighting the need for further study of this species, but especially from mainland China.


Shrubs or trees to 12 m tall. Young branchlets yellowish brown to brown, with sparse to dense light yellow stellate trichomes, occasionally glabrous; older branchlets reddish brown, glabrous. Petiole 3–5(–9) mm long, dense with yellowish brown stellate trichomes, rarely sparse to subglabrous, trichome arms to 0.1–0.61 mm long. Two most proximal leaves on each shoot subopposite, rarely alternate. Lamina of fertile shoots 3.5–8.8 (–11.1) × 1.7–4.7(–5) cm, those of sterile shoots to 13.6 × 7.1 cm, 1.1–2.8 × as long as wide, usually chartaceous, occasionally subcoriaceous, elliptic to elliptic-obovate to elliptic-rombic, occasionally obovate; abaxial surface yellowish brown to grayish brown when dry, with yellowish brown stellate trichomes, trichome arms to 0.1–0.64 mm long, scattered on to completely covering whole surface, denser along veins and in axils of midveins and secondary veins; adaxial surface brown to dark brown when dry, with yellowish brown stellate trichomes, trichome arms to 0.1–0.53 mm long, pubescence sparse to scattered on whole surface, trichomes denser along midvein, rarely subglabrous; base rounded to broadly cuneate; margin serrulate or serrate; apex rounded to acute, rarely acuminate; secondary veins 5 to 9 on each side of midvein, abaxially prominent, adaxially plane, tertiary veins reticulate, abaxially and adaxially plane. Fertile shoots (3.5–)6.5–17.8(–21.5) cm long, 4- to 6-leaved. Lateral inflorescences racemose, rarely paniculate, (1–)1.5–6 cm long, (1- to) 2- to 19-flowered; pseudodeterminate inflorescences subpaniculate or paniculate, with fascicled to dense nodes, 2.3–8.8(–10.5) cm long, (5- to)11- to 42-flowered, rachis brown, dense to completely covered with yellowish brown
Styrax fortunei from Styrax series Cyrta 617. This species also

Distribution.—China (Anhui, Chongqing, Guangxi, Guizhou, Henan, Hubei, Hunan, Jiangsu, Jiangxi, Shaanxi, Sichuan, Yunnan, and Zhejiang); Fig. 6.

Habitat.—In mixed forests and thickets, occasionally in open rocky areas, on hillside slopes and valleys, along streams and roadsides; 3000 m.

Vernacular names.—Chui zhu hua (China, Jiangxi; C.M. Tan 99228); hui-ye-an-xi-xiang (China; Hwang & Grimes 1996); hui-lu-tui (China, Henan; Ding & Wang 1997); hui-ye-ye-mo-li (China, Anhui; Liu 1991); xiao-ye-ying-tian-luo (China, Fujian; Liu 1989).

Conservation assessment.—Styrax fortunei is a common and widespread Chinese endemic species. Collections have been made from > 90 geographic localities throughout central China, from Sichuan and eastern Yunnan to Zhejiang, covering a broad area with an EOO of ca. 798,805 km². There appears to be a significant amount of suitable habitat for S. fortunei throughout its distribution and it is also locally abundant in some areas (notes on some specimens remark on its common occurrence, e.g., R.C. Ching 5963). This species also occurs in several protected areas in parts of its geographic range. We therefore categorize this species as Least Concern (LC).

Discussion.—Styrax fortunei has a range that overlaps the northern ranges of S. faberi and S. confusus. To distinguish S. fortunei from S. confusus and S. faberi, see the discussion under S. faberi. Styrax fortunei also overlaps geographically with S. rubifolius, but can easily be distinguished from it by its smooth fruit wall interior and seeds (vs. reticulately pitted fruit wall interior and strongly tuberculate seeds). For more comments about the two species, see the entry for S. rubifolius.
Styrax fortunei has long been treated as two separate species, *S. dasyanthus* and *S. calvescens*. In the *Flora of China*, Hwang and Grimes (1996) differentiate *S. calvescens* from *S. dasyanthus* by the abaxial surface of the leaf being completely covered in dense stellate pubescence (vs. nearly glabrous). However, the density of trichomes on a leaf in *Styrax* can vary considerably within many species, and our examination has revealed a continuous range of pubescence density among these entities, from scattered over the whole surface to completely covering the surface of the leaf. Even the type of *S. calvescens* represents an intermediate between the two extremes, the abaxial surface of the leaf having dense pubescence but not so dense as to completely cover the surface. Unlike some species of *Styrax* in China (e.g., *S. hemsleyanus* Diels; Huang et al. 2003) and North America (e.g., *S. americanus* Lam., and *S. redivivus* (Torr.) L.C. Wheeler; Fritsch 1997), but similar to *S. glabrescens* Benth. in Mexico and Central America (Fritsch 1997), a geographic correlation is not evident: pubescence that completely covers the abaxial surface of the leaf occurs scattered throughout the range of individuals that have leaves with nearly glabrous surfaces. Moreover, there are no obvious elevation or habitat correlations. Because we detected no characters that can reliably differentiate *S. calvescens* from *S. dasyanthus*, we treat them as a single species.

Perkins (1907) excluded *Styrax fortunei* from her treatment because she was not able to see the type specimen; floras and treatments since then have not addressed this problem. We were able to locate the type of *S. fortunei* among the specimens from K. Although the type, having six flowers per pseudoterminal inflorescence, has fewer flowers than is typical for the species, they are too small to be any other species apart from *S. dasyanthus* or *S. faberi*. It is not *S. faberi* because of the lack of reddish brown trichomes overtopping the basal

![Fig. 6. Geographic distribution of *Styrax fortunei*.](image-url)
pubescence of the calyx and the presence of too many flowers on the lateral inflorescences. We therefore synonymize *S. dasyanthus* with *S. fortunei*, the older name.

*Styrax dasyanthus* var. *hypoleucus* was not included in the *Flora of China* (Hwang & Grimes 1996), for unknown reasons. From our examination of digital images of the type stored at FI it is clear that it is a specimen of *S. fortunei*, as based on the pubescence that completely covers the abaxial surface of the leaf. We therefore synonymize this name with *S. fortunei*.

Although most specimens of *Styrax fortunei* have > 11 flowers per pseudoterminal inflorescence, several (e.g., W.R. Carles 541, R.C. Ching & C.L. Tso 695, K. Ling 7941, and Tso 1115) have substantially fewer. These specimens all have pseudoterminal inflorescences with 6 to 8 flowers, like *S. confusus*, but fewer than is typical for *S. fortunei*. The flowers are too small and the corolla lobes too thin, however, for typical *S. confusus*. Similarly, R.C. Ching 2866, a fruiting specimen, has too few fruits per pseudoterminal infructescence for typical *S. fortunei*, but fruits too small for typical *S. confusus*. All these specimens were collected from the area in which Jiangsu, Anhui, and Zhejiang meet and where the distributions of *S. confusus* and *S. fortunei* overlap. These specimens may represent introgressants with *S. fortunei*.

Regional isolation among populations of *Styrax fortunei* has apparently resulted in geographically correlated morphological trends. Some collections from Guizhou (e.g., Anhui Team 1335, Qiannan Team s.n. [KUN25482], and Sino-American Guizhou Botanical Expedition 4 and 1939) have fertile shoots that are much longer, fertile leaves that are much larger, and leaves that tend to be more strongly rhombic and acuminate than are typical for *S. fortunei*.

*Cheng 101* is a fruiting specimen of *Styrax fortunei* that has longer petioles than is typical for the species. However, the fruits are typical of *S. fortunei*, being small and thin-walled. Although they are poorly preserved, the infructescences appear to be paniculate and would appear to have > 11 fruits per infructescence.

As was discussed under *Styrax faberi*, the P duplicate of A. Henry 3450 does not resemble the other duplicates of that collection, and should not be considered part of the type collection of *S. confusus* var. *microphyllus* (= *S. faberi*). It lacks the reddish brown trichomes overtopping the basal pubescence of the calyx, and the calyx is too small for *S. faberi*. Although the small number of flowers is atypical for *S. fortunei*, we assign these specimens to *S. fortunei* based on the abaxial pubescence of the leaves and the small size of the flowers. *A. Henry 3943* also resembles these two specimens in the dense pubescence on the abaxial surface of the leaf and small flowers, although the inflorescences have been further reduced to 1 or 2 flowers. However, this specimen is heavily galled, which may have affected the development of the inflorescences. As such, we have excluded the latter specimen from our treatment.

In the protologue of *Styrax fortunei*, Hance (1882) cites T.L. Bullock 21229 as original material but does not state clearly in which herbarium the specimen is deposited. Although we have only located one specimen of *T.L. Bullock 21229*, we cannot be sure that this is the only specimen of that gathering. Therefore, as we have mentioned in the discussion concerning the typology of *S. fukienensis* (= *S. confusus*), the specimen that we have seen can only be regarded as a syntype. Thus, we designate the BM specimen of *T.L. Bullock 21229* as the lectotype because BM is the herbarium where Hance deposited his types; it is the only specimen of the type material that we have seen.

The protologue of *Styrax dasyanthus* only cites *A. Henry 5977* as the type. In the introduction to the article in which this species was published, Perkins (1902) indicated that the material examined was located at B; we presume that the holotype was destroyed during World War II. Although we saw nine duplicates of *A. Henry 5977*, the specimen at G has Perkins’s annotation label to confirm her examination of that specimen. We therefore designate the G specimen as the lectotype.

Perkins (1907) indicates *A. Henry 721* as the holotype of *Styrax calvescens* in the protologue, with B and K duplicates cited. Even though Perkins’s primary herbarium was B, in this case we can lectotypify on the K specimen of *A. Henry 721* because it is specifically mentioned in the protologue with standing equal to the B specimen. We have lectotypified on this specimen because the B sheet was presumably destroyed in World War II and now is represented only by a photograph of the specimen at A, along with a leaf fragment.
The holotype of *Styrax dasyanthus* var. *cinerascens* is *E.H. Wilson 2571* and is stored at A, Rehder's primary herbarium. *E.H. Wilson 2571* at A consists of two sheets, one of flowering material collected in May 1907 and one of fruiting material collected in June 1907. Because of their different collection dates, we must treat these as two separate collections. We designate the May 1907 sheet of *E.H. Wilson 2571* with the flowering material as the lectotype because it has more inflorescences that are more intact, better illustrating the many-flowered inflorescences typical of *S. fortunei*.

Additional specimens examined. **CHINA. Anhui:** Anyou Qu, Xioli Xiang, Yuanbao Shan, [23.389°N, 109.168°E], 1200–1500 m, 9 Oct 1939 (fr), S. Q. Chen 16777 (KUN); Damaoshan [=Longshu Miaoza Zixizhixian], Jiuyuan Dashan, Dongdong Xiang, Dalu, [23.173°N, 108.823°E], 1100 m, 27 May 1937 (fr), S. Q. Chen 410 (KUN); Damaoshan [=Longshu Miaoza Zixizhixian], Sanfang Qu, Chidong Xiang, Jiuyuan Shan, Yulong Huangjiawan, [23.203°N, 108.679°E], 900–1100 m, 18 Jun 1958 (KUN), S. Q. Chen 14337 (KUN); Damaoshan [=Longshu Miaoza Zixizhixian], Sanfang Qu, Chidong Xiang, Jiuyuan Shan, Zhaoguang, [23.203°N, 108.679°E], 900 m, 23 Jun 1958 (fr), S. Q. Chen 14692 (KUN); Damaoshan [=Longshu Miaoza Zixizhixian], Sanfang Qu, Chidong Xiang, Jiuyuan Shan, Zhanxian, [23.203°N, 108.679°E], 1300 m, 13 Jul 1958 (fr), S. Q. Chen 150565 (KUN); Leye Xian, Liuiwei Bawang Shan, [24.8°N, 106.567°E], 1500 m, 9 May 1989 (fr), Hongshui River Expedition 1085 (KUN)[2]; Longlin Gezu Zixizhixian, De’er, [24.423°N, 106.089°E], 4000 ft, 14 Jun 1928 (II), R. C. Ching 5963 (A); Xilin Xian, Guizhuxiang, [24.386°N, 104.668°E], 1600 m, 19 May 1989 (fr), Hongshui River Expedition 89-1426 (KUN)[2]; locality unknown, 17 Jun 1928 (II), Guizhuxiang 6079 (A); **GuiZhou.** Anlong Xian, Shipan Gongshe, Shihuiyao, [25.271°N, 105.615°E], 1300 m, 15 May 1977 (II), Guizhou Team 3012 (KUN); Anlong Xian, Shitan Gongshe, Shihuiyao, [25.271°N, 105.615°E], 1300 m, 15 May 1977 (II), Guizhou Team 3034 (KUN); Anlong Xian, Xianheping, [24.978°N, 105.607°E], 1600 m, 4 Jul 1973 (fr), C.Y. Deng 86012 (KUN); Anlong Xian, Xianheping, [24.978°N, 105.607°E], 1300–1500 m, 12 Oct 1998 (fr), S.G. Wu et al. 100724 (KUN); Anlong Xian, Xianheping, [24.978°N, 105.607°E], 1300–1500 m, 12 Oct 1998 (fr), Sino-Japan Expedition 100724 (KUN); [Congjiang Xian], Jiaju Qu, Jiaju Xian, [25.669°N, 108.717°E], 1230 m, 7 Apr 1979 (II), M. F. Tan & S. Q. Lin 1948 (MO); [Xilin Xian], Jinlong, 1200 m, 25 Jun 1958 (fr), Hongshui River Expedition 2899 (KUN); [Xilin Xian], She-won-san, Hsufeng, [27.133°N, 106.667°E], 1 Jul 1936 (fr), S. G. Teng 90472 (A); [Jiangkou Xian], Fanjing Shan, Gaotong, [27.94°N, 108.614°E], 1100 m, 17 Jul 1959 (fr), T.P. Zhu & Z.F. Liu 576 (KUN); [Jiangkou Xian], Fanjing Shan, Pingzhu Forest Farm, [27.94°N, 108.614°E], 1150 m, 14 May 1959 (fr), T.P. Zhu & Z.F. Liu 576 (KUN); [Jiangkou Xian], Fanjing Shan, Yu’ao He, [27.895°N, 108.717°E], 1100 m, 23 Jun 1988 (fr), Wuling Shan Expedition 1231 (KUN)[2]; Jiangkou Xian, Heiwan River on the SE side of the Fanjing Shan mountain range in the vicinity of ecological station of the Guizhou Academy of Sciences, [27.695°N, 108.843°E], 560 m, 19 Aug 1986 (fr), Sino-American Guizhou Botanical Expedition 4 (BR, CAS); Leishan Xian, Fangxiang Gangshe, Leigongping, 26°27’20”N, 108°15’27”E, 1820 m, 2 Jul 1965 (II), W. Zhang & Y.F. Pang 50117 (KUN); Leishan Xian, Gaoyan Xiang, [25.339°N, 109.144°E], 5 Jun 1955 (II), Qianman Team 2149 (KUN); Leishan Xian, Wudong Forest Farm to Getoufanshui Ling western ravine, 26°23’N, 108°13’20”E, 1250 m, 4 Jun 1955 (II), W. Zhang & Y.F. Pang 50743 (KUN); Leishan Xian, Wudong to Xumuchang, 26°22’40”N, 108°10’10”E, 1230 m, 23 May 1965 (II), W. Zhang & Y.F. Pang 50182 (KUN); [Leishan Xian], Xijiang Gongping [=Xijiang Zhen], [26.49°N, 108.178°E], 1100 m, 22 May 1959 (II), Qianman Team 2087 (KUN); Pu’an Xian, Qingshan Gangshe, [25.509°N, 105.008°E], 1800 m, 7 Sep 1959 (fr), Anhui Team 1355 (KUN); Pu’an Xian, Qingshan Gangshe, [25.509°N, 105.008°E], 1800 m, 7 Sep 1959 (fr), Anhui Team 1613 (KUN); Shiquan Xian, Jischai to Ma Xi, [27.333°N, 108.063°E], 1500 m, 2 Aug 1988 (fr), Wuling Shan Expedition 2985 (KUN)[2]; Songtao Miaoza Zixizhixian, Tiansmah, Hsi-jai-wan, [28.043°N, 108.828°E], 950 m, 6 Jun 1988 (II), Wuling Shan Expedition 141 (KUN)[2]; Songtao Miaoza Zixizhixian, Tiansmah, Hsi-jai-wan, [28.043°N, 108.828°E], 950 m, 6 Jun 1988 (II), Wuling Shan Expedition 141 (KUN)[2]; Songtao Miaoza Zixizhixian, Tiansmah, Hsi-jai-wan, [28.043°N, 108.828°E], 950 m, 6 Jun 1988 (II), Wuling Shan Expedition 141 (KUN)[2]; Songtao Miaoza Zixizhixian, Tiansmah, Hsi-jai-wan, [28.043°N, 108.828°E], 950 m, 6 Jun 1988 (II), Wuling Shan Expedition 141 (KUN)[2]; Songtao Miaoza Zixizhixian, Tiansmah, Hsi-jai-wan, [28.043°N, 108.828°E], 950 m, 6 Jun 1988 (II), Wuling Shan Expedition 141 (KUN)[2].
Li and Fritsch, Taxonomic revision of Styrax series Cyrta


Hunan: Changsha Shi, locality unknown, [28.196°N, 112.972°E], year 1927 (fr), V.M. Grabh 140 (BM), Hsinhiwa [-Xinhua Xian], ad minas Hskwангshan [-Xikuangshan] prope urbs Hsinhiwa [-Xinhua County] ad rivum infra vicum Tyldudianj, [27.782°N, 111.502°E], 500 m, 29 May 1918 (fr), H.F. Handel-Mazzetti 2474 (A); Yangzhou Qu, Hengshan, Fanguang Xi, [27.231°N, 112.643°E], 450 m, 5 Jun 1943 (fr), S.Q. Chen 3508 (KUN), Suhuang Xian, locality unknown, [26.703°N, 110.183°E], 13 Jun 2004 (fr), F.J. Huang 10 (CAS).  

Jiangsu: Nanking Shi [-Nanjing Shi], ad rivum infra vicum Tyldudianj, [27.867°N, 118.66°E], 15 Aug 1928 (fr), Y.L. Keng 1644 (A); [Jiangning Qu], [Jiangning Shi], Yuntai Shan [-Yuntai Mountain], south Nanking, [31.737°N, 118.723°E], 16 Aug 1928 (fr), Y.L. Keng 2381 (A); [Gulou Qu], Zijiang [-Zijin] Shan (Purple Mountain), N extension of Mao Shan; NE (A); Chinkiang [-Zhenjiang Shi], locality unknown, [32.2°N, 119.417°E], May 1890 (fr), R.C. Ching & C.L. Tso 695 (KUN); [Jiangsu: Nanking Shi, locality unknown, [32.2°N, 119.417°E], May 1890 (fr), W.R. Carles 439 (A), Chinkiang [-Zhenjiang Shi], locality unknown, [32.2°N, 119.417°E], May 1890 (fr), W.R. Carles 541 (A), Chinkiang [-Zhenjiang Shi], locality unknown, [32.2°N, 119.417°E], Dec 1895 (fr), W.R. Carles 541 (K), [Gulou Qu], Zijiang [-Zijin] Shan (Purple Mountain). N extension of Mao Shan, NE of Sun Yat-sen memorial and tomb, slope overlooking Buddhist depository of ancient texts, 32.5°N, 118.4°E, 150–200 m, 22 Jun 1897 (fr), Sino-American Purple Shan Botanical Expedition Team 45270 (A); [Gulou Qu], Zijiang [-Zijin] Shan (Purple Mountain), south Nanking, [31.737°N, 118.723°E], 16 Aug 1928 (fr), Y.L. Keng 1644 (A), [Jiangning Qu], Bai Yuan Shan [-Yantuо Xian], [31.137°N, 119.073°E], 28 May 1933 (fr), W.C. Cheng 4419 (P), Nan-kiang [-Nanjing Shi], kih shan, S Nan-kiang [-Nanjing], [32.05°N, 118.767°E], 25 Aug 1928 (fr), Y.L. Keng 1911 (A), Nan-kiang [-Nanjing Shi], locality unknown, [32.05°N, 118.767°E], May 1925 (fr), K. Ling 7941 (A); [Pukou Qu], Jiangzi, Shizi Ling, [32.061°N, 118.352°E], 250 m, 1 May 1936 (fr), M.B. Deng et al. 3811 (KUN), [Qi-Xia Qu], Qi-Xia Shan, [32.16°N, 118.963°E], 30 May 1985 (fr), P.P. Ling 105 (AUN); Shenxiao [Xian], [31.787°N, 119.507°E], 160 m, 15 Sep 1956 (fr), Z.Y. Wu L-77 (KUN); Xian [Xian], Hwang-sai-gu, Stone Sheep Cave, [29.278°N, 115.048°E], 19 Jul 1947 (fr), Y.K. Hsiung 5411 (KUN), X.M. Gao 1554 (CAS); Wuling? [-Wuning Xian], Hsing Shan Hsien [-Hsing Shan Hsien], locality unknown, [30.839°N, 111.152°E], 1883–1888 (fr), A. Henry 3928 (E), locality unknown, Aug 1932 (fr), H.H. Chung 9108 (A).

This document is intended for digital-device reading only. Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

This document is intended for digital-device reading only.
**Vernacular names.**—Hong-ye-ye-mo-li (China, Yunnan; Ming 1983).

**Conservation assessment.**—Styrax rubifolius is a rare Chinese endemic known to us from only four localities: three in Sichuan and one in Yunnan. We were only able to examine ten collections of the species, and the last known collection was made in 1964 by the Yunnan Northeast Team. The EOO is 4,390 km² and AOO is 16 km², and only one of the known subpopulations appears to occur in a protected area: Mount Emei in Sichuan, a protected World Heritage Site. From satellite imagery in Google Maps, two of the other localities appear to be threatened by deforestation. The type locality of Cheng Feng Shan, Yunnan appears to have extensive terrace farming on its slopes. Another collection was made in the hills of Leshan, an area which is now heavily urbanized. We propose to recognize one location for each of these regions. In conjunction with the two subpopulations without any plausible current threat, we propose four locations for this species. We therefore classify this species as Endangered (EN): B2ab(iii).

**Discussion.**—Styrax rubifolius is easily distinguished from the other members of S. series *Cyrt a* with valvate corolla aestivation by the strongly tuberculate seed and pitted-reticulate interior wall of the pericarp. Even though its distribution overlaps that of *S. fortunei*, *S. rubifolius* can be distinguished from *S. fortunei* by the glabrous, chestnut-colored inflorescence rachis with well-spaced flowers. *Styrax rubifolius* also tends to have longer fertile shoots and inflorescences than the other members of this group. Although *S. rubifolius* was synonymized in *Flora of China* with *S. dasyanthus*, the morphological differences between these two taxa warrant treating them as separate species.

In the protologue of *Styrax rubifolius*, two collections (syntypes) are cited by Guillaumin (1924): F. Ducloux 2138 and F. Ducloux 2213. We designated F. Ducloux 2138 as the lectotype instead of F. Ducloux 2213, for the following reasons. One of the sheets of *F. Ducloux 2138* has a label with a description of the specimen with wording very similar to that in the protologue and in a handwriting we suspect is Guillaumin’s. Furthermore, there are three sheets of *F. Ducloux 2138*, whereas there are only two of *F. Ducloux 2213*. Finally, there is more flowering material on *F. Ducloux 2138*, and it is better preserved. Of the three sheets comprising *F. Ducloux 2138*, we chose P562364 as the lectotype because it is the one with the descriptive label.

**Additional specimens examined.** CHINA. Sichuan: Kiating [=Leshan], [29.567°N, 103.767°E], Jun 1903 (fl), E.H. Wilson 4066 (A, BM, P); Lo-shan Hsien [=Lushan Xian & vicinity], [30.144°N, 102.928°E], 800–1300 m, 24 Aug 1931 (fr), F.T. Wang 23581 (A, P). Yunnan: [Shuifu Xian], forests of Tchen fong chan [=Cheng Feng Shan], [28.410°N, 104.233°E], (fl), E.E. Maire s.n. (P); [Shuifu Xian], Liangwan Qu [=Liangwan Xiang], Chengfeng Gongshe, Erfang Shengchan Dui, [28.410°N, 104.233°E], 1000 m, 19 Sep 1964 (fr), Yunnan Northeast Team 1163 (KUN), [Shuifu Xian], Tchen fong chan [=Cheng Feng Shan], [28.410°N, 104.233°E], May 1901 (fl), F. Ducloux 2213 (P); [Shuifu Xian], Tchen fong chan [=Cheng Feng Shan], [28.410°N, 104.233°E], 750 m, Jul 1894 (fr), J.M. Delavay s.n. (P).


Shrubs or trees to 18.3 m tall. Young branchlets light brown, scattered or occasionally completely covered with yellowish brown stellate trichomes; older branchlets brown to grayish brown, glabrous to sparsely pubescent with yellow stellate trichomes. Petiole 4–8–(11) mm long, with sparse to dense tightly appressed stellate trichomes, occasionally with larger stellate trichomes, trichome arms up to 0.05–0.2–0.3 mm long. Two most proximal leaves on each shoot alternate. Lamina of fertile shoots 3.1–12–(14) × 1.8–5.6 cm, those of sterile
shoots to 19 × 6.7 cm, 1.3–3.7 × as long as wide, thinly chartaceous to chartaceous, elliptic to lanceolate, occasionally oblong, rarely ovate or obovate; abaxial surface yellowish brown to green when dry, with yellow stellate trichomes, trichome arms up to 0.06–0.36(–0.55) mm long, pubescence scattered on whole surface, trichomes occasionally denser in axils of midvein and secondary veins; adaxial surface dark green to grayish green to brown when dry, nearly glabrous or with sparse yellowish brown stellate trichomes, trichome arms up to 0.09–0.38 mm long, pubescence mostly along midvein, rarely over whole surface; base rounded to broadly cuneate, occasionally acute; margin serrulate to serrate, occasionally with some teeth much larger than others; apex short-acuminate to acute, occasionally acuminate, rarely obtuse; secondary veins 4 to 6 on each side of midvein, abaxially prominent, adaxially plane or sunken, tertiary veins parallel, perpendicular to secondary veins, abaxially and adaxially prominent. Fertile shoots 6.1–17.5 cm long, 3– to 5– (to 6-)leaved. Lateral inflorescences racemose, 0.6–2.8 cm long, 1– to 7-flowered; pseudoterminal inflorescences racemose, with densely spaced nodes, occasionally fascicled, 2.5–8.5 cm long, 5– to 22-flowered, rachis yellow, completely covered with stellite trichomes. Pedicel 5–12 mm long, completely covered with short-armed yellow appressed stellite trichomes and scattered long-armed yellow to yellowish brown erect stellite trichomes; bracteoles 1.2–4.9 mm long, linear or subulate, positioned at base of pedicels, occasionally in middle of pedicels, very rarely at base of calyx, the larger leaf-like ones closer to base of inflorescences, up to 5.6 mm long. Flowers 1–1.7 cm long. Calyx 3–6 × 3–6 mm, cupuliform, rarely funnelform; abaxially with dense short-armed yellow appressed stellite trichomes and scattered long-armed yellow to yellowish brown, rarely brown, erect stellite trichomes, usually with trichomes becoming less dense towards calyx margin, trichome arms up to 0.22–0.74(–0.93) mm long; adaxially brown with scattered 2- or 3-armed trichomes; margin with 5 evenly distributed teeth or unevenly deep sinuses and unevenly distributed teeth 0.3–0.8 mm long; marginal teeth deltoid or obtuse, contiguous or not, densely pubescent on both surfaces. Corolla 0.9–1.6 cm long, white, tube 1.7–4(–4.9) mm long, abaxial surface proximally glabrous and distally scattered with stellite trichomes, lobes 5(or 6), 6.5–11.9(–13.2) × 1.7–3.9 mm, chartaceous, oblong to lanceolate, rarely elliptic, apex acute, abaxially completely covered with pale yellow appressed stellite trichomes, adaxially glabrous except margins or with 2- or 3-armed trichomes, denser at apex. Stamens (9 to)10(to 11); filaments 1.6–5.4 mm long, flexuous, wider in middle, proximally dense with stellite trichomes, distally glabrous; anthers (3.2–)3.8–5.9 mm long, wider than distal portion of filament, with sparse yellow stellite trichomes; connective with sparse yellow stellite trichomes. Style 0.9–1.5 cm long, glabrous, with stellite trichomes at base; stigma 0.3–0.7 mm wide, capitate. Fruiting calyx 3–5 × 5–10 mm, funnelform, occasionally nearly salverform. Fruit 0.8–1.5(–2) × 0.5–1.3 cm, indehiscent or dehiscent by three valves, ellipsoid to oblique-ellipsoid, apex rounded to pointed, rarely slightly rostrate; pericarp dry, 0.15–1 mm thick, outside smooth, very rarely rugose, with dense yellowish brown appressed stellite trichomes, inside with scattered to dense stellite trichomes, smooth. Seeds light brown to brown, ovoid, smooth, usually with shallow longitudinal fissures, glabrous.

Illustrations.—Ming 1986:869, fig. 335 (3–4); Hwang 1987b:114, pl. 39 (7–11); Yin 1990:896, fig. 472 (7–9) (as S. casearifolius); Svengsuska & Vidal 1992:173, pl. 31 (5–6); Wu & Raven 2000:208, fig. 208 (7–12).

Phenology.—Flowering: February–September. Fruiting: January–November.

Distribution.—Bangladesh (Chittagong and Sylhet), Bhutan (Chukha and Sarpang), China (Xizang and Yunnan), India (Arunaloch Pradesh, Assam, Bihar, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Sikkim, Tripura, and West Bengal), Laos (Louangphrabang, Oudomxai, Phongsali, and Xiangkhoang), Myanmar (Kachin, Mandalay, and Shan), Nepal (Kosi and Mechi), and Thailand (Nan); Fig. 4.

Habitat.—In a variety of forests and jungles, on hillside slopes, in moist soils or by rivers; 0–2438 m.

Vernacular names.—Chi-ye-an-xi-xiang (China; Hwang & Grimes 1996); Chi-ye-ye-mo-li (China, Xizang; Ming 1986); dot bay pha (Laos, Louangphrabang; E. Poliane 20611); dot phao (Laos, Louangphrabang; E. Poliane 20594); hpun-pyaw-hpun (Myanmar, Kachin; J. Keenan 3128); koom-jameva (India; Roxburgh 1832); Jia-ci-ye-ye-mo-li (China, Yunnan; Ming 1983); masine ixat (India, West Bengal; J.M. Cowan s.n.); pa-riat (Thailand, Nan; A.F.G. Kerr 4986); padong mew (Laos, Xiangkhoang; Svengsuska & Vidal 1992); pung loo (Laos, Xiangkhoang; A.F.G. Kerr 20917); sob-la-paiet (India, Meghalaya; L.F. Ruse 20).
Conservation assessment.—*Styrax serrulatus* is a widespread species that occurs in the highlands of the Eastern Himalaya, the north side of the Arakan Mountains, the border region of Myanmar and Yunnan, China, northern Laos, and northern Thailand. The range of the species extends farther west in eastern Asia than any other species of *S. series* *Cyrtta.* Collections have been made from > 110 localities throughout this wide area (EEO = ca. 1,264,204 km²). There appears to be a significant amount of suitable habitat for *S. serrulatus* throughout its distribution and it is also locally abundant in some areas (notes on some specimens remark on its common occurrence, e.g., *F. Kingdom Ward 18397†). This species also occurs in several protected areas in parts of its geographic range. We therefore categorize this species as Least Concern (LC).

Discussion.—As discussed under *Styrax agrestis*, *S. serrulatus* and the *S. agrestis* complex both have short-armed trichomes on the abaxial surface of the petiole, especially apparent at the junction of the petiole and blade. Also, in these four species the two most proximal leaves on each shoot are alternate (vs. opposite or subopposite). Fruiting *S. serrulatus* can be easily differentiated from typical members of the *S. agrestis* complex by an ellipsoid fruit that lacks a rostrum and by glabrous seeds, vs. rostrate fruits and stellate-pubescent seeds. *Styrax serrulatus* and *S. rubifolius* both have ellipsoid fruits, but the seeds are distinct: *S. serrulatus* has smooth seeds and *S. rubifolius* has strongly tuberculate seeds. *Styrax fortunei* can be difficult to distinguish from *S. serrulatus*: both tend to have a higher number of flowers per inflorescence than the other members of the study group. The fruits are reliable for distinguishing the two species, with *S. serrulatus* having ellipsoid fruits that can be indehiscent or dehiscent and *S. fortunei* having subglobose fruits that are always dehiscent. The fruits of *S. serrulatus* also tend to be larger, usually being > 1 cm long (vs. usually < 1 cm). *Styrax serrulatus* also has racemose inflorescences (vs. paniculate).

When in flower, *Styrax serrulatus* can be more difficult to distinguish from some of the other species in the study group in nearby areas. *Styrax finlaysonianus* can easily be distinguished from *S. serrulatus* by its thicker corolla lobes. However, *S. agrestis* can be more difficult to distinguish from few-flowered specimens of *S. serrulatus*. Although *S. serrulatus* can have up to 22 flowers per pseudoterminal inflorescence (vs. 9 in *S. agrestis*), it can also have as few as 5 per pseudoterminal inflorescence. Also, although *S. serrulatus* can have pedicels up to 12 mm long (vs. up to 6 mm in *S. agrestis*), it can have pedicels as short as 5 mm. Ultimately, characters of the fruit are those most reliable in distinguishing these two species.

*Styrax casearifolius* was described from specimens with some old fruits and extremely young flower buds. Craib (1920) described the species as having oblong to ovate-oblong leaves and densely packed flower buds with long pallid subhirsute trichomes. However, specimens of the study group with extremely young buds can be difficult to identify to species, sometimes with only the number of flowers per inflorescence being an obvious difference, and the flowers are likely to become less dense as the inflorescence develops. Moreover, leaf shape can vary extensively in some species of this group. The fruit, although very fragmented, resembles that of *S. serrulatus*. Based on these characters, we synonymize *S. casearifolius* with *S. serrulatus*.

Don (1837) cites *N. Wallich 4400* as the the original material on which the description of *Styrax virgatus* was based. *N. Wallich 4400* is composed of two distinct collections, *N. Wallich 4400A* (collected by Francis De Silva) and *N. Wallich 4400B* (collected by Henry Bruce). However, it is unlikely that Don based his description of *S. virgatus* on *N. Wallich 4400B* because the description of *S. virgatus* describes corolla shape, but the specimens of *N. Wallich 4400B* that we could locate lack corollas. Furthermore, these two specimens were found in the collections of G and K, as opposed to BM, where Don deposited the types he studied. For these reasons, we are lectotypifying on *N. Wallich 4400A*. *N. Wallich 4400A* consists of two sheets with poorly preserved fertile material, with only several buds and some inflorescences with only the rachis and some pedicels. The specimen at BM is likely the one that Don examined, because BM is where Don was based. For this reason, we are lectotypifying on the BM specimen of *N. Wallich 4400A*. This specimen is found on the same sheet as a specimen of *S. hookeri* and a few fragments of flowering material from another specimen of *S. serrulatus*. It is possible that Don described *S. virgatus* using all three specimens found on the sheet. Although the protologue does describe the margin of *S. virgatus* as having denticulations like the specimen of *S. hookeri* on the sheet, all the other parts of the description more closely match the other two specimens on the sheet, e.g., lanceolate corolla lobes and downy branches.
The only other species of *Styrax* known from the type locality of *S. virgatus* [Mont. Sillet (= Khasi Hills)] are *S. hookeri* and *S. serrulatus*. Even though the inflorescences are poorly preserved in the type material of *S. virgatus*, they appear to have more potential flowers than the 2 or 3 flowers most commonly found on the pseudoterminal inflorescences of *S. hookeri*, vs. the racemes of 5–22 flowers in *S. serrulatus*. Furthermore, the leaves of *N. Wallich 4400A* more closely resemble those of *S. serrulatus* in their short-acuminate apices (vs. more strongly acuminate in *S. hookeri*) and more sharply serrulate margins (vs. denticulate in *S. hookeri*). Lastly, Perkins (1907), having presumably seen the flowers on a specimen of *S. virgatus* that we were unable to examine, described the species as having valvate corolla aestivation (like *S. serrulatus*) vs. imbricate (like *S. hookeri*). We thus synonymize *S. virgatus* with *S. serrulatus*.

The collection *C.S. Ye 603* was identified on the label as *Styrax confusus*, but the characters of this specimen do not match those for our concept of *S. confusus* and more closely resemble those of *S. serrulatus*. The fruits are ellipsoid, much like those of *S. serrulatus*, and have a wall that is too thin for typical *S. confusus*. The petioles are also too long for *S. confusus*, but within the range of variation for *S. serrulatus*. Nonetheless, the specimen is from Jiangxi, which is far outside the geographic range of *S. serrulatus*. Furthermore, although the infructescences are not completely intact, they may be paniculate, which is never the case in *S. confusus* or *S. serrulatus*. The paniculate inflorescence suggests *S. fortunei*, but if it is this species then the shape of the fruit and length of the petiole are atypical. We therefore have excluded the specimen from our treatment; efforts should be made to recollect the population from which this specimen came.

* A.C. d'Alleizette s.n. [*P562368*] and s.n. [*P562367*] are the only specimens we examined from southern Vietnam. These specimens are difficult to identify because they only have very immature fruits. They cannot be *Styrax finlaysonianus* because of the distinctly serrulate leaves, and they cannot be *S. agrestis* because the pedicels and inflorescences are too long. They resemble *S. serrulatus* because the fruits appear not to have a rostrum, but because the fruits are immature we cannot confirm whether the seed is glabrous or has stellate trichomes. The two collections are far out of the geographic range of *S. serrulatus*. We have excluded these specimens from the species description of *S. serrulatus*. More collections of plants resembling these specimens need to be collected from the region before any additional insights can be gained as to the taxonomic status of these collections.

The protologue of *Styrax serrulatus* does not indicate a type (Roxburgh 1832). Roxburgh, based at the Botanical Gardens in Calcutta, did not keep specimens of the plants he described, on the presumption that they would not preserve well in the heat and humidity, but instead preferred to have illustrations made. These illustrations are today considered to be the types of the corresponding Roxburgh names (Royal Botanic Gardens, Kew 2006). Sengsuksa & Vidal (1992) may not have been aware of this when they cited *Wallich 4402* as the holotype, and appear to have inadvertently lectotypified *S. serrulatus* on this collection. Furthermore, because they were not able to see *Wallich 4402*, they were not aware that it comprises two separate collections. It is highly unlikely that Roxburgh based the description of *S. serrulatus* on any specimens of this collection. We therefore cite Roxburgh's illustration no. 2058 in *Icones Roxburghianae* as the holotype.

In the protologue of *Styrax casearifolius*, Craib (1920) cited A.F.G. Kerr 2432 as the type, but two sheets of this specimen are housed at K. We designated the K specimen with loan accession number H20000/01016-44 as the lectotype because 1) this sheet has the species name and publication in handwriting we suspect to be Craib's and 2) it contains fruiting material in the packet, which is the other specimen lacks.

Clarke (1882) cited *Ham. in Wall. Cat 4402* in the protologue of *Styrax serrulatus* var. *agrestis* as the type, but two different collections from two different localities comprise the *Wallich 4402* entry. We lectotypified on *Wallich 4402B/Buchanan-Hamilton 1081-2* because it most closely matches Clarke's description by having a calyx with spreading brown-hirsute trichomes, *Wallich 4402A/Buchanan-Hamilton 1081-1* is similar to the common version of *S. serrulatus*, lacking the brown-hirsute trichomes. We consider these differences to be taxonomically trivial and thus do not recognize varieties within *S. serrulatus*.

Additional specimens examined. **BANGLADESH. Chittagong:** Chittagong District, Jaldi, [21.984°N, 91.95°E], Feb 1921 (fl), J.M. Cowan 2363 (E); Chittagong District, locality unknown, [22.367°N, 91.8°E], (fr), J.M. Cowan 1058 (E); Chittagong District, locality unknown, [22.367°N, 91.8°E], (fl), J.M. Cowan 2239 (E); Chittagong Hill Tracts, year 1886 (fl), Dr. King's Collector 324 (L); Chittagong Hill Tracts, year
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

CHINA. Xizang: Motuo Xian, Dzayi Zhan, [24.83°N, 95.5°E], 1300 m, 10 Aug 1974 (fr), Qinghai-Xizang Expedition 74-1726 (KUN[2]); Motuo Xian, Hammi, [29.36°N, 91.13°E], 1100 m, 29 Oct 1992 (fr), H. Sun et al. 968 (KUN[3]); Motuo Xian, near Medog, Dzing Xiang, [29.32°N, 93.5°E], 1100 m, 28 Apr 1993 (fl), H. Sun et al. 881 (KUN[4]).

CHINA. Assam: Dima R.L. Keenan s.n. (L).

India: J. Britten [Cachar District], locality unknown, 24.78°N, 92.8°E, 3000–4500 ft, 8 Apr 1949 (fl), G. Kingdon Ward 18495 (A); Tirap District, Khela to Chalong, 27.07°E, 95.63°E, 1800 ft, 16 Mar 1938 (fl), S.K. Murti 12986 (L).

INDIA. Arunachal Pradesh: Chonglang -Changlang District, locality unknown, 27.13°N, 95.7°E, 3000 ft, 29 Mar 1919 (fr), Dr. King’s Collector 434 (L, P). Chittagong Hill Tracts, year 1887 (fr), Dr. King’s Collector 449 (P). Rangamati District, Rangamati, [22.63°N, 92.2°E], Mar 1880 (fr), J. S. Gamble 7950 (K).

This document is intended for digital-device reading only. Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
Li and Fritsch, Taxonomic revision of Styrax series Cyrta 629

Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

This document is intended for digital-device reading only.
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
trichomes on abaxial surface, trichome arms up to 0.05–0.21 mm long. Two most proximal leaves on each shoot alternate. Lamina of fertile shoots 4.4–11.5 × 1.7–4.7 cm, those of sterile shoots to 12.5 × 5 cm, 1.7–3.4 × as long as wide, chartaceous, elliptic to lanceolate, at times oblique, rarely ovate; abaxial surface yellowish brown when dry, rarely olive green, with yellow stellate trichomes, trichome arms up to 0.1–0.4 mm long, pubescence scattered on whole surface, trichomes especially large and dense in axils of midvein and secondary veins, with largest trichomes along midvein; adaxial surface brown when dry, rarely dark green, with yellow stellate trichomes, trichome arms up to 0.05–0.17 mm long, pubescence scattered to nearly glabrous on whole surface, trichomes denser in midvein; base cuneate, occasionally acute; margin undulate and serrulate; apex short-acuminate to acute, occasionally acuminate; secondary veins 5 to 7 on each side of midvein, abaxially prominent, adaxially plane, midvein sunken, tertiary veins parallel, perpendicularly to secondary veins, abaxially prominent, adaxially plane. Fertile shoots 5–17 cm long, 3–7–(to 10-)leaved. Lateral inflorescences racemose, 1.1–3.9 cm long, 1–5-flowered; pseudoterminal inflorescences racemose, rarely subpaniculate, with well-spaced nodes, 1.8–6.1 cm long, 4–12-flowered, rachis yellow, completely covered with stellate trichomes 1.1–3.9 cm long, 1–5-flowered; pseudoterminal inflorescences racemose, 1.1–3.3 mm long, linear or subulate, positioned on basal half of pedicels. Flowers 0.8–1.6 cm long. Calyx 3.5–5 × 3–5 mm, cupuliform; abaxially faintly striate with dense short-armed yellow appressed stellate trichomes and scattered long-armed yellow to yellow brown erect stellate trichomes, occasionally with trichomes becoming less dense towards calyx margin, trichome arms up to 0.11–0.38 mm long; adaxially brown with scattered 2–3-armed trichomes; margin with 5(or 6) evenly distributed teeth 0.2–1 mm long; marginal teeth deltoid or obtuse, contiguous, densely pubescent on both surfaces. Corolla 0.9–1.4 cm long, white, tube 2.1–4.5 mm long, abaxial surface proximally glabrous and distally scattered with stellate trichomes, lobes 5(or 6), 6.4–8.9 (≈11.4) × 1.7–3 mm, chartaceous, oblong to lanceolate, apex acute, abaxially completely covered with pale yellow appressed stellate trichomes, occasionally becoming sparser towards tube, adaxially glabrous except margins or with sparse 2–3-armed trichomes. Stamens 10(or 12); filaments 2.6–3.7 mm long, straight, of equal width throughout, proximally dense with stellate trichomes, distally glabrous, rarely with stellate trichomes extending along nearly whole filament; anthers (2–)2.6–4.9 mm long, wider than distal portion of filament, with yellow stellate trichomes; connective with yellow stellate trichomes. Style 1–1.4 cm long, proximally dense with white stellate trichomes, distally glabrous; stigma 0.2–0.4 mm wide, punctiform, rarely capitate. Fruiting calyx 3–5 × 4–6 mm, funnelform. Fruit 1–2.2 × 0.5–0.8(–1) cm, indistinct or rarely showing signs of partial dehiscence at base of fruit (dried material), obliquely and narrowly ellipsoid, apex rostrate or rarely pointed, rostrum up to 6 mm long; pericarp dry, 0.23–0.35 mm thick, outside smooth, slightly striate around rostrum, with dense yellowish brown appressed stellate trichomes, inside with scattered stellate trichomes, smooth to rugose. Seeds light brown to brown, ellipsoid, rugose, with dense stellate trichomes.

Illustrations.—Steenis 1932: 222, fig. 3 (4) (as S. agrestis); ibid.: 242, fig. 5 (as S. agrestis); Steenis 1949:51, fig. 2, fruit in top row; second from right, fig. 3 (as S. agrestis); Croft 1981:266, fig. 62 (as S. agrestis).

Phenology.—Flowering: January–December. Fruiting: January–December.

Distribution.—Indonesia (East Kalimantan, Moluku, Papua, Southeast Sulawesi, and West Papua), Micronesia (Kosrae), Palau (Melekeok), Papua New Guinea (Bougainville, East New Britain, Manus, Milne Bay, Morobe, New Ireland, Southern Highlands, West New Britain, and Western Province), and Solomon Islands (Choiseul, Guadalcanal, Isabel, and Western Province); Fig. 8.

Habitat.—In a variety of dense forests, mountain ridges, swampy forests and rainforests, growing on limestone, schist, or red clay soil; 0–1676 m.

Vernacular names.—Aigasi (Solomon Islands, Guadalcanal Province; B. Sirute’e 9885); ai-gasi (Solomon Islands, Guadalcanal Province; E.J.H. Corner 78); aingasi (Solomon Islands, Choiseul Province; I.H. Gafui 17564); berwewa (Indonesia, Daj. Koetai; Steenis 1949); born-borna (Solomon Islands, Guadalcanal Province; S.F. Kajewski 2499); kaju abu (Indonesia, Daj. Koetai; Steenis 1949); kakase (Papua New Guinea, Southern Highlands Province; W.N. Takeuchi 9177); kapata (Papua New Guinea, Bougainville Province; J.H.L. Waterhouse 565); kaviso (Papua New Guinea, Bougainville Province; J.H. L. Waterhouse 692-B); mamagili...
Conservation assessment.—"Styrax warburgii" is the only species of "S. series Cyrta" with valvate corolla aestivation in Malesia. It occurs from Borneo east to the Solomon Islands, with outlier populations in Palau and Kosrae, Micronesia. Collections have been made from > 60 geographic localities spanning an area with an EOO of 7,230,563 km². Even if the EOO were to be reduced to take into account areas where "S. warburgii" has not been collected, the geographic distribution would remain large. There appears to be a significant amount of suitable habitat for "S. warburgii" throughout its distribution and it is also locally abundant in some areas (notes on some specimens remark on its common occurrence, e.g., D.R. Pleyte 943). We therefore categorize this species as Least Concern (LC).

Discussion.—"Styrax warburgii" resembles "S. agrestis" in morphology, the main differentiating feature being that "S. warburgii" has slightly thicker fruit walls. For further discussion of the species, see the entry for "S. agrestis".

Hosokawa (1938) differentiates "Styrax rostratus" from "S. warburgii" by the presence of glabrous 10-veined leaves and larger flowers. Upon inspecting a digital image of the holotype material, however, we do not consider the flowers to be particularly larger. Furthermore, laminar pubescence is highly variable within most species of the study group. Some specimens of "S. warburgii" possess glabrous leaves. Also, the number of veins on "Styrax" leaves always exhibits a range of variation, and so the 10-veined leaves cited as a differentiating feature...
character can be discounted. We therefore synonymize *S. rostratus* with *S. warburgii*, although in-person examination of the holotype is desirable.

In the protologue of *Styrax warburgii*, Perkins (1907) cites *O. Warburg 16364* as the type. Much of the material Perkins examined was located at B and destroyed during World War II; we presume that *O. Warburg 16364* was destroyed then. Because there is no known duplicate of this specimen, we have designated a neotype for this name. The locality of *O. Warburg 16364*, as indicated in the protologue, is Manipi, South Sulawesi. We were unable to examine any specimens from Manipi, but we did examine two other specimens from Sulawesi. Although one of the specimens, M. Coode 6147, is from a locality that is slightly closer geographically to Manipi, *G. Kjellberg 690* has both fruits and flowers preserved, so we have selected *G. Kjellberg 690* as the neotype. Two sheets of *G. Kjellberg 690* are housed at BO but we were only able to examine the sheet with accession number BO 399343, so we have selected that specimen as the neotype.

In the protologue of *Styrax ledermannii*, Perkins (1928) cites *C.L. Ledermann 12298* as the type. Much of the material Perkins examined was located at B and destroyed during World War II; we presume that *C.L. Ledermann 12298* was destroyed then. Steenis (1932) describes the Ledermann material as differing only in possessing longer white stellate hairs on the inflorescences. However, van Steenis regards this only as part of continuous variation within the species, noting that specimens representing an intermediate between the two forms of pubescence have been collected; he thus synonymized *S. ledermannii* with *S. agrestis* in *The Styracaceae of Netherlands India*. Steenis’s concept of *S. agrestis* included *S. warburgii*, whereas we are recognizing these as distinct species, as discussed under *S. agrestis*. Based on van Steenis’s justification of synonymy and because the distribution of *S. warburgii* encompasses the locality of the type of *S. ledermannii*, we provisionally place *S. ledermannii* in synonymy of *S. warburgii* until a duplicate of the type of *S. ledermannii* can be located.

In the protologue of *Styrax rostratus*, Hosokawa (1938) cites *T. Hosokawa 9044* as the type but does not state clearly in which herbarium the specimen is deposited. Although we have only located one specimen of *T. Hosokawa 9044*, we cannot be sure that this is the only specimen of that gathering. As we have mentioned in the discussion about the typology of *S. fukienensis* (= *S. confusus*), the specimen we have seen can only be regarded as a syntype. We thus designate the TA specimen of *T. Hosokawa 9044* as the lectotype because TA is the herbarium where Hosokawa deposited his types. It is the only specimen of the type material that we have seen.

Additional specimens examined. **INDONESIA. Kalimantan Timur:** a long road Lojanan [=Loa Janan] to Tenggarong of km. 6, [0.586°S, 117.023°E], 26 Oct 1995 (Iftr), Ambri et al. 1400 (K, P); Midden Oest Borneo, Ond. Afd., W. Koeter [=Kutai], Sabentoeoeng [=Sabitung], [0.117°S, 116.773°E], 10 m, 20 Jun 1925 (Il), F.H. Endert 1543 (BO, L), P.; Midden Oost Borneo, Ond. Afd., West-Koeter [=Kutai], [0.148°N, 115.092°E], 10 m, 29 Jun 1925 (If), F.H. Endert 1741 (A, L); S.O. Borneo, M. Pahu [=Muaara Pahu], [0.326°S, 116.06°E], 4 Aug 1908 (If), H.J.P. Winkler 3140 (BM, L); Sungai pedang Kota bangun ulu, Samarinda, [0.502°S, 117.154°E], 20 m, 23 Feb 1992 (Il), Ambri & Artijn 442 (L).

**Maluku:** Ceram [=Seram Island], [3.133°S, 129.5°E], (II), H.L.B. O (L); Ceram [=Seram Island], [3.133°S, 129.5°E], (fr), H.L.B. O (L); Ceram [=Seram Island], [3.133°S, 129.5°E], 1859–1860 (fl), W.H. de Vriese & J.E. Tejmann s.n. (L); NW Seram, Wai Hanou(?), [3.133°S, 129.5°E], 15 Oct 1910 (Iftr), L.M.R. Ruten 1731 (L), W. Seram, Riring, [2.982°S, 128.422°E], 600–700 m, 30 Sep 1918 (If), L.M.R. Ruten 1731 (L), W. Seram, along a trail between Buria and the foot of Mt. Batu Putih until a long road Lojanan [=Loa Janan] to Tenggarong of km. 6, [0.586°S, 117.023°E], 26 Oct 1995 (Iftr), Ambri et al. 1400 (K, P); Midden Oest Borneo, Ond. Afd., W. Koeter [=Kutai], Sabentoeoeng [=Sabitung], [0.117°S, 116.773°E], 10 m, 20 Jun 1925 (Il), F.H. Endert 1543 (BO, L), P.; Midden Oost Borneo, Ond. Afd., West-Koeter [=Kutai], [0.148°N, 115.092°E], 10 m, 29 Jun 1925 (If), F.H. Endert 1741 (A, L); S.O. Borneo, M. Pahu [=Muaara Pahu], [0.326°S, 116.06°E], 4 Aug 1908 (If), H.J.P. Winkler 3140 (BM, L); Sungai pedang Kota bangun ulu, Samarinda, [0.502°S, 117.154°E], 20 m, 23 Feb 1992 (Il), Ambri & Artijn 442 (L).
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
Shrubs to 3 m tall. Young branchlets brown, with appressed yellow stellate trichomes; older branchlets brown, glabrous. Petiole 2–6 mm long, sparse with yellow stellate trichomes, trichome arms to 0.07–0.17 mm long. Two most proximal leaves on each shoot subopposite. Lamina of fertile shoots 3.4–6.6 × 1.4–2.9 cm, those of sterile shoots to 7.2 × 2.9 cm, 2–2.6 × as long as wide, chartaceous, rhombic, occasionally elliptic-rhombic; abaxial surface grayish brown when dry, with yellowish stellate trichomes, trichome arms to 0.07–0.12 mm long, sparse on whole surface; adaxial surface dark brown to brownish green when dry, with yellowish brown stellate trichomes, trichome arms to about 0.08 mm long, pubescence sparse along midvein; base acute to cuneate; margin dentate-serrate; apex acute to short-acuminate; secondary veins 5 to 7 on each side of midvein, abaxially prominent, adaxially plane, tertiary veins reticulate, abaxially and adaxially plane. Fertile shoots 3.5–6.6 cm long, 3- or 4-leaved. Lateral inflorescences solitary, 1.4–1.9 cm long; pseudoterminal inflorescences race-mose, 2.6–2.8 cm long, 1- to 3-flowered, rachis dark brown, sparse with short-armed stellate trichomes. Pedicel 12–17 mm long, dark brown, sparsely pubescent with short-armed stellate trichomes; bracteoles about 1 mm long, linear-lanceolate. Flowers 1–1.7 cm long. Calyx about 3 × 4–5 mm, cupuliform; abaxially dark brown becoming lighter near margins, subglabrous, arms of trichomes to 0.13–0.14 mm long; adaxially subglabrous; margin glandular with 5 or 6 unevenly distributed teeth 0.3–0.5 mm long; marginal teeth deltoid, not contiguous, glabrous on both surfaces. Corolla white, tube about 3 mm long, lobes 5, 10–12 × 1.8–4.5 mm, lanceolate or ovate-lanceolate, apex acute, abaxially densely yellow stellate tomentose, adaxially glabrous. Stamens 10; filaments proximally dense with stellate trichomes, distally glabrous; anthers 4–6 mm long. Style about 1.4 cm long, glabrous; stigma capitate. Fruiting calyx 4–5 × 5–7 mm, funnelform. Fruit 0.6–1.1 × 0.5–1 cm, dehiscent, dehiscing from apex to base, ovoid, apex pointed; pericarp dry, outside smooth, completely covered with yellow stellate trichomes.

Illustrations.—Hwang 1980:160, pl. 3; Hwang 1987b:103, pl. 35 (7–13); Zheng 1989:92, fig. 5-121; Liu 1991:67, fig. 1770; Wu & Raven 2000:204, fig. 204 (8–14); He 2006:891, fig. 1269.

Phenology.—Flowering: April. Fruiting: May, July.

Distribution.—China (Anhui, Jiangxi, and Zhejiang); Fig. 4.

Habitat.—In forests and thickets, occasionally in open rocky areas, on sunny hillside slopes and valleys, along streams and roadsides, on damp soil; 450–540 m.

Vernacular names.—Gou luan zi (China, Zhejiang; S.Y. Zhang 26071); wan-gan-an-xi-xiang (China, Anhui; Liu 1991); wu-yuan-an-xi-xiang (China; Hwang & Grimes 1996).

Conservation assessment.—Styrax wuyuanensis is a narrowly distributed endemic known to us from only eight localities in China: five in Jiangxi, two in Zhejiang, and one in Anhui. The EOO is 1,556 km² and AOO is 28 km², and none of the collections appear to be from protected areas. The last known collections of this species were made in 1959. From satellite imagery in Google Maps, two of the localities, both in Jiangxi, are under threat of possible deforestation from encroaching agriculture or increasing urbanization in the area; we thus propose one location for this area under the threat of possible deforestation. This species tends to occur in valleys and by riversides, where the most deforestation in the area has occurred. We treat the other six localities that are not under an immediate plausible threat as four separate subpopulations, for a total of five locations. We therefore propose to categorize this species as Endangered (EN): B2ab(iii).

Discussion.—Styrax wuyuanensis is only known from the border region of Zhejiang, Jiangxi, and Anhui. It can easily be distinguished from all the other members of S. series Cyrt a with valvate corolla aestivation by its subglabrous calyx and pedicel. Because we were only able to examine a single physical fruiting specimen, the description was supplemented with measurements from the protologue.

Additional specimen examined. CHINA. Zhejiang: Kaihua Xian, locality unknown [29.144°N, 118.411°E], 27 May 1959 (fr), Zhejiang Bot. Resource Team 26071 (MO).

Excluded Name

We have located no material referable to this name, and the holotype has likely been destroyed, because much of the material Perkins examined was located at B and destroyed during World War II. This variety was previously synonymized with *S. faberi* by Hwang (1980). In the protologue, however, it is described as having imbricate corolla lobes. We thus remove this name from synonymy and exclude this name from our treatment.

### APPENDIX 1

List of species.

1. **Styrax agrestis** (Lour.) G. Don
2. **Styrax bracteolatus** Guillama
3. **Styrax confusus** Hemsl.
4. **Styrax faberi** Perkins
5. **Styrax finlaysonianus** Wall. ex G. Don
6a. **Styrax formosanus** Matsum. var. formosanus

### APPENDIX 2

Index to exsiccatae.

All specimens examined by the authors are listed alphabetically by collector followed by collection number and, if collectors or collection numbers are unknown, by the herbarium or herbaria in which the specimen is deposited. Numbers in parentheses correspond to those in the numerical list of species. Numbers in brackets represent the number of specimens deposited in the herbarium they follow. If more than two persons participated in the collection, only the first collector listed on the label is cited. Collections with only a date indicated do not have a collection number; for these, herbarium acronyms are indicated to help distinguish them from other collections by the same collector that are also lacking a collection number.

#6 Expedition Team 1208 (9).

Aert & Ildjan 210 (10); 320 (10). A.C. d’Alleeijette in Jun 1908 (2) (L); in Jul 1908 (17) (L); in Jun 1909 (7) (P2). A. Allison 55 (3). Ambri & Arfin 442 (10). Ambri et al. 1400 (10). J. Anderson in 24 Apr 1866 (9) (K). Y. Ando et al. 341 (6a). Anhui Team 1355 (7); 1613 (7); 2714 (11).

Anonymous in 2 Jul 1830 (9) (K); in 15 Jun 1850 (9) (K); in 13 May 1974 (7) (KUN); s.n. (6a) (A); 196 (3) (A); 517 (4) (A); 1431 (3) (KUN); 1667 (3) (KUN); 1720 (3) (KUN); 1744 (3) (KUN); 1964 (4) (KUN); 2245 (3) (KUN); 2384 (3) (KUN); 2666 (3) (KUN); 2732 (3) (KUN); 2845 (6a) (KUN); 3202 (3) (KUN); 3205 (3) (KUN); 3656 (3) (KUN); 3822 (4) (KUN); 3907 (3) (KUN); 4119 (3) (KUN); 4194 (3) (KUN); 4507 (3) (KUN); 4693 (3) (KUN); 5003 (3) (KUN); 7073 (9) (KUN). Anta 32 (10). G. Argent 1109 (10).

H.L. B. 000 (10). H.L. Bailey in 13 Jun 1917 (7) (A). B. Balansa 4357 (1). S.Y. Bao 885 (9). S.P. Barchet s.n. (3) (MO). B. Bartholomew & D.E. Boufford 3951 (9); 6219 (6a). B. Bartholomew et al. 8755 (9). H.H. Bartlett 807 (6a). E. Beddome 3025 (3) (KUN); 3202 (3) (KUN); 3450 (3) (KUN); 3656 (3) (KUN); 3822 (4) (KUN); 3907 (3) (KUN); 4119 (3) (KUN); 4194 (3) (KUN).

This document is intended for digital-device reading only. Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.
Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.

This document is intended for digital-device reading only.

APPENDIX 3

Index to the taxonomic treatment of scientific names.

Numbers in parentheses correspond to taxon numbers in the text. Synonyms and excluded names are italicized.
ACKNOWLEDGMENTS

We thank the curators of A, AAU, BM, BO, BR, BRIT, C, CAS, DS, E, GH, K, KUN, KYO, L, MO, P, TAI, and TI for loans or other access to collections; Armin Lockher and Chiara Nepi for their timely responses to requests for digital images of type specimens; Michael Goldman, Tom Daniel, and Bob Patterson (along with PWF) for being on GL’s master’s thesis committee; Yelin Huang and David Boufford for helpful comments on the manuscript; Felix Li and Helen Pang for assisting with Chinese translation; Rebecca Peters for help with the database; Dennis Wen-Zhang Ma for information about the type localities of Styrax bracteolatus and S. rubifolius; Mark Watson for insights into the typology of S. serrulatus; and Alan Chou for the illustrations. This work was performed by the first author as partial fulfillment of a master’s degree at San Francisco State University.

REFERENCES


FinLAYSON, G. 1826. The mission to Siam and Hué, the capital of Cochin-China, in the years 1821–2. Murray, London, U.K.


This document is intended for digital-device reading only.

Inquiries regarding distributable and open access versions may be directed to jbrit@brit.org.


KANEHRA, R. 1936. Formosan trees indigenous to the island (revised). Department of Forestry, Government Research Institute, Formosa, Taipei, Taiwan.


