

- FIG. 29. *Platca species*, Y. U. 20201.
Vessel from the outer secondary xylem. $\times 55$.
FIG. 30. *Apodytes dimidiata* E. Mey., Y. U. 14933.
Vessel from the outer secondary xylem. $\times 55$.
FIG. 31. *Emmotum holosericeum* Ducke, Y. U. 33816.
Vessel from the outer secondary xylem. $\times 55$.

Group II

- FIG. 32. *Stemonurus luzoniensis* (Merr.) Howard, Y. U. 2310.
Vessel from the outer secondary xylem. $\times 55$.
FIG. 33. *Medusanthera samoensis* (Rein.) Howard, H. U. 19471.
Vessel from the outer secondary xylem. $\times 55$.
FIGS. 34-36. *Medusanthera samoensis* (Rein.) Howard, A. 3061.
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Scalariform type of perforations in a vessel from the inner secondary xylem. $\times 220$.
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Vessel from the outer secondary xylem. $\times 55$.
FIGS. 40-41. *Leptaulus grandifolius* Engl., Zenker 14.
Types of perforations in vessels from the inner secondary xylem. $\times 220$.
FIG. 42. *Gonocaryum melanocarpum* Hochr., Krukoff 4218.
Vessel from the outer secondary xylem. $\times 55$.
FIGS. 43-45. *Gonocaryum melanocarpum* Hochr., Krukoff 4218. Types of perforations in vessels from the inner secondary xylem. $\times 220$.

Group III

- FIG. 46. *Desmostachys Vogclii* Stapf, Y. U. 15097.
Vessel from the outer secondary xylem. $\times 55$.
FIG. 47. *Mappia racemosa* Jacq., Y. U. 12196.
Vessel from the outer secondary xylem. $\times 55$.
FIG. 48. *Phytocrene macrophylla* Bl., H. U. 2770.
Vessel from a small stem. $\times 55$.
FIG. 49. *Iodes ovalis* Bl., H. U. 2775.
Vessel from a small stem. $\times 55$.
FIG. 50. *Merrilliodendron rotense* Kanehira, Y. U. 33233.
Vessel from the outer secondary xylem. $\times 55$.

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STUDIES IN THE THEACEAE, VI
THE GENUS *SYMPLOCOCARPON* AIRY-SHAW

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IN 1936, Bullock described a new species of *Eurya*¹ from Mexico and gave it the name *Eurya Hintoni* after the collector, G. B. Hinton. The following year Airy-Shaw² described a new genus, *Symplococarpon*, based upon *Eurya Hintoni* Bullock and three additional Hinton specimens from Mexico, the type species being *Symplococarpon Hintoni* (Bullock) Airy-Shaw. This outstanding new genus is characterized by an inferior or nearly inferior ovary, fruit resembling that of the genus *Symplocos*, and persistent bracteoles. Its nearest relative in the Theaceae is the genus *Cleyera*, with which it agrees in "the arborescent habit, foliage, fasciculate long-pedicelled flowers, and anther structure." A detailed discussion of its generic status and relationships is so well recorded by Airy-Shaw that it would be superfluous to repeat it in this study. The following generic description contains additional information based on the more abundant material available from the Gray Herbarium, Field Museum of Natural History, Missouri Botanical Garden, New York Botanical Garden and the United States National Museum.

Symplococarpon Airy-Shaw in Hooker's Icon. Pl. 34: t. 3342. 1937.

Trees with alternate branches. Leaves alternate, entire or serrate. Flowers hermaphroditic, axillary, fasciculate; pedicels minutely bracteate at the base with 2 persistent bracteoles, opposite or nearly so, at or near the juncture of the pedicel and the hypanthium. Sepals 5, imbricate, persistent. Petals 5, alternate with the sepals, imbricate, slightly connate at the base. Stamens 25–40, uniseriate; filaments connate at and adnate to the base of the corolla; anthers oblong-elliptic, tapering at the apex into a distinct subulate mucro. Ovary inferior, 2-celled, extreme apical portion usually exerted slightly above the base of the persistent calyx-lobes, appearing as a disk; ovules solitary in each cell; styles 2, rarely 3, free to the base, arising erect from the center of the seeming disk. Fruit indehiscent, subglobose, crowned by the persistent calyx and styles, two-celled, two-seeded.

¹Kew Bull. Misc. Inform. 1936: 391. 1936.

²Hooker's Icon. Pl. 34: t. 3342. 1937.

TYPE SPECIES: *Symplococarpon Hintoni* (Bullock) Airy-Shaw.

KEY TO THE SPECIES

- A. Apex of ovary (superior portion) hirsute.
 - B. Filaments of the stamens not thickened at the base.
 - C. Styles glabrous; leaf-margin entire with only an occasional vestige of denticulation; veins obscure on both surfaces.1. *S. Hintoni*.
 - CC. Styles hirsute on lower half; leaf-margin sharply serrate; veins very prominent on both surfaces.6. *S. Brenesii*.
 - BB. Filaments of the stamens noticeably thickened at the base.
 - D. Fascicles 3-4-flowered; styles 2-3; leaves obtuse or rounded at the apex; leaf-margin entire or lightly undulate; small tree up to nine meters.4. *S. chiriquiense*.
 - DD. Fascicles up to 11-flowered; styles 2; leaves acuminate at the apex; leaf-margin serrate; large tree up to 25 meters.5. *S. multiflorum*.
- AA. Apex of ovary (superior portion) glabrous.
 - E. Leaves lanceolate, 5-9 cm. long, 2.0-2.8 cm. wide; calyx-lobes 1.5-2.0 mm. wide; petals 2.0-3.5 mm. wide; mucro of the stamens 0.25-0.50 mm. long.2. *S. Airy-Shawianum*.
 - EE. Leaves oblong-obovate, 8-15 cm. long, 2.5-5.5 cm. wide; calyx-lobes 3-4 mm. wide; petals 4-6 mm. wide; mucro of stamens 1.50-1.75 mm. long.3. *S. Purpusii*.

1. *Symplococarpon Hintoni* (Bullock) Airy-Shaw in Hooker's Icon. Pl. 34: t. 3342. 1937, pro parte typica.

Eurya Hintoni Bullock in Kew Bull. Misc. Inform. 1936: 391. 1936.

Small tree (*Hinton* 8653, 10 m.) with rough, glabrous, densely lenticellate branchlets. Leaves glabrous, oblong-elliptic, coriaceous, very smooth but not shining, 4-7 cm. long, \pm 2 cm. wide, acute at the apex, cuneate at the base, subentire with an occasional minute denticulation on the upper half of the leaf, the midrib deeply canaliculate; petiole 1-3 mm. long. Flowers axillary, in fascicles of 1-3; pedicel \pm 7 mm. long, glabrous, graceful, usually recurved. Bracteoles 2, minute, \pm 1 mm. long, subopposite, sepaloid, ciliolate, otherwise glabrous. Hypanthium obconic-obovoid, glabrous, \pm 2 mm. long. Calyx-lobes 5, unequal, imbricate, suborbicular, 1-2 mm. long, 1.5-2.0 mm. wide, glabrous except for the ciliolate margin. Petals 5, unequal, imbricate, 3.5-5.0 mm. long, 2.0-3.5 mm. wide, obtuse, the margin incurved. Stamens \pm 30, uniseriate; filaments up to 2 mm. long, adnate to the base of the corolla; anthers less than 1 mm. long; mucro subulate, 0.25-0.50 mm.

long. The superior (disk-like) portion of the ovary sparingly hirsute. Styles 2, free, \pm 3 mm. long. Fruit unknown.

MEXICO: District of Temascaltepec, State of Mexico, Mina de Agua, in a barranca, *G. B. Hinton* 8653 (TYPE, Kew; isotypes, AA, FM, NY), Nov. 13, 1935 (tree 10 m.).

Recently, while engaged on some preliminary work on American Theaceae, I discovered that the species *Ternstroemia Purpusii* Brandegee belongs to *Symplocarpon*. At first, I assumed that it belonged to *S. Hintoni*, but on comparison realized that it was a new species, very distinct from the type. This species will be discussed later. It was during this comparison that I reached the conclusion that Airy-Shaw had included two entities in his *S. Hintoni*. Fortunately, the four Hinton numbers cited by Airy-Shaw are available for my examination. Of these, I find that no. 8653, the type of *Eurya Hintoni* Bullock (now the type of *Symplocarpon Hintoni*) is distinct from the other three numbers, 2426, 3081 and 3678. The type, no. 8653, has narrowly elliptic, coriaceous leaves, 4–7 cm. long and ca. 2 cm. wide, entire or nearly so (slight indication of serration of a few leaves), with a canaliculate midrib. Also, the leaves are smooth and opaque, hardly shining. Because of the coriaceous texture, the veins (8–10 pairs) are quite obscure. The petals of the corolla measure 3.5–5.0 mm. long and 2.0–3.5 mm. wide. The young branchlets are densely lenticellate. The apex of the ovary above the hypanthium and calyx-lobes is sparsely hirsute. The fruit, as described by Airy-Shaw, belongs to the following species.

2. *Symplocarpon Airy-Shawianum*, sp. nov.

Symplocarpon Hintoni Airy-Shaw in Hooker's Icon. Pl. 34: t. 3342. 1937, pro parte.

Arbor 10-metralis (procerior, fide *Hinton* 3678), ramulis glabris sparse lenticellatis. Folia lanceolata vel sub lanceolata, 5–9 cm. longa et 2.0–2.8 (–3) cm. lata, basi cuneata vel rare subrotundata, apice abrupte acuminata, submembranacea, glaberrima, opaca, costa supra complanata, margine leviter serrata, nervis lateralibus ca. 14-jugis gracilibus anastomosantibus, petiolis 2–5 mm. longis. Flores axillares, 1–6 fasciculati, pedicellis basi minute bracteatis, apice infra hypanthium bi-bracteolatis, bracteolis oppositis vel suboppositis persistentibus minutissimis ca. 1 mm. longis sepaloideis ciliatis; hypanthium obconico-obovoideum, ca. 2 mm. longum, basi ca. 1 mm. et apice ca. 2 mm. diametro, glabrum, calycis lobis 5 inaequalibus imbricatis glabris ovatis vel subrotundatis pergamenaceis ca. 2 mm. longis et 1.5–2.0 mm. latis

marginem ciliolatis; petala 5, ovata vel obovata, 5–7 mm. longa et 1.5–2.0 mm. lata, margine incurvata; stamina 30–40, uniseriata, filamentis glabris ad 2 mm. longis, basi petalis adnatis, antheris ca. 1 mm. longis, mucrone subulato 0.25–0.50 mm. longo; ovarium toto inferius vel fere, glabrum; styli 2, liberi, 2.5–3.5 mm. longi. Fructus (*Hinton 3678*, immaturus ?) viridis, oblongo-obovatus, ad 13 mm. longus et 7 mm. diametro, lobis calycis et stylis coronatus.

MEXICO: District of Temascaltepec, State of Mexico, Manchititla, in barranca, *G. B. Hinton 3081* (TYPE FM; isotypes, NY, US), January 2, 1933 (tree 10 m. high).—Temascaltepec, in barranca, alt. 2080 m., *G. B. Hinton 3678* (AA), March 31, 1933 (large tree; a fruiting specimen of *Hinton 2426*.)

This species is characterized by leaves 5–9 cm. long and 2.0–2.8 (–3) cm. wide, membranaceous, lanceolate-acuminate (the apex more abruptly and longer acuminate than *S. Hintoni*), denticulate, opaque, not shining, midrib (unlike *S. Hintoni*) flat. The veins are more numerous (ca. 14 pairs) and more pronounced on the lower surface than in *S. Hintoni*. The superior portion of the ovary, above the hypanthium, is strictly glabrous while in *S. Hintoni*, it is hirsute.

The fruit, probably immature, is indehiscent, oblong-obovate, up to 13 cm. long and 7 cm. diameter, brownish green, crowned by the persistent calyx-lobes and styles.

3. *Symplococarpon Purpusii* (Brandegge), comb. nov.

Ternstroemia Purpusii Brandegge in Univ. Calif. Publ. Bot. 6: 187. 1915.

Tree (probably) with glabrous, rather smooth, sparsely lenticellate branchlets. Leaves glabrous, oblong-obovate, membranaceous, shining, 8–15 cm. long, 2.5–5.5 cm. wide, obtusely acuminate at the apex, cuneate at the base, the margin crenulate, the midrib flat, not canaliculate; petiole 2–3 mm. long. Flowers axillary, in fascicles of 1–3; pedicel \pm 8 mm. long, glabrous, sturdy, usually erect, ca. 1 mm. diameter at the hypanthium. Bracteoles 2, subopposite, minute, sepaloid, ciliolate. Hypanthium obconic-obovoid, glabrous 2–3 cm. long. Calyx-lobes 5, unequal, imbricate, suborbicular, 2–3 mm. long, 3–4 mm. wide, glabrous except for the ciliolate margin. Petals 5, unequal, imbricate, 5–7 mm. long, 4–6 mm. wide, obtuse, the margin incurved. Stamens \pm 30 (25–40), uniseriate; filaments 1.5–2.5 mm. long, adnate to the base of the corolla; anthers up to 2 mm. long; mucro subulate, 1.50–1.75 mm. long. The superior (disk-like) portion of the ovary glabrous. Styles 2, free, 4–5 mm. long. Fruit unknown.

MEXICO: State of Chiapas, Finca Irlanda, C. A. Purpus 7434 (isotypes of *Ternstroemia Purpusii* AA, G, FM, NY), June 1914.

This species is based upon *Ternstroemia Purpusii* Brandegees collected by C. A. Purpus (no. 7434) in the State of Chiapas, Mexico. It was the study of this specimen that led to the present brief survey of *Symplococarpon*.

The leaves of this species are considerably larger than those of the other two species mentioned above, 8–15 cm. long and 2.5–5.5 cm. wide, membranaceous, oblong-obovate, obtusely acuminate at the apex with a delicately serrate margin. In the leaf-margin, the flat open midrib, and the glabrous ovary, this species resembles *S. Airy-Shawianum*. The pedicels in all three Mexican species vary not more than 2 mm. in length. However, the first two are characterized by graceful recurved pedicels which measure 0.5 mm. in diameter at the base of the flower. In the plate accompanying the description of the new genus, the flowers appear to be borne on erect pedicels. The flowers in the Hinton collections studied at the Arnold Arboretum are on recurved pedicels. *Symplococarpon Purpusii* is characterized by more sturdy pedicels, varying little from those of the Hinton numbers in length, but at the point of the bracteoles the pedicels measure ± 1 mm. in diameter, as opposed to ± 0.5 mm. of *S. Hintoni* and *S. Airy-Shawianum*. This trifling difference in diameter does cause the flowers in most instances, to stand erect, especially those in the axils of the upper leaves, where they are less crowded. Some of the flowers in the lower axils do curve somewhat but not to the degree shown by those in *S. Hintoni* and *S. Airy-Shawianum*. The mucro of the stamen in this species is three-times longer (1.50–1.75 mm.) than the mucro in any other known species (up to 0.5 mm.).

4. *Symplococarpon chiriquiense*, sp. nov.

Arbor parva, 6–9-metralis (fide collectore), ramulis glabris, non lenticellatis. Folia oblongo-obovata, glabra, coriacea vel subcoriacea, 4–6 cm. longa et 1.8–3.0 cm. lata, supra nitida, subtus pallidiora, apice obtusa vel rotundata, basi cuneata, margine integerrima vel leviter undulata, costa supra complanata, nervis ca. 5–7 paribus utrinque prominentibus, petiolis glabris 2–3 mm. longis. Flores axillares, 3–4-fasciculati; pedicelli glabri, recurvi, 11–12 mm. longi, apice infra hypanthium bracteolis 2 inaequalibus 0.3–1.0 mm. longis oppositis vel suboppositis persistentibus sepaloideis ciliolatis; hypanthium glabrum, obconico-obovoideum, ca. 2 mm. longum, calycis lobis 5 inaequalibus imbricatis pergamenaceis ca. 1 mm.

longis et 1.5 mm. latis, apice obtusis vel flabelliformibus, margine ciliolatis; petala 5, obovata vel subrotundata, imbricata, 6–7 mm. longa et 4–6 mm. lata, margine incurvata; stamina ca. 25, uniseriata, filamentis glabris ad 3 mm. longis, basi subcrassis et petalis adnatis, antheris ca. 0.75 mm. longis, mucrone subulato ca. 0.3 mm. longo; ovarium fere totum inferius ovarii parte superiore dense albo-hirsuta; bi- vel ? triloculare; styli 2 vel 3, liberi, ca. 3 mm. longi, glabri. Fructus ignotus.

PANAMA: Boquete District, Chiriqui Prov., alt. 1500 m., *M. E. Davidson* 799 (FM), June 27, 1938 (small tree 20–30 ft. high with cream-colored flowers.)

This species may be characterized by oblong-obovate, entire, glabrous leaves, conspicuously veined on both surfaces. The flowers are axillary and 3–4-fascicled. All parts, except the somewhat flat apex of the ovary, the very young buds and the midrib (lower surface) of the youngest leaves, are glabrous. The filaments are about 3 mm. long. The styles vary in number from two to three. This is the first instance of three styles appearing in the genus and it links *Symplocarpon* even closer to the genus *Cleyera*.

Its nearest relative is *S. multiflorum*, which can be separated from *S. chiriquiense* by the many-flowered fascicles (up to nine) as compared to the few-flowered fascicles of the present species. Also, the number of styles in *S. multiflorum* is consistently two, the leaves are serrate, and the alternate bracteoles are situated somewhat below the hypanthium. *Symplocarpon chiriquiense* and the two following Central American species differ from the Mexican species in their densely hirsute ovaries (at the apex). The ovary of *S. Hintoni* has a few scattered hairs similar in type to those of the Central American species. However, in the other two Mexican species, *S. Airy-Shawianum* and *S. Purpusii*, the ovaries are strictly glabrous.

5. *Symplocarpon multiflorum*, sp. nov.

Arbor 20–25-metralis (fide *Austin Smith* A487), ramulis ferrugineis glabris, lenticellis sparsis vel nullis. Folia oblongo-obovata vel oblongo-elliptica, glabra, coriacea, 4–7 cm. longa et 1.5–3.0 cm. lata, supra nitida, subtus pallidiora, apice acuminata, basi cuneata, margine serrata, costa supra complanata, nervis ca. 7–8 paribus utrinque prominentibus, petiolis glabris 5–7 mm. longis. Flores ad 8–11 in fasciculis axillaribus; pedicelli glabri, recurvi, 10–12 mm. longi, bracteolis 2 suboppositis minutissimis ca. 0.5 mm. longis sepaloideis inaequalibus persistentibus; hypanthium glabrum, obconico-obovoideum, 2.0–2.5 mm. longum, calycis

lobis 5 inaequalibus imbricatis pergamenaceis glabris 1–2 mm. longis et 1.7–2.0 mm. latis, apice rotundatis vel flabelliformibus, ciliolatis; petala 5, inaequalia, imbricata, subrotundata vel obovata, 5–6 mm. longa et 4–5 mm. lata, margine incurvata; stamina ca. 25, uniseriata, filamentis ca. 3 mm. longis glabris, basi manifeste crassis et petalis adnatis, antheris ca. 0.75 mm. longis, mucro subulato ca. 0.25 mm. longo; ovarium fere totum inferius, bi-loculare, ovarii parte superiore dense albo-hirsuta; styli 2, liberi, ca. 3 (–5) mm. longi, glabri. Fructus ignotus.

COSTA RICA: Palmira, region of Zarcero, alt. 1800 m., *Austin Smith 4487* (TYPE, AA; isotypes, FM, MBG), Oct. 5, 1937 (tree 75 ft. high, 3 ft. at the base; bark dark brown; flowers deep salverform, cream-colored; anthers ferrugineous).—La Junta (La Chonta), *H. E. Stork 2305* (FM), May 27, 1928.—Santa Maria, alt. 1700 m., *H. E. Stork 1808* (FM), May 5, 1928 (small roadside tree with yellow flowers).

As the name indicates, this species is characterized by its many-flowered fascicles, varying from four to nine. The bracteoles, in the type, are nearly opposite and are located just below the hypanthium. In *Stork 1808* the bracteoles are alternate, nearly 2 mm. apart in some instances, with the upper bracteole as much as 2 mm. below the hypanthium. However, this character is not consistent. The filaments of the stamens are enlarged at the base. This thickened portion, which is approximately 1 mm. long, approaches the anther in size. The leaves are coriaceous and serrate.

The collector of the type states that the specimen was taken from a large tree 75 ft. high, 3 ft. at the base. *Stork 1808* is described by the collector as a small roadside tree.

6. *Symplococarpon Brenesii*, sp. nov.

Arbor parva 4–6-metralis (fide Brenes), ramulis brunneis glabris lenticellatis. Folia lanceolata, glabra, coriacea, 4.0–7.5 cm. longa et 1.5–2.75 cm. lata, supra nitida, subtus pallidiora, apice acuminata, basi cuneata, margine serrata, costa supra complanata, venis ca. 7–9 paribus utrinque prominentibus, petiolis glabris ca. 5 mm. longis. Flores axillares, 1- vel 2- (rare 3-) fasciculati; pedicelli glabri, recurvi, 10–11 mm. longi, apice bracteolis 2 suboppositis inaequalibus sepaloideis minutis 0.5–0.7 mm. longis obtusis glabris persistentibus; hypanthium glabrum, obconico-obovoideum, ca. 2 mm. longum, calycis lobis 5 inaequalibus imbricatis glabris pergamenaceis 1.0–1.5 mm. longis et ca. 1.5 mm. latis, apice obtusis vel flabelliformibus, margine ciliolatis; petala

5, inaequalia, imbricata, obtusa ca. 5 mm. longa et 4.5 mm. lata, margine incurvata; stamina uniseriata, ca. 25, filamentis glabris ad 3 mm. longis, basi petalis adnatis et non incrassatis, antheris ca. 1 mm. longis, mucrone subulato ca. 0.5 mm. longo; ovarium fere totum inferius, ovarii parte superiore dense hirsuta; styli 2, liberi, ca. 3 mm. longi, parte inferiore hirsuti. Fructus (*Brenes* 6228) obovoideus vel subglobosum, subligneus, rugosus, ca. 8 mm. longus et 6 mm. latus, calyce stylisque persistentibus coronatus, apice excepto glaber, bi-locularis, 2-spermus; semen ovoideum, brunneum, ca. 4 mm. longum et 3.5 mm. latum, intus leviter concavum, extus hemisphaericum et rugosum basi apiceque obtusum.

COSTA RICA: La Palma y El Socorro de San Ramón, alt. 1175 m., *A. M. Brenes* 4396 (TYPE, FM), August 27, 1925 (leaves ca. 9 cm. long and 3.5 cm. wide). — Same locality, woods and pastures, alt. 1180 m., *A. M. Brenes* 4453 (FM), September 29, 1925 (tree 4–6 m. tall with spreading round crown; fruit immature). — Same locality, pastures and woods, alt. 1150 m., *A. M. Brenes* 5151 (FM), November 24, 1926 (small tree with rounded crown; fruit blue, small). — Same locality, woods and pastures, alt. 1150–1175 m., *A. M. Brenes* 5720 (FM), October 5, 1927 (small tree 4–5 m. tall, very branched; fruit axillary, isolated or in twos, green becoming black in drying, frequently 6–8 mm. long and 3–4 mm. diameter, surface rugose, pericarp thick, nearly woody; seeds ovoid, fleshy, light purple, 2×3 mm.). — Same locality, *A. M. Brenes* 6228 (FM), July 24, 1928.

Symplocarpon Brenesii is characterized by glabrous, shining, coriaceous, serrate, lanceolate leaves. The flowers are somewhat smaller than those of the other Central American species and are disposed in fascicles of one or two, rarely three, flowers. The styles are hirsute along the lower half and the filaments of the stamens lack the basal thickening found to a marked degree in *S. multiflorum* and to a lesser degree in *S. chiriquiense*.

With the exception of *S. Airy-Shawianum*, this species is the only one in the genus to have been collected in fruit. All the specimens cited above, with the exception of the type, are fruiting specimens. Probably for the first time, mature or nearly mature fruit has been collected and recorded. A. M. Brenes, the collector, notes that the fruits are blue (no. 5151). In the immature stage (no. 4453) the fruit is oblong-obovate and probably green, with the hirsute apex and the persistent calyx-lobes clearly visible. On maturing (nos. 5151, 6228), the two-seeded fruit appears more nearly globose, the pericarp becomes somewhat woody and thickened, and the small persistent calyx-lobes, although



Kobuski, Clarence Emmeren. 1941. "Studies in the Theaceae, VI. The genus *Symplocarpon* Airy-Shaw." *Journal of the Arnold Arboretum* 22(2), 188–196.
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