

NOTES ON THE GENUS *HOLMSKIOLDIA* (VERBENACEAE)

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Lack of time this late in life prevents the preparation of the detailed monograph of this genus as was originally planned and announced, but it has been thought worthwhile to place on record here the bibliographic and herbarium notes on the genus assembled by my wife, Alma L. Moldenke, and myself over the past fifty-two years. Full explanation of the herbarium acronyms employed have been published in previous papers and are repeated in *PHYTOLOGIA MEMOIRS* 2: 463--469 (1980) and are the same as used by me in my series of papers on 62 other genera in this and some other journals.

HOLMSKIOLDIA Retz., Obs. Bot. 6: 31. 1791.

Synonymy: *Hastingia* König ex J. E. Sm., Exot. Bot. 2: 41, pl. 80. 1806 [not *Hastingia* König ex Endl., 1966]. *Platunium* A. L. Juss., Ann. Mus. Hist. Nat. Paris 7: 76. 1806. *Hastingia* J. E. Sm. apud Reichenb., Conspect. Reg. Veg. 1: 117. 1828. *Holmskidia* Dumort., Anal. Fam. Pl. 22. 1829. *Holmskioldia* Bocq., Adansonia, ser. 1, 3: 184, sphalm. 1862. *Holmskjöldia* Retz. ex Kuntze, Rev. Gen. Pl. 2: 588. 1891. *Holmskiöldia* Retz. apud Gamble, Man. Indian Timb., ed. 2, imp. 1, 544. 1902. *Platinum* Juss. apud DeWild., Icon. Select. Hort. Then. 4: pl. 159, in syn. 1903. *Platunum* A. Juss. apud Dalla Torre & Harms, Gen. Siphonog. 433. 1904. *Florissantia* Knowlton, Proc. U. S. Nat. Mus. 51: 270. 1916. *Hastingsia* König apud H. Hallier, Meded. Rijks Herb. Leid. 37: 84, in syn. 1918 [not *Hastingsia* S. Wats., 1879]. *Holmskjoeldia* Retz. ex H. J. Lam, Verbenac. Malay. Arch. 321. 1919. *Holmskjöldia* Retz. ex Porsch., Jahrb. Wiss. Bot. 63: 565, 577, 584, & 656--659, fig. 1--4. 1923. *Holmskioldia* Navarro Haydon, Fl. Com. Puerto Rico [15]. 1936. *Hastingsia* J. E. Sm. ex Mold., Prelim. Alph. List Inv. Names 26, in syn. 1940. *Platinum* Juss. ex Mold., Suppl. List Inv. Names 6, in syn. 1941. *Holmskioldia* Helfer ex Mold., Alph. List Inv. Names Suppl. 1: 10, in syn. 1947. *Holmskioldia* Thorel ex Mold., Résumé Suppl. 3: 32, in syn. 1962. *Hastingsia* P. & K. apud Airy Shaw in J. C. Willis, Dict. Flow. Pl., ed. 7, 522, in syn. 1966. *Holmskioldia* Fourn., Imp. Tree Fam. Costa Rica 13. 1966. *Hastingia* "König ex Sm." apud Mold., Résumé Suppl. 16: 22, in syn. 1968. *Holmskioldia* Retz. apud Misra, Bull. Bot. Surv. India 12: 136, sphalm. 1970. *Holmskjöldia* Retz. ex Mold., Phytologia 23: 432. 1972. *Holmskioldia* Retz. ex Anon., Commonw. Myc. Inst. Ind. Fung. 38 823, sphalm. 1972. *Holmskjöldia* Pleyte ex Mold., Phytologia 26: 373, in syn. 1973. *Holmskioldia* Woodrow ex Mold., Phytologia 31: 400, in syn. 1975. *Holmskioldia* Thorel ex López-Palacios, Fl. Venez. Verb. 323, in syn. 1977. *Holmskioldia* López-Palacios, Fl. Venez. Verb. 649, in syn. 1977. *Holmskioldia* Retz. ex Kannan, Journ. Bomb. Nat. Hist. Soc. 75 (suppl.): 1050, sphalm. 1980.

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Straggling or climbing glabrous or incanous-pubescent shrubs or trees, unarmed or armed with small axillary spines aiding in climbing; branches often elongate and more or less clambering, obtusely and often obscurely tetragonal; leaves simple, decussate-opposite, petiolate, deciduous, entire or dentate, exstipulate, often glandular-dotted beneath; inflorescence cymose or racemiform, spuriously axillary and short-pedunculate in the axils of the upper cauline leaves or foliaceous bracts, or crowded at the apex of the branchlets in terminal fashion, leafy, short, few-flowered, the higher ones often 1-flowered and the apex of the panicle then racemiform; bracts often small, deciduous; bracteoles absent; calyx gamosepalous, large, rotate or broadly obconic to patelliformly patent above the short basal urceolate tube, membranous, often highly colored, very much accrescent in age, entire and subtruncate to very broad and more or less obscurely 5-lobed, often very venose, inferior; corolla gamopetalous, tubular or hypocrateriform, zygomorphic, the tube cylindric, incurved, slightly antrorsely ampliate, the limb oblique, spreading, shortly 5-lobed or -parted, the lobes usually short, unequal, the 2 posterior ones exterior in bud, the 2 lateral ones smaller, the anterior

one largest; stamens 4 or 5, didynamous, inserted in the corollatube at or below the middle, shortly exserted; anthers ovate or ovoid, the 2 thecae parallel; pistil single, composed of 2 bilocular carpels; style single, terminal, filiform, slightly exserted; stigma shortly bifid or bilobed, the posterior lobe short and obtuse, the anterior one long and thin; ovary superior, bicarpellary, rotund, very obtuse and entire or apically obscurely depressed or 4-lobed, 4-locular, the cells 1-ovulate; ovules lateral, solitary, subpendulous, affixed in the upper anterior angle of the locule; fruiting-calyx much enlarged, wide-spreading, patelliform or rotate, often brightly colored, often 2 cm. or more in width, almost enclosing the fruit at its contracted base; fruit drupaceous or capsular, obovoid, apically truncate and shortly to divaricately and deeply 2--4-lobed or even almost 4-horned, usually more or less enclosed in the urceolate base of the persistent calyx-tube, the exocarp often somewhat juicy, the mesocarp thin, the endocarp hard, splitting into 1--4 nutlets or bony pyrenes; seeds oblong, exalbuminous, the testa membranous.

Type species: *Holmskioldia sanguinea* Retz.

This is a small genus of about 19 or 20 specific and subspecific taxa native to southern Asia, southeastern Africa, and Madagascar; one species widely cultivated and often escaped and more or less naturalized in both the East and West Indies and elsewhere; 2 fossil species are known from the Eocene, Miocene, and Oligocene of North America. There is said to be a form of the genus with "greenish-yellow calyx and corolla" which may or may not prove to be *H. sanguinea* f. *citrina* Mold.

The genus is named in honor of Theodor Holmskjöld [né Holm] (1732--1794), a Danish nobleman who wrote on the flora of Denmark. Benth (1876), Gürke (1895), Chittenden (1951), Preston (1969), and Palmer & Pitman (1972) regarded the genus as comprising only 3 species; Briquet (1895) and Dalla Torre & Harms (1904) gave the number as 3 or 4; Jafri & Ghaffoor (Flora of West Pakistan, mss.) as 6; the Baileys (1976) and Encke (1960) as 10; López-Palacios (1977) as 11; and Angely (1956) as 14. The natural distribution is usually given as paleotropical from the Himalaya region of India, east-central Africa, and Madagascar.

Vernacular and common names for the members of the genus include "Chinese-hat", "holmskioldia", "holmskioldie", "Japanese-hat", and "parasol-flower", but these apply mostly to the type species, *H. sanguinea* Retz.

The genus belongs in the *Didynamia Angiospermia* of Linnaeus; Tribe *Viteae* Schau., Subtribe *Viticeae* (Bartl.) Schau. of Schauer (1847); Tribe *Viticeae* (Bartl.) Benth. of Benth (1876); and Subfamily *Viticoideae* Briq., Tribe *Clerodendreae* Briq. of Briquet (1895). Reichenbach (1828) and Firminger (1874) placed it in the *Labiatae* [*Lamiaceae*].

An interesting comment is made by Lindley (1823) in speaking of the scientific generic name, *Holmskioldia*: "The appellation has been criticized as uncouth to our utterance, but still we suspect it will be more easily pronounced by an Englishman, than the generic one so justly derived from our monosyllable Smith can

be by a Dane or indeed any foreigner."

The fossil genus, *Florissantia*, is based on *F. physalis* Knowlton from the Miocene at Florissant, Colorado, now known as *Holmskioldia speirii* (Lesq.) MacGinitie.

The *Hastingsia* S. Wats. (1879), referred to in the generic synonymy above is a synonym of *Schoenolirion* Durand in the *Liliaceae*, while *Hastingsia* "König ex Endl." [apud Willis] is a synonym of *Abroma* Jacq. in the *Sterculiaceae*. In regard to *Hastingsia* "P. & K.", Airy Shaw (1966) credits this name to Post & Kuntze, but these authors in their *Lexicon*, p. 267 (1904) definitely and very plainly credit the name to J. E. Smith, but Smith, in turn (1806), plainly credits it to König! The Smith reference, incidentally, is erroneously cited as published in "1805" by Dalla Torre & Harms (1904).

It is worth noting here, once again, that, according to Benth-
am's own account ["On the joint and separate work of the authors of Bentham and Hooker's *Genera Plantarum*" in *Journ. Linn. Soc. Lond. Bot.* 20: 304--308. 1883], the entire treatment of the *Verbenaceae* in that work was by Bentham alone. Most writers on this group erroneously credit the verbenaceous discussions to both Bentham & Hooker.

Compton (1966) lists an unidentified species of *Holmskioldia* from the poorts of Swaziland -- this probably will prove to be *H. tettensis* (Klotzsch) Vatke. Mukherjee's (1965) listing of an unidentified species from the "creeper jungles" of West Bengal probably applies to *H. sanguinea* Retz.

Dr. Gillett has written to me several times concerning an as yet undescribed and unnamed species in Kenya, represented by *Faden*, *Faden*, *Gillett*, & *Gachathi* 77/439 in my personal herbarium. He states that it is a narrow-crowned tree, about 12 m. tall, with tan-colored bark peeling off with the permanent lenticels, the leaves opposite, their blades oblong, about 30 cm. long and 15 cm. wide, with dense reticulate venation, and the mature fruiting-calyx 6 cm. wide. It was collected only in the fruiting stage in February on limestone rodes with *Commiphora zimmermannii*, *Erythrina saculeuxii*, *Ficus* sp., *Gyrocarpus americana*, *Sterculia appendiculata*, *Ricinodendron* sp., etc., just north of Nwara Kenya on the Chonyi to Ribe road 4.8 km. north of the turn-off on the Kilifi to Kalolena road, at 30°47' S., 39°42' E. at about 140 m. altitude. He reports only a single tree and a single sapling were observed. This plant certainly cannot represent any presently known species in the genus and I hope that flowering material may eventually be collected, something which Dr. Gillett writes me that he is continuing to try to do.

Sweet (1839) asserts that "*Holmskioldia* occurs in p. 546 [of his work], under *Labiatae*, and in p. 551, in *Verbenaceae*; it is doubtful which of the two genera will ultimately stand; the latter, however, may be altered to *Hastingsia* for the present." Actually, there is no homonymous genus in the *Lamiaceae*.

Junell (1934), basing his work on an *Herb. Forest Fl. Siwalis & Jaunsur Div. s.n.* collection of *H. sanguinea* Retz., says for the genus *Holmskioldia*:

"Der Fruchtknoten ist schwach lobiert.....Die Plazenten verwachsen verhältnismässig hoch oben im Fruchtknoten. (Bei den vorhergehenden Arten sind die Plazenten bis nahe an den Grund der Fruchtknothenhöhle getrennt.) Die Fruchtblattränder bleiben jedoch auch bei dieser Gattung von einander frei. Die mittleren Partien der Fruchtblätter sind schwach verdickt. Sowohl aussen am Fruchtknoten als auf den Plazenten und besonders auf den Samenanlagen kommen reichlich grosse Drüsen vor.....Wie bei *Oxera*, *Faradaya* und *Hosea* sind die Samenanlagen mit ihrem chalazen Teil an der Plazenta befestigt. Der Embryosack ist oben etwas erweitert. Dieser Subtribus kann möglicherweise in zwei Gruppen getrennt werden. Bei den Gattungen *Faradaya*, *Oxera*, *Hosea* und *Holmskioldia* sind nämlich die Samenanlagen ungewöhnlich hoch inseriert und mit ihrem chalazen Teil an der Plazenta befestigt; bei den übrigen Gattungen hingegen sind sie unmittelbar oberhalb der Mitte der Samenanlage inseriert."

Gibbs (1974) reports saponins "absent or probably absent" and tannins definitely absent in the genus. An unidentified member of the genus is said to be host to the parasitic fungus, *Cercospora holmskioldiae*.

The *C. Smith* 297, identified and distributed in some herbaria as *Holmskioldia* sp., actually is *Nyctanthes arbor-tristis* L., *Pleyte* 722 is *Petraeovitex multiflora* (J. E. Sm.) Merr., and *Jenkins* s.n. [Assam] is *Premna esculenta* Roxb.

Excluded species:

- Hastingsia alba* S. Wats., Proc. Amer. Acad. 14: 242. 1879 =
Schoenolirion album (S. Wats.) Durand, *Liliaceae*
Hastingsia bracteosa S. Wats., Proc. Amer. Acad. 20: 377. 1885 =
Schoenolirion bracteosum (S. Wats.) Durand, *Liliaceae*
Holmskioldia angustifolia Mold., Bull. Torrey Bot. Club 77: 397.
 1950 = *Capitanopsis angustifolia* (Mold.) Capuron, *Lamiaceae*

An artificial key to the accepted taxa of *Holmskioldia*:

1. Fossil species.
 2. Calyx unlobed, about 3.2 cm. wide; Eocene of British Columbia.....*H. quilchenensis*.
 - 2a. Calyx distinctly angulate-lobed, about 5 cm. wide; Miocene of Colorado and Oligocene of Montana.....*H. speirii*.
- 1a. Modern species.
 3. Fruiting-calyx about 6 cm. wide.....*H. sp. nov. ined.*
 - 3a. Fruiting-calyx only 1.2--3.5 cm. wide.
 4. Branches spiny.
 5. Leaf-blades narrowed to the base.....*H. spinescens*.
 - 5a. Leaf-blades basally rounded.....*H. mucronata*.
 - 4a. Branches unarmed.
 6. Native to continental Africa.
 7. Leaf-blades distinctly toothed.
 8. Corollas white.....*H. tettensis* f. *alba*.
 - 8a. Corollas lilac or violet to purple.
 9. Calyx pink.....*H. tettensis*.
 - 9a. Calyx yellow.....*H. tettensis* f. *flava*.
 - 7a. Leaf-blades entire or subentire.....*H. subintegra*.

6a. Native to tropical Asia or Madagascar, not Africa.

10. Native only to Madagascar.

11. Leaf-blades glabrous or very obscurely pilosulous beneath.

12. Mature fruiting-calyx about 1.5 cm. in diameter; mature leaves 1.5--3 cm. long. *H. microphylla* var. *glabrescens*.

12a. Mature fruiting-calyx to 3.3 cm. in diameter; mature leaves 3.5--9 cm. long.

13. Lobes of fruiting-calyx separate almost to the base; fruit about 7 mm. long and wide. *H. mira* var. *fissa*.

13a. Lobes of fruiting-calyx separate only to the middle or slightly beyond; fruit about 4 mm. long and wide.....*H. mira*.

11a. Leaf-blades densely pubescent, puberulent, or tomentose beneath.

14. Leaf-blades densely tomentose beneath....*H. microcalyx*.

14a. Leaf-blades merely pubescent or puberulent beneath.

15. Leaf-blades densely appressed white-canescens beneath, small, 5--27 mm. long, 5--12 mm. wide, basally cuneate; mature fruiting-calyx about 1 cm. in diameter...
.....*H. microphylla*.

15a. Leaf-blades not appressed white-canescens beneath, larger, 4--8 cm. long and 2--4 cm. wide.

16. Leaf-blades apically attenuate-acute; petioles 15--20 mm. long.....*H. madagascariensis*.

16a. Leaf-blades apically obtuse, rounded, or emarginate; petioles only 5--10 mm. long.

17. Mature fruiting-calyx 2.5--3.5 cm. in diameter....
.....*H. microcalyx* var. *glabrescens*.

17a. Mature fruiting-calyx about 2 cm. in diameter....
.....*H. humberti*.

10a. Native only to tropical Asia, widely cultivated elsewhere.

18. Corollas red or orange.....*H. sanguinea*.

18a. Corollas yellow.....*H. sanguinea* f. *citrina*.

HOLMSKIOLDIA HUMBERTI Mold., Bull. Torrey Bot. Club 77: 398. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 398. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 119. 1953; Mold. in Humbert, Fl. Madag. 174: 254, 261, & 263--264, fig. 42 (5 & 6). 1956; Mold., Résumé 156 & 456. 1959; Mold., Fifth Summ. 1: 261 (1971) and 2: 880. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 261, fig. 42 (5 & 6). 1956.

Shrub or small tree, about 2 m. tall; branchlets very slender, rather irregular, corky-lenticellate, not plainly tetragonal, minutely puberulent or glabrescent; twigs abbreviated, rather densely puberulent; nodes not annulate; principal internodes much abbreviated, 0.2--2 cm. long; leaves decussate-opposite; leaf-scars rather large and prominent, corky; buds densely tomentellous; petioles slender, 7--10 mm. long, densely puberulent with subappressed antrorse hairs; leaf-blades subcoriaceous, grayish-green on both surfaces, broadly elliptic or short-ovate, 3--4.3 cm. long, 2.2--3.7 cm. wide, apically obtuse or rounded, marginally entire, basal-

ly rounded, finely puberulent above (more densely so along the midrib), very densely puberulent or cano-tomentose and resinous-punctate beneath; midrib slender, mostly subimpressed above, prominent beneath; secondaries slender, 4--6 per side, arcuate-ascending, subimpressed above, prominent beneath, joined in many loops some distance from the margins; vein and veinlet reticulation very abundant, rather conspicuously subimpressed above, prominent to the ultimate divisions beneath; inflorescence axillary, 1-flowered, subequaling or shorter than the subtending leaf; peduncles filiform, 1.5--2 cm. long, rather densely spreading-puberulent; pedicels filiform, 7--10 mm. long, densely spreading-puberulent; bractlets caducous; corolla yellow-green; fruiting-calyx patelliform, star-shaped, thin-textured, about 2 cm. wide, venose, puberulent on both surfaces, more densely so on the outer surface, its tube campanulate, about 6 mm. long, the 5 lobes somewhat unequal, broadly elliptic, 7--8 mm. long, apically obtuse; fruit oblate-spheroid, about 5 mm. wide, thin-textured, densely puberulent and more or less resinous-punctate.

This endemic species of northwestern Madagascar is based on a collection made by Dr. Henri Humbert (no. 19032) in the tropophilous forest near Ambodimagodro, in the limestone hills and plateaus of Ankarana, Diego-Suarez, Madagascar, at an altitude of 150--200 m., collected between December, 1937, and January, 1938, and deposited in the Paris herbarium. Bernardi reports it as "apparently rare" and encountered it in flower and fruit in November.

Citations: MADAGASCAR: *Bernardi* 11258 (Ac, N); *Humbert* 19032 (N--isotype, P--type).

HOLMSKIOLDIA MADAGASCARIENSIS Mold., Bull. Torrey Bot. Club 77: 398--399. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 398--399. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 119. 1953; Mold. in Humbert, Fl. Madag. 174: 259 & 261--263, fig. 42 (4). 1956; Mold., Résumé 156 & 456. 1959; Mold., Fifth Summ. 1: 261 (1971) and 2: 880. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 261, fig. 42 (4). 1956.

Shrub or tree; branchlets irregular, dark, rather slender, not plainly tetragonal, appressed-puberulent, glabrescent in age; twigs very slender, very densely short-pubescent with sordid-grayish hairs; nodes not annulate; principal internodes 0.3--2 cm. long, mostly greatly abbreviated; leaf-scars very large and prominent, corky-margined; leaves decussate-opposite; petioles very slender, 1.3--2 cm. long, densely short-pubescent with appressed whitish antrorse hairs; leaf-blades firmly chartaceous or subcoriaceous, light-green above (brunnescent in drying when immature), whitish beneath, lanceolate-ovate, 4--8 cm. long, 1.8--4 cm. wide, apically acute, basally mostly acute and occasionally asymmetric, marginally entire, rather densely short-pubescent with subappressed whitish hairs above, very densely short-pubescent (especially on the venation to its ultimate divisions) beneath,

the hairs whitish and subappressed; midrib slender, subimpressed above, prominent beneath; secondaries slender, 4--6 per side, arcuate-ascending, subimpressed above, prominent beneath; vein and veinlet reticulation very abundant, rather conspicuous and subimpressed above, very prominent beneath; inflorescence axillary on the young twigs, shorter than the subtending leaf; peduncles solitary in each axil, very slender, 1.3--2.1 cm. long, very densely short-pubescent like the twigs, usually 1-flowered and with a single pair of bractlets; pedicels very slender, 5--9 mm. long, very densely short-pubescent like the twigs; bractlets linear, 3--4 mm. long, densely short-pubescent; calyx campanulate, very densely white-tomentellous, its tube about 4 mm. long and wide, its 5 lobes 3--4 mm. long, broadly ovate, apically acute; corolla densely white-tomentellous on the outer surface; fruiting-calyx patelliform, star-shaped, herbaceous, about 2 cm. wide, very densely short-pubescent or tomentellous on both surfaces, the lobes broadly ovate, about 6 mm. long and wide, apically acute.

The species is based on *Service Forestier 50* from Ankara-fantsika, in the Seventh Reserve, Madagascar, collected sometime before April 4, 1933, and deposited in the Paris herbarium. The species is probably endemic to low altitude woods on limestone plateaus in western Madagascar. The type collection is erroneously given as "30" in Humbert's *Flora* (1956).

Citations: MADAGASCAR: *Service Forestier 50* (F--photo of type, N--photo of type, P--type, Z--photo of type).

HOLMSKIOLDIA MICROCALYX (J. G. Baker) Pieper, Engl. Bot. Jahrb. 62: Beibl. 141: 80. 1928.

Synonymy: *Vitex microcalyx* J. G. Baker, Journ. Linn. Soc. Lond. Bot. 25: 341. 1890. *Vitex macrocalyx* J. G. Baker ex Mold. in Humbert, Fl. Madag. 174: 260, in syn. 1956. *Holmskioldia macrocalyx* (J. G. Baker) Pieper ex Mold. in Humbert, Fl. Madag. 174: 260, in syn. 1956.

Bibliography: J. G. Baker, Journ. Linn. Soc. Lond. Bot. 25: 341. 1890; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 1, 457. 1906; Pieper, Engl. Bot. Jahrb. 62: Beibl. 141: 80. 1928; A. W. Hill, Ind. Kew. Suppl. 8: 119. 1933; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 2, 457. 1941; Mold. in Humbert, Fl. Madag. 174: 253 & 260--262, fig. 42 (1 & 2). 1956; Durand & Jacks., Ind. Kew. Suppl. 1, imp. 3, 457. 1959; Mold., Résumé 156, 298, 386, 418, & 456. 1959; Mold., Fifth Summ. 1: 261 (1971) and 2: 527, 721, 722, 775, & 880. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 261, fig. 42 (1 & 2). 1956.

Shrub or tree, 2--2.5 m. tall; branchlets medium to slender, rather irregular, dark, obtusely tetragonal, densely puberulent when young, soon glabrescent, sometimes corky-lenticellate; twigs slender, very densely short-pubescent with sordid-cinereous hairs; nodes not annulate; principal internodes usually 2--7 mm. long on the twigs, sometimes elongate to 3 cm. on the branchlets;

leaf-scars very large and divergent-prominent, very corky; buds densely villosulous; leaves decussate-opposite, short-petiolate; petioles slender, 0.8--2 cm. long, very densely short-pubescent or villosulous with sordid-cinereous or flavidous hairs; leaf-blades subcoriaceous or coriaceous, elliptic or ovate-elliptic to broadly ovate, 2--10 cm. long, 2--9.5 cm. wide, apically obtuse or rounded (sometimes even subemarginate), marginally entire, basally varying from subacute or obtuse to truncate or even deeply cordate, densely velutinous on both surfaces or obscurely albidous-pubescent above and densely so beneath; midrib rather stout, mostly subprominulous above, very prominent beneath; secondaries slender, 4--6 per side, arcuate-ascending, often somewhat subimpressed above, prominent beneath; vein and veinlet reticulation abundant, obscure or subimpressed above, prominent beneath; inflorescence axillary or terminal, 1--3-flowered; peduncles very slender, 1--3 cm. long, very densely villosulous; pedicels filiform, 4--19 mm. long, very densely villosulous; bractlets linear, to 5 mm. long, densely short-pubescent; calyx very densely villosulous throughout, the tube campanulate, about 3 mm. long and wide, its 5 lobes broadly ovate, about 3 mm. long and wide, apically acute; corolla almost 1.5 cm. long, externally densely pubescent; stamens and pistil long-exserted, 2.5--3 cm. long; fruiting-calyx patelliform, star-shaped, firmly chartaceous or coriaceous, 2.5--3.5 cm. wide, its tube densely villosulous on both surfaces, the 5 somewhat unequal lobes rather densely short-pubescent on both surfaces, venose, broadly elliptic or semi-orbicular, apically rounded or short-cuspidate; fruit oblate-spheroid or depressed-globose, about 5 mm. wide, thin-textured, densely villosulous.

This endemic species of eastern, western, and central Madagascar is based on *Baron 5369* ["next 5390"] from Madagascar, deposited in the Kew herbarium. The plant has been collected in "bois sablonneux secs", "pentes rocailleuses (rochers siliceux)", and "exceptionnellement forêt orientale", at 800--1000 m. altitude, flowering and fruiting in October. Dandouau comments "un seul arbre que les indigenes ne reconnaissent plus, relicté de l'ancienne forêt orientale".

Citations: MADAGASCAR: *Baron 5369* (K--type, N--photo of type, P--isotype, Z--photo of type); *Dandouau s.n.* [Herb. Perrier 18587] (P); *Decary 8183* (N, P); *Humbert 3009* (P); *Perrier 1123* (P), *10212* (N, P); *Pervillé 1123* (P); *Seyrig 237* (N, P).

HOLMSKIOLDIA MICROCALYX var. *GLABRESCENS* Mold., Bull. Torrey Bot. Club 77: 399. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 399. 1950; Mold. in Humbert, Fl. Madag. 174: 254 & 261--262, fig. 42 (3). 1956; Mold., Résumé 156 & 456. 1959; Mold., Fifth Summ. 1: 261 (1971) and 2: 881. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 261, fig. 42 (3). 1956.

This variety differs from the typical form of the species in having its leaves merely chartaceous, lightly puberulent, and

with elevated venation above, lightly puberulent and resinous-punctate beneath, and the fruiting-calyx merely lightly and very obscurely puberulent on both surfaces.

The plant is said to be a tree, 12 m. tall, with a trunk diameter to 40 cm. It is endemic to Madagascar, based on *Service Forestier 17* from sandy slopes, at an altitude of 100 m., in the Seventh Reserve of western Madagascar, collected sometime before April 4, 1933, and deposited in the Paris herbarium. It has been found in anthesis in November, its wood is used locally in construction, and a recorded vernacular name is "mafangalaty". Thus far it is known only from the original collection.

Citations: MADAGASCAR: *Service Forestier 17* (F--photo of type, N--isotype, N--photo of type, P--type, Z--photo of type).

HOLMSKIOLDIA MICROPHYLLA Mold., Bull. Torrey Bot. Club 77: 399--400. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 399--400. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 119. 1953; Mold. in Humbert, Fl. Madag. 174: 254, 255, & 256--258, fig. 41 (5--8). 1956; Mold., Résumé 156 & 456. 1959; Mold., Fifth Summ. 1:262 (1971) and 2: 881. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 255, fig. 41 (5--8). 1956.

Shrub or small tree, to 2 m. tall; branches and branchlets very slender, brunnescent in drying, densely appressed-puberulent when young, glabrescent in age, very obscurely tetragonal or subterete, sometimes conspicuously lenticellate with round, corky lenticels; nodes not annulate; principal internodes 0.5--2 cm. long or less; leaf-scars comparatively large, prominent, corky; buds densely tomentose; leaves decussate-opposite, abundant, small; petioles very slender, 2--11 mm. long, densely white-tomentellous; leaf-blades thin-chartaceous, gray-green above, whitish beneath, varying from ovate or orbicular to elliptic, 0.6--2.7 cm. long, 0.5--2 cm. wide, apically rounded or emarginate, marginally entire, basally subacute or rounded, densely short-pubescent or puberulent above, very densely matted-tomentellous with white hairs beneath; midrib slender, flat or obscure above, prominulous beneath; secondaries very slender, 3 or 4 per side, arcuate-ascending, obscure or indiscernible above, prominulous beneath, they and the midrib sometimes very prominent beneath, arcuately joined some distance from the margins beneath; vein and veinlet reticulation usually indiscernible above, sometimes prominulous beneath; inflorescence axillary, usually branched and several-flowered, sometimes merely 1-flowered; peduncles filiform, 7--15 mm. long, densely white-pubescent with very short subappressed antrorse hairs; pedicels filiform, 4--5 mm. long, densely white-pubescent like the peduncles and inflorescence-branches; bractlets linear, 1--2 mm. long, densely white-pubescent with appressed antrorse hairs; calyx patelliform, its tube about 4 mm. long, densely white-pubescent with appressed antrorse hairs, its limb 5-lobed, the lobes about 3 mm. long and 2.5 mm. wide, apically subacute, densely

puberulent on both surfaces; corolla white or greenish, with one violet or pale-violet lobe or suffused with violet throughout, its tube about 6 mm. long, externally densely white-pubescent, the lobes 5, unequal, 5--10 mm. long, the inner one cucullate in bud, enlarged, irregularly dentate, clawed, membranous-margined; stamens and pistil long-exserted, the stamens 4, inserted near the summit of the corolla-tube, the filaments basally pilose; ovary tomentulose; fruiting-calyx much enlarged, 1.2--1.9 cm. wide, very densely white-pubescent on both surfaces, the 5 lobes linguulate, 3.5--4 mm. long, usually shorter than or equaling the tube; fruit oblate-spheroid, about 4 mm. wide, densely white-pubescent.

This endemic species of southwestern Madagascar is based on *Decary* 9402 from the upper valley of the Mananbolo river, collected on November 24, 1931, and deposited in the Paris herbarium. Vernacular names recorded for the plant are "forimbitiky", "hasota", and "hazombaza". Collectors have encountered it on gneiss, in xerophilous bush among limestone rocks, and on limestone hillslopes and rocky plateaus, at 2--600 m. altitude, in flower from November to January, and in fruit from November to February as well as in June and August. The species is said to inhabit "Bush xérophile, forêt sèche; forêt basse sclérophyle, à basse ou moyenne alt. (jusqu'à 900 m.) Sur coteaux calcaires, rocailles, gneiss, dunes.....Le bois sert à faire des pirogues, des charpentes.....les feuilles son utilisées comme médicament dans les maladies des yeux."

The corollas are said to have been "white" on *Humbert* 12908 and "greenish with one pale-violet petal" on *Decary* 9507.

Citations: MADAGASCAR: *Afzelius* s.n. [Bèhera, 28.12.1912] (S), s.n. [20.10.1912] (S); *Collector undetermined* 281 (P); *Decary* 9320 (P), 9402 (F--photo of type, N--photo of type, P--type, Z--photo of type), 9507 (P); *Geay* 3338 (P); *Humbert* 5196 (P), 6895 (N, P), 12761 (P), 12830 (P), 12908 (P), 19831 (P), 20242 (P); *Perrier* 10235 (P).

HOLMSKIOLDIA MICROPHYLLA var. *GLABRESCENS* Mold., Bull. Torrey Bot. Club 77: 400. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 400. 1950; Mold. in *Humbert*, Fl. Madag. 174: 253, 255, & 258, fig. 41 (9). 1956; Mold., Résumé 156 & 456. 1959; Mold., Fifth Summ. 1: 262 (1971) and 2: 881. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in *Humbert*, Fl. Madag. 174: 255, fig. 41 (9). 1956.

This variety differs from the typical form of the species in having its leaves and calyxes only very finely appressed-puberulent or even subglabrescent and resinous-punctate.

The variety is based on *Humbert* 20048 from a tropophilous forest and xerophytic bush on reddish-brown sand, at 80--150 m. altitude, in the neighborhood of Manombo in the forest region of Isono west of Ankililoaka, in southwestern Madagascar, collected on January 28, 1947, and deposited in the Paris herbarium. So far it is known only from the original collection.

Citations: MADAGASCAR: *Humbert 20048* (F--photo of type, It--photo of type, N--isotype, N--photo of type, Z--photo of type).

HOLMSKIOLDIA MIRA Mold., Bull. Torrey Bot. Club 77: 400--401. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 400--401. 1950; E. J. Salisb., Ind. Kew. Suppl. 11: 119. 1953; Mold. in *Humbert. Fl. Madag.* 174: 243, 255, & 258--259, fig. 41 (10 & 11). 1956; Mold., *Résumé* 156 & 456. 1959; Becker, *Geol. Soc. Am. Mem.* 82: 87 & 119, pl. 30, fig. 4 & 7. 1961; Mold., *Fifth Summ.* 1: 262 (1971) and 2: 881. 1971; Mold., *Phytol. Mem.* 2: 250 & 550. 1980.

Illustrations: Mold. in *Humbert, Fl. Madag.* 174: 255, fig. 41 (10 & 11). 1956; Becker, *Geol. Soc. Am. Mem.* 82: pl. 30, fig. 4 & 7. 1961.

A shrub or small tree, to 5 m. tall or more; branches and branchlets slender, gray, lenticellate, very obscurely tetragonal or subterete, glabrous; leaf-scars large and prominent, corky; lenticels often prominent and corky; buds densely tomentose-villous; nodes not annulate; principal internodes 0.2--3.5 cm. long, those on the twigs usually much abbreviated; leaves decussate-opposite, aromatic; petioles slender, 3--12 mm. long, canalliculate above and there rather densely pilosulous-puberulent, otherwise subglabrate; leaf-blades very thinly membranous and nigrescent or brunnescent in drying during anthesis, firmly chartaceous at maturity and then usually not nigrescent, varying from elliptic or broadly elliptic to ovoid, 3--8 cm. long, 2--5 cm. wide, apically acute or obtuse to rounded or emarginate, marginally entire, basally acute or more usually obtuse or rounded, usually lightly pilosulous along the midrib above, otherwise glabrous on both surfaces, very shiny when mature; midrib slender, flat above, prominulous beneath; secondaries slender, 5--7 per side, arcuate-divergent, mostly obscure or indiscernible at anthesis, prominulous on both surfaces on mature leaves, joining in many loops some distance within the margins beneath; vein and veinlet reticulation very abundant, mostly indiscernible at time of anthesis, conspicuously prominulous on both surfaces on mature leaves; inflorescence axillary; flowers solitary or paired in each axil; peduncles filiform, 1--3 cm. long, issuing from a villous cushion-like base, otherwise glabrous, bearing an opposite or subopposite pair of filiform bractlets 1.5--2 mm. long at the apex; pedicels filiform, 5--8 mm. long, glabrous; calyx patelliform, its tube 3--4 mm. long, the limb somewhat irregularly 5-lobed, membranous, 1.1--1.4 mm. wide, the lobes about 4 mm. long and 3.5--5 mm. wide, apically rounded and apiculate, glabrous on both surfaces, venose; corolla greenish- or pale grayish-blue to greenish-white or white; stamens 4, long-exserted; filaments glabrous, about 2 cm. long; pistil equaling or surpassing the stamens; fruiting-calyx much enlarged, star-shaped, firmly chartaceous, very venose and shiny, 2--3.5 cm. wide, the apically acute or rounded lobes separated only 1/2 to 2/3 to the base, glabrous on both surfaces; fruit oblate, 3--4 mm. long, about 4 mm. wide, thin-shelled, glabrous, shiny, not plainly sulcate nor ve-

nose.

This species, endemic to northwestern and perhaps central Madagascar, is based on *Service Forestier* 22 from Ankarafantsika in the Seventh Reserve, Madagascar, collected sometime before April 4, 1933, and deposited in the herbarium of the Museum National d'Histoire Naturelle in Paris.

Collectors refer to the plant as a shrub or tree, to 15 feet tall, and have encountered it on sand dunes, as well as in woods on plateaus. According to Humbert it is a "Bois sub sables, ou moins souvent rocailles calcaires, parfois aux lisières; a basse alt." It has been collected in anthesis from September to December and in fruit in August and from October to April. The corollas are said to have been "white" on *Decary* 8196, "greenish-white" on *Decary* 8171, and "pale grayish-blue" on *Boivin* 2316. The label accompanying the last-mentioned collection is inscribed "genus novum" by someone in the Paris herbarium. Material has also been misidentified and distributed as *Clerodendrum emirnense* Bojer.

Citations: MADAGASCAR: *D'Alleizette* s.n. [Mandraka, Dec. 1905] (P); *Boivin* 2316 (P), s.n. [Madagascar, 1847-1852] (P); *Decary* 8171 (P), 8196 (P), 19027 (N, P); *Perrier* 332 (P), 1331 (N, P), 10202 (P), 10213 (P), 10291 (N, P), 11782 (P); *Pervillé* 672 (P); *Service Forestier* 22 (F--photo of type, N--photo of type, P--type, Z--photo of type).

HOLMSKIOLDIA MIRA var. *FISSA* Mold., Bull. Torrey Bot. Club 77: 401--402. 1950.

Bibliography: Mold., Bull. Torrey Bot. Club 77: 401--402. 1950; Mold. in Humbert, Fl. Madag. 174: 253, 255, & 259, fig. 41 (12). 1950; Mold., Résumé 156 & 456. 1959; Mold., Fifth Summ. 1: 262 (1971) and 2: 881. 1971; Mold., Phytol. Mem. 2: 250 & 550. 1980.

Illustrations: Mold. in Humbert, Fl. Madag. 174: 255, fig. 41 (12). 1950.

This variety differs from the typical form of the species in having its leaf-blades to 8.5 cm. long and 7.5 cm. wide, the fruiting-calyx 3.5--4.3 cm. wide, its lobes separate almost to the base (to within 5 mm. of the base), and the mature fruit about 7 mm. long and wide, very hard and woody, very shiny, brown, sulcate, and venose, splitting at maturity into 4 parts.

This endemic variety is based on *Bernier* 360 from Linguatou in northwestern Madagascar, collected in about 1834 and deposited in the Paris herbarium. *Bernier* describes the plant as 10--12 feet tall.

Material of this variety has been misidentified and distributed in some herbaria as *Turnera hildebrandtii* Boivin.

Citations: MADAGASCAR: *Bernier* 360 (F--photo of type, N--photo of type, P--type, Z--photo of type); *Boivin* 2485 (N, P); *Hildebrandt* 3376a (P).

HOLMSKIOLDIA MUCRONATA (Klotzsch) Vatke, Linnaea 43: 536. 1882.

Synonymy: *Cyclonema mucronatum* Klotzsch in Peters, Naturwiss.

Reise Mossamb. 6 (1) [Bot.]: 260. 1861. *Holmskioldia mucronata* Vatke apud Hutchins. & Corbish., Kew. Bull. Misc. Inf. 1920: 332. 1920. *Holmskioldia mucronatum* (Klotzsch) Vatke ex Mold., Alph. List Inv. Names 22, sphalm. 1942.

Bibliography: Klotzsch in Peters, Naturwiss. Reise Mossamb. 6 (1) [Bot.]: 260--261. 1861; Vatke, Linnaea 43: 536. 1882; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 1, 1: 679. 1893; Gürke in Engl., Pflanzenw. Ost-Afr. C: 342. 1895; J. G. Baker in Thiselt.-Dyer, Fl. Trop. Afr. 5: 314 & 315. 1900; Hutchins. & Corbish., Kew Bull. Misc. Inf. 1920: 332. 1920; Hutchins. in Dyer, Flow. Pl. S. Afr. 2: pl. 49. 1922; Mold., Alph. List Inv. Names 22. 1942; Mold., Known Geogr. Distrib. Verbenac., ed. 1, 51 & 93. 1942; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 679. 1946; Mold., Known Geogr. Distrib. Verbenac., ed. 2, 119, 120, & 186. 1949; E. J. Salisb., Ind. Kew. Suppl. 11: 120. 1953; Mold., Résumé 149, 150, 276, 298, & 456. 1959; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 679. 1960; Mold., Fifth Summ. 1: 248, 251, & 473 (1971) and 2: 527 & 881. 1971; Mold., Phytol. Mem. 2: 237, 241, & 550. 1980.

An erect, branched, spiny, pubescent shrub, to 4 m. tall; stems grayish-white; branches short, spiny, about 5 cm. long, horizontally divaricate; branchlets opposite or alternate, short, erect, white-pubescent, spinescent; leaves opposite, short-petiolate; leaf-blades membranous, oval or ovate, 2.5--7.5 cm. long, 1.6--3 cm. wide, apically rounded-apiculate or short-cuspidate (the cusp itself apically rounded), marginally entire or very rarely sinuate-dentate (the teeth variable even on the same plant), basally rounded or those at the apex of the branchlets broader and subcordate, deep-green and sparsely pubescent above, gray-green and densely incanous-pubescent beneath; cymes corymbiform, axillary, pedunculate, finely pubescent, about 5 cm. long, solitary, few-flowered, bracteolate; peduncles 2.5--3.5 cm. long; bracts small, membranous, broadly ovate, about 3 mm. long and wide, apically short-acute, very sparsely pilose above, villous beneath, deciduous; pedicels densely villous; calyx purplish-white, membranous, patelliform, 6--8 mm. long and wide, finely pilose on both surfaces, persistent, 5-angled and 5-dentate, basally urceolately contracted; corolla zygomorphic, bright-blue, slightly shorter to longer than the calyx, glandular-pubescent on both surfaces, "somewhat like that of an *Aristolochia* in appearance", its tube very short, hardly exserted from the calyx, reclinate, the limb sub-bilabiate, unequally 5-parted, spreading; stamens 4, subdynamous, exserted; filaments densely glandular-puberulent below, sparsely so above; pistil somewhat surpassing the anthers, filiform, glabrous; ovary top-shaped, apically matted-villous or tomentose, basally glabrous, 4-celled, 4-ovulate; fruiting-calyx about 1.8 cm. wide.

This species is based on a Peters collection from Rios de Sena, Mozambique. It has been collected in anthesis in December and is said to be "very common" in Zimbabwe.

Citations: ZIMBABWE: Whellan 328 [Govt. Herb. Salisb. 18463] (N), 493 [Govt. Herb. Salisb. 31176] (Bm, N).

HOLMSKIOLDIA QUILCHENENSIS Mathewes & Brooke, Syesis 4: 214 & 215, fig. 15, 16, & 18. 1971.

Synonymy: *Holmskioldia quilchensis* Mathewes & Brooke ex Mold., Phytol. Mem. 2: 368 & 550, sphalm. 1980.

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Illustrations: Mathewes & Brook, Syesis 4: 215, fig. 15, 16, & 18. 1971.

This is a fossil species known thus far only from the [fruiting] calyx, which is "wholly connate, orbicular with no visible lobation, diameter 3.2 cm; hydathodes visible and so disposed in the calyx circumference as to seemingly divide it into five approximately equal segments; primary veins either extending to margin of calyx or less commonly forking inside the margin; primary veins joined by lateral nervilles in a polygonal or rectangular reticulate pattern."

The species is known thus far only from Middle Eocene rocks in the Coldwater beds approximately 2 miles south of Quilchena, on the west side of Quilchena Creek, British Columbia, Canada, collected there in 1968 and 1969.

Mathewes & Brooke (1971) comment that "Although MacGinitie (1953) noted a similarity between the fossil *Holmskioldia speirii* and the extant *H. sanguinea* Retz., the comparability of calyx shape and venation is even stronger between *H. quilchenensis* and *H. sanguinea* due to the absence of calyx lobation.....This characteristic is the primary one used to separate *H. quilchenensis* from previously described forms. The Mid-Eocene occurrence of *Holmskioldia* at Quilchena ranks among the oldest known. The genus is cited as an especially good indicator for the Oligocene by Becker (1961). Holotype: Q97 (counterparts)."

HOLMSKIOLDIA SANGUINEA Retz., Obs. 6: 31--32. 1791.

Synonymy: *Hastingia coccinea* J. E. Sm., Exot. Bot. 2: 41--42, pl. 80. 1806. *Platinum rubrum* A. L. Juss., Ann. Mus. Hist. Nat. Paris 7: 76. 1806. *Holmskioldia rubra* Pers., Syn. Pl. 2: 144. 1807. *Hastingia scandens* Roxb., Hort. Beng., imp. 1, [95]. 1814; Fl. Ind., ed. 2, 3: 66. 1832. *Hastingia angusta* König ex Lindl. in Edwards, Bot. Reg. 9: pl. 692. 1823. *Holmskioldia scandens* Sweet, Hort. Brit., ed. 1, 323. 1826. *Hastingia coccinea* König ex Roxb., Fl. Ind., ed. 2, 3: 65--66. 1832. *Holmskiöldia sanguinea* Retz. apud Gamble, Man. Indian Timb., ed. 2, imp. 1, 544. 1902. *Platinum rubrum* Juss. apud DeWild., Icon, Select. Hort. Then. 4: pl. 159, in syn. 1903. *Hastingia angusta* König apud DeWild., Icon. Select. Hort. Then. 4: pl. 159, in syn. 1903. *Holmskioldia sanguinea* Retz. apud DeWild., Icon. Select. Hort. Then. 4: pl. 159, in syn. 1903. *Hastingsia coccinea* König apud H. Hallier, Meded. Rijks Herb. Leid. 37: 84, in syn. 1918. *Holmskoldia sanguinea* Woodrow, Gard. Trop., ed. 6, 442. 1918. *Holmskjoeldia sanguinea* Retz. apud H. J. Lam, Verbenac. Malay. Ar-

ch. 321. 1919. *Holmskjoldia sanguinea* Retz. apud Porsch, Jahrb. Wiss. Bot. 63: 656--669, fig. 4--13. 1923. *Hastingsia coccinea* Sm. ex Mold., Prelim. Alph. List Inv. Names 26, in syn. 1940. *Hastingsia coriacea* Wall. ex Mold., Prelim. Alph. List Inv. Names 26, in syn. 1940. *Holmskioldia coccinea* Retz. ex Mold., Prelim. Alph. List Inv. Names 27, in syn. 1940. *Platumium rubrum* Juss. ex Mold., Suppl. List Inv. Names 7, in syn. 1941. *Holmskioldia sanguinea* Retz. ex Mold., Suppl. List Inv. Names 3, in syn. 1941. *Holmskioldia sanguinea* Retz. ex Mold., Alph. List Inv. Names Suppl. 1: 10, in syn. 1947. *Holmskioldia sanguinea* L. ex Mold., Alph. List Inv. Names Suppl. 1: 11, in syn. 1947. *Holmskioldia sanguinea* Wall. ex Mold., Résumé 299, in syn. 1959. *Homoskioldia sanguinea* Retz. apud Misra, Bull. Bot. Surv. India 12: 135. 1970. *Hastingsia coriacea* Wall. ex Mold., Fifth Summ. 2: 526, in syn. 1971. *Holmsköldia sanguinea* Retz. ex Mold., Phytologia 23: 432, in syn. 1972. *Holmskioldia sangiunea* Retz. ex Mold., Phytologia 23: 432, in syn. 1972. *Holmskjöldia sanguinea* Retz. ex Mold., Phytologia 31: 400, in syn. 1975. *Holmskoldia sanguinea* Retz. ex Mold., Phytologia 31: 400, in syn. 1975. *Holmskoldea sanguinea* Retz. ex Kannan, Journ. Bomb. Nat. Hist. Soc. 75 [Suppl.]: 1050. 1980. *Hastingsia scandens* Roxb. ex Mold., Phytol. Mem. 2: 411, in syn. 1980. *Hastingsia coccinea* Wall., in herb.

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A large, straggling or clambering, loose or densely bushy shrub or small slender tree, to 10 m. tall and 4 m. in overall circumference, usually only a low bush, sometimes a creeper or woody vine, pubescent or glabrate, freely flowering; stems solitary or several, tetragonal, to 7 cm. in diameter; branches usually arching and swaying, sometimes long and pendent, usually erect when young, later scandent and vine-like, often starting at the base of the plant, the lowest often procumbent; branchlets and twigs very slender, rather acutely tetragonal, more or less densely and softly short-pubescent on the younger parts, becoming glabrescent in age, with a large pith; wood light-red, moderately hard, 43 pounds in weight per cubic foot, the pores large and numerous in spring wood, small and more scanty in the rest, often much subdivided, enclosed in a paler-colored tissue of loose texture, the larger pores prominent in a vertical section; medullary rays fine, numerous, producing a silver grain of narrow reddish plates; bark pale-brown to reddish-brown or grayish, smooth or rough, with short horizontal fissures and a few vertical bands, the papery exterior followed by a green layer of cambium; blaze

yellow, "cheesy"; nodes more or less obscurely annulate; principal internodes 2.5--9.3 cm. long; leaves decussate-opposite, evergreen; petioles very slender, 0.8--3 cm. long, usually not $\frac{1}{4}$ the length of the leaf-blade, canaliculate above, lightly and softly short-pubescent; leaf-blades membranous or thin-chartaceous, bright-green, ovate, 3--12 cm. long, 1.5--8.5 cm. wide, apically rather long-acuminate or caudate (the acumination itself 1--1.5 cm. long), marginally entire or subentire to (usually) lightly crenate-serrate with appressed often very shortly apiculate teeth, basally truncate or subtruncate to rounded or even subcordate, slightly prolonged centrally into the petiole, glabrate above, lightly short-pubescent on the venation beneath and there conspicuously glant-dotted or squamellate, often also more or less impressed-punctate above; midrib very slender, flat above, prominent beneath; secondaries filiform, 4 or 5 per side, ascending and rather straight, not much arcuate except near the margins where they are actually joined in many loops, flat above, very slightly prominent toward the midrib beneath; veinlet reticulation fine, mostly indiscernible above, flat beneath; inflorescence much abbreviated, to 5 cm. long, paniculate, axillary and subequaling or somewhat surpassing the subtending petiole, lax, or terminal and then more dense and subracemiform, composed of 2--6 opposite cymules, the cymules 3-flowered or reduced to a single long-pedicellate central flower and 2 sterile lateral bractlets; peduncles very short and slender, mostly less than 5 mm. long, scattered-pilosulous or glabrous; pedicels slender, 2--10 mm. long, scattered-pilosulous or glabrous; foliaceous bracts often present in the terminal inflorescence, ovate or elliptic, 5--20 mm. long, 4--9 mm. wide, red or dark-red to deep pink-red, orange-red, or orange, yellow-green when young, persistent, glabrescent; bractlets very minute; flowers very showy and attractive, profuse; calyx large, shallowly cupuliform or flattened and subrotate-campanulate to saucer-shaped or rotate, persistent, red or brick-red to bright-red, pale russet-red, orange-red, orange, burnt-orange, or bronze, occasionally reddish-yellow, $\frac{1}{4}$ to $\frac{1}{3}$ as long as the corolla, 2--2.5 cm. wide, thin-textured, marginally entire, shaped like a miniature Japanese umbrella or Chinaman's hat, radially reticulate-venose, the primary veins ending in very minute apiculations, externally glabrous, internally lightly scattered-pilosulous or puberulous; corolla tubular or infundibular, curvate, varying from red, russet, crimson, or scarlet to red-orange or orange, rarely red-brown, the tube 1.5--2.5 cm. long, curved, externally minutely pilosulous, the limb short, oblique, 5-lobed, 2-lipped, the lobes apically subacute or rounded, the 4 upper ones very short, the lower one declined, more than twice as long as the upper; stamens attached in the throat or at the middle of the corolla-tube, slightly exserted, declined; anthers oval, white, the 2 thecae parallel; style slender, about 2 cm. long, about equaling the stamens and parallel to them; stigma narrow, subbifid; ovary glabrous, 4-celled, 1 ovule per cell; fruiting-calyx accrescent, greatly expanded, rotate and circular or flattened, 1.5--2.5 cm. wide, papery, bronze-color or red to

orange-red or scarlet, darker than during anthesis, basally minutely pulverulent-puberulent or glabrous throughout, conspicuously reticulate-venose; fruit drupaceous or seemingly capsular, brown, globose or obovoid, to 10 mm. long and 8 mm. wide, almost dry, included in the accrescent calyx-tube, 1--4-seeded, often verruculose or rugose, apically deeply and divaricately 4-lobed to about half way down, splitting into 4 pyrenes or nutlets which are covered with white waxy droplets and 4--8 mm. long, each lobe obliquely turbinate, clavate, rugose, of the size of a small lentil. 1-celled, 1-valved, with a thick, soft, spongy texture, dark brownish-black; seeds conforming to the capsule-lobe in size and shape, the integument single, rather thick, white, soft, tough; perisperm absent; embryo erect, amygdalous, the 2 cotyledons oval, thick; plumule small, semilunar; radicle inferior, oval; chromosome number: $2n = 32$ or $n = 18$.

This is the type species of the genus and is apparently native to streambanks and ravines in the dry hills of the subtropical sub-Himalayan region of Nepal, Bhutan, Sikkim, and Bangladesh, but has been widely introduced in Sri Lanka, India, Malaysia, Indonesia, Mauritius, the West Indies, and elsewhere, and tends to escape and become naturalized in suitable climates. It is widely cultivated outdoors for ornament in subtropical and tropical lands and indoors in Europe, the United States, South Africa, and elsewhere.

No actual holotype was designated by Retzius, his original description merely stating: "Habitat in vallibus Bengaliae", but the specimen preserved in the König herbarium at Lund is probably the type and should be so considered (Fischer, 1932).

Past authors give the original native habitat of the species as "Silhet" (Don, 1839), "subtropical Himalaya" (Freeman & Williams, 1928; Nielsen, 1965), "North India" (MacMillan, 1943), "East India" (Bojer, 1837), "Burma" (Woodrow, 1910), "South Asia" (Standley, 1938), and "Southern slopes of the Himalayas" (Backer & Bakhuizen, 1965). Collett (1902) reports it from "Valleys below Simla, Subathoo" where he claims that it flowers from October to December. He gives its natural range as "Outer Himalaya, from the Sutlej to Assam and Burmah, ascending to 3000 feet." Watt (1889) reports it ascending to 4000 feet in the subtropical Himalaya from Kumaon to Bhutan and the Prome hills.

Kingdon-Wards reports the species "not rare" in Burma, while Pancho refers to it as "rare" in the Philippines. Parker (1924) says that it is found in the "Sub-Himalayan tract and Outer Himalaya from Chamba eastwards" in the Pinjab, but is "not common", flowering there from October to December. Kanjilal (1939) asserts that it is "common" throughout Assam, and Rao & Rabha (1966) also found it there, while Banerjee (1968) and Misra (1970) list it from Bihar, Prain (1963) from Chota Nagpur, Mukherjee (1965) and Matthew (1966) from West Bengal, Kitamura (1959) from Nepal, Razi (1950) from Mysore, and Yamazaki (1966) from "Kumaon to Bhutan". The Baileys (1976) assert that it is "Now a characteristic plant [in cultivation] throughout the tropics".

The corollas of *Holmskioldia sanguinea* are described as "red"

by Neal (1965), Deb & al. (1969), and the Baileys (1976) and on Abbott s.n., Allard 14358, Bailey & Bailey 643, Chand 4217, Daniel 5594, Dress 1260, Duss 4701, Fryxell 1720, Hu 9084, Khan 79, López-Palacios & Idrobo 3690, Moore 6771, Nafday 163, Pancho 2908, Rosas R.71, and Standley 23666, "red or orange" (Deb, 1961), "red to orange" (Britton & Wilson, 1925), "dark-red" on Nicolson 2879, "deep-red" (Briquet, 1895), "bright-red" (Osmaston, 1927) and on Bullock 863, "light-red" on Bailey 396, "brick-red" (Sayeeduddin & Moinuddin, 1939) and on Koeltz 25771, "russet-red" on Morley 152, "brick-red or orange" (Brandis, 1906; Standley, 1938), "brick-red or somewhat orange" (Clarke, 1885), "pale-russet" on Gillis 7050, "deep orange-red" (Suwal, 1969), "red-orange or dark vermillion" (Maheshwari, 1963), "orange-red" (MacMillan, 1943) and on Moldenke & al. 28134, "red-orange" on Molina R. 14679 and Wagner 402, "red-brown" on Wood 1152, "reddish-brown" (Pal & Krishnamurthi, 1967), "brownish-red" (Smiley, 1970), "scarlet-red" on White 71, "scarlet" (Bose, 1920; Freeman & Williams, 1928; Haines, 1922; Chittenden, 1951; Graf, 1963; Preston, 1969) and on Fosberg 27077 and Stern 2110, "orange" (Degener, 1950) and on Chevalier 173, DeWolf 1914, and Read 1205, "orange-red to crimson" on Wagner 402, "R.H.S. Blood Red 820" on Peale 404, "crimson" (Kurtz, 1877) and on Koeltz 25938, "burnt-orange" (Menninger, 1953), "bright tawny-red" (Firminger, 1874), and "dark burnt-orange, the base yellowish" on Huhn 16. Stewart (1972) refers to the "large, scarlet calyxes, tinged with orange".

A yellow-flowered form of the species is f. *citrina* Mold. (which see, below). Menninger (1970) informs us that in the botanical garden at Bangalore, India, this yellow-flowered form is being cultivated as well as "a deep red-flowered" one. Other authors speak of a distinct orange-flowered form. Alexander (1971) avers that in Hong Kong "When the flowers are developing they are yellowish-pink but as they enlarge they become brick-red" -- presumably this is the typical form of the species and the orange-flowered form may deserve a form name.

The species is widely cultivated. Cheesman reports it common in Trinidad gardens, Lind & Tallantire (1962) report it cultivated in Uganda, Gledhill (1962) in Sierra Leone, Williams (1949) in Zanzibar, Bojer (1837) in Mauritius, Tingle (1967) in Hong Kong, Jafri & Ghafoor (pers. comm.) in Pakistan, Nicolson (herb.) in Nepal, Sen & Naskar (1965) in India, Bose (1920) in Calcutta, Sharma (1975) in the Punjab, Burkill (1966) in Malaysia (commenting that it "grows freely in Penang, but with difficulty in Singapore"), Lord (1964) on the east coast of Australia, Lasser (1974) in Venezuela, Pesman (1962) in Mexico, Molina (1975) in Honduras, Gooding (1965) in the Barbados, Questel (1941) on St. Bartholomew, Britton & Wilson (1925) in Puerto Rico and the Virgin Islands, Standley (1938) in Costa Rica, Calderón & Standley (1941) in El Salvador, and Freeman & Williams (1928) in Trinidad. Eggers reports it "naturalized near dwellings" on Dominica. López-Palacios reports it "perfectly acclimated" in Venezuela. My wife and I saw it cultivated in Sri Lanka and in Dr. Halbinger's garden in Mexico, and, in 1961, grown as a hedge plant in Hawaii. The

Buswell s.n. [Nov. 29, 1938], cited below, is accompanied by a label which bears no indication that the specimen was collected from a cultivated plant, but I am assuming that it was; similarly, the unnumbered Cook and Forbes collections from the University of Hawaii campus have labels that give no direct evidence to this effect, but, again, I assume that they represented cultivated (rather than naturalized) plants. On the other hand, the *Bailey* 428, *Barrow* 485, and *Orcutt* 2657, cited below as from naturalized plants, may actually be from cultivated material. The *Herb. Hort. Monac.* s.n. [1932] collection, cited below, was taken from plants cultivated in Munich from seed collected in Costa Rica.

Collectors have found *H. sanguinea* growing along cemetery walls, in dry places, roadside thickets, woodlands, and creeper jungles, in weedy overgrown gardens, in oak woods on steep sunny slopes, in full sunlight on white sandy soil, and even among mangrove vegetation. Taylor reports it from "old field edges in moist, gray-black volcanic soil" in Costa Rica. They have found it at altitudes from sealevel to 2700 m., in anthesis in every month of the year, and in fruit in September and December. Duss tells us that in the French West Indies it flowers all through the year. In Assam it is said to bloom from October to December "in the hot season and at the end of the cold season". Broadway says that it "is always in bloom" in Trinidad & Tobago. Smiley (1960) says that it "flowers much of the year, even in winter, in the tropics".

Santapau (1961) and Rao (1961) report the chromosome complement as $n = 18$, but Sharma & Mukhopadhyay (1963), Cave (1964), and Bolkhovskikh (1969) report it as $2n = 32$.

Woodrow (1910) speaks of a "red circular involucre" -- obviously referring to the rotate calyx -- and refers to the species as "a useful hardy plant in tropical gardens." Preston (1951) refers to it as a "stove evergreen" in England, thriving best in a light, rich soil. He avers that cuttings root readily in sandy soil "under glass in heat", and that the species was introduced into England from India in 1792, but Burkill (1966) gives the date of introduction as 1796. Loudon (1830) says the "*H. scandens*" form was introduced in 1824. Sweet (1826) gives the same dates, but says that the introduction was from the "E. Indies" [probably a careless error for Eastern India]. The Kew herbarium, when I worked there in 1934, contained 8 cultivated collections from Jamaica and one from Brazil. Menninger (1955) offered 1--4-foot tall seedlings at \$1 a foot to the horticultural trade. Bailey (1935) lists the Royal Palm and Hugh Evans Nurseries as offering the species at that time. The species is depicted in full color on a 6 d. postage stamp issued by Jamaica in 1966 (no. 166 in Scott's postage stamp catalogue).

Melchior (1964) and Kannan (1980) point out that *H. sanguinea* is a "bird-flower", habitually visited by birds for nectar [hummingbirds in the New World, sunbirds in the Old]. Questel (1941) observed hummingbirds in the French West Indies hovering in front of the flowers, wings rustling, boring deep into the corolla-tube with their long beaks. Porsch (1923) asserts that the species is regularly pollinated by these birds.

Brenan (1961) reports that the epidermis of the corolla is reinforced by a layer of collenchyma cells. Gibbs (1974) reports cyanogenesis absent from the leaves, syringin doubtfully absent from the stems, and the HCl/methanol test negative. The gynoeceum morphology is discussed by Junell (1934). Anatomical studies were conducted in detail by Sayeeduddin & Moinuddin (1939). Mound & Halsey (1978) report that *H. sanguinea* is one of the hosts for the whitefly, *Bemisia tabaci* (Gennadius) Takahashi.

Common and vernacular names reported for the species are: "arnamamir", "bloody holmskioldia", "bonite chino", "bougambilia" [probably erroneously applied here], "chapeau chinois", "Chinese hat", "Chinese hat plant", "Chinese hat-plant", "Chinese-hat-plant", "Chinese-hatplant", "Chinese-hats", "Chinese-umbrella", "Chinese-umbrellas", "Chinaman's hat", "Chinaman's-hat", "climbing holmskioldia", "Common Chinese hatplant", "crimson holmskioldia", "cup and saucer", "cup-and-saucer", "cup and saucer plant", "cup-and-saucer plant", "daudmaree", "dieng-skor-khnai", "flor roja", "holmskioldia", "holmskioldie", "hurмили", "Japanese-umbrellas", "japanische kamperfoetie", "jermei-snam-khmut", "jhimbiriya", "jhule phul", "kapni", "khem-juta-phang", "kul tolia", "kultolia", "kumaon" [this is erroneously listed as a vernacular name for this plant; it is merely the name of the region where it was found!], "lau-papale-pākē", "long-i-arong", "mandarin hat", "mandarin-hat", "manukataphut", "manu-kata-phul", "mei-da-kyma", "misinahchil", "misi-nasil", "misiwahchil", "moonwort", "palito chino", "paraguas chino", "paragüita chino", "paraguita de chino", "paraguitas japonés", "paraguito chino", "paraguito chino", "parasol flower", "parasol-flower", "pia e jarro", "relampagos japonés", "rithoul", "sanguine", "sarpattia", "scarlet holmskioldia", "siveltechin", "sivettachin", "sombbrero chino", "sombbrero chino", "sombbrero flower", "sombbrero-flower", "syntew-nong-smud", "trinitaria extranjera", and "wo-so".

Firminger (1918) says that in India this plant flowers in October and November, bearing "very curious flowers, in form like diminutive chamber-candlesticks, of a bright tawny red, in boundless profusion, and is then a most beautiful object; [it] requires to be cut closely in after flowering to keep it compact and within bounds. In a recently introduced variety the flowers are of a beautiful orange tint." It is propagated either by cuttings or from seed. Bor & Raizada (1954) add that "The plant will grow even in poor soil and does best in full sunshine.....[It] is very popular for cut flowers for even when the corolla has fallen the calyx is pretty and very effective. Usually propagated by layers, as cuttings are sometimes hard to start." They also speak of "A variety with orange flowers has recently been introduced from Assam where it is wild. It is prettier than the type." Menninger (1953) notes that the species "has a tendency to climb, but if pruned back severely be kept as a rounded 6-foot shrub".

Encke (1963) says of it: "Prächtiger tropischer Zierstrauch, unter Glas jedoch meist nur unbefriedigend blühend und deshalb nur wenig gezogen [in Germany]. Kultur im hellen und luftigen Warmhaus in lehmig-humoser Erde. Vermehrung durch Aussaat und durch

Stecklinge im geschlossenen Warmbeet bei 25-30° [C.]."

Backer & Bakhuizen (1965) assert that in Java it is "often cultivated as an ornamental in gardens and parks", at 1--1300 m. altitude. Pal & Krishnamurthi (1967) aver that "The plant is fastidious with regard to its exposure to sunshine for normal growth. It has to be pruned carefully on completion of the flowering period or else it develops into a scrambler." They add that "A variety with deeper-coloured flowers is now available and is a distinct improvement on the type."

Lindley (1823) comments that "This very elegant plant was brought originally from China into the Botanic Garden at Calcutta [actually it was introduced into China from India first!], though native to the interior parts of Bengal. In the garden it grows to be a small tree if trained up with a single stem, but if left alone the branches spread far around from the base of the stem close to the ground and strike root. The bark is ash-coloured and tolerably smooth. The flowering [in England] is in the cold season, when nothing can exceed it in beauty."

Nair & Rehman (1962), on the basis of *Herb. Nat. Bot. Gard. Luck.* 28920, describe the pollen as follows: "3-zonicolpate, prolate (39 x 29 μ , range 35--42 x 28--32 μ). Colpi ends acute, tenuimarginate (in some grains [the] margin is interruptedly incrassate). Apocolpium diameter 8.4 μ . Exine 2.1 μ thick. Ectine almost as thick as endine, faintly granulate. The palynogram shown is typical for *Premna*, *Tectona*, *Sphenodesma* and *Symphorema* also, except for the ornamentation of [the] ectine surface."

Degener (1950) tells us that the species was introduced into Hawaii from Puerto Rico in 1914 by J. Edgar Higgins of the Hawaii Agricultural Experiment Station. "Since that time it has become a fairly common ornamental for border backgrounds, hedges and rock gardens.....In the wild state the plant is much more robust than when cultivated. In its native habitat sheep and goats eat the leaves for fodder."

Tiwari (1968) cites *BIXL.3* & *BXXXVIII.7* from Madhya Pradesh; Deb & al. (1969) cite *Sengupta 892* & *Deb 296* from Bhutan; Panigrahi (1966) cites his no. 11677 from Bihar; Deb (1961) cites his no. 359 from Manipur where the plant grows "at edges of forest all over Manipur"; Maheshwari (1963) cites his no. 587 from Delhi; Haines (1922) cites unnumbered collections by Camp, Campbell, and Wood from Bihar & Orissa; Wallich (1829) cites his no. 2087/1 from Nepal, 2087/2 from Silhet (Assam), and 2087/3 from the Botanical Garden at Calcutta. Griffith & Hyland (1966) cite *U. S. D. A. Pl. Inventory 247168* as cultivated in Maryland, originally cultivated as their no. 18649 in São Paulo, Brazil. Srivastava (1976) cites his no. 1232 and notes: "Commonly planted in gardens for its petaloid, ornamental bracts; also seen near gardens probably as an escape." Gamble (1908) cites *Curtis 2879* from Penang, while Lam (1919) cites *Curtis 2872* from the same state, asserting that the species is naturally distributed in the subtropical Himalayas, from sealevel to 1330 m. altitude, "Often cultivated and sometimes escaped" in the Malayan Archipelago.

Hallier (1918) cites *Hallier C.130*, deposited in the Boissier and Delessert Herbaria, cultivated in Java - "Strauch mit überhängenden Zweigen; Blüthen roth", flowering in July. He gives the natural distribution as Sikkim, Assam, Khasia, and Prome.

López-Palacios (1977) cites the following collections from Venezuela: Aragua: *Badillo* 4619, *Trujillo* 5631. Distrito Federal: *Aristeguieta* 6647, *Labbiente* 20. Mérida: *Bernardi* 3115; López-Palacios 1702 & 2168; Ruiz-Teran 1201; Ruiz-Teran & López-Palacios 6217; *Trujillo* 3200; *Velasco* 363. Miranda: *Trujillo* 5301.

Material of *H. sanguinea* has been misidentified and distributed in some herbaria as *Clerodendrum* sp., *Gomphrena globosa*, *Rubiaceae*, and *Scrophulariaceae*. On the other hand, the R. W. Read 1369, distributed as typical *H. sanguinea*, actually represents *f. citrina* Mold.

The collections cited below before the "CULTIVATED" section do not bear any indication on their accompanying labels that they came from cultivated plants, so I am assuming that they represent persistents after cultivation, escaped from cultivation, waifs, or actual naturalizations.

Citations: MEXICO: Veracruz: *Rosas R.* 71 (W--2534605). COSTA RICA: Cartago: *R. J. Taylor* 4250 (N). CUBA: Havana: *Roig* 11612 (Es). Province undetermined: *Sagra* 758 (P). JAMAICA: *Orcutt* 2188 (W--1414782), 2657 (Ca--430617, W--1478356), 3674 (W--1478357). HISPANIOLA: Dominican Republic: *Allard* 14382 (N, W--1958855). PUERTO RICO: *Barker s.n.* [Hato Bay, April 7, 1921] (Ba); *DeWolf* 1914 (N); *M. J. Fisher* 19 (W--848252); *Otero* 2 (N), 231 (Mi), *M.71* (Mi). LEEWARD ISLANDS: Dominica: *Eggers* 1451 (W--1323372). WINDWARD ISLANDS: Barbados: *Barrow* 485 (N). Grenada: *L. H. Bailey* 428 (Ba). St. Lucia: *Hummel s.n.* [4/2/1958] (S). VENEZUELA: Mérida: López-Palacios 2168 (Ft). Miranda: *Hermanos Christianos* 192 (W--1802992). MASCARENE ISLANDS: Mauritius: *Bouton s.n.* [Herb. Hance 1925] (S). NEPAL: *Nicolson* 2879 (W--2571594); *Ram* 189 (Ca--396093); *Upafhyay* 1350 (W--2581496). INDIA: Assam: *Chand* 2463 (Mi), 4217 (Mi); *W. R. Fisher s.n.* [1880] (Bz--21374); *Herb. Hort. Bot. Calcutt. s.n.* [Khasia Hills, Oct. 1878] (Bz--21375); *Hooker & Thomson s.n.* [Mont. Khasia] (M, Mu--4918, S); *Jenkins s.n.* [Assam] (Mu--4921); *Khan* 79 in part (W--262744); *Koelz* 25771 (Mi), 25938 (Mi); *Miller s.n.* (Pd); *Native Collector s.n.* [Khasia Hills] (Bz--21383, Mu--4920); *Schlagintweit* 4315 (W--804637), 13483 (S); *Simons s.n.* [Assam & Khasia Hills] (Bz--21377, Bz--21378, Bz--21380, Bz--21381, Bz--21382, Mu--4922). Maharashtra: *Nafday* 163 (Ba). Manipur: *Bullock* 863 (N); *Grant s.n.* [Munnipore] (Le--908265-750). Rajasthan: *Kingdon-Ward* 18208 (N). Sikkim: *Craib* 402 (Bz--21373); *J. D. Hooker s.n.* [Sikkim, 3--5000 ped.] (Mu--4917, Pd, S); *Kurz s.n.* [Sikkim Terai] (Bz--21376); *Lepcha* 2667 (Ca--348577); *T. Thomson s.n.* [Sikkim] (Pd); *Treutler* 1028 (Pd). Siwalik & Jaunsar: *Bakhsh* 92 (N); *Choudhury* 91 (W--1170163, W--2638175); *Dusfriptu* 81 (Ca--228135); *Khan* 79 in part (Mu--9641); *Punj* 97 (N); *K. N. Singh* 117 (N); *Sware* 105 (Pd). Tamil Nadu: *Kuriakose s.n.* [11-2-33] (N); *Moll s.n.* [Misiones Tranguibaricae] (Br). Uttar Pradesh: *Duthie* 10781 (Ca--269789, Gg--127014); *Gairola* 882 (W--1347718); *Hamid* 1482 (W--1372661); *Kalaky s.n.* (N); *Mohite R.45* [96] (S);

Murdia 103 (Pd); *Raizada* s.n. [Dehra Dun, 21st Nov. 1929] (N); *G. Singh* s.n. [Dehra Dun] (N); *R. R. Stewart* 17167 (Ca--972849, N, W--1942112); *Strachey & Winterbottom* 942 (Br); *Umashankar* 4956 (Bl--182263, Mu). West Bengal: *C. B. Clarke* 9950b (Bz--21379), 13214 [610] (W--802410); *W. Griffith* 6068/1 (S); *Helper* 18 (Cm), 508 (Mu), s.n. [1836--38] (Gg--222537, I); *Mukerjee* 1277 (S). State undetermined: *Bentham* s.n. (T); *Biswas* 37 [Munsong] (We), s.n. [Singla, 23/XII/1937] (Bz--21384); *Blackburn* s.n. (T); *Bojer* s.n. [India orient.] (Mu--4916); *Chandron* s.n. [Ihano, 23rd Nov. 1927] (W--1719591); *Collector undetermined* 886/1 [Charswar] (Le--908265-730); *Falconer* 738 (T); *W. Griffith* s.n. [West Himalaya] (Mu--4919, T); *Herb. Bentham* s.n. [Ind. or.] (Mu--4927); *Herb. Hort. Bot. Calcutt.* s.n. [Singla, 23/ XII/1936] (N), s.n. [23/XII/1937] (W--175905); *Hort. Roxburgh* s.n. (Br); *Hügel* s.n. [mont. Himal. Belaspara] (Mu--4925, Mu--4926); *König* s.n. [Bantantensum] (Mu--4913, Mu--7360), s.n. [Ind. orient.] (Br); *Kuntze* 6443 (N, N); *A. B. Lambert* 51 (Q); *R. W. Parker* 21691 (S); *Prain* s.n. [Mungpoo] (Pd); *Roxburgh* s.n. [12 Nov. 1796] (Br); *Voigt* s.n. (Cp, Cp, Cp); SRI LANKA: *D. Fairchild* 1040 (Ca--301229). BANGLADESH: East Bengal: *W. Griffith* 6068/1 (Mu--4924, Pd). PHILIPPINE ISLANDS: Luzon: *R. Mendoza* s.n. [Philip. Nat. Herb. 33336] (W--2212408). GREATER SUNDA ISLANDS: Java: *Bakhuizen* 3902 (Le--923138-928); *Bijhouwer* 160 (Bz--21370); *Brinkman* 355 (Bz--21363); *Dorgelo* 3178 (Le--144160-496); *Herb. Lugd.-Bat.* 202530 (Le--908232-456); *Zollinger* 683 (Le--908265-709, S). Sabah: *Melegrito* s.n. [D. D. Wood 1152] (Ca--232391). Sumatra: *Jacobson* 32 (Bz--21372); *Koch-Reichenhall* s.n. [1927] (Mu). MOLUCCA ISLANDS: Island undetermined: *DeVriese* 13 (Le--908233-1243). NEW CALEDONIA: *Ball* s.n. (W--369413). HAWAIIAN ISLANDS: Hawaii: *Meebold* s.n. (Mu). CULTIVATED: Belgium: *M. Martens* s.n. (Br, Br). Brazil: *Butler* 2086 (N, Sf); *Pickel* 1354 (Sf). Burma: *O. E. White* 71 (W--2073126). California: *Eastwood* s.n. [Santa Barbara, Aug. 1916] (Gg--31099), s.n. [Santa Monica, June 28, 1928] (Gg--157412); *Greer* 1 (Sd--34578); *Herb. Univ. Calif. L. A.* s.n. [Hugh Evans garden, Santa Monica] (La, La); *McClintock* 149 in part (La), s.n. [Lower Hillside Park, Nov. 27, 1957] (Ba, Gg--411788); *R. V. Moran* 1494 (Sd--51491); *Paddock* s.n. [Dec. 1, 1947] (Ba); *Poindexter* s.n. [W. Los Angeles, June 28, 1936] (Ba); *Walther* s.n. [Santa Barbara, Jan.--Feb. 1931] (Gg--185159), s.n. [Santa Monica, Oct. 20, 1931] (Gg--189159). Cayman Islands: *N. Chevalier* 173 (N). China: *Ping* s.n. [Herb. Lingn. Univ. 10912] (W--1249662). Colombia: *Daniel* 5594 (W--2457916); *López-Palacios* 4022 (Ld); *López-Palacios & Idrobo* 3682 (N), 3690 (Ld, N); *Lopez-Palacios & Jaramillo* M.3682 (Ac). Cuba: *Roig* 7231 (Es), 11612 (Es). Dominican Republic: *Allard* 14358 (S, W--1958838). El Salvador: *P. C. Standley* 23666 (W--1139351). England: *Collector undetermined* s.n. [H. Kew 1855] (S). Florida: *Buswell* s.n. [Nov. 29, 1938] (Ba); *DeWolf* 649 (Ms--34245); *Dress* 1260 (Ba); *Gillis* 7050 (Ft--2561); *McFarlin* 6465 (Mi); *H. N. Moldenke* 21454 (Z); *R. W. Read* 1205 (Ba, Ft--2199); *P. O. Schallert* 20862 (Bl--124800), 22907 (S), 22997 (B, S, Ws); *Tisdale* s.n. [Gainesville, 19 Nov. 1937] (Fl--28047); *Vaskar* s.n. [Wildermere, 9-10-29] (Fl--21001). Germany: *Herb. Hort. Monac.* s.n. [1932] (Mu); *Herb. Kummer* s.n. [Hort.

bot. Monac., 2 Novemb. 1855] (Mu--6620); *Herb. Hort. Lips. s.n.* (Mi). Guadeloupe: *Duss* 2391 (N). Haiti: *Ekman* H.5166 (W--1412595). Hawaiian Islands: *J. Abbott s.n.* [4 March 1945] (Bz); *A. R. Cooke s.n.* [Univ. Hawaii campus, 3/ 10/54] (St); *Degener, Degener, & Munro* 28539 (N, W--2562087); *Forbes s.n.* [October 13, 1953] (St); *F. R. Fosberg* 9370 (Bi), 27077 (N, W); *J. A. Harris* C.242.275 (Bi, N); *Nitta* 47 (N); *P. Rankin* 13 [Wood 3628] (Bi); *Rock s.n.* [Sept. 18, '17] (Bi); *Storey s.n.* [Jan. 8, 1930] (Bi); *Y. Tanaka s.n.* [Dec. 4, 1929] (Bi); *Yoshinaga s.n.* [11/20/29] (Bi); *Yuncker* 3594 (Dp). Honduras: *Molina* R. 14679 (N, W--2566541); *H. E. Moore* 6771 (Ba). Hong Kong: *S. Y. Hu* 9084 (W--2711886), 9644 (W--2730999). India: *Herb. Hort. Bot. Calcutt. s.n.* (Mu--4923, Pd, T); *Shantha* 60 [Herb. Hyderabad. 163] (Hi--309618); *Wallich* 2087c (Mu--4914, Mu), *s.n.* [H. bot. Calcutta] (S), *s.n.* (Cp). Jamaica: *Morley* 152 (Mu). Java: *Bakhuizen van den Brink* 2749 (Ut--24903a), 3902 (Bz--21364); *Bakker* 7 (Bz--21371); *Eyken s.n.* [Sept. 1912] (Bz--21369); *Haagen* 318 (Bz--21368); *Hemken* 11 (Bz--21358); *Herb. Hort. Bot. Bogor.* 413 H.B. (Bz--21385, Le--92266-561), X.F.1 (Bz--21359), X.F.29 (Bz--21362), XI.G.66 (Bz--21360), XI.G.66 en a (Bz--21356, Bz--21357, Bz--21361), XI.G.68 (Bz--21354), XI.G.68a (Bz--21354, Bz--21355), XV.F.27a (Bz--26341, Bz, Bz), XV.I.IV.13 (Bz--26423), XV.J.A.XII.3 (Bz--26338, Bz--26339, Bz); *Herb. Mus. Bot. Bogor.* X.F.1 (Bz--25587), X.F.29 (Bz--25588), XI.G.66 en a (Bz--25589), XV.F.27 (Bz--26340, Bz--26555, Bz, N), XV.J.A.XII.3 (Bz--26337, N); *Leeuwen-Reijnvaan s.n.* [7 April 1911] (Bz--21367); *Van Oosten* 29 (Bz--21366), 45 (Bz--21365). Martinique: *Duss* 4701 (N). Mexico: *Dryxell* 1720 (Ba). Missouri: *Huhn* 16 (W--274554). Mozambique: *Gomes e Sousa* 3 (Ul). Pakistan: *Qureshi s.n.* [4.12.1965] (Kh); *R. R. Stewart* 29099 (Kh). Pennsylvania: *Peele* 404 (Ba). Philippine Islands: *J. V. Pancho* 2908 (Ba); *Stern* 2110 (Mi). Réunion: *Hombron* 2 (P); *Richard s.n.* [hort. bot. Bourbon] (P, P). Singapore: *Nur s.n.* [2 Oct. 1924] (Ba). Puerto Rico: *Cowles s.n.* [April 3, 1922] (N); *Moldenke & Moldenke* 19534 (N); *R. J. Wagner* 402 (Ba, S). St. Kitts: *L. H. Bailey* 396 (Ba). Sri Lanka: *Collector undetermined s.n.* [Roy. Bot. Gard. May 1887] (Pd); *Moldenke, Moldenke, & Jayasuriya* 28134 (Ac, Gz, Ld, Pd, W--2764403); *Sumithraarachchi* 1] (Pd). Sudan: *Kassas* 106 (Gz), 665 [105] (Gz). Switzerland: *Herb. Hort. Basil. s.n.* (T). Tobago: *W. E. Broadway* 4798 (N). Trinidad: *Bailey & Bailey s.n.* [Port-of-Spain, Feb. 1921] (Ba); *W. E. Broadway s.n.* [Trin. Bot. Gard. Herb. 1377] (R, W--938229), *s.n.* [30 Oct. 1926] (B, B), *s.n.* [November 7, 1932] (I). Venezuela: *Bailey & Bailey* 643 (Ba), 1472 (Ba); *Bernardi* 3115 (N); *Ruiz-Teran & López-Palacios* 6217 (N); *Vogl* 1305 (Mu). Zaire: *RR.PP. Salesiens* 293 (Br). LOCALITY OF COLLECTION UNDETERMINED: *Collector undetermined s.n.* (Pd); *Haller s.n.* [Haram Petty] (Pd); *Herb. Alstroemer s.n.* (S); *Herb. Burman s.n.* (Le--908265-710); *Jacquemont* 2505 [Indes orient.] (W--2497116). MOUNTED ILLUSTRATIONS: *Géel, Sert. Bot. Cl. 14.* 1823 (N); *H. N. Moldenke* color slide 202 (Z); *DeWild., Icon. Select. Hort. Then.* 159. 1903 (Br).

HOLMSKIOLDIA SANGUINEA f. *CITRINA* Mold., *Phytologia* 8: 58. 1961.

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This form differs from the typical form of the species in having its fresh corollas and calyxes both the same lemon-yellow color, the older calyxes becoming greenish-yellow and drying light-brown.

The form is based on *Colin Potter FL.1264* from a cultivated plant in the Foster Botanical Garden, Honolulu, Oahu, Hawaiian Islands, collected on September 20, 1961, and deposited in my personal herbarium. Miss Neal, in a letter to me dated September 21, 1961, says "about the *Holmskioldia* with greenish-yellow flowers: when I asked our Foster Botanical Gardens for a specimen for you (we have none in the herbarium [of Bishop Museum]) they immediately looked it up and found that their single plant was bearing a few flowers, though only recently planted out in the ground. A specimen from this they have just given us, and it is now in the press and will be sent to you soon. As their specimen was obtained locally, they do not know the source. I saw the same color form in Oct. 1955, when it was introduced by Mrs. A. Lester Marks of Honolulu, probably from some nursery on the mainland [of the U.S.A.]." All evidence points to the taxon being native to Assam.

While this is described as a "greenish-yellow" form, R. W. Read (below) refers to his plant as a "brilliant yellow flowered form"; Mrs. Parry describes her Assam plant as having the "bracts and flowers yellow". De (1939) says that "Recently I discovered a yellow-flowering variety of this species [*H. sanguinea*]." Whether all these plants represent the same form *citrina* is not certain -- possibly a greenish-yellow and a pure yellow form are here involved. Menninger (1970) says: "In the botanical garden at Bangalore, India, is a deep red-flowered form and also a bright yellow-flowered form of this plant [*H. sanguinea*]." It is not at all certain to me if the red-flowered and orange-flowered specimens cited under typical *H. sanguinea* really represent the same taxon or if two (or three) color forms are here included. Only careful field work can settle this problem.

Citations: INDIA: Assam: *Parry 1193* (N). CULTIVATED: Florida: *R. W. Read 1369* (Ft--2200). Hawaiian Islands: *C. Potter FL.1264* (Z--type).

HOLMSKIOLDIA SPEIRII (Lesq.) MacGinitie, *Carnegie Inst. Wash.*

Publ. 599: 156--157, pl. 74, fig. 1 & 2. 1953.

Synonymy: *Porana speirii* Lesq., *U. S. Geol. Surv. Terr. Rep.* 8: 172, pl. 28, fig. 15. 1883. "Convolvulaceous (?) flower" Kirchner,

Trans. St. Louis Acad. Sci. 8: 187, pl. 15, fig. 2. 1898.

Porana similis Knowlton, Proc. U. S. Nat. Mus. 51: 288, pl. 27, fig. 1 & 2. 1916. *Florissantia physalis* Knowlton, Proc. U. S. Nat. Mus. 51: 270. 1916. *Hydrangea bendirei* Berry, U. S. Geol. Surv. Prof. Paper 154: 251, pl. 52, fig. 7. 1929 [not *H. bendirei* (Ward) Knowlton, 1901]. *Viburnum palmatum* Chaney & Sanborn, Carnegie Inst. Wash. Publ. 439: 97, pl. 40, fig. 4. 1933.

Bibliography: Lesq., Rep. U. S. Geol. Surv. Terr. 8: 172, pl. 28, fig. 15. 1883; Ward, Rep. U. S. Geol. Surv. 5: 446. 1885; Lesq., Proc. U. S. Nat. Mus. 11: 16, pl. 8, fig. 4. 1888; Kirchner, Trans. St. Louis Acad. Sci. 8: 187, pl. 15, fig. 2. 1898; Knowlton, Cat. Cret. Tert. Pl. [Bull. U. S. Geol. Surv. 152:] 182. 1898; Knowlton, Bull. U. S. Geol. Surv. 209: 60, pl. 9, fig. 6 & 7. 1902; Knowlton, Proc. U. S. Nat. Mus. 51: 270 & 288, pl. 27, fig. 1 & 2. 1916; Knowlton, Bull. U. S. Geol. Surv. 696: 294, 323, & 499. 1919; Chaney, Carnegie Inst. Wash. Publ. 346: 66, 70, 71, 76, 80, 94, 134, & [140]. 1927; Berry, U. S. Geol. Surv. Prof. Paper 154: 251, pl. 52, fig. 7. 1929; Chaney & Sanborn, Carnegie Inst. Wash. Publ. 439: 97, pl. 40, fig. 4. 1933; Brown, Journ. Paleont. 9: 583, pl. 69, fig. 1--3. 1935; Brown, Journ. Wash. Acad. Sci. 30: 353. 1940; MacGinitie, Carnegie Inst. Wash. Publ. 599: 156--157, pl. 74, fig. 1 & 2. 1953; Mold., Résumé 266, 294, 301, 336, 379, & 456. 1959; Becker, Geol. Soc. Am. Mem. 82: 87 & 119, pl. 30. 1961; R. Pearson, Anim. Pl. Cenozoic Era 33. 1964; Becker, Nat. Hist. 74 (2): 41. 1965; Becker, Palaeontogr. B. 127: 123, pl. 39, fig. 6. 1969; Mathewes & Brooke, Syesis 4: 215. 1971; Mold., Fifth Summ. 1: 376 (1971) and 2: 518, 531, 604, 709, 881, & 970. 1971; Mold., Phytol. Mem. 2: 368 & 550. 1980.

Illustrations: Lesq., Rep. U. S. Geol. Surv. Terr. 8: pl. 28, fig. 15. 1883; Kirchner, Trans. St. Louis Acad. Sci. 8: pl. 15, fig. 2. 1898; Knowlton, Proc. U. S. Nat. Mus. 51: pl. 27, fig. 1 & 2. 1916; Berry, U. S. Geol. Surv. Prof. Paper 154: pl. 52, fig. 7. 1929; Chaney & Sanborn, Carnegie Inst. Wash. Publ. 439: pl. 40, fig. 4. 1933; Brown, Journ. Paleont. 9: pl. 69, fig. 1--3. 1935; MacGinitie, Carnegie Inst. Wash. Publ. 599: pl. 74, fig. 1 & 2. 1953; Becker, Geol. Soc. Am. Mem. 82: pl. 30. 1961; Becker, Nat. Hist. 74 (2): 41. 1965; Becker, Palaeontogr. B. 127: pl. 39, fig. 6. 1969.

This fossil species is known only from the fruiting-calyces which are solitary, scarious in texture, borne on slender pedicels about 3 cm. long, 5-lobed, 2--5 cm. wide, the lobes connate, rather angular, deltoid, about 1/4 the radius of the calyx, basally 1.3--1.5 cm. wide, apically rounded or rather obtusely subacute, each with 5 veins diverging from the base and extending in a straight line to the margins where they unite by means of anastomosing loops, one prominent vein leading to the points of the sinuses and giving off a few lateral branches toward the extremities, the veins joined by lateral nervilles or crossties to form a conspicuous reticulum of irregularly polygonal or rectangular meshes; the pedicels slender, about 3 cm. long, apically bearing a small club-shaped expansion surmounted by a terminal ridge or ring supporting the calyx.

This fossil species, apparently known from numerous individual specimens, was supposed by some paleobotanists to represent a convolvulaceous corolla (Lesquereux, Knowlton) and by others a sterile flower of *Hydrangea* (Berry) or *Viburnum* (Chaney & Sanborn), but seems clearly to be the mature fruiting-calyx of a *Holmskioldia*, not very unlike the modern *H. sanguinea* Retz. Another supposed fossil *Porana* (*P. tenuis* Lesq., *P. cockerelli* Knowlton), similar to some species of *Heisteria* (*Olacaceae*), has been shown actually to represent a species of *Astronium* (*Anacardiaceae*).

MacGinitie (1953) has summed up the situation as follows: "The fossils leave no doubt that they are true calyces and not corollas. The length of the pedicel shows that they cannot have grown in close umbels as in *Hydrangea* or *Viburnum*. The specimen showing the calyx in side view was a valuable help in final identification. The fossil calyces correspond very closely to those of *Holmskioldia*, a large vine from subtropical and tropical southeastern Asia. *Holmskioldia sanguinea* Retzius from the southeastern Himalaya region furnishes the closest match. This positive identification as *Holmskioldia* leaves a question concerning the contrast between the habitat of the living plant and the indicated habitat of the fossil flora. It is probable that the fossil species was entirely distinct from any now living and was adapted to more temperate habitats. However, the climate of the northwestern range for the living genus, in the eastern Himalayas, is not greatly different from that of the southern Appalachians, where several species related to those of the fossil flora are now growing. *Holmskioldia* calyces have been found in fossil deposits at Fossil, Wyoming; Goshen, Cove Creek, and Bridge Creek, Oregon; and at Republic, Washington, ranging in age from Middle (or possibly Upper) Eocene to late Oligocene."

Holmskioldia speirii is based on Princeton Univ. Paleobot. Coll. 650, with hypotypes U. S. Nat. Mus. Cat. 33686, 34736, & 34737, Denver Mus. Nat. Hist. 658, and Univ. Calif. Mus. Paleobot. Ser. 3619 & 3620.

Becker (1961) comments that "Several well-defined calyces with counterparts exhibit considerable detail in outline and venation. The five connate, rounded calyx lobes are 2.3 cm in diameter, and the fossils conform to Chaney's (1927) description for *Porana* of the Crooked River specimens, as well as to those by Brown (1935, p. 483) from the Green River material. The Ruby specimens with a calyx diameter of 4.5 cm. as against 3.5 cm. for those of the Green River are some of the largest reported. MacGinitie (1953, p. 156) assigned material from Florissant to this species, but transferred it along with five other forms.....to the genus *Holmskioldia* of the *Verbenaceae*. Calyx venation of the Florissant specimens is of the *Holmskioldia* type. These Florissant calyx lobes are obtusely pointed and therefore markedly different from the Ruby specimens, the one figured by Lesquereux, and others identified by Brown (1935, Pl. 69, figs. 1, 3) from the Green River flora. Lobes of an intermediate shape have not been reported in the fossil state. Possibly the material consists of two

species. The remains of *Holmskioldia* furnish an excellent stratigraphic index for the early Cenozoic, especially the Oligocene.....Calyces of the living *Holmskioldia sanguinea* Retzius (Pl. 30, fig. 6) from subtropical areas of southeastern Asia correspond in venation most nearly with the fossil. Obtuse as well as rounded lobes occur in the living *H. mira* Moldenke (Pl. 30, figs. 4, 7) and in the smaller *H. angustifolia* Moldenke (Pl. 30, fig. 5), both from Madagascar." However, the last-named of these species has since been proved actually to be a species of the genus *Capitanopsis* S. Moore in the *Lamiaceae*.

Becker (1969) found "several 5-lobed calyces of *Holmskioldia speirii*" in the Tertiary of Beaverhead Basin in southwestern Montana. "They are 5 cm. in diameter, connate, prominently 5-veined, obtuse but with somewhat more pointed lobes, and generally larger than the Florissant specimens. The characters preclude confusion of the fossil with *Astronium*, *Hydrangea* or *Viburnum*. None of the living species is exactly like the fossil, but the generic characters are diagnostic. *Holmskioldia* is described from North America only from the upper Eocene to the late Oligocene, but may have extended into the Lower Miocene."

In a letter to me, dated April 16, 1951, Dr. MacGinitie says: "The *Verbenaceae* in the Florissant are *Petraea perplexans* (Cockerell) MacGinitie and *Holmskioldia speirii* (Lesquereux) MacGinitie. They were formerly called *Buettneria perplexans* and *Porana speirii*. These names are both founded on calyces and appear to be as certain as any paleobotanical identifications can be."

The *Hydrangea bendirei* (Ward) Knowlton, referred to in the synonymy (above), is a presently accepted fossil species based on *Marsilea bendirei* Ward [*Porana bendirei* (Ward) Lesq., 1888] from the Mascall formation in Grant County, Oregon.

HOLMSKIOLDIA SPINESCENS (Klotzsch) Vatke, *Linnaea* 43: 536. 1882.

Synonymy: *Cyclonema spinescens* Klotzsch in Peters, *Naturwiss. Reise Mossamb.* 6 [Bot.] (1): 262. 1861 [not *C. spinescens* Oliv., 1876]. *Holmskioldia spinescens* Vatke apud Hutchins. & Corbish., *Kew Bull. Misc. Inf.* 1920: 332. 1920.

Bibliography: Klotzsch in Peters, *Naturwiss. Reise Mossamb.* 6 [Bot.] (1): 262. 1861; Oliv., *Journ. Linn. Soc. Lond. Bot.* 15: 96. 1876; Hook., *Icon. Pl.* 13: pl. 1221. 1877; Vatke, *Linnaea* 43: 536. 1882; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 1, 1: 679. 1893; Gürke in Engl., *Pflanzenw. Ost-Afr. C.* 342. 1895; J. G. Baker in Thiseit.-Dyer, *Fl. Trop. Afr.* 5: 314. 1900; Hutchins. & Corbish., *Kew Bull. Misc. Inf.* 1920: 332. 1920; Hutchins., *Flow. Pl. S. Afr.* 2: pl. 49. 1922; Stapf, *Ind. Lond.* 2: 380. 1930; Mold., *Known Geogr. Distrib. Verbenac.*, ed. 1, 51 & 93. 1942; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 2, 1: 679. 1946; Mold., *Known Geogr. Distrib. Verbenac.*, ed. 2, 120 & 136. 1949; E. J. Salisb., *Ind. Kew. Suppl.* 11: 119. 1953; Mold., *Résumé* 150, 276, & 457. 1959; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 3, 1: 679. 1960; Mold., *Fifth Summ.* 1: 251 & 473 (1971) and 2: 881. 1971; Mold., *Phytol. Mem.* 2: 241 & 550. 1980.

Illustrations: Hook., *Icon. Pl.* 13: pl. 1221. 1877.

A many-stemmed much-branched erect shrub, to about 2.5 m. tall; stems whitish, rather flattened; branches whitish, rather flattened, armed with short, white, erect, wide-spreading, 6--8 mm. long, subulate, glabrous, and woody spines; young branchlets erect, terete, densely pubescent; leaves small, decussate-opposite, deciduous; petioles very short, terete, about 2 mm. long; leaf-blades light-green, oblong, 1.2--4 cm. long, 6--8 mm. wide, apically very shortly acute, marginally entire, basally narrowed-cuneate, slightly pubescent above, densely whitish-pubescent beneath; cymes axillary, borne at the apex of the branchlets, pedunculate, lax, few-flowered, pubescent, bracteate; bracts minute, villous, caducous; calyx in anthesis cyathiform-campanulate, 0.8--1.2 cm. wide, obtusely 5-lobed, pubescent on both surfaces, accrescent; corolla irregular, slightly longer than the calyx, 1.2 cm. long, externally densely pubescent, the tube short, reclinate, densely glandular, the limb unequally 5-parted, subbilabiate, patent; stamens 4, subdidynamous, long-exserted, equaling the tips of the corolla-lobes; filaments filiform, glandular-puberulent below, glabrous above; style glabrous, exserted; ovary villous or white-pubescent; fruiting-calyx rigidly coriaceous, to 2.5 cm. wide; fruit densely villous, apically deeply 4-lobed.

This species appears to be endemic to the lower part of the Zambezi valley in Tete, Mozambique, where the type was collected by Peters and the species again by Kirk. The *Cyclonema spinescens* of Oliver (1876), referred to in the synonymy (above), is a synonym of *Kalaharia uncinata* (Schinz) Mold.

The *Faden*, Gillett, & Gachathi 77/439, distributed as *H. spinescens* actually represents a new, as yet undescribed, species awaiting the collection of more complete material.

Chase refers to *H. spinescens* as a shrub, 7--8 feet tall, with simple, opposite leaves, and fruits attached to the mature calyx, and with "4-pointed seeds". He encountered the plant on hill-tops and riverbanks, at 900 feet altitude, fruiting in July.

Citations: MOZAMBIQUE: Tete: N. C. Chase 2217 [Govt. Herb. Salisb. 29056] (N), 2218 [Govt. Herb. Salisb. 29055] (N).

HOLMSKIOLDIA SUBINTEGRA Mold., Bol. Soc. Brot., ser. 2, 40: 122. 1966.

Bibliography: Mold., Bol. Soc. Brot., ser. 2, 40: 122. 1966; Mold., Résumé Suppl. 13: 4. 1966; Anon., Assoc. Etud. Tax. Fl. Afr. Trop. 1967: 62. 1968; Anon., Biol. Abstr. 49: 390. 1968; Mold., Fifth Summ. 1: 251 (1971) and 2: 881. 1971; Heslop-Harrison, Ind. Kew. Suppl. 15: 69. 1974; Mold., Phytol. Mem. 2: 241 & 550. 1980.

A tree, 5--7 m. tall, apparently much-branched; branchlets twiggy, conspicuously lenticellate with elevated lenticels, the youngest parts densely short-pubescent with gray hairs; principal internodes much abbreviated, 1--4 cm. long; leaves decussate-opposite or approximate, sessile or subsessile; leaf-blades firmly chartaceous or parchment-like, brunnescent in drying, lighter beneath, obovate or obovate-elliptic, usually widest above the middle, apically acute to short-cuspidate, marginally

entire or subentire-repand, basally acute, rather densely short-pilose or -pubescent above, more densely so beneath especially along the venation; secondaries about 6 per side, practically indiscernible above, prominulous beneath; inflorescence axillary, usually shorter than or equaling the subtending leaves; peduncles very slender, 2--3 cm. long, densely short-pubescent; cyme-branches 2 or 3, shorter than the peduncle, short-pubescent, divergent in fruit; fruiting-calyx firmly chartaceous, rotate, distinctly 5-lobed, conspicuously venose, pinkish, 2.5--3 cm. wide, puberulent.

The type of this apparently endemic species was collected by Eduardo Campos de Andrada (no. 1755) near Furancungo, Macanga, Tete, Mozambique, on July 14, 1949, and is deposited in the Ultramar herbarium at Lisbon. Thus far it is a species known only from this type collection.

Citations: MOZAMBIQUE: Tete: *Andrade 1755* (U1--type, Z--isotype).

HOLMSKIOLDIA TETTENSIS (Klotzsch) Vatke, *Linnaea* 43: 536. 1882.

Synonymy: *Cyclonema tettensis* Klotzsch in Peters, *Naturwiss. Reise Mossamb.* 6 [Bot.] (1): 261--262. 1861. *Holmskioldia speciosa* Hutchins. & Corbish., *Kew Bull. Misc. Inf.* 1920: 332, fig. 1. 1920. *Holmskioldia tettensis* Vatke apud Hutchins. & Corbish., *Kew Bull. Misc. Inf.* 1920: 332. 1920.

Bibliography: Klotzsch in Peters, *Naturwiss. Reise Mossamb.* 6 [Bot.] (1): 261--262. 1861; Vatke, *Linnaea* 43: 536. 1882; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 1, 1: 679. 1893; Gürke in Engl., *Pflanzenw. Ost-Afr. C*: 342. 1895; J. G. Baker in Thiseit.-Dyer, *Fl. Trop. Afr.* 5: 314. 1900; Hutchins. & Corbish., *Kew Bull. Misc. Inf.* 1920: 332--333, fig. 1--3. 1920; Hutchins. in Dyer, *Flow. Pl. S. Afr.* 2: pl. 49. 1922; Wangerin, *Justs Bot. Jahresber.* 51 (1): 553. 1923; A. W. Hill, *Ind. Kew. Suppl.* 6: 103. 1926; Fedde & Schust., *Justs Bot. Jahresber.* 48 (1): 498. 1927; Wangerin, *Justs Bot. Jahresber.* 49 (1): 521. 1928; Stapf, *Ind. Lond.* 3: 433. 1930; Fedde, *Justs Bot. Jahresber.* 49 (2): 436 (1932) and 51 (2): 310. 1933; Worsdell, *Ind. Lond. Suppl.* 1: 484. 1941; Mold., *Known Geogr. Distrib. Verbenac.*, ed. 1, 51 & 93. 1942; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 2, 1: 679. 1946; Neal, *Gard. Hawaii*, ed. 1, imp. 1, 645 & 783 (1948) and ed. 1, imp. 2, 645 & 783. 1949; Mold., *Known Geogr. Distrib. Verbenac.*, ed. 2, 120, 122, 160, & 186. 1949; Mold., *Résumé* 150, 152, 153, 219, 276, & 457. 1959; E. J. Salisb., *Ind. Kew. Suppl.* 11: 120. 1953; Kuck & Tongg, *Mod. Trop. Gard.* 109, 116, & 233. 1955; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 3, 1: 679. 1960; Dyer, Verdoorn, & Codd in Letty, *Wild Fls. Transv.* 280 & [282], pl. 140 (1). 1962; Mold., *Résumé Suppl.* 3: 32. 1962; H. P. Riley, *Fam. Flow. Pl. S. Afr.* 129. 1963; Neal, *Gard. Hawaii*, ed. 2, 732 & 896. 1965; F. White, *Webbia* 19: 677. 1965; R. H. Compton, *Journ. S. Afr. Bot. Suppl.* 6: 66. 1966; Mold., *Résumé Suppl.* 13: 4. 1966; Anon., *Assoc. Etud. Tax. Afr. Trop. Ind.* 1967: 62. 1968; Anon., *Biol. Abstr.* 49: 390. 1968; Van der Schijff, *Check List Vasc. Pl. Kruger Nat. Park* 81--82. 1969;

Elliovson, Compl. Gard. Book South. Hemisph., ed. 6, 160. 1970; Mold., Fifth Summ. 1: 251, 254, 256, 363, & 473 (1971) and 2: 528 & 881. 1971; Palmer & Pitman, Trees S. Afr., ed. 2, 3: 1968--1971. 1972; Mold., Phytologia 26: 368. 1973; Howes, Dict. Useful Pl. 55. 1974; Clay & Hubbard, Haw. Gard. Trop. Shrubs 198 & 290. 1977; Mold., Phytologia 36: 37. 1977; Mold., Phytol. Mem. 2: 241, 243, 245, 354, & 550. 1980.

Illustrations: Hutchins. & Corbish., Kew Bull. Misc. Inf. 1920: 333, fig. 1--3. 1920; Hutchins. in Dyer, Flow. Pl. S. Afr. 2: pl. 49 (in color). 1922; Dyer, Verdoorn, & Codd in Letty, Wild Fls. Transv. [272], pl. 140 (1) (in color). 1962; Palmer & Pittman, Trees South. Afr. 3: 1968 (in color) & 1970. 1972.

A large, erect, twiggy bush, small shrub, or slender shrubby tree, branched, very floriferous, pilose-pubescent; branches and branchlets woody, unarmed, decussate-opposite, obtusely tetragonal or terete, slender, whitish, suberect, shortly soft-pubescent or sparsely villous, with pale lenticels; twigs gray-brown; principal internodes about 2 cm. long; leaves decussate-opposite; petioles short, about 7 mm. long, plano-convex in cross-section, densely pubescent; leaf-blades soft, papyraceous, broadly ovate or obovate to oblong or triangular, 2.5--4 cm. long, 1.5--3 cm. wide, apically triangular and shortly acute, basally broadly cuneate or rounded, marginally irregularly and coarsely crenate-dentate or scalloped, with about 3, deep, wide, & blunt or rounded teeth, deep-green above and velvety to sparsely short-pubescent or very short-setulose with evanescent hairs, paler green beneath and conspicuously glandular short-pubescent especially on the venation; secondaries about 3 per side; inflorescence axillary at the tips of the branchlets, cymose or corymbose, pedunculate, few-flowered, incanous-pilose, bracteate; peduncles slender, soft-pubescent; lower bracts more or less foliaceous, spatulate-obovate or rhomboid, 6--8 mm. long, about 4 mm. wide, apically acute, puberulent on both surfaces, short-stalked, green or pale pink-mauve, caducous; pedicels 1.2--2 cm. long, densely villous, with 2 small linear opposite bracteoles above the middle; calyx cyathiform or broadly top-shaped, pink or mauve to dull pink-lilac, obtusely 5-dentate, basally urceolately contracted, externally densely villous or glandular-pubescent, gradually accrescent; corolla-buds purple-violet; corolla violet or purple to deep-blue, 2--2.5 cm. long, irregular, slightly shorter than the calyx, externally glandular soft-pubescent, the tube short, 1--1.5 cm. long, reclinate, glandulose, the limb unequally 5-lobed, subbilabiate, spreading, externally articulate-villous, the lobes apically broadly rounded; stamens 4, subdidynamous, long-exserted; filaments filiform, purple or violet, basally glandulose-puberulent, apically glabrous; anthers greenish-yellow; style a little longer than the stamens, slender, glabrous; ovary orbicular, 4-celled, externally villous throughout or only on the upper part; fruiting-calyx much accrescent, papyraceous or rigidly membranous, to 2.5 cm. wide; fruit subtriangular, broadest apically, truncate, 4-horned, included by the mature fruiting-calyx, explosively dehiscent

when mature.

The type of this species was collected by Peters "Auf Ebenen in der Umgebung von Tette", Mozambique. Klotzsch (1861) records the vernacular name, "camunga-cansomba", and speaks of the ovary as "viereugich", by which he probably means 4-celled. He also comments that the "Staubgefäße [anthers] und Griffel [style] sind in ihrer Bekleidung" the same as those of *H. spinescens*.

Hutchinson (1922) comments that this plant "when in full bloom is one of the most conspicuous objects in the veld. The calyx... very soon becomes almost fully developed, and the young corolla is at first only visible as a minute ball at the base of the saucer-shaped calyx."

The type of Hutchinson & Corbishley's *H. speciosa* was collected by I. B. Pole Evans (no. 16879) at Komanti Poort in the Limpopo basin, Transvaal, South Africa, on November 29, 1917.

Palmer & Pitman (1972) assert that "In South Africa it is confined to the north-eastern and eastern Transvaal and to Zululand -- it also occurs in Swaziland -- where it grows in mixed bushveld on rocky mountain slopes. It is common on the Lebombo Mountains. Patches of trees grow almost alongside the road on the Lydenburg side of the Abel Erasmus Tunnel, in mid and late summer making patches of soft colour". They continue: "The flowers bloom from spring to late summer.....In shape and colour they are beautiful and unusual. The calyx in a mature flower is large and saucer-shaped and stiffly papery, with 5 shallow lobes, a soft pink or mauve shade. The corolla in the heart of this is first only a small ball, and this develops into a 2-lobed tube up to 2.5 cm long, violet or deep blue and softly velvety, with 4 long [h]airy stamens protruding.....The Bantu name....means "to crackle" because when ripe [the fruits] explode with small crackling sounds, shooting out the seeds.....It is well worth cultivating for its abundant, soft-coloured blooms."

Collectors have found this plant growing on steep hillsides and on stony or rocky mountain slopes, in open wood in lowveld, in red gritty soil of bushveld, in shallow stony soils, in *Sclerocarya-Combretum apiculatum-Acacia nigrescens* bush, and in woods with *Pterocarpus rotundifolius*, *Combretum* spp., *Sclerocarya caffra*, *Acacia* spp., and *Peltophorum africanum*, at 500--1000 feet altitude, in anthesis from October to April, as well as in July, and in fruit in February.

The "flowers" [=corollas?] are reported as "purple" by Kuck & Tongg (1955) and on Borle 271 and Exell & al. 471, "pale-purple" on Edwards 2944, "blue-purple" on Gillis 11046, "violet-blue" on Bayliss 10602, "blue" on Strey 6556, "dark-blue" on Van Wyk 404, "blue-pink" on Schlieben & Strey 8391, "lilac" on Barbosa 737, "violet" on Torre 1849 & 6839, "mauve" on Codd 3254, and "wine-color" on Mendonça 2964, and the corollas specifically as "violet" on Compton 28619 & 30396, "reddish-blue" on Mendonça 1658, and "pink" on Meeuse 10643. The calyx specifically is described as "lilac-rose" on Mendonça 1658, "pink" on Compton 30396, "pinkish" on Exell & al. 471, "mauve" on Meeuse 10643, and "russet" on Compton 28619.

[to be continued]



Moldenke, Harold N. 1981. "Notes on the genus *Holmskioldia*." *Phytologia* 48, 313–356.

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