

A SYNOPSIS OF THE CHINESE SPECIES OF
ASARUM (ARISTOLOCHIACEAE)

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THE GENUS *Asarum* L. has its center of distribution in eastern Asia, especially in China and Japan. The genus includes two distinct subgenera, each with several subcategories. Subgenus ASARUM is characterized by almost distinct perianth lobes and more or less united styles with terminal stigmas, while subg. HETEROTROPA has an obvious floral tube and six free styles with lateral stigmas. Due to these and other differences, the genus has occasionally been divided into two, three, or even more segregate genera (e.g., *Hexastylis* Raf., *Heterotropa* Morren & Dcne., *Asiasarum* Maekawa, *Japonasarum* Nakai, and *Geotaenium* Maekawa). The characters utilized to distinguish these genera, however, are of comparatively minor significance. Since *Asarum* appears to be a natural and consistent taxon with close relationships among its species and salient evolutionary trends in its floral structures, it has been maintained by most authors (e.g., Braun, 1861; Hayata, 1915; Maekawa, 1932; Liu & Lai, 1976), as well as by the present ones. In this paper we divide *Asarum* into two subgenera and propose five sections and four series, essentially following Araki's (1937) hierarchy but with some emendations and modifications.

In China species of *Asarum* that produce pungent aromatic roots are used in traditional medicine as a remedy for pain and colds. Among them, *A. heterotropoides* var. *mandshuricum* is considered of the greatest value, although *A. sieboldii* is believed to have been the first species used in ancient Chinese medicine. All the remaining species, including those utilized in folk medicine, are used for the same or slightly different purposes.

CONSPECTUS OF THE GENUS ASARUM IN CHINA¹

Asarum L. Sp. Pl. 442. 1753; Gen. Pl. ed. 5. 201. 1754. LECTOTYPE SPECIES: *A. europaeum* L., *fide* Britton & Brown, Ill. Fl. N. U. S. ed. 2. 1: 642. 1913.

Hexastylis Raf. Neogenyton, 3. 1825. TYPE SPECIES: *H. arifolia* (Michx.) Raf., based on *Asarum arifolium* Michx. (U. S. A.)

Heterotropa Morren & Dcne. Ann. Sci. Nat. II. 2: 314. t. 10. 1834. TYPE SPECIES: *H. asaroides* Morren & Dcne. (Japan.)

Japonasarum Nakai, Fl. Sylv. Koreana 21: 16. 1936. TYPE SPECIES: *J. caulescens* (Maxim.) Nakai, based on *Asarum caulescens* Maxim. (Japan, Korea.)

Asiasarum Maekawa *in* Nakai, Fl. Sylv. Koreana 21: 17. 1936. TYPE SPECIES: *A. sieboldii* (Miq.) Maekawa, based on *Asarum sieboldii* Miq. (Korea.)

Geotaenium Maekawa, Proc. VII Pacific Sci. Congr. 5: 217. 1953. TYPE SPECIES: *G. epigynum* (Hayata) Maekawa, based on *Asarum epigynum* Hayata. (China, Taiwan.)

¹Some species occurring in Taiwan are not included in this treatment because we have not seen adequate material.

Perennial herbs; rhizomes short and oblique or long and prostrate; roots and rhizomes pungently aromatic. Leaves 1 or 2, usually long-petiolate, variously cordate or sagittate. Flowers solitary, axillary or between 2 opposite leaves, greenish, usually with tufts of short purplish hairs (rarely glabrous); peduncles usually short, with 1 or 2 cataphylls at base; perianth of 3 sepals, these separate or coalescent at base and forming a cupular, urceolate, campanulate, or funnel-form tube, the tube often ridged or tessellate on inner surface and constricted at upper end to form orifice, the orifice usually with laminate ring; perianth lobes 3, erect, spreading, or reflexed; stamens 12 in 2 series, rarely with extra whorl of 3 aberrant stamens or staminodes, filaments evident or anthers subsessile; ovary inferior or half inferior (sometimes nearly superior), 6-loculate, the placentation axile with numerous ovules, the styles 6, distinct with essentially terminal stigmas or united and with lateral stigmas. Fruit a fleshy, berrylike capsule, splitting irregularly when ripe; seeds numerous, more or less cordate, convex dorsally, plane or grooved ventrally, arillate at base. $2n = 12, 24, 26$.

About ninety species, mostly in the warm-temperate region of eastern Asia; a few species in North America and one endemic to Europe. Thirty-one species, three varieties, and one form occur in China and are distributed mainly along the Yangtze River. A key to the subgenera, sections, and series into which these species fall is presented below.

KEY TO THE SUBGENERA, SECTIONS, AND SERIES OF ASARUM

1. Perianth with lobes essentially free above ovary, not forming distinct tube or only very short one; stamens with \pm long filaments; styles united into column, the 6 stigmas radiating, essentially terminal (subg. ASARUM).
 2. Perianth with tube completely lacking, the lobes free, erect or rarely reflexed (sect. ASARUM).
 3. Perianth lobes erect, caudate or pointed. ser. Calidasarum.
 3. Perianth lobes reflexed, neither caudate nor long-pointed. ser. Japonasarum.
 2. Perianth with tube very short; the lobes united at very base, erect or reflexed. sect. BREVITUBA.
1. Perianth with lobes united above ovary, forming tube of various shapes; stamens subsessile or with very short filaments, if with long filaments then inserted on ovary; styles 6, free or rarely united basally, often bifid at apex, stigmas lateral or rarely \pm terminal (subg. HETEROTROPA).
 4. Stamens inserted on ovary, filaments longer than anthers; ovary often half inferior, styles short; perianth smooth throughout, orifice lacking laminate ring. sect. ASIASARUM.
 4. Stamens not inserted on ovary, filaments usually very short; ovary inferior or half inferior, rarely almost superior, styles long; perianth with lobes often with papillate or pulvinate areas at base, orifice usually with laminate ring.
 5. Perianth with tube usually 1–4 cm long, often with conspicuous orifice ring, papillate area localized at base of lobes (sect. HETEROTROPA).
 6. Styles not bifid at apex, stigmas terminal or subterminal. ser. Achidasarum.
 6. Styles bifid at apex, stigmas lateral. ser. Bicornis.
 5. Perianth with tube usually 5–8 cm long, orifice lacking evident ring, papillae scattered from middle of lobes downward into tube and arranged in vertical rows. sect. LONGIFLORA.

SUBGENUS ASARUM

Asarum subg. Asarum

Asarum subg. *Choridasarum* Araki, Acta Phytotax. Geobot. 6: 125. 1937.

Perianth lobes free or united only at base and forming very short tube; stamens with filaments usually longer than anthers; styles united into column, 6-lobed at apex, stigmas mostly terminal. TYPE SPECIES: *A. europaeum* L.

Nine species and one variety in two sections and two series in China.

Key to the Species of *Asarum* subg. ASARUM

1. Perianth lobes totally free, erect or reflexed, not forming tube.
 2. Perianth lobes erect and caudate or long-pointed.
 3. Perianth lobes with abrupt tail ca. 1 cm long; lobes of styles entire, stigmas terminal.
 4. Leaves broadly ovate, triangular-ovate, or ovate-cordate, green and mostly without white blotches above. 1. *A. caudigerum*.
 4. Leaves mostly subcordate or broadly ovate, with minute, densely spaced white blotches above. 1a. *A. caudigerum* var. *cardiophyllum*.
 3. Perianth lobes gradually tapering into long point to 1 cm long; lobes of styles notched, with stigmas at base of notches. 2. *A. renicordatum*.
 2. Perianth lobes reflexed, with apex acute or obtuse, never caudate or long-pointed; leaves usually 2 to 4, apparently opposite.
 5. Plants densely covered with long, white hairs (black when dry); stamens and styles not exerted, stigmas terminal; leaves broadly ovate, acute or short-acuminate. 3. *A. pulchellum*.
 5. Plants sparingly pubescent; stamens and styles often exerted; lobes of styles notched, stigmas outside of notches; leaves cordate, acuminate. 4. *A. caulescens*.
1. Perianth lobes united at base, forming very short tube above ovary.
 6. Perianth lobes with short tail 1–4 mm long; leaves pubescent only along veins.
 7. Plants 20–30 cm high; perianth lobes with incurved tail ca. 2 mm long; stamens 12, connectives elongated and ligulelike. 5. *A. caudigerellum*.
 7. Plants 10–15 cm high; perianth lobes acute or, if short-tailed, tail not incurved; stamens 12 or fewer, connectives not elongated. 6. *A. debile*.
 6. Perianth lobes not tailed; leaves usually with scattered pubescence on lower surface.
 8. Perianth lobes reflexed; styles slender, stigmas not radiating downward; peduncles long and filiform. 7. *A. himalaicum*.
 8. Perianth lobes erect or spreading; styles short and thick, stigmas radiating downward; peduncles rather stout, never filiform.
 9. Leaves cordate or broadly ovate; ovary broadly ovoid, with 6 pronounced ribs; mainland China. 8. *A. geophyllum*.
 9. Leaves narrowly ovate or triangular-ovate; ovary narrowly obovoid, lacking ribs; Taiwan and Hainan. 9. *A. epigynum*.

Asarum sect. Asarum

Asarum sect. *Euasarum* Braun, Index Sem. Berol. Append. 12. 1861.

Asarum sect. *Ceratasarum* Braun, *ibid.*

Perianth lobes essentially free, not forming true tube.

Asarum sect. ASARUM comprises two series with four species and one variety in China.

Asarum ser. **Calidasarum** (Araki) C. Y. Cheng & C. S. Yang, stat. nov.

Asarum sect. *Calidasarum* Araki, Acta Phytotax. Geobot. **6**: 125. 1937.

Perianth lobes erect, long-pointed to caudate at apex. TYPE SPECIES: *Asarum leptophyllum* Hayata (= *A. caudigerum* Hance).

Two species and one variety in China.

1. **Asarum caudigerum** Hance, London Jour. Bot. **19**: 142. 1881; Hemsley in Curtis's Bot. Mag. **116**: t. 7126. 1890. TYPE: Guangdong, East River, Hance 21336 (n.v., photo PE²).

Asarum leptophyllum Hayata, Ic. Pl. Formosa. **5**: 147. 1915. TYPE: Taiwan, Arisan, Hayata & Ito s.n. (photo PE).

Asarum leptophyllum var. *triangulare* Hayata, *ibid.* TYPE: Taiwan, "Arisan," Ito & Hayata s.n. (photo PE).

DISTRIBUTION. Zhejiang, Jiangxi, Fujian, Taiwan, Hubei, Hunan, Guangdong, Guangxi, Sichuan, Guizhou, and Yunnan. Thickets along streams and roadsides; frequently at 350–1160 m alt.

Hayata described *Asarum leptophyllum* from Taiwan in 1915. He stated that it is allied with *A. caudigerum* Hance and is distinguished only in having light green flowers instead of reddish ones. He also considered plants with triangular leaves to constitute var. *triangulare*. In fact, the reddish flowers of *Asarum* are due to the presence of reddish hairs on the otherwise greenish perianth lobes. Both the amount of pubescence and the shape of the leaves are variable on individual plants. Based on comparisons of material from Fujian with the figures presented by Liu and Lai (1976), we cannot support the separation of these three taxa.

- 1a. **Asarum caudigerum** Hance var. **cardiophyllum** (Franchet) C. Y. Cheng & C. S. Yang, comb. et stat. nov.

BASIONYM: *Asarum cardiophyllum* Franchet, Bull. Mus. Hist. Nat. Paris **1**: 66. 1895.

SYNTYPES: Yunnan, Long-ki, Delavay 5150 (photo PE), 5205 (n.v.).

According to Franchet, *Asarum cardiophyllum* is closely related to *A. caudigerum* Hance, differing in having floral stems that bear four leaves in two pairs, and styles that are united into an undivided column. These features, however, also occur in typical *A. caudigerum*. Since plants of *A. cardiophyllum* from Sichuan and northern Yunnan have mainly cordate leaves, usually with

²Acronyms for herbaria follow those outlined by Holmgren, Keuken, & Schofield in *Index Herbariorum*, ed. 7. 1981 (Regnum Vegetabile **106**), with the following exceptions (all located in the People's Republic of China) that do not appear in that work: AHU, Anhui University, Hefei, Anhui; GIM, Guizhou Institute of Chinese Traditional Medicine, Guiyang, Guizhou; HIM, Hangzhou Institute of Materia Medica, Zhejiang Academy of Experimental Sanitary Sciences, Hangzhou, Zhejiang; OTS, Sichuan School of Chinese Traditional Medicine, Omei, Sichuan; PTM, Beijing Chinese Traditional Medicinal College, Beijing; and SIT, Sichuan Institute of Chinese Traditional Medicine, Chongqing, Sichuan.

fine white patches on the upper surface, we feel that these plants are best accorded varietal status under *A. caudigerum*.

2. ***Asarum renicordatum*** C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 1.

Proximum *A. caudigero*, sed foliis renicordatis, lobis perianthii apice longe attenuatis, lobis stigmatis obcordatis, differt.

Acaulescent perennial herbs from long, slender rhizomes. Leaves 2, opposite; petiole 10–14 cm long; blade renicordate or subcordate, 3–4 by 6–7.5 cm, rounded and obtuse (rarely acute) at apex, with scattered hairs above, more densely pubescent below, margin densely ciliate. Flowers solitary between leaves; peduncle ca. 2.5 cm long, densely pubescent; perianth campanulate, yellowish brown–hairy outside, the lobes slightly united at base but not forming tube, triangular-lanceolate, ca. 10 by 4 mm, usually attenuated into point 4–10 mm long at apex; stamens with filaments ca. 1 mm long, connectives awl shaped; styles united and 6-lobed at apex, the lobes notched, \pm inverted heart-shaped, the stigmas attached at notches. Fruits not seen.

TYPE. Anhui, Huang-shan, mountain slope near stream, *Nanjing Pharmacy College s.n.* (holotype, PTM; isotype, PEM).

ADDITIONAL SPECIMEN EXAMINED. **Anhui:** Jui-hua-shan, 720 m alt., *An 5583* (AHU).

Asarum renicordatum is closely related to *A. caudigerum* Hance, but differs in having renicordate leaves, perianth lobes with gradually tapering, long-pointed apices, and notched style tips. While its leaves are similar to those of *A. forbesii* Hance, its flowers differ considerably. The specific name is derived from the broad, kidney-shaped leaves of the plants.

Asarum* ser. *Japonasarum (Nakai) C. Y. Cheng & C. S. Yang, stat. nov.

Japonasarum Nakai, Fl. Sylv. Koreana **21**: 16. 1936.

Asarum sect. *Japonasarum* (Nakai) Araki, Acta Phytotax. Geobot. **7**: 125. 1937.

Perianth lobes reflexed downward. TYPE SPECIES: *Japonasarum caulescens* (Maxim.) Nakai (= *Asarum caulescens* Maxim.).

Two species in China, others in Japan and Korea.

3. ***Asarum pulchellum*** Hemsley, Gard. Chron. III. **7**: 422. 1890; Jour. Linn. Soc. **26**: 360. 1891. TYPE: Hubei, *Henry 7800* (photo PE).

DISTRIBUTION. Anhui, Jiangxi, Hubei, Sichuan, and Guizhou. In woods in mountainous areas, often in loamy soil; abundant at 700–1700 m alt.

This species is easily distinguished from near allies by its dense, long, white hairs, which become black when dry.

4. ***Asarum caulescens*** Maxim. Bull. Acad. Sci. St.-Pétersb. **17**: 162. 1872. TYPE: Japan, *Tschonoski s.n.* (photo of syntype PE).

Asarum caulescens var. *setchuenense* Franchet, Jour. Bot. Morot **12**: 302. 1898. Type: SICHUAN, Tchen keou tin, *Farges s.n.* (n.v.).

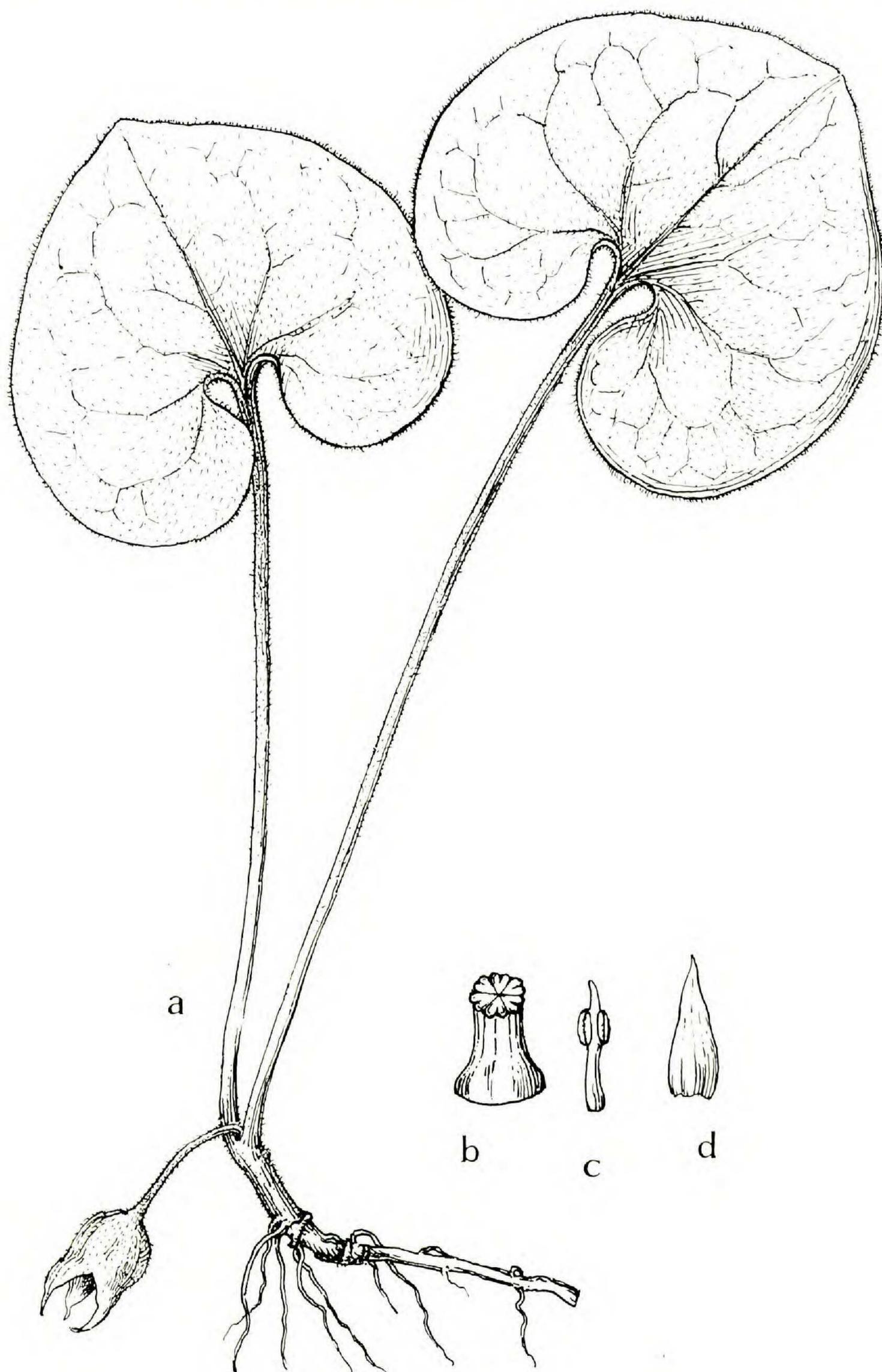


FIGURE 1. *Asarum renicordatum*: a, habit of flowering plant, $\times .8$; b, styles and radiating stigmas, $\times 1.6$; c, anther, $\times 1.6$; d, perianth lobe, $\times 1.6$.

Asarum franchetianum Diels, Bot. Jahrb. **29**: 308. 1901. TYPE: Sichuan, Nanchuan, Bock von Rosthorn 2446 (photo PE).

Japonasarum caulescens (Maxim.) Nakai, Fl. Sylv. Koreana **21**: 17. 1936.

DISTRIBUTION. Shaanxi, Gansu, Hubei, Sichuan, and Guizhou.

This species was first described from Japan. It has not been found in the eastern provinces of China, although it has often been collected in western China. This discontinuous distribution caused Franchet to distinguish the Chinese plant as *Asarum caulescens* var. *setchuenense*, and he even contemplated recognizing it as an independent species. Franchet distinguished the Chinese plants on the basis of their cordate style lobes and their stamens that are slightly shorter than the stylar column. However, dissections of flowers from Japanese specimens and comparisons with dissections of Chinese specimens (including plants from Sichuan, Hubei, and Shaanxi) indicate few if any differences between the Japanese and Chinese plants. Consequently, we include var. *setchuenense* in synonymy. With regard to *Asarum franchetianum*, Diels pointed out that the perianth tube is adnate to the ovary only halfway in the Japanese plant, while in the plants from Sichuan the adnation is almost complete. However, if the overall similarity of floral morphology is considered, *A. franchetianum* seems inseparable from *A. caulescens*.

Asarum sect. **Brevituba** C. Y. Cheng & C. S. Yang, sect. nov.

Perianthium lobis basi coalescentibus et tubo brevi. TYPE SPECIES: *Asarum himalaicum* Hooker f. & Thomson.

Four or perhaps five species in China.

5. **Asarum caudigerellum** C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 2.

Species A. debili similis laminis foliorum in medio margineque leviter incurvatis, base perianthiis breve tubularibus et lobis in apicem brevissime caudatis, differt plantis altioribus. foliis apice acuminatis vel longe acuminatis, connectivis antherarum apice valde productis, longe ligulatis.

Perennial herbs, 20–40 cm high; rhizomes long and horizontal with prolonged internodes; stems 2–5 cm long, inclined at tip, with 1 or 2 pairs of opposite leaves. Leaves with petiole 4–18 cm long, the cataphylls at its base broadly ovate, ca. 2 by 1–1.5 cm, densely ciliate; blade cordate or oblong-cordate, 3–7 by 4–10 cm, acuminate or long-acuminate at apex, slightly incurved at margin, cordate at base. Flowers dark purple; peduncle 1–1.5 cm long; perianth with the tube very short, ca. 5 mm long, 10 mm in diameter, the lobes triangular-ovate, 10 by 7 mm, acuminate with incurved tail ca. 5 mm long, pilose on outer surface; stamens with filaments usually longer than anthers; ovary inferior, subspherical, 6-ribbed, pilose, the styles united, with 6 short radiating branches at apex.

TYPE. Sichuan, Mt. Omei, between 1700 and 2100 m alt., under thickets, along mountain path, K. H. Yang 54370 (PE).

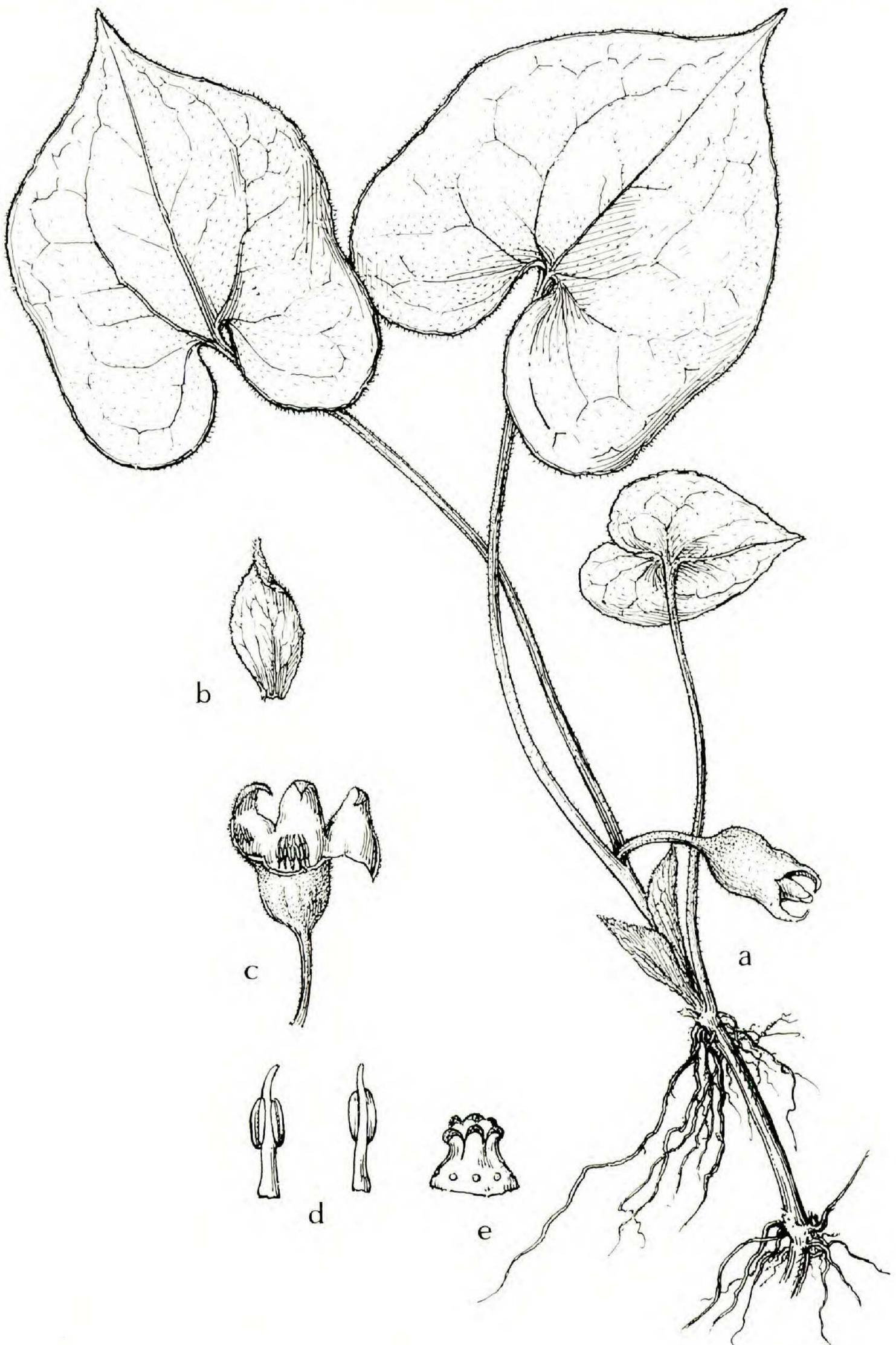


FIGURE 2. *Asarum caudigerellum*: a, habit of flowering plant, $\times .65$; b, cataphyll, $\times 1.3$; c, flower, with perianth lobe cut to expose stamens, $\times 1$; d, stamens, $\times 1.3$; e, styler column, showing coherent portion and terminal stigmas, $\times 1.3$.

ADDITIONAL SPECIMENS EXAMINED. **Sichuan:** Mt. Omei, 1900 m alt., *C. Y. Cheng 807a* (PEM); Nanchuan, *J. H. Xung 90302* (PE); Beichuan, *Econ. Exped. 505* (SIT); Tien-quan, *H. L. Tsiang 34001* (sz). **Hubei:** He-feng, *H. J. Li 8487* (PTM); Xuan-en, *H. J. Li 3989* (PTM). **Guizhou:** Na-yung, *Bi-jieh Exped. 420* (PE). **Yunnan:** I-liang, *H. T. Tsai 52083* (PE).

Asarum caudigerellum is closely related to *A. debile* Franchet but differs in having a larger stature; acuminate leaves; and 12 stamens, all of which are normally developed, produce viable pollen, and have anther connectives with long-produced tips. *Asarum debile*, on the other hand, is a small, weak plant with acute leaves, 12 or usually fewer stamens, and anther connectives that are not produced.

The specific name, a diminutive of *caudigerum*, refers to the short tail on the perianth lobes.

6. **Asarum debile** Franchet, Jour. Bot. Morot **12**: 305. 1898. TYPE: Sichuan, Cheng-kou, *Farges s.n.* (P, n.v.).

DISTRIBUTION. Anhui, Shaanxi, Hubei, and Sichuan. Found occasionally in rocky, moist places near streams; 1300–2300 m alt.

7. **Asarum himalaicum** Hooker f. & Thomson ex Klotzsch, Monatsber. Deutsch. Akad. Wiss. Berlin **1**: 385. 1859; Duchartre *in* DC. Prodr. **15**: 424. 1864; Hooker f. Fl. Brit. India **5**: 72. 1890. TYPE: Sikkim Himalaya, *J. D. Hooker s.n.* (K).

DISTRIBUTION. Shaanxi, Gansu, Hubei, Sichuan, Guizhou, Yunnan, and Xizang; also in India. Near streams and under thickets in shady, moist places.

8. **Asarum geophyllum** Hemsley, Gard. Chron. III. **7**: 422. 1890; Hooker f. Curtis's Bot. Mag. **117**: t. 7168. 1891. TYPE: Guangdong, "North River," *Ford 125* (photo PE).

Asarum cavaleriei Lévl. Repert. Sp. Nov. **9**: 78. 1910. TYPE: Guizhou, "Lofou," *Cavalerie 3671* (K, n.v., photo PE).

DISTRIBUTION. Guizhou, Guangxi, and Guangdong. In shady forests or moist valleys; 250–700 m alt.

9. **Asarum epigynum** Hayata, Ic. Pl. Formosa. **5**: 140. 1915; Liu & Lai *in* Li, Fl. Taiwan **2**: 557. 1976; Maekawa, Jour. Jap. Bot. **52**: 231. 1977. TYPE: Taiwan, without precise locality, *T. Soma s.n.* (n.v.).

Geotaenium epigynum (Hayata) Maekawa, Proc. VII Pacific Sci. Congr. **5**: 219. 1953; Jour. Jap. Bot. **52**: 251. 1977; *ibid.* **53**: 291. 1978.

DISTRIBUTION. Taiwan and Hainan. In moist valleys and forests.

Maekawa removed this species from *Asarum* and placed it in the genus *Geotaenium* on the basis of the plant's chromosome number ($2n = 12$) and its flowers with a rudimentary "corolla." Otherwise, this species is a typical *Asa-*

rum, and its floral structure suggests a close relationship with *A. geophyllum*. The rudimentary "petals" appear to be staminodia, and staminodia are also present in the flowers of *A. macranthum* (Maekawa, 1978). An extra whorl of aberrant stamens has also been reported in the flowers of *A. caudigerum* of the same subgenus.

SUBGENUS HETEROTROPA

Asarum subg. **Heterotropa** (Morren & Dcne.) Schmidt *in* Engler & Prantl, Nat. Pflanzenfam. ed. 2. **16b**: 230. 1935. *Heterotropa* Morren & Dcne. Ann. Sci. Nat. II. **2**: 314. *t.* 10. 1834.

Asarum subg. *Gamoasarum* Araki, Acta Phytotax. Geobot. **6**: 125. 1937.

Perianth lobes united above ovary, forming variously shaped perianth tubes; stamens with very short filaments or subsessile; styles often free, rarely short and subconnate (in Japanese species), often bifid at apex, rarely subentire. TYPE SPECIES: *Heterotropa asaroides* Morren & Dcne. (= *Asarum asaroides* (Morren & Dcne.) Makino).

Twenty-two species, three varieties, and one form in China, these falling into three sections and two series.

Key to the Species of *Asarum* Subg. HETEROTROPA

1. Stamens with filaments evident, longer than anthers; ovary half inferior; styles short; perianth with the tube naked at throat, lacking papillae and ring, the lobes smooth at base, lacking papillae or pulvinate areas.
 2. Perianth lobes erect or spreading, never reflexed at anthesis; leaves short-acuminate, with scattered hairs over upper surface.
 3. Leaves usually hairy only on veins on lower surface, petiole glabrous. 10. *A. sieboldii*.
 3. Leaves usually densely pubescent on lower surface, petiole pubescent. 10a. *A. sieboldii* f. *seoulense*.
 2. Perianth lobes reflexed at anthesis; leaves acute or blunt at apex, short-pubescent on veins above. 11. *A. heterotropoides* var. *mandshuricum*.
1. Stamens with filaments shorter than anthers; ovary inferior or half inferior, occasionally nearly superior, styles rather long; perianth having tube with (rarely without) orifice ring at throat, lobes papillate or pulvinate at base.
 4. Styles not bifid at apex, stigmas terminal or subterminal.
 5. Perianth having the tube with orifice ring, inner surface tessellate with slightly elevated bars (rarely longitudinally ridged), the lobes not reflexed, usually papillate near base.
 6. Rhizomes long and slender, mostly creeping; leaves elliptic-ovate, acuminate; perianth tube gradually dilated above orifice, forming neck, then divided into lobes. 12. *A. chinense*.
 6. Rhizomes short and thick, erect; leaves cordate or variously ovate, obtuse; perianth tube without neck, divided immediately into lobes. 13. *A. ichangense*.
 5. Perianth with the tube lacking orifice ring, inner surface longitudinally ridged, the lobes strongly reflexed laterally, pulvinate at base. 14. *A. fukienense*.
 4. Styles bifid at apex, stigmas attached laterally just below fork.
 7. Perianth having the tube generally urceolate with conspicuous constriction at

throat, usually with ring, inner walls longitudinally ridged or tessellate, the lobes papillate or pulvinate at base.

8. Perianth tube tessellate on inner surface.
 9. Perianth tube only slightly constricted at throat, orifice ring narrow.
 10. Perianth tube broad, cup shaped or hemispherical, the orifice large, ca. 1.5 cm in diameter, ring inconspicuous or very narrow; leaves with white patches on upper surface. 15. *A. chingchengense*.
 10. Perianth tube narrow, obconical, campanulate or cylindrical, the orifice small, 4–5 mm in diameter, ring conspicuous.
 11. Flowers ca. 10 mm in diameter; perianth with the tube cylindrical or campanulate, the lobes broad-ovate, ca. 5 mm long, without papillae at base. 16. *A. forbesii*.
 11. Flowers 20–30 mm in diameter; perianth with the tube obconical, the lobes triangular or triangular-ovate, 10–15 mm wide, with papillate area at base.
 12. Leaves ovate, 4–5 by 3–4 cm, usually light green beneath; cataphylls ovate, 1 cm long; perianth lobes with densely papillate area at base. 17. *A. taitonense*.
 12. Leaves broad-ovate or triangular-ovate, 8–10 by 7–9 cm, purplish beneath; cataphylls long, narrowly ovate, ca. 7 mm long; perianth lobes with only scattered papillae. 18. *A. infrapurpureum*.
 9. Perianth tube strongly constricted at throat, orifice ring broad and evident.
 13. Stigmas elongated, each extending along notch of bifid style and \pm hooked at free end.
 14. Leaves triangular-ovate, veins reddish beneath, petiole streaked reddish brown; stamens oblong, anther connectives thick and bilobed at apex; stigmas elongated, decidedly hooked. 19. *A. macranthum*.
 14. Leaves ovate-cordate or narrowly ovate, the veins green beneath, the petiole green, not streaked; stamens triangular, anther connectives not bilobed at apex; stigmas oblong-ovoid, slightly hooked. 20. *A. crispulatum*.
 13. Stigmas \pm ovoid, neither elongated nor hooked.
 15. Flowers to 5 cm in diameter; perianth with the tube subcylindrical, orifice ring 2–3 mm wide, the lobes broad-ovate, ca. 3 by 3–4 cm; leaves large, 7–15 by 6–11 cm. 21. *A. delavayi*.
 15. Flowers to 2.5 cm in diameter; perianth with the tube urceolate, orifice ring ca. 1 mm wide, the lobes broad- or triangular-ovate, ca. 8 by 8–12 mm; leaves 6–10 by 5–7 cm.
 16. Leaves dull green, white blotched above, purplish red below; anther connectives pointed. 22. *A. porphyronotum*.
 16. Leaves deep, lustrous green and not blotched white above, light green below; anther connectives rounded. 22a. *A. porphyronotum* var. *atrovirens*.
8. Perianth tube longitudinally ridged on inner surface, cross bars lacking or very faintly developed.
 17. Perianth tube swollen toward middle or apex, forming barrel-shaped or girdlelike dilated zone.
 18. Perianth with the lobes having pinkish, triangular, papillate area at base, the tube having dilated zone broad and near apex, inner surface with longitudinal ridges ca. 0.5 mm apart, orifice with narrow ring. 23. *A. inflatum*.

18. Perianth with the lobes having white or yellowish, circular or semicircular pulvinate area at base, the tube having inner surface of dilated zone without ridges, orifice ring absent.
19. Perianth having the lobes with transverse rows of papillae below pulvinate area, the tube with dilated zone at middle and girdlelike, and with orifice large, ca. 1 cm in diameter; pedicels 1–5 cm long. 24. *A. maximum*.
19. Perianth with the lobes lacking transverse rows of papillae below pulvinate area, the tube with dilated zone near apex, orifice small; pedicels ca. 9 cm long. 25. *A. insigne*.
17. Perianth tube enlarged gradually, not forming prominent dilated zone.
20. Perianth tube and lower leaf surface glabrous.
21. Perianth having the tube constricted slightly at throat, lacking orifice ring, the lobes with insignificant area of papillae. 26. *A. nanchuanense*.
21. Perianth having the tube constricted deeply at throat, with conspicuous orifice ring, the lobes with prominent papillate area at base.
22. Robust plants with short rhizomes and \pm thick, fleshy roots; leaves narrowly to broadly ovate, or hastate-oblong, 15–25 by 11–14 cm; flowers usually 2; anther connectives pointed. 27. *A. sagittarioides*.
22. Slender plants with long rhizomes and fibrous, rarely \pm fleshy roots; leaves cordate or narrowly elliptic-ovate, 8–14 by 5–8 cm; flowers usually solitary; anther connectives ligulate. 28. *A. longerhizomatosum*.
20. Perianth tube and lower leaf surface densely pubescent with yellowish hairs. 29. *A. wulingense*.
7. Perianth with the tube funnellform, not constricted at throat or only slightly so, lacking orifice ring but occasionally with ring of papillae, the lobes with papillae at base usually large and scattered, sometimes in vertical rows and extending downward into tube.
23. Perianth tube erect and symmetrical; leaves triangular-ovate or elliptic-ovate, acute or short-acuminate; rhizomes short, erect.
24. Perianth tube 3–5 cm long, not much widened above; leaves triangular-ovate or subtriangular, the upper surface with whitish blotches, pubescent only on veins. 30. *A. magnificum*.
24. Perianth tube ca. 1 cm long, widened from middle; leaves elliptic-ovate, the upper surface sparingly pubescent, not white blotched. 30a. *A. magnificum* var. *dinghuense*.
23. Perianth tube often inclined to one side (slightly constricted at throat), slightly asymmetric; leaves narrowly ovate, triangular-ovate, or oblong-hastate, long-acuminate; rhizomes to 20 cm long, horizontal. 31. *A. petelotii*.

Asarum sect. **Asiasarum** (Maekawa) Araki, Acta Phytotax. Geobot. **6**: 126. 1937.

Asiasarum Maekawa in Nakai, Fl. Sylv. Koreana **21**: 17. 1936.

Perianth with tube lacking orifice ring, lobes smooth throughout; stamens inserted on surface of ovary, with long filaments. TYPE SPECIES: *Asarum sieboldii* Miq. (Japan).

Two species and one variety in China.

10. *Asarum sieboldii* Miq. Ann. Mus. Bot. Lugduno-Batavum **2**: 134. 1865.
TYPE: Japan, Yezo, *Siebold s.n.* (L, n.v.).

Asiasarum sieboldii (Miq.) Maekawa in Nakai, Fl. Sylv. Koreana **21**: 22. 1936.

DISTRIBUTION. Shandong, Henan, Shaanxi, Anhui, Zhejiang, Jiangxi, Hubei, and Sichuan; also in Korea and Japan. Moist soil in forested areas; 1200–2100 m alt.

- 10a. *Asarum sieboldii* Miq. f. *seoulense* (Nakai) C. Y. Cheng & C. S. Yang, stat. nov.

BASIONYM: *Asarum sieboldii* Miq. var. *seoulense* Nakai, Repert. Sp. Nov. **13**: 267. 1914; Bot. Mag. Tokyo **28**: 519. 1914. TYPE: Korea, Mt. Peukansan, *N. Okada s.n.* (TI?, n.v.).

Asiasarum heterotropoides Schmidt var. *seoulense* (Nakai) Maekawa in Nakai, Fl. Sylv. Koreana **21**: 20. 1936.

DISTRIBUTION. Liaoning, Jilin, and extending northward into Korea. Habitat similar to that of the typical form.

Nakai compared the Korean plant with *Asarum sieboldii* and established var. *seoulense* on the basis of the dense pubescence on the lower leaf surface. This character, however, does not seem sufficient to warrant varietal status, and we think that the taxon is better recognized at the rank of forma.

11. *Asarum heterotropoides* Schmidt var. *mandshuricum* (Maxim.) Kitagawa, Lineam. Fl. Manshur. 174. 1939.

Asarum sieboldii var. *mandshuricum* Maxim. Mélanges Biol. Bull. Phys.-Math. Acad. Sci. St.-Pétersb. **8**: 399. 1871. TYPE: S Manchuria, without collector or number (LE, n.v.).

Asiasarum heterotropoides (Schmidt) Maekawa var. *mandshuricum* (Maxim.) Maekawa in Nakai, Fl. Sylv. Koreana **21**: 18. 1936.

DISTRIBUTION. Heilongjiang, Jilin, and Liaoning; occasionally cultivated in the southern provinces. Moist, cool, shady forests.

- Asarum* sect. *Heterotropa* (Morren & Dcne.) Braun, Index Sem. Hort. Bot. Berol. Append. 13. 1861.

Heterotropa sect. *Circinaria* Maekawa, Jour. Jap. Bot. **57**: 262. 1982.

Perianth tubes variously shaped, usually with orifice ring; stamens subsessile or with very short filaments, never inserted on surface of ovary. TYPE SPECIES: *Asarum asaroides* (Morren & Dcne.) Makino.

Eighteen species and one variety in China, these falling into two series.

- Asarum* ser. *Achidasarum* (Duchartre) C. Y. Cheng & C. S. Yang, stat. nov.

Asarum sect. *Achidasarum* Duchartre in DC. Prodr. **15**: 426. 1864.

Styles entire at apex, stigmas terminal. TYPE SPECIES: *Asarum elegans* Duchartre = *A. parviflorum* (Hooker f.) Regel (Japan, Yokohama).

A small series comprising three species in China.

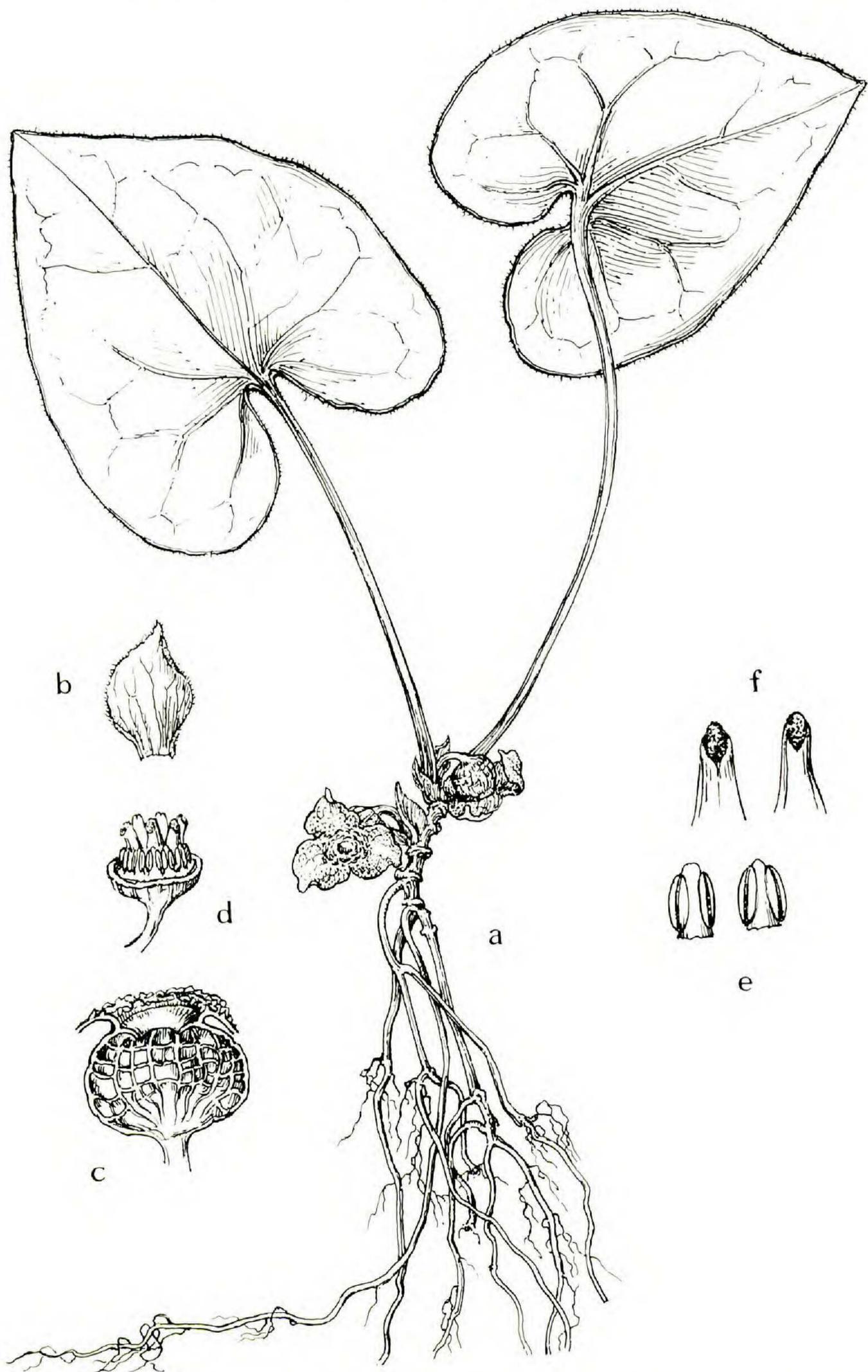


FIGURE 3. *Asarum ichangense*: a, habit of flowering plant, $\times .65$; b, cataphyll, $\times 1.3$; c, longitudinal section of perianth tube, showing tessellate inner surface and broad orifice ring, $\times 2.6$; d, flower with perianth tube removed to show androecium and gynoecium, $\times 1$; e, stamens, $\times 1.3$; f, apex of styles, with terminal stigmas, $\times 2$.

12. *Asarum chinense* Franchet, Jour. Bot. Morot **12**: 303. 1898. TYPE: Sichuan, Cheng-kou, *Farges 1205* (P, n.v., photo PE).

Asarum fargesii Franchet, Jour. Bot. Morot **12**: 306. 1898. TYPE: Sichuan, Cheng-kou, *Farges 966* (P, n.v., photo PE).

DISTRIBUTION. Hubei and Sichuan. In forested ravines; 1300–1500 m alt.

Both *Asarum fargesii* and *A. chinense* were described by Franchet from material collected at Cheng-kou in northern Sichuan Province. During a special trip to the type locality of these two species to observe these plants in the field, we found that the criteria used by Franchet to distinguish plants of the two species (leaf coloration and the internal structure of the perianth tubes) do not hold. We have therefore placed *A. fargesii* in the synonymy of *A. chinense*.

13. *Asarum ichangense* C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 3.

Affine *A. chinensi*, sed rhizomatis brevioribus, foliis cordatis vel ovato-cordatis apice obtusis, tubo perianthii valde constricto ad orem haud constricto ad collum, differt.

Perennial herbs from short, nearly perpendicular rhizomes. Leaves with petiole 3–15 cm long, the cataphylls at its base ovate or narrowly ovate, ca. 1 cm long, ciliate; blade cordate or cordate-ovate (rarely hastate), 3–6 by 3.5–7.5 cm, obtuse or acute at apex, cordate at base, usually dark green or rarely with white patches along midvein above, shortly pubescent along veins above, glabrous below. Flowers purplish green to dark purple, 1–1.5 cm in diameter; peduncle ca. 1 cm long, recurved; perianth with the tube spherical, ca. 1 cm in diameter, tessellate on inner surface, strongly constricted at narrowly ringed throat, the lobes triangular-ovate, 1–1.4 cm by 9–10 mm, with small rugose, papillate area at base; anthers with connective produced, rounded with notch at apex; ovary \pm superior, the styles united, with 6 short, radiating arms at apex, the stigmas ovoid, terminal.

TYPE. Hubei, Ichang, on shady and moist mountain slopes, *Yang & Xueh 74004* (holotype, PTM).

ADDITIONAL SPECIMENS EXAMINED. **Zhejiang**: Shou-chang, in forests or in open grass land, *Bot. Res. Exped. 27075* (PE); Mt. Peishan, near Kin-hua, *Migo s.n.* (IBK, PE). **Jiangxi**: Lu-shan, *M. C. Wang 707* (LUS, PE); Wu-gung-shan, in shady, moist thickets, *Jiangxi Exped. 530* (PE). **Hunan**: Nan-yueh, Lung-chi, *L. H. Liu 15744* (PE); Heng-shan, *Anonymous 172* (PE).

Asarum ichangense is widely distributed along the Yangtze River and may extend southward into Fujian, Guangdong, and Guangxi provinces. Its leaves vary considerably in shape, size, and color patterns. The close relationship of *A. ichangense* and *A. chinense* is evidenced by their floral structure—both have small flowers with united styles and terminal stigmas. *Asarum chinense* differs, however, in its long, running rhizomes, its acuminate and essentially elliptic-

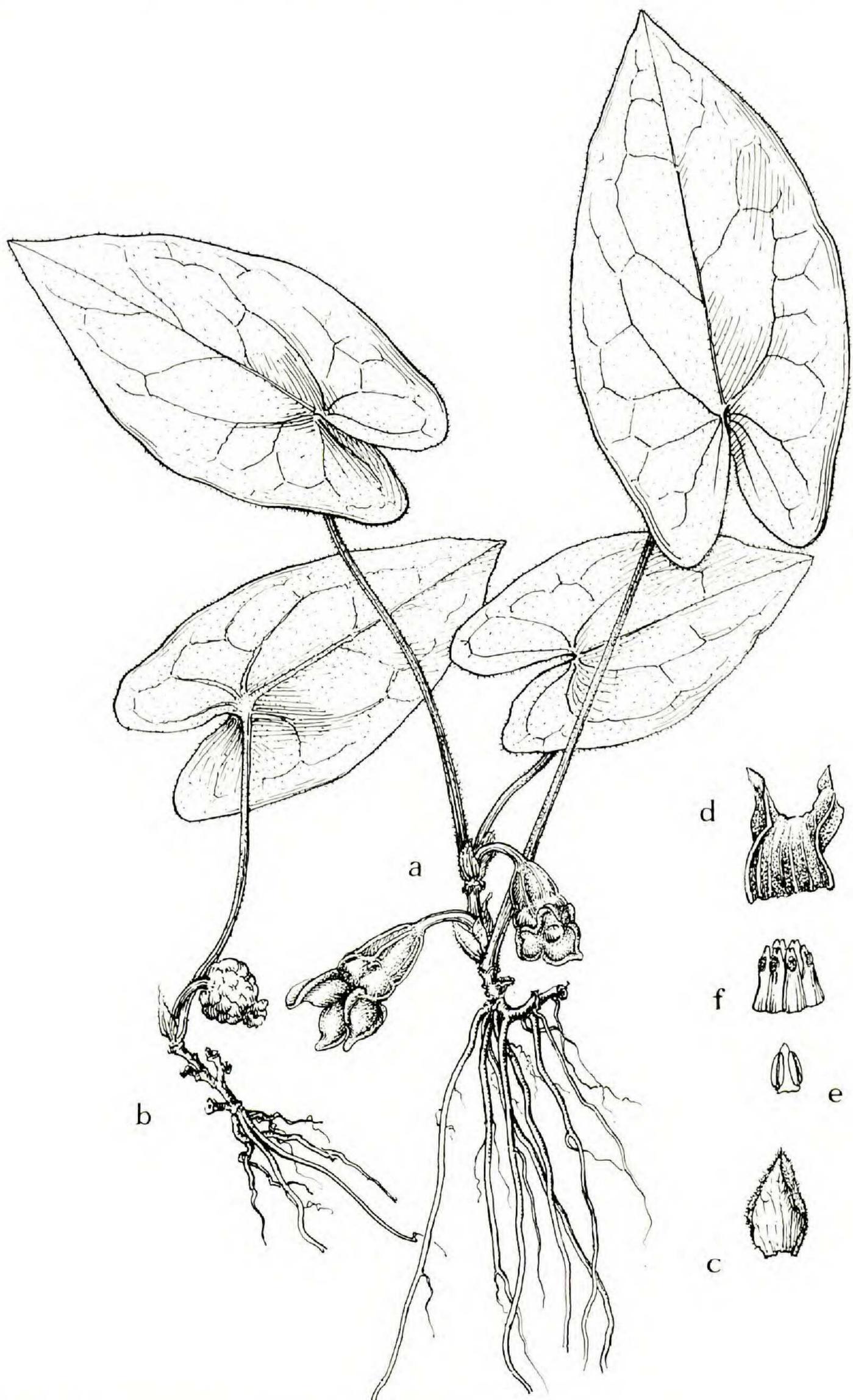


FIGURE 4. *Asarum fukienense*: a, habit of flowering plant, $\times .65$; b, habit of fruiting plant, $\times .65$; c, cataphyll, $\times 1.3$; d, portion of inner surface of perianth tube and reflexed lobe, $\times 1.3$; e, stamen, $\times 1.3$; f, styles, $\times 2$.

ovate leaves, and its perianth tubes with a short neck above the constriction. In *A. ichangense* the rhizomes are perpendicular, short, and thick, the leaves are generally cordate with obtuse or acute apices, and the perianth tubes lack a neck.

14. ***Asarum fukienense*** C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 4.

Foliis deltoideo-ovatis, foliis subtus et pedunculisque pilis fulvis vestitis, species haec habitu *A. wulingense* similis, sed lobis perianthii sub anthesis marginibus reflexis, ex medio ad basin pulvinatis, stylis apice stigmatis coronatis interdum apice leviter bilobis lateraliter stigmatosis, differt.

Perennial herbs from short rhizomes with clustered roots. Leaves subcoriaceous, triangular-ovate or narrowly ovate, 4.5–10 by 4–7 cm, acute or shortly pointed at apex, auricular-cordate at base, deep green with occasional white patches above, densely yellowish brown–pubescent below. Flowers purplish green; peduncle 1–2.5 cm long, densely pubescent with soft, yellowish hairs; perianth with the tube cylindrical, 1.5 cm long, 1 cm in diameter, yellowish-pubescent outside, longitudinally ridged on inner surface, lacking constriction or orifice ring at throat, the lobes broadly ovate, 15 by 10 mm, with margins recurved, especially laterally, and with yellowish, semicircular, pulvinate area extending from base to middle; stamens with filament very short, connective pointed; ovary inferior, the styles 6, free, entire (rarely shallowly notched) at apex, the stigmas terminal or subterminal. Capsules ovate-spheroid, 7–17 mm in diameter, often with persistent remains of perianth.

TYPE. Fujian, Wu-i-shan, shady thickets, *M. J. Wang 1929* (holotype, LUS; isotype, PE).

ADDITIONAL SPECIMENS EXAMINED. **Anhui:** Qi-men, in valley in mixed forest, *M. X. Deng 5005* (PE); same locality, at 1500 m, shady moist place, *W. D. Sun 30* (PE); same locality, at 870 m, *J. S. Yueh et al. 5321* (NAS, PE); Wu-i-shan, *M. J. Wang et al. 2418* (LUS, PE). **Fujian:** Shang-hang, *Y. Lin 4150* (PE). **Zhejiang:** Shuei-chang, *Bot. Res. Exped. 25738, 25903* (PE).

Asarum fukienense is characterized by its yellowish brown pubescence and its nonconstricted perianth tubes with the lobes strongly recurved laterally. In overall appearance, *A. fukienense* is similar to *A. wulingense* from Guangxi Province, but the latter differs considerably in having constricted perianth tubes with spreading, nonrecurved perianth lobes, distinct styles with bifid apices, and lateral stigmas.

Asarum* ser. *Bicorne Araki, Acta Phytotax. Geobot. **6**: 127. 1937.

Perianth with the tube 1–2 cm long (rarely longer), longitudinally ridged or tessellate internally, constricted at throat, orifice evident and often having laminate ring, the lobes having papillate or pulvinate area at base. TYPE SPECIES: *Asarum asaroides* (Morren & DCne.) Makino.

Fourteen species and one variety in China.

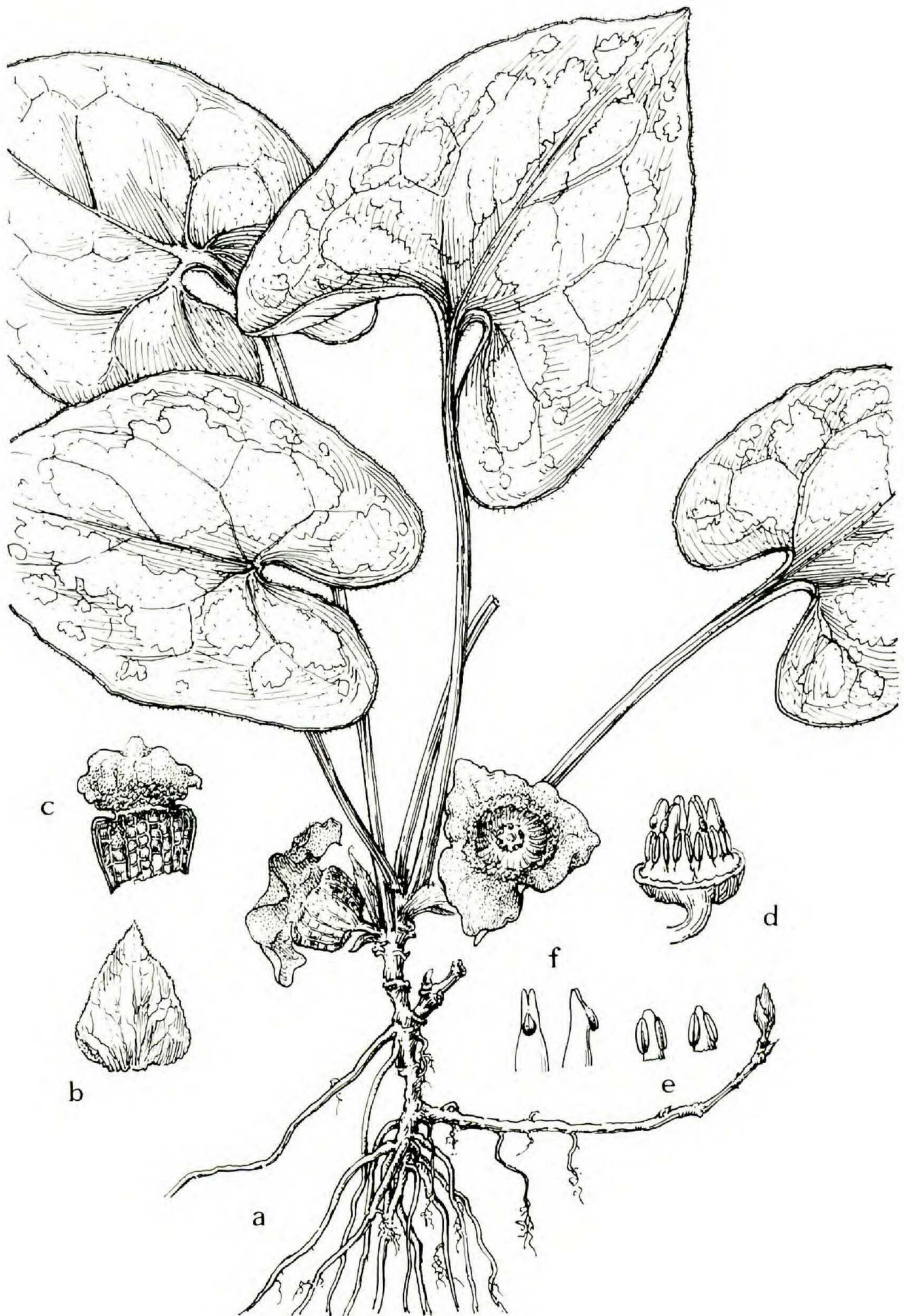


FIGURE 5. *Asarum chingchengense*: a, habit of flowering plant, $\times .6$; b, cataphyll, $\times 1.2$; c, portion of inner surface of perianth tube and lobe, $\times 1.5$; d, flower with perianth removed, showing androecium and gynoecium, $\times 2.4$; e, stamens, $\times 1.2$; f, bifid style tips and lateral stigmas, $\times 1.2$.

15. *Asarum chingchengense* C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 5.

Tubis perianthii leviter constrictis, ovariis subsuperioribus haec nova species habitu *A. taitinensi* similis, sed tubis perianthii cupularis non profundis ad orem leviter constrictis ad maximam aperturam, foliis et petiolis pedunculique glabris, differt.

Perennial herbs from long, horizontal rhizomes, internodes ca. 1.5 cm long with \pm thick and fleshy roots clustered at nodes. Leaves with petiole 6–18 cm long, the cataphylls at its base triangular-ovate, 2 by 1.5 cm, ciliate; blade ovate-cordate, long-ovate, or nearly hastate, 6–10 by 5–9 cm, acute at apex, deeply auriculate or subcordate at base, green, usually with white blotches and sparingly pubescent above, glabrous beneath. Flowers purplish green; peduncle ca. 2 cm long; perianth having the tube cupular or hemispherical, ca. 1.4 cm long, 2 cm in diameter, slightly constricted at throat, orifice large with ring very narrow and inconspicuous, inner surface tessellate, the lobes broad-ovate, ca. 2 by 2.5, with semicircular, rugose, papillate area at base; stamens with filament very short, connective rounded; ovary \pm superior, the styles 6, free, forked or notched at apex, the stigmas ovoid, lateral.

TYPE. Sichuan, Guan-xien, moist slopes in thickets or partial shade, C. Y. Cheng & C. S. Yang 63001 (holotype, PEM).

ADDITIONAL SPECIMENS EXAMINED. **Sichuan:** Ching-cheng-shan, F. T. Wang 20386 (PE); Chung-qing, Jin-yun-shan, C. Y. Cheng & C. S. Yang s.n. (PEM, PTM). **Guizhou:** Meitan, J. M. Chen 207 (PE); Chishuei, X. L. Chen 005 (GIM).

Asarum chingchengense is closely related to *A. taitonense* Hayata from Taiwan, which differs from the Sichuan plant in having deeper perianth tubes with a narrower throat, and pubescent lower leaf surfaces, petioles, and peduncles.

16. *Asarum forbesii* Maxim. Bull. Acad. Sci. St.-Petersb. **31**: 92. 1887. TYPE: N. Zhejiang, Forbes 2056 (photo PE).

DISTRIBUTION. Henan, Anhui, Jiangsu, Jiangxi, Hubei, Hunan, and Sichuan. Fairly common in thickets and forests; 200–800 m alt.

17. *Asarum taitonense* Hayata, Ic. Pl. Formosa. **5**: 148. 1915; Liu & Lai in Li, Fl. Taiwan **2**: 581. 1976. TYPE: Taiwan, Mt. Taiton, Faurie s.n. (photo of fragment PE).

Heterotropa taitonensis (Hayata) Maekawa ex Nemoto, Fl. Jap. Suppl. 165. 1936; Jour. Jap. Bot. **53**: 299. 1978.

DISTRIBUTION. Endemic to Taiwan. In forests and thickets; low to medium altitudes.

18. *Asarum infrapurpureum* Hayata, Ic. Pl. Formosa. 146. 1915; Liu & Lai in Li, Fl. Taiwan **2**: 579. 1976. TYPE: Taiwan, Sasaki s.n. (n.v.).

DISTRIBUTION. Endemic to northern Taiwan. In thickets and wet places.

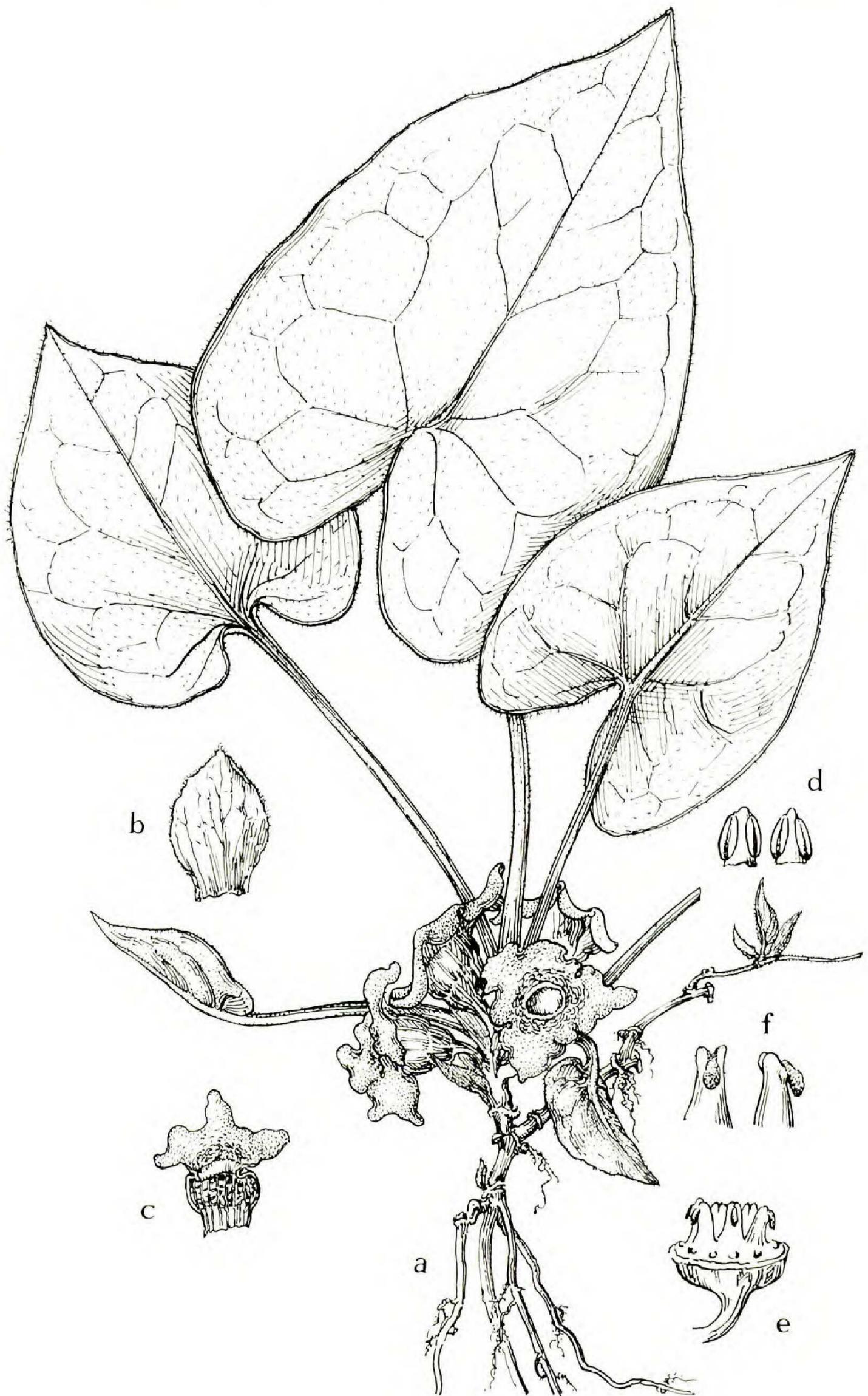


FIGURE 6. *Asarum crispulatum*: a, habit of flowering plant, $\times .65$; b, cataphyll, $\times 1.3$; c, longitudinal section through perianth, $\times .65$; d, stamens, $\times 1.3$; e, gynoecium, $\times 1.3$; f, styles, $\times 1.3$.

19. **Asarum macranthum** Hooker f. Curtis's Bot. Mag. **116**: t. 7022. 1888; Liu & Lai *in* Li, Fl. Taiwan **2**: 579. 1976; Maekawa, Jour. Jap. Bot. **53**: 296. 1978. TYPE: Taiwan, Kelung, Ford s.n. (K, n.v.).

DISTRIBUTION. Endemic to Taiwan. Forested habitats; low to medium altitudes.

Although J. D. Hooker did not designate a type for *Asarum macranthum*, he did indicate the sources of the dried specimens and the living plants utilized in drawing up his description. The material at Kew collected by Ford should be studied if a lectotype is to be selected.

20. **Asarum crispulatum** C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 6.

Affinis *A. macranthi* sed lobis perianthii modice undulatis, staminibus triangularibus, foliis subtus viridibus non rubris nervis et petiolis non-maculatis, differt.

Perennial herbs from short rhizomes with clustered roots. Leaves with petiole 6–15 cm long, pubescent with short, soft hairs, the cataphylls at its base ovate, ca. 2 by 1.3 cm, ciliate; blade ovate-cordate or narrowly ovate, 5–9 by 2–2.5 cm, acute or short-acuminate at apex, cordate or auricular-cordate at base, deep green with occasional whitish patches and scattered hairs above, light green and glabrous beneath. Flowers purplish green, ca. 3–5 cm across; peduncle ca. 1 cm long; perianth having the tube urceolate, ca. 1.5 cm long, 1.2–2 cm in diameter, orifice small with ring ca. 1.5 mm broad, inner surface tessellate, the lobes ovate, 1.8–2.2 by 2–2.6 cm, margins \pm undulate; stamens triangular, the filament short, broadened at base, the connective acute or obtuse at apex; ovary half inferior, the styles 6, bifid at apex, the stigmas oblong-ovoid, inserted in notch and hanging free, free end slightly hooked.

TYPE. Sichuan, Nan-chuan, in moist habitat, Yang & Li 72004 (holotype, PTM).

ADDITIONAL SPECIMENS EXAMINED. **Sichuan**: without further locality, Yang 78-lan-001 (OTS). **Cultivated**: hort. Beijing Medical College, Cheng 7808 (PEM).

Asarum crispulatum is allied to *A. macranthum*, which differs in having blotched or spotted petioles, strongly undulate perianth lobes, linear-oblong stamens with notched connectives, and strongly hooked stigmas. The specific epithet of the new species, *crispulatum*, refers to its undulate perianth lobes.

21. **Asarum delavayi** Franchet, Bull. Mus. Hist. Nat. Paris **1**: 66. 1895; Jour. Bot. Morot **12**: 304. 1898. SYNTYPES: Yunnan, Long-ki, Delavay 5105 (P, photo PE), Delavay 5205 (P, n.v.).

Heterotropa splendens Maekawa, Jour. Jap. Bot. **57**: 261. pl. 14. 1982.

DISTRIBUTION. Sichuan and northern Yunnan. Shady, moist slopes of forests and thickets, usually of southern exposure; 800–1600 m alt.

The leaves of *Asarum delavayi* are variable in both shape and coloration. They are generally large (9–18 by 6–14 cm), with the upper surface green and the lower surface light green. Some leaves are occasionally found with white

blotches above or reddish purple coloration below, and other leaves combine these color variations.

22. ***Asarum porphyronotum*** C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 7.

Similis *A. delavayi*, sed differt foliis subtus semper purpureis, floribus pluribus minoribus urceolatis circa 2.5 cm longis et 2–2.5 cm in diametro, tubis perianthii brevioribus ovaliformibus circum oreum intus angustatis annulis instructis, connectivis antherarum apice breviori-pyramidalibus.

Perennial herbs from short rhizomes. Leaves with petiole purplish or purplish brown, the cataphylls at its base usually 2, broadly ovate, lower one larger, ciliate; blade elliptic-oblong to broadly ovate (rarely subhastate), 5–15 by 6–13 cm, acute or obtuse at apex, auriculate to cordate at base, margin ciliate, dull green and white-blotched above, purplish red below. Flowers purple, 2–2.5 cm in diameter; peduncle ca. 1 cm long; perianth having the tube urceolate, ca. 12 mm long, 11–14 mm in diameter, constricted and with narrow orifice ring, tessellate internally, the lobes broadly triangular-ovate, ca. 8 by 11 mm, densely papillate in triangular pattern at base; stamens with filament very short, connective acute; ovary \pm superior, the styles 6, bifid at apex, the stigmas ovoid, lateral.

TYPE. Sichuan, without precise locality, *Cheng 7501* (holotype, PEM; isotype, PTM).

ADDITIONAL SPECIMENS EXAMINED. **Cultivated:** hort. Beijing Medical College, *Cheng 7601, 7607, 7816, 7944* (PEM).

Related to *Asarum delavayi* Franchet, *A. porphyronotum* is characterized by its urceolate perianth tubes, its very narrow orifice ring, its shortly acute anther connectives, and its leaves with persistent white patches above and purplish red coloration below. *Asarum delavayi*, by contrast, has larger flowers (3–4 cm long and 4–6 cm in diameter), with the perianth tubes usually constricted near the apex and then dilated, forming a collar. The specific name of the new species refers to the purplish red undersurfaces of the leaves.

22a. ***Asarum porphyronotum*** var. ***atrovirens*** C. Y. Cheng & C. S. Yang, var. nov. FIGURE 8.

A varietate typica differt foliis angustioribus paribus supra atroviridibus nunquam praeditis albo-maculatis, connectivis antherarum apice haud productis.

TYPE. Sichuan, without precise locality, *Cheng 7562* (holotype, PEM; isotype, PTM).

This new variety is readily separated from *Asarum porphyronotum* var. *porphyronotum* in having lustrous, deep green leaves that are never dull green or white-blotched above or purplish red below. In addition, the flowers are often smaller, and the stamen connectives are rounded. The epithet, *atrovirens*, refers to the color of the leaves.

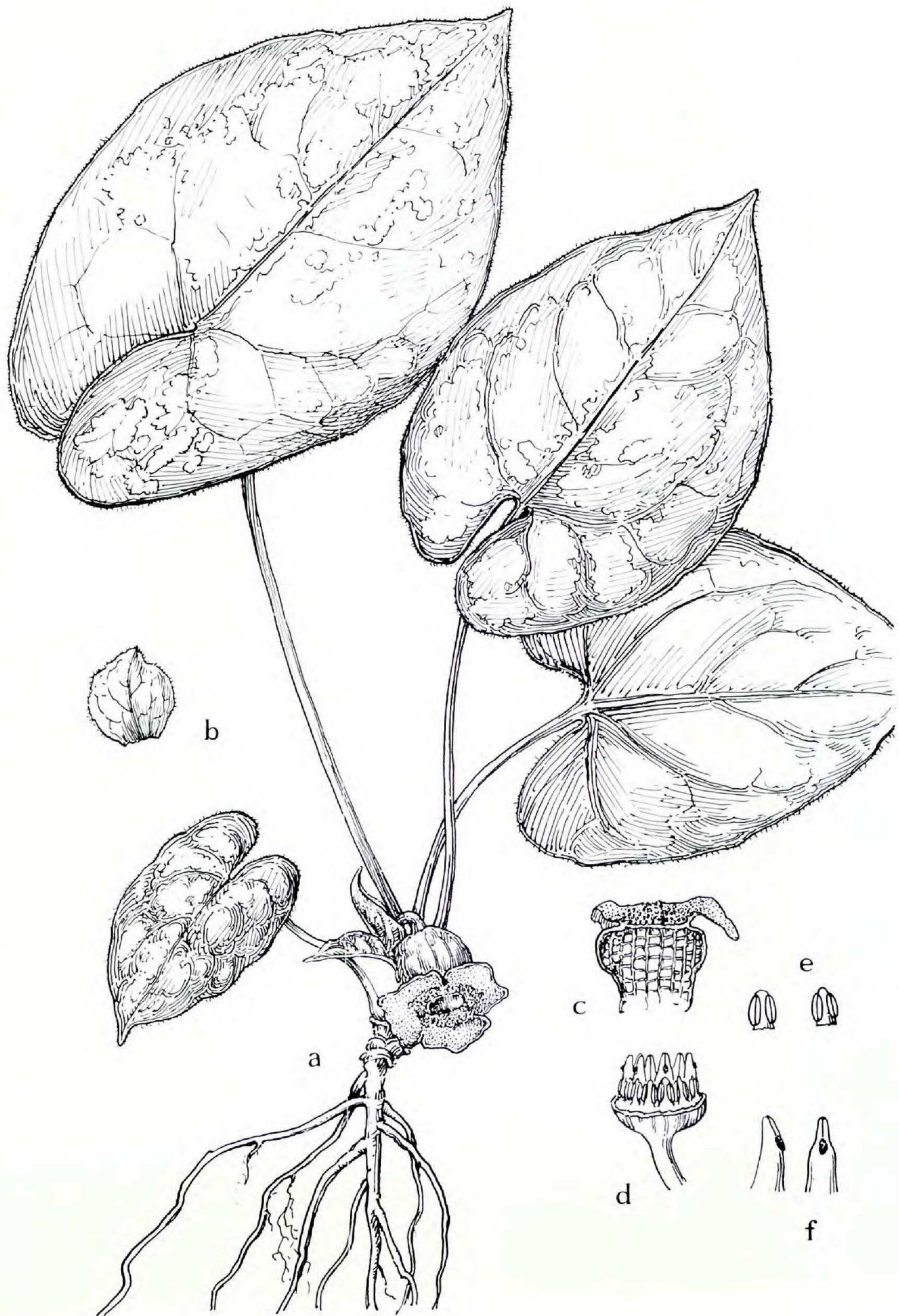


FIGURE 7. *Asarum porphyronotum*: a, habit of flowering plant, $\times .65$; b, cataphyll, $\times .65$; c, longitudinal section through perianth, showing inner surface, $\times 1.3$; d, flower with perianth removed, showing androecium and gynoecium, $\times 1.3$; e, stamens, $\times 1.3$; f, styles and stigmas, $\times 1.3$.

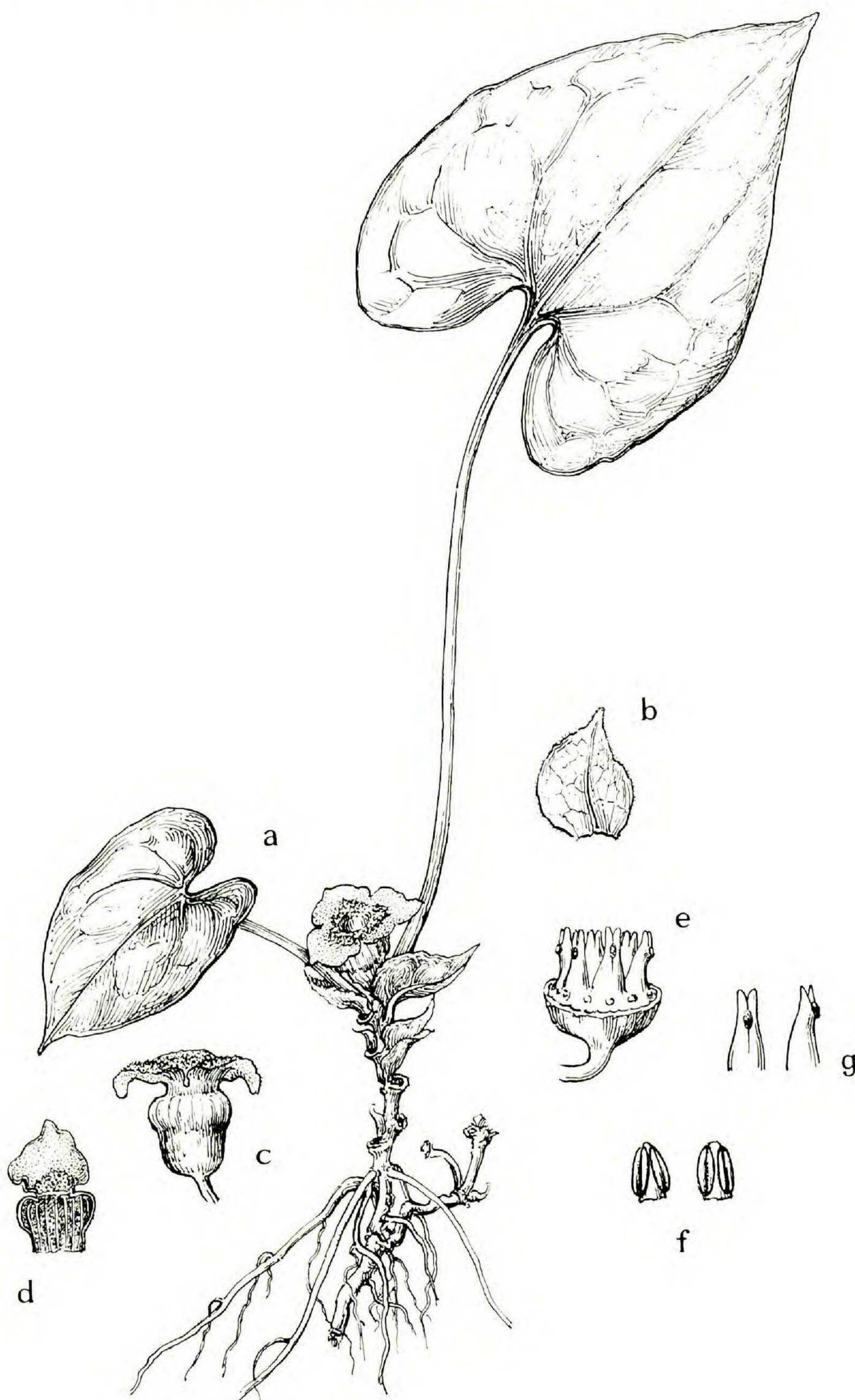


FIGURE 8. *Asarum porphyronotum* var. *atrovirens*: a, habit of flowering plant, $\times .7$; b, cataphyll, $\times 1.4$; c, flower, lateral view, $\times 1$; d, portion of perianth, showing inner surface of tube and lobe, $\times 1$; e, flower with perianth and androecium removed, showing gynoecium, $\times 1.75$; f, stamens, $\times 1.4$; g, styles and stigmas, $\times 1.4$.

23. *Asarum inflatum* C. Y. Cheng & C. S. Yang, sp. nov. FIGURE 9.

Planta tubo perianthii supra medium extus annulo crasso cincto *A. maximo* affinis, sed tubis perianthii valde constrictis, annulo crassiore altioreque intus longitudinaliter crassius plicato, lobis perianthii longe ovatis basi papillato-rugosis haud pulvinatis, differt.

Perennial herbs with short rhizomes and numerous \pm fleshy roots. Leaves with petiole 7–10 cm long, the cataphylls at its base ovate, ca. 1.5 cm long, densely ciliate; blade ovate, triangular-ovate, or nearly hastate, 4–11 by 5–11 cm, acute at apex, auriculate at base with divaricate lobes, shortly pubescent on veins above, glabrous beneath. Flowers dull purple; peduncle ca. 1 cm long; perianth having the tube lantern shaped, with the lower portion broadly cylindrical, ca. 1 cm long, 1.5 cm in diameter, densely striate, and with the upper portion abruptly swollen into broad, hollow disc ca. 9 mm high, 2 cm in diameter, longitudinally ridged externally, rugosely ribbed internally, constricted at apex into narrow orifice with broad, flat ring, the lobes ovate, to 3.5 by ca. 2.5 cm, with triangular, rugose, papillate area at base continuing to orifice; stamens with filament very short and anther connective obtuse; ovary half inferior, the styles 6, apices bifid and hornlike, stigmas lateral below notches.

TYPE. Sichuan, Cang-xi, moist places in ravine and rock fissures, at 1000 to 1400 meters, *Anonymous* 72N-576 (holotype, SIT).

ADDITIONAL SPECIMEN EXAMINED. **Sichuan:** Wang-cang, *Sichuan Econ. Exped.* 4747 (SIT).

The flowers of *Asarum inflatum*, like those of *A. maximum*, are relatively large and prominently swollen. However, in *A. inflatum* the swollen portion is near the top of the perianth tube and is broad with vertical ridges. In *A. maximum*, by contrast, the swollen area occurs at the center of the tube and is girdlelike, and the prominent ridges are lacking. The perianth lobes of *A. inflatum* are beset with rough papillae, while those of *A. maximum* have only a pulvinate region. The epithet *inflatum* has been applied to this new species because of its swollen perianth tubes.

24. *Asarum maximum* Hemsley, Gard. Chron. III. 7: 422. 1890; Jour. Linn. Soc. Bot. 26: 359. 1891; J. D. Hooker, Curtis's Bot. Mag. 122: t. 7456. 1896. TYPE: Hubei, Ichang, *Henry* 3669 (K, n.v., photo PE).

DISTRIBUTION. Hubei and eastern Sichuan. On cliff faces and in litter on forest floors; 600–800 m alt.

25. *Asarum insigne* Diels, Notizbl. Bot. Gart. Berlin-Dahlem 10: 855. 1930. TYPE: Guangxi, Da-yao-shan, *C. Wang* 39031 (isotype, SYS).

Asarum longepedunculatum Schmidt, Sunyatsenia 1: 121. pl. 30. 1933. TYPE: Guangdong, Ying-de, *S. P. Ko* 50476 (isotype, SYS).

Asarum gracilipes C. S. Yang, Acta Phytotax. Sinica 13(2): 19. pl. 4, figs. 3–8. 1975. TYPE: Guangxi, Xing-an, *C. F. Liang* 34161 (holotype, IBK).

DISTRIBUTION. Guangdong and Guangxi. Moist, shady forests; frequent at ca. 500 m alt.

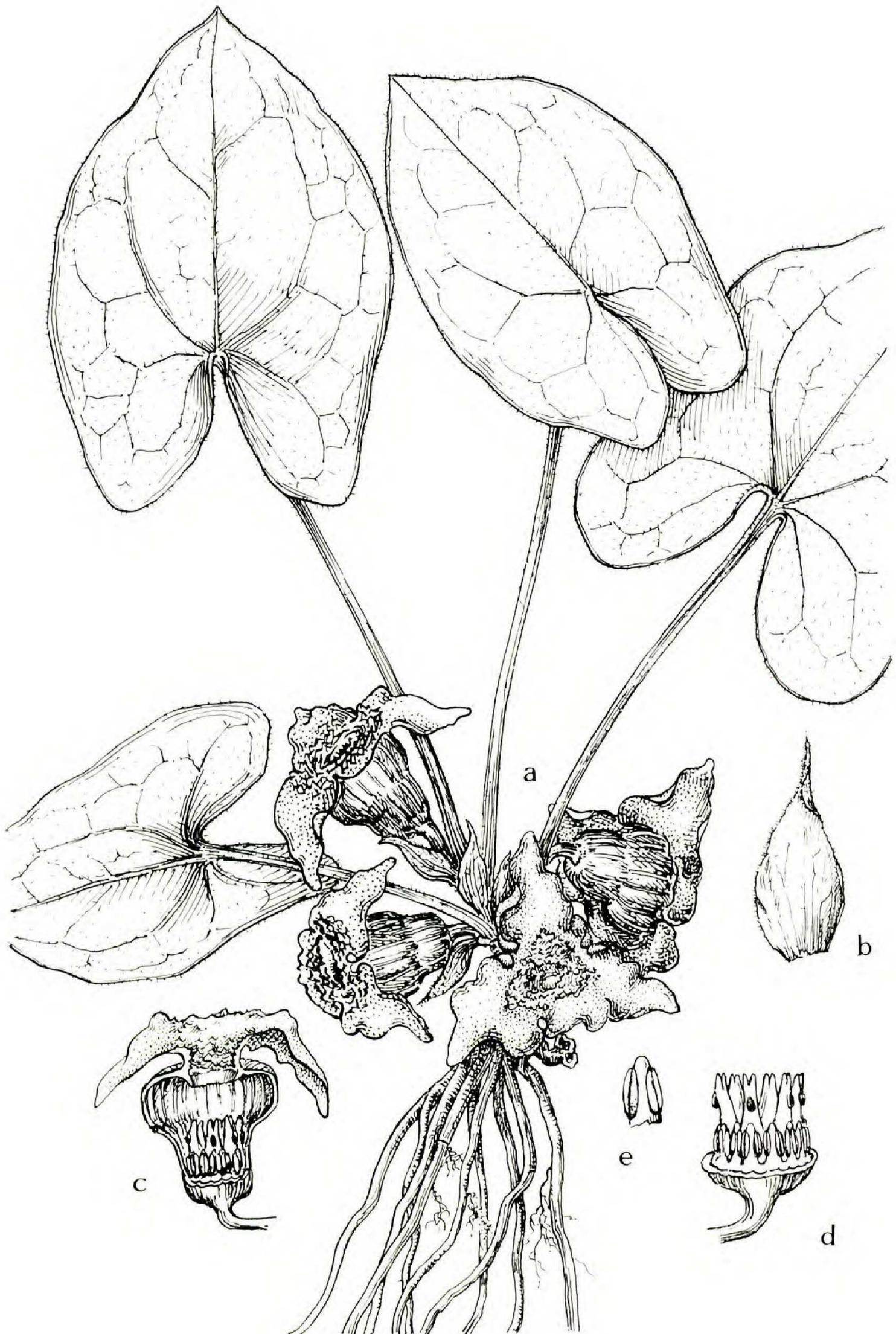


FIGURE 9. *Asarum inflatum*: a, habit of flowering plant, $\times .62$; b, cataphyll, $\times 1.25$; c, longitudinal section through flower, $\times .62$; d, flower with perianth removed, showing androecium and gynoecium, $\times 1.25$; e, stamen, $\times 1.25$.

When he described *Asarum longepedunculatum*, Schmidt stated that it differed from *A. insigne* in having longer (to 9 cm) peduncles and obtuse anther connectives. As more material has become available, however, it has become evident that these are both variable characters and that *A. longepedunculatum* cannot be maintained. Likewise, *A. gracilipes* is merely a slender form of *A. insigne*, and Yang's name is placed in the synonymy of *A. insigne*.

26. ***Asarum nanchuanense*** C. S. Yang & J. L. Wu,³ sp. nov. FIGURE 10.

Habitu species nova *A. maximum* similis, sed tubo perianthii extus annulatis crassis nullis, lobis perianthii basi minime pulvinatis non papillato-rugosis, foliis subtus purpureis, differt.

Perennial herbs from short rhizomes and \pm fleshy roots. Leaves with petiole 2.5–7.5 cm long, the cataphylls at its base broadly ovate, 2 by 1.8 cm, ciliate; blade cordate, 5–7 by 6–8.5 cm, the lobes at base 2–2.5 cm long, the upper surface deep green with white blotches, shortly pubescent along lateral veins, the lower surface reddish purple. Flowers 3–4 cm across; peduncle ca. 1.5 cm long; perianth with the tube cylindrical, 2–2.5 cm long, ca. 2 cm in diameter, slightly constricted, with large, naked orifice, ring inconspicuous, internal surface usually with 10 longitudinal ridges, the lobes broadly ovate, ca. 1.5 cm long, having small pulvinate areas ca. 2 mm in diameter at base; stamens with filament very short, anther connective produced into acute apex; ovary inferior, the styles 6, apically notched, the stigmas outside notches.

TYPE. Sichuan, Nan-chuan, Cha-sha, in rock crevices in thickets, Z. L. Yang 37 (holotype, PTM).

ADDITIONAL SPECIMENS EXAMINED. **Sichuan:** Nan-chuan, C. S. Yang 72004 (PEM, PTM).

Allied to *Asarum maximum* of Hubei Province, *A. nanchuanense* differs from that species in having gradually dilated perianth tubes that lack a girdlelike dilated zone, and perianth lobes with only a small pulvinate area near the base. Moreover, there is no white collar, and papillae are absent around the orifice. The specific name is derived from the type locality in Sichuan Province.

27. ***Asarum sagittarioides*** C. F. Liang, Acta Phytotax. Sinica **13**(2): 23. pl. 5, figs. 7–11. 1975. TYPE: Guangxi, Jin-xiu, K. Y. Li 40958 (holotype, IBK).

DISTRIBUTION. Endemic to Guangxi Province. On slopes and near streams, usually under thickets; 900–1200 m alt.

28. ***Asarum longerhizomatosum*** C. F. Liang & C. S. Yang, Acta Phytotax. Sinica **13**(2): 21. pl. 1, fig. 2; pl. 2, figs. 4–10. 1975. TYPE: Guangxi, Daming-shan, C. L. Chang 001 (isotype, PTM).

DISTRIBUTION. Endemic to Guangxi. Open thickets or sunny, rocky areas.

³J. L. Wu, formerly of the Beijing Chinese Traditional Medicinal College, Beijing, is a student of the Aristolochiaceae who is collaborating with Professor Yang; he is now at the Sichuan Chinese Traditional Medicinal School, Omei.

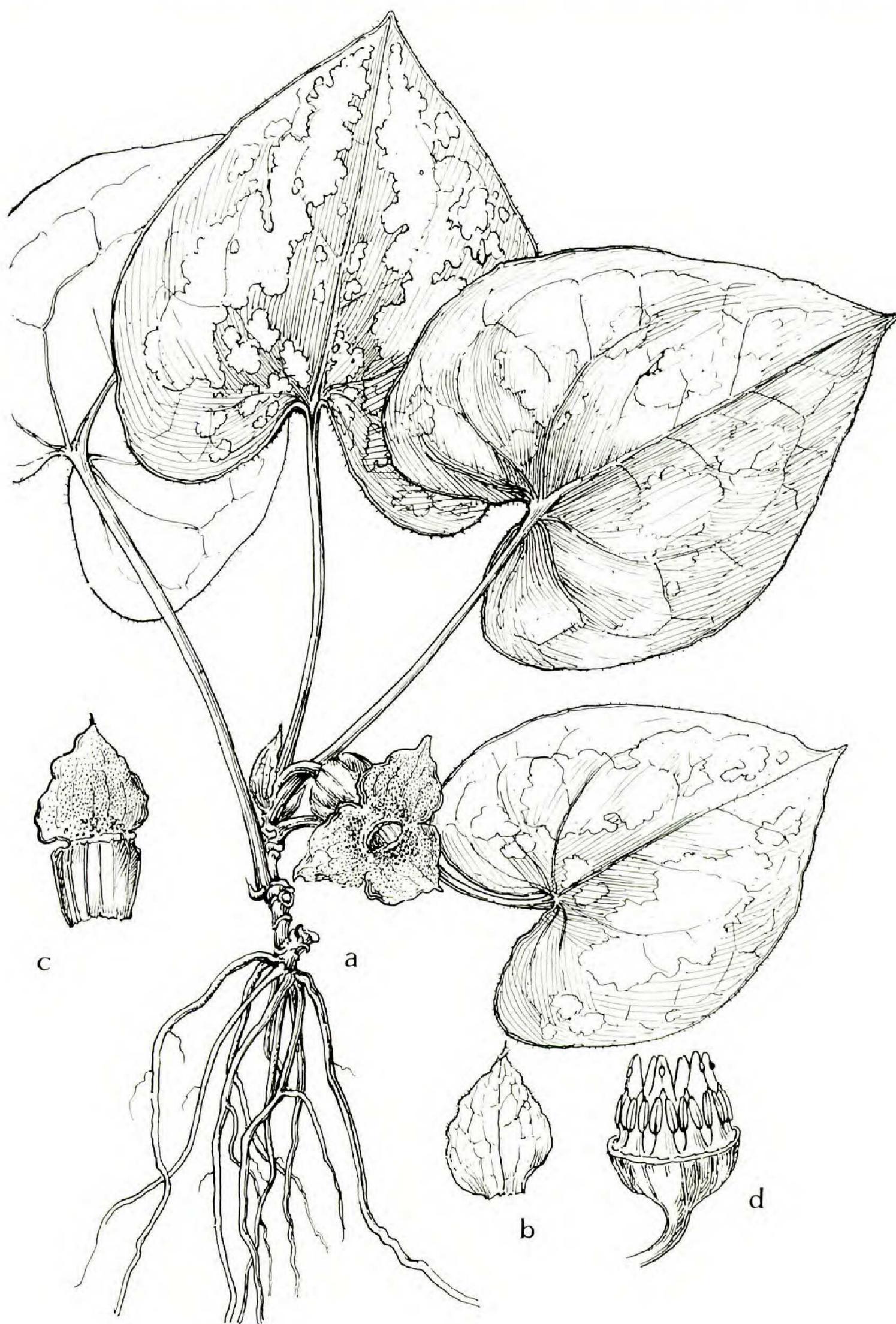


FIGURE 10. *Asarum nanchuanense*: a, habit of flowering plant, $\times .62$; b, cataphyll, $\times 1.25$; c, portion of perianth, showing inner surface of tube and lobe, $\times 1.25$; d, flower with perianth removed, showing androecium and gynoecium, $\times 1.85$.

29. ***Asarum wulingense*** C. F. Liang, Acta Phytotax. Sinica **13**(2): 22. pl. 5, figs. 1–6. 1975. TYPE: Guangxi, Lung-sheng, S. L. Yu & H. F. Qin 700702 (holotype, IBK).

DISTRIBUTION. Hunan, Guangdong, and Guangxi. 800–1000 m alt.

This species is one of the few in *Asarum* that has an indumentum of soft, yellowish brown hairs.

Asarum* sect. *Longiflora C. Y. Cheng & C. S. Yang, sect. nov.

Tubis perianthii longis et infundibuliformibus non constrictis nonnunquam leviter constrictis, sine annulo ad orem, papillis remote dispositis e medio lorum ad imum tubo in seriebus verticalibus. TYPE SPECIES: *Asarum magnificentum* Tsiang ex Cheng & Yang (Hunan).

Two species and one variety in China.

30. ***Asarum magnificentum*** Tsiang ex C. Y. Cheng & C. S. Yang, sp. nov.

FIGURE 11.

Asarum magnificentum Tsiang, Fl. Hupehensis **1**: 208. fig. 278. 1976. Description in Chinese, lacking a Latin diagnosis.

Heterotropa magnifica (Tsiang) Maekawa, Jour. Jap. Bot. **57**: 262. 1982. An invalid new combination based on *Asarum magnificentum* Tsiang, *ibid.*

Planta floribus maximis, tubis perianthii longissimis intus sparsim longitudinaliter papillato-rugosis a *A. petelotio* similis, sed tubis perianthii erectis ad orem haud constrictis circum orem annulatis non instructis, foliis triangulari-ovatis vel oblongo-ovatis apice acutis vel breve acuminatis supra ad costam albo-maculatis, rhizomatis brevioribus, differt.

Perennial herbs from short rhizomes with clustered, \pm fleshy roots. Leaves with petiole 6–16 cm long, the cataphylls at its base 3 or 4, ovate, ca. 1.5 cm long, densely ciliate; blade subcoriaceous, triangular- or oblong-ovate, 6–13 by 5–12 cm, acute or acuminate at apex, auriculate at base, white-blotched along midvein above (midvein often covered by short hairs), glabrous below. Flowers purplish green, large, 4–5 cm across, peduncle ca. 1.5 cm long; perianth with the tube funnelform, 3–5 cm long, 1.5 cm in diameter, not constricted (hence no definite orifice), internal surface having large papillae in vertical rows (toward base these often replaced by longitudinal ridges), the lobes triangular-ovate, ca. 3 by 2–2.5 cm, having purplish crescent toward middle and triangular, papillate area beneath continuous with papillae of tube; anthers with connective acute; ovary inferior, the styles 6, free, bifid at apex, the stigmas lateral.

TYPE. Hunan, Qi-yang, in shade, Y. Tsiang & S. C. Chen 859 (holotype, IBSC).

ADDITIONAL SPECIMENS EXAMINED. **Jiangxi**: Da-mao-shan, beside stream, in shade, 700 m, W. D. Yang 24 (LUS). **Zhejiang**: Chun-an, Bot. Res. Exped. 27513 (HIM).

In addition to its distribution in Hunan, Jiangxi, and Zhejiang provinces, *Asarum magnificentum* is also known to us to occur in Hubei and Guangdong

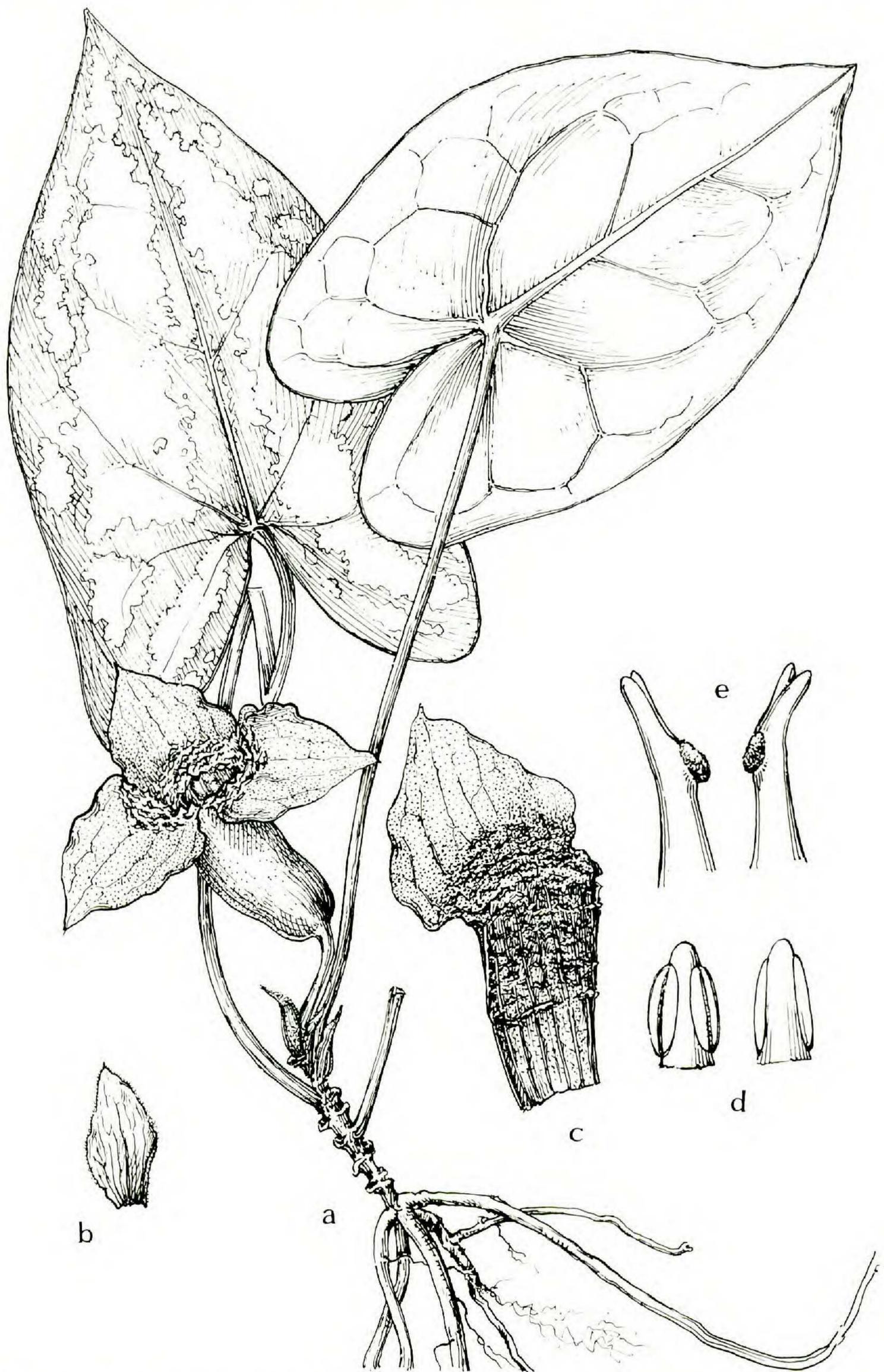


FIGURE 11. *Asarum magnificum*: a, habit of flowering plant, $\times .65$; b, cataphyll, $\times .65$; c, portion of perianth, showing inner surface of tube and lobe, $\times 1$; d, stamens, $\times 2.6$; e, styles and lateral stigmas, $\times 2.6$.

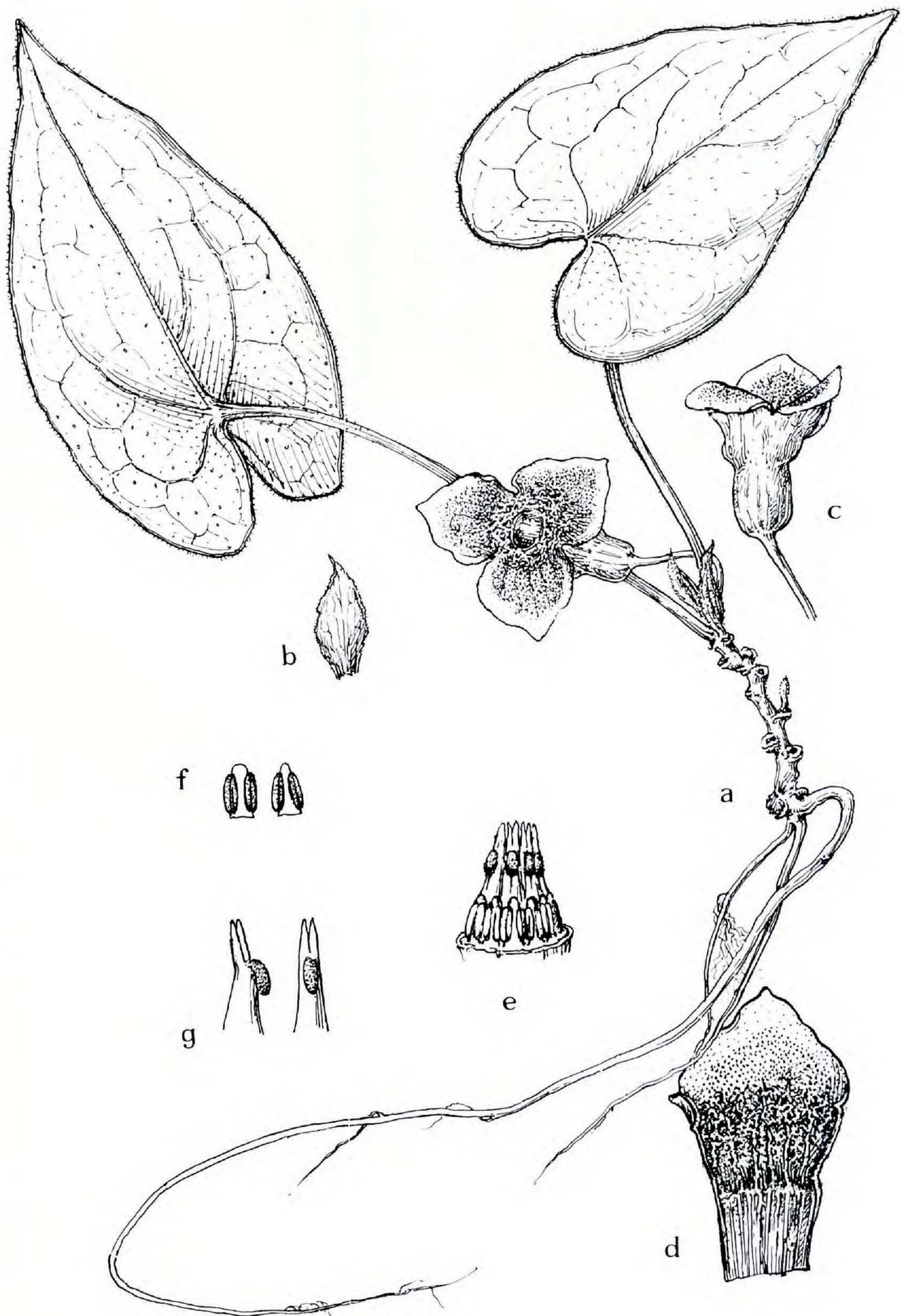


FIGURE 12. *Asarum magnificentum* var. *dinghuense*: a, habit of flowering plant, $\times .62$; b, cataphyll, $\times .62$; c, flower, lateral view, $\times .62$; d, portion of perianth, showing inner surface of tube and lobe, $\times 1.25$; e, flower with perianth removed, showing androecium and gynoecium, $\times 1.25$; f, stamens, $\times 1.25$; g, styles and stigmas, $\times 1.25$.

provinces and probably also grows in Shaanxi. *Asarum magnificum* was initially identified and named in the herbarium of Guangdong College of Agriculture and Forestry by Professor Ying Tsiang, but it was never published. It is closely related to *A. petelotii*, from Yunnan southward into Indochina, and both species are characterized by their large flowers with unconstricted perianth tubes that lack an orifice ring but have large papillae on the inner surface. *Asarum magnificum*, however, is distinguished by its straight, symmetrical perianth tubes, its triangular- or oblong-ovate leaves with acute apices and white-blotched upper surfaces, and its very short, nearly perpendicular rhizomes.

30a. ***Asarum magnificum* var. *dinghuense*** C. Y. Cheng & C. S. Yang, var. nov. FIGURE 12.

A typo tubis perianthii brevioribus circum 1 cm longis et 8 mm in diametro et supra medium ad 1 cm in diametro dilatis, intus tenuiter et parce papillois, foliis saepe ovato-oblongis supra non albo-maculatis parce breviter hirtis subtus interdum oleosipunctatis, differt.

TYPE. Guangdong, Chao-ting, Ding-hu-shan, alt. 300–700 m, in damp, shady thickets, *G. Q. Ding et al. 1039* (IBSC).

ADDITIONAL SPECIMENS EXAMINED. **Guangdong:** Ding-hu-shan, *L. Teng 11066* (IBSC); Xin-i, *C. Wang 37999* (IBSC).

Asarum magnificum var. *dinghuense* differs from var. *magnificum* in having smaller flowers with fewer papillae on the perianth lobes, and leaves green throughout, sometimes with punctate lower surfaces.

31. ***Asarum petelotii*** Schmidt, Notizbl. Bot. Gard. Berlin-Dahlem **11**: 100. 1931. TYPE: Vietnam, Tonkin, *Pételot 3891* (B, n.v.).

DISTRIBUTION. Southeastern Yunnan; also Vietnam. In moist, forested areas; 1100–1700 m alt.

Previously unrecorded for China, this species has large flowers with the perianth tubes slightly asymmetric due to a bend to one side.

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