

Reappraisal of *Fosbergia shweliensis* (Rubiaceae), a species endemic to the Gaoligong Mountains, Western Yunnan, China

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Abstract Based on collections from the Gaoligong Mountains in 1998–2004, western Yunnan, China, the present paper describes in detail the fruit characters of *Fosbergia shweliensis* (Anth.) Tirveng. & Sastre (Rubiaceae), a species endemic to the Gaoligong area. The paper also reviews the flower structure and reports on the habit and distribution of the species. Comparing the original description of *Randia shweliensis* Anth. (the basionym of *Fosbergia shweliensis*), our collections are the same species as *Fosbergia shweliensis*.

Key words *Fosbergia shweliensis*, Gardenieae, Rubiaceae, Reappraisal.

From 1998 to 2004, during our expeditions to southern Gaoligong Mountains, we collected a series specimens with massive fruits and large flowers of Rubiaceae. Comparing our collections with the genera distributed in China and belonging to the tribe Gardenieae of Rubiaceae, we determined our collections to be one of the species of *Fosbergia* (Tirvengadam & Sastre, 1997). *Flora Reipublicae Popularis Sinicae* (Chen W-Q, 1999), *Flora of Gaoligong Mountains* (Tao et al., 2000), and *Flora Yunnanica* (Chen W-Q, 2003) do not mention the genus *Fosbergia*, and Rubiaceae in the web version of the *Flora of China* still keeps the genus *Randia* which at present is considered to be strictly a neotropical genus of approximately 90 species (Gustafsson & Persson, 2002). However, *Fosbergia* as a good genus in the Rubiaceae is different from other genera in the tribe Gardenieae by having large showy flowers and massive fruits as well as a unique microstructure of the seed coat. It differs from *Aidia* Lour. by terminal inflorescences (non axillary or opposite to leaf), large flowers (corolla lobes >2.5 cm long, non <10 mm), massive fruits (>4 cm diam., non <10 mm as that in *Aidia*), and included anthers (non exposed). Thus, Tirvengadam and Sastre (1997) moved the *Randia shweliensis* Anth. into their new genus *Fosbergia* as the type species *F. shweliensis* (Anth.) Tirveng. & Sastre. We also suggested that *Aidia shweliensis* (Anth.) W. C. Chen (1999, 2003) be changed to *Fosbergia shweliensis*. Unfortunately, both Tirvengadam and Sastre as well as W. C. Chen did not check the type specimen in detail and could not describe the fruit of this species.

Fosbergia is restricted to Southeast Asia along an axis extending from the Gaoligong Mountains (Northern Myanmar and southwestern China) to southern Vietnam (Tirvengadam & Sastre, 1997).

After checking the type specimens and the original description of *Randia shweliensis*, the basionym of *Fosbergia shweliensis*, and careful observation on the flowers and fruits of our collections, a detail description of *Fosbergia shweliensis* is provided as following.

Fosbergia shweliensis (Anth.) Tirveng. & Sastre, Biogeographica 73 (2): 88. 1997, p.p. specimen C. W. Wang 78281 exclud. —*Randia shweliensis* Anth. in Notes Roy. Bot. Gard.

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Edinb. 18: 205. 1934; C. Y. Wu, Index Fl. Yunnan. 2: 1270. 1984.—*Aidia shweliensis* (Anth.) W. C. Chen in H. S. Lo, Fl. Reip. Pop. Sin. 71 (1): 350. 1999; W. C. Chen in C. Y. Wu, Fl. Yunnan. 15: 179. 2003, syn. nov. Type: China. Yunnan (云南), Shweli-Salwin divide (瑞丽江-怒江分水界), 25°40' N, alt. 7000–8000 ft. 1919-06, *G. Forrest 18064* (holotype, E!; isotypes, A!, BM, K).

瑞丽茜 Fig. 1

Tree without spines, 8–20 m tall, d.b.h. 11–17 cm, bark coarse, brown, bearing minute lenticels; branches dichotomous, internodes 1–2.5 cm long, glabrous; annual branches 10–15 cm long, brown, hirsutulous, bearing 2–3 pairs of leaves, bark easily peeling off, greenish inside. Petiole 5–10 mm long, glabrous. Leaf blades green, chartaceous, obovate-lanceolate, 15 × 6 cm, 9.5 × 3.5 cm or smaller on annual branches, entire, unequal-sided, abruptly acuminate, slightly caudate at apex, narrowly cuneate at base, glabrous on both surfaces, sparsely hirsute on main and lateral nerves below; main nerve inconspicuous above, slightly prominent below, lateral nerves 10–12 per side, raising to margins, nervules reticulate, inconspicuous. Stipules triangular, ca. 5 mm long, hirsutulous outside, with filiform acumen ca. 5 mm at apex.

Inflorescence terminal, young flower buds pseudo-axillary between 2 young and difficult for seeing branch-buds, flowering cyme consisting of 3(–4) flowers, sitting between 2 short opposite annual leaved branches and much shorter than latter; young buds appearing in August, and flowering in June next year. Peduncle 1–1.5 cm long, robust, hirsutulous to glabrous, lenticels grayish white, bracts 1-pair, opposite at the top of the peduncle, linear lanceolate, aristate at apex, 4 × 2 mm, hirsutulous; flowers 3–4, usually 1–2 flowers reduced; pedicel green, 1–1.8 cm long, 2–3 mm in diam., glabrous, with a pair of tiny bracteoles at the middle, usually bracteoles reduced; bracteoles narrowly lanceolate, aristate at apex, ca. 3 mm long, early deciduous. Calyx tube cylindrical to narrow bell-shaped, green outside, greenish inside, glabrous on both sides, 8–13 mm long, 5 mm in diam.; calyx lobes 5, linear lanceolate, 5 mm long, 2 mm wide at base, aristate at apex. Corolla tube pale greenish to yellowish, long campanulate, coriaceous, 2.2–2.5 cm long, 4 mm in diam. at lower part, 6–7 mm in diam. at upper part, glabrous outside, yellowish tomentose at middle part inside; corolla lobes 5, longer than calyx lobes, lanceolate, imbricate in the bud, greenish yellow to yellow, thickly coriaceous, fragile when fresh, glabrous on both surfaces, recurved, 2.6 cm long, 6 mm wide at base. Anthers 5, setting at throat of corolla tube and opposite to lobes; filament almost absent, anther oblong, yellow, extrorse, 5 mm long, bilocular, dehiscing by longitudinal slit; style yellowish green, glabrous, 2 cm long; stigma clavate, 5 mm long, deeply bilobed; ovary inferior, pyriform or obovate, green, 4 mm in diam., bilocular with axile placentation, ovules many per locule, amphitropous. Fl. June.

Young fruit (ca. 60 days after flowering) usually one per inflorescence, erect, green, oblong, ovate-globose, 3.2–5 × 2.8–3.5 cm, green calyx persistent at the top, stalk green, 1.7–3.5 cm long. Mature fruit pendulous, dirt green, ovate-globose, up to 11 × 9 cm and larger, top rounded with cupped calyx tube; exocarp woody, greenish white, thickened, up to 3 cm at the top, 1.3–1.7 cm at the lateral; endocarp white, soft bony, translucent; seeds many, white, irregularly triangulate ovate or oblong, 1.2 × 0.7 cm, hiding in the white, fleshy, axile placentation; seed coat membranous, translucent; embryo large, white, bony; stalk brown, 1.5–2 cm long. Mature fruits 2 years (?) after flowering.

Distribution: This species is distributed in west slope and watershed of the southern Gaoligong Mountains, Yunnan, China, belonging to the Irrawaddy drainage. It is endemic to Gaoligong Mountains. Tirvengadam and Sastre in *Fosbergia shweliensis* cited C. W. Wang 78281 (2 sheets, A, KUN), which was collected from Meng Soong (Mengsong), Dahl Meng

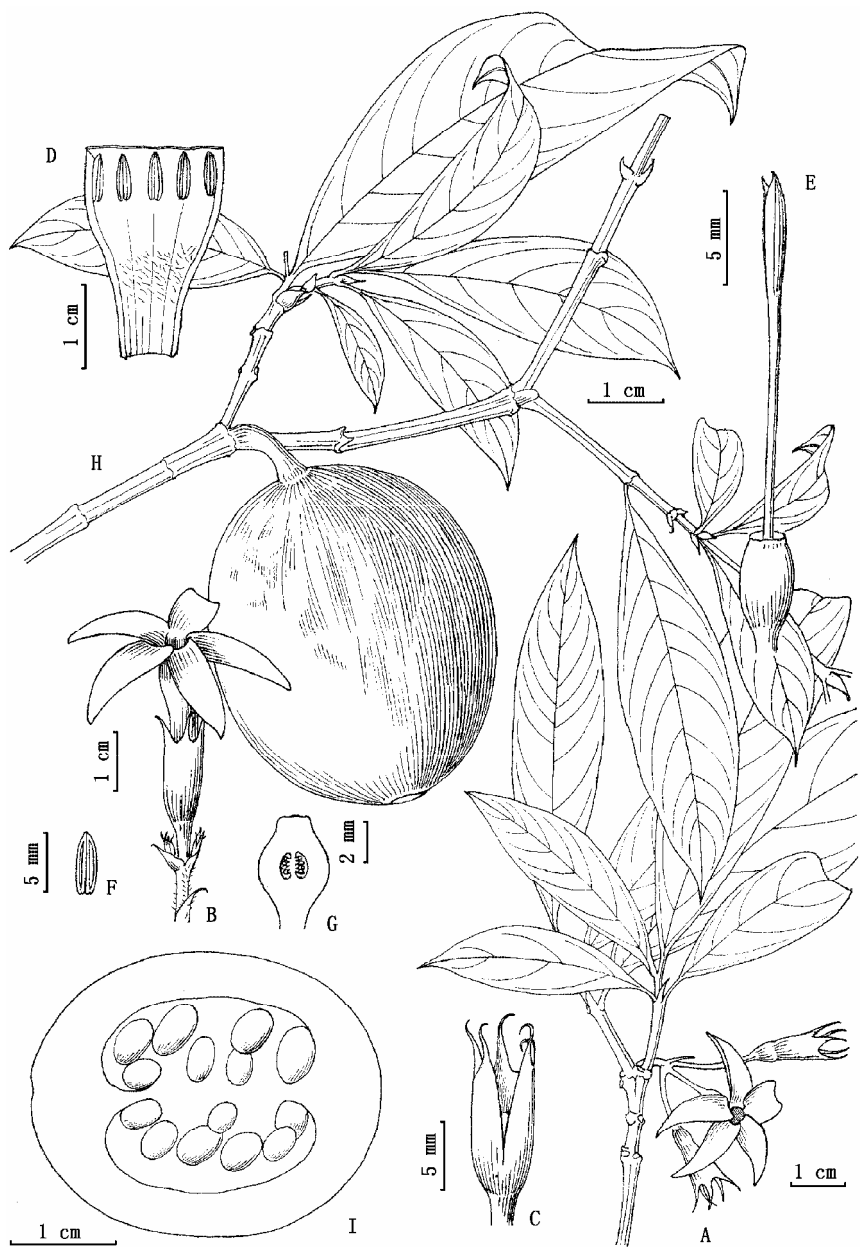


Fig. 1. *Fosbergia shweliensis* (Anth.) Tirveng. & Sastre. A, branch with flowers; B, flower and young branches; C, calyx; D, corolla tuber; E, style & stigma; F, stamen; G, longitudinal section of ovary; H, branch with fruit; I, longitudinal section of fruit. A, B, C, D, E, F and G are based on *J. H. Li s.n.*; H and I on *Gaoligong Shan Biodiversity Survey 17745*; drawn by X. L. Wu.

Lung, Che-Li Hsien (=Jinghong County), alt. 1900 m. These specimens with large fruits differ from *Fosbergia shweliensis* in thinned exocarp (less than 1 cm), triangular seeds, and distribution area belonging to Mekong drainage area. In Fig. 1 the collection locality of *C. W. Wang 78281* is incorrectly shown nearly south of the collection locality of *G. Forrest 18604* and *18855*, south of Gaoligong Mountains (Tirvengadum & Sastre, 1997). Therefore, the

authors of this paper considered that *C. W. Wang 78281* is an additional specimen of *Fosbergia thailandica* Tirveng. & Sastre, distributed in Northern Thailand.

Phenology: Flower buds appear in July to August, flowering in next June, fruiting from June through several years.

Ecology: The type specimen of *F. shweliensis* was collected from an open thicket, while the present populations of *F. shweliensis* are distributed in primary moist subtropical evergreen broadleaf forests in the Gaoligong Mountains State Nature Reserve. Here all trees of *Fosbergia* are in old age. On stems and branches there are abundant mosses, and many epiphytic plants such as *Rhaphidophora decursiva* (Roxb.) Schott, *Epigeneium rotundatum* (Lindl.) Summerh., *Otochilus fuscus* Lindl., *Aeschynanthus bracteatus* Wall. ex A. DC., *Lysionotus forrestii* W. W. Smith, and ferns such as *Lepisorus bicolor* (Takeda) Ching, and *Lepidogrammitis rostrata* (Bedd.) Ching. The forest is dominated by *Lithocarpus* spp., *Michelia doltsopa* Buch.-Ham. ex DC., and *Manglietia insignis* Bl. The second layer of forest consists of *Cinnamomum porrectum* (Roxb.) Kosterm., *Sterculia euosma* W. W. Smith, *Reevesia pubescens* Mast., *Acanthopanax evodiifolius* Franch., and *Ilex* spp. The forest floor consists of *Arisaema decipiens* Schott, *Sarcopyramis bodinieri* Lévl. & Van., *Polygonum wallichii* Meisner, *Selaginella* spp., and other ferns. In the forest it is difficult to find young trees of *Fosbergia shweliensis* as well as gemmiferous seeds.

Additional specimens examined:

China. Yunnan (云南): Baoshan (保山), Lujiang (潞江), Lihuipo (里惠坡) near Nankang village (赧亢村), alt. 2210 m, 24°50'8" N, 98°46'4" E, tree ca. 10 m tall, fruit green, 2003-08-26 (fr. KUN), Gaoligong Shan Biodiversity Survey (高黎贡山生物多样性队) 17745; the same location and the same tree as the specimen Gaoligong Shan Biodiversity Survey (高黎贡山生物多样性队) 17745, flower greenish to yellow, 2004-06-12, J. H. Li (李家华) s.n. (fl. KUN). Tengchong (腾冲), Shangying (上营), Small N-S valley in the Tanchang (炭厂) area, alt. 2200 m, 24°57'7" N, 98°43'52" E, tree ca. 10 m tall, fruit green, persistent for several years, 2003-09-02, Gaoligong Shan Biodiversity Survey (高黎贡山生物多样性队) 18501 (KUN, CAS, E), alt. 2208 m, 24°57'31" N, 98°44'4" E, tree ca. 10 m tall, flower buds axillary, 2003-09-03, Gaoligong Shan Biodiversity Survey (高黎贡山生物多样性队) 18667 (flower buds, KUN, CAS, E); the same tree as collection number 18667, old fruit green, 2003-09-03, Gaoligong Shan Biodiversity Survey (高黎贡山生物多样性队) 18668 (fr. KUN, CAS, E); Datianpo (大田坡), alt. 2170 m, 24°57'30" N, 98°44'4" E, broadleaved evergreen forest, tree ca. 8 m tall, fruit green, 1998-11-06, H. Li et al. (李恒等) 11584 (KUN, CAS, E).

Discussion

The new collections of *Fosbergia shweliensis* are different from the original description of Anthony (1934) in having cylindrical to narrow bell-shaped calyx tube glabrous on both sides; biggish pale greenish to yellowish corolla 2.2–2.5 cm long, 4 mm in diam. in lower part, 6–7 mm in diam. in upper part, long campanulate corolla tube glabrous outside, yellowish tomentose at middle part inside; lanceolate recurved corolla lobes imbricate in the bud, greenish yellow to yellow, thickly coriaceous, fragile when fresh, glabrous on both surfaces, 2.6 cm long, 6 mm wide at base. At our request, Mr. Lawrie Springate from Royal Botanic Garden Edinburgh removed the flower bud from the type specimen *Forrest 18064* and cut open. He found: "The calyces seem glabrous throughout on both sides. I can not explain Anthony's statement 'intus inter lobos villosus', though there are many fungal 'hairs' inside on top of the ovaries of old flowers. The corollas are glabrous outside. The tube of the dissected corolla is 22 mm long and the lobes 16 mm long. It is densely villous inside from 4–10 mm above its base..." Therefore, we are convinced that the new collections are the same species as the type of *F. shweliensis*.

Because after collections of Forrest (in 1919) there were no additional collections in the last 85 years, the fruit of *F. shweliensis* is described for the first time. However, the following features may indicate that our collections with fruits might be the same species as *G. Forrest 18604*, namely, *F. shweliensis*: the mature (?) fruit up to 11 × 9 cm and larger; exocarp woody, greenish white, thickened, up to 3 cm at the top, 1.3–1.7 cm laterally; endocarp white, soft bony, translucent; seeds many, white, irregularly triangulate ovate, 1.2 × 0.7 cm, hidden in the white, fleshy, axile placentation; seed coat membranous, translucent; embryo large, white, bony.

We really do not know when the fruit is in the mature stage, how many years or months after flowering, because we never found any mature fruit under the trees, but some massive pendulous fruits on the trees.

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瑞丽茜(茜草科)的再确认

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摘要 瑞丽茜*Fosbergia shweliensis* (Anth.) Tirveng. & Sastre的基名为*Randia shweliensis* Anth., 是高黎贡山地区的特有种。根据作者1998–2004年从云南西部高黎贡山所采集的标本, 本文补充了瑞丽茜果实的形态描述, 更正了关于本种原描述的若干错误, 报道了本种的生活习性、生境和分布情况。

关键词 瑞丽茜; 梔子族; 茜草科; 再确认