

*Veratrum shanense* W. W. Sm. (*Melanthiaceae*)  
– A Review of Its Taxonomy and Distribution Range –

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A comparative morphological survey based on herbarium specimens shows that two Chinese species of *Veratrum*, *V. stenophyllum* Diels and *V. yunnanense* O. Loes., are conspecific with *V. shanense* W. W. Sm. from Myanmar. The two Chinese species are, accordingly, reduced to *V. shanense*. *Veratrum shanense* as delimited here is distributed in M. E. Myanmar, and N.W. Yunnan, S.W. Sichuan and Guizhou, China. Lectotypes of both *V. stenophyllum* and *V. yunnanense* are designated. In *V. shanense*, infraspecific variations are found in some characters, such as perianth color, the size of tepals and bracts, and the pubescence of leaves, but no taxa appear to be clearly delimited. *Veratrum stenophyllum* var. *taroense* F. T. Wang & Z. H. Tsi with papillose-puberulent leaf veins is reduced to *V. shanense*. *Veratrum shanense* show andromonoecism and the bisexual flowers are strongly protandrous. Morphological description, synonymy, bibliography, and some other information on this species are also provided.

**Key words:** Andromonoecism, distribution range, *Melanthiaceae*, protandry, taxonomic revision, *Veratrum shanense*, *Veratrum stenophyllum*, *Veratrum yunnanense*.

*Veratrum shanense* was described by Smith (1911) from Myanmar. Subsequently *V. stenophyllum* Diels (Diels 1912) and *V. yunnanense* O. Loes. (Loesener 1926, 1928) were described from Yunnan, China, which is adjacent to Myanmar on the western border.

Zimmerman (1958, unpublished; 1961) treated the three species above as conspecific. Mathew (1989) stated that *V. shanense* and *V. yunnanense* are probably identical, but *V. stenophyllum* is distinct from them. In most of the recent floras of China, the two Chinese species were treated as conspecific, but the Myanmar species was not mentioned at all (e.g., Tsi 1980, Tu 1990, Yang 1991, Li 1997,

Chen and Takahashi 2000). Taxonomic views on the three species are, thus, diverse among the taxonomists.

In view of this taxonomic inconsistency, the present study was undertaken to clarify their relationships. In this study, the three species are compared morphologically based on herbarium specimens. Reproductive aspects are also noted below.

***Veratrum shanense* from Myanmar**

*Veratrum shanense* W. W. Sm. was described based on a specimen from southern Shan State, Myanmar (MacGregor 826, CAL; Figs. 1, 2). The type specimen comprises two

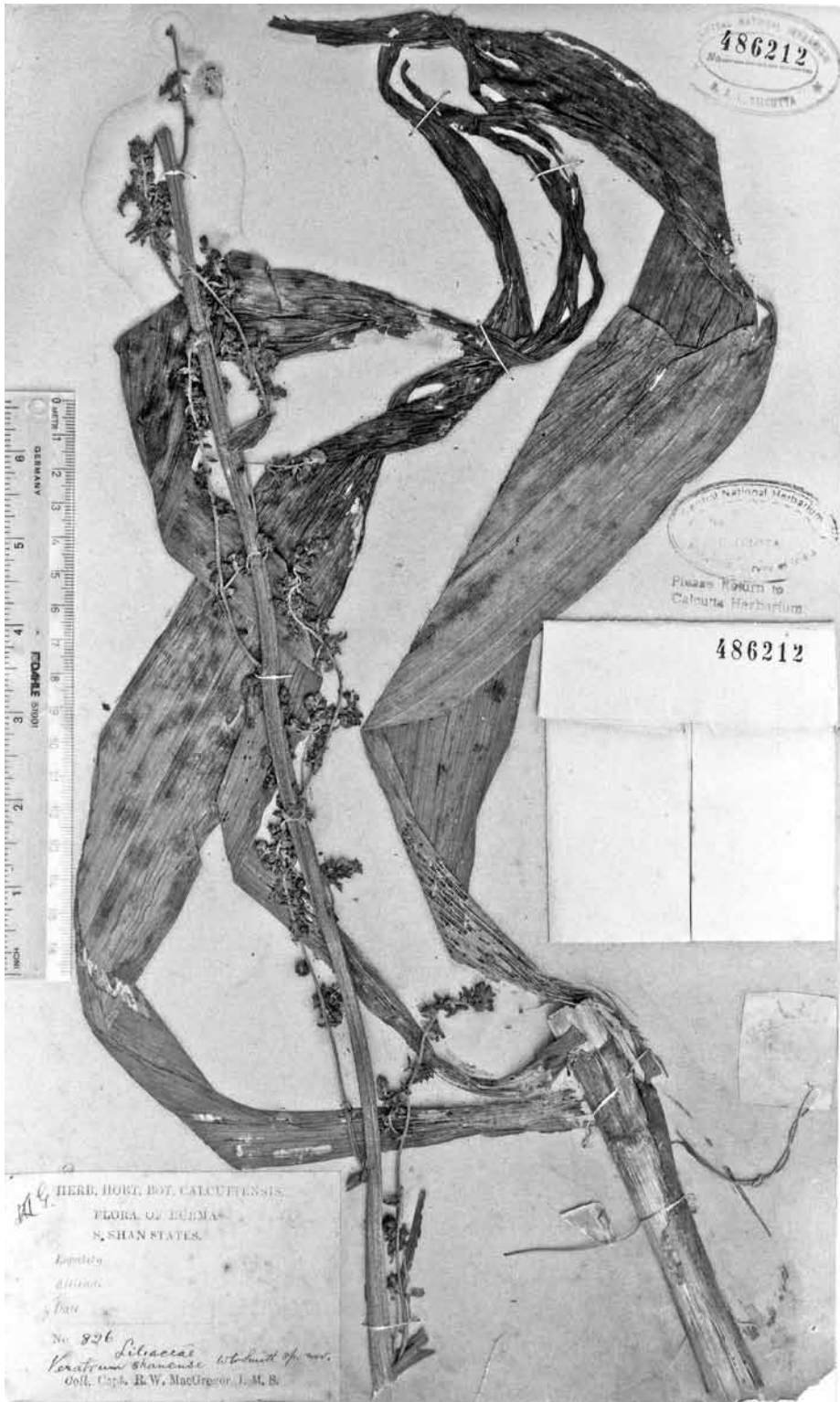


Fig. 1. Type specimen of *Veratrum shanense* from Myanmar (MacGregor 826, CAL).

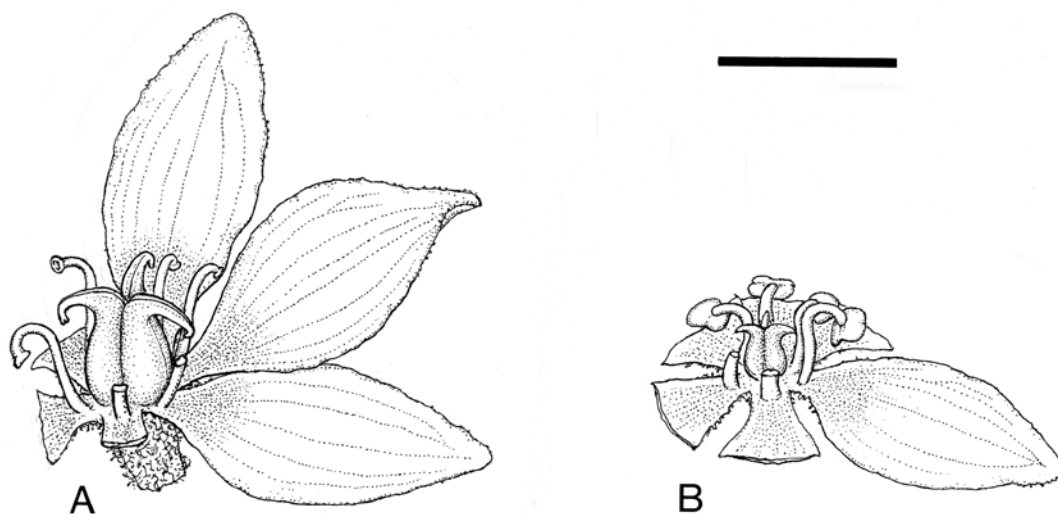


Fig. 2. *Veratrum shanense* from Myanmar (type: MacGregor 826, CAL). A. Part of bisexual flower in female phase. Anthers already fallen off. Three tepals and two filaments removed from near base. B. Part of male flower with depauperate pistil. Five tepals and two filaments removed from near base. Drawn by Noriyuki Tanaka. Scale bar = 3 mm.

fragmentary parts probably derived from one individual; the middle and proximal part of an inflorescence (the rachis 37.5 cm long), and probably the basal part of a stem (12.5 cm long) with three leaves. Judging from the size of the two parts, the whole plant may exceed 1.2 m in height. The three leaves are narrowly elliptic, acute at the apex, attenuate at the base, up to about 60 cm long, to 6 cm broad, and glabrous on both surfaces. The inflorescence is a panicle, although the terminal part is lacking. The inflorescence has many lateral branches, most of which further have a few lateral branchlets. The axes of the branches are slender, ascending, and up to 12 cm long. The pedicels on the branches are short, about 3 mm long, as long as or slightly shorter than the floral bracts. The tepals are narrowly elliptic or elliptic, subacute at the apex, clawed at the base, 5–7 mm long, 2–3.5 mm broad (Fig. 2). Each tepal bears a narrowly flavelliform or cuneate nectary on the basal 1/5 to 1/4. The staminal filaments are 2–2.8 mm long, and inserted to the basal part of the claw of each tepal (i.e., epitepalous) (Fig. 2). The anthers fully dehisced are peltate, orbicular

or quadrangulately orbicular, 0.6–0.7 mm long and broad (Fig. 2B). Most flowers on the lateral branches are male (Fig. 2B), and only several flowers are hermaphroditic (Fig. 2A), although their pistils are often somewhat depauperate. The pistils are normally developed about 2 mm long, with three strongly divergent and recurved styles.

In Myanmar this species has been recorded only from the type locality.

#### **Identities of *Veratrum stenophyllum* and *V. yunnanense* from China**

*Veratrum stenophyllum* Diels was based on three specimens from Yunnan; Forrest 2635 (Fig. 3), 4663 (Fig. 4) and 3039, all conserved in E. The last specimen, Forrest 3039, was later segregated by Loesener (1928) as *V. mentzeanum* O. Loes., and is excluded from the scope of the present study. Forrest 2635 includes three individuals (Fig. 3), which were later distinguished by Loesener (1928) into two species. He referred the right individual, designated by him as “a”, to *V. stenophyllum*, and two others, left and middle, designated

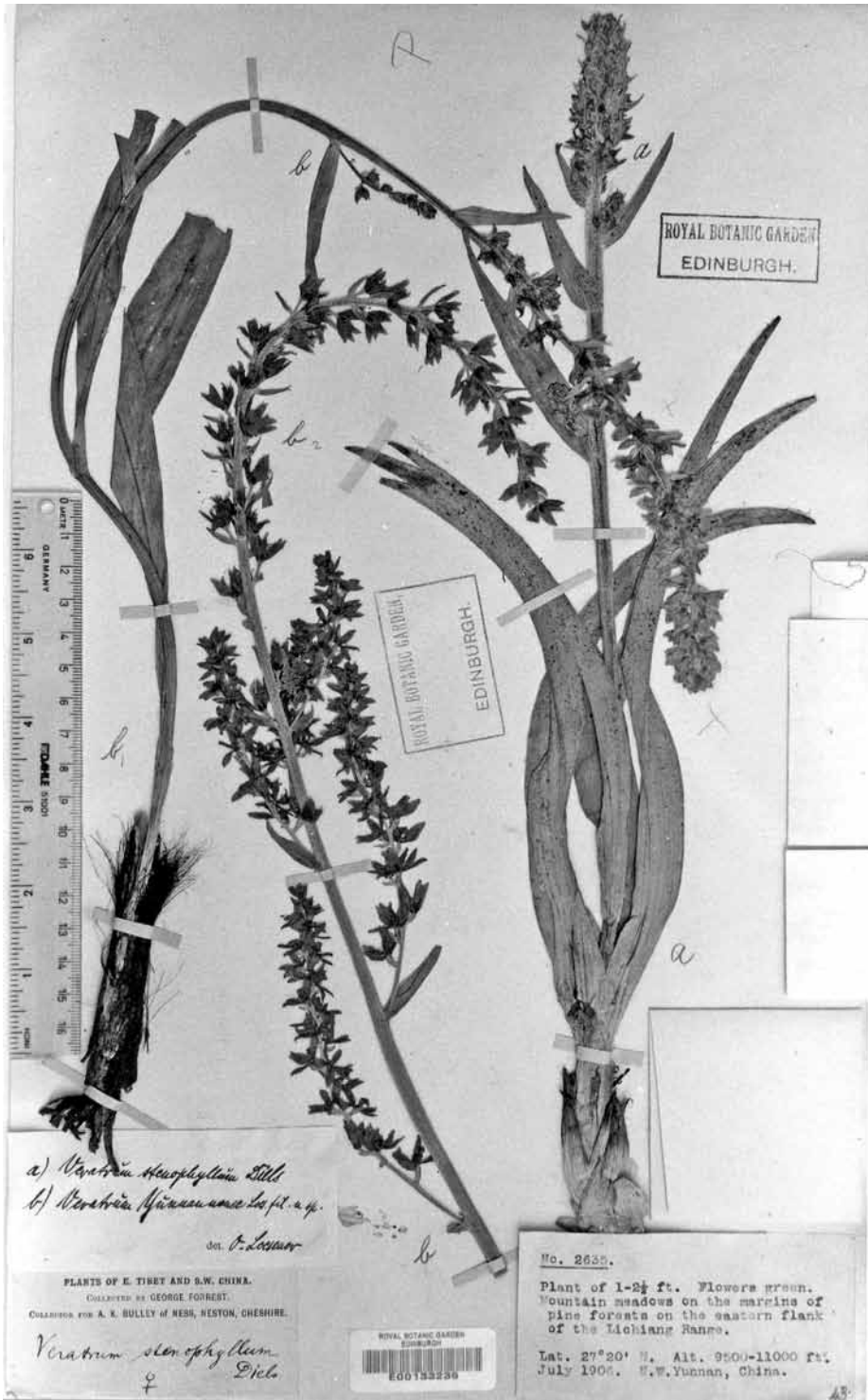


Fig. 3. Lectotype of *Veratrum stenophyllum* Diels from N.W. Yunnan, China (G. Forest 2635, E). Loesener (1928) designated the right individual as “a”, the left one as “b<sub>1</sub>” and the middle one as “b<sub>2</sub>”. See text for further remark.

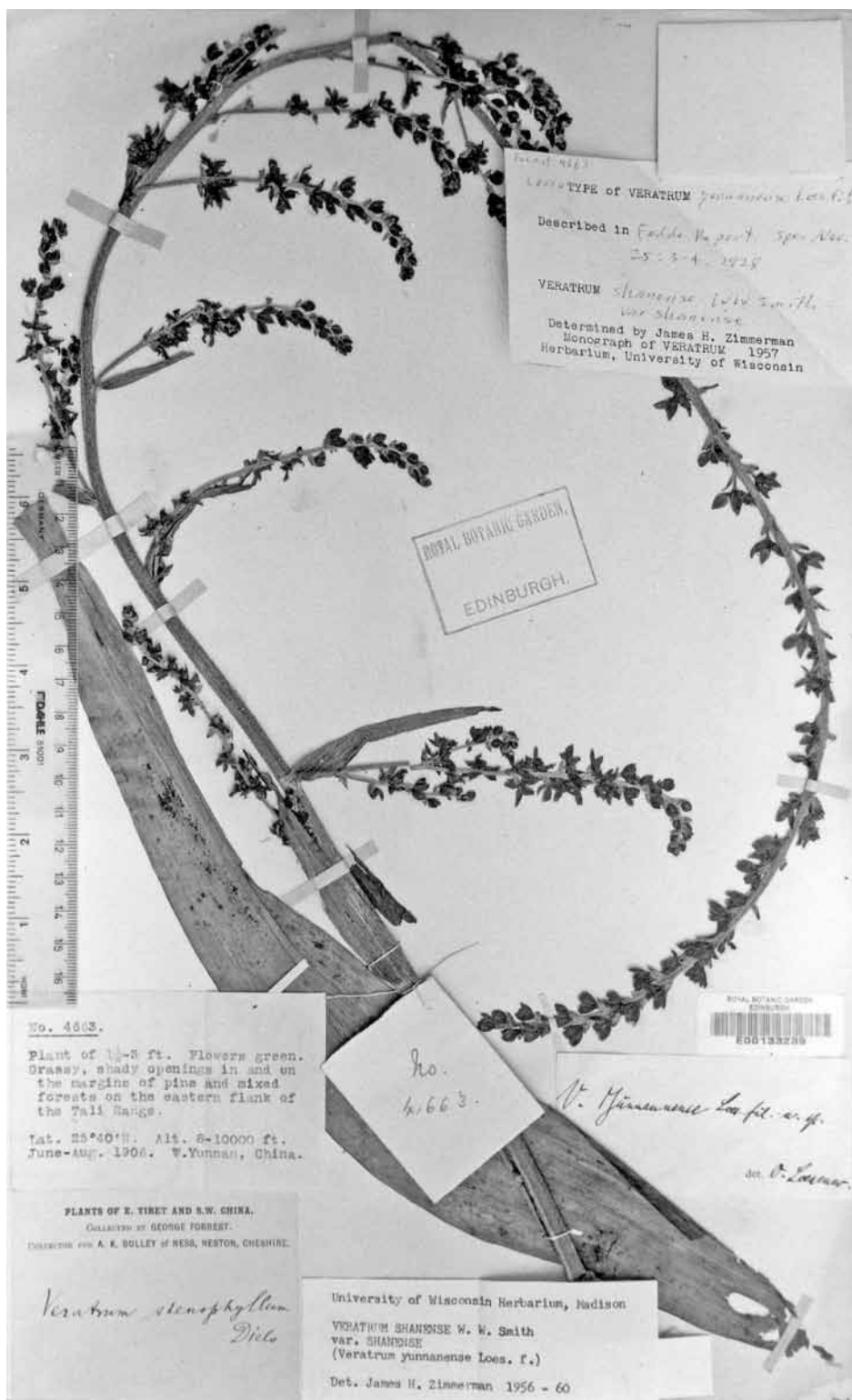


Fig. 4. Lectotype of *Veratrum yunnanense* O. Loes. from W. Yunnan, China (G. Forrest 4663 E).

by him as “b (b1 and b2, respectively)”, to his new species *V. yunnanense* O. Loes. Loesener (1928) also cited in his paper several other specimens from Yunnan and Sichuan, China, as *V. stenophyllum*, and several other specimens from Yunnan, including Forrest 4663 (Fig. 4), as *V. yunnanense*. In the present study, several specimens corresponding to *V. stenophyllum* and *V. yunnanense*, including syntypes, were examined, and compared with the type of *V. shanense*. The results indicate that these three species (Figs. 1–5) are essentially similar in many respects. For instance, as in *V. shanense* from Myanmar, the axes of the lateral racemes of the two Chinese species are slender, ascending, and comparatively short, to 15 cm long. The pedicels of the lateral racemes are short, usually to 5 mm long. The tepals are clawed at the base, and the staminal filaments are inserted to the basal part of the claw (i.e., epitepalous) (Figs. 5A, 5B). The nectary is cuneate, sharing the basal 1/5–1/4 of each tepal. According to Loesener (1926, 1928), *V. stenophyllum* (Forrest 2635 “a”, Fig. 3) differs from *V. yunnanense* (Forrest 2635 “b”, Fig. 3; Forrest 4663, Fig. 4) by its smaller habit, shorter inflorescence with fewer lateral branches, and narrower leaves. However, it does not appear that the two species are clearly delimited by these diagnostic characters, due to the presence of intermediate forms (see also the following chapter). As for the specimen Forrest 2635 (Fig. 3), the three individuals on the sheet, which were distinguished by Loesener (1928) into the two species as mentioned above, do not appear to differ qualitatively. They are apparently at different stages of growth, and their differences are rather transitional. In growth, the middle individual “b<sub>2</sub>” is the most advanced, while the right one “a” the most retarded. Tsi (1980) and Chen and Takahashi (2000) treated *V. yunnanense* as conspecific with *V. stenophyllum*. This unification seems appropriate. They did not make any remark on *V. shanense* in connection with the treatment. It appears that both *V. stenophyllum* and *V. yunnanense* are also

conspecific with *V. shanense*, as they have no significant differences (Figs. 1–5). The inclusion of the two Chinese species in *V. shanense* was first made by Zimmerman (1958, unpublished; 1961). His treatment is quite agreeable, and followed in the present paper. Mathew (1989) stated that *V. shanense* and *V. yunnanense* are probably identical, although he regarded *V. stenophyllum* as distinct from them.

### Intraspecific variations of *Veratrum shanense* (sensu lato)

Intraspecific variations of *Veratrum shanense* as delimited here (i.e., including *V. stenophyllum* and *V. yunnanensis*) are noted below.

Specimens from Lijiang District, N.W. Yunnan (e.g., Forrest 2635, E, lectotype of *V. stenophyllum*, Fig. 3; Forrest 6202, E) and S.W. Sichuan (Rock 23755, E), which are ca. 2800 to 4000 m in altitude, tend to be somewhat small in habit (up to 85 cm tall), and often have comparatively long, narrowly lanceolate or subulate floral bracts as long as or surpassing the flowers. The tepals are green, yellowish green or yellow. This form corresponds to *V. shanense* var. *stenophyllum* (Diels) J. H. Zimmerman (1958, unpublished, 1961; name invalid, due to Articles 34.1(a) of the International Code for Botanical Nomenclature, edited by McNeil et al. 2006). On the other hand, specimens from Dali District, Yunnan (e.g., Forrest 4663, E, lectotype of *V. yunnanense*, Fig. 4; Forrest 7027, E), which is from ca. 2400 to 3300 m in altitude, are often tall (up to 1.5 m), usually bear a large panicle of green flowers and somewhat small floral bracts not surpassing flowers. This form is quite similar to *V. shanense* s. str. from Myanmar (Figs. 1, 2) as Mathew (1989) stated, and corresponds to *V. shanense* var. *shanense* (Zimmerman 1958, unpublished; 1961, name invalid).

Zimmerman (1958, p. 230) regarded the *Veratrum shanense* complex as a graded series or continuum, although he created two varieties, *shanense* and *stenophyllum*, under the species.

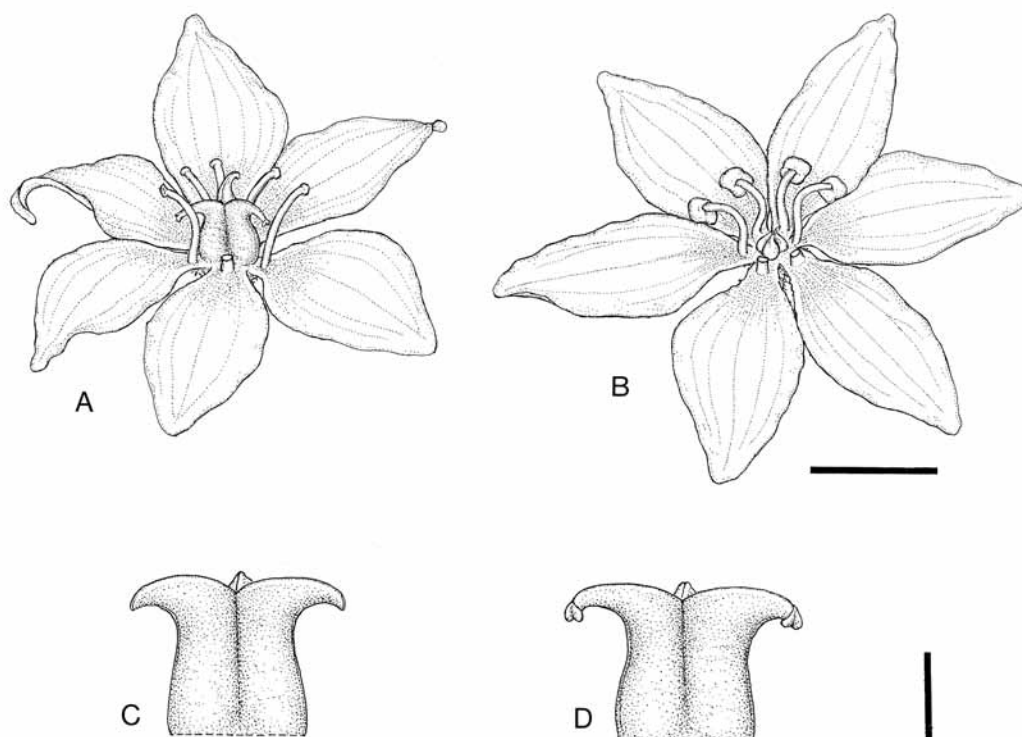


Fig. 5. *Veratrum shanense* (s. lat.) from Yunnan, China (Maire 2985, NY). A. Bisexual flower in female phase. Anthers fallen off. One filament removed from near base. B. Male flower with vestigial pistil. Two filaments removed from near base. C. Pistil in male phase of bisexual flower with closed stigmatic carpel. D. Pistil in female phase of bisexual flower with bilobulately open stigmatic carpel. Drawn by Noriyuki Tanaka. Upper scale bar = 3 mm for A and B. Lower scale bar = 1 mm for C and D.

In my observations also, the two forms are not clearly separable, due to the presence of transitional forms.

*Veratrum stenophyllum* var. *taroense* F. T. Wang & Z. H. Tsi (Tsi 1980) was based on a specimen from N.W. Yunnan. According to the description, this variety differs from var. *stenophyllum* by the papillose-puberulent veins on the abaxial surface of the leaves, shorter and more slender lateral racemes, and smaller flowers. The tepals are reported to be 4–4.5 mm long (vs. 5–7 mm long in var. *stenophyllum*) by Chen and Takahashi (2000). However, the difference in the tepal length is small. Further, the veins are often papillose in *V. shanense* (s. lat., including *V. stenophyllum* sensu Tsi 1980), and the papillose veins even occur in plants with

tepals over 5 mm long (tepals 5–5.5 mm long, Maire 6386, NY; 7–8 mm long in Ducloux s. n., NY; 7–10 mm long, Forrest 7027, E). Therefore var. *taroense* does not appear to be a distinct variety.

#### Sexual reproductive characters

Of the 23 individuals on herbarium sheets of *Veratrum shanense* (s. lat.) examined, 22 were andromonoecious. One smallest individual, about 33 cm in height including the inflorescence (one of the four individuals collected by Murata et al. 338, MAK), had only male flowers (i.e., androecious). In the andromonoecious plants, bisexual flowers (Figs. 2A, 5A) are mostly confined to the terminal raceme, while male flowers (Figs. 2B, 5B) to the lateral racemes. This observation agrees with the previous report

made on *V. yunnanense* by Loesener (1928). Andromonoecism appears to be prevalent in this genus, as it has also been reported in several other congeners (Müller 1883, Robertson 1896 [under *Melanthium*], Knuth 1909, Takeda 1910, Loesener 1928, Krause 1930, Makino 1940, Kitamura 1964, Okuyama 1966, Shimizu 1983, Zomlefer 1997).

It is apparent that the flowers of *Veratrum shanense* are entomophilous, as they bear nectaries on the tepals.

Bisexual flowers of *Veratrum shanense* (Figs. 2A, 5A) are dichogamous. In them, the maturity of the anthers precedes that of the stigmas. While the anthers are dehiscent and functioning, the carpel of a stigma remains closed along the suture (Fig. 5C), and hence the stigmas are not receptive of pollen. In this phase, the filaments are excurved distally and the anthers, which are extrorsely dehiscent, are turned towards the nectaries of the tepals. If a nectar-seeking small insect like a fly visits the flower, it must brush the anthers by its back and be dusted with pollen while moving on the tepals to sip the nectar. The flowers in this phase are functionally male. The anthers are fugacious, and after they have fallen off, the stigma comes to open, exposing the inner side (Figs. 5A, 5D). The stigmas are minutely bilobed and look to be receptive of pollen. The styles are strongly divergent and the stigmas are protruded from the assembly of the persistent nearly vertical filaments, so that the stigmas are likely to touch pollen-covered insects visiting the flowers. The flowers in this phase are functionally female (Figs. 2A, 5A). Bisexual flowers of *V. shanense* are, accordingly, strongly protandrous.

Protandry has been reported in several other species of *Veratrum*, such as *V. album* L. (Müller 1883, Knuth 1909), *V. virginicum* (L.) W. T. Aiton (Robertson 1896, under *Melanthium*) and *V. viride* Aiton (Mulligan and Munro 1987). This character also appears to be rather prevalent in the genus (Zomlefer 1997).

Protandry apparently facilitates cross-

pollination. In *Veratrum shanense*, many flowers of the same inflorescence bloom simultaneously, so that self-pollination may also take place. In this species, reproduction may mainly be achieved sexually, as vegetative reproduction, such as rhizomic propagation, appears to be minimal.

Meanwhile, in the male flowers of *Veratrum shanense* (Figs. 2B, 5B), dehiscent anthers are directed towards the nectaries of the tepals. As in the male phase of the bisexual flowers, small insects visiting the tepals for nectar are likely to be dusted with pollen by the anthers.

No report has been made on the pollinator for the flowers of this species. According to Müller (1883), the visitors to the flowers of *Veratrum album* are principally flies (Diptera). In *V. virginicum*, mostly flies and beetles (Coleoptera) are observed to visit the flowers (Robertson 1896, under *Melanthium*). In *V. woodii* Robbins ex A. W. Wood, several kinds of flies are observed to visit the inflorescence (Deam 1940).

### Taxonomic treatment

***Veratrum shanense*** W. W. Sm. in J. Proc. Asiat. Soc. Bengal 7: 75 (1911); J. H. Zimmerman in Kupchan & al. in Lloydia 24: 11 (1961); B. Mathew in Plantsman 11: 44, 49 (1989).

**Type:** Burma [Myanmar]. S. Shan States, R. W. MacGregor 826 (CAL). [Figs. 1–5]

*Veratrum stenophyllum* Diels in Notes Roy. Bot. Gard. Edinb. 5: 303 (1912), p.p., excl. Forrest 3039 (E); O. Loes. in Verh. Bot. Vereins Prov. Brandenburg 68: 144, 163 (1926); Repert. Spec. Nov. Regni Veg. 25: 3 (1928); Icon. Corm. Sin. 5: 427, t. 7684 (1976); Z. H. Tsi, Fl. Reip. Pop. Sin. 14: 29 (1980); B. Mathew in Plantsman 11: 48 (1989); X. Q. Chen & Hir. Takah., Fl. China 24: 85 (2000).

**Lectotype** (designated here): China. N.W. Yunnan. Eastern flank of the Lichiang Range, 9500–11000 ft, July 1906, G. Forest 2635 (E).

[Fig. 3]



*Veratrum yunnanense* O. Loes. in Verh. Bot. Vereins Prov. Brandenburg **68**: 144, 163 (1926), ut *V. junnanense*; Repert. Spec. Nov. Regni Veg. **25**: 3 (1928); Z. H. Tsi, Fl. Reip. Pop. Sin. **14**: 29, 1980, pro syn. sub *Veratro stenophyllo*; X. Q. Chen & Hir. Takah., Fl. China **24**: 85, 2000, pro syn. sub *V. stenophyllo* var. *stenophyllo*.

**Lectotype** (designated here): China. W. Yunnan. Eastern flank of the Tali Range, 8000–10000 ft, June–Aug. 1906, G. Forrest 4663 (E).

[Fig. 4]

*Veratrum stenophyllum* var. *taroense* F. T. Wang & Z. H. Tsi in Z. H. Tsi, Fl. Reip. Pop. Sin. **14**: 29, 282 (1980); X. Q. Chen & Hir. Takah., Fl. China **24**: 85 (2000).

Type: China. Yunnan. Taron-taru Divide, Oct. 1938, T. T. Yü 20813 (PE, non vidi).

Perennial herb. Rhizome thickened, subscapose, 1.5 cm long, producing fleshy fibrous contractile roots. Stem subscapose, simple, strict, 30 to 150 cm tall, including inflorescence, floccose distally, base subbulbose with membranous tunics tan to dark brown and usually fibrillose above. Leaves basal or subbasal, progressively reduced upwards, glabrous, sometimes papillose on veins of abaxial surface and on margins; basal or subbasal leaves narrowly elliptic to linear, recurved, acute to subobtusate at apex, clasping at base, to 60 cm long, 1.2–6 cm broad, upper cauline leaves narrowly lanceolate or sublinear. Panicle 14–87 cm long, floccose on axes; terminal raceme to 38 cm long; axes of lateral simple or compound racemes slender, to 15 cm long. Pedicels 1–5(–9) mm long (pedicels of terminal raceme usually slightly longer than those of lateral ones), floccose. Floral bracts ovate, lanceolate or sublinear, acuminate or acute, floccose abaxially and on margins, to 3 cm long. Flowers bisexual or male on same individual (andromonoecious), or occasionally only male on small individual (androecious); bisexual flowers mostly confined to terminal raceme, strongly protandrous; male flowers mostly confined to lateral racemes, with vestigial pistil; tepals 6 in 2 whorls, narrowly

elliptic, elliptic or ovate, (sub)acute to obtuse at apex, unguiculate or subunguiculate at base, entire, often sparsely hairy on margins, (4–)5–12 mm long, 2–4 mm broad, pale green to yellow, bearing narrowly flabellate or cuneate nectary on basal 1/5 to 1/4, slightly floccose-pubescent on basal abaxial surface especially of outer tepals, persistent. Stamens 6; filaments excurved above, becoming straighter or even slightly incurved above after anthers fallen off, 2–3 mm long, slightly dilated below, inserted to basal part of claw of each tepal, persistent; anthers basifixed, confluent unilocular, reniform or half-orbicular when closed, more or less orbicular when fully dehiscent, 0.6–0.8 mm long and broad, fugacious; pollen pale yellow. Pistil 1, tricarpellate, weakly syncarpous, truncate, (1.5–)2–3 mm long (excluding basal part sunken in receptacle); styles 3, separate, strongly divergent, recurved, rostrate; stigmas minutely bilobed at maturity; ovary ovoid, trigonous, trisulcate, trilocular, glabrous, slightly inferior, 2–3 mm long; ovules 11–14 per locule, biseriate on central marginal placenta. Capsules ovoid, deeply trisulcate, 1.3–2 cm long, septically-ventricidally dehiscent above when ripe, usually containing up to 8 seeds in each locule; seeds (including testa) oblong or narrowly oblong-ovate, subacute at apex, rounded at base, often slightly curved, complanate, broadly winged around, 8–9.5 mm long, 3–3.5 mm broad, straw-colored (in sicco).

Flowering period: (June–) July–August.

Ripening time: October–November.

Distribution: MYANMAR. S. Shan State. CHINA. N.Y. Yunnan (cf. Li 1997), S.W. Sichuan (cf. Yang 1991), and Guizhou (Tu 1990 and Tsi 2002).

Other specimens examined: CHINA. **Sichuan**: Southwest Szechuan. Dzampe sheren mountains, west of Wuato Gomba, eastern Muli, 11500 ft, May–June 1932, J. F. Rock 23755 (E). **Yunnan**: Prefectural District of Likiang, eastern slopes of Likiang Snow Range, 12000–13000 ft, May–Oct. 1922, J. F. Rock 4531 (NY), 5680 (E); eastern flank of the Lichiang Range, 11000–12000 ft, July 1910, G. Forrest 6202 (E); Lichiang Snow Range, 3400 m, 25 July

1937, T. T. Yü 15361 (E); Dali, Hua-dian-ba, 2950–3300 m, 10 Aug. 1990, J. Murata et al. 338 (MAK); eastern flank of the Tali Range, 10000 ft, Aug. 1920, G. Forrest 7027 (E); Dali Xian, Diancan Shan mountain range, vicinity of Huadianba herbal medicine farm, 3300 m, 18 July 1984, 1984 Sino-Amer. Bot. Exp. Yunnan 1126 (B. Bartholomew et al.) (E); behind Toung Tchouan, 2700 m, July 1910, Maire 2985, Série B (NY); Ma Hong, 3000 m, Nov. 1910, E. E. Maire 6386 (NY); sine loco, F. Ducloux s.n. (NY); Dali, Mt. Zhonghe, Canshan, 2700 m, 18 Oct. 1991, N. Tanaka et al. 134 (TEU).

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田中教之：ミャンマー産シュロソウ属の1種 *Veratrum shanense* W. W. Sm. (シュロソウ科) の分類と分布域の再検討

ミャンマーの中東部からシュロソウ属の1種 *Veratrum shanense* W. W. Sm. が記載されている (Smith 1911)。後に、中国の雲南省北西部からもこれに類似する同属の2種、*V. stenophyllum* Diels (1912) と *V. yunnanense* O. Loes. (1926, 1928), が記載された。中国のシュロソウ属を扱っている最近の植物誌 (たとえば中国植物誌 14 巻 [1980] や Flora of China, vol. 24 [2000]) では、*V. yunnanense* が *V. stenophyllum* と同種として扱われているが、近隣のミャンマー産の *V. shanense* については全く触れられていない。今回、基準となる標本を含めて資料を比較検討した結果、これらの3種は基本的性質において一致し、同一種と見なせることが判明した。これら3種が同一種であることは既に Zimmerman (1961) によって指摘されており、本研究結果はこの見解を支持する。上

記の中国産2種を包含した *V. shanense* (広義) は、ミャンマー中東部、中国の雲南省北西部、四川省西南部、および貴州 (Tu 1990, Tsi 2002) に分布する。*Veratrum stenophyllum* と *V. yunnanense* について、レクトタイプをそれぞれ指定した。

Tsi (1980) や Chen and Takahashi (2000) は、花がやや小型で、葉の裏面の脈上に乳頭状毛が出る1型を変種 *V. stenophyllum* var. *taroense* F. T. Wang & Z. H. Tsi として区別したが、これらの判別形質にも変異があり、変種として区別するのは困難である。

*Veratrum shanense* の個体の花序には通常雄花と両性花の両方がつく (雄花両性花同株 andromonoecism)。両性花は最頂の総状花序に偏在する傾向があり、完全な雄性先熟 (protandry) であることを確認した。

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