

Pueraria yunnanensis (Fabaceae) reinstated

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Pueraria yunnanensis Franch. has frequently been regarded as a synonym of *P. peduncularis* (Graham ex Benth.) Benth. After examining many of the types and other specimens, and observing their leaf epidermis under LM and seed coat under SEM, the specific status of *P. yunnanensis* is reinstated.

Key words: Fabaceae, *Pueraria yunnanensis*, taxonomy

Franchet (1889) described *Pueraria yunnanensis* using material collected in Tapintze, Yunnan province, China (Delavay 506; Figs. 1 and 2) which was characterized by long filiform pedicels and a small glabrous membranous calyx. At the same time he proposed a new variety, *P. peduncularis* (Graham ex Benth.) Benth. var. *violacea* Franch., which differed from the typical variety in the color and length of corolla. Both of the taxa proposed by Franchet have been regarded as synonyms of *P. peduncularis* (Wang & Tang 1955, Lackey 1977: 69–79, van der Maesen 1985, 2002, Lock & Heald 1994, Wu *et al.* 1994, Wu 1995). Van der Maesen (1985) considered that *P. yunnanensis* had only minimal differences, and fell completely within the range of variability of *P. peduncularis* var. *violacea*.

Lackey (1977: 69–79) suggested that *P. peduncularis* should be removed from *Pueraria*, because of its minute bracteoles, puckered calyx base and flat, papery pods. However, he recognized that tradition and stability of nomenclature were better served if the species were in

Pueraria. Van der Maesen (1985, 2002) and Le (2007) treated it as a distinct species in *Pueraria*.

After examining many types and specimens, we found some distinct and stable differences between *P. yunnanensis* and *P. peduncularis*. The taxonomic status of *P. yunnanensis* is here reinstated, and its morphology, distribution, phenology, leaf epidermis under LM and seed coat under SEM are compared with *P. peduncularis*.

We observed several new distinguishing morphological characters in the type of inflorescence and the shape of seeds, which support the treatment of *P. yunnanensis* and *P. peduncularis* as two distinct species. In *P. yunnanensis*, the pseudoraceme with (2–)3–7 flowers cluster like an umbel on the rachis, and flowers develop from the bottom upwards; pods are membranaceous and glabrous; seeds are snuff-colored to black, kidney-shaped, 2.8–3.4 mm long, 4.3–5.2 mm wide, 0.9–1.4 mm thick. In *P. peduncularis*, the nodose pseudoraceme with four or more flowers per node clustered like a glomerule on the rachis,

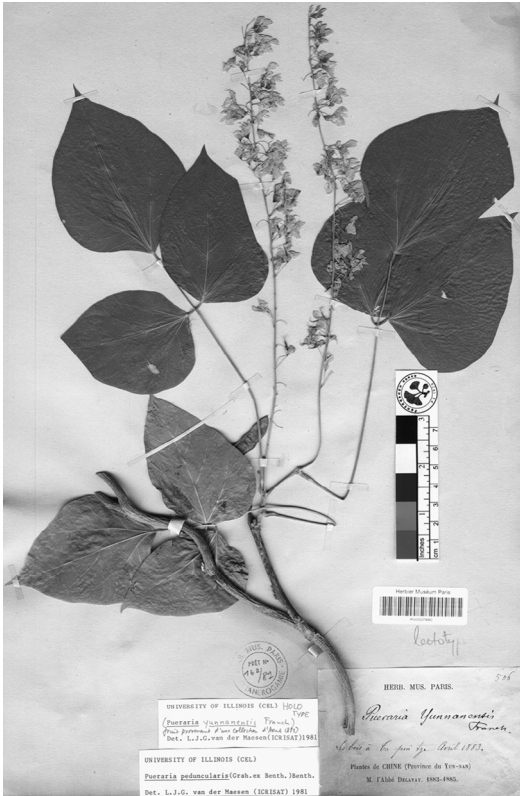


Fig. 1. The lectotype of *Pueraria yunnanensis*.



Fig. 2. A paratype of *Pueraria yunnanensis*.

and one or two flowers may develop while others are still undeveloped buds; pods are papyraceous and pubescent; seeds are dark mahogany to black with red streak, oval, 2.1–2.5 mm long, 3.3–3.9 mm wide, 1.2–1.8 mm thick. In our opinion the inflorescence and fruit are reliable diagnostic features. The differences between *P. yunnanensis* and *P. peduncularis* are given in more detail in Table 1.

The independent taxonomic status of *P. yunnanensis* is also supported by the characters of the leaf epidermis under LM and the seed coat under SEM. We examined the leaf epidermis from different populations. The leaf epidermal characters of the two taxa are very distinct. On the adaxial epidermis, the cells are polygonal and the anticlinal walls are straight to curved in *P. yunnanensis* (Fig. 3A), while the cells are irregular and the anticlinal walls are repand in *P. peduncularis* (Fig. 3C). The stomata on the abaxial epidermis are smaller and less closely spaced than in *P. yunnanensis* (Table 2 and Fig.

3B and D). The seed coat features are also different. Their seed coat ornamentations are both favulariate, a finely ribbed surface separated by zigzag furrows. In *P. yunnanensis*, the ridges are narrow and full of sporadic granules; the furrows are full of coiled granules and white stain (Fig. 4A–C). However, in *P. peduncularis*, the ridges look like rolling mountains, with sporadic granules upon the ridges; both sides of the ridges and the furrows are indented (Fig. 4D–F). Therefore, the leaf epidermis and seed coat, as well as other morphological characters support recognition of *P. yunnanensis* and *P. peduncularis* as two distinct species.

According to Articles 8.2 and 9.4 of the International Code of Botanical Nomenclature (McNeill *et al.* 2006), the types of *P. yunnanensis* are syntypes consisting of two collections: Apr. 1883 two sheets; Aug. 1885 one sheet, although they were collected by Delavay from the same locality and given the same code. Van der Maesen (1985) apprehended mistakenly the

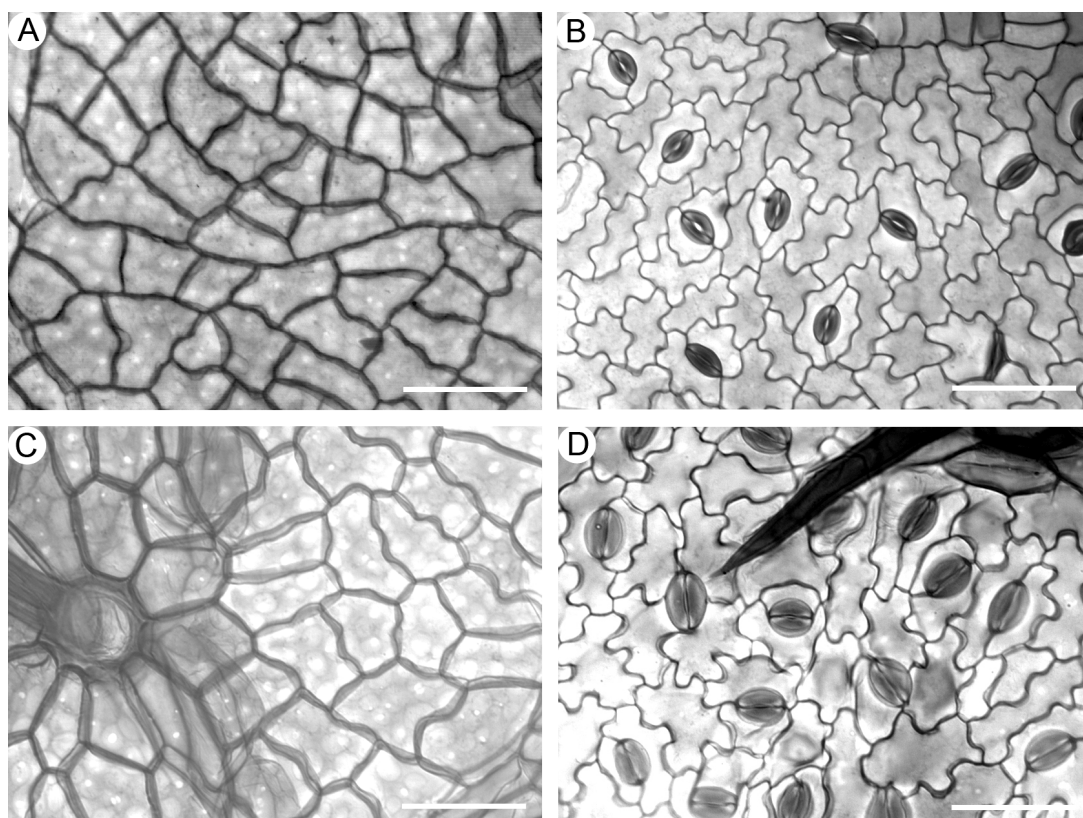


Fig. 3. Characteristics of epidermal cells (LM). — **A** and **B:** *Pueraria yunnanensis*. **A:** Adaxial epidermis. **B:** Abaxial epidermis. — **C** and **D:** *P. peduncularis*. **C:** Adaxial epidermis. **D:** Abaxial epidermis. Scale bar = 50 μ m.

Table 1. Comparison between *Pueraria yunnanensis* and *P. peduncularis*.

Character	<i>P. yunnanensis</i>	<i>P. peduncularis</i>
Leaflets	membranaceous, glabrous or pubescent on the vein; apex long-acuminate, base obtuse	papyraceous, dense pubescent when young, lessen when grown; apex acute, base acute
Inflorescence	pseudoraceme with (2–)3–7 flowers clustered-like umbel, flowers develop from the bottom upwards	nodose pseudoraceme with 4–7 flowers per node clustered-like glomerule, one or two flowers may develop while others are still undeveloped buds
Flowers	yellow or white	purple, blue, mauve or purple only on the tip of wing and keel while other parts white
Standard	orbicular-ovate, ca. 11 mm long, ca. 8 mm wide, auricles inflexed	obovate, 11–12 mm long, 6–7 mm wide, auricles truncate
Wing	7–8 mm long, ca. 3 mm wide, claw ca. 4 mm long	7.5–10 mm long, ca. 3 mm wide, claw ca. 3 mm long
Keel-petals	oblong, 6–6.5 mm long, ca. 3 mm wide, claw ca. 4 mm long, obtuse at apex	obovate, 7–9 mm long, ca. 4 mm wide, claw 3–4 mm long, right-angled at apex
Stamen	10–10.5 mm long	11–15 mm long
Pod	membranaceous, glabrous, obtuse at apex, 3.4–7.8 cm long, 0.7–1.1 cm wide	papyraceous, pubescent, acuminate at apex, 4–7.5 cm long, 0.5–0.8 cm wide
Seeds	kidney-shaped; 2.8–3.4 mm long, 4.3–5.2 mm wide, 0.9–1.4 mm thick	oval; 2.1–2.5 mm long, 3.3–3.9 mm wide, 1.2–1.8 mm thick

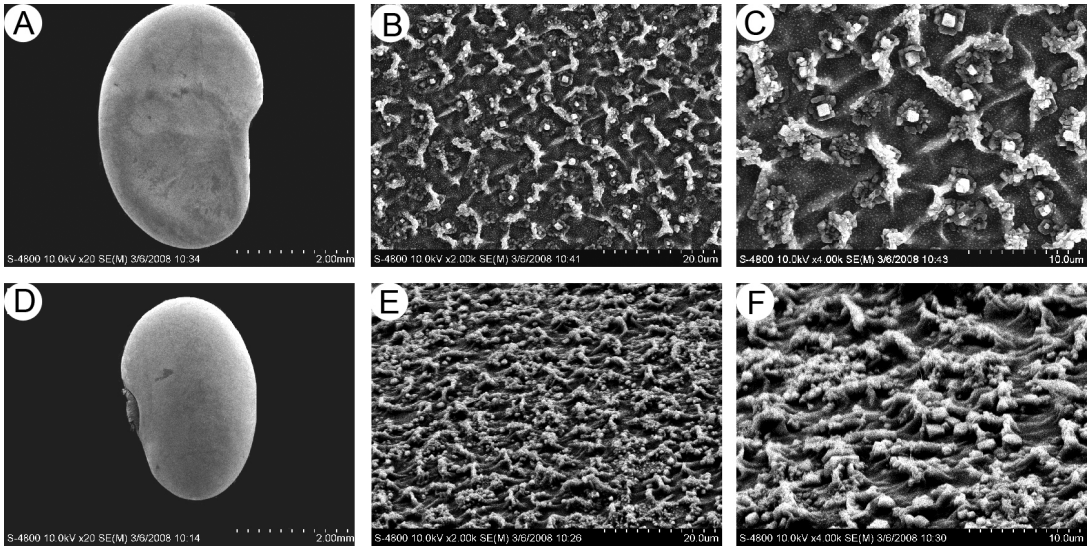


Fig. 4. SEM photographs of seeds and seed-coats. — A–C: *Pueraria yunnanensis*. — D–F: *P. peduncularis*.

original material as one collection and designated two flowering sheets as a holotype and an isotype. The name *P. yunnanensis* is lectotypified in accordance with the Article 9.9 of McNeill *et al.* (2006).

Pueraria yunnanensis Franch.

Pl. Delav. 181. 1890. — LECTOTYPE (designated here): China. Yunnan, Tapintze, IV. 1883 *Delavay 506* (P!; isolectotypes P!).

Derris bonatiana Pamp., Nuovo Giorn. Bot. Ital., n.s. 17(1): 8. 1910. — TYPE: China. Yunnan, source of the Pe-long-tan, 8.V.1904 *Ducloux 377* (lectotype FI).

LIANA. Stems striate, pubescent when young, glabrous when developed. Stipules lanceolate, basifixed. Leaves pinnately trifoliolate, entire, membranaceous, glabrous or pubescent on vein;

terminal leaflets symmetrical, broadly ovate to rhomboid, apex long-acuminate, base cuneate or obtuse; lateral leaflets obliquely so. Pseudoraceme axillary, flowers (2–)3–7 clustered-like umbel, sometimes 1–2 flowers sterile, flowers develop from bottom upwards, yellow or white; bracts linear, caducous, and bracteoles 2 per flower, setiform, caducous. Calyx membranaceous, subglabrate, 4 mm long, tube ca. 3 mm long, upper two teeth completely connate, obtuse at connate part, lateral lobes acuminate at apex. Pedicel tenuous, more than 4 mm long. Standard orbicular–ovate, ca. 11 mm long, ca. 8 mm wide, apex emarginated, claw ca. 2 mm long, auricles inflexed, no callosities; wings banner oblong, 7–8 mm long, ca. 3 mm wide, claw ca. 4 mm long; keel-petals 6–6.5 mm long, ca. 3 mm wide, claw ca. 4 mm long, obtuse at apex. Stamens monadelphous, vexillary stamen free, 10–10.5

Table 2. Leaf epidermal characters of *Pueraria yunnanensis* and *P. peduncularis*. Irr = irregular; Pol = polygonal; Str-curv = straight to curved; Rep = repand; Sin = sinuous; Ano = anomocytic; Ani = anisocytic; Par = paracytic.

Taxon	Adaxial epidermis		Abaxial epidermis		Size of stomata (μm)	Stomatal index (%)	Stomatotype (%)		
	Shape of cells	Pattern of anticlinal walls	Shape of cells	Pattern of anticlinal walls			Ano	Ani	Par
<i>P. yunnanensis</i>	Pol	Str-curv	Irr	Sin	18.78 × 11.22	14.14	6.56	7.67	85.77
<i>P. peduncularis</i>	Irr	Rep	Irr	Sin	21.85 × 14.54	22.43	23.07	14.59	62.33

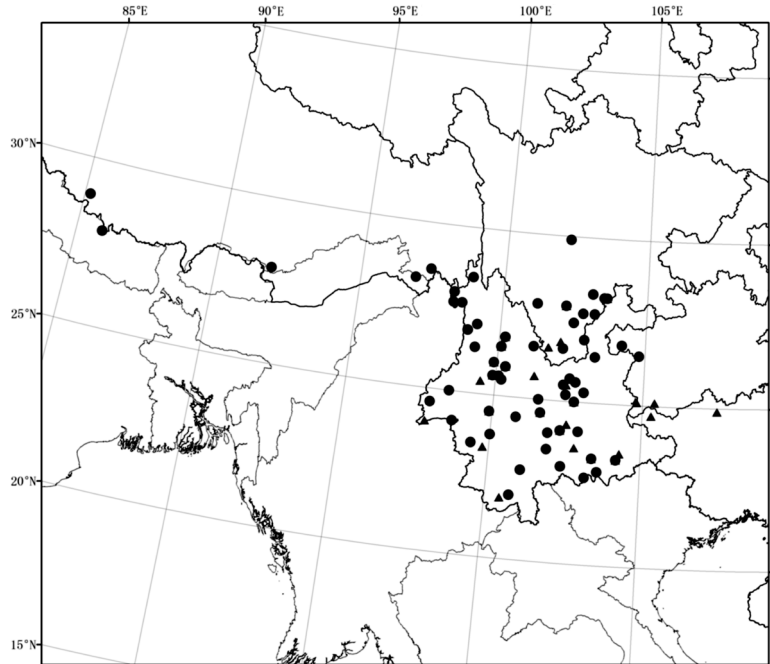


Fig. 5. Distribution of *Pueraria yunnanensis* (▲) and *P. peduncularis* (●) in China.

mm long. Pistil sessile, flattened, ca. 10.5 mm long, with disk at base. Pods membranaceous, glabrous, flattened-oblong, 3.4–7.8 cm long, 0.7–1.1 cm wide. Seeds kidney-shaped, 4.5–5 mm long, ca. 3 mm wide, ca. 1 mm thick. Flowering April–June, fruiting May–December.

ECOLOGY. On thickets, ravines, wet woodland, near streams or on dry sandy soil or rocks on slopes.

DISTRIBUTION. Known only from Guangxi, Guizhou, Sichuan and Yunnan in China (Fig. 5). Alt. 1000–2300 m.

SELECTED SPECIMENS EXAMINED: — **China.** Guangxi: *C. F. Liang & T. L. Wu, 32490* (IBSC, photograph); Guizhou: Anlong, Longguang Gongshe, Yonghe, upon thickets, 1100 m, *Guizhou Exped. 4003* (PE); Sichuan: Xichang, Lushan, 1700 m, *L. N. Zhao 2090* (PE); Yunnan: Kunming, from Longwangsi to Xiaorulang, *T. N. Liou 20821* (PE). A complete list of 43 examined specimens is available from the authors.

***Pueraria peduncularis* (Graham ex Benth.) Benth.**

J. Linn. Soc., Bot. 9: 124. 1867. — *Neustanthus peduncularis* Graham ex Benth., Pl. Jungh. 2: 235. 1852. — *Pueraria peduncularis* Graham, Numer. List: n. 5354, 1831–1832,

nom. nud. — TYPE: Nepal. Graham, *Wallich Cat. No. 5354* (holotype K! photograph seen).

Pueraria peduncularis (Graham ex Benth.) Benth. var. *violacea* Franch., Pl. Delav. 182. 1890. — TYPE: China. Yunnan, in the woods of Hoang-li-pin, above Tapintze, 18.VIII.1885 *Delavay 1983* (lectotype P!).

LIANA. Stems striate, pubescent. Stipules lanceolate, basifixed. Leaves pinnately trifoliolate, entire, papyraceous, dense pubescent when young, lessen when grown; terminal leaflets symmetrical, ovate to rhomboid, apex acute, base acute; lateral leaflets obliquely so. Nodose pseudoraceme with 4–7 flowers per node in a cluster-like glomerule, one or two flowers may develop while others are still undeveloped buds; purple, blue, mauve or purple only on tip of alae and keel while other parts white; bracts linear, caducous, and 2 bracteoles per flower, setiform, caducous. Calyx papyraceous, adpressed pubescent, 4–5 mm long, tube 3–3.5 mm long, upper two teeth connate or almost connate, obtuse at connate part, lateral lobes acuminate at apex. Pedicel tenuous, ca. 4 mm long. Standard obovate, 11–12 mm long, 6–7 mm wide, apex emarginate, claw ca. 2 mm long, auricles truncate, no callosities; wings banner oblong, 7.5–10 mm long, ca. 3 mm wide, claw ca. 3 mm long; keel-

petals obovate, 7–9 mm long, ca. 4 mm wide, claw 3–4 mm long, right-angled at apex. Stamens monadelphous, vexillary stamen free, 11–15 mm long. Pistil sessile, flattened, ca. 12–15 mm long, with disk at base. Pods papyraceous, pubescent, acuminate at apex, 4–7.5 cm long, 0.5–0.8 cm wide. Seeds oval; 2.1–2.5 mm long, 3.3–3.9 mm wide, 1.2–1.8 mm thick. Flowering (April) June–November, fruiting August–December.

ECOLOGY. On open pasture, upon thickets, in ravines, on moist forested slope, under secondary broadleaved evergreen mixed forest and scrub, on wet woodland, near road and river side, on rock cliff.

DISTRIBUTION. Known only from Guizhou, Sichuan, Xizang and Yunnan in China (Fig. 5). Alt. 800–4300 m.

SELECTED SPECIMENS EXAMINED: — **China.** Guizhou: Shuicheng, on hill slopes, *P. C. Tsoong 1779* (PE); Sichuan: Butuo, the Jiaojihe opposite hill, shady roadside in the slope of forests, 2400 m, *Sichuan Econ. Pl. Exped. 5817* (PE); Yunnan: Heqing, N of Lianping, upon thickets, 2600 m, *R. C. Ching 23704* (PE); Xizang: Zayü, near Nong-Ken-Tuan, in evergreen forest and ravine, 1500 m, *C. C. Ni & Y. Z. Wang 0481* (PE). A complete list of 127 examined specimens is available from the authors.

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