



Pueraria stracheyi, a new synonym to *Apios carnea* (Fabaceae)

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Abstract

Pueraria stracheyi has long been recognized as erroneously placed in the genus *Pueraria*. Here we examined the history behind this collection, past hypotheses concerning its taxonomic affinities, and morphological and ecological comparisons with *Shuteria* and *Apios carnea*, wherein we conclude that *Pueraria stracheyi* represents a synonym of the latter.

Key Words: Leguminosae, taxonomy, India, Sir Richard Strachey, *Shuteria*

Introduction

Pueraria stracheyi Baker (1876: 198) was described from a single collection made by Sir Richard Strachey, the species' namesake, and Mr. J.E. Winterbottom during their 1848 expedition across the Himalayas that extended from the Rohilkhand Plains of Uttarakhand (formerly designated the province of Kumaon) to Rakas-Tal and Manasarowar Lakes of Tibet. This expedition produced the bulk of plants that constituted the Strachey & Winterbottom Herbarium, a collection of over 2000 specimens enumerated in the *Catalogue of the Plants of Kumaon and of the Adjacent Portions Garhwal and Tibet: Based on the Collections Made by Strachey and Winterbottom During the Years 1846 to 1849 and on the Catalogue Originally Prepared in 1852* (Strachey 1906). The collection "...was principally made along a line extending through the province of Kumaon, across the Himalaya in a direction generally perpendicular to that of the ranges of mountain of which the chain consists, over a distance of some eighty or ninety English miles. The region traversed passes from South-West to North-East, commencing in the plain of Rohilkhand at an elevation of about 1,000 ft. above the sea-level, through the snowy ranges, following for the most part the customary routes, and terminating in the Tibetan plateau at an altitude of between 14,000 and 15,000 ft. on the upper course of the river Sutlej." Very little is known about this collection. To our knowledge, only one herbarium specimen exists and is found at Kew Herbarium (K) (Fig. 1).

Geography

Pueraria stracheyi is annotated as collected from 'Kalimundi', Kumaon province around 7300 ft. This locality information is confirmed in print in the above mentioned catalogue (pg. 50–51; Strachey 1906). 'Kalimundi' is a locality listed on numerous collections by Strachey & Winterbottom, but is rarely mentioned in any other context and not found in any online gazetteer. A rigorous internet search aimed at determining the geographical placement of "Kalimundi" yielded only two results. The first originates from a random text upload (source unknown) discussing the geographic range of *Cupressus tortulosa* D. Don ex Lambert (1824: 18), stating "In north-eastern Kumaun, it occurs along the Kalimundi range, separating the Ramganga from the Gori..." (<http://202.41.82.144/rawdataupload/upload/0105/106/TXT/00000861.txt>; accessed on 3 April 2015). The second clue comes from the work of Gibbons & Spanner (2009) during their study of *Trachycarpus takil* Beccari (1905: 50) in Northern India: "Kalamuni (or

Kalimundi) is a steep limestone ridge above Gini Village in Pithoragarh District, over which a small pass road winds between the towns of Girigaon and Munsyari.” Using these clues, we were able to determine that the likely location of the collection was along the Munsyari-Thal Road, between Ginni village and Munsyari, a span of about 30 km that encompasses elevations from 6300 feet and above, including the top of the pass at Kalamuni of 9027 ft. This road spans the watersheds that feed the Ramganga and Goriganga rivers and represents a trade route used for centuries by nomadic tribes, herders, and traders to travel between Thal and Munsyari where annual trade fairs were held. Munsyari is near the Goriganga river, is the gateway to the Johar valley of the inner Himalayas, and lies on an ancient salt and trade route that connects Tibet to the Rohilkhand plains of India. It is highly likely that this “customary route” would have been employed by Strachey and Winterbottom during their expedition. A map drawn to illustrate the regions of Strachey’s expeditions include this area (Fig. 2; Strachey 1851).

Ecology

Strachey gives us further clues as to the true location of *Pueraria stracheyi* in his detailed botanical account in his treatise *On the Physical Geography of the Provinces of Kumáon and Garhwál in the Himálaya Mountains, and of the Adjoining Parts of Tibet* (1851: 74–79). In the temperate elevation zone between 6000–8000 feet, Strachey discovered that Oak (*Quercus* Linnaeus (1753: 994) spp.; Fagaceae) and *Rhododendron* Linnaeus (1753: 392) were plentiful, along with Andromeda (*Pieris Formosa* (Wallich) D. Don (1834: 159); Ericaceae). Strachey (1851: 75) also noted “The peculiarities of the climate, which even in the higher parts of the mountains partakes of a certain share of the extreme heat and wet of the tropics, produce corresponding peculiarities in the features of the vegetation in these more elevated regions. We thus still find a palm (*Chamaerops*) reaching an elevation of upwards of 8000 feet, a little below which it grows to a height of more than 50 feet in a locality where it is regularly covered with snow every winter.” In 2009, Gibbons and Spanner (2009: 98) described a similar forest composition: “While adjacent slopes have long been cleared of any forest, the Kalamuni ridge is still mostly covered by majestic *Cupressus torulosa*, large evergreen oaks and massive *Rhododendron* trees. Scattered among them on SW, W and N facing slopes around 2200 m a.s.l. were mostly juvenile *Trachycarpus* and some mature, reproducing trees.” Strachey’s *Chamaerops* was likely *Chamaerops fortunei* Hooker (1860: tab. 5221), the northernmost distributed palm in the world, now known as *Trachycarpus fortunei* (Hooker) Wendland (1861: 429) as detailed by Gay (1861). The vegetative accounts of Strachey (1851) and Gibbons and Spanner (2009), along with the notation of *Cupressus torulosa* from the above-mentioned website, confirm the unique forest composition of ‘Kalimundi’ or Kalamuni and help to definitively place the collection locality of *Pueraria stracheyi* (Fig. 2).

Previous Hypotheses concerning *Pueraria stracheyi*

Other botanists before us have suspected the erroneous alliance of *P. stracheyi* within the genus *Pueraria*. In his comprehensive dissertation work on phaseoloid legumes, James A. Lackey completed a detailed review of *Pueraria* de Candolle (1825: 97), wherein he groups *P. stracheyi* in his group D, those species that should be removed from *Pueraria*, stating “The only poor material I have seen resembles a *Shuteria*.” (Lackey 1977). The only specimen Lackey would have had access to was at the Kew herbarium (K), the same sheet referred to as the holotype of *P. stracheyi* by van der Maesen (1985) who excluded it from *Pueraria* based on Lackey’s hypothesis (see Plate 30 of van der Maesen (1985) for a photograph of the specimen). Lackey suggests it to be a species of *Shuteria* Wight & Arnott (1834: 270), a genus of 5–6 species (Sa and Gilbert 2010a; Thuan 1972). That said, Lackey gives no clue as to why he hypothesizes this or any indication of which *Shuteria* species it most resembles. From our study of *Shuteria*, the only possible species Lackey could have thought on was *Shuteria hirsuta* Baker (1876: 198), a species described by Baker in the same volume as *Pueraria stracheyi* (1876: 182). This is the only *Shuteria* species that has flowers larger than 1 cm with ovate-acuminate leaves. The one poor specimen of *P. stracheyi* available to Lackey superficially resembles *S. hirsuta* in its leaves and large flowers, and yet, *P. stracheyi* is better described as having obovate-oblong to oblong leaves (vs. ovate leaves with acuminate apex in *S. hirsuta*) that are commonly caudate (vs. acuminate in *S. hirsuta*) with flowers greater than 1.5 cm long (rarely exceeding 1.2 cm in *S. hirsuta*). The holotype of *Pueraria stracheyi* clearly differs from *S. hirsuta* in flower size, inflorescence length, flower color, keel shape, and other morphological features (Table 1; see Appendix 1 for specimens examined). Here, we reject the assertion that *P. stracheyi* is a *Shuteria* species.

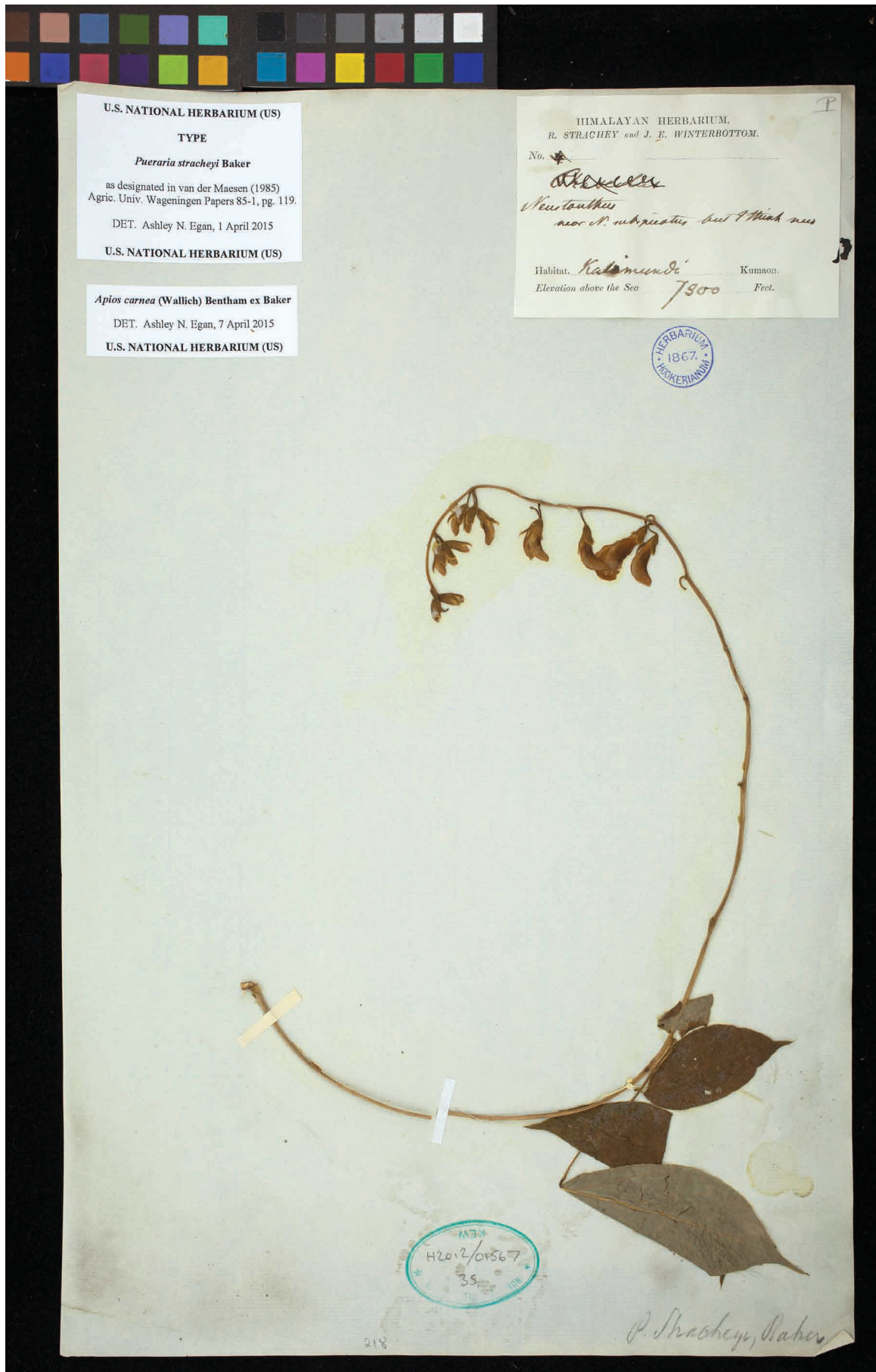


FIGURE 1. Holotype of *Pueraria stracheyi* Baker collected by *Strachey & J.E. Winterbottom* s.n. (K). Photographed with permission by Ashley N. Egan while on loan to the U.S. National Herbarium (US).

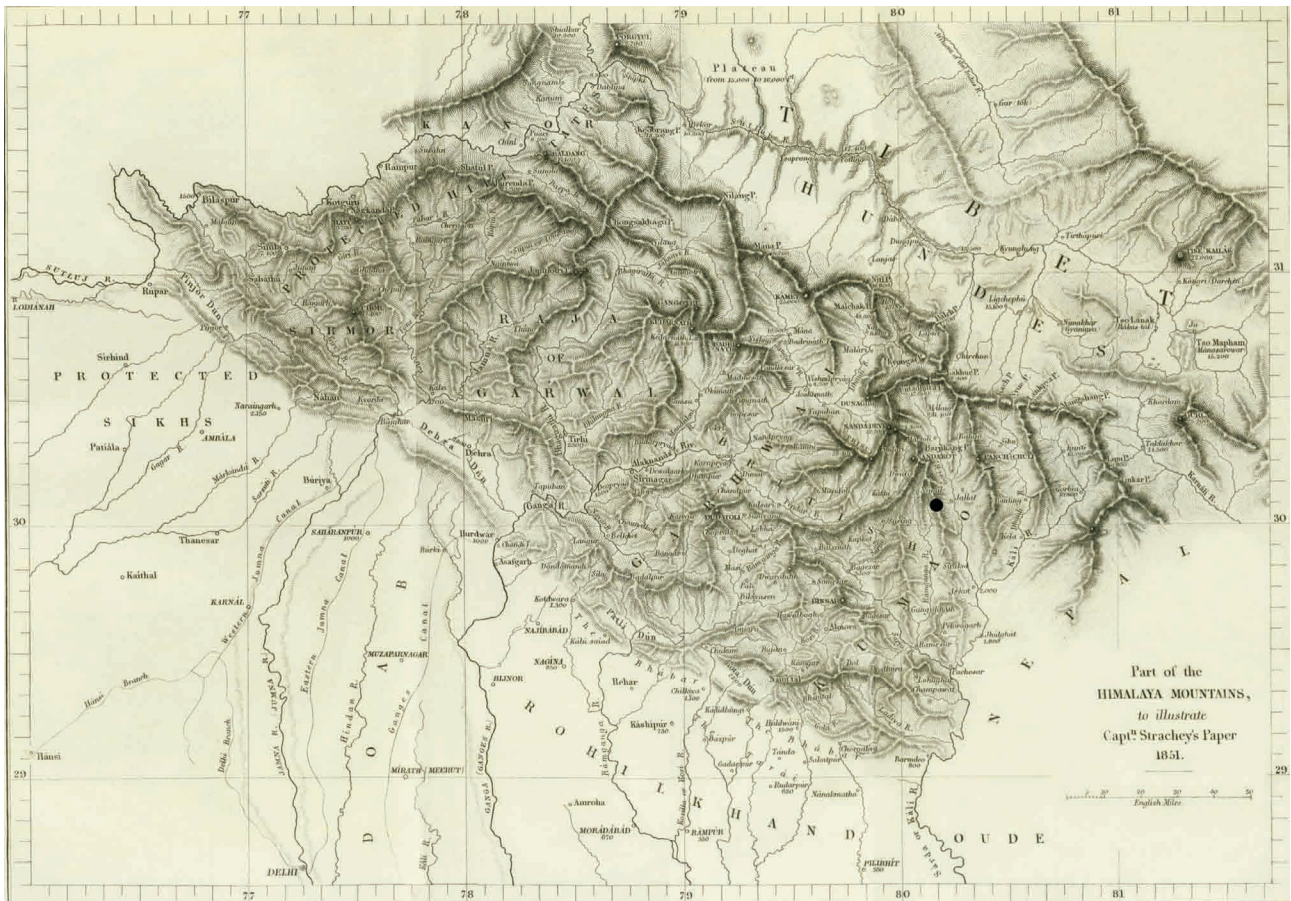


FIGURE 2. Map illustrating the area of Sir Richard Strachey's expeditions, including that accompanied by J.E. Winterbottom in 1848. Black dot represents the likely locality of *Pueraria stracheyi* Baker. Map reproduced from Strachey (1851). Map drawn by John Arrow Smith. Courtesy of JSTOR.

TABLE 1. Morphological comparisons of *Pueraria stracheyi* with *Shutteria hirsuta* and *Apios carnea*.

	<i>Shutteria hirsuta</i>	<i>Pueraria stracheyi</i>	<i>Apios carnea</i>
leaflet shape	ovate	obovate-oblong	obovate-oblong to oblong
No. of leaflets	3	5	5
leaflet apex	acuminate	caudate	acute to caudate
inflorescence length	to 16 cm	~27 cm	to 40 cm
No. flowers per node	2	3+	1–many
corolla color	white tipped with purple	reddish	pink, red, or orange
flower length	12 mm	15–25 mm	15–25 mm
keel shape	linear	curved	linear, curved, to circular

Similarities to *Apios carnea*

A key feature that stands out on the holotype of *Pueraria stracheyi* (Fig. 1) is the distinct curvature of the flowers in bud. Author A.N. Egan first saw flower buds with a similar shape whilst collecting legumes in Thailand in 2013 where she collected *Apios carnea* (Wallich 1830: 50) Bentham ex Baker (1876: 188). The same distinct curvature was observed by author B. Pan during his collection of *Apios carnea* in Menghai County, Yunnan, China, a photograph of which is shown in Figure 3. Upon further investigation, both authors concluded that *P. stracheyi* is actually an *Apios*. In the same volume where he described *P. stracheyi*, Baker also described *Apios carnea*, therein attributed to Bentham. *Apios* Fabricius (1759: 176) is a genus of about eight species. Like a number of other East Asian genera, *Apios* has a disjunct distribution with six species in East Asia and two species endemic to North America (Sa and Gilbert 2010a).

Apios is easily distinguished by its large, usually strongly curved keel with highly reduced wing petals relative to the standard and keel petals. It also has a curved staminal column with a circular style. These features coupled with leaves having (3–)5–9 leaflets place the genus as somewhat uncharacteristic within *Phaseoleae*. Phylogenetically, *Apios* is suggested to be the sister to remaining phaseoloid legumes (Egan *et al*, unpublished data).

Apios carnea is distinct from its Asian congeners by having red, reddish purple, or orange flowers coupled with leaflets longer than 5 cm (Sa and Gilbert 2010b). In addition, it is the only Asian species with inflorescences commonly longer than 30 cm (B. Pan, personal observations; Sa and Gilbert, 2010b). *Apios carnea* shares similar flower color with its American congeners, *A. americana* Medikus (1787: 355) and *A. priceana* B.L. Robinson (1898: 451), but is differentiated by its longer calyx lobes: the top two fused calyx lobes are 4–5 mm long in *A. carnea* whereas the American species exhibit a top calyx lobe that is almost truncate, with a length of less than 1 mm (Woods 2005). The longer calyx lobes are markedly evident in Figure 3. Furthermore, *A. carnea* has a long, lax inflorescence that often exceeds 30 cm whilst those of *A. priceana* and *A. americana* are densely flowered with inflorescence lengths usually less than 16 cm long.



FIGURE 3. Flowers and buds of *Apios carnea*. Note the caudate leaf apex in the upper left hand corner. Locality: Hesong, Menghai County, Xishuangbanna, Yunnan, China. Photographed by Bo Pan.

The holotype of *Pueraria stracheyi* (Fig. 1) fits well within the description of *Apios carnea*. Although the flowers on the holotype are not quite open, the largest shows the distinctly curved keel petal (Fig. 1). *Pueraria stracheyi* is described as being a scandent herb with red flowers that was found flowering in August (Strachey 1906), a description that fits perfectly with that of *Apios carnea* (Sa and Gilbert 2010b). *Pueraria stracheyi* shares a number of leaf features with *Apios carnea*, including obovate-oblong leaflets with a caudate apex and darker green coloration above with a paler coloration below (Table 1). In addition, flower features also unite the two: *P. stracheyi* has a flower length

exceeding 2 cm, pedicel length of 5 mm, a calyx of ~1 cm with distinct calyx lobes, the upper two lobes entirely connate, 4–5 mm long, the shorter, lateral lobes deltoid, 2–3 mm, and the lower lobe lanceolate, 4–6 mm long. Lastly, according to collection records collated by the Global Biodiversity Information Facility (www.gbif.org), *Apios carnea* is distributed throughout southeast Asia and is prevalent across the Himalayas. The collection that was later described as *Pueraria stracheyi* fits easily into the range described for *Apios carnea* (Fig. 4). The conglomeration of matching features leaves no doubt that *P. stracheyi* is actually *Apios carnea*. We here designate *Pueraria stracheyi* as a synonym of *Apios carnea*. A key to species is also presented.

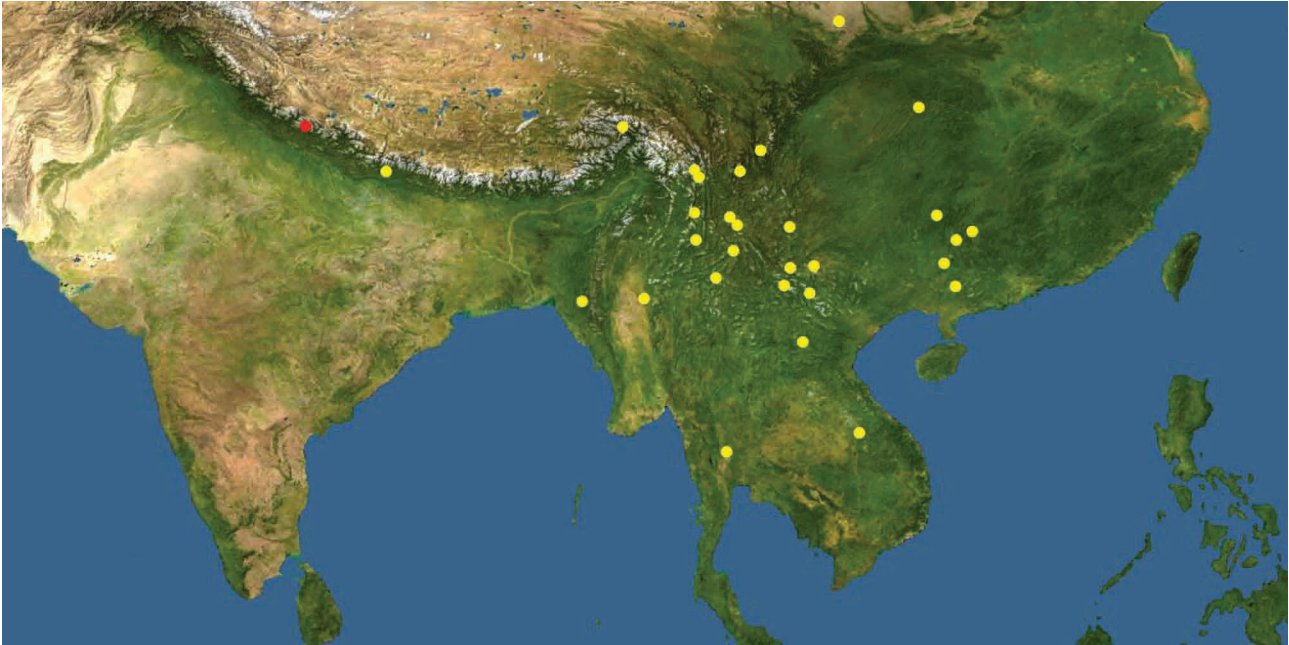


FIGURE 4. Distribution of *Apios carnea* in Asia (yellow dots); probable locality for *Pueraria stracheyi* (red dot). Data collected from the Global Biodiversity Information Facility.

Key to species of *Apios*:

1. Stipule 4 mm long or greater and plants of North America2
- Stipule 4 mm long (up to 6 mm in *A. delavayai*) or less and plants of Asia3
2. Stipule 4–6.5 mm long, pedicel 2–3 mm long, flowers deep maroon to pale maroon with white, standard 10.5–12.5 mm long
..... *A. americana*
- Stipule 7–9 mm long, pedicel 4–5 mm long, flowers pale green suffused with rose purple, standard 12–15(–18) mm long
..... *A. priceana*
3. Flower red, reddish purple, or orange; leaflets usually more than 5 cm *A. carnea*
- Flower green, yellow, or purple; leaflets usually less than 5 cm4
4. Flowers paired on top of a single, common pedicel, corolla purple, leaflets oblong-linear to narrowly lanceolate, usually less than 1.2 cm in width
..... *A. gracillima*.
- Flowers each on their own pedicel, corolla light yellow to light green, sometime suffused with light purple, leaflets lanceolate to ovate-lanceolate or ovate, usually more than 1.2 cm in width5
5. Standard greater than 1.6 cm long6
- Standard less than 1.6 cm long7
6. Leaflets lanceolate, generally less than 2 cm wide, flowers 1–3 per node *A. delavayai*
- Leaflets lanceolate to ovate-lanceolate, 2–3.5 cm wide, flowers 2 per node *A. macrantha*
7. Leaflets ovate to rhomboid-ovate, flowers yellowish green or light green, keel coiled, style coiled, plants of China and Japan
..... *A. fortunei*
- Leaflets ovate to ovate-lanceolate, flowers yellowish light purple, keel extended and inflexed but not coiled, style twisted, plants of Taiwan *A. taiwaniana*

Taxonomy

Priority between the names *Pueraria stracheyi* and *Apios carnea* has not been established, as they were both described by Baker in the same volume. Here we designate *Apios carnea* as having priority due to the genus being described by

Philipp Conrad Fabricius in 1759, as well as for nomenclatural stability and ease of implementation: many thousands of specimens are annotated as *Apios carnea*.

Apios carnea (Wallich) Bentham ex Baker (1876: 188).

Basionym:—*Cyrtotropis carnea* Wallich (1830: 50).

TYPE:—NEPAL. *Wallich* 5527 (lectotype, E! isolectotype K!,E!).

=*Pueraria stracheyi* Baker (1876: 198), *syn nov.*

TYPE:—INDIA. Uttarakhand: Kumaon, Kalimundi, 7300 ft. *Strachey & Winterbottom s.n.* (holotype K!). Fig. 1.

Stems twining, slender, glabrescent. Leaves pinnately (3)5-foliolate, green above, paler below; stipules caducous; petiole glabrous; leaflets opposite, obovate-oblong to oblong, membranous, sparsely hairy to glabrate, base cuneate to rounded, apex acuminate or acute, shortly caudate. Inflorescence a long, lax raceme, lower pedicels fascicled with 5+ flowers per node, becoming solitary above. Bracts and bracteoles minute, caducous. Calyx campanulate, 2-lipped; lobes shorter than the tube, upper two calyx lobes connate, lower tooth lanceolate, lateral teeth shorter, deltoid. Corolla red to reddish-purple or orange, ~twice as long as the calyx, standard 1–2.5 cm; wings shorter than the keel; keel narrow, to 2 cm, strongly curved to more rarely linear. Filament to 2 cm. Style strongly curved to circular. Legume linear, compressed, to 20 cm long, straight or very slightly curved, glabrous, apex beaked. Seeds dark brown, shiny.

Distribution:—Cambodia, China, Himalaya (N. India, Nepal, Bhutan), Laos, Myanmar, Thailand, Vietnam (Fig. 4).

Habitat:—Forests, riversides, roadsides, rock outcrops; 400–2600 m.

Specimens Examined:—**CHINA. Hunan:** Xinning Xian, Ziyun Shan, 1150 m, 14 September 1984, Zhen-Yu Li 1931 (US). Tibet: Tse-Kou, 1908, Abbe Monbeig s.n. (US). **Yunnan:** Between Tengyueh and Lungling, October 1922, J.F. Lock 7094 (US); Chien-chuan-Mekong divide, 9–10000 ft, 26 40 N 99 40 E, September 1922, G. Forest 22237 (US); Dali, between km marker 12 and 13 on road from Xiaoguan to Dacang, 2400–2500 m, 25 31 N 100 12 e, 9 July 1984, 1984 Sino-Amer. Bot. Exped. 917 (US); Mengzi, A. Henry 9337B (US); Near Ngaza, drainage basin of the Yangtze, west of Likiang, August 1923, J.F. Lock 10570 (US); Simao, 5000 ft, A. Henry 12586A (A, NY, US); Songming Xian, in the vicinity of Longshan, ca. 59 km N of Kunming., 2100 m, 25 28 N 102 46 E, 27 July 1984, 1984 Sino-Amer. Bot. Exped. 1331 (US); Taihoa sse, 29 August 1916, O. Schoch 313 (US); West of Tailifu, Mekong watershed, en route to Youngchang and Tengyueh, September 1922, J.F. Lock 6669 (US); Yangbi, W side of Diancangshan, 2500–2600 m, 25 50 N 99 59 E, 30 June 1984, 1984 sino-Amer. Bot. Exped. 601A (US); Yangtze watershed, western slopes of Likiang Snow Range, 6 June 1922, J.F. Lock 5409 (US). **INDIA. Meghalaya:** Khasia, 4–6000 ft, J.D. Hooker s.n. (US). **THAILAND. Chiang Mai:** Summit of Doi Chom Cheng, Doi Sootep mountain range, 1500–1650 m, 1 December 1920, J.F. Lock 277 (US); Summit of Doi Chom Cheng, Doi Sootep mountain range., 1500–1650 m, 1 December 1920, J.F. Lock 290 (US); Summit of Doi Chom Cheng, Doi Sootep mountain range., 1500–1650 m, 1 November 1920, J.F. Lock 372 (US).

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Appendix 1. List of specimens examined of *Shuteria hirsuta* for comparison with *Apios carnea*.

CHINA. Yunnan: Longpa, Jinuo, Jinghong, 1150 m, 13 November 2005, Shi-Shun Zhou 3205 (QBG); Mengzi, 5500 ft, A. Henry 9312 (K, NY, US); Mengzi, 5000 ft, A. Henry 9312C (US). **INDIA. Manipur:** Ukhrul, 5000 ft, 14 July 1948, F. Kingdon Ward 17785 (NY). **Rjasthan:** Sirohi, 16 July 1948, F. Kingdon Ward 17802 (NY). **Sikkim:** Darjeeling, 3500 ft, 22 October 1869, C.B. Clarke 9656 (BM); Goke, 2500 ft, 3 October 1875, C.B. Clarke 24892 (BM); Mintogong, 4000 ft, 4 October 1875, C.B. Clarke 24962 (BM, K). **West Bengal:** Darjeeling, 3000 ft, September 1881, J.S. Gamble 9822 (US); Darjeeling, 3000, 23 October 1870, C.B. Clarke 13493A (K). **LAOS. Sedone:** Pakson, 26 April 1939, E. Poilane 28389 (AAU). **MYANMAR. S. Toppin** 231 (E). **Kachin:** Descent from Sadon to Myitkyina, 3500 ft, September 1912, G. Forest 9130 (E). **S. Shan State:** R.W. MacGregor 962 (E); Between the Siamese border, Ban Meh Huak, and Pang Mah Ki Hat, 21 January 1922, J.F. Lock 1934 (US). **Sagaing:** Katha district. Galon Reserve, 30 November 1908, J.H. Lace 4437 (E, K). **Tanintharyi:** Tavoy (Dewai), Tenasserim river, 13 January 1927, R.N. Parker 2418 (K). **THAILAND. Chantaburi:** Khao Soi Dao, 250–300 m, 13 N 102 15 E, 19 December 1974, R. Geesink 7913 (C, K); Tap Sai, Chantabun, 200 m, 11 December 1924, A.F.G. Kerr 9603 (K). **Chiang Mai:** Ban San Pa Sak, Mae Sai, 611 m, 29 December 2010, M. Norsaengsri 48658 (QBG); Bong Duat Nature Park Hot Springs, Bah Bae Subdistrict, 850 m, 19 November 1992, J.F. Maxwell 92–743 (L); Dohng Village area, Ban Wat Chan Subdistrict, 1025, 7 December 1998, J.F. Maxwell 98–1430 (BKF); Doi Chiangdao, 18 December 2003, S. Mattapha 486 (QBG); Doi Chiangdao, 1400–1600 m, 7 November 1922, A.F.G. Kerr 6633 (AAU, K); Doi Chiangdao Wildlife Sanctuary, Huay Mae Gawk station reservoir, 1475 m, 4 February 1996, J.F. Maxwell 96–191 (L); Doi Chiengdao, 1400–1600 m, 7 November 1922, A.F.G. Kerr 4433 (BM, K); Doi Chiengdao, Me Pa Tang, 500 m, 7 January 1954, H.B.G. Garrett 1430 (K); Doi Luang National Park, west side of and below Doi Nawk, 1400 m, 28 October 1997, J.F. Maxwell 97–1257 (BKF); Doi Sutep, east side, road to Chang Kian, 1000 m, 21 January 1989, J.F. Maxwell 89–72 (L); Doi Sutep, Wasser fall, 14 December 1904, C.C. Hosseus 232 (K); Fang, 22 February 1958, Th. Sørensen 1515 (C); Foot of Doi Chiangdao, 440 m, 6 December 1951, H.B.G. Garrett 1365 (K, US); Huai Puu, QBG, Maerim, 19 December 2000, C.

Glamwaewwong 22 (QBG); Kew Pa Ka, 1800 m, 19 November 1999, P. Suksathan 2127 (QBG); Kuhn Jae National Park, headquarter area, 925 m, 5 December 1997, J.F. Maxwell 97–1435 (BKF, L); Maemae, Maerim-Samoeng Rd., 700–900 m, 20 November 1995, W. Nanakorn 5273 (QBG); Mok Fah Waterfall 40 km NE of Chiangmai, along road to Pai, 1095., 500 m, 19 3 N 98 13 E, 24 November 1993, K. Larsen 44794 (AAU); Pong Dueat Nat. Park, 55 km NE of Chiangmai; km 40 on the Pai road, 600 m, 19 8 N 98 45 E, 26 November 1993, K. Larsen 44907 (AAU); Summit of Doi Chom Cheng, Doi Sootep mountain range, 1500–1650 m, 1 November 1920, J.F. Rock 308 (US); Summit of Doi Chom Cheng, Doi Sootep mountain range, 1500–1650 m, 1 November 1920, J.F. Rock 432 (US); Western flank of Doi Inthanond, Mae Pau, 700–800 m, 18 40 N 98 25 E, 5 December 1969, C.F. van Beusekom 2324 (AAU, BKF, L). **Chiang Rai:** Doi Luang National Park, west side of and below Doi Nawk, 1400 m, 28 October 1997, J.F. Maxwell 97–1257 (L). **Chumphon:** Ta Ngaw, 100 m, 17 January 1927, A.F.G. Kerr 11487 (K). **Kanchanaburi:** Toong Yai Naresuan Wildlife Reserve, Lai Wo Subdistrict, Ban Saneh Pawng area, 225 m, 13 January 1994, J.F. Maxwell 94–34 (BKF, L); Huay Bankau, 750 m, 14 55 N 90 45 E, 8 November 1971, C.F. van Beusekom 3494 (C, K, L); Sai Yok, 16 December 1961, K. Larsen 8754 (C); Wangka, Kanburi, 200 m, 28 January 1926, A.F.G. Kerr 10322 (BM, K). **Lampang:** Doi Kuhn Dahn National Park, east side, Mae Pry Station area, 400 m, 4 December 1994, J.F. Maxwell 94–1264 (BKF); Jae Sawn National Park, along Mae Mawn Stream near Jae Sawn waterfalls, 475 m, 14 December 1996, M. Panatkool 65 (L); Jae Sawn National Park, along Mae Mawn Stream near Jae Sawn waterfalls, 525 m, 15 February 1997, M. Panatkool 66 (L); Jae Sawn National Park, Muang Bahn, 475 m, 7 January 1992, J.F. Maxwell 92–1 (L); Jae Sawn National Park, along Huay Dahm, west of Jae Sawn and Toong Nawk Villages, 350 m, 28 January 1997, J.F. Maxwell 97–75 (L). **Loei:** Nahaew, 10 December 1996, W. Nanakorn 8121 (QBG). **Nan:** Ban Hue Sui, 800 ft, 22 February 1912, A.F.G. Kerr 2411 (K); Doi Phu Wae, Doi Phu Kha NP., Pua , 1300 m, 13 November 2000, P. Srisanga 1835 (QBG); Kae Nok Mountain ridge-Nam Ka, Tham Sokoeng NP, Song Khwae, 1170 m, 19 22 55.61 N 100 30 53.98 E, 30 November 2011, W. La-ongsri 1981 (QBG). **Phetchaburi:** Kaeng Kra Chan Nat. Park. Along road to Tor Tip Waterfall at km 28, 600–700 m, 12 47 N 99 20 E, 5 December 1993, K. Larsen 45090 (AAU). Phrae: Mae Khaem Stream, 440 m, 18 7 N 100 9 E, 5 January 1972, C.F. van Beusekom 4627 (C, K). **Udon Thani:** Huai Ei Hang, Nam Som, 362 m, 17 41 42.2 N 102 3 7.3 E, 9 December 2009, W. Boonprakop 141 (QBG). **Uthai Thani:** Kow Hin Dang, Huay Ka Kaeng Reserve, Ban Rai Dist., 400 m, 9 February 1976, J.F. Maxwell 76–84 (AAU). **Uttaradit:** Phu Soi Dao, 1438 m, 19 November 2009, M. Norsasengri 6279 (QBG); Doi Kum, 360 m, A.F.G. Kerr 1653 (E); Dong Lan Forest, 28 November 1958, Th. Sørensen 6107 (C, K); near Ban Meh Yah (between Lakon & Phre), 21 February 1910, A.F.G. Kerr 998 (BM); A.F.G. Kerr 11489 (AAU).