

葛的学名及其在美国的入侵教训

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摘要: 葛 (*Pueraria montana*), 豆科多年生藤本, 原产东亚、南亚和东南亚, 热带和温带广泛栽培并逸为野生; 不仅学名多而混乱, 而且已成为美国危害最严重的外来入侵种之一。考证了葛的学名并给出异名, 同时介绍葛在美国从鼓励引入到大量栽培, 最后被列入联邦危害植物并全面禁止的引种教训。

关键词: 葛; 学名; 入侵; 美国

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The Identity of Kudzu and Its Invasive in the USA—The Lesson Learned from Deliberately Introducing an Aggressive Plant

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Abstract: Kudzu, *Pueraria montana*, a native of eastern, southern and southeastern Asian species of Legumes, is also a serious invasive species in the United States. However, its scientific name is much confused in the history, both in its native area and in the rest of the world. This paper is to provide it with the correct name, along with its synonyms, and a brief introduction of its invasive history in the USA, a lesson of deliberately introducing a notoriously aggressive plant we can all learn from.

Key words: Kudzu (*Pueraria montana*); Scientific name; Invasive; United States

Kudzu (originated from Japanese word ‘kuzu’), *Pueraria montana* (Leguminosa/Fabaceae), perennial vine (woody at base), up to 20–30 m long, deciduous, alternate, trifoliate, petiole 10–20 cm, leaflets 14–18 cm long and 10 cm wide, entire or 2–3 lobed, pubescent underneath; panicles, 10–25 cm long with about 30–80 flowers, each 1–1.5 cm long, purple, fragrant; pod, brown, hairy, flattened, with several seeds; tuberous roots fleshy and thicken, reaching depths of up to 3–4 m, up to 1.5 m long and 20–30 cm or more in diameter, and weighing as much as 180 kg.

Flowering in late summer and fruiting in late autumn. Once established, kudzu grows rapidly, extending as much as 20–30 m per season at a rate of 30 cm per day^[1], and extending and scrambling extensively over various vegetations, with basal stems 1–10 cm in diameter, and as many as 30 stems from a single root. Kudzu grows well under a wide range of conditions and

in most soil types, but prefers forest edges, abandoned fields, roadsides, and undisturbed areas, or where sunlight is abundant. Drought and shade tolerant, damaged by frost only above ground^[2,3]. It forms new perennial roots from stem nodes touching the ground, and it can take 3–10 years of repeated herbicide treatment to deplete root reserves^[2]. Seeds dispersed by mammals and birds^[3].

Native to Asia, from east, south to southeast, including Bhutan^[1], China (except Heilongjiang, Inner Mongolia, and Qinghai^[4]), northeast India, Indo-China, Japan, northern Thailand, Indonesia, Malaysia and Philippines, Pacific Oceania Islands^[3–5]. However, since it was cultivated for a long time, its native origin is uncertain, but around warm tropical Asia, including south China, northeast India, Indo-China, and Myanmar.

Widely naturalized in the United States, throughout the southeast, north to Illinois^[5] and New England and west to Texas and Oklahoma, including Hawaii (Kudzu

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1) Not all reference listed, see nomenclature citation for detail.

has been invaded in 28 states in USA)^[6], and some reports even to Nova Scotia, Canada^[7-10], also invaded in east, south^[11] and west Africa, central America^[12], Australia and New Zealand^[13] and, introduced into southern Ukraine and the Caucasus, naturalized in Black Sea Coast near Batumi, Georgia, and planted in Russian Far East^[14,15].

The tuberous root of kudzu is very rich in starch with a long traditional use in history by local people in native area^[5,9,10,16-18]. It is not only a kind of food^[9,16-18], but also a kind of important traditional medicine in east Asia^[19-21]. Kudzu, known as 'Ge' or 'Ko' in Chinese, is still used and available not only in China and many other countries in Asia, but also in most markets of the Chinatown in the United States, such as in New York City^[16].

1 Invasive history in the USA

Introduced in 1876 at the Centennial Exposition in Philadelphia as an ornamental vine from Japan^[8,22], kudzu was developed for use as forage in the 1920s in Florida and promoted by the United States Soil Conservation Service (USDA) for erosion control in the 1930s^[8,9,16,17,22], since its fast growing with good quantity of production and the forage has been greatly enjoyed by livestock^[23]. During the first half of the 20th century, c. 134 760 hm² of kudzu was planted throughout the southeast United States as forage and for erosion controls^[23-25]. Its coverage was about 3 million hm² in 1950, but due to its rapid growth it smothered trees, houses and telephone poles, and further use as covers were discouraged^[24]. In 1954, kudzu was removed from the list of acceptable cover crops and eradication became the focus of research^[26]. The USDA declared kudzu a weed in 1981^[26], and listed as Federal Noxious Weed in 1998 by the United States Congress^[25-27]. Forming large impenetrable masses, growing over woody vegetation and being able to completely engulf unwooded areas^[27], kudzu can completely envelop a tree, killing it by shutting out all light^[22], as a serious and widespread invader of semi-natural or natural habitats^[3,28]. Today,

kudzu has become one of the most aggressive and invasive species in the United States, and dominates an estimated 810 000 hm² of mesic forest communities in the eastern United States even the eradication of kudzu has been attempted on a large scale by various controls since 1950s^[1,28,29]. It costs millions and millions of dollars for the American forestry, agriculture, landscape and nature heritage as well as many other fields^[13,24,26]. The lesson of introducing kudzu as a useful plant and it becoming a notoriously invasive plant in the USA is really a great case in the invasive world to be thought over and again^[30].

2 Taxonomic treatment

The nomenclature of kudzu is very complex. It was given to *P. hirsuta* Mastum. in Japan^[18], but it was widely known as *P. thunbergiana*^[8,9]. Van der Maesen^[26] revised the genus, but recognized it as *P. lobata* var. *montana*, which was followed by many works both locally and worldwide, and even until very recently^[25]. A few years later, the name for kudzu was changed to *P. montana* (Lour.) Merr. var. *lobata*^[31], but *P. lobata* var. *montana* has been used worldwide, and the late change published in a local journal was given no attention to the world until ten years later^[18].

Today, its nomenclature is still confused; for example, a recent industrial monograph of *Pueraria*^[32] treated kudzu as *P. montana* var. *lobata* in the botanical section, but in other chapters in the same work, *P. lobata* var. *montana* was used instead. More trouble is that the three varieties (var. *thomsonii*, *lobata* and *montana*), either under *P. lobata*^[26] or *P. montana*^[31] are ambiguous and continuous in characters, and it is impossible to separate in the field or identify in the herbarium²⁾. In fact, they have never been accepted by recent works^[1-3,33,34], but only a few local check lists³⁾.

There are more scientific names for kudzu if one checked modern literature. For example, it is represented by 188 *P. lobata*, 45 *P. thunbergiana*, 17 *P. montana*, 6 *P. thomsonii*, and 3 *P. hirsuta* under kudzu in BIOSIS (1980-2007).

2) LI, Zhenyu (PE), personal communication by email of March 13, 2006.

3) See nomenclature citation for detail.

Only the earliest scientific name for kudzu, *Pueraria montana* (Lour.) Merr., is legally available according to the nomenclatural code (Article 23, Vienna Code, 2006). Moreover, no further division within species is necessary, either as variety or subspecies, because overlapping characters and continuous in distribution. Since it was complex in history and in literatures, following citations of synonyms, apparently, is useful and necessary.

3 *Pueraria montana* (Lour.) Merr.

In *Trans. Amer. Philos. Soc.*, n. s. 24 (2): 210. 1935, Chun, *Fl. Hainan.* 2: 319, 1965, Anon, *Icon. Cormoph. Sin.* 2: 501, 1972, Tanaka, *Tanaka's Eyclop. Edib. Pl. World* 602, 1976, Huang & Ohashi in Li, *Fl. Taiwan.* 3: 367, 1977 & in Huang, *Fl. Taiwan* ed. 2, 3: 356, 1993, Lackey, *Synops. Phaseol.* 72, & 74, 1977, Thuan in *Fl. Camb., Laos et Vietn.* 17: 80–82, 1979, He in Lin, *Fl. Fujian.* 3: 84, 1987, Maesen & Almeida in *J. Bombay Nat. Hist. Soc.* 85 (1): 234, 1988, Xiao & Xie, in Ye, *Fl. Guizhou.* 7: 586, 1989, Lock & Heald, *Leg. Indo-Chin.* 117, 1994, Ho, *Illus. Fl. Vietn.* 1 (2): 1196/3407 & 1: 948/3799, 1991/1999, Singh *et al.*, *Fl. Manip.* 1: 313, 2000, Singh & Karthikeyan, *Fl. Mahar.* 1: 730, 2000, Ohashi, *Fl. Jap.* 274, 2001, Maesen in Keung, *Pueraria in Genus Pueraria*, 12, 2002, Kumar & Sane, *Leg. South Asia*, 363, 2003, Lock & Ford, *Leg. Males*, 212, 2004. **Basionym**: *Dolichos montanus* Lour. *Fl. Cochinchin.* 2: 440–441. 1790 (Holotype: Vietnam, habitat in sylvis montanis Cochinchinae, Loureiro s. n. (P)).

4 Synonyms

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Hayata, *Enum. Pl. Formos.* 111, 1906, Lev. in *Bull. Soc. Bot. France* ser 4, 8–55: 425, 1908, Merr. in *Philipp. J. Sci. Bot.* 3: 410, 1908, Nakai, *Fl. Kor.* 1: 165, 1909, Merr. in *Philipp. J. Sci. Bot.* 5: 123, 1910, & *Fl. Manila* 253, 1912, Lev., *Fl. Kouy-Tcheou* 241, 1914; Gagn., *Fl. Gen. Indo-Chin.* 2: 249, 1916, & in *Lec. Not. Syst.* 3: 205, 1916, Crevost & Lemarie, *Cat. Prod. Indochin.* 133–135, 1917, Brandis, *Indian Trees* 228, 1921, Merr., *Enum. Philipp. Fl. Pl.* 312, 1923, Hosokawa in *J. Soc. Trop. Agric. Taih.* 4: 309, 1932, Hand.-Mazz., *Symb. Sinicae* 7: 582, 1933, Degener, *Fl. Hawai.* 2: 10–12, 1934, Merr. in *Trans. Am. Philos. Soc. n. s.* 24–2: 211, 1935, Ohwi in *Acta Phytotax. Geobot.* 5: 62, 1936, Merr. in *J. Arn. Herb.* 19: 348, 1938, Kanjila *et al.*, *Fl. Assam.* 2: 81, 1938, Rehder, *Manual Cultivat. Trees & Shrubs*, 522, 1940, Li, *Woody Fl. Taiwan*, 359, 1963, Maheswari, *Fl. Delhi*, 130, 1963, Hutchinson, *Gen. Fl. Pl.* 1: 426, 1964, Rao & Joseph in *Bull. Bot. Surv. India* 7: 44, 1965, Chun, *Fl. Hainan.* 2: 319–320, 1965. **Basionym**: *Pachyrhizus thunbergianus* Sieb. & Zucc., *Abh. Acad. Munchen* 4–3: 237, 1846.

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P. thomsonii Benth. in *J. Linn. Soc. Bot.* 9: 122, 1867, Baker in *Hooker, Fl. Brit. Ind.* 2: 198, 1876, Taubert in *Engler, Nat. Pflanzenfam.* 3–3: 371, 1894, Prain, *J. Asiat. Soc. Bengal* 66–2: 419–420, 1897, Gagn., *Fl. Gen. Indo-Chin.* 2: 251, 1916, & in *Lec., Nat. Syst.* 3: 203, 1916, Craib, *Fl. Siam. Enum.* 1–3: 451, 1928, Merrill, *Trans. Am. Philos. Soc. n. s.* 24–2: 211, 1935, Chun, *Fl. Hainan.* 2: 320, 1965, Anon., *Icon. Cormoph. Sin.* 2: 502, 1972, Tanaka, *Tanaka's Cyclop. Edib. Pl. World* 602, 1976, Thuan, *Fl. Camb., Laos et Vietn.* 17: 79–80, 1979, Wu, *Fl. Xizang.* 2: 752, 1985, Xiao & Xie, in Ye, *Fl. Guizhou.* 7: 587–588, 1989; Wu *et al.*, *J. Trop. & Subtrop. Bot.* 2 (3): 16–17, 1994, Sun & Zhou, *Seed Pl. Big Bend Gorge Yalu Tsangpo in SE Tibet, E Himalayas*, 155, 2001, Chaudhuri, *Pl. Darjeeling & Jalpaiguri For.* 184, 2004.

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2: 114 – 115. 1907. **Basionym:** *Dolichos hirsutus* Thunb. in *Trans. Linn. Soc.* 2: 339, 1794, Merr. in *Trans. Am. Philos. Soc. n. s.* 24 (2): 211, 1935, non Kurz in *J. Asiat. Soc. Bengal*, pt. 2, *Nat. Hist.* 42: 254. 1873, Kimura in *J. Jap. Bot.* 8: 115 – 123, 1932.

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P. omeiensis Wang & Tang, in *Illu. Chin. Leg.* 679, 1955, Anon. in *Icon. Cormoph. Sin.* 2: 501, 1972, nom. nud.

P. elegans Wang & Tang, Fu, *Fl. Hubei* 2: 263, 1979/2002, nom. nud.

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