

# Plant Diversity Website

## ***Pueraria montana*** (Lour.) Merr.

**Common Names:** Kudzu, Japanese arrowroot, acha, aka, nepalem, wa yaka (12).

**Etymology:** The generic name *Pueraria* is in recognition of an 18<sup>th</sup> century Swiss botanist, Marc Nicolas Puerari. The occasionally applied varietal name *lobata* is derived from the Greek *lobos*, referring to the lobed leaflets (2).

**Botanical synonyms (8):**

*Dolichos hirsutus* Thunb.

*Dolichos lobatus* Willd. (basionym)

*Neustanthus chinensis* Benth.

*Pachyrhizus thunbergianus* Siebold & Zucc.

*Pueraria hirsuta* (Thunb.) Matsum.

*Pueraria lobata* (Willd.) Ohwi

*Pueraria lobata* var. *chinensis* (Benth.) Ohwi

*Pueraria pseudohirsuta* Tang & F. T. Wang,

*Pueraria thunbergiana* (Siebold & Zucc.) Benth.

*Pueraria triloba* (Houtt.) Makino

**FAMILY:** Fabaceae (the pea family)

**Quick Notable Features:**

- ▮ pubescent trifoliate leaves
- ▮ bright red-pink flowers in tall racemes
- ▮ leaflets with broad basal lobes
- ▮ plant climbing with apical coiling, no specialized tendrils

**Plant Height:** Grows up to 30m in stem length (2).

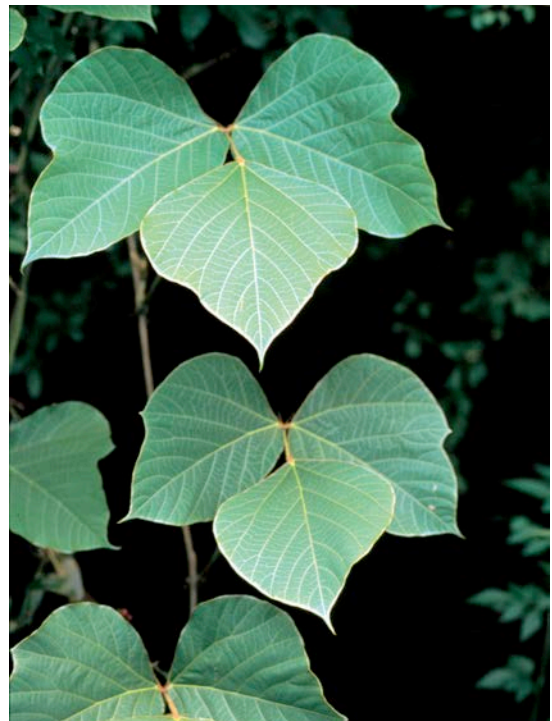
**Subspecies/varieties recognized:**

*Pueraria montana* (Lour.) Merr. var. *thomsonii* (Benth.) Wiersema ex D.B.Ward

*Pueraria montana* (Lour.) Merr. var. *lobata* (Willd.) Maesen & S. M. Almeida ex Sanjappa & Predeep

**Most Likely Confused with:** Other members of the Fabaceae such as *Strophostyles helvula*, *Pisum* spp, *Amphicarpaea bracteata*, *Wisteria* spp., *Apios americana*, and *Desmodium* spp. It might also be confused with *Toxicodendron radicans*, poison ivy.

**Habitat Preference:** Kudzu has the ability to grow in a wide variety of sunny places: along highways,



riversides, fencerows, even in forest interiors. It has been photographed numerous times growing over old houses and barns, cars, and old farm equipment. It seems to do best on deep loamy soil and does not do well in very wet areas. It is not eradicated easily; however, it is reported that it does not do well under heavy grazing (2).

**Geographic Distribution in Michigan:** The species is not officially recognized in Michigan, either in the Michigan Flora (6) or by the USDA. However, it has been collected in Allegan County, documented by herbarium specimens at the UMICH herbarium of a single site there. It



is documented in states adjacent to Michigan, but not in counties close to the Michigan border. It was reported in southern Ontario, Canada in late 2009 (14).

**Known Elevational Distribution:** In Japan, *P. montana* v. *lobata* grows up to 1000m (2).

**Complete Geographic Distribution:** Native to tropical and eastern Asia (2); an escapee from

cultivation in the entire southeastern part of the United States, and north as far as Illinois and Massachusetts. It is known as far west as Texas and Oklahoma in its southern range, but has also been reported as escaped in Oregon and Washington states. Heaviest infestations occur along the southern Gulf Coast (Mississippi, Georgia, Alabama). In the Northeastern U.S. it has been noted as an escapee from gardens since 1900 (2,7). It is cited in many states as a noxious weed.

**Vegetative Plant Description:** *P. montana* v. *lobata* is a climbing or trailing, herbaceous to semi-woody perennial vine (2). It forms a mealy tuberous root (perenniating in this root), which can be up to 2 meters long (2). The root seems to be the reason it is hard to eradicate as it can withstand very cold winters in the dormant state. These roots can reach several hundred kilos in weight (2)! Spreading of the plant in the vegetative state is by lateral growth of both stems and roots. The plant has abundant tan to bronze hairs (2), especially on the stems, leaf undersurfaces, and fruits. The stems grow easily 10m tall, but exceptions up to 20m tall are known. Growth in girth of up to 2.5cm in diameter has been reported in a single season. Very large diameter stems up to 30.5 cm in diameter have been reported (11).

Kudzu bears alternate, pubescent trifoliate leaves. Each leaflet is either entire or palmately lobed, broadly ovate, and up to 18cm long (usually 2-15cm x 5-12cm). The stipules are striate, attached by the abaxial leaf surface, ovate to oblong, and at least as long as the petiolules. The stipules are subulate (15,16). The leaves





bear pulvini at the base of the petiole and can easily reorient to avoid direct impact of the sun's rays and help to prevent self-shading (1). The above-ground plant parts (leaves and stems) are extremely sensitive to frost, dying back to the ground.

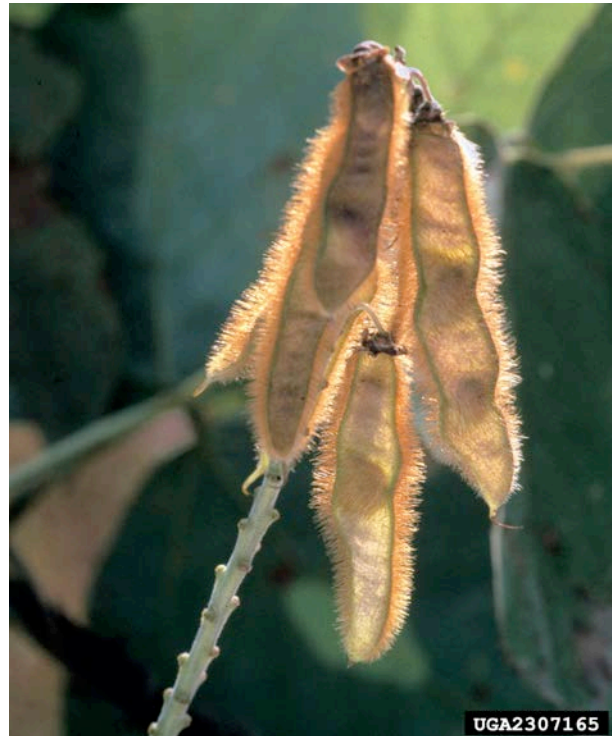
**Climbing Mechanism:** Using its apex *Pueraria montana* grows upward using a right-handed spiral (twining from left to right).

**Flower Description:** Racemose inflorescences are 10-30cm tall with deciduous linear bracteoles. The densely silky-pubescent pedicels bear flowers up to 2.5cm long. The 5 fused sepals are deeply lobed in an asymmetric tube with acuminate lobes. This calyx is dark purple-red and pubescent. The petals are reddish-purple or violet-purple with yellow spots at the base of the standard petal. The wing petals are curved and bear linear auricles at the base, while the keel petals exceed the wings in width and bear minute auricles. The flower have a fragrance reportedly like grapes (2). Stamens are 10; arranged in a group of 9 fused by their filaments and a single free stamen. The single carpel is superior.

**Flowering Time:** Depending on the geographic location, flowers are borne from Late July through September and flowers best in direct sun. It has been suggested that flowering is poor in the northern part of the range (2),

**Pollinator:** Thornton (9) reports flower visitation by native hymenopterans in the southern United States.

**Fruit Type and Description:** The fruits are a legume that is 4-5cm (up to 14cm) in length and 6-13mm in width; they are hairy (especially along the margins), and flattened. Kudzu produces only a few viable seeds per flower cluster (10, 15).



**Seed Description:** The seeds are compressed, round or kidney-shaped, and about 3-4mm in length. They are reported to be difficult to germinate and that the seedlings are poor competitors (2). Scarification appears to be essential for high germination percentages (1).

**Dispersal Syndrome:** Animal dispersal is not reported to be common, however with the scarification needed for germination, it is most likely that some gut residence is the typical means for natural scarification.

Kudzu can root at almost any point where the stem touches the ground, enabling it to reproduce vegetatively quite quickly (1).

**Distinguished by:** *Pueraria* can be distinguished from all species of *Wisteria* by its trifoliate (not multifoliate) leaves. It is distinguished from the trifoliate leaves of *Strophostyles helvula* by the larger leaf and leaflet size as well as the pubescence (in *Pueraria*). Members of the genus *Pisum* can have a remarkably similar flower color, but are distinguished by the tendrillate leaf tips, and usually glabrous leaves. *Desmodium rotundifolium*, a weakly climbing vine in Michigan, can generally be distinguished by the relative lack of dense pubescence and the very round terminal leaflet. *Amphicarpaea bracteata*, another potential leguminous impostor in Michigan, bears similar-appearing leaflets but they are much less pubescent and the plant bears a fruit only 0.5 cm long whereas kudzu bears fruits up to 8cm long. *Pueraria montana* can be distinguished easily from *Toxicodendron radicans* because *T. radicans* grows with adventitious roots and has much more clearly lobed leaflets.

**Other members of the family in Michigan** (number species): *Amorpha* (2), *Amphicarpaea* (1), *Anthyllis* (1), *Apios* (1), *Astragalus* (3), *Baptisia* (4), *Caragana* (1), *Cercis* (1), *Chamaecrista* (2), *Cladrastis* (1), *Colutea* (1), *Crotalaria* (1), *Cytisus* (1), *Dalea* (1), *Desmodium* (12), *Genista* (1), *Gleditsia* (1), *Glycine* (1), *Gymnocladus* (1), *Hedysarum* (1), *Kummerowia* (1), *Lathyrus* (10), *Lespedeza* (13), *Lotus* (1), *Lupinus* (2), *Melilotus* (2), *Mimosa* (1), *Orbexilum* (1), *Phaseolus* (2), *Pisum* (1), *Robinia* (3), *Securigera* (1), *Senna* (1), *Strophostyles* (1), *Tephrosia* (1), *Trifolium* (9), *Vicia* (8), *Vigna* (1), *Wisteria* (1) [6]

**Ethnobotanical Uses:** *Pueraria montana* is grown for food in various parts of the old world tropics (Java, Sumatra, etc.) (2). Kudzu has been cultivated for millennia. While the first reports seem to be of eating the leaves, the roots are also used as a starch source and as a natural medicine by 1200AD.

In Japan, it is prized in mountainous areas because it grows where other things fail. There, it is also fed to sick horses who will eat it above all else. The starch of the root, ground into flour, is claimed to be the finest known flour. The burnt stems may act as a mosquito repellent (2).

**Phylogenetic Information:** *Pueraria* is a genus comprised of 17 species in the subfamily Faboideae within the family Fabaceae. Fabaceae, along with the Polygalaceae, Quillajaceae, and Surianaceae form the Fabales order. The Fabales, Rosales, Cucurbitales, and Fagales form a monophyletic clade within the Eurosids I within the larger Rosid group of the Eudicot angiosperms (5).

**Interesting Quotation or Other Interesting Factoid not inserted above:** *Pueraria montana* is may cover > 3 million hectares of the eastern United States and spreads to an additional 50,000 hectares each year (1). It can grow from 3-19cm in length per day and has been attributed with a regular growth of 20-30m in a single season (1). As a member of the Faboideae subfamily of the Fabaceae, *P. montana* can fix atmospheric nitrogen which allows it to flourish even in soils of poor quality. *Pueraria montana* is reported as a medium to high-producer of the atmospheric gas isoprene, which may contribute strongly to green-house gas emissions (4). The aggressive growth of kudzu has even made it a candidate source of ethanol (13).

#### **Literature and websites used:**

- 1) Forseth, I.N., Jr & A.F. Innis 2004. Kudzu (*Pueraria montana*): History, physiology, and ecology combine to make a major ecosystem threat. *Critical Reviews in Plant Sciences* 23(5): 401-413.
- 2) Mitich, L.W. 2000. Kudzu [*Pueraria lobata* (Willd.) Ohwi]. *Weed Technology* 14:231-235.
- 3) Uva. R.H., J.C. Neil, & J.M. DiTomaso 1997. Weeds of the Northeast. Ithaca, NY Cornell

University Press 397p.

- 4) Sharkey, T.D. & Loreto 1993. Water stress, temperature, and light effects on the capacity for isoprene emission and photosynthesis in Kudzu leaves. *Oecologia* 95: 328-333.
- 5) Angiosperm Phylogeny Group 2003. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. *Botanical Journal of the Linnean Society* 141(4):399-436
- 6) Voss, E.G. 1985. *Michigan Flora Part II: Dicots (Saururaceae – Cornaceae)*. Ann Arbor, Michigan, USA: Regents of the University of Michigan.
- 7) USDA, National Resource Conservation Service. 2008. The PLANTS Database (<http://plants.usda.gov>, 13 April 2008). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
- 8) USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL: <http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl?314966> (13 April 2008).
- 9) Thornton, M. R. 2001. Native and naturalized arthropod fauna of Kudzu (*Pueraria montana*) (Lour.) Merr. variety *lobata* (Willd.) Maesen & Almeida in North Carolina. Master's thesis, North Carolina State University, Raleigh, NC
- 10) Langeland, K.A. & K. Craddock Burks 1998. Identification and Biology of Non-Native Plants in Florida's Natural Areas. IFAS Publication SP 257. University of Florida, Gainesville. 165 pp. as pdf available at <http://aquat1.ifas.ufl.edu/pueumon.html>
- 11) University of Florida IFAS Extension Center for Aquatic and Invasive Plants Species page on *Pueraria montana*. <http://plants.ifas.ufl.edu/node/354> accessed November 21, 2008.
- 12) USDA, NRCS. 2008. The PLANTS Database, Version 3.1, National Plant Data Center, Baton Rouge, LA 70874-4490 USA. <http://plants.usda.gov/> (November 21, 2008)
- 13) Tseng, N.-H. 2008. Kudzu could be the next biofuel. Cox News Service, published on 06/19/08 in Atlanta Journal-Constitution.
- 14) CBC News 2009. Invasive plant species takes root in Canada, September 23, 2009 at <http://www.cbc.ca/technology/story/2009/09/23/leamington-kudzu-092309.html>
- 15) Wu, D. & M. Thulin 2010. *Flora of China*, Vol. 10. [www.efloras.org/florataxon.aspx?flora\\_id=2&taxon\\_id=127620](http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=127620)
- 16) Fernald, M. L. 1950. *Gray's Manual of Botany*, 8<sup>th</sup> ed. New York: American Book Company.

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