

PAULOWNIACEAE Nakai

* Paulownia Family

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Trees, not succulent, autotrophic. **Stems** woody. **Leaves** deciduous [persistent], cauline, usually opposite, rarely in whorls of 3, simple; stipules absent; petiole present; blade not fleshy. **Inflorescences** terminal thyrses of (1--3--8(--11))-flowered cymes. **Flowers** bisexual, perianth and androecium hypogynous; sepals 5, connate, bilaterally symmetric; petals 5, connate, bilaterally symmetric; stamens 4, didynamous, staminode 0; pistil 1, 2-carpellate, ovary superior, 2-locular, placentation axile; ovules anatropous, unitegmic, tenuinucellate; style 1; stigma 1. **Fruits** capsular, dehiscence loculicidal. **Seeds** +/- 2000, brown, ellipsoid, margins winged, wings clear or tan; embryo straight, endosperm present.

Genera 1, species 7 (1 in the flora): introduced; e Asia; introduced also in Europe, e Asia.

Paulownia has been allied with Bignoniaceae or Scrophulariaceae based on morphological, anatomical, and embryological evidence (D. H. Campbell 1930; J. E. Armstrong 1985). Cladistic analysis of molecular data suggests placement in a clade comprising Orobanchaceae, Phrymaceae, and, possibly, some Asian taxa (R. G. Olmstead et al. 2001; B. Oxelman et al. 2005).

SELECTED REFERENCES Campbell, D. H. 1930. The relationships of *Paulownia*. Bull. Torrey Bot. Club 57: 47--50. Hu, S. Y. 1959. A monograph of the genus *Paulownia*. Quart. J. Taiwan Mus. 12: 1--54. Hu, S. Y. 1961. The economic botany of the paulownias. Econ. Bot. 15: 11--27. Liang, Z. Y. and Chen Z. Y. 1997. Studies of the cytological taxonomy of the genus *Paulownia*. J. Huazhong Agric. Univ. 16: 609--613. Millsaps, V. 1936. The structure and development of the seed of *Paulownia tomentosa* Steud. J. Elisha Mitchell Sci. Soc. 52: 56--75.c

1. PAULOWNIA Siebold & Zuccarini, Fl. Jap. 1: 25. 1835 * Paulownia [For Anna Paulowna Romanov, 1795--1865, Grand Duchess of Russia and daughter of Czar Paul I, Hereditary Princess of the Netherlands] I

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Trees. **Thyrse:** bracts absent; bracteoles absent. **Pedicels** present. **Flowers:** sepals connate medially; corolla funnelform, abaxial lobes 3, adaxial lobes 2; stamens adnate to corolla proximally; filaments glabrous; stigma capitate. $x = 20$.

Species 7 (1 in the flora): introduced; Asia (China, possibly Korea and Japan); introduced also in Europe.

Paulownias long have held mythical, spiritual, cultural, and economic significance in China and Japan (Hu S. Y. 1959, 1961). The wood of some species is highly prized in Asia; *Paulownia tomentosa* is grown in the United States in plantations for wood that is exported to Japan.

The fossil record provides evidence of *Paulownia* in North America and Europe during the Tertiary (C. J. Smiley 1961).

1. *Paulownia tomentosa* (Thunberg) Steudel, Nomencl. Bot. ed. 2, 2: 278. 1841 * Empress-tree, princess-tree, royal paulownia F I W

Bignonia tomentosa Thunberg in J. A. Murray, Syst. Veg. ed. 14, 563. 1784

Stems to 20 m; crown spreading; bark grayish brown, thin, slightly fissured; twigs usually viscid when young, pith hollow or chambered, lenticels conspicuous, white. **Leaves** usually largest on sprouts, smallest near inflorescences; petiole (1.5--5--21(--36) cm, usually floccose or sparsely to densely lanate, rarely glabrate; blade ovate to broadly ovate, (6--14--40(--50) x (4--8--30(--56) cm, base mostly cordate, sometimes truncate, margins entire or shallowly 3(--5)-lobed and usually serrate to dentate on leaves of young plants, apex acute, acuminate, or cuspidate, floccose or sparsely to densely lanate abaxially, sometimes only along veins, glabrate or sparsely lanate adaxially. **Thyrse** 18--40 cm; verticillasters 6--10, interrupted, conical, axis glabrous or sparsely lanate; peduncle ascending, 0--5 cm, glabrous or sparsely to densely lanate. **Pedicels** 0.8--1.5 cm, brownish lanate, jointed at apex with flower. **Flowers** pendent, fragrant; calyx tube campanulate, 6--9 mm, brownish lanate, lobes ovate to broadly ovate or oblong, 7--9 x 5--8 mm, leathery, brownish lanate, margins entire, apex obtuse to acute; corolla lavender, pinkish purple, or purple externally, whitish or yellowish internally on palate and lined with reddish purple nectar guides, bilabiate, 4--6 cm, glandular-pubescent externally, glabrous internally, tube 1--1.5 cm, slightly downcurved, throat gradually inflated, 1.5--2 cm diam., palate 2-ridged, abaxial lobes projecting-spreading, adaxial lobes reflexed; stamens included; anther sacs opposite, white, tan, or brown, flattened, 1.8--2.3 mm, dehiscing across connective, glabrous; styles 24--30 mm, sparsely hairy proximally. **Capsules** persistent, ovoid, 2.5--5 x 1.5--2.6 cm, cartilaginous, viscid, floccose distally. **Seeds** 3--4 mm, fusiform, surrounded by prominent wings, margins irregular, wings reticulate. $2n = 40$.

Flowering Apr--Jun. Roadsides, riparian areas, forest margins, old homesteads, strip mines, soil banks, clearcuts; 0--1200 m; introduced; Ala., Ark., Conn., Del., D.C., Fla., Ga., Ill., Ind., Ky., La., Md., Mass., Miss., Mo., N.J., N.Y., N.C., Ohio, Okla., Oreg., Pa., R.I., S.C., Tenn., Tex., Va., Wash., W.Va.; Asia (China); introduced also in Europe, Asia (Japan, Korea).

Paulownia tomentosa was brought to the United States around 1844 from plants introduced into cultivation in Europe (Hu S. Y. 1961); it has been planted as an ornamental and shade tree in the eastern and northwestern United States, southern Canada, Europe, Japan, and Korea. Trees are fast-growing and produce sturdy, light wood. Princess-tree is a prolific seed producer, resprouts from suckers when cut, and can become an aggressive invader in disturbed habitats. In North America, it shows a tendency to invade

natural habitats more frequently than do plants in central Europe (E. Franz 2007); it is increasingly invading natural forests in the southern Appalachian Mountains. *Paulownia tomentosa* was designated in 2004 as an exotic with a “severe threat” to escape in Tennessee (Tennessee Exotic Pest Plant Council 2004); it is a “noxious” species that is prohibited in the nursery trade in Connecticut (Connecticut Invasive Plant Council, <http://www.hort.uconn.edu/CIPWG/invplantsCT09commonname.pdf>). The broad wings of the seeds aid in wind dissemination and apparently facilitate imbibition (R. Vujičić et al. 1993). A count of 2000 seeds per capsule, which appears widely in the literature, apparently came from R. S. Walker (1919).

The type and abundance of hairs of *Paulownia tomentosa* varies greatly with phenology and location on plants. Dendritic hairs occur on leaves and in inflorescences; they are dense on pedicels and calyces. Their abundance on leaves varies, and there they may occur mixed with eglandular or glandular, erect, unbranched, multicellular hairs. Leaf vestiture has been used to distinguish two varieties: var. *tomentosa*, with leaf blades densely lanate abaxially, and var. *tsinlingensis* (Pai) Gong Tong, with leaf blades glabrous or sparsely lanate abaxially when young (Hong D. Y. et al. 1998). The validity of these varieties cannot be evaluated from North American material alone.