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Populus tomentosa

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JAMES ARMITAGE¹, VALÉRY MALÉCOT² and LU ZHANG³ have done some research into a beautiful and puzzling poplar.

It is perhaps surprising how much the cultivated flora of Beijing has in common with that of many European cities. *Ailanthus*, juniper, *Platanus*, *Rhus* and sycamore abound while *Salix* × *sepulcralis* finds a counterpart in *S. matsudana* var. *pseudomatsudana*. However, there is one common tree that most Western travellers would fail to recognise: *Populus tomentosa*, mao bai yang, the Chinese white poplar. This can be seen everywhere in parks and other amenity plantings and as a majestic street tree. It is always conspicuous for its large, dark, white-backed leaves, its tall, straight trunk and, particularly, its ash-grey bark that with age becomes mottled grey-black and studded with diamond-shaped markings. It is a most striking species and one that should be better known outside its native land.

***Populus tomentosa* in China** *Populus tomentosa* has a long history as a cultivated plant in China. It is mentioned being grown in Beijing in a book of the fourth century and is frequently recorded in books and paintings of the Ming dynasty (1368-1644) and the Qing dynasty which followed it (Gu, 1983). However, many of the largest trees were lost between 1930 and 1950

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Opposite. *Populus tomentosa*, the Chinese white poplar, growing in Beijing where it is a common tree forming long avenues.

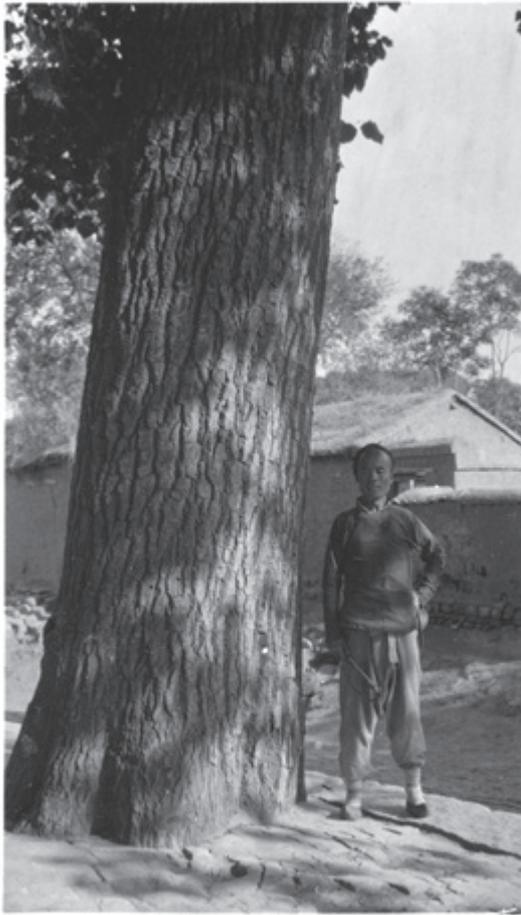
Above. The distinctive foliage and flowers of *Populus tomentosa* and right, the tall, straight trunks have mottled grey bark studded with diamond shaped markings.

when the city was ravaged by war and now only a few mighty veterans remain, such as the 75 year-old, 24 m tall specimen that stands in a corner of the Summer Palace. After the Second World War *P. tomentosa* became an important element in the development of the city because of its rapid rate of growth and tolerance of cold winters, hot summers and pollution but it was not until 1973 with the approval of the Master Plan for the Urban Development of Beijing that it was heavily and widely planted (Hu, 2009; Li & Han, 2013).

This widespread planting was to have unforeseen consequences when the plants matured as the female trees produced clouds of fluffy fruit prompting a mass allergic reaction. In the dry, windy Beijing spring this continues to cause a public nuisance each May, making the trees unpopular with the inhabitants of the city.

Populus tomentosa can be found commonly elsewhere in northern China, The fruit of the female trees litter the streets in May.





Trunk nearly 4 feet in diameter [1.2 m] believed to be a specimen of *Populus tomentosa* growing in a village north of Peking [Beijing], on the Peking-Kalgan [Zhangjiakou] road, China. October 1905.

Photograph taken by John George Jack.

including Shanghai, but does not respond well to the humidity of the south. It is not only grown as an ornamental but is also much planted for timber, paper-production and matchwood (Fang *et al.*, 1999). Its ubiquity as a cultivated plant has led to uncertainty regarding its native range and even its status as a naturally occurring species.

It appears very likely that *P. tomentosa* is of ancient hybrid origin. Bean & Clarke (1976) follow Bialobok (1964) in reporting that it is probably a hybrid between *P. alba* and *P. tremula* var. *dauriana*, making it essentially an eastern version of *P. canescens*, and this is supported by the work of Zhang *et al.* (1995). However, others, including Li *et al.* (1997), give the parentage as *P. alba* × *P. adenopoda* and it may be that multiple species are involved (Du *et al.*, 2012).

Though doubtless its range has been extended by forestry and horticulture, *P. tomentosa* is not solely a species of cultivation. Fang *et al.* (1999) give it as distributed over much of north and central China, to Zhejiang in the east and as far south as Yunnan in the west. It inhabits the plains around the Yellow River, where it plays an important role in ecological and environmental protection (Du *et al.*, 2012), and can also be found in more mountainous areas (C. Yu pers. comm. 2014).

The economic and landscape value of the tree is such that, since the 1980s, its improvement as a crop plant has been a state-supported aim. Efforts to produce better timber trees were encouraged by the detection of a triploid female plant in Yi County (Zhu, 1998) which yielded particularly high-quality fibre (Zheng, 1990). All attempts to breed from this individual failed but trees with superior performance have been achieved through a programme of artificial chromosome doubling carried out at Beijing Forestry University. This not only has the effect of improving vigour, growth rate and fibre quality but also reduces fertility and fruit production so making them more amenable subjects for urban planting (Zhang *et al.*, 2000).

Further attempts to rapidly improve resistance to pests and environmental extremes have employed genetic engineering techniques (e.g. Li *et al.*, 2006) and a recent study has achieved the suppression of some genes responsible for flower development (Chen *et al.*, 2014). The genetic profile of *P. tomentosa* itself is increasingly scrutinised and potentially useful genes have been isolated and cloned from it (e.g. Zhang, *et al.*, 2014; Liu *et al.*, 2014).

Being dioecious, self-incompatible and wind-pollinated trees of hybrid origin, *P. tomentosa* can exhibit great variability (Zhang *et al.*, 2007) and nearly 20 botanical varieties and forms have been named (though only one, *P. tomentosa* var. *truncata* is recognised in the *Flora of China* [Fang *et al.*, 1999]). This morphological diversity may be one reason why the identity of trees grown as *P. tomentosa* outside China has remained so much in doubt.

Introduction to the West Bialobok (1964) and Bean & Clarke (1976) give 1897 as the original date of introduction of *P. tomentosa* to Europe and this is also reported by Armitage *et al.* (2014). However, its first appearance was some years before this when Eugène Simon, then working for the French Ministry of Agriculture, despatched a herbarium specimen (the type) which arrived at the Muséum National d'Histoire Naturelle in Paris in 1863. It appears he also sent material for propagation to the Jardin des Plantes at the same time because a specimen dated 1866 at the Paris Herbarium is annotated (no doubt later) "Culta - doit provenir de Ning-po (Eugène Simon), n'existe plus dans les cultures de cette origine" ("Cultivated - must come from Ning-po (Eugène Simon), no longer exists in the collections [i.e. Paris's living collections] from this provenance"). The conclusion that the plant originated in Ning-po (now usually given as Ningbo) in Zhejiang is probably based on Simon's later

having been based there as French Consul and appears to have been a false assumption as Breitschneider (1898) gives the place of collection as Si wan tze (Xiwanzi), Inner Mongolia, around 100 miles north west of Beijing. Given Simon's movements in the area this dates the collection to autumn 1862 (Breitschneider, 1898).

Though it was from the material sent by Simon that Carrière first described *P. tomentosa* (Carrière, 1867) it seems, as the note on the specimen suggests, that this lineage died out. It was a later introduction in 1897 of three young plants sent to the Jardin des Plantes by Père Provost, a missionary in Beijing, which finally established the species in France (Henry, 1903). A herbarium

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Populus tomentosa growing in Europe.

Above. Suckering growth at Alice Holt from a tree propagated from a specimen planted in the late 1950s received from North America as *P. tomentosa* but thought to have been blown down in 1987.

Right. A tree grown as *Populus tomentosa* at Wisley was planted in 1998 and is thought to be derived from the Alice Holt introduction.

Photographs © James Armitage



Opposite. *Populus tomentosa* growing at the Jardin des Plantes in Paris was planted in 1897. It is labelled as a historic tree and has characteristic leaves (*top far left*) and bark (*below far left*) on a very straight trunk (*left*).

specimen at Paris dated November 1906 shows this collection to be an impressively large-leaved plant of significant horticultural potential for which Henry (1903) provided the name *P. pekinensis*, now treated as a synonym of *P. tomentosa*. Apparently all but one of the trees died but Bialobok (1964) reports that from this survivor many ramets were introduced to the nursery trade and distributed over France and elsewhere. Elwes & Henry (1913) point out that what was circulated in France as *P. tomentosa* was often actually *P. bogueana* (probably a form of *P. alba*) and so it may not have been as commonly cultivated as once thought.

A survey of French arboreta and other collections reveals that now only one tree of *P. tomentosa* grows in France, at the Jardin des Plantes. This plant has very large leaves, to 20 cm long, and so is probably Provost's original introduction. Attempts were made in the 1970s to propagate it but without success. In addition to their great size, the leaves of this tree have undulate and cartilaginous margins which has led some to query whether it is actually correctly attributable to *P. tomentosa*. However, as it is likely to be a living example of the type of *P. pekinensis* it must be considered a representative of *P. tomentosa* if currently accepted synonymy is followed.

Plants grown as *P. tomentosa* on the other side of the Atlantic in North America had a different route into cultivation. In 1905 John Jack sent back cuttings and grafts to the Arnold Arboretum from material collected near Beijing (Bialobok, 1964). The original tree planted grew successfully, as did propagules from it, until 1938 when all accessions were lost in a hurricane that devastated the Arboretum's collections. A further plant named *P. tomentosa* was received by the Arboretum from Al Johnson in 1952 but by 1957 this too had died (K. Richardson and M. Dosmann pers. comm. 2014).

The identity of the Jack collection is not certain. Specimens collected from trees grown in the Arnold Arboretum have leaves to only around 7 cm long, much toothed and lacking a clearly cordate base. One example shows very heavy lobing but it must be suspected this was collected from suckering material of the rootstock. Images of the specimens sent to experts at the Institute of Botany at the Chinese Academy of Sciences were identified as *P. alba*.

Another introduction was apparently made in 1916 by Frank Meyer (Fairchild, 1917) from Wangyuko, Shensi but it is unclear, to us at least, if this ever became established in collections. It seems that stock believed to be *P. tomentosa* did not die out entirely in the United States, however, as the USDA website shows it as currently present at two places in Louisiana.

Populus tomentosa in the British Isles Bean & Clarke (1976) report "A tree in the Forestry Commission collection at Alice Holt, received from the USA as *P. tomentosa*, has not yet been verified botanically. It is of pendulous habit and most ornamental, worthy of cultivation whatever its identity." Jobling

(1990) states that the tree was planted in 1959 having been received in 1955 as a cutting from stock at the Ontario Forest Research Centre, Canada, derived from a tree at the Arnold Arboretum. The Forestry Commission records specify the sender as (Dr Carl C.) Heimburger and reveal another staging post by identifying it as "No. 3828 of Highland Park, Rochester, N.Y." (R. Jinks pers. comm. 2014).

Dr Richard Jinks of Forest Research speculates that the tree was blown down in the great storm of 1987 and only then propagated. The most recent inventory of the Alice Holt poplar collection gives five accessions but an on-site inspection reveals only three remain. These are rather lost among thickets of suckering growth but are starting to make trees of reasonable size with something of the pendulous habit mentioned by Bean & Clarke but showing little of the bright bark so characteristic of *P. tomentosa* in China.

Stock from Alice Holt did make it into horticultural trade around the mid-1980s when John Jobling, then responsible for the poplar collection, provided material to Geoff Locke of Mount Pleasant Trees in Gloucestershire. A tree planted by Mr Locke about 25 years ago is now more than 15 m tall with a trunk diameter of 55 cm and has proved to be female. He estimates that over the years perhaps 50 specimens have been sold (G. Locke pers. comm. 2014), one of them to RHS Garden Wisley where it was planted in 1998 and continues to grow on the western boundary of the Arboretum.

The correct attribution of the British trees remains in doubt. A comparison with specimens of the Jack collection, from which the records suggest they are derived, shows a much narrower base and less acuminate tip to the leaves and they appear to fit fairly satisfactorily within the variation encountered in *P. canescens*. It seems likely that somewhere along the route of distribution from the Arnold Arboretum a substitution has occurred. Against this must be weighed the possible effect of a cooler, milder, wetter climate and the apparent reliability of each link in the chain. A more in-depth study and a survey of the natural variability and phenotypic plasticity of *P. tomentosa* will be required to settle the question.

Conclusion *Populus tomentosa* is a tree rich in history and associations and a most beautiful horticultural plant. Though careful thought should be given to the planting of female trees, it remains a highly desirable subject for the collector of woody plants. We hope these notes might help to bring to light further examples of the species outside China and encourage efforts to propagate and distribute them.

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