Tree of the Year : *Eucommia ulmoides*

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– with contributions from John Anderson, Koen Camelbecke, Brigitte de la Rochefoucauld, John Hillier, Anne Rieber and Mark Smith – writes about this native of central China, rarely seen in the wild.

"If you want to try something really *recherché*, there is a gutta-percha tree that grows well in Kerry."

(A. Henry in Pim 1966)

Introduction

Dr Augustine Henry (1857-1930) was stationed in China as a medical officer from 1881 to 1900 apart from a few short periods on home leave. He began collecting plants in earnest *c.* 1884 and sometime between 1887 and 1890 sent back to Kew for identification, material of the Tu-chung tree: *A. Henry* 3182 (foliage only), 3182A, 4683 and 7936 (all in fruit). Henry had never seen this plant in the wild but noted that the bark was highly prized by the Chinese for its medicinal value.

Based on the above specimens, Dr Daniel Oliver described the plant in 1890 as *Eucommia ulmoides* along with a fine plate of the fruit and foliage. However as he had not seen any flowering material, Oliver was unable to assign a family beyond the possibility of a tribe of the Euphorbiaceae. However, he noted:

"The most singular feature about the plant is the extraordinary abundance of an elastic gum in all the younger tissues – excepting perhaps the wood proper – in the bark (in the usual sense of the word), the leaves and petioles, and pericarp; any of these snapped across, and the parts drawn asunder, exhibit the silvery sheen of innumerable threads of this gum..... 'The bark, Dr Henry, under No. 3182 wrote, 'is a most valued medicine with the Chinese, selling at 4s. to 8s. per lb'. Under No. 4683 (the cultivated Patung specimens), he says further: 'It is planted from the seeds (fruit). The tree is cut down in the third to sixth Chinese months and stripped of its bark .... During the last twenty years the production seems to be diminishing in Szechwan, from where it chiefly comes and the price has increased four- or fivefold ..... Whether the bark has any real medicinal properties I do not know'." (Oliver 1890)

The French missionary Paul Farges (1844-1912) collected in N.E. Sichuan for many years. Adrien Franchet (1896) noted that by 1896 Farges had sent him four large consignments of plants at the Muséum d'Histoire naturelle in Paris. Fournier (1932) stated that since 1892, Farges had not ceased to send important collections to the Museum; the one in 1896 contained some 2000 species, while another in 1900 consisted of 3500 species. Between these two large consignments, several smaller ones had also arrived in Paris.

Flowering and fruiting specimens of the Toú-tchoúng or Sè Mien tree which Farges had found cultivated in 1874, finally reached the Muséum in 1894, accompanied by the following note from him:

photograph © Christine Leon

A leaf of *Eucommia ulmoides* broken to show the fine silk-like thread of gum.

"Lorsqu'on brise l'écorce les vaisseaux corticaux s'étirent comme des fils de soies; c'est pour cela qu'il est appelé aussi vulgairement *sè mien*. Ecorce officinale usitée dans les maladies des reins et comme une charpie dans les blessures."
(Farges in Anon. 1901)

These words are also written on a label attached to *Farges s.n.* comm. September 1894 (K!).

Material was sent to Dr Oliver at Kew and in 1895 he published an emended description and another plate showing both male and female flowers. He placed *Eucommia* in the Trochodendraceae after consulting Professor F.E. Weiss's anatomical work on additional wood samples sent by Henry and correspondence with Professor H.E. Baillon. Oliver considered *Euptelea, Eucommia* and *Cercidiphyllum* to be closely related and Baillon suggested that the three genera had an affinity with Saxifragaceae and Hamamelidaceae (Oliver 1895, Anon. 1901).

Further research carried out by Dr H. Solereder on flowering material sent from Paris and fruits from Kew caused Solereder in 1899 to place the genus in the Hamamelidaceae (Anon. 1901, Harms 1933). P. van Tieghem also did not believe that *Eucommia* should be in the Trochodendraceae and therefore in

1900 placed it in its own family Eucommiaceae, thus emphasizing its isolated position. H.G.A. Engler agreed with van Tieghem and in the 1919 edition of his *Syllabus der Pflanzenfamilien*, Eucommiaceae was put in the Rosales, next to the Hamamelidaceae (Parkin 1921).

Today, molecular evidence places Eucommiaceae close to the monogeneric Aucubaceae, Garryaceae and perhaps Icacinaceae. As can be seen from above, *Eucommia* has been associated with many different taxa but it is the aucubin found in its bark which indicates its true affinity (Mabberley 2008).

Meanwhile, living material of *E. ulmoides* had finally arrived at the Jardin des Plantes, Paris *c.* 1897 or shortly before. Soon plants were growing at the Jardin colonial at Vincennes, as well as at the celebrated nursery of Vilmorin, Andrieux & Cie, Paris. Material from both sources were sent to J.J. Barthelet for his anatomical investigations, published in 1900 and for the economic research of J. Dybowski, the director of the Jardin colonial, and G. Fron, published in the same year. Detailed discussion of the findings of both can be seen in Anon. (1901) and Parkin (1921).

It was on his first Veitch Expedition to China during 1899-1901, that E.H. Wilson collected his original specimens of *E. ulmoides*, of which seed was sent back to Veitch at their Coombe Wood Nursery, Kingston upon Thames. Sargent (1913) listed *A. Aldridge* 629 from an unknown locality, near Ichang, which must have been from a cultivated source. From herbarium specimens under Wilson's name, seen at Kew and RGB Edinburgh, No. 629 was collected in July 1900 in fruit. Sargent (1917) listed No. 629 as an E.H. Wilson collection. There are also fruiting and bark specimens at K! and E!, comm. *A. Aldridge s.n.*, September 1891, 'Tu-Chung', Ichang.

After consulting the Kew Archives, it appeared that Arthur Aldridge had written to Kew on 5 August 1891 from the Custom House, Ichang and his letter arrived on 29 September.

> "Some months back, I forwarded to Dr Henry late of Ichang some shoots of the Chinese plant Tu-Chung, in which you are, he has told me, much interested. I now send you some of the flowers by Parcel Post; the man who got them says the tree is about the size of a peach tree...."
>
> (Aldridge in RBG Kew Miscellaneous Report)

Annotated on the letter was a comment by W.B. Hemsley that he believed a bottle of young shoots in preservative had been handed to Dr Oliver for microscopic examination. Another annotation noted that when asked for further specimens with male flowers, Armitage had sent young fruits. A memo drafted by Daniel Oliver on Armitage's letter read:

> "Specimens of Tu-Chung are unfortunately all in young fruit and similar to those sent by Dr Henry. The tree is clearly unisexual – that is bearing only stamens or only pistils upon the same tree. What we so particularly desire is the stamen-bearing Tu-Chung ....."

> "The young shoots sent a few months ago are at present under examination (By Dr Weiss) to have ..... upon. They do not bear either staminate or pistillate flowers."

While collecting for the Arnold Arboretum in 1907, Wilson collected *E.H. Wilson* 383 and 383A from cultivated plants in western Hubei. The former was gathered in male flower in April and May, female flower in May and in fruit in October. He mentioned in Sargent (1913) that "the removal of the bark causes the death of the tree which probably accounts for it being so far unreported in a wild state."

Fossil leaves of a long-extinct species were found in *Braunkohl* deposits in Germany dating from the Tertiary. In North America fossil fruits were discovered from Eocene strata in Tennessee and Oligocene or early Miocene strata in Montana (Spongberg 1990).

Economic usage: mostly rubber production and medicinal

> "**Gut´ta-per´cha** (*gutta*, a drop), a kind of c[h]aoutchouc, said to be derived from *Dichopsis Gutta*, Benth. and Hook. f." (Jackson 1928)

> "**Caoutchouc** [- Fr. *caoutchouc* – Carib *cahuchu*; in G. *kautschuk*] Indian-rubber or Gum Elastic; the milky resinous juice of certain tropical trees, chiefly the Brazilian *Siphonia elastica* (*Euphorbiaceae)* which coagulates on exposure to the air, and becomes elastic, and is waterproof." (Onions 1973)

> "**Gum** (*gummi*, gum), a viscid secretion frequently extruded from stems and hardening in the air." (Jackson 1928)

> "**Latex** (Lat. juice), (1) the milky juice of such plants as spurge or lettuce ..." (Jackson 1928)

In his invaluable little book, *Notes on Economic Botany of China* which was published by the United States Department of Agriculture in 1893 – without Dr Henry's permission – Henry had noted that it was of the utmost importance that flowering specimens be obtained from both male and female trees in order to aid identification. He also mentioned that:

> "The Japanese and the natives of Kiangsu apply the name *Tu-chung* to a Euonymus: but the bark of the latter is totally different from that of the Szechuan tree." (Henry 1893)

The Euonymus in question was *E. japonicus* and is a good example of how common or colloquial names can cause confusion. This was discussed by Oliver (1890), Holmes (1891) and Anon. (1899, 1901), as the bark known as *Tu Chung* had already attracted attention years before. After the Paris Exhibition of 1878, the Kew Museum was sent:

> "Specimens of a drug consisting of blackened fragments of bark and small pieces of twigs. These when broken across are seen to contain an abundance of caoutchouc which can be drawn in out in fine elastic threads ...."
>
> (Anon. 1901)

Similar material had also been sent to the Museum from the Smithsonian Institution in Washington D.C. but no one was sure exactly what plant they were looking at and where it came from. Various suggestions were made and a notice was placed in the *Kew Report* for 1881. It was not until Dr Henry's specimens were described by Oliver in 1890 that the matter was cleared up (Anon.1901). This confusion also arose in a paper on Chinese printing blocks, where the identity of the woods used came into question. In this case, the *Tu Chung* used for printing blocks was a *Euonymus* (Anon. 1899).

As a result of the deep interest surrounding *Eucommia ulmoides*, Augustine Henry was requested to provide any additional information concerning this species.

> "*Tu Chung* is the name given by the Chinese to the tree, which has been described by Prof. Oliver as *Eucommia ulmoides*. The bark is the only part used, and it is much esteemed by the Chinese as a drug tonic and various other properties being assigned to it. It is described in nearly all Chinese works on materia medica and botany, the earliest mention of it being given in the herbal of which the Emperor Shên-Nung is the reputed author, and which was committed to writing probably as early as the first century of our era."

> "The tree is cultivated in small plantations in the mountainous regions of Szechwan, Hupeh, and Shensi; and from these districts it is brought to Hankow, the great mart for drugs that are produced in the western provinces. From this port about 100 tons are annually exported by steamer to the other treaty ports. The value of this export is put down in the Customs returns at about £18,000; the price varies much from year to year and with the quality of the bark."

> "In the Customs List of Medicines mention is made of a small export, about 100 pounds annually, from Pakhoi, and this is said to be produced in the province of Kwangsi."

> "On my trip to the mountains which lie north-west of Ichang, I was not fortunate enough to come upon the tree in the wild state, but the natives report that it is occasionally to be met with wild in the woods on the great mountain range that form the water parting of the Han and Yangtze rivers; and I was regaled with a story of a lawsuit which had been brought by a man in the Fang district, against the purchaser of a tree which had been unwittingly sold as firewood, but turned out to be the valuable *Tu Chung* tree."
>
> (Henry in Anon. 1904)

> "*Eucommia,* however, is exceptional in having its gutta-like substance existing in the dry solid state in the living plant; so that no milky juice exudes from any part when punctured."
>
> (Parkin 1921)

Major Parkin also noted that the Compositae members *Parthenium argenteum* and *Chrysothamnus nauseosus* also shared this characteristic. In 1910 he

Bark of *Eucommia ulmoides*. Described as "Tu chung... Elastic bark from Chinese merchants". Pharmaceutical Society Museum, now in the Economic Botany Collection, Royal Botanic Gardens, Kew, EBC 42258.

Caoutchouc-yielding bark of *Eucommia ulmoides*, given to Kew by Dr Henry in 1888. Economic Botany Collection, Royal Botanic Gardens, Kew, EBC 43494.

obtained two bales of *Eucommia* bark from China, one weighed 56lbs, while the other contained about half that amount. This was the year of the rubber boom and there was considerable interest in the genus but it soon subsided. Parkin decided to investigate the properties of the bark and after a preliminary examination decided that the substance did not have the qualities of rubber, and although it resembled gutta-percha, it was tougher and less plastic when heated. In 1911, an interested firm of engineers attempted to separate the gutta-percha from the bark in the smaller bale but they could not free the substance from particles of the bark. The larger bale went to Dr Philip Schidrowitz, who after much effort managed to separate the gutta-like substance. He found that it was "tough and almost horny in consistency", dark in colour but without the elasticity of most raw rubbers. It was not sticky and by mechanical extraction the bark yielded 2%, while typical *Eucommia* trees produced two to three times that amount. Also, mechanically extracted *Eucommia* gutta soon became brittle with age (Parkin 1921, Schidrowitz 1921).

Thus as far as the economic possibilities of rubber-like production went, John Parkin was not hopeful that the cultivation of gutta-percha in the British Isles would be financially feasible or worthwhile.

The *Moscow News* announced in August 1931, that the Soviet Union

would be stepping up its production in rubber. They had already cultivated a number of rubber-bearing plants including [cokomia] *Eucommia* and would be increasing the number of the latter to 200,000 trees. All the rubber-bearing plantations within the Union were controlled by the Kautchukenos Trust and they had established six state rubber farms, three in Kazakstan, and one each in Turkmenistan, Trans-caucasia and the Ukraine. They had also created two research institutes to deal with rubber-related problems. By the mid 1930s, the Soviet Union intended to produce 50,000 tons of rubber and 60,000 of gutta-percha annually (Anon. 1931).

Interestingly, when Roy Lancaster visited the Sukhumi Botanical Garden, Georgia in 1979, he was told about a project that took place there during the 1920s.

> "At that time rubber had been produced from eucommia equal in quality to that of Indonesian rubber. Despite this success, on orders from Moscow, production had not been taken up because at the time, it was cheaper to produce synthetic rubber."
>
> (Lancaster 2008)

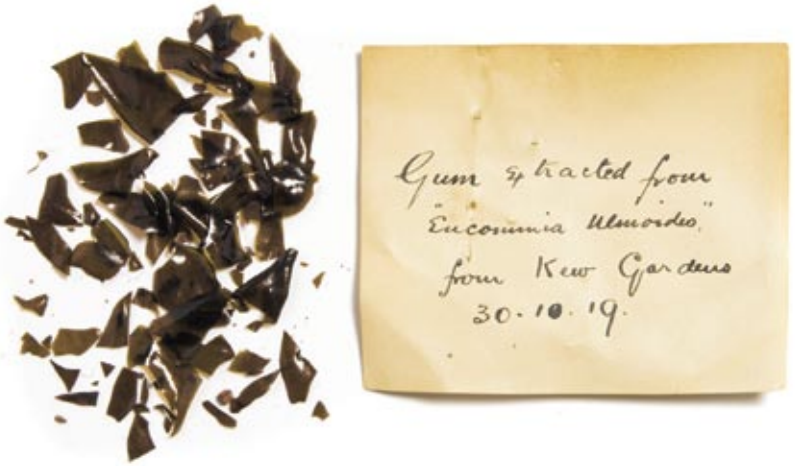
John Hillier *pers. comm.* remembers his father reminiscing about a huge order from Russia, of *c.* 100,000 trees sometime in the late 1920s or early 1930s. Needless to say, it was impossible for them to produce that amount!

It was reported in 1934 that great efforts were being made in Germany to find a substitute for rubber, independent of foreign sources and they were concentrating on *E. ulmoides* (Anon. 1934). One presumes that this must be linked in some way with the publication of Harms's paper (see p. 30) in 1933, despite his negative conclusion.

Today in China, the solidified latex is used for lining oil pipelines, insulating electric cables and for tooth fillings. It is grown as a street tree, while the timber is used to make furniture and as a fuel (Mabberley 2008, Zhang *et al.* 2003).

The gathering of information concerning traditional Chinese medicine reaches back to the Han Dynasty (206 BC-220 AD). The *Sheng Nong Ben Cao Chien* or the Herbal Classic of the Divine Ploughman is the earliest known Chinese pharmacopoeia, dating from *c.* 100 BC. Some 365 traditional remedies are listed, which are then categorised into three classes based on toxicity. Within the first-class remedies, (those that have no bad side effects and thus can be used regularly to boost overall health), is du zhong, which is the medicine derived from the bark of *Eucommia*. It claims to revitalise the internal organs, to increase prowess, to strengthen bones, muscles and tendons and even to delay aging when taken continuously (Forrest 1995). Is it thus any wonder that this tree is now rarely seen in the wild!

The Chinese value *Eucommia* more for its medicinal properties than for other uses mentioned above. They use the dried leaves in soups, teas, pills and tinctures, while the bark lowers blood pressure and increases one's strength.



Gum of *Eucommia ulmoides*, extracted in 1919 from a tree grown at Kew Gardens. In an attached note the Gutta Percha Company of Wharf Road, London, reports "Sir, I have pleasure in sending herewith a piece of the gum extracted from *Eucommia ulmoides* branches and twigs of which you so kindly gave me on the 30th ult. The gum is present in the twigs, taken as a whole, to the extent of 1.14% and in the bark or skin of the branches it amounts to 0.87%. I also send a sample of the bark from a tree grown in China, which may be of interest to you. I shall feel extremely obliged if you will be good enough to inform me of the probable age of such a tree. Thanking you for your attention in this matter. H.J.Garnett." Economic Botany Collection, Royal Botanic Gardens, Kew, EBC 43493.

Bark of *Eucommia ulmoides*, given to Kew in 1881 by Burgoyne, Burbridge & Co, a well-known pharmaceutical manufacturer in London. Economic Botany Collection, Royal Botanic Gardens, Kew, EBC 43496.

> "Farmers harvest eucommia in April, when the bark can be easily removed from the trunk of the tree. The process involves a number of steps. First, harvesters peel bark from trees with a diameter of greater than six inches, being careful not to girdle and kill the plants. They then tie the strips of bark together in bundles and sweat them under straw for a week or until the white inner bark turns black. Next, they lay the strips in the sun, drying the bundles so they can remove the outer bark, leaving only the stringy inner bark. They then chop the strips of inner bark into blocks and send them to market. Herbalists prepare these blocks according to a number of different recipes, depending on the needs of the patient."
>
> (Forrest 1995)

Chemists in North America and Europe have isolated active compounds from *Eucommia* bark, which contains aucubin, an iridoid glycoside. In 1976 tests carried out at the University of Wisconsin supported the claim that du zhong has potential as a antihypertensive drug; while magnocurarine has a neuromuscular blocking effect and causes the skeletal muscles to relax. As there are already similar drugs available, these compounds have not been developed for use within North America (Zhang *et al. 2003,* Forrest 1995, Koller 1978).

Koeller (1978) pointed out that the People's Republic of China banned all exports of the bark in 1977. This was due to overuse and limited supply; thus the bark became increasingly difficult to obtain in Chinese-American shops, as well as much more expensive.

The Economic Botany Collections at RBG Kew contain some 15 items relating to *Eucommia*. These include bark from Chinese merchants, Augustine Henry, John Parkin and others; extracts from the twigs, gum shavings, samples of wood and root bark, (see pp. 21 and 23).

Eucommia ulmoides Oliv.

(*E. ulmoides* var. *yunnanensis* Lévl. nom. nud.)

Common names: gutta-perche tree, Chinese gutta-perche tree, hardy rubber tree, Tu Chung, Shih Mien, Mu Muin, Mu Mien *pro parte*, Toú-tschoúng, Sè Mien, Tsze-mien, du zhong.

Deciduous, broadly dome-shaped trees to 20m, dioecious. Bark pale grey, with deep thick, criss-crossing fissures. Branches spreading, upper ones untidily curling; branchlets olive-brown, hollow, pith chambered. Exstipulate. Leaves (5-)7-15(-18) × 2.5-7(-10)cm, hanging, alternate, simple, lanceolate-elliptic, narrowly ovate to elliptic, oblong-ovate to broadly so**,** deep glossy green and smooth but pubescent when young, containing gum, pinnately veined, hairy along the sunken veins when young; base often unequal, broadly-cuneate or rounded**,** margins serrate with gland tipped teeth, apex acuminate to long**-**acuminate; petiole 1-2.5cm long. Flowers solitary and stalked, greenish-brown, without petals or sepals, in the axils of bracts, below the upper leafy portions of the shoots; appearing April-May, wind pollinated. Male flowers crowded, consisting of (5)6-12 linear stamens, *c.* 1cm long, greenish yellow,

photograph © Brian Schrire

Eucommia ulmoides (1930-91101) at the Royal Botanic Gardens, Kew in 2008.

anthers greyish black. Female flowers solitary or less crowded, bright green, ovary *c.* 1cm long, 1-celled with 2 hanging ovules, style terminal, 2-lobed, translucent white (earwig-like). Fruit indehisent, a samara, 2.5-3.5(-4) × 1-1.3cm long, ellipsoid, with narrow, longitudinal wings, terminally notched; in clusters, resembling those of an elongated elm; seed 1.3-1.5cm × 3mm.

A native of central China, where it is very rarely seen in the wild, (has anyone seen it there?). It is distributed sporadically in western Henen, southern Shaanxi, eastern Gansu, Sichuan, Guizhou, western Hubei, northwestern Hunan and is commonly cultivated in these provinces, as well in Liaoning, Hebei, Shanxi, Shandong, Jiangsu, Zhejiang, Anhui, Jiangxi, Fujian, Guangdong, Guangxi, Yunnan and Taiwan (Tian & Ren 1992, Zhang *et al.* 2003).

This species can be found growing in fertile soil in mixed or sparse forests, thickets, on the lower mountain slopes, on ridges, valleys, dry ravines; usually in sunny sites at (100-)300-2500m alt. Where cultivated, it is also becoming locally naturalised (Tian & Ren 1992, Zhang *et al.* 2003).

Eucommia ulmoides is listed as Vunerable VU A2 on the China Species Red List, when viewed on 26 February 2009. Tian & Ren (1992) regarded its status as rare but mentioned that the number of individual trees "had been much reduced by ruthless cutting, peeling and stripping of the bark for medicinal uses". Infrequent regeneration has also been a factor. These authors further pointed out that urgent action is needed regarding its future. Back in the 1920s, Hu & Chun (1927) had noticed that:

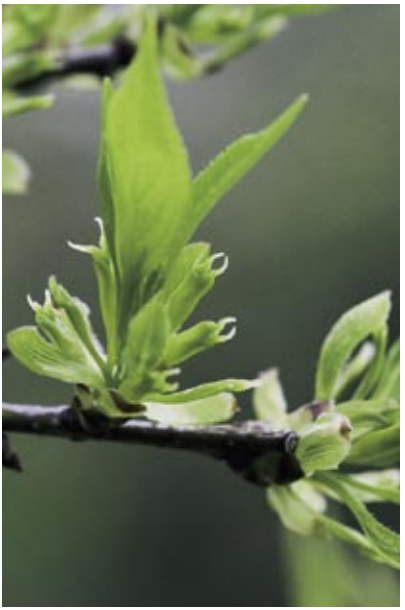
> "Trees of large size in wild state were said at one time to be very common in S.E. Anhwei and W. Chekiang but they were gradually all cut down for fuel by villagers. Fine specimens are still often met with at present in this region."

var. *yunnanensis* was published without a locality or description (Léveillé 1916) but according to Rehder (1936), the name can only refer to the single specimen of *E.E. Maire* s.n., August 1911-1913; Yunnan, forêts de Long-ky, alt. 700m (E!). Rehder could see no difference between this and typical *E. ulmoides* and he also presumed that the material was collected from a tree in cultivation.

Eucommia ulmoides in cultivation: Europe

As mentioned, the first living material of *E. ulmoides* had arrived in Paris by the mid 1890s. Abbé Paul Farges had also been sending various seeds directly to Maurice de Vilmorin in exchange for vegetable seeds for his local Chinese farmers. De Vilmorin (1849-1918) began planting up his family estate at Les Barres from 1894 (Lancaster 2008) and it is probable that he had received some seed of *E. ulmoides* from Farges. In November 1897, Maurice presented a plant to Kew. He had two plants in his own garden in Paris, which were growing against a wall with no protection. In 1899, he stated that they had survived well in the last two mild winters with the temperatures down to 18° or 19°F (Anon. 1901). Maurice had retired from the family business, Vilmorin, Andrieux & Cie some years before, handing over to his brother Philippe. The latter, first offered young plants in his 1902-1903 catalogue, in which was stated that unlike all the other cauotchouc-yielding trees which are tropical, the *Eucommia* could be easily grown in a temperate climate and survive temperatures of 17°F or below (Vilmorin & Andrieux 1902, Watson 1903, Lancaster 2008). *Eucommia* was also grown at another of the family estates, at Verrières-le-Buisson, southwest of Paris, by 1905:

> "Vers le mileu du siècle dernier, cette plante a été introduite ou du moins étudiée à Kew, mais elle est retombée dans l'oubli jusqu'en 1898, époque où M. M. L. de Vilmorin en reçut des graines provenant de Chine [ex Farges]. L' *Eucommia*



The female flowers ***left*** and male flowers ***right*** of *Eucommia ulmoides* (1930-91102, 1930-91101) on plants in the Royal Botanic Gardens, Kew collection.

> *ulmoides* renferme, dans toutes ses parties, une quantité considérable de substance gommeuse, sur la qualité industrielle de laquelle on n'est pas encore parfaitment fixé. La plante est très vigoureuse et supporte parfaitement les hivers moyens sous le climat de Paris."
>
> (de Vilmorin 1906)

In 1904, W.J. Bean noted that plants at RBG Kew had been grown outside without any protection for the last six years. Although the winters had been fairly mild, on a couple of occasions *c.* 20°F of frost had been recorded. He had no doubt that this species would prove perfectly hardy in most parts of Great Britain. Bean described it as a "vigorous, free-rooting plant" which transplanted easily and appears to thrive in most soils (Anon. 1904).

The original de Vilmorin plant was planted in a border near the Economic House (No. 12) at Kew (Watson 1903). It was a male and there are flowering specimens collected by Bean in the Kew Herbarium dated 9 April 1910. Another tree, planted in the Berberis Dell first produced male flowers in spring 1908 (not in 1909 as is usually stated). Bean collected foliage on 3 September 1903 and the flowers on 4 April 1908. Could this tree be 1969.10989?

I do not know what happened to the de Vilmorin tree, when it died or whether it was removed. However, a cutting from it was planted in the

Cambridge Cottage Garden (now the Duke's Garden) *c.* 1917-1918 (Cotton 1942). In time 1969.14459 produced male flowers and in early 2004 was removed due to being blown down in a storm. It does not appear that any surviving cuttings were taken from this historic plant.

In 1920 Bean wrote to John Parkin regarding the *Eucommia* at Kew:

> "At present we have four trees viz. the original one which never having been trained, has remained bushy and comparatively low; and three trees raised from cuttings taken from the original tree. The largest of these is now about 23 feet high, its trunk 22 inches in girth and clear of branches up to 7 or 8 feet. The other two have trunks 21 and 16 inches in girth respectively."
>
> (Parkin 1921)

Following on from Bean's statement, 1969.14459 (see above) was one of the plants raised from the original; could the other two have been 1969.10989 in the Berberis Dell where five accessions can be seen, and 1973.19642 by the Aroid House (now the Nash Conservatory)? Both trees are of unknown source and age but the latter does have a spread of 13.5m (see p. 35).

Parkin (1921) noted that RBG Edinburgh had two trees, both raised from *Wilson* 383 (see p. 19). They were planted out on a lawn in 1911 and measured 2.4m and 1.5m in height with girths of 12.7cm and 10.1cm during the winter of 1920-21. Both were bushy and had yet to flower. By 1960 one of these was *c.* 10m in height and female, according to a herbarium specimen, E! Neither is alive today. Two plants at the Botanic Gardens, Glasnevin in Dublin were also raised from Wilson's seed. They were about ten years old, one was 4.5m on a single stem, while the other was 2.4m high and bushy, (see pp. 34-35). At the University Botanic Garden in Cambridge were another two trees. One came from Veitch & Sons in 1905 (ex *Wilson* 629) and was 4.8m with a girth of 25cm. The origin of the second plant was unknown but it stood < 4.5m in height with a 30.4cm girth; both were tree-like in habit. Both of these trees can still be seen, (see p. 35). The former is a female and it would be interesting to note when it first flowered. In 1960 it stood 9 × 4.5m. The other tree, a male, is a good specimen according to Pete Atkinson *pers. comm.* and in April 1974 flowered profusely.

Other reports were collated by Major John Parkin (1921), from several private gardens in Britain. These included: Sprowston Hall, near Norwich, where Sir Eustace Gurney planted several specimens ex de Vilmorin. They came in as rooted cuttings and all but two were discarded. At ten years old they stood some 3.6m in height with a girth of 22.8cm. Reginald Cory at Duffryn, near Cardiff had two trees; one ex Veitch, planted in 1911 and since being transplanted stood at 4.6m high with an 20.3cm girth, while the other was a sucker from the first; five to six years old and stood over 3.9m in height. [One of these produced male flowers, as there is a specimen in the herbarium at Kew dated 23 May 1922.] Gerald Loder at Wakehurst Place in Sussex had

The male flowers ***left*** and fruit ***right*** of *Eucommia ulmoides*.

three trees, all ex Veitch. One, planted in 1910 in poor dry soil was 3.3m high with a 22.8cm girth; while the other two were planted in 1914, one in loam and the other in clay, 2.8m and 2.7m high, with girths of 7.6 and 10.2cm. At Aldenham House, Elstree, Hertfordshire, the Hon. Vicary Gibbs had several trees planted from E.H. Wilson's seed. Grown in heavy clay, planted between 1911-1913, the measurements of the following three were sent in–3.6m × 20.3cm, 3.5m × 12.7cm and 2.8m × 12.7cm.

Everyone confirmed that *E. ulmoides* was perfectly hardy; at Duffryn the trees were unharmed after 26°F of frost during the winter of 1916-17. At Aldenham, they withstood below 0°F. By 1921, the only one of all the aforementioned trees to have flowered was the Kew plant ex de Vilmorin in 1897 (Parkin 1921) but in fact another male tree at Kew had also produced flowers (see p. 27).

In spring 1910, John Parkin acquired a plant from France. This was planted in a sunny site in his Cumberland garden, *c.* 200ft asl and eight miles inland. It grew well, 5.1m × 33cm by 1921. It produced male flowers in the spring of 1919, 1920 and 1921. A fair amount of new growth was killed off by the severe frost of November 1919, which affected the north-west of England. Two plants were then obtained in April 1911 from Messrs. Barbier & Cie, Orléans. One

was planted in a frost pocket and did not survive a winter, while the other was placed in garden soil, transplanted once and was 2.8m x 10.1cm (Parkin 1921). In later years one of the above grew too large for its site and was removed. A portion of trunk was sent to the Wood Museum at Kew (Parkin 1941), and today it can be seen under Cat. No. 16472 in the Economic Botany Collections.

In the autumn of 1911, Major Parkin bought in 24 year-old seedlings ex Wilson's seed. They were over wintered in a cold greenhouse and planted out the following spring. They started off well, but the attempt to grow them under forestry conditions did not succeed. By 1917 ten had died and the remainder were not flourishing. Parkin's conclusions about establishing a *Eucommia* plantation in north-west England was that such a venture would need shelter and be planted in cultivated ground (Parkin 1921).

W.S. Smith (1934) announced that he had a plantation on his estate in Harpford, near Sidmouth, Devon of about 600 *E. ulmoides* trees. The oldest plants were 16 years old. He noted that they were perfectly hardy in growth but that the main difficulty lay in finding an economic method of extracting the "gum" (Smith 1934).

Professor H. Harms of Berlin (1933) compiled a detailed account of *E. ulmoides*. He pointed out that the tree at Darmstadt Botanic Garden, planted before 1907 (Anon. 1934) had first flowered in 1916. Also that in May 1932, Dr Diels of the Berlin Botanic Garden, had observed male flowers on their tree. In fact, no one in Europe or America had seen any female flowers on their trees to date! Like others before him, Harms ended up by saying that *Eucommia* was of no value if it was not possible to extract the "gum" more economically than at present.

Major Parkin had commented already on the dearth of flowers:

> "So far only the Kew authorities and myself have reported the production of flowers (male ones in both cases) by *Eucommia* in this country. As they are inconspicuous, they could be easily overlooked by anyone not familiar with them and not especially interested in the plant. They are produced just before the leaves in late April or early May, and the greenish-yellow appearance they give the tree might be mistaken for the bursting forth of the foliage leaves. This refers to the male (staminate) blooms only, but judging from analogy the female (pistillate) ones are likely to be even less noticeable. It is therefore quite possible that *Eucommia* may have flowered elsewhere in the British Isles, but the occurrence has escaped notice."
>
> *(Parkin 1921)*

One of the joys of having access to the Herbarium and Library at RBG Kew is that you never know what gems of information one is going to unearth! While foraging through an old file on *Eucommia,* I came across carbon copies of letters sent by the then Director of Kew, Sir Arthur William Hill (1875-1941); he was the one who died in harness, so to speak!

Writing to Prof. Fr. M. Calvino, San Remo, Italy on 15 August 1934, Hill remarked that nearly all the trees in Britain and Europe were probably male, and that there was no known source of seed in the West to date. He noted that there were trees growing at La Mortola, Ventimiglia and elsewhere in Italy; then followed with:

> "One of the largest firms of nurserymen in this country (Messrs. Hillier & Sons, Nurserymen, Winchester), has a large female tree in cultivation. It flowered this year and fruits were produced in June. Apparently, these were sterile owing to the absence of a male tree nearby for pollination. We propose attempting to graft scions from this female tree on to our male stocks ....."

There are two specimens in female flower dated 27 June 1934 from Hillier & Sons in the Kew Herbarium. According to John Hillier *pers. comm.*, this tree was growing in their Winchester Garden Centre on pure chalk. It was removed a few years ago as it was rotten in the middle. He remembers it as being about 7.2m in height, (see p. 35).

On 28 January 1935, Hill wrote to a Professor G. Bossé on the subject of *Eucommia.* He stated that the trees at Kew were all male, and that they had never known the trees to change sex. The oldest trees at Kew were about 30 years old and that they grew well apart from wind damage. The bark had never been stripped off for experimental purposes and that cuttings had been taken but not in large numbers.

> "Our original tree was procured from France. The original was probably raised from seed received from China and our tree was probably raised from a cutting."

In 1930 a couple of plants arrived at Kew from the Arnold Arboretum. 1930.91101 and 1930.91102 were male and female. Herbarium specimens made on 4 September 1942 noted that the latter was fruiting well that year. By 1964 it was some 20 ft in height (*R. Melville s.n.* K!), (see p. 35).

The *RHS Plant Finder* 2008-2009 lists nine nurseries that supply *E. ulmoides*.

Eucommia ulmoides in cultivation: North America

According to Forrest (1995), the oldest specimen of *E. ulmoides* in the Arnold Arboretum probably originated from *E.H. Wilson* 629 (see p. 18); as AA #14538 arrived as a plant from the Veitch Nursery on 15 November 1907. This was a male plant and is still flourishing. Was this the first record for the gutta percha tree in North America? At Kew we have a herbarium specimen collected in male flower by Alfred Rehder on 8 May 1919; could it have been from this plant?

Of the 12 holdings mentioned by Todd Forrest (1995), I only saw five accessions when I was at the Arnold in early November 2008. Of these the more mature holdings were: #21931 A & B – two grafted female trees from a

uncertain source (one N.T. Kidder, Milton, MA); they arrived in February 1929, while #112-40 A & B were scions from #21931B and accessioned in February 1940. It would be interesting to know when these trees began to flower?

According to Bickford (1917), the US Department of Agriculture distributed several hundred small trees and even in central Kansas, the plant appeared perfectly hardy. Dirr (1990) noted that it is hardy in Zones 4-7 and has survived -20°F at the Secrest Arboretum, Wooster, Ohio. He rated it highly as a shade tree, especially in the Midwest and in particular commented on the pest-free foliage during summer months. However, Dirr also pointed out that *E. ulmoides* had never been popular and he had his doubts regarding its tolerance in urban situations.

Koller & Dirr (1979) had reported that it had been successfully planted as street trees in Cleveland, Ohio and Indianapolis, Indiana and thus deserved further consideration. However, the wide spreading crowns of *E. ulmoides* made parks and more open areas a better option.

The most striking specimens that I have seen to date are a magnificent erect male and female pair of trees at the Dawes Arboretum, Newark, Ohio in late October 2008. They arrived in 1950 from Kohankie & Sons of Painsville, Ohio and have produced lots of viable seedlings, some years better than others. *Eucommia* is regularly sold by Ohio nurserymen as a landscape plant (Payton & Larsen *pers. comms.*), (see p. 34).

Jacobson (1996) noted that the nursery trade only sold *E. ulmoides* from *c.* 1940 and that it still remained very rare in cultivation until the 1980s. The 4th, 5th and 6th editions of the *Anderson Source List* mention 13, 13 and 15 stockists respectively (Isaacson 1996, 2000, 2004).

Propagation and pruning

W.J. Bean noted that this species propagated easily and young trees struck from cuttings five years ago were now 1.8m high, making 0.6-0.7m of growth per season.

He used two methods:

> "The quickest method is to take pieces of the current season's growth, about 6 inches long, in late July or early August, insert them in pots of very sandy soil (the usual mixture for cuttings), and then place the pots in a house or frame where slight bottom-heat can be afforded. The cuttings should be made of shoots in what gardeners term a "half-woody" condition. They will take root in a few weeks and can then after a "hardening-off" period be planted in nursery beds. The second method is to make the cuttings of the leafless wood in November and dibble them in sandy soil in a cool frame or out of doors under a *cloche* or hand-light. They will take root the following spring. This method is not so quick as the other, nor have we found it so sure."

> "We have had no experience with plants raised from seed, but we find that with plants raised from cuttings it is necessary in order to make them assume a tree-like form, that they should be pruned for the first few years. This pruning consists in keeping the plant to a single leader by removal of rival ones, the

photograph © Brian Schrire

A detail of the bark of *Eucommia ulmoides* at RBG, Kew.

> shortening back of side shoots that have become unduly vigorous, and the gradual removal of the lower branches as the tree increases in height till a clean trunk of (say) 6 feet has been formed. Unless the plants are pruned they assume a more or less bushy form."
>
> (Bean in Anon. 1904)

John Parkin (1921) mentioned that although *Eucommia* grew quickly, its habit of growth was not very satisfactory, as it was inclined to produce more sucker-like growths rather than a decent leader. These shoots could be up to 0.9m long and he thought that they were probably induced through the die-back of the previous summer's growth. He also wondered if layering might work as a method of propagation.

Dirr (1990) recommended that the seeds needed cold moist stratification for two to three months.

IDS members comments

Mark Smith of Ballacurn on the Isle of Man has a 6m specimen, which he has grown from seed. He mentions that the latex in the seeds prevents mice eating them but queries whether removing the wings of the fruit hinder or aid seed germination?

Brigitte de la Rochefoucauld has five *E. ulmoides* planted between 1992 and 2000 in the Arboretum des Grandes Bruyères, some 70 miles south of

Paris. The tallest is 8m and dates from 1992. *Eucommia* do extremely well in the area and appear to like the soil conditions, which are a light sand over clay; the latter can vary from 40cm to one meter deep. In the winter the soil turns into a bog when wet, while during the summer months the sand layer heats up. Therefore, the trees send their roots deep into the soil to survive and *E. ulmoides* does this happily.

Koen Camelbeke, Curator of the Arboretum Wespelaar, outside Brussels, Belgium notes that they have four specimens, two female, one male and another which has yet to flower. They grow well but the new growth can be susceptible to spring frosts. In the mid 1980s a fifth plant was killed by frost. One of the above came from the National Botanic Garden of Belgium at Meise in 2007, where it had been grown from Kyoto Botanic Garden seed.

In BELTREES (the database of Trees in Belgium), Koen could locate only five specimens, (see p. 35); thus it is a rare plant in Belgium.

Anne Rieber outside Bergen in Norway noted that *Eucommia* had been tried out at the Norwegian Arboretum, Milde. Seed was obtained from Taipei Botanic Garden, Taiwan in 1986 and a young seedling was planted out in 1992. It was alive in 1994 but not by 1997.

LOCATION	ACC./ TREE NO.	HT. + SPREAD (m)	TRUNK DIAM. (cm) @ 1m	NOTES
Arnold Arboretum	21931-A	21.5	43.5	pl. 1929, female
Jardin des Plantes, Paris		19.5	0.9m (1982)	pl. 1936
Dawes Arb., Ohio	D1950-0013.0 02	19	52.3	pl. 1950, female
Dawes Arb., Ohio	D1950-0015.0 01	18.1	43.3	pl. 1950, male
Les Barres, France		17.5	(1984)	pl. 1922
NBG Glasnevin, Dublin		17	0.8m (1987)	ex Wilson seed, RIP
Arnold Arboretum	112-40-B	16.8	(2008)	pl. 1940, female
Philadelphia Co., PA		16.5	1.9m (1980)	Jacobson (1996)
Arnold Arboretum	14538A	16.1	61.1 (2008)	pl. 1907, male
Seattle, WA		15.9	0.9m (1990)	Jacobson (1996)
Mount Usher, Co Wicklow		15		ex Wilson seed

LOCATION	ACC./ TREE NO.	HT. + SPREAD (m)	TRUNK DIAM. (cm) @ 1m	NOTES
Nymans, Sussex		13.8	1.4m (1983)	
Arnold Arboretum	21931-B	13.8	74	pl. 1929, female
Cambridge BG	10005920	13.5 x 14.5	65 (2009)	male, N of South Walk
Citadelpark, Gent, Belgium			1.93m at base	3 trunks
RBG Kew	1930-91101	*c.* 12.9 x 12.4	60 (2009)	pl. 1930, male ex Arn. Arb.,
RBG Kew	1969-14459	12.6	47 (1981)	Prop. ex de Vilmorin pl. of 1897; pl. 1917-18, male, RIP
Hartford, CT		12.3 x 14.4	1.5m (1988)	Jacobson (1996)
BG Belgium, Meise		12	1.69m at 1.5m (1995)	
Hillier Garden Centre, Winchester		12	1.3m (1882)	Female, first flowered in 1934
Abbeyleix, Co Laois, Ireland		12	0.9 at 0.9 (1985)	
Hof-Ter-Saksen, Beveren, Belgium		12	64 (2002)	pl. 1983
RBG Kew	1930-91102	*c.* 12 x 9.7	31 (2009)	pl. 1930, female, ex Arn. Arb.
Cambridge BG	10005854	10.4 x 8.6	36 (2009)	Ex Veitch 1905, female, nr. Lynch Walk
RBG Kew	1973-19642	*c.* 9.7 x 13.5	54 (2009)	forking at 1.3m, 2 trunks, male
Arnold Arboretum	112-40-A	9.7	46 at 75 (2008) 48.5 at base	pl. 1940, female
RBG Kew	1969-10989	*c.* 9.6 x 9.4	50 (2009)	male
RBG Kew	1980-6469	*c.* 9 x 5.6	22 (2009)	ex For. Comm., male
NBG Glasnevin, Dublin	XX000497	9 x 5.4	43 (2009)	pl. c. 1911, ex Wilson seed. In Chinese Shrubbery
Kastel von Bever, Grimbergen, Belgium		6	57 (2004)	
Bokrijk, Belgium		6	32 (199?)	Baudouin & de Spoelberch (1992)
RBG Edinburgh	19760163	*c.* 4 x 4	(2009)	pl. 1976

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Tree of the Year 2009:

For 2009, the chosen taxon is the monotypic *Trochodendron aralioides* in the Trochodendraceae. In recent years some striking plants have been observed and it would be useful to collate this information.

Please send your comments, photographs and any other information (in any language) to Susyn Andrews, 86 Thompson Avenue, Kew, Richmond, Surrey, TW9 4JN to arrive not later than 31 October 2009.