METASEQUOIA GLYPTOSTROBOIDES

50 years out of China.

Observations from the United States and Denmark.

by

Donald R. Hendricks* and Poul Søndergaard**

*The Dawes Arboretum, 7770 Jacksontown Road, S.E. Newark, Ohio 43096-4380 U.S.A.
**Royal Veterinary- and Agricultural University Arboretum, 2970 Hørsholm, Denmark.

METASEQUOIA GLYPTOSTROBOIDES

ude af Kina i 50 år

Iagttagelser fra U.S.A. og Danmark

Keywords: *Metasequoia glyptostroboides,* growth and development, genetics.

ABSTRACT:
Metasequoia glyptostroboides has been in cultivation outside China since 1948. Seed was collected by a Chinese expedition during late summer 1947 and distributed with the main part to the Arnold Arboretum, which had arranged a grant for the collection of seed. A few samples were also shipped to Europe, i.a. Denmark. When China reestablished contacts to the western world, seed of *Metasequoia* were again sent out of China: to Denmark in 1979 and to The U.S.A. in 1990. Examples are given of the development of plants from the three collections.

INTRODUCTION

Hundreds of articles have been written about the dawn redwood or water fir since it was discovered by botanists in 1941. T. Gan from the National Central University, Nankin saw the dawn redwood in Hubei during late autumn 1941, when he was travelling in Central China (Florin 1952). The tree was without leaves and difficult to determine. In the same year, 1941, the Japanese botanist, S. Miki, described a new coniferous genus from fossilized leaves and cones, which he called *Metasequoia.* Foliage shoots and cones were collected in 1944 and again in 1946 and brought back to Nanking. It was finally realized that

this was a conifer species new to China's living flora, and not the Chinese swamp cypress, *Glyptostrobus lineatus,* which was a first assumption. It also became clear that this species belonged to the genus *Metasequoia,* described by Miki. A full description was given by H.H. Hu and W.C. Cheng in 1948, and they coined its specific epithet: *glyptostroboides.* Its local name is „*shuishan*" (Fu & Jin 1992). This was translated to water-fir and adopted as the common name in Great Britain. At first it was called Chinese redwood in the United States, because of its close relationship to the Californian redwood. However, American journalists preferred the more romantic dawn redwood, which is now the commonly used name in the U.S. The Danish name „*vandgran*", is an attempt to a direct translation of *shuishan.*

DESCRIPTION OF METASEQUOIA GLYPTOSTROBOIDES

The dawn redwood grows to 50 m tall in the wild, with diameters to 2.5 m, and estimated ages of the biggest trees exceeding 300 years (Kuser, Sheeler & Hendricks 1997). Young trees (to 50 years) are pyramidal with tapering stems, and most trees have strongly buttressed bases with an intricate pattern of vertical pits and ridges. The bark is fissured, brown to dark grey, peeling off on mature trees in long threads, which in Denmark is popular among squirrels for building nests. Branches are normally opposite (Böcher 1964), young shoots green (sometimes bluish) and glabrous, later turning brown, with exfoliating bark; eventually brownish grey. The distichously arranged short shoots are deciduous together with the leaves in winter. Leaves opposite, soft, light green on both surfaces, arranged in two ranks, 10 - 30 mm long and 2 - 3 mm wide, decussate, with a flattened lamina, slightly falcate and grooved on the upper (adaxial) surface. The plants are monoecious. Microsporangiate strobili (male cones) are about 5 mm long, arranged in racemes or panicles. Macrosporangiate strobili (female cones) are pendulous, subglobose, ripening in the first year, 15 - 25 mm long, 13 - 20 mm in diameter, with five to nine winged seeds under each scale.

Dawn redwood pollinates in March, in both the U.S. and Denmark. Trees produce female cones (macrosporangiate strobili) when they attain a height of 9 - 15 m. The male cones (microsporangiate strobili) are not produced until the tree reaches a height of 18 - 25 m. At pollen flight, female strobili are 4-5 mm long, emerald green in color, and very sticky. The effective range of the pollen seems to be approx. 100 meters. Male cones have seldom been seen in Denmark and seem to be very scarce (except in 1998), while female cones occur more often and sometimes abundantly. No fertile seed has been found in *Metasequoia* cones in Denmark. The species is apparently at- or beyond

its limit for natural reproduction, which probably is caused by heat sums that are insufficient for the initiation of male strobili.

Metasequoia belongs to the Taxodiaceae and is similar to the bald cypress, *Taxodium distichum*, in its deciduous habit. However, the leaves in *Taxodium* are spirally inserted on the branchlets, while they are strictly opposite in *Metasequoia*.

NATURAL RANGE AND HABITAT

The natural range of native *Metasequoia* as observed by Gressit in 1948 (Li, 1963) was approximately 800 square kilometers and includes sections of western Hubei, northern Hunan and eastern Sichuan provinces. The majority of the largest plants are found in Hubei within a 20 kilometer canyon. The valley is enclosed on all four sides and has a small river flowing through it. The valley bottom is mostly occupied by rice paddies with farm houses on both sides of the stream. The west side of the valley is fairly steep, but the east contains many side canyons, where some of the tallest trees occur (Bartholomew 1981). Altitude ranges between 750 - 1500 meters. Annual rainfall is approx 1.22 meters with some snow and ice. Rainfall is abundant in the summer months. Trees are primarily growing on an acidic yellow soil (mollisol).

J. L. Gressitt, from University of California at Berkeley, on a trip to the valley in late summer 1948, noted that there are many familiar-looking trees including beeches, willows, poplars, oaks, maples, chestnuts, and sassafrases. He later wrote that an American or European viewing only the trees might think himself near home (Sand, 1992). Chu and Cooper (1950) also visited the area in 1948 and made a description of the natural habitat of the *shuishan* and listed the main tree species with which it was associated (arranged after decreasing presence inside the 10 x 10 m quadrats laid out in areas in which *Metasequoia* was important): *Metasequoia glyptostroboides, Cunninghamia lanceolata, Castanea sequinii, Liquidambar formosana, Cornus controversa, Lindera glauca, Meliosma oldhamii, Acer davidii, Styrax japonica, Idesia polycarpa, Populus adenopoda, Nyssa sinensis, Prunus* sp., *Kalopanax pictus, Clerodendron mandarinorum, Taxus chinensis, Pterocarya paliurus, Morus* sp., *Quercus variabilis, Torricelia angulata, Salix* 2 spp., *Cercidiphyllum japonicum* var. *sinense, Betula luminifera, Carpinus fargesii, Ficus heteromorpha, Litsea elongata.* Outside the plots were noted other close associates of *Metasequoia: Cephalotaxus fortunei, Fagus longipetiolata, Quercus acutissima, Sassafras tsumu, Tapiscia sinensis* and *Ulmus multinervis.* In addition to the 33 species of trees they list 47 species of shrubs and woody lianas (e.g. *Hedera nepalensis, Spiraea japonica, Parthenocissus tricuspidata, Akebia trifoliata, Actinidia chinensis,*

Cotoneaster horizontalis, Euonymus alata, Evodia officinalis, Decaisnea fargesii, Helwingia japonica, Picrasma quassioides, Rhamnus utilis, Hibiscus syriacus). Even if many of the mentioned species are familiar to professional and amateur dendrologists, a similar richness in species can not be found in European forests and hardly in any other warm temperate area.

Expeditions 1946 - 1948

As soon as Dr. Merrill (then-director of The Arnold Arboretum) saw the evidence of *Metasequoia* in 1946, he arranged a grant for the collection of seed. [Arnold's total grant to China was $250 US dollars which yielded $9,750,000 in Chinese currency at that time (Merrill, 1948)].

After three months of collecting in the late summer and fall of 1947, one kilogram of seed was sent to the U.S., Copenhagen and Amsterdam from China. The seeds received by Arnold were divided into over 600 packets and distributed to 76 institutions and persons in the U.S. and Europe (Kuser 1990).

There has been much debate about how the seed was collected and from which trees in China they originated. Some thought the source included only one big tree in the village of Modaoqi, while others claimed that it came from multiple trees (up to 100) throughout the native range of Metasequoia. Recent genetic work and the discovery of missing correspondence has solved that issue, se page 17.

Another expedition was mounted in 1948 by J. Linsley Gressitt of California, University of Berkley to study the flora and fauna, but no collecting was done.

It was also discovered in the U.S., as in Denmark, that cuttings readily rooted, so the cuttings were distributed to any nursery interested and many plants were distributed that way.

The Bamboo Curtain (lapse 1949 - 1980)

The 1948 trip was the last to be made to China before the communists gained control and drove nationalists off the mainland in 1949. During the 1970es contacts were renewed between botanists in China, Denmark and the U.S.. In 1974 a Danish delegation directed by Gunnar Seidenfaden, former Danish ambassador to China (and internationally recognized as an expert on the Orchidaceae) was invited to China. The group was joined by the former director of the Hørsholm Arboretum, Bent Søegaard and dendrologist Søren Ødum, who is now director at Hørsholm and who pulled the strings in 1974. From the U.S. a similar visit took place in 1978, when a delegation of American botanists was invited to visit botanical gardens and institutions in the Peoples republic of China.

Finally, China was reopened to foreign trade and investment, and exchange of plant material was revived by a shipment of *Metasequoia* seed to Hørsholm in 1979, and by the joint Sino-American expedition, which collected in China in 1980 and i.a. visited the *Metasequoia* valley for three days.

Growth and development in the US of plants from the 1947 seed

Many trees were grown from the original seed that entered the U.S. It was first thought that the species could not survive in the colder climates, because of the mild climate of the site where the type specimen was found, but, as time went by, it was discovered that *Metasequoia* preferred climates where there was ample moisture year round. It grows well in Santa Barbara, California (USDA Zone 10) and has survived winters with temperatures down to -35 C in Ohio (USDA Zone 5). It grows equally well on the Pacific Coast, eastern North America and Europe. Since nothing was known about how dawn redwood would adapt to U.S. and European conditions, the growth of *Metasequoia* has now become one of the best documented plant introduction projects ever.

In 1981, John Kuser of Rutgers University, New Jersey, sent questionnaires to everyone he could find who had one of the 1947 trees. His compilation of the 50 largest trees included specimens from the U.S., England, Netherlands, New Zealand, and Canada. Reports ranged from 104' (34 m) trees in Virginia to 35' (12 m) in Vancouver (Kuser, 1982).

In the U.S. where groves of *Metasequoia* occurred, cross-pollination did produce offspring, once the trees had male cones. As early as 1983 young seedlings were found growing in Knoxville, Tenn. The following year seedlings were discovered in New Jersey (Kuser 1990).

Trees grown in isolated conditions do not seem to produce viable seed. *Metasequoia* seems to have a similar genetic predisposition to self fertilization as *Pseudotsuga menziesii* (Kuser, 1983).

Dawn Redwood in Denmark

In December 1947 seed was also distributed from China to botanical institutions outside the U.S.A., i.a. The Copenhagen Botanical Garden, The Arboretum at Hørsholm and its satellite garden, The Forest Botanical Garden, Charlottenlund. The seed arrived in mid February 1948 accompanied by the following letter:

The Arboretum,
National Central University,
Ting Chia Chiao, Nanking,
China.

Dec. 26, 1947

Director,
Forest Botanical Garden,
Charlottenlund, Denmark.

Dear Sir,

I beg to inform you that we have recently discovered a living species of the fossil genus *Metasequoia* of Coniferae. The genus was described by S. Miki in the Japanese Journal of Botany XI. p. 261 (1941). The genus has ten fossil species and one living species. The only new living species, *Metasequoia glyptobostroides* Hu et Cheng, is confined to eastern Szechuan and southwestern Hupeh in Eastern China. This is a big tree up to 35 m tall and 2,3 m in diameter. It is manifestly allied to the American genera *Sequoia* and *Sequoiadendron*, but differs from both in the deciduous habit and in the opposite branchlets, leaves, flowers and cone scales. It seems to be an intermediate link between Taxodiaceae and Cupressaceae. The mature seeds of the *Metasequoia* were secured this year.

Enclosed here I am sending you a few mature seed of *Metasequoia glyptostroboides* Hu et Cheng for propagating in your country. I think that you are interested to have them. I should be most obliged to you if you send us some seeds of conifers or other arborescent species and your publications.

Thank you in advance.

With kind regards,
Sincerely Yours,

Wan-Chun Cheng
Professor of Dendrology

The Copenhagen Botanical Garden received a similar batch of seed. Most of the seed of the two lots were sown at Hørsholm in April 1948. Germination was excellent, and 159 plants were raised in the arboretum nursery (Syrach-Larsen 1967). Four months later, in August 1948, cuttings taken from the young plants (in mid-July) were rooted. More or less simultaneously, juvenile cuttings were rooted in the U.S. (Creech 1948). The Dawn Redwood is easily propagated by cuttings, and this is, by far, the most used method for multiplying the species in Denmark. Of the original 15 plants from 1948 planted at Charlottenlund, 12 are left, and of the 17 planted at Hørsholm 12 are remaining (see fig 1).

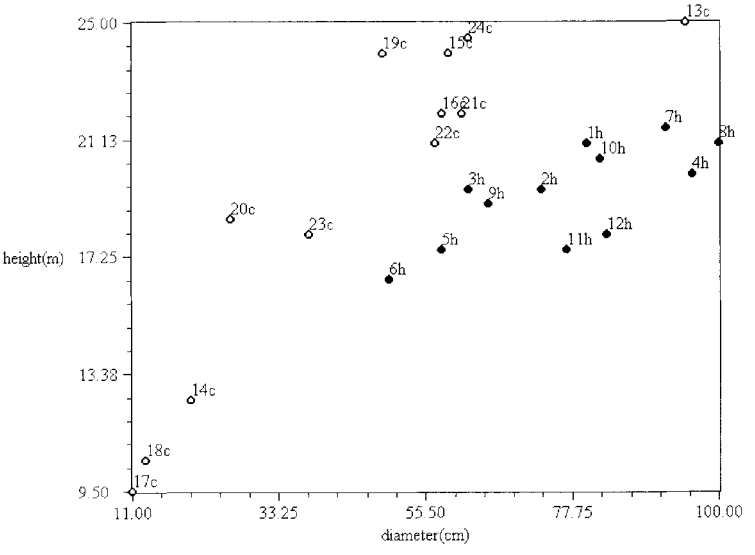


Fig. 1. Height/diameter plot for the 1948 plants from seed (298-48) c = Charlottenlund, h = Hørsholm. Højde/diameter-fordeling i 1998 for 1948-træerne fra frø.

There is a clear difference between the trees in The Forest Botanical Garden at Charlottenlund and those at Hørsholm, fig. 1 . The trees at Charlottenlund are generally taller and more slim than the trees at Hørsholm. This is most certainly due to the fact that the Hørsholm Arboretum (from 1936) was still a very young collection, when the dawn redwoods were planted in 1950. Because of that the trees were constantly exposed to wind and strong competition from the ground vegetation. In The Forest Botanical Garden (from 1838) the plants were protected from the very beginning by an old, open, forest-like vegetation. The tallest tree at Charlottenlund was 25 m, when measured in March 1998. The three smallest trees were between 9.5 and 13.5

m in height. Two of those were planted very close to an old Lime, *Tilia x europaea*, and suffered from too strong shade. The weak development of the smallest tree, 9.5 m, could be explained by genetic differences. It is growing a few meters from the tallest tree, and has had the same possibilities as this to grow big. At Hørsholm there are no conspicuous small trees. Slow growing trees could either have been taken away or died naturally; no records have been kept in that respect. However, it seems that the seed received in 1948 was of good quality, and it certainly produced a large number of plants, in which depression of growth was not apparent. This seems to correspond to the results with 1948 plants in the U.S., demonstrated by Kuser, Sheely & Hendricks (1997). Heights have been measured a few times on three of the 1948- trees at Charlottenlund, see table 1. The trees seem to have grown very fast during the first twenty years (0.5 - 0.7 m per year), while there has been a slow down between 20 and 50 years of age (between 0.3 and 0.4 m per year). Height development for the fastest growing tree (nbr. 1) is comparable to the performance of Norway spruce, *Picea abies*, (the most planted conifer in Denmark) under the most favorable conditions, site quality I. However, dawn redwood is light demanding and develops very slowly in deep shade. This probably means that it must be planted with good spacing in order to obtain a satisfactory development.

Table 1. Height development for three of the 1948 trees at Charlottenlund.

Year	1954	1966	1967	1998
Tree nbr. 1	3.7 m	12.2 m	13.2 m	25.0 m
Tree nbr. 2	3.6 m	10.6 m		24.0 m
Tree nbr. 3	2.3 m			22.0 m

Ten plants were in 1950 selected for vegetative propagation (acc. nbrs. 720-50 to 729-50) and a varying number of plants from these clones were transplanted to the collections at Charlottenlund in 1966. Fifteen trees of seven of the 1950- clones are left at Charlottenlund, see fig. 2.

It was uncomplicated to transplant the fifteen year old clonal plants (Syrach-Larsen 1967), and their growth has not been slower than that of the original plants from seed. Neither is there clear differences in other characters between the clonal plants and the plants from seed at Charlottenlund.

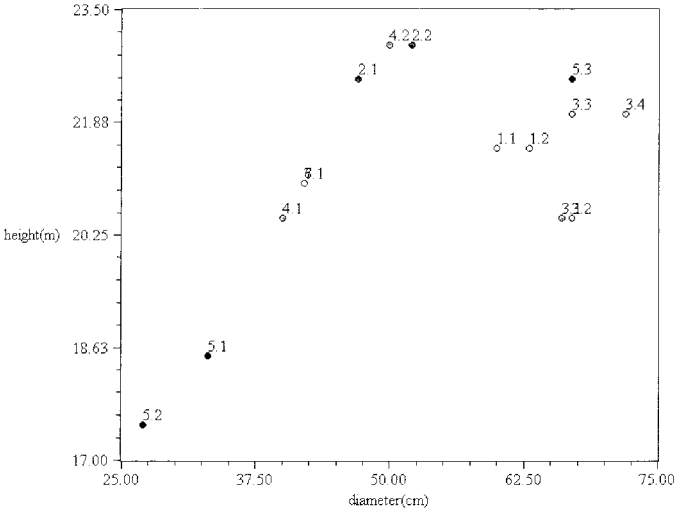


Fig. 2. Height/diameter plot for clonal plants at Charlottenlund. Clones 720-50, 721-50, 723-50, 726-50, 727-50,728-50, 729-50 (ex. 1.1 = clone 720 tree no. 1, 2.1 = clone 721 tree no. 1). Højde/diameter-fordeling for klonerne fra 1950 (eks. 20.1 = klon 720 træ nr 1)

One of the trees from seed (298-1948) at Charlottenlund and one of the clonal trees from 1950 differ from the remaining by not - or hardly having buttressed bases. They might be interesting for forestry from a commercial point of view, while the more irregular buttressed bases can be an appreciated quality in amenity plantings.

Seedlings, and plants of the 1947 seed, were distributed to different collections in Denmark in the beginning of the 1950's, and by way of vegetative propagation the dawn redwood was available in most commercial nurseries from the late 1950's. It has since become a popular tree in Danish gardens and parks and in a few cases as a street tree. No inventory has been made of the number of dawn redwood in Denmark. During a twenty kilometer tour in the suburbs of Copenhagen one can count between ten and twenty mature trees of *Metasequoia*, and there probably is far beyond 50,000 trees in Denmark. Most of the trees are descendants from clones selected around 1950.

New introductions of Metasequoia from China

A new batch of seed was collected in Li-chuan county, Hubei , from a natural seed production stand (Pan Zhigang 1998) and shipped from Peking to the Hørsholm Arboretum in 1979. This was a spinn off from

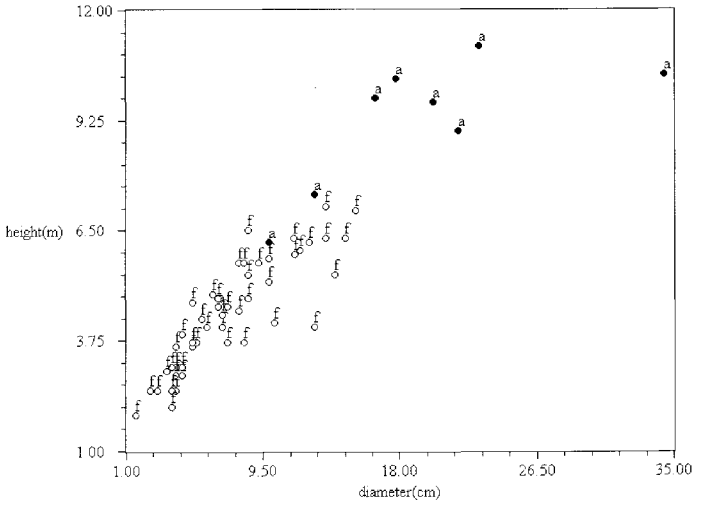


Fig. 3. Height/diameter plot for the 1979 plants (109-79) at Hørsholm transplanted 1986. a = old arboretum area (from 1936), f = Frihedslyst (10 ha extension from 1986). Højde/diameter fordeling for 1979-træerne fra frø.

the Danish delegation to China in 1974. From this accession 58 plants were planted at Hørsholm and 2 in Charlottenlund, at both places in 1986, see fig. 3.

Nine plants were planted in the old arboretum area from 1936 (A1 - A9) and 49 (F10 - F58) in the 10 ha extension, Frihedslyst, from 1986. The old arboretum and Frihedslyst were both established on former farm-land. The plot in the old arboretum was protected by the surrounding trees and have grown faster both in diameter and height than the trees in the open and wind exposed Frihedslyst. This reminds of the situation in 1950, when there was a similar difference in environment between Hørsholm and Charlottenlund

In May 1990 professor Minghe Li of Huazhong Agricultural University wrote to Dr. John Kuser at Rutgers University, New Jersey.. „There were about 6.000 big trees growing in a valley area of Hubei Province (in 1940). In 1985 (by my memory), big trees of the species were also found in Hunan Province. Now, several millions of trees of the species (mostly rooted cuttings) are planted in the central, southern and eastern part of China each year. I believe the (genetic variation) is much larger than in the U.S.. Seed collection is possible if you can provide some financial support"... Dr. Kuser managed to raise funds for seed collection i.a. from The Dawes Arboretum, Ohio, and in April 1991 seed was received by Dr. Kuser at Rutgers sent by pro-

fessor Li; 53 packets from 52 parent-trees. The seeds were germinated at Rutgers and 48 of the 52 parent trees produced offspring. A randomly arranged trial planting was established at the Rutgers University and a similar number of plants (344) was shipped to The Dawes Arboretum and planted in a replicate trial on 8 acres.

The latest accessions of *Metasequoia* at the Hørsholm Arboretum were shipped from Dawes Arboretum in February 1996 (the cuttings arrived at Hørsholm less than 36 hours after cutting, packing and dispatch from Ohio). 1675 cuttings were taken from 335 individual plants in the replicate trial planting, representing 48 parent trees in China. Most of the cuttings were divided in two, planted in a mist house in March 1996 and overwintered in a glasshouse during the following winter. In the summer 1997 the plants were transplanted to shaded frames in the open. From here they will be transplanted to the nursery in 1999 and eventually to the forest (two or three years later). 367 cuttings of the original 3,018 were rooted and were well established in August 1998. They represent 33 parent trees. Due to a malfunction of the propagation facility more than 80 % was lost during the first two years. However, 367 plants representing 33 parent trees is a good contribution to the Danish gene pool of *Metasequoia.* They are growing vigorously in the nursery with average height exceeding 50 cm .

THE GENETICS OF METASEQUOIA GLYPTOSTROBOIDES

It is generally accepted that as a population dwindles in size, the chances for genetic diversity decrease proportionally. *Franklinia alatamaha* is a good example of a few plants comprising all the genetics of the species.

A similar circumstance occurs in *Metasequoia glyptostroboides.* If the seed producing population was a mere 100 trees when the 1947 seed was collected, then distributed, the genetic diversity can never be greater than the plants that yielded those seeds.

It has been discussed that *Metasequoia glyptostroboides* has the same self-fertilization problem that *Pseudotsuga menziesii* has. Isolated trees either fail to self-pollinate or if seed is produced, the plants exhibit varying degrees of inbreeding depression (Kuser 1983).

When the first *Metasequoia* was discovered in 1941, three (3) trees were found growing in a village. By 1947, 1,000 trees had been found, but only 100 were large enough to produce seed. 1,000 grams of seed had been collected.

When explorations were again allowed onto China in 1980, many trees were found (no seedlings), but most of those found had been grown from cuttings. Over 200 stumps were found, some over 2 meters in diameter.

By 1990, only fifty-two (52) original trees remained. Professor Li from China, with funds from numerous sources in the U.S., collected seed from those trees and sent 282 grams of seed to Rutgers for propagation. Of those seedlots, 48 of the 52 produced a total of 1,400 seedlings.

Based on studies of allelic frequencies and measures of genetic diversity in the plants of the 1947 seed collection compared to the 1990 collection, Kuser, et al. conclude that seed was collected from more than one tree for the 1947 collection, contrary to what was earlier believed (Kuser, Sheeler &Hendricks 1997).

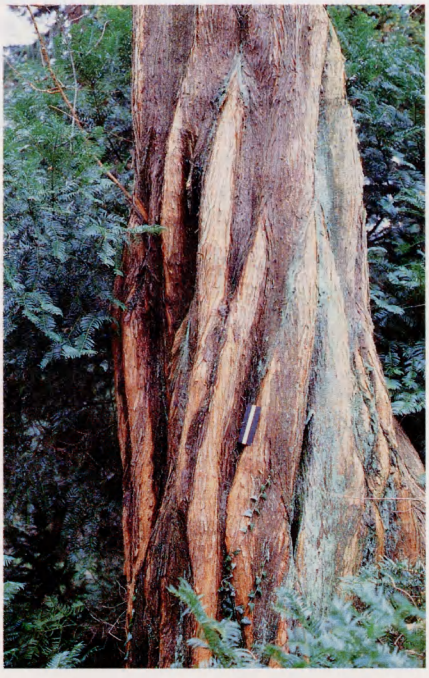
Hybridization with other related trees, so far, has not been successful. The obvious crosses with *Sequoia* and *Sequoiadendron* have not worked.

FUTURE USES

Metasequoia glyptostroboides is planted by the million each year in Central, South and East China (Li 1990) and it is used as a forest species in plantations in North Korea (Ødum 1998). Dawn redwood is not used in commercial forestry in the U.S. or Denmark, and at present there are no convincing arguments for introducing it. It will probably remain a valuable species for parks and gardens and, maybe, has a future in road- and street plantings. With the latest introductions to the U.S. and Denmark we have probably obtained most of the remaining genetic variation in the species, which in the near future should enable us to select clones for amenity plantings superior to the material now available.

Acknowledgements: Thanks to: Kim Thomsen, Niels Arp Hansen, Jerry Leverenz, Søren Ødum, the garden staff at Hørsholm and the Municipality of Copenhagen for information and assistance with the present manuscript.

The tallest (25 m to the left) and second tallest (24 m to the right) *Metasequoia* at Charlottenlund (March 1998). Den højeste *Metasequoia* (25 m tv) og næsthøjeste (24 m t.h.) i Charlottenlund.



Basis of the tallest tree at Charlottenlund (Diam at 1.3 m = 95 cm, March 1998). Basis af den højeste og tykkeste vandgran i Charlottenlund.

Sapwood and heartwood of 50 year old dawn redwood (Charlottenlund, March 1998). Splint og kerne i 50 år gammel vandgran.

Donald R. Hendricks in front of the replicate trial with plants from 1990-seed at the Dawes Arboretum, Ohio, summer 1998. Forsøgsplantning med 1990 planter i Dawes Aboretum.

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DANSK RESUME

(MED ENKELTE UDVIDELSER I FORHOLD TIL DEN ENGELSKE TEKST)

Vandgran har været genstand for meget stor interesse, siden botanikere i 1941 for første gang fandt levende træer af arten i Hubei i det centrale Kina. Lokalbefolkningen kaldte arten for shuishan, oversat til vandgran på dansk. Først mod midten af 1940erne blev der samlet tilstrækkeligt godt materiale til en botanisk bestemmelse og beskrivelse. I en artikel, publiceret i 1948, beskrev de kinesiske botanikere H.H. Hu og W.C. Cheng den nye art som *Metasequoia glyptostroboides*. Navnet *Metasequoia* blev i 1941 givet af den japanske botaniker, S. Miki, til en ny slægt, som han opstillede på grundlag af fossilt materiale fra Japans sene tertiærtid. Artsepitetet, *glyptostroboides*, refererer til den kinesiske sumpcypres, *Glyptostrobus lineatus*, et løvfældende nåletræ, som er nært beslægtet med den amerikanske sumpcypres, *Taxodium distichum*. Indtil H.H. Hu kombinerede det nye fund med Mikis beskrivelse fra 1941 blev shuishan anset for at tilhøre slægten *Glyptostrobus*.

Vandgranen er et løvfældende nåletræ som i sine naturlige omgivelser bliver op til 50 m høj, med diametre op mod 2,5 m, og alderen antages at nå over 300 år. Unge træer bliver i Danmark kegleformede med stærkt afsmalnende stamme som næsten altid er uregelmæssigt furet og kammet fra basis og ofte flere meter op. Barken som er løs og trevlet benyttes ofte af egern til redebygning. Skuddene er modsat stillede og årsskuddenes sideskud fældes samtidig med årets nåle. Nålene er også modsat stillede, hvilket bl.a. skiller den fra sumpcypres, som har spredtstillede nåle. Blomstringen finder sted i det tidlige forår. Hanblomstring forekommer sjældent i Danmark, men havde et relativt stort omfang i marts 1998. Hunblomstring og koglesætning sker derimod ofte og i stort omfang, men hidtil med goldt frø.

Vandgranens naturlige vokseområde ligger i grænseområdet mellem provinserne Hubei, Sichuan og Hunan omkring 29 - 30 N og 108 - 109 E , hvor den findes i bjergene mellem 750- og 1500 m.o.h.. Hovedforekomsten findes omkring landsbyen Shuishan-pa i en kasseformet dal (Box Valley) omgivet af bjergkæder, ca. 60 km syd for Yangtze floden. Floden gennem dalen har sit udspring på ca 1500 m højde i nord og løber i 950 m højde under et kalkfjeld i syd for til sidst at ende i Yangtze Kiang. Vandgranen vokser fortrinsvis nær breddenog på skråningerne ned mod vandløb i blandingsskov med en række forskellige arter af vedplanter (i alt registreret omkring 80 arter af vedplanter i 1948 (Chu and Cooper 1950), se side 8. Området ligger 25 grader længere mod syd end vores hjemlige breddegrad og i lav højde sammenlignet med indsamlingsområder i Sydkina, som har givet godt resultat i Danmark. Alligevel kan mange af de anførte arter (eller provenienser af dem) dyrkes i det danske klima.

Med financiering fra Arnold Arboretet i Boston, blev der i 1947 samlet frø i Shuishan dalen. Hovedparten af frøet blev i december 1947 sendt til Arnold Arboretet, hvor en stor del blev sået, mens resten blev fordelt til en række botaniske samlinger i U.S.A. og Europa. Professor Wan Chun Cheng sendte også frø fra Nanking til Forstbotanisk Have i Charlottenlund og Botanisk Have i København. Hovedparten af de to portioner blev sået i Arboretet i Hørsholm. Frøet spirede godt og gav 159 planter i løbet af foråret 1948. Allerede i juli/august samme år lykkedes det at få rod på stiklinger skåret af de små planter, nogenlunde samtidig med at et tilsvarende forsøg lykkedes i U.S.A.. Vandgran er let at formere med stiklinger, og i Danmark foregår kommerciel formering både med stiklinger og med frø indført fra bl.a. Kina og Centraleuropa.

Af de 17 frøplanter, som blev sat ud i Arboretet i Hørsholm, er der 12 træer tilbage, og af de 15, som blev plantet i Forstbotanisk Have i Charlottenlund, er der ligeledes 12 træer tilbage, som alle har været igennem 51 vækstsæsoner. Træerne i Forstbotanisk Have er gennemgående højere end træerne i Arboretet, se fig. 1, hvilket helt sikkert skyldes, at de i Forsthaven har stået beskyttet mod vinden, mens de i det endnu unge arboret var væsentligt mere vindudsatte. Det højeste træ står i Forstbotanisk Have. Det var 25 m højt i foråret 1998 og havde en diameter på 95 cm, se fig. 1 og tabel 1. Indtil for få år siden antog man, at det frø, som blev høstet i 1947, stammede fra et enkelt træ. Den gode spiring af frøet både i Danmark og i U.S.A. og det meget ringe antal svagtvoksende planter kunne imidlertid tyde på høst fra flere træer og en relativt beskeden grad af selvbestøvning. Molekylærbiologiske undersøgelser i U.S.A. kombineret med erindringer fra Kina (Kuser, Shieler & Hendricks 1997) viser, at der højst sansynligt blev høstet frø fra flere træer i 1947.

I 1950 blev der i Arboretet udvalgt 10 planter til stiklingeformering. Planterne blev sat ud i Forstbotanisk Have i 1966, og flytningen af de store planter lykkedes forbavsende godt (Syrach- Larsen 1967), hvilket viser en værdifuld egenskab ved vandgran for park- og alléplantning. Femten træer af de syv kloner findes stadig i Forstbotanisk Have, med højder op mod 23 m og diameter til 70 cm. Der er ikke væsentlige forskelle mellem klonerne, og de adskiller sig ikke fra de træer, som stammer direkte fra frø.

I 1949 sænkede „bambustæppet" sig mellem Kina og den øvrige verden. Blandt de første til at bryde den botaniske isolation var en dansk delegation til Kina i 1974 under ledelse af ambassadør Gunnar Seidenfaden og med deltagelse af bl. a. daværende arboretforstander Bent Søegaard og nuværende arboretforstander Søren Ødum, som var manden bag ideen. Et resultat af denne rejse var en sending frø af vandgran i 1979 til Arboretet i Hørsholm fra The Chinese Academy of Forestry i Beijing formidlet af dr. Pan Zhigang. Dr. Pan har senere oplyst at frøet blev samlet i en naturbevoksning af vandgran i Li-chuan County i Hubei provinsen, eller i kærneområdet af vandgranens naturlige udbredelse. Frøet spirede godt, og 58 planter blev i 1986 sat ud i Arboretet i Hørsholm og 2 i Forstbotanisk Have. I Hørsholm blev planterne fordelt med 49 i det nye arboretområde på Frihedslyst fra 1986 og 9 i den gamle del af arboretet fra 1936. En sammenligning mellem de to plantninger, fig. 3, viste en væsentlig langsommere højdeudvikling på det åbne, vindudsatte Frihedslyst sammenlignet med det mere beskyttede, gamle arboretområde. Den samme forskel blev fundet mellem 1948-planterne i det endnu unge og vindudsatte arboret i Hørsholm og Forstbotanisk Have med et mere beskyttet skovklima.

Både højdeudviklingen og planternes generelle trivsel viser, at vandgran ikke befinder sig godt i vindudsatte områder.

Den seneste større sending af vandgran kom i februar 1996 til Arboretet i Hørsholm fra Dawes Arboretum i Ohio, USA. Sendingen bestod af 1675 stiklinger skåret på 335 individer, som igen var planter af frø samlet i 1990 på 48 modertræer i artens naturlige udbredelsesområde i Kina (Kuser, Sheeler and Hendricks 1997). De fleste stiklinger blev delt i to og sat i tågeformeringshus i marts 1996 . I august 1998 var der 367 veludviklede planter tilbage af de oprindelige 3018 stilklinger. De 367 planter repræsenterer 33 modertræer og gennemsnitshøjden er over 50 cm (efter 3 vækstsæsoner). Efter yderligere to til tre år i planteskolen skal de plantes ud i skoven i en forsøgsplantning, som med tiden kan vise, hvilke kloner det kunne være interessant at benytte i Danmark, ligesom en sådan samling vil kunne afspejle en evt. større variation inden for arten end den hidtil kendte.

Vandgran plantes ikke som skovtræ i Danmark eller U.S.A.. Stammeformen er for uregelmæssig med for mange kamme og for stærk afsmalning. Derimod plantes den i millionvis i det Centrale-, sydlige- og østlige Kina og Søren Ødum så i 1996 plantager i Nordkorea. Veddet er relativt let med en lys splint og brunrød kerne fig. 6. Det er let at bearbejde indeholder ikke stærke lugtstoffer og er uden harpiks. Det burde derfor være anvendeligt som bl.a. som kassetræ. Som optændingsbrænde er det fortræffeligt, mens det, i lighed med andre lette vedtyper som poppel, pil og f.eks. ædelgran, har lille brændværdi.

Efterskrift

I en kommunal plantning i midterrabatten på Enghavevej i København fra begyndelsen af 1970erne (af stiklingeformerede planter) er der ca. 60 træer tilbage, som varierer i højde fra 3 til 14,5 m, hvilket for de for de hurtigst voksende svarer til ca. 0,5 m/ år. Enghavevej er vindudsat, og der ser ud til at være en sammenhæng mellem træernes højde og udvikling og læ eller mangel på læ.

Der produceres og sælges hvert år et ganske stort antal vandgran i Danmark. Thomsens Planteskole i Skalborg formerer udelukkende med stiklinger og Kim Thomsen oplyser, at planteskolen årligt sælger mellem 200 og 800 planter. Siden 1990 har Levinsens Skovfrøhandel årligt solgt mellem 200 og 500 g frø af vandgran (høstet i Kina, Tyskland og England). Indehaveren, Niels Arp Hansen, oplyser at der gennemsnitligt er 110.000 gode frø pr kg, hvilket kunne tyde på, at den årlige produktion og omsætning af vandgran kan være af en ganske betydelig størrelse