Propagation Aspects of *Sciadopitys verticillata* and *Sequoiadendron giganteum* 'Hazel Smith'[1] ©

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INTRODUCTION

New attention is being given to two of the most ancient and revered conifers, the Japanese umbrella-pine (*Sciadopitys verticillata* Sieb. et Zucc.) and the giant sequoia [*Sequoiadendron giganteum* (Lindl.) Buchh.]. Both have had limited landscape value, and they are not commonly grown in the U.S.A. and Europe except in arboreta, botanical gardens, and on prestigious estates. Recent developments, including the discovery of several cultivars, have raised the possibility of broader use of these magnificent conifers.

Sciadopitys verticillata is now listed by Farjon (1998) in the monotypic family Sciadopityaceae but had been traditionally listed under Taxodiaceae. Although its common name is listed as "pine", it doesn't resemble a pine or any other conifer. The needles are thick and flat and arranged in an upward whorl like an inverted parasol (Fig. 1). In some respects it appears more ancient than other conifers, and indeed the fossil record goes back to the Upper Triassic. It is native to only one country, Japan, where it grows in the more southerly regions on slopes along with deciduous angiosperm trees. Once propagated, the plant grows well in containers. It is also substantially free from insect and disease problems and is somewhat adaptable to part shade.

Sequoiadendron giganteum is native only to the western slopes of the southern Sierra Nevada in the state of California, U.S.A. It is found at mid elevation in groves or mixed with other trees. It grows to enormous size in the native habitat sometimes reaching more than 75 m in height. There is a 100-year-old tree at Blithewold Arboretum in Rhode Island, U.S.A. which is over 30 m high. In England and New Zealand there are a number of large trees at various locations. When the trunk can be viewed, the giant sequoia looks massive, the trunk appearing to be very broad compared to the height.

The giant sequoia cultivar, 'Hazel Smith' originated as a seedling at the Watnong Nursery in Morris Plains, New Jersey, U.S.A. about 1960 (Fig.2). The original tree is now 18 m high and the trunk diameter is 0.87 m (1 m from the ground). There are two very nice trees at the New Jersey Botanical Garden in the northeastern part of the state and one at Frelinghuysen Arboretum in Morristown, New Jersey. They are all believed to be about 25 to 30 years old.

Neither the Japanese umbrella-pine or the giant sequoia are suitable for colder inland areas of the U.S.A., either at higher elevations or in the north central states which endure drastic wind and wide ranging intra-day temperature variations. The umbrella-pine, although it is root hardy to U.S.D.A. Zone 5, will often turn a bronze-brown color in the winter. This characteristic may vary, depending on the specific clone. A new cultivar, 'Wintergreen', developed by Dr. Sidney Waxman has the possibility of remaining attractive in harsher winter weather (Goodhart, 1998).

Giant sequoia is cold hardy to U.S.D.A. Zones 6 to 8. The tree does grow well in the

[1] Parts on the propagation of *Sciadopitys verticillata* excerpted with permission from the Bulletin of the American Conifer Society, Vol. 13(3) 1998.

more moderate climates in America, such as along the New England and Pacific northwest coasts and in the milder climates of northern European countries such as England, Holland,and Germany. One cultivar, 'Hazel Smith', has the possibility of being consistently hardy in areas colder than Zone 6. This cultivar is bluish compared to the species, thus, offering additional ornamental value. Another blue cultivar, 'Glaucum', is also being propagated and grown selectively, and it has been postulated that the blue forms are more hardy than the species.

In view of the need for smaller, long-living trees in the landscape, both the Japanese umbrella-pine and the giant sequoia ironically seem well suited to alternative faster growing conifers which often overrun their assigned space. In an average climate both may grow only about 40 cm per year which is less than that of other popular conifers. With improved cultivar selections these conifers may be grown in colder climates. More successful propagation practices and methods will certainly be factors that permit wider distribution and usage. Already in the U.S.A., cultivars of *S. verticillata* 'Wintergreen' and 'Joe Kozey' are being grown by several large nurseries. In Europe a thick-needled cultivar, 'Sternschnuppe', is now coming into commerce and a golden variegated type, 'Golden Rush', is also being grown. However, only a few nurseries propagate the *S. giganteum* 'Hazel Smith' or 'Glaucum' and grafting is the generally accepted propagation practice, although the giant sequoia can be propagated vegetatively from cuttings (Platt, 1980). Grafted plants may not be as hardy as those grown from cuttings since normal rootstock of seed-grown trees is used. Although micropropagation has been used successfully (Iliev, 1998) it appears this method is not being routinely used.

REVIEW OF PROPAGATION TECHNIQUES

Sciadopitys verticillata. The propagation of *Sciadopitys* from cuttings has been difficult for many growers. It has not been that reliable on a year-to-year basis and this fact together with the fairly long rooting time has discouraged many would-be propagators. Hence, some nurseries are more comfortable growing the plant from seeds. However, as a result of the research started by Dr. Sidney Waxman some 40 years ago, propagation from both seeds and cuttings and the optimal techniques to be used are now better understood.

One of the earliest references to propagation from cuttings indicated that the Japanese have several cultivars which they propagate by cuttings struck under shade (Anon., 1861). The problem of propagation of gymnosperms was addressed by Fordham and Spraker (1937) and it was particularly pointed out that *S. verticillata* usually produces only cotyledons or seed leaves the first year and true leaves the second. The seedling doesn't produce the typical leaf whorl until the third year and at this point may be the size of a typical cutting. [Author's note: Cuttings today may include the entire portion of the prior year's growth and could equal or exceed 15 cm]. The same authors using either naphthalene acetic acid (NAA) or indolebutyric acid (IBA) produced rooted plants from cuttings taken at different times of the year; the time required was 5 to 8 months. Seedlings exhibited variable growth rates and shapes, while rooted cuttings were typical of the tree from which the cuttings were taken.

Starting in 1957 Dr. Waxman published several papers in the *Combined Proceedings of the International Plant Propagators' Society* which explained the propagation problems with *Sciadopitys* and recommended solutions and improvements in

Figure 1. *Sciadopitys verticillata,* Japanese umbrella-pine with thick and flat needles arranged in an upward whorl like an inverted parasol.

methods. His earliest work (Waxman, 1957) indicated that cuttings were difficult to root and that seeds were slow to germinate, the latter taking up to 100 days. He found that seedlings were extremely slow growing, were only 1½ inches tall 1 year after germination, and contained four leaves. After 3 years, seedlings only had about 18 leaves and were nearly 3 inches tall. Experimenting with varying the photoperiod indicated that germination was best when seed was subjected to 9 h of light or a normal day length. Excessive light from both 18- and 24-h treatments nearly eliminated germination. Soaking the seed with water was advantageous and the improvement was based on elimination of water-soluble inhibitors. Recognizing the limitations of seed propagation, Dr. Waxman moved on to other methods.

Propagation by layering was reported to be successful (Waxman, 1960), but this has been a subject for further study since it is too difficult to produce large amounts by this method. Grafting *S. verticillata* experiments on understock of *Thuja occidentalis*, *Chamaecyparis pisifera*, or *Cryptomeria japonica* Elegans Group (Waxman, 1960) was performed and found to be successful only with *Cryptomeria*. Again there has been no reported follow-up on this method nor is it practiced in this country. Just prior to 1960, Dr. Waxman began research to discover the most favorable times for cutting propagation and also began to investigate rooting variability between different individual trees.

William Flemer of Princeton Nurseries was apparently stimulated by Dr. Waxman's work and reported on various factors affecting propagation from cuttings taken from a 38-year-old tree (Flemer, 1961). Factors investigated were date of sticking, strength of Hormodin powder, and number of wounds. Cuttings from the prior season's growth and lower half of the tree which was 15 ft tall were used and the

Figure 2. The original *Sequoiadendron giganteum* 'Hazel Smith'.

rooting medium was 50% peat and 50% perlite (1 : 1, v/v). Only 10 cuttings were used for each treatment and all conditions yielded a success rate of 40% and up to 90% in 5 months.

A later report by Waxman (1978) entitled *Propagation of Umbrella Pine — Clonal Differences in Root Initiation* addressed not only the issue of the variability of rooting between various trees but the method of auxin application, the effect of resin flow from the cuttings, the effect on propagation, and seasonal variation. These studies were carried out using peat and perlite medium (1 : 1, v/v) maintained at 22°C, a mist system, and a light intensity activated controller. It was found that exposing cuttings to a solution of 200 ppm IBA for 24 h to remove the resin and treating the cuttings for a longer time period was superior to a quick dip in 2000 ppm IBA or 8000 ppm IBA in talc. Eighty percent of the propagations from the 24-h soaking in IBA solution were rooted compared to 20% or less from the other treatments. In addition, the number of roots generated from the long exposure to IBA far exceeded the number generated from other treatments. The study on seasonal variation included ten cuttings from each of 10 clones. Cuttings were taken each month over a period of 1 year. Results varied from a low of 34% in December to a high of 90% in February.

The three best rooting percentages were obtained inFebruary (90%), March (86%), and July (86%) (Waxman, 1978).

Next, 10 different trees were tested for clonal variation both with and without a 48-h soaking period. Two clones were difficult to root based on both number and length of the roots. Two other clones consistently provided the greatest number of roots. On removal of the resin by means of a 48-h soak, all three aspects of rooting were improved, e.g., rooting percentage, number of roots, and length of roots (Waxman, 1978).

The above studies serve as the basis for propagation of the Japanese umbrella-pine today. Many of the complications and factors affecting propagation were noted by Waxman and these factors may be taken into account by anyone wishing to propagate this plant. As with any propagation practice, variation in techniques among growers is common. This is no doubt related to the many complexities of plant propagation in general, and to some extent, the special requirements of the umbrella-pine. While optimal techniques are still being developed, some general guidelines may be given for those who want to do propagation on their own. Good starting primers for propagation of *Sciadopitys* from cuttings are the findings published and summarized by Waxman and an article in *American Nurseryman* by Paul Halladin (Halladin, 1991). The latter article covers all the factors that one would consider in propagation practice.

***Sequoiadendron giganteum* 'Hazel Smith'**. Ordinary propagation techniques such as wounding, use of a strong rooting hormone, misting, and bottom heat are satisfactory for rooting this cultivar. Cuttings taken in October are sometimes ready for potting the following April, but the entire rooting process may take 5 to 8 months. Cutting size may be up to 40 cm and include all of the present year's growth. Cuttings are placed in individual pots having depths of 10 to 15 cm. The placement depth is about 5 cm. This type of scheme permits multiple roots to form which are evident at the drainage holes after 5 to 6 months. Double staking of each cutting helps to stabilize it.

SUMMARY

With advances being made in propagation techniques and the development of new cultivars, there are possibilities for both the Japanese umbrella-pine and the giant sequoia to be used more frequently as landscape plants. Indeed there seems to be a trend to use smaller and more unusual trees and these two conifers could be more useful in the future.

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