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DWARF CONIFERS FROM WITCHES'-BROOMS

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The project I have been working on at the University of Connecticut is the development of new forms of dwarf conifers. The dwarf plants that I have developed are not the result of hybridization, but originate from seed obtained from mutations found on various conifers. These mutations, called witches'-brooms, occasionally produce seed which give forth plants of which half are dwarf and half are normal.

We have at our nursery over 20,000 plants that range from two to 22 years of age. Although a graft taken from a broom would provide a dwarf plant, I prefer to collect seed because of the variability that occurs among the dwarf seedlings.

We have found that not only do the individual seedlings within a progeny exhibit variability, but differences also occur among progenies obtained from different brooms. Seedlings obtained from two red pine (*Pinus resinosa*) witches'-brooms, for example, have exhibited two different forms of growth.

In one, the plants are all upright while in the other, the branches are horizontal. We are, therefore, on the constant alert for new

sources of brooms with the hope that they would provide seedlings with even more variability.

We regularly evaluate all groups of seedlings and select those few having the greatest potential for developing into unique plants.

We are currently growing and evaluating seedlings obtained from *Larix laricina*, *Picea abies*, *Tsuga canadensis*, *Pinus banksiana*, *P. densiflora*, *P. rigida*, *P. resinosa*, *P. strobus*, and *P. sylvestris*.

We also compare the ease in rooting among the select seedlings. Our objectives are to select and name those seedlings that are relatively easy to root. Unfortunately the good rooting clones are not always the most interesting ones.

Once we have named and introduced a new plant, we send cuttings or scions to cooperating growers for them to propagate and grow on.

We have found, in general, that the factors affecting rooting of dwarf conifers are similar to those that influence rooting of most difficult-to-root species, i.e.:

1. Young or juvenile plants root more easily than older or mature plants.
2. Clonal differences, in the ease of rooting, occur among seedlings.
3. The stage of plant development or the time of the year may influence the degree of rooting.

We recently compared the rooting of cuttings taken from two select groups of Norway spruce (*Picea abies* (L.) Karst) witches'-broom seedlings: the 'West Street' clone, seven years old, and the 'Spt-Ldy' clone, 8 years old. Ten cuttings each were taken on January 9, 1986 and dipped into talcum powder containing 1000 ppm indolebutyric acid. The needles at the base of the cuttings were left intact. All cuttings were stuck into flats containing equal parts of peatmoss and sand and placed under a mist system. Rooting results were measured on June 11, 1986 (Tables 1 and 2).

Rooting among the 'Spt-Ldy' cuttings (Table 2) was generally high, over 80%, for all clones, whereas rooting among the 'West Street' clone varied from 10 to 100%.

Another test was carried out with two different Canadian hemlock (*Tsuga canadensis* (L.) Carr.) witches'-broom progenies on January 9, 1986 (Table 3 and Table 4). Ten cuttings each were taken from five different 'Hills' witches'-broom seedlings which were eight years old and from nine different seven year old 'Woodstock' witches'-broom seedlings. The cuttings were given a 3 sec. dip into a solution containing 20,000 ppm IBA in 50% alcohol, stuck into flats of peatmoss/perlite 1:1, and placed under a mist system.

Rooting results were taken on June 11, 1986.

Table 1. Clonal differences in rooting cuttings¹ taken from Norway spruce witches'-broom seedlings.

West St. ² Clone No.	Percent of cuttings rooted	Average root length	Average number of roots per rooted cutting
3	80	7.9 cm	9.0
6	60	6.1	3.2
43	90	9.7	7.2
64	40	1.4	4.5
135	100	10.2	6.2
143	90	9.0	6.2
144	100	1.5	14.5
155	10	3.4	6.0
205	100	8.8	7.2

¹10 cuttings per treatment

²seven year old plants

Rooting was variable, with some clones (135, 144 and 205) rooting 100%, while others exhibited a poor response (clones 87 and 155), rooting as low as 10 percent.

Table 2. Clonal differences in rooting of cuttings¹ taken from Norway spruce witches'-broom seedlings.

Spt-Ldy ² Clone No.	Percent of cuttings rooted	Average root length	Average number of roots per rooted cutting
1	100	9.2 cm	13.4
2	80	8.1	9.2
3	80	5.6	5.3
4	90	7.8	6.8

¹10 cuttings per treatment

²eight year old plants

Table 3. Clonal differences in rooting of cuttings¹ taken from Canadian hemlock witches'-broom seedlings.

Woodstock ² Clone No.	Percent of cuttings rooted	Average root length	Average number of roots per rooted cutting
1	0	—	—
4	70	0.5 cm	2.0
8	60	5.0	18.2
12	100	1.5	8.2
13	100	35.3	9.6
25	90	2.5	25.0
66	50	7.5	2.0
70	80	23.0	2.5
229	90	21.0	2.0

¹10 cuttings per treatment

²all clones were 15 years old

Table 4. Clonal differences in rooting of cuttings¹ taken from Canadian hemlock witches'-broom seedlings.

Hills ² Clone No.	Percent of cuttings rooted	Average root length	Average number of roots per rooted cutting
0	70	6.0 cm	0.5
11	100	6.5	37.9
16	100	7.0	27.9
17	100	7.5	38.5
21	90	8.0	41.2

¹10 cuttings per treatment

²all clones were 10 years old

With the exception of clone No. 0 all cuttings from the 'Hills' progeny rooted at 90 percent or greater and had large numbers of roots per cutting.

Considerable variability occurred, however, among the nine 'Woodstock' clones. Two clones had 20% and 0% while three clones exhibited over 90% rooting.

The following plants have already been named and introduced to the nursery trade from the University of Connecticut:

Pinus strobus 'Sea Urchin'—is a true miniature shrub. It has very small needles, 3 cm long. After 10 years of growth it has developed into a low mound having a height of only 35 cm and a width of 55 cm. The foliage has a bluish-green appearance.

P. strobus 'U Conn'—is relatively fast-growing compared to other dwarf evergreens, and is currently producing approximately 38 cm of stem growth annually. It has grown to a height of three meters and has a diameter of 2.6 meters in 12 years. The needles are bright green and are approximately five cm long. It is the largest of the dwarf plants named. Its form changes with time from pyramidal to flat-topped.

P. strobus 'Blue Shag'—is moderately fast growing and remains very dense. Growth is mainly lateral; resulting in a plant almost twice as broad as tall. The needles are a bright blue-green. The overall dimensions, after eight years growth, are 0.9 m tall and 1.6 m wide.

P. strobus 'Green Shadow'*—is a multi-trunk, dwarf shrub with a rounded top and with dark green foliage. It has grown to a height of 3 m in 20 years. Its form is broad when young and becomes more tree-like with age. The needles are 7.5 cm long, and thicker than other cultivars.

P. strobus 'Blue Jay'—is a dense low mound which is approximately twice as wide as high. After 10 years, it has reached a height of 0.5 m and a width of slightly more than 1.3 m. The foliage has a distinct bluish cast.

P. strobus 'Soft Touch'—is a dense flattened mound. The needles are relatively short and thin and have a slight twist. It has grown 0.6 m high and 1.2 m across in 8 years.

P. strobus 'Golden Candles'—is an upright shrub with moderately dense branching. Both the candles and the current years foliage have a bright golden color. Grafts of Golden Candles have grown 2.0 m tall and 1.5 m across in 8 years.

P. resinosa 'Sandcastle'—is a dwarf and very dense upright shrub with tufts of short deep-green needles. It has reached a height of 1.8 m and a width of 1.8 m after 15 years growth.

P. resinosa 'Thunderhead'—is a broad low shrub having very long dark green needles. Its branches are loosely arranged. After 15 years it has attained a height of 1.0 m and a width of 2.0m.

Larix decidua 'Varied Directions'¹—is a relatively fast-growing larch that sends out vigorous branches that reach out in various directions. Its lateral branches are pendulous while its major branches tend to curve upwards. Its lateral growth is approximately 0.5 m per year.

Tsuga canadensis 'Florence'—is a low broad shrub with branches that spread horizontally and are layered. Its branch tips tend to curve down slightly. Its size, after 15 years, is 0.6 high and 1.8 m wide.

Sciadopitys verticillata 'Wintergreen'¹—is a beautiful deep green cultivar that does not turn bronze during the winters we experience in New England. Its growth rate is relatively fast and, in addition, it roots easily from cuttings. Its growth under our conditions is approximately 30 cm per year and reaches a height of 2 m in 10 years from a rooted cutting.

¹ not of witches'-broom origin

Figure 1 shows a witches'-broom occurring on a mature white pine tree. Figures 2 through 4 show plants derived from witches'-brooms.



Figure 1. A white pine witches'-broom photographed in Maine.



Figure 2. A grouping of 13-year-old white pine witches'-broom seedlings. Japanese umbrella pines in the background. University of Connecticut Horticulture Research Farm.



Figure 3. *Pinus strobus* 'Golden Candles'—a golden yellow white pine seedling selection collected from a witches'-broom.



Figure 4. *Tsuga canadensis* (Hills progeny). A dwarf seedling obtained from a Canadian hemlock witches'-broom.