

# VARIABILITY AMONG WITCHES'-BROOM SEEDLINGS

SIDNEY WAXMAN

*Department of Plant Science  
University of Connecticut  
Storrs, Connecticut 06269-4067*

One very productive method of developing new forms of dwarf conifers is by the germination of seeds collected from witches'brooms. These mutations which occur on many conifer species are far more common than I thought they were when I first started looking for them 25 years ago. At that time I would drive hundreds of miles to see them. Now, after all this time I have come to realize that they are not so rare. On my property, consisting of ten acres, I have found two white pine witches'-brooms, one of them no further than two feet from my deck.

Grafts made from a witches'-broom will of course, result in a group of dwarf plants all genetically identical. Propagation of seeds from a broom, however, will result in a group of diverse seedlings, each having its own genetic makeup. Witches'-broom progenies usually consist of seedlings in which half are dwarf and half are normal. The normal seedlings are either discarded or used for rootstocks. It is among the former group of seedlings that we may discover dwarf forms that are unusual. Such variability occurs not only among seedlings within a progeny, but also between different witches'-broom progenies (Figure 1).



**Figure 1.** Witches'-broom plantings at the University of Connecticut



Variation among different seedlings may be observed in: foliage color, needle length, needle density, stem diameter, branch density, branch rigidity, branch orientation, annual rate of growth, and plant form. In addition there are differences among seedlings in their ability to be propagated by cuttings.

An example of variation in rooting among seedlings within a progeny is shown in Table 1, where percentage rooting ranged from 0 to 100%. The cuttings were taken August 15, 1989 and rooted by November 15, 1989. Terminal shoots were treated with Hormodin -3, placed in flats of peat and perlite (1:1, v/v) then placed under mist.

**Table 1.** Variability in the rooting of six *Larix laricina* witches'-broom clones September 1, 1989, to November 15, 1989.

Clone number	Percent of cuttings rooted	Average number of roots per rooted cutting
62	0 <sup>1</sup>	0.0
15	100	4.75
60	40	3.50
45	95	8.00
50	70	3.90
61	80	4.70

<sup>1</sup> 20 cuttings per treatment

We have grown, over the past 25 years, several hundred thousand witches'-broom seedlings. These seedlings were obtained from brooms found on:

<i>Larix laricina</i>	eastern larch
<i>Picea abies</i>	Norway spruce
<i>Pinus banksiana</i>	jack pine
<i>P. densiflora</i>	Japanese red pine
<i>P. resinosa</i>	red pine
<i>P. rigida</i>	pitch pine
<i>P. strobus</i>	eastern white pine
<i>P. sylvestris</i>	Scotch pine
<i>Tsuga canadensis</i>	Canada hemlock

My objectives are to constantly evaluate and eventually select those plants that are slow growing, aesthetically pleasing, and different from other dwarf forms currently available. I am very selective and usually wait until the plants are at least seven years old before naming and introducing them to the trade. During the past 25 years I named only 19 plants, most of which were over 10 years old before being named.

Once a plant is named and published, scions or cuttings are distributed to nurserymen who then propagate them and list them in their catalogs.

The characteristics of the various seedlings raised could be described as miniature, dwarf, semi-dwarf, upright, spreading, weeping and prostrate. Several species exhibited seedlings having dark-green, golden-yellow or variegated needles. Variation in needle length, shoot length, and annual growth were dramatic (Table 2). Shape also varies widely among witches'-broom seedlings.

**Table 2.** A comparison of the dimensions of the largest and smallest witches'-broom seedlings.

	Species and age			
	<i>Pinus sylvestris</i> (5 years)	<i>Pinus strobus</i> (25 years)	<i>Picea abies</i> (10 years)	<i>Tsuga canadensis</i> (18 years)
<i>Smallest seedling</i>				
Height (cm)	21 0	40 6	20.0	90 0
Width (cm)	25 0	60 0	30 0	2 8
Shoot length (cm)	3.0	4.0	3.0	22.0
Needle length (cm)	1 4	2.5	0 7	0.9
<i>Largest seedling</i>				
Height (cm)	28 0	3400.0	2600.0	4200 0
Width (cm)	27 0	3200 0	2900 0	2900 0
Shoot length (cm)	18 0	15 0	14.0	15.0
Needle length (cm)	3.7	7 0	2 0	0 6

Although seedlings within a single broom progeny show considerable variation from one another, an exception occurs in *Pinus resinosa* (red pine) and *Larix laricina* (eastern larch). Here, all seedlings are generally similar in needle length and form. Differences arise however when comparing one broom's progeny with another. In one red pine progeny the needles were very long, the branches loosely arranged and horizontal. In the other, the plants were upright with short needles and very dense stiff branching. *Larix laricina* (eastern larch) also showed minor differences among seedlings within a progeny but showed major differences among broom progenies. In the first progeny all seedlings were conical with a much greater rate of growth than those in the second progeny which were low mounds with a very low rate of growth.

Seedlings from one *Picea abies* (Norway spruce) broom were extremely variable in form and in rate of development. In this progeny were plants that were ovate, circular, broadly ovate,

obovate, and triangular. In another progeny were plants that were mainly broadly ovate and slow growing. In both progenies branching was very dense.

*Pinus densiflora* (Japanese red pine), *P. sylvestris* (Scots pine) and *P. strobus* (eastern white pine) showed extreme variation in needle length, growth rate, branch density and form.

*Tsuga canadensis* (Canada hemlock) differed from the other species by exhibiting two degrees of dwarfness within a progeny.

In one progeny some of the seedlings, after 16 years, were taller than wide (4.2 meters high x 2.9 meters wide), while others were wider than tall (1.8 meters wide and 0.9 meters high).

In the final analysis, witches'-broom seedlings are unusual. They are aesthetically pleasing, and functionally valuable. Their wide variation in form and in rate of growth should make them excellent sources of new plant introductions.

VOICE: How long do you evaluate the cultures before introduction? I am particularly interested in height and width.

SIDNEY WAXMAN: As far as my introductions go, I usually wait more than 10 years.

ELWIN ORTON: I understand that you sell your excess plants to generate funds. With so many of them similar, don't you think that some of them are going to get into the trade?

SIDNEY WAXMAN: We sell them to landscapers and ask them not to propagate them.