

The loosely formed weeping hemlock shown in this slide is located beside a country road. It is distinctly pendulous, but not nearly so impressive in this character as Sargent hemlock or numerous other weeping hemlocks now known in cultivation.

This prostrate form found at the edge of a pasture is growing under very poor conditions. In character it is somewhat like 'Cole's Prostrate.' It has been propagated and in a few years we will know how it will perform when provided with better growing conditions.

A number of white pines, differing from the normal, have appeared in the woods. This particular one is about 4 feet tall and unusual because of its contorted branches.

This white pine, apparently a slow-grower, has better than usual foliage color. When propagated it may well produce a good ornamental dwarf.

The white pine now shown could, when propagated, make a good upright plant for the angle of branching, as seen near the top, is quite tight. *P. strobus fastigiata* when young has a narrow upright shape but it broadens with age. This specimen at the Arnold Arboretum was grafted nearly 70 years ago in 1897 and through the years has widened to this extent.

This small white pine has a multibranched framework which indicates that it will be a slow growing bush type rather than a normal tree. It was found together with many others in the vicinity of a fruiting witches' broom.

This small *Juniperus communis* found in a pasture, is a very slow growing hemispherical mound about 12 inches high by 22 inches in diameter, with a framework which shows it to be quite old. Cuttings have been rooted and it will be under observation to see if the slow growth and mound shape persist in cultivation.

A second *Juniperus communis*, one of many taking over an abandoned pasture, shows an odd growth habit and yellow coloration. We plan to propagate it and add it to the Arboretum collection.

WHITE PINE WITCHES' — BROOM SEEDLINGS

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Last year at the St. Louis Meeting, I presented a series of slides depicting this white pine witches'-broom which grows in the Berkshire Hills of western Massachusetts. It has fruited and shed seeds for many years. Within its dispersal area over 200 genetically dwarf forms were found. In the intervening year some of its seeds have been germinated thereby providing an opportunity to observe the behavior of its progeny. The next slide shows the small twig and cone characteristics of the broom when compared with those of normal pine. These cones

when compared with those taken from a normal tree show the variety of subnormal sizes which it produced.

Far fewer viable seeds were produced than would be expected in normal cones for many were abortive. However, 154 were acquired from the limited number of cones available.

On September 20, 1963 the seeds were separated into two lots and started on a stratification period of three months at 40 degrees. The first lot contained 135 seeds while the second, consisting of 19 miniature seeds was handled separately to see whether or not size would affect the outcome.

On the 20th of December both lots were sown and by January 3rd a general germination had taken place. Seventy-five seedlings developed from lot #1 while in lot #2 only five seedlings appeared. On the 27th of January they were potted and placed on long days using Dr. Sidney Waxman's recommendation of a 30 second light interval every fifteen minutes throughout the night. This worked well and the seedlings in eleven months were comparable with plants grown for three years in the conventional way. Under this program the normal pine seedlings produced one apical growth after another in contrast to the abnormal forms which were then easily segregated.

Differences in the seedlings became apparent by April 22 so the first photographs were taken. Some had gone past the cotyledon stage while those smaller and weaker found it an effort to shed their seed caps. Some cotyledons were greatly distorted while others formed a tightly clenched ball.

A set of slides made in July show the development to this point. Some of those considered to be dwarf have developed adult leaf bundles, while none of those thought to be normal have yet done so.

In September and October the compact character of the abnormals became more defined with many buds breaking in the region of the cotyledons but producing only very short growth. The latest photographs taken in early November, show a new set of branches developing. Last week, November 27, some dwarf seedlings had advanced to a point where 22 branches were evident on 2 inch plants.

Mr. Albert G. Johnson, University of Minnesota, who has been working with witches'-brooms, sent us seeds of *Pinus banksiana* collected from a broom near Gordon, Wisconsin. They were sown on the 21st of February and by the 4th of March had produced general germination. Those dwarf in nature could be quickly separated as they responded to long days better than did the white pines. However, they produced a whorl of stubby branches at each growth flush in contrast to the white pines where branching occurred mostly in the cotyledon area.

This witches'-broom was located along a country roadside in Foxboro, Massachusetts. In late May, when white pine blossoms in Massachusetts, a trip was made to see if it flowered and to observe their sex. Widening of the road was in progress and as the broom was in the path of construction it was collected.

In characteristics it is quite different from the rest of the tree. The leaves which were borne on abnormally short and thick shoots measured from seven-eighths to one inch in length while on the same branch the normal leaves measured from 2½ to 3¼ inches.

This series of photographs will show where the abnormal development began. The broom shows nine flushes of growth which would indicate it to be nine years old. The normal whorl of six branches as seen on the right would have started development ten years ago. The following year another six branches developed and one of these gave rise to the broom. Five of these were located beneath the broom in a position where they were too densely shaded to survive but the terminal shoot had enough light to continue as a spindling growth.

A close-up of the joint at which this occurred. The smaller branch with its small leaf surface has developed to about pencil thickness while the broom with its relatively vast leaf surface has caused the entire branch to thicken. Here we see the broom as it was positioned on the tree.

In the Arnold Arboretum we have a broom on *Pinus rigida*. This picture shows an example of its cones. The two large ones in the center were taken from the main part of the tree while those on the sides were collected from the witches'-broom. Although the cones and seeds from the broom were a great deal smaller than usual the seedlings showed no abnormality.

This broom is located in a cemetery in Millis, Massachusetts. In late May while checking it for flowers, a colorful mass was noticed at its base. Upon investigation with binoculars it proved to be the most patriotic crows nest ever seen as it was composed of American flags stolen from the graves of veterans. Within fifty yards of the tree all flags had been ripped from their staffs and worked into the construction of the nest. A telephoto shot taken on a rainy day shows the broom structure together with the jazzy crows nest positioned to take advantage of the brooms' density. Tattered remnants such as these littered the ground under the broom bearing tree.

Two members of the Society, Sid Waxman our secretary, and Radcliffe Pike from the University of New Hampshire, are shown with a white pine broom collected in Grafton, New Hampshire during a seed collecting trip last September. This also provides an example of witches'-broom development from a single lateral bud.

MODERATOR BORK, JR.: The second speaker is Dr. Wesley Hackett from the University of California who will speak to us on growth phases in relation to plant propagation.