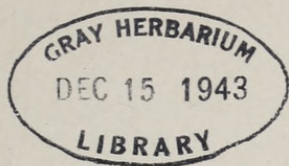


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SIMPLE FOLIAGE KEY TO THE HEMLOCKS AND SPRUCES

THIS is a group of narrow leaved evergreens which is extremely difficult to identify from foliage characters alone. Especially is this true of the spruces. One of the reasons they are difficult is because of the fact that the needles soon fall off when they are dry. The key which follows is prepared solely for the determination of material which is fresh. It cannot be used with dead material. Such a key has its good points and its bad points — good because the obvious characteristics such as color of foliage and twigs are used and it can be used in the field without the use of a lens (in most cases), bad because the key is only usable for the period of a few days after the branches have been taken from the living tree.

All that is said in *Arnoldia*, Volume 3, No. 10, 1943, describing the Key to the Pines, is also applicable to this key to the spruces and hemlocks. The key is offered for the garden enthusiast who is not a trained botanist, but the key should not be used as a means of final identification, standard texts and illustrations should be consulted.

Most of the characters used can be observed with the naked eye. Since many nurserymen grow the spruce species from seed, there is the opportunity for hybrids to creep into the trade and obviously these always prove troublesome in any key.

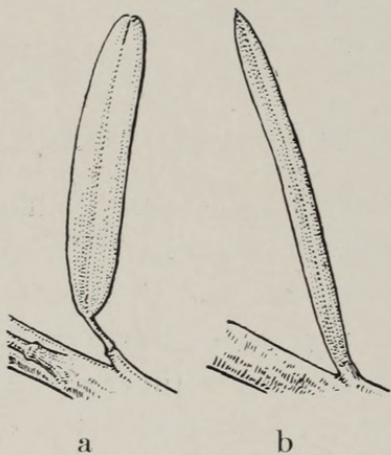
It is interesting to note that there are only 7 species of spruce native to North America, and all are included in this key. There are about 22 species available in the trade, all of which are included in the key, as well as 10 varieties in addition. There are about 26 varieties of *Picea Abies* offered by various nurseries, and the differences among these are frequently so slight, especially in the younger stages of plant development, that it is impossible to make a satisfactory key for them. Consequently, it has only been possible to list the dwarf varieties of *P. Abies* as a group.

Of the hemlocks, four species are native and these are included in the key of six species. At least 15 varieties of *Tsuga canadensis* are offered in the trade and probably many more. It was impossible to make a foliage key for these because in many cases their differentiation depends on their shape alone.

As in the Key to the Pines, habitats are given for all species and Hardiness Zones refer to the Hardiness Map, *Arnoldia*, Vol. 3, No. 10, 1943, p. 53.

FOLIAGE KEY TO THE HEMLOCKS AND SPRUCES
(Native or available in North America)

Needles borne singly, leaf bases persistent **Picea and Tsuga**
1. Needles narrowed at base to form distinct petioles **Tsuga species**



This character must be clearly interpreted. Sometimes when the needle of a spruce is pulled off, a small portion of the twig bark also comes off, looking like a petiole unless observed with a lens. The needles of all spruces are without petioles, their leaf-blades being attached directly to the twig.

FIGURE 1. Needle of hemlock (a) with petiole and spruce (b) without petiole.

- | | |
|-----------------------------------|---------------------------------|
| <i>canadensis</i> —Canada Hemlock | <i>heterophylla</i> —Western H. |
| <i>caroliniana</i> —Carolina H. | <i>Mertensiana</i> —Mountain H. |
| <i>diversifolia</i> Japanese H. | <i>Sieboldii</i> —Siebold H. |

- 2. Needles with white lines on under surface only, cones less than 2 inches long
- 3. Needles noticeably blunt and notched at tip
 - 4. One year branchlets pubescent **T. diversifolia**
(Japan) Zone 5
 - 4. One year branchlets glabrous **T. Sieboldii**
(Japan) Zone 5
- 3. Needles not noticeably notched at end but rounded

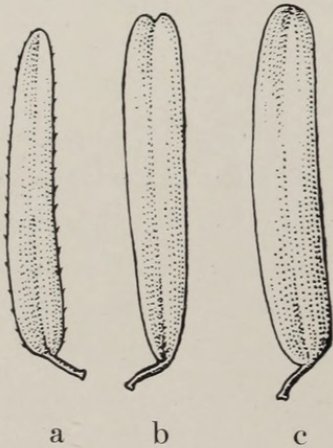


FIGURE 2. a. *Tsuga canadensis*. The very fine serrulate margin can only be seen with a lens.
b. *Tsuga Sieboldii*
c. *Tsuga caroliniana*

4. Many of the needles on vigorous one year shoots wider at base than at the tip; i.e., gradually tapering from base to tip; needles mostly two ranked, in one plane, and with a very fine serrulate margin (when examined with a lens); cones $\frac{3}{4}$ inch or less in length **T. canadensis**
(Nova Scotia and eastern U.S.) Zone 4

4. Majority of needles on vigorous one year shoots not tapering but about as wide at base as at tip; needles in several planes about twig; needle margin of *T. caroliniana* entire and *T. heterophylla* is serrulate (when examined with a lens). Cones longer than $\frac{3}{4}$ inch

5. One year twigs orange brown, cones 1 to $1\frac{1}{2}$ inches long
(Southeastern U.S.) Zone 4 **T. caroliniana**

5. One year twigs pale yellowish brown; cones $\frac{3}{4}$ to 1 inch long
(Alaska to Idaho and California) Zone 6 **T. heterophylla**

2. Needles with white lines on upper and lower surfaces, cones 2 inches or more in length **T. Mertensiana**
(Alaska to Idaho and California) Zone 5

1. Needles without distinct petioles

Picea species

Abies—Norway Spruce

Abies vars.—some 26 varieties available in the trade

asperata—Dragon S.

bicolor—Alcock S.

Breweriana—Brewer S.

Engelmanni—Engelmann S.

glauca—White S.

glauca albertiana—Alberta S.

glauca conica—Dwarf Alberta S.

glauca densata—Black Hills S.

Glehnii—Sakhalin S.

jezoensis—Yeddo S.

Koyamai—Koyama S.

mariana—Black S.

mariana Doumetii—Doumet S.

obovata—Siberian S.

Omorika—Serbian S.

orientalis—Oriental S.

orientalis aurea—Bronze Oriental S.

polita—Tigertail S.

pungens—Colorado S.

pungens argentea—Silver S.

pungens Bakeri—Baker S.

pungens glauca—Blue Colorado S.

pungens Kosteriana—Koster S.

pungens Moerheimii—Moerheim S.

purpurea—Purple Cone S.

rubens—Red S.

Schrenkiana—Schrenk S.

sitchensis—Sitka S.

Smithiana—Himalayan S.

Wilsonii—Wilson S.

2. Needles on current year's growth mostly at right angles to twig; also see Fig. 5, p. 61. (NOTE: In no specimen are *all* the needles exactly at right angles to the twig. Some needles always point towards the end of the twig hence making an angle less than a right angle. However, the plants in the group with needles at right angles should have more than fifty per cent of their needles at right angles to the twig. In case of reasonable doubt, certain plants can be located again under the second No. 2—"Needles mostly at an angle considerably less than a right angle.")

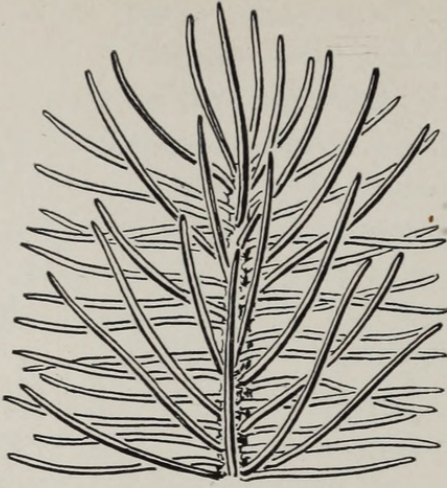


FIGURE 3. Tip of one year shoot of *Picea pungens* showing a majority of the needles nearly at right angles to the twig.

- 3. Needles $\frac{1}{2}$ inch long or less
- 4. Needles showing intense white lines when observed from tip looking towards base of branch; branchlets pubescent
- 5. Plant a tree, loose and open in habit **P. mariana**
(Labrador to Alaska; Wisconsin and Michigan) Zone 2
- 5. Plant not so tall, dense conical habit **P. mariana Doumetii**
- 4. Needles not showing intense white lines, plant a low dense pyramid of tightly compact light green foliage; branchlets glabrous
P. glauca conica
- 3. Needles mostly more than $\frac{1}{2}$ inch long
- 4. Terminal bud lustrous, dark brown, prominent, about $\frac{1}{4}$ inch long; its tight fitting scales remaining snugly tight fitting and blackish at base of branchlets for several years **P. polita**
(Japan) Zone 5

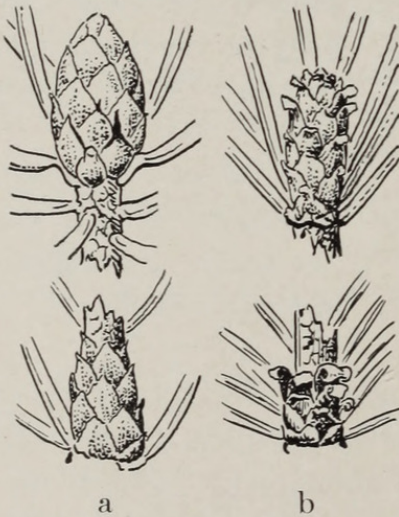


FIGURE 4. End bud and base of one year shoot of *Picea polita* (a) and *Picea Abies* (b) showing the tight fitting scales on bud and shoot base of *P. polita* as compared with those of *P. Abies*.

- 4. Terminal bud not lustrous nor as prominent, light brown. The scales, if they remain at the base of the current year's branchlets are curled and indistinct, not snugly tight fitting
- 5. Foliage of one year twigs definitely blue
P. pungens glauca
P. pungens argentea
P. pungens Moerheimii

The only way to tell these three apart is to determine the *degree* of blue color. *P. pungens glauca* is the least blue, *P. pungens argentea* the typical “Koster’s Spruce” of the trade is next, and *P. pungens Moerheimii* is the deepest blue.

NOTE: (Visualize the blue of *P. pungens argentea* [the typical “Koster’s Spruce” of the trade, sometimes incorrectly named *Kosteri* or *Kosteriana*] and the green of the Norway spruce. These are the two sharp color divisions. Plants with foliage a color between these two extremes come under the second No. 5—“Foliage bluish to grayish green”

5. Foliage bluish to grayish green

6. Needles rigid, extremely sharp to the touch, one year shoots strong and vigorous often 6 to 10 inches long

7. Needles frequently curved **P. asperata**
(West China) Zone 5

7. Majority of needles straight **P. pungens**
(Wyoming to New Mexico) Zone 2

6. Needles not so rigid and sharp to the touch, one year shoots not so vigorous

7. One year twigs greenish gray **P. Wilsonii**
(Central and West China) Zone 5

7. One year twigs yellowish to orange brown **P. glauca**
(Canada and northern U.S.) Zone 2

5. Foliage uniformly green. Usually most of the needles of this species are not at right angles to the twigs but sometimes on very vigorous shoots they are **P. Abies**

(North and Central Europe, naturalized in eastern U.S.) Zone 2

2. Needles on current year’s growth mostly at an angle considerably less than a right angle with the twig; i.e., needles pointing towards the tip of the twig. Also see Fig. 3, p. 60.

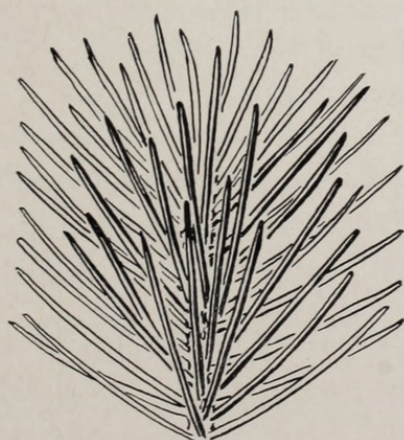


FIGURE 5. Tip of one year shoot of *Picea Engelmanni* showing a majority of the needles at less than right angles to the twig.

3. Foliage of current year’s shoots uniformly blue. (NOTE: Visualize the blue of *P. pungens argentea* [the typical “Koster’s Spruce” of the trade]

and the green of the Norway spruce. These are the two sharp color divisions. Plants with foliage a color between these two extremes come under the second No. 3—"Foliage bluish to grayish.")

- 4. One year twigs densely pubescent, noticeable without a lens
(British Columbia to Arizona) Zone 2 **P. Engelmanni**

- 4. One year twigs glabrous

- 5. Plant with rigid, horizontal branches **P. pungens Bakeri**

- 5. Plant with pendulous branchlets **P. pungens Kosteriana**
(Not to be confused with the Silver spruce, *P. pungens argentea*, which does not have pendulous branchlets)

- 3. Foliage of current year's growth bluish to grayish or whitish; especially when viewed from tip of branch, looking toward base of branch; green when viewed from above the branch

- 4. Needles $\frac{3}{4}$ inch or less in length

- 5. One year twigs greenish gray **P. purpurea**
(West China) Zone 5

- 5. One year twigs yellowish to brown

- 6. Needles flat in cross section



FIGURE 6. Cross section of needle of *Picea Omorika* (below) and *Picea glauca* (above).



- 7. Winter buds resinous

- 8. Branchlets glabrous and horizontal, foliage intensely white when viewed from underneath the branch

- 9. Needles pungent, $\frac{1}{2}$ to 1 inch long **P. sitchensis**
(Alaska to California) Zone 6

- 9. Needles not pungent, $\frac{1}{2}$ to $\frac{3}{4}$ inch long **P. jezoensis**
(Manchuria and Japan) Zone 4

- 8. Branchlets pubescent, usually markedly pendulous; foliage not intensely white when viewed from beneath

- (Oregon to northern California) Zone 5 **P. Breweriana**

- 7. Winter buds not resinous; branchlets pubescent **P. Omorika**
(Southeastern Europe) Zone 4

- 6. Needles angular in cross section, usually 4-sided

- 7. Two and three year old twigs black on upper side of branch at least, giving a dark appearance to the tree; needles sharp; branchlets pubescent **P. mariana**

- (Labrador to Alaska, Wisconsin to Michigan) Zone 2

7. Two year twigs usually light brown; branchlets glabrous, needles blunt
8. Tree slow growing, dense and compact **P. glauca densata**
8. Tree more open in habit **P. glauca**
(Canada and northern U.S.) Zone 2
- P. glauca albertiana**
(Alaska and British Columbia to Montana) Zone 2
- (NOTE: It is difficult to tell these two apart with the naked eye. *P. glauca albertiana* is considered a geographical variety of the species.)
5. One year twigs definitely a red brown
6. Cones $2\frac{1}{4}$ to $4\frac{3}{4}$ inches long **P. bicolor**
(Japan) Zone 4
6. Cones 2 to 3 inches long **P. Glehnii**
(Japan) Zone 3
- (Here is a case where differentiation between these two species without a lens and without fruit is very difficult; the differences are largely those of *degree*. The white markings on the upper surface of the needles of *P. bicolor* are more intense, whereas the pubescence of the branchlets and the dark green color of the branchlets of *P. Glehnii* is more marked.)
4. Needles more than $\frac{3}{4}$ inch long
5. Needles flat in cross section; see Fig. 6, p. 62.
6. Branchlets glabrous; foliage intensely white when observed from underneath branch **P. sitchensis**
(Alaska to California) Zone 6
6. Branchlets pubescent; usually markedly pendulous; foliage not intensely white when observed from underneath branch
(Oregon to northern California) Zone 5 **P. Breweriana**
5. Needles angular in cross section, usually 4-sided
6. Winter buds resinous **P. Smithiana**
(Himalayas) Zone 6
6. Winter buds not resinous **P. Schrenkiana**
(Central Asia) Zone 5
3. Foliage uniformly green
4. The majority of the needles $\frac{1}{2}$ inch or less in length
5. Needles flattened against branchlets; a markedly uniform dark glossy green above and below **P. orientalis**
(Caucasus and Asia Minor) Zone 4
5. Needles not flattened against branchlets except in some *P. Abies* varieties which are dwarf shrubs and not trees; nor a marked uniform glossy green above and below except sometimes in *P. rubens*

6. Plants usually low, dense, dwarf shrubs **P. Abies varieties**
(NOTE: Some 26 dwarf varieties are offered in the trade.)
6. Plants not low, dense, dwarf shrubs, but trees
7. One year twigs yellowish, foliage gray green **P. glauca**
(Canada and northern U.S.) Zone 2
7. One year twigs reddish brown; foliage green
8. Needles only slightly glossy, branchlets pubescent
(Nova Scotia to North Carolina) Zone 2 **P. rubens**
8. Needles not glossy, branchlets glabrous **P. koyamai**
(Japan and Korea) Zone 4
4. The majority of the needles at least $\frac{1}{2}$ inch and usually approaching $\frac{3}{4}$ inch in length
5. Foliage dark green, branchlets usually orange
6. Terminal bud lustrous, dark brown, prominent, about $\frac{1}{4}$ inch long; its tight fitting scales remaining snugly tight fitting and blackish at base of branchlets for several years; foliage decidedly harsh to the touch; see Fig. 4, p. 60 **P. polita**
(Japan) Zone 5
6. Terminal bud not lustrous. The scales if they remain at the base of the current year's branchlets are curled and indistinct, not snugly tight fitting; foliage not harsh to the touch; see Fig. 4, p. 60 **P. Abies**
(North and Central Europe, escaped in U.S.) Zone 2
5. Foliage grayish green, one year twigs yellowish
6. Needles usually rigidly upright on the upper side of the branchlets; needles dense, even on four year old branchlets; tree open in habit **P. glauca**
(Canada and northern U.S.) Zone 2

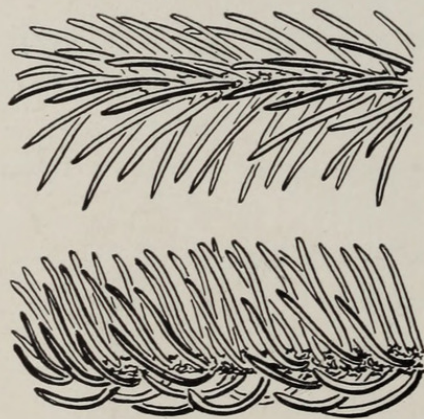


FIGURE 7. Side view of shoot of *Picea obovata* (above) and *Picea glauca* (below) showing the difference in the way the needles are borne on the twig.

6. Needles usually appressed or held closely along the upper side of the branch, not upright; needles sparsely borne; tree dense and conical in habit **P. obovata**
(Northern Europe to Kamchatka and Manchuria) Zone 2
3. Foliage bronze golden, at least when the needles first appear in spring. The majority of the needles less than $\frac{1}{2}$ inch long; plant a tree **P. orientalis aurea**

DONALD WYMAN



Wyman, Donald. 1943. "Simple Foliage Key to the Hemlocks and Spruces." *Arnoldia* 3(11), 57–64.

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