

PICEA

THE characters of the Genus *Picea* and of the two sections into which it is divided have been given in Vol. I. pp. 75-76, with a description of the species belonging to the section *Omorica*. At that time the Sikkim spruce (*P. spinulosa*), one of this section, was imperfectly known, and a full account of it is now given at the end of this article. See p. 1392.

In the section *Eu-picea*, the leaves are quadrangular or rhombic in section, and bear stomatic lines on all their four sides. About fifteen species of quadrangular-leaved spruces are known,¹ which may be readily distinguished by the following key, based on the characters of the branchlets, buds, and leaves.

KEY TO SECTION EU-PICEA

I. *Branchlets quite glabrous.*

* *Leaves on lateral branches radially arranged, spreading uniformly on all sides.*

1. *Picea Smithiana*, Boissier. Western Himalayas. See p. 1366.

Branchlets pendulous, grey. Buds large, resinous, pointed. Leaves slender, about $1\frac{1}{2}$ in. long.

2. *Picea Maximowiczii*, Regel. Japan. See p. 1374.

Branchlets not pendulous, reddish brown. Buds small, resinous. Leaves, $\frac{3}{8}$ to $\frac{1}{2}$ in. long.

** *Leaves on lateral branches in an imperfect radial arrangement, not pectinate in two sets on the lower side of the branchlets, which are not pendulous.*

3. *Picea Schrenkiana*, Fischer and Meyer. Central Asia, in the Alatau and Thianshan ranges. See p. 1364.

Branchlets ashy grey. Terminal buds subglobose, girt with a ring of keeled pointed pubescent ciliate scales. Leaves rigid, sharp-pointed, $\frac{3}{4}$ to $1\frac{1}{4}$ in. long.

4. *Picea pungens*, Engelmann. Wyoming, Colorado, Utah, New Mexico. See p. 1389.

Branchlets at first glaucous, becoming reddish brown. Buds with the tips of their upper scales usually loose and reflexed. Leaves stout, rigid, with a hard sharp-pointed apex, $\frac{3}{4}$ to $1\frac{1}{4}$ in. long.

¹ Not including the spruces of China, of which two or three species introduced by Wilson are in cultivation at Coombe Wood, but are too young to describe.

1336 The Trees of Great Britain and Ireland

5. *Picea polita*, Carrière. Japan. See p. 1370.

Branchlets yellow. Buds shining reddish brown, with closely imbricated scales. Leaves rigid, stout, curved, ending in a spine-like point.

*** *Leaves on lateral branches, imbricated on the upper side of the branchlet; those below, pectinate and spreading laterally in two sets.*

6. *Picea alba*, Link. North America. See p. 1380.

Branchlets greyish or pale brown, usually glaucous. Buds with glabrous non-ciliate bifid scales. Leaves disagreeable in odour when bruised, about $\frac{1}{2}$ in. long.

7. *Picea bicolor*, Mayr. Japan. See p. 1372.

Branchlets yellow, glabrous on lateral branches, pubescent in the furrows on leading shoots. Buds with scarios scales. Leaves, with two conspicuous white stomatic bands, each of five to six lines, on the two dorsal sides, and two bands of two lines on the two ventral sides.

II. *Branchlets*¹ *variable, quite glabrous or with slight scattered pubescence.*

8. *Picea excelsa*, Link. Europe. See p. 1337.

Branchlets reddish, usually quite glabrous, or with slight pubescence often confined to the grooves between the pulvini. Terminal buds conical, acute, without resin, girt with a ring of keeled pubescent ciliate pointed scales. Leaves, usually $\frac{3}{4}$ to 1 in. long, with two to three stomatic lines on each of the four sides.

9. *Picea albertiana*, Stewardson Brown. Alberta, British Columbia, Montana, Wyoming. See p. 1385.

Branchlets greyish yellow, either glabrous or with minute pubescence usually confined to the pegs from which the leaves arise. Buds slightly resinous with rounded entire scales. Leaves, in an imperfect radial arrangement on the lateral branches, $\frac{1}{2}$ to 1 in. long.

III. *Branchlets always plainly pubescent. Leaves arranged on lateral branches, as in P. excelsa.*

* *Terminal buds with a ring of conspicuous long subulate scales.*

10. *Picea nigra*, Link. North America. See p. 1375.

Branchlets covered with dense short glandular pubescence. Leaves bluish or glaucous green, about $\frac{1}{2}$ in. long.

11. *Picea rubra*, Link. North America. See p. 1377.

Branchlets, as in *P. nigra*. Leaves yellowish green or dark green, not glaucous, $\frac{1}{2}$ to $\frac{5}{8}$ in. long.

12. *Picea Glehnii*, Masters. Saghalien, Yezo. See p. 1369.

Branchlets reddish, with short non-glandular pubescence, confined to the furrows between the pulvini. Leaves slender, $\frac{1}{3}$ to $\frac{1}{2}$ in. long.

¹ Cf. *P. bicolor*, No. 7, which has pubescent leading shoots and glabrous lateral branches.

Picea

1337

** *Terminal buds without long subulate scales.*

13. *Picea orientalis*, Carrière. Asia Minor, Caucasus. See p. 1362.
 Branchlets slender, pale brown, covered with dense short non-glandular pubescence. Leaves, $\frac{1}{4}$ to $\frac{2}{5}$ in. long, shining dark green, blunt and bevelled at the tip.
14. *Picea Engelmanni*, Engelmann. Western North America. See p. 1387.
 Branchlets greyish yellow, with a sparse minute glandular pubescence. Leaves disagreeable in odour when bruised, bluish green, $\frac{7}{8}$ to 1 in. long.
15. *Picea obovata*, Ledebour. Northern Scandinavia, Russia, Siberia; sporadic at high altitudes in the mountains of Central Europe. See p. 1359.
 Branchlets reddish brown, covered with a dense minute non-glandular pubescence. Leaves, $\frac{2}{5}$ to $\frac{3}{5}$ in. long, short-pointed, with three to four stomatic lines on each side.

PICEA EXCELSA, COMMON SPRUCE

- Picea excelsa*, Link, in *Linnaea*, xv. 517 (1841); Willkomm, *Forstl. Flora*, 67 (1887); Mathieu, *Flore Forestière*, 540 (1897); Ascherson and Graebner, *Syn. Mitteleurop. Flora*, i. 196 (1897); Schröter, in *Vierteljahrs. Naturf. Ges. Zürich*, xliii. 125-252 (1898); Kent, Veitch's *Man. Conif.* 432 (1900); Kirchner, Loew and Schröter, *Lebengesch. Blütenpfl. Mitteleuropas*, 99 (1904); Clinton-Baker, *Illust. Conif.* ii. 38 (1909).
- Picea rubra*, Dietrich,¹ *Fl. Berol.* 795 (1824).
- Picea vulgaris*, Link, in *Abhand. Akad. Berlin*, 1827, p. 180 (1830).
- Picea Abies*, Karsten, *Pharm. Med. Bot.* 324 (1881).
- Pinus Abies*, Linnæus, *Sp. Pl.* 1002 (1753).
- Pinus Picea*, Du Roi, *Obs. Bot.* 37 (1771) (not Linnæus).
- Pinus excelsa*, Lamarck, *Fl. Franc.* ii. 202 (1778).
- Abies Picea*, Miller, *Dict.*, 8th ed., No. 3 (1768).
- Abies excelsa*, De Candolle, in Lamarck, *Fl. Franc.* iii. 275 (1805); Loudon, *Arb. et Frut. Brit.* iv. 2293 (1838).
- Abies carpatica*, Lawson, *Pinet. Brit.* ii. 137, t. 20 (1867).

A tree, often attaining in Britain 120 to 140 ft. in height and 10 to 12 ft. in girth, in central Europe attaining 200 ft. high and 15 to 20 ft. in girth. Bark on young stems brownish, thin, smooth; on older trees thick, and scaling off on the surface in thin small scales. Young branchlets, reddish or yellowish brown, glabrous or with a minute scattered non-glandular pubescence, often confined to the furrows between the pulvini. Buds conical, acute, reddish brown, without resin, with rounded scarious scales; terminal bud girt with a few acuminate keeled pubescent ciliate scales.

Leaves on erect shoots radially spreading, more or less appressed to the twigs with their tips directed upwards: on lateral branches, pectinate below, the lower side of the twig being laid bare, most of the leaves being directed forwards and outwards; while on the upper side of the twig, the leaves in the middle line are more or less

¹ Dietrich's name and description apply to the common European spruce, and not to the American red spruce, as is often erroneously supposed.

1338 The Trees of Great Britain and Ireland

appressed, with their tips directed forwards and slightly upwards. Leaves, variable in size, usually $\frac{1}{2}$ to $\frac{3}{4}$ in., occasionally 1 in. long, rigid, straight or curved, ending in a short callous point, rhombic in section, with two or three stomatic lines on each of the four sides; resin-canals variable, occasionally absent or only one present, usually two, one at each end of the transverse axis of the rhomb, close to the epidermis.

Staminate flowers solitary in the axils of the leaves of the branchlets of the preceding year, rarely terminal on lateral branchlets, ovoid, about an inch long; stamens numerous, spirally arranged, reddish, each with two pollen-sacs directed downwards and dehiscing longitudinally, and a prominent denticulate connective; pollen grains, each with two air-vesicles.

Pistillate flowers, appearing in summer as brown buds at the tips of the branchlets of the current year, developing in the following spring, about 2 in. long; sessile, erect, cylindrical, purplish red; scales carmine red, oval, with a truncate erose apex; bracts about half the length of the scales, not increasing in size after the time of flowering, ovate-lanceolate, denticulate, with a long acuminate apex. After fertilisation the young cones leave the erect position, and gradually become pendulous, their scales becoming closely imbricated, and in the usual form of the species green in colour.

Cones ripe in October, when they turn brownish; cylindrical, pendulous, variable in size, about 4 to 6 in. in length; usually opening in spring and letting the seeds escape when a dry east wind is blowing; falling from the tree in the subsequent summer or autumn; scales thin and flexible, rhombic, with a truncate emarginate or dentate apex, variable in size, $\frac{5}{8}$ to $\frac{3}{4}$ in. wide, 1 to $1\frac{1}{4}$ in. long, pale brown and glabrous on the exposed part, dark reddish brown and minutely pubescent on the concealed part; bract about $\frac{1}{5}$ in. long, lanceolate, denticulate at the acute or acuminate apex. Seed about $\frac{1}{8}$ in. long, dark dull brown; seed with wing about $\frac{3}{8}$ in. long; wing broadest near the obliquely rounded denticulate apex.

Seedling.—Seeds sown in spring germinate in four or five weeks, the radicle first making its way out of the seed coats, and the caulicle carrying up the cotyledons, which are at first enveloped as with a cap by the albumen of the seed. The cap is soon cast off, and the cotyledons spread in a whorl. The cotyledons are six to ten in number, united at their base by a sheath, about $\frac{1}{2}$ in. long, triangular in section, with the upper edge faintly serrate, without resin-canals, stomatic on the two inner surfaces, deciduous at the end of the second year. The plant at the end of the first year is about 2 to 3 in. high, the young stem bearing, in addition to the whorl of cotyledons, spirally arranged primary needles, which are rhomboidal in section, serrulate on the four angles, with two resin-canals, and inserted on raised pulvini. Branching occurs in the third or fourth year, when the leaves assume their adult form, being entire and not serrulate. No tap root is formed, the root dividing into numerous branches spreading in all directions. Throughout the life of the tree the absence of the tap root, seen in the seedling, persists; and the roots of the spruce are usually spreading and do not penetrate the soil to any great depth.

The spruce is normally monœcious, but instances have been known of

Picea

1339

individuals which always bear staminate flowers; and hermaphrodite flowers have been observed. The flowers are pollinated by the wind, the pollen being carried to an immense distance; as far as eight miles in a case which was noticed near Munich. In the vicinity of spruce forests the pollen often descends in enormous quantity, covering the ground and the surface of lakes and rivers with yellow patches.

I. The following variations occur in the form of the scales of the cone :—

1. Var. *europæa*, Schröter, *op. cit.* 142 (1898).

Var. *montana*, Ascherson and Graebner, *op. cit.* 198 (1897).

Picea vulgaris, Link, var. *europæa*, Teplouchoff, in *Bull. Soc. Nat. Mosc.*, xli. pt. ii. 249 (1869).

Cone-scales rhombic, gradually narrowing in the upper third to a truncate, slightly inflexed, emarginate or denticulate apex. This is the common form of *P. excelsa*, widely distributed throughout central Europe, and also occurring in southern Sweden. In the Alps it is rarely found over 5000 feet elevation.

2. Var. *acuminata*, Beck, in *Ann. Nat. Hofm. Wien*, ii. 39 (1887).

Cone-scales, contracted suddenly into a long bifid recurved undulate apex. This variety is of rarer occurrence in central Europe than the preceding; but is found in the Jura¹ and the Alps, and is said to be common in eastern Prussia and in southern Sweden.

3. Var. *triloba*, Ascherson and Graebner, *op. cit.* 199 (1897).

Scales of the cone trilobed at the apex. This is a much less common variation, which has been noticed in a few trees growing at Blankenburg² in the Harz Mountains, at Soglio³ to the north of Lake Como, and in Moravia.⁴

II. There appear to be two races of the common spruce in the continental forests, which are mainly distinguishable by the colour assumed by the unripe cones in August.

4. Var. *chlorocarpa*, Purkyne, in *Allg. Forst. u. Jagdzeit*, liii. 1 (1877). Cones remaining green in August.

5. Var. *erythrocarpa*, Purkyne, *loc. cit.* Cones becoming dark violet in August.

Purkyne considered that important differences in the growth of the tree, in the character of the wood, in the staminate and pistillate flowers, and in the soil occupied by each form, were correlated with the differences in the colour of the cones; but Schröter considers that these are not established, and suggests further investigation.

III. The spruce varies much in habit in the wild state, and several remarkable sports have been described.

6. Var. *viminalis*, Caspary, in *Schr. Phys. Oekon. Ges. Königsberg*, xiv. 126 (1873).

Pinus viminalis, Sparrman, ex Alstroemer, in *Vet. Ac. Handl. Stockh.* xxxviii. 310 (1777).

Pinus hybrida, Liljebblad, in *Svensk Fl.* (1792).

¹ Cf. Aubert, *Flore de la Vallée de Joux*, 345 (1900).

² A. Braun, in *Verh. Bot. Verein Prov. Brandenburg*, xviii. Sitzb. 13 (1876).

³ Ascherson and Graebner, ex Schröter, *op. cit.* 204, fig. 31 (1898).

⁴ Wilhelm, in *Oesterr. Forstzeit.* 1888, p. 169.

1340 The Trees of Great Britain and Ireland

Branches in remote almost horizontal whorls, with very long and slender branchlets (often 10 ft., occasionally 20 ft. long) without or with very few lateral branchlets. Leaves radially spreading.

This remarkable form of the weeping spruce was considered by Linnæus¹ to be a hybrid between the spruce and *Pinus sylvestris*. It has been observed in about twenty places in Sweden, where it is vulgarly called *Tysk gran* or German spruce, in about the same number of localities in Norway, and in isolated cases in Livland, East Prussia, Poland, Thuringia, Tyrol, Styria, Carinthia, Carniola, and Switzerland.² When sown, the peculiar habit is occasionally reproduced.³

7. Var. *pendula*, Jacques and Hérincq, *Man. Gén. Plantes*, iv. 340, 341 (1857).

A remarkable form of the weeping spruce, narrow and columnar in habit, with pendulous branches almost appressed to the stem. Conwentz⁴ has described this form, known to him as a single tree⁵ in the Stelin forest near Elbing in West Prussia, another⁶ at Jegothen, near Heilsberg in East Prussia, and two others⁷ near Schierke in the Harz Mountains. Kraemer⁸ found another in a forest near Kreut in Bavaria. Solitary examples have also been found in Switzerland,⁹ in northern Hungary,¹⁰ and in the Bukowina.¹¹ The seed of the weeping spruce near Jegothen, when sown by Conwentz,⁴ gave twelve trees, only one of which showed a tendency to the weeping habit.

A similar tree with longer leaves, lighter in colour than the typical form, was discovered¹² about the year 1860 by Mr. R. Smith Carrington in a plantation near Kinlet Hall, Shropshire, which was propagated by R. Smith and Company, Worcester, who sold it under the name *Abies excelsa inverta*,¹³ Gordon, *Pinet. Suppl.* 4 (1862), a name scarcely worth keeping distinct from var. *pendula*, Jacques and Hérincq, which antedated it a few years. A fine example, about 30 ft. high, was growing¹⁴ in 1897 at Ide Hill, Sevenoaks, Kent; and a good specimen exists at Murthly Castle. There is also a good example¹⁵ at Barbier's nursery, Orleans.

Other kinds of weeping spruce, probably including *Abies excelsa pendula*, Loudon, a form introduced by Booth, are irregular in habit and much more spreading. A very fine example occurs at Durris.

¹ Linnæus refers to it as *Abies procera viminalis* in *Fl. Suec.* 288 (1745).

² Cf. Schröter, *op. cit.* 151, who draws attention to the fact that *P. Breweriana*, of the Siskiyou Mountains, has this habit as a constant specific character.

³ Cf. Wilhelm, in *Verh. K. K. Zool. Bot. Ges. Wien*, xxxvii. (1887).

⁴ *Beob. Seltene Waldbäume W. Preussen*, 135 (1895).

⁵ Figured in *Gartenflora*, 1899, p. 618, fig. 86; and by Conwentz, *op. cit.* 141, figs. 12, 13.

⁶ Figured by Conwentz, *op. cit.* 147, fig. 14.

⁷ Figured in *Gartenflora*, 1901, p. 315, figs. 48, 49; and by Conwentz, *op. cit.* 150, 152, figs. 15, 16.

⁸ In *Flora*, 1841, p. 700.

⁹ Schröter, *op. cit.* 156 (1898).

¹⁰ Schilberszky, in *Kertészeti Lapok*, vii. (1892), describes a weeping spruce near Leutschau.

¹¹ Cf. *Oesterr. Forst. u. Jagdzeit.* 1897, p. 356.

¹² Nicholson, in *Woods and Forests*, 1884, p. 691; and *The Garden*, xxv. 229 (1884).

¹³ *Picea excelsa inversa*, Beissner, *Nadelholzkunde*, 361 (1891).

¹⁴ *Gard. Chron.* xxii. 368, fig. 109 (1897). Cf. also *Gard. Chron.* xxix. 263, fig. 98 (1901).

¹⁵ Figured in *Gartenflora*, 1899, p. 617, fig. 87; and by Conwentz, *op. cit.* 163, fig. 17.

Picea

1341

The "Cornish fir" which was mentioned by Hayes¹ as growing in 1794 at Avondale in Co. Wicklow, was pendulous in habit and bore large cones, sometimes nearly a foot in length. The remarkable pendulous spruce² at Shelsley Walsh, in the Teme Valley in Worcestershire, bears cones 9 in. in length, and appears to be identical with Hayes' variety.

8. Var. *columnaris*, Carrière, *Conif.* 248 (1855). Narrowly columnar in habit, with short horizontal branches, clothed with dense short branchlets and foliage.

This form, which has been known a long time in cultivation, exists in the wild state in Switzerland, where six trees are known by Schröter in the five localities of Stanserhorn, Stockhorn, la Brévine, Chavannes, and la Berboleuse, all at high altitudes between 4000 and 5800 ft.

The columnar spruce³ is to be carefully distinguished from the narrow spruce, known as the *spitzfichte*,⁴ in which the habit does not result as a sport, but is due to a severe climate, which checks the growth of the branches. The *spitzfichte* is similar to the columnar spruce in form, being narrowly cylindrical, but the stem is sparingly clad with short branches, wide apart, and forming a thin crown of foliage. The *spitzfichte* is never seen at low levels in the Alps and Jura, but occurs near the timber line, often forming small groves in exposed situations. This climatic form is much more common in *P. obovata* in Lapland, Finland, and northern Scandinavia.

9. Var. *pyramidata*, Carrière, 247 (1855).

Var. *stricta*, Schröter, *op. cit.* 158 (1898).

Branches ascending at a narrow angle, forming a nearly fastigate tree. Trees of this kind are occasionally seen in the forests of central Europe, and are rarely found in the seed bed in nurseries.

10. Var. *strigosa*, Christ, in *Garden and Forest*, ix. 252 (1896).

A form with numerous slender horizontal branchlets, spreading from all sides of the branches, giving the tree the habit of the common larch. This variety occurs in one locality in the canton of St. Gall in Switzerland.

11. Var. *eremita*, Carrière, in Jacques and Hérincq, *Man. Gén. Plantes*, iv. 341 (1857).

A tree of slender pyramidal habit with numerous branches, directed upwards at a small angle with the stem, short stout branchlets, large buds, and distant short thick sharp-pointed needles.

Var. *Remonti*, said by Kent⁵ to be a dwarf modification of this, is described by Masters⁶ as of dense compact pyramidal habit, recalling that of *Cupressus Lawsoniana*, var. *erecta viridis*.

¹ *Planting*, 165 (1794). It is first mentioned apparently in *London Catalogue of Trees* (1730), as the long-coned Cornish fir, said to have been "brought from America some years previously and planted in Devon and Cornwall."

² Erroneously referred to *P. Smithiana* (as *P. Morinda*) in *Gard. Chron.* 1869, p. 713, and xix. 132 (1896).

³ Dr. Christ, in *Garden and Forest*, ix. 252 (1896), uses the term columnar spruce for the *spitzfichte*, which is not strictly accurate.

⁴ First named and described by Berg, in *Jahrbuch K. Sächs. Akad. Forst. Tharand.* xiii. 83 (1859).

⁵ Veitch's *Man. Conif.* 433 (1900).

⁶ In *Gard. Chron.* vii. 578 (1890).

1342 The Trees of Great Britain and Ireland

12. Var. *virgata*, Caspary, *op. cit.* xiv. 125 (1873).

Abies excelsa, De Candolle, var. *virgata*, Jacques, in *Ann. Soc. Hort. Paris*, xlv. 653 (1853).

Abies excelsa Cranstonii, Knight and Perry, *Syn. Conif.* 36 (1850).

Picea excelsa, Link, var. *denudata*, Carrière, in *Rev. Hort.* iii. 102, fig. 7 (1854).

Branches very few and usually not in whorls, elongated, straight or curved, with very few or without branchlets. Leaves radially arranged, either longer or shorter than in the common spruce, persistent ten or twelve years.

This variety,¹ which is known as the snake spruce, owes its peculiarities to the arrest of nearly all the buds, which do not develop. Most of the examples recorded are young trees, but one² forty years old at Buttes, near Neuveville in the Swiss Jura, was 40 ft. high in 1898. The snake spruce is not uncommon in Norway, where Schübeler found it in seventeen localities between lat. $59\frac{1}{2}^{\circ}$ and $61\frac{1}{2}^{\circ}$; and also occurs here and there in Sweden between lat. 58° and 63° . Isolated examples are reported from Finland, Livland, and Courland which are probably *P. obovata*; and others occur in different parts of Germany. It is common in Bohemia; and one example is known in Moravia. Schröter mentions seventeen trees growing in ten localities in Switzerland. Carrière knew only one example, growing in Cochet's nursery at Suynes, near Brie-Comte-Robert, in Seine-et-Marne.

Varieties intermediate between the snake spruce and vars. *pendula*, *monstrosa*, and *viminalis* also occur, but are very rare.

13. Var. *monstrosa*, Schröter, *op. cit.* 170 (1898). (Not Carrière.³)

Abies excelsa, De Candolle, var. *monstrosa*, Loudon, *Arb. et Frut. Brit.* iv. 2295 (1838).

Abies aclada, Salvi, in *Flora*, 1844, p. 519.

Picea excelsa, Link, var. *monocaulis*, Nördlinger, *ex Willkomm, Forstl. Flora*, 76 (1887).

This variety, which never develops any lateral branches, has a single thickened stem, bearing leaves near the apex, persistent for many years, and about $1\frac{1}{3}$ in. in length.

This variety was first described by Loudon, who mentions a single specimen growing in the Chiswick garden, twelve years planted, and about 3 ft. in height. A specimen at High Canons, Hertford, produced cones of the ordinary form in⁴ 1907. Salvi found in 1842 four specimens, growing wild in the Euganean Hills, west of Padua. One of these which was transplanted to Isola Bella in Lake Maggiore, where I saw it in 1909, is attached to a bamboo, and trained up the wall of the château; it measures about 30 ft. in height and is nearly as thick ($1-1\frac{1}{2}$ inch) at the top as at the bottom, bearing leaves with very sharp points only on the upper two feet of the stem. Schröter records another specimen at Stockach in Baden, another in Bohemia, and another at Ansbach in Bavaria. A form of this variety is recorded

¹ An analogous form of the common silver fir, *Abies pectinata*, var. *virgata*, Caspary, in *Bot. Zeit.* 778, t. ix. (1882), occurs; but only four examples are known—two in Alsace, one in the Bohemian forest, and another in the Swiss Jura near Neuveville. The latter is described and figured by Schröter, *op. cit.* 168, fig. 15 (1898). Cf. vol. iv. p. 722.

² The oldest known to Schröter was one near Dorpat, in Livland, said by Berg, in *Schrif. Naturf. Ges. Univ. Dorpat*, ii. t. 2 (1887), to be sixty years old.

³ Carrière, *Conif.* 248 (1855), wrongly applied the name *monstrosa* to var. *virgata*, Caspary.

⁴ According to *Gard. Chron.* xxv. 146 (1886), var. *monstrosa* at Lucombe, Pince and Co.'s Nursery, Exeter, produced cones in 1886 which were similar to those of the ordinary spruce.

Picea

1343

from Silesia and Thuringia, which bears a few undivided branches at the base, the upper part being without branches.

14. Var. *globosa*, Berg, in *Schrift. Naturf. Ges. Univ. Dorpat*, ii. 19, 20 (1887).

In this variety, normal growth is replaced by numerous close branches, irregularly dividing into a great number of branchlets, similar to a witches' broom, and forming either a globose bush without any leader, or a conical bush with a leader arising out of a globose base. I saw a remarkable example of the globose spruce in 1909 at the Forestry Experimental Station, Zurich. Seedlings had been raised, one quarter of which had reverted to the habit of the ordinary spruce, the others being very various in appearance and intermediate between the parent form and the normal habit of the species.¹

In the true dwarf forms² of the spruce, the branching is regular, but the growth of the shoots is very small, and the needles are very short. The most important are :—

15. Var. *Clanbrassiliana*, Carrière, in Jacques and Hérincq, *Man. Gén. Plantes*, iv. 341 (1857).

Abies excelsa, De Candolle, var. *Clanbrassiliana*, Loudon, *Arb. et. Frut. Brit.* iv. 2294 (1838).

A compact low dense globose bush, seldom higher than 5 or 6 ft. ; branches and branchlets, much shortened ; leaves about $\frac{1}{4}$ to $\frac{1}{2}$ in. long ; buds very red in colour. This is supposed to have been found on the Moira estate, near Belfast, about the end of the eighteenth century, when it was introduced into England by Lord Clanbrassil. This dwarf form has been found growing wild in Thuringia, and near Stockholm, and in Jemtland in Sweden. It is always sterile, and is propagated by cuttings.

Elwes found at Tullymore Park, Co. Down, a large bush of this form measuring 10 ft. high and 28 ft. in circumference, which he was informed was either the original or a part of it, and was supposed to be about one hundred and fifty years old. A specimen at Aldenham has reverted to the normal type, and is now growing rapidly into an erect tree.

16. Var. *tabulaeformis*, Carrière, *Product. et Fixat. Variétés*, 52 (1865), *Conif.* 333 (1867).

A prostrate form, with slender branchlets spreading horizontally over the ground. This is said by Carrière to have been taken, probably as a cutting, from a witches' broom, growing on an ordinary spruce in the Trianon. Torssander³ found a similar plant in Södermanland in Sweden, thirty years old, and only 20 in. high.

17. Other dwarf forms have been named, as vars. *pumila*,⁴ *pygmæa*,⁵ *Gregoryana*,⁶ *Maxwelli*,⁷ etc.

¹ Cf. Engler, in *Mitt. Schweiz. Forst. Versuch.* viii. pt. ii. 117, figs. 8, 9 (1904).

² See under *Witches' Brooms*, p. 1345.

³ In *Södermanland Botan. Notiser*, 1897, p. 169.

⁴ Beissner, *Nadelholzkunde*, 365 (1891).

⁵ Loudon, *op. cit.* 2295 (1838).

⁶ Said by Gordon, *Pinetum*, 9 (1875) to have been raised in the Cirencester Nursery.

⁷ Originated as a seedling in Messrs. Maxwell's nursery, Geneva, New York. Cf. *Woods and Forests*, 1884, p. 502, and Rehder, in Bailey, *Cycl. Amer. Hort.* iii. 1333, fig. 1798 (1901).

1344 The Trees of Great Britain and Ireland

IV. Several varieties are known in which the leaves are coloured :—

18. Var. *aurea*, Carrière, *Conif.* 246 (1855).

Leaves yellowish white, shining. The golden spruce has been found wild in Carinthia.

19. Var. *finedonensis*, Gordon, *Pinet. Supp.* 4 (1862).

Leaves pale yellow at first, changing to a bronze colour, and ultimately becoming green.¹ This originated at Finedon Hall, Northamptonshire, where it came up accidentally in a bed of common spruce. It often loses its colour in cultivation, and at Colesborne has entirely reverted to the normal green. Var. *mutabilis*² has the young shoots creamy yellow in colour, changing to green by the end of the season. Mr. Bean³ saw in Hesse's nursery, Weener, Hanover, a very beautiful variety, with creamy white young shoots, which is called var. *argenteo-spica*.

20. Var. *variegata*, Carrière, *Conif.* 246 (1855).

Leaves variegated with pale yellow. A variegated form is mentioned by Loudon; and Wittrock⁴ found a tree with leaves variegated white at Helsingfors.

V. The colour of the bark of the common spruce varies from whitish grey to brown, probably due to influence of soil and climate. The following sports have been observed.

21. Var. *corticata*, Schröter, *op. cit.* 184 (1898).

Bark thick, up to $3\frac{1}{2}$ in., longitudinally fissured, and resembling that of a pine in external appearance, though in microscopical structure like the ordinary spruce. Schröter knew in 1898 only six spruces with thick bark, occurring in Austria, Bohemia, Hesse, Bavaria, and Switzerland; but more than twenty are now known⁵ in the latter country alone.

22. Var. *tuberculata*, Schröter, *op. cit.* 190 (1898).

Lower part of the stem covered with corky excrescences, projecting about an inch above the surface of the bark, where side branches are given off.⁶ Four examples only were known to Schröter in 1898, two in Austria, one in Bavaria, and one in Switzerland; but Badoux⁵ states that many more have since been found in Switzerland.

VI. In addition to the varieties and sports just described, which are of unknown origin, there are many peculiar forms of the spruce which are due to external influences, and which cannot, properly speaking, be named varieties or sports.

1. The candelabra spruce is often produced, when the leading shoot is broken off by the force of the wind or by other causes. A whorl of secondary branches becomes erect below the broken part of the stem, and forming a series of leaders, grows up, giving the tree a candelabra-like appearance.

2. Dwarf spruces,⁷ which are mere bushes, with irregular branches, dense

¹ Fowler, in *Gard. Chron.* 1872, p. 76, speaks of the inconstancy of the colour in different parts of the tree.

² Cf. Masters, in *Gard. Chron.* vii. 578 (1890).

³ *Kew. Bull.* 1908, p. 391.

⁴ In Hartman, *Skand. Flora*, 35 (1889).

⁵ Badoux, in *Journ. Forest. Suisse*, 1907, quoted by Beissner, in *Mitt. Deut. Dend. Ges.* 1910, p. 122.

⁶ Cf. Cieslar, in *Centralblatt Gesamte Forstwesen*, xx. Heft 4, pp. 145-149 (1894). Schröter compares these corky excrescences with those developed on the stems of *Zanthoxylum*, studied by Barber, in *Ann. Bot.* vi. 155 (1892).

⁷ *Picea ellipsoconis*, Borbas, *Magyar Bot. Lapok*, i. 26 (1902), a shrub-like spruce growing as scrub near tree-limit in the western Carpathians, with short broad cones, is considered by Pax, in *Pflanzenverb. Karpathen*, ii. 177 (1908), to owe its peculiarities to the high altitude, similar shrubs being recorded for the eastern Alps by Beck.