

## PINUS

*Pinus*, Linnæus, *Gen. Pl.* 293 (*ex parte*) (1737); Duhamel, *Traité des Arbres*, ii. 121 (1755); Bentham et Hooker, *Gen. Pl.* iii. 438 (1880); Engelmann, in *Trans. Acad. St. Louis*, iv. 161 (1886); Masters, in *Journ. Linn. Soc. (Bot.)*, xxvii. 236, 248, 258, 269, 309 (1891), xxx. 37 (1893), and xxxv. 560 (1904); Mayr, *Wald. Nordam.* 425 (1890), and *Fremdländ. Wald- u. Parkbäume*, 340 (1906); Shaw, in *Bot. Gaz.* xliii. 205 (1907).

EVERGREEN trees or shrubs, belonging to the division Abietinæ of the order Coniferæ. Bark usually thick, rough, and deeply fissured; but in some species thin and scaly, and in a few others peeling off in thin flakes like a plane tree. Branches arising from the stem in apparent whorls. Shoots of two kinds: short shoots, which are minute spurs of limited growth, bearing the adult leaves in clusters and deciduous with them; and long shoots, the ordinary branchlets, which continue growth.

In the majority<sup>1</sup> of pines, the long shoot produced in spring is a single internode, consisting of (*a*) a leafless base, which bears the staminate flowers, when these are developed; and (*b*) a longer upper portion bearing foliage, and ending in (*c*) a terminal bud, subtended by a whorl of smaller buds, one or more of which may be replaced by pistillate flowers (young cones). The buds and young cones being close to the apex of the shoot, are said to be subterminal. In the second year the mature cones and the branchlets, which have developed from the single whorl of buds of the first year, are situated beneath the base of the new shoot of the year, which has sprung from the terminal bud of the preceding season.

In another group<sup>2</sup> of pines, the long shoot produced in spring consists of two (rarely three or more) internodes, each with a leafless base, a leaf-bearing portion, and a whorl of buds (with or without young cones). The buds and young cones are in two or more whorls, and are both subterminal and lateral in position. Similarly, in the second year, the branchlets and mature cones are in two or more whorls.

In young or vigorous trees of any species of either group the subterminal whorl of buds and young cones, already formed in spring, is occasionally placed in a lateral position by the development above it of a summer shoot, which is distinguished from

<sup>1</sup> Termed uninodal pines by Shaw.

<sup>2</sup> Multinodal pines of Shaw, who points out that when the trees are old or diminishing in vigour, they often produce shoots with only one whorl of buds, but recognisable as having two internodes by the presence of two leafless bases; or they may, when very feeble, only develop one internode to each shoot.

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the normal spring shoot with long leaves and brown withered scale-leaves, by bearing short leaves with green scale-leaves. In this exceptional case, which is, however, common in certain species, the buds and cones are said to be pseudo-lateral.

Buds, varying in the different species in shape and in the characters of their spirally imbricated scales, which are united together by their fringed margins or matted hairs, or are embedded in resin, their tips being erect, spreading, or reflexed. The buds are compound; their outer scales empty and persistent at the base of the shoot, when the bud unfolds; their inner scales enclosing minute buds, which develop into the short shoots and adult foliage (and when flower-bearing, into the staminate flowers as well). These inner scales persist on the developed branchlets as scale-leaves.

Leaves of three kinds: (*a*) Primordial leaves, borne on seedling plants, solitary, spirally arranged, spreading, linear-lanceolate, keeled on both surfaces, serrulate. (*b*) Scale-leaves, containing in their axils the short shoots and adult leaves, triangular-lanceolate, entire or fringed in margin, usually<sup>1</sup> quickly deciduous in part, their basal portion only persisting. (*c*) Adult leaves, needle-like, persistent two to twenty years, in clusters of one to five (rarely six or seven), at the apex of the short shoot, serrulate or entire in margin; section<sup>2</sup> plano-convex in two-leaved species, triangular in three- to five-leaved species; fibro-vascular bundle branched or simple; resin-canals, two to twelve, marginal or median. The sheath at the base of each cluster, formed by the scales of the minute buds, is either quickly and entirely deciduous or persistent; in the latter case usually becoming, with age, shortened, blackened, and lacerated, but in certain species dividing into segments, which become reflexed and surround the base of the leaf-bundle as a rosette.

Flowers monoecious. Staminate flowers,<sup>3</sup> clustered in a head or spike at the base of the current year's shoot, ovoid or cylindrical, surrounded at the base by an involucre of scale-like bracts, composed of numerous imbricated sessile two-celled anthers; connective crest-like, nearly orbicular; pollen-grains with two lateral air-vesicles. Pistillate flowers or young cones, sub-terminal or lateral, solitary or in clusters, surrounded at the base by sterile bracts; composed of two series of scales, minute carpels becoming obsolete in the ripe cone, and large ovuliferous scales, each of the latter bearing two pendulous ovules. Pollination occurs in the first year, when the scales open to receive the pollen, closing immediately afterwards; but fertilisation, the arrival of the pollen-tube at the embryo-sac, does not occur till May or June in the second year; in consequence the cone remains small in the first year, and increases only in size in the second year.

Fruit a woody cone,<sup>4</sup> ripening in nearly all the species<sup>5</sup> at the end of the second

<sup>1</sup> In the species with leaves densely crowded on the branchlets, the scale-leaves persist during the first year.

<sup>2</sup> In *P. monophylla*, the section of the solitary leaf is terete.

<sup>3</sup> Shaw, *Pines of Mexico*, I (1909), points out that in the Soft Pines the buds enclosing the staminate flowers are not sufficiently advanced at the end of the growing season to be distinguishable; but in the Hard Pines they are recognisable by their larger size. In the latter, the young staminate flowers are either (*a*) enclosed in the general outline of the bud, or (*b*) they form about the nodes of the bud characteristic enlargements, which are constant for each species.

<sup>4</sup> The subterminal, lateral, or pseudo-lateral position of the cone referred to in descriptions of species is, as already defined above, that of the young cone in the first year.

<sup>5</sup> In *P. Pinea*, *P. leiophylla*, and *P. chihuahuana* the cones take three years to ripen; and in these the umbo of the scale shows separate growths of the first and second years.

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year; symmetrical, or oblique with the scales larger on the outer side of the cone. The exposed part of each scale in the unopened cone, known as the *apophysis*, is thickened and shows the apex of the growth of the first year as a terminal or dorsal protuberance or scar called the *umbo*, which is either unarmed or provided with a sharp prickle or stout spine. The cones in most species open their scales when ripe, allowing the seed to escape; but in *P. Cembra*, *P. pumila*, and *P. albicaulis* the scales are incapable of dehiscence, and the seeds are liberated by the attacks of squirrels and other animals. In other species a large proportion of the cones remain on the trees unopened for many years, the scales ultimately separating when scorched by forest fires. Usually the cones fall through decay at the insertion of their peduncle; but in *P. resinosa*, *P. ponderosa* and *P. palustris* separation occurs near the base of the cone, a few of the lower scales remaining attached by the stalk to the branch.

Seeds, two on each scale, obovate, triangular or cylindrical; wing embracing by its rim-like base the sides and part of the upper surface of the seed, and either separating freely from it as in the Hard Pines, or adhering closely and breaking off from it irregularly as in *P. Strobus* and its allies. In certain species, the seeds of which are edible and distributed by animals, the wing, no longer serving for flight, is either reduced to a mere vestige only visible on the upper surface of the seed, as in *P. Cembra* and its allies, or it is much shortened and reduced to a narrow lateral rim, which usually remains on the scale when the seed falls, as in *P. Pinea*, *P. cembroides*, *P. Bungeana*, and their allies.

In germination the shell of the seed, from which the wing has usually fallen, is raised as a hood on the top of the cotyledons,<sup>1</sup> which vary from three to eighteen in number and are usually triangular, flat, and green below, and keeled and marked with stomata above, entire in margin, acute or mucronate at the apex. The young stem elongating bears primordial leaves, in the axils of which the adult fascicled leaves are usually produced in the second year.

About eighty species of *Pinus* are known, distributed through the northern hemisphere from the Arctic circle to Central America, the West Indies, Canary Islands, Morocco, Algeria, Syria, Himalayas, Burmah, Philippine Islands, Sumatra, and Borneo. Of these about fifty-two species are in cultivation, which may be arranged as follows:—

I. HAPLOXYLON, Koehne, *Deutsche Dendrologie*, 28 (1893). Soft Pines.<sup>2</sup>

Leaves with a single fibro-vascular bundle. Scale-leaves subtending the leaf-clusters inserted on prominent bases, which are not decurrent on the branchlets. Cones symmetrical, opening when ripe. Seed-wing present or obsolete, not readily detachable from the seed. Cortex persistent on young trees for many years. Walls of tracheids of medullary rays of the wood not dentate. The wood is usually soft, close-grained, and light in colour; sap wood generally narrow.

<sup>1</sup> The number of cotyledons in each species is variable within narrow limits, and is stated by Dr. Masters in *Journ. Linn. Soc. (Bot.)* xxvii. 236 (1891). Cf. also Hill and de Fraine, in *Ann. Bot.* xxiii. 199 (1909).

<sup>2</sup> The shoots are always uninodal in the soft pines.

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### A. LEAF-SHEATH ENTIRELY DECIDUOUS. LEAVES IN FIVES.

#### § 1. STROBUS, Spach. White Pines.

Leaves serrate in margin, with marginal resin-canals. Cones sub-terminal, elongated, pendulous, usually long-stalked; scales thin, each with a terminal unarmed umbo. Seeds with long wings, closely adherent and breaking off irregularly.

\* *Branchlets glabrous.*

1. *Pinus excelsa*, Wallich. Himalayas. See p. 1011.

Branchlets glaucous, green. Buds conic, shortly acuminate. Leaves 5 to 8 in. long, spreading, slender; some sharply bent as if broken.

2. *Pinus Peuke*, Grisebach. Balkan Peninsula. See p. 1014.

Branchlets shining green. Buds ovoid, shortly acuminate. Leaves about 4 in. long, densely tufted towards the end of the shoot, and not spreading or broken as in *P. excelsa*.

\*\* *Branchlets pubescent. Bud-scales free at their apices.*

3. *Pinus Ayacahuite*, Ehrenberg. Mexico. See p. 1017.

Branchlets covered with a short rusty-brown pubescence. Buds ovoid, acuminate, resinous. Leaves 4 to 6 in. long, spreading, occasionally bent as if broken, as in *P. excelsa*.

\*\*\* *Branchlets pubescent. Bud-scales closely appressed.*

4. *Pinus Lambertiana*, Douglas. Oregon, California. See p. 1020.

Branchlets with short brown, partly glandular pubescence. Buds cylindrical, rounded at the apex or sharp-pointed. Leaves about 4 in. long, twisted a complete turn, rigid, ending in a sharp cartilaginous point.

5. *Pinus monticola*, Don. Western North America. See p. 1022.

Branchlets with short brown, partly glandular pubescence. Buds ovoid, acuminate. Leaves 4 in. long, slightly twisted in their upper half, blunt at the apex.

6. *Pinus Strobus*, Linnæus. Eastern North America. See p. 1025.

Branchlets with pubescent tufts below the insertions of the leaf-clusters, elsewhere usually glabrous. Buds ovoid, acuminate. Leaves 3 in. long, very slender, not twisted.

7. *Pinus parviflora*,<sup>1</sup> Siebold et Zuccarini. Japan, Kurile Isles. See p. 1033.

Branchlets greyish, with a scattered minute pubescence. Buds ovoid, not acuminate. Leaves 2 in. long, white on the inner surfaces, blunt at the apex.

#### § 2. CEMBRA, Spach. Stone Pines.

Leaves serrate or entire in margin, with median or marginal resin-canals. Cones sub-terminal, short-stalked; scales thickened, each with a terminal unarmed umbo. Seeds large, edible, with rudimentary or obsolete wings.

<sup>1</sup> This species, which is variable in the length of the seed-wing, is intermediate in character, and forms a connecting link between the first two sections.

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\* *Leaves serrate, with median resin-canals.*

8. *Pinus Cembra*, Linnæus. Alps, Carpathians, North-Eastern Russia, Siberia.  
 See p. 1035.

Branchlets covered with a dense orange-brown shaggy tomentum. Buds ovoid, acuminate, resinous. Leaves  $2\frac{1}{2}$  to  $3\frac{1}{2}$  in. long, with few serrations at the tip.

9. *Pinus koraiensis*, Siebold et Zuccarini. Amurland, Manchuria, Korea, Japan.  
 See p. 1041.

Branchlets and buds as in *P. Cembra*. Leaves with numerous sharp serrations at the tip, otherwise as in *P. Cembra*.

10. *Pinus Armandi*, Franchet. China. See p. 1043.

Branchlets olive green, glabrous or with minute scattered hairs. Buds with free or appressed scales. Leaves 4 to 6 in. long, spreading, and often bent, as in *P. excelsa*.

\*\* *Leaves entire in margin, with marginal resin-canals.*

11. *Pinus pumila*, Regel. Kamtschatka, Eastern Siberia, Amurland, Saghalien, Kurile Isles, Japan. See p. 1045.

Buds and branchlets as in *P. Cembra*. Leaves<sup>1</sup> also similar, but usually shorter and differing in the position of the resin-canals.

12. *Pinus flexilis*, James. Western North America. See p. 1046.

Branchlets glabrous or covered with a minute brown soft pubescence. Buds ovoid, sharp-pointed, resinous. Leaves 2 to 3 in. long, stout, rigid, curved, sharp-pointed.

13. *Pinus albicaulis*, Engelmann. Western North America. See p. 1048.

Scarcely distinguishable from *P. flexilis* in the absence of cones, though the branchlets apparently differ in their scattered minute stiff pubescence.

B. LEAF-SHEATH ENTIRELY DECIDUOUS. LEAVES IN THREES.

- § 3. GERARDIANÆ, Engelmann. Plane-bark Pines.

Leaves serrulate, with marginal resin-canals. Cones sub-terminal; scales much thickened, each with a dorsal umbo. Seeds large, edible; wing reduced to a narrow deciduous rim, remaining on the scale when the seed falls.

14. *Pinus Bungeana*, Zuccarini. China. See p. 1050.

Branchlets glabrous, green, smooth. Buds spindle-shaped, with scales free at their tips. Leaves 3 in. long, shining green, rigid, with the basal sheaths deciduous in the first year.

15. *Pinus Gerardiana*, Wallich. Western Himalayas. See p. 1052.

Branchlets glabrous, green, smooth. Buds conic, acuminate, resinous. Leaves 3 to 4 in. long, duller in colour and less rigid than in *P. Bungeana*, with the basal sheaths deciduous in the second year.

<sup>1</sup> In the insular form of this species, the leaves are indistinctly serrulate in margin.



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C. LEAF-SHEATHS PARTLY DECIDUOUS, THEIR INNER PART PERSISTING AS A ROSETTE OF REFLEXED SCALES AROUND THE BASE OF THE LEAF-BUNDLE. LEAVES ENTIRE IN MARGIN.

\* *Leaves in fives.*

§ 4. BALFOURIANÆ, Engelmann. Fox-tail Pines.

Cones sub-terminal, short-stalked, cylindrical; scales each with a dorsal umbo, armed with a slender prickle. Seeds with long wings, easily separable.

16. *Pinus Balfouriana*, Balfour. California. See p. 1054.

Branchlets stout, pubescent. Buds ovoid, acuminate. Leaves  $1\frac{1}{2}$  in. long, without stomata on the outer surface, rigid, curved.

17. *Pinus aristata*, Engelmann. Colorado, Utah, Nevada, Arizona, South-eastern California. See p. 1055.

Differs from the preceding species in the numerous resinous exudations on the leaves, and in the cones and seeds.

\*\* *Leaves solitary or in twos, threes, or fours.*

§ 5. CEMBROIDES, Engelmann. Nut Pines.

Cones sub-terminal, sub-sessile, globose; scales few, much thickened, each with a dorsal umbo, unarmed or with a minute prickle. Seed large, edible, with wing reduced to a narrow rim, remaining on the scale.

18. *Pinus monophylla*, Torrey. Utah, Nevada, Arizona, California, Lower California. See p. 1056.

Leaves solitary, rigid, terete, sharp-pointed,  $1\frac{1}{2}$  in. long, remotely placed on the branchlets.

19. *Pinus edulis*, Engelmann. Wyoming, Colorado, Utah, New Mexico, Texas, Arizona, Northern Mexico. See p. 1058.

Leaves in twos, rarely in threes, rigid, sharp-pointed,  $\frac{3}{4}$  to  $1\frac{1}{2}$  in. long, remotely placed on the branchlets.

20. *Pinus cembroides*, Zuccarini. Arizona, Lower California, Northern Mexico. See p. 1059.

Leaves in threes, rarely in twos, softer and more slender than in the other species of the section, and densely crowded on the branchlets.

21. *Pinus Parryana*, Engelmann. Southern California, Lower California. See p. 1060.

Leaves in fours, rarely in fives,  $1\frac{1}{2}$  in. long, rigid, sharp-pointed, remotely placed on the branchlets.

II. DIPLOXYLON, Koehne, *Deutsche Dendrologie*, 30 (1893). Hard Pines.

Leaves with a divided fibro-vascular bundle. Bases of the scale-leaves subtending the leaf-clusters, decurrent on the branchlets. Cones sometimes asymmetrical, and often remaining closed for several years after ripening; scales always with dorsal umbos. Seed-wing present, occasionally reduced to a narrow rim; always readily detachable from the seed. Walls of tracheids of the medullary rays of the wood not dentate. The wood is usually heavy, coarse-

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grained, and dark-coloured ; sapwood thick, and paler in colour than the heart-wood.

D. LEAF-SHEAF PERSISTENT IN ALL THE CULTIVATED SPECIES. LEAVES ALWAYS SERRATE.

*a. Leaves in fives.*

§ 6. PSEUDOSTROBUS, Engelmann. Leaves with median resin-canals. Cones sub-terminal. Shoots uninodal.

22. *Pinus Montezumæ*, Lambert. Mexico, Guatemala. See p. 1061.

Branchlets stout, not glaucous, reddish brown. Buds ovoid, pointed, an inch long, reddish brown, scarcely resinous. Leaves about 9 in. long ; basal sheaths  $1\frac{1}{4}$  to 2 in. long. Scale-leaves persistent.

22A. *Pinus Montezumæ*, Lambert, var. *Hartwegii*, Engelmann. Cold regions and high altitudes of Mexico. See p. 1062.

Branchlets and buds, as in the type, but the latter smaller,  $\frac{1}{2}$  to  $\frac{3}{4}$  in. long, usually with resinous appressed scales. Leaves 5 to 6 in. long ; basal sheaths 1 in. long. Scale-leaves persistent.

23. *Pinus pseudostrobus*, Lindley. Mexico. See p. 1064.

Branchlets slender, glaucous. Buds, leaves, and scale-leaves as in *P. Montezumæ*.

24. *Pinus Torreyana*, Parry. Coast of California near San Diego, and Santa Rosa island. See p. 1065.

Branchlets glaucous, dull grey in the second year. Buds cylindro-conic,  $\frac{1}{2}$  in. long ; scales pale brown with appressed points. Leaves 7 to 13 in. long, very stout ; basal sheaths an inch long. Scale-leaves deciduous.

*β. Leaves in threes.*

§ 7. TAEDA, Mayr.

Leaves with median resin-canals. Cones variable in size and position. Shoots uninodal or multinodal.

\* *Buds resinous ; points of bud-scales appressed.*

† *Leaves more than 6 in. long.*

25. *Pinus Coulteri*, Don. California. See p. 1067.

Branchlets stout, glaucous, remaining green in the second year. Buds ovoid, stout, acuminate or cuspidate, 1 to  $1\frac{1}{2}$  in. long. Leaves 10 to 14 in. long, dark green, spreading from the upper part of the branchlets of the first and second years.

26. *Pinus Sabiniana*, Douglas. California. See p. 1069.

Branchlets slender, glaucous, remaining green in the second year. Buds narrowly cylindrical, an inch long. Leaves 7 to 12 in. long, greyish green, spreading or drooping from the upper part of the branchlets of the first and second years.

27. *Pinus ponderosa*, Lawson. Western N. America. See p. 1071.

Branchlets stout, reddish, not glaucous, becoming nearly black in the second

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and third years. Buds cylindro-conic, an inch long. Leaves 6 to 10 in. long, dark green, densely crowded on the greater part of the branchlets, directed outwards and forwards.

- 27A. *Pinus ponderosa*, Lawson, var. *Jeffreyi*, Vasey. California and Lower California. See p. 1072.

Branchlets stout, glaucous, becoming dark-coloured in the second and third years. Buds stout, cylindro-conic, reddish brown, an inch long, with scales less resinous and their points more free than in the type.

†† *Leaves less than 6 in. long.*

28. *Pinus tuberculata*, Gordon. Oregon, California. See p. 1077.

Branchlets reddish brown, not glaucous. Buds cylindrical, pointed, an inch long. Leaves 4 to 5 in. long, rigid, dark green; basal sheath  $\frac{1}{2}$  in. long.

29. *Pinus radiata*, Don. Coast of California, near Monterey. Islands of Santa Cruz, Santa Rosa, and Guadalupe. See p. 1079.

Branchlets reddish brown, not glaucous. Buds cylindrical, pointed,  $\frac{1}{2}$  to  $\frac{3}{4}$  in. long. Leaves 4 to 5 in. long, slender, flexible and soft in texture, light green, densely crowded on the branchlets; basal sheath  $\frac{1}{2}$  inch long.

\*\* *Points of the bud-scales free and slightly spreading, not reflexed.*

30. *Pinus patula*, Schlechtendal et Chamisso. Mexico. See p. 1085.

Branchlets glaucous. Buds cylindro-conic,  $\frac{1}{2}$  to  $\frac{3}{4}$  in. long. Leaves 6 to 9 in. long, filiform, soft and very slender, drooping; basal sheath, 1 in. long.

31. *Pinus Teocote*, Schlechtendal et Chamisso. Mexico. See p. 1086.

Branchlets glaucous, the epidermis of the decurrent pulvini peeling off in the second and third years. Buds cylindro-conic, resinous,  $\frac{3}{4}$  in. long. Leaves 4 to 8 in. long, rigid, spreading; basal sheath an inch long.

32. *Pinus rigida*,<sup>1</sup> Miller. Eastern Canada, and North-eastern United States. See p. 1087.

Branchlets not glaucous. Buds cylindro-conic,  $\frac{1}{2}$  to  $\frac{3}{4}$  in. long. Leaves  $3\frac{1}{2}$  to 4 in. long, rigid; basal sheath  $\frac{3}{8}$  to  $\frac{1}{2}$  in. long.

33. *Pinus serotina*,<sup>1</sup> Michaux. South-eastern and Southern United States. See p. 1090.

Distinguishable from *P. rigida* by the different cones and longer leaves, 6 to 10 in. long; but in cultivated trees in England the leaves are as short as in that species.

\*\*\* *Buds non-resinous; bud-scales with free, fimbriated, and recurved points. The apex of the second year's branchlet is marked with a conspicuous sheath of the persistent recurved bud-scales.*

34. *Pinus palustris*, Miller. South-eastern and Southern United States. See p. 1091.

Branchlets stout, orange brown. Buds  $1\frac{1}{2}$  to 2 in. long, with silvery white scales. Leaves 8 to 18 in. long, densely crowded on the branchlets; basal sheath  $\frac{3}{4}$  to 1 in. long. Scale-leaves persistent.

<sup>1</sup> Adult trees of both these species are readily recognisable by the adventitious shoots on the old branches and stems. Occasionally the buds in *P. rigida* are very resinous, with closely appressed scales.



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35. *Pinus Taeda*, Linnæus. South-eastern and Southern United States. See p. 1094.  
 Branchlets glaucous. Buds  $\frac{1}{2}$  in. long, with brown scales. Leaves 6 to 9 in. long, spreading; basal sheath nearly 1 in. long. Scale-leaves persistent.
36. *Pinus canariensis*, Smith. Canary Islands. See p. 1096.  
 Branchlets yellow, not glaucous. Buds  $\frac{3}{4}$  in. long, with reddish brown scales. Leaves 7 to 12 in. long, densely crowded on the branchlets, slender, flexible.  
*γ. Leaves in twos; in one species, clusters of three leaves also occur.*  
 See § 8 and § 9.
- § 8. BANKSIA, Mayr.  
 Cones lateral. Shoots multinodal, a vigorous branch showing a whorl of buds, branchlets, or cones in the middle of each year's shoot, in addition to the subterminal whorl.  
*\* Leaves in twos and in threes, on the same branch.*
37. *Pinus echinata*, Miller. South-eastern United States. See p. 1098.  
 Branchlets slender, brittle, glaucous, with the bark in the third year exfoliating in large flakes. Buds  $\frac{1}{4}$  in. long, brownish, shining, with resinous appressed scales. Leaves 3 in. long, resin-canals median; basal sheath  $\frac{3}{8}$  in. long.  
*\*\* Leaves always in pairs.*  
*† Buds non-resinous, with free and recurved points to their scales.*
38. *Pinus halepensis*, Miller. Mediterranean region, Caucasus. See p. 1099.  
 Branchlets glaucous. Leaves  $2\frac{1}{2}$  to 4 in. long; resin-canals marginal; basal sheath  $\frac{1}{3}$  in. long. In var. *Brutia* the leaves are 4 to 6 in. long.  
*†† Buds resinous, with appressed scales.*
39. *Pinus muricata*, Don. California. See p. 1104.  
 Branchlets stout, reddish brown. Buds cylindrical,  $\frac{3}{4}$  to 1 in. long; scales encrusted with white resin. Leaves 4 to 6 in. long, stout, rigid; resin-canals median; basal sheath  $\frac{1}{2}$  in. long.
40. *Pinus pungens*, Michaux. Alleghany Mountains. See p. 1106.  
 Branchlets shining brown. Buds cylindrical,  $\frac{3}{4}$  in. long. Leaves 2 to  $2\frac{1}{2}$  in. long, stout, rigid, very sharp-pointed; resin-canals median; basal sheath  $\frac{1}{4}$  in. long.
41. *Pinus virginiana*, Miller. Eastern United States. See p. 1107.  
 Branchlets slender, glaucous violet. Buds cylindrical,  $\frac{3}{8}$  in. long. Leaves  $1\frac{1}{2}$  to 3 in. long; resin-canals median; basal sheath  $\frac{3}{16}$  in. long.
42. *Pinus Banksiana*, Lambert. Canada, east of the Rockies; United States, Minnesota to Maine. See p. 1109.  
 Branchlets slender, greenish. Buds ovoid,  $\frac{1}{2}$  in. long. Leaves 1 in. long; resin-canals median; basal sheath  $\frac{1}{8}$  to  $\frac{1}{6}$  in. long.
- § 9. PINASTER, Mayr.  
 Cones subterminal. Shoots uninodal, a branch, even when vigorous, showing only one whorl of branchlets, buds, and cones, in each year's shoot, close to its apex. Leaves always in pairs.

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\* *Buds non-resinous; bud-scales with free and recurved points.*

43. *Pinus Pinaster*, Solander. Mediterranean region. See p. 1113.  
 Branchlets stout. Buds stout, spindle-shaped, pointed,  $\frac{3}{4}$  to 1 in. long. Leaves 5 to 6 in. long, stout, rigid; resin-canals marginal; basal sheath 1 in. long.
44. *Pinus Pinea*, Linnæus. Mediterranean region. See p. 1119.  
 Branchlets slender. Buds ovoid, pointed,  $\frac{3}{8}$  in. long. Leaves 4 to 5 in. long; resin-canals marginal; basal sheath  $\frac{4}{10}$  in. long.
- \*\* *Buds resinous; bud-scales free at the apex. Bark of upper part of the stem reddish and peeling off in thin papery scales.*
45. *Pinus sylvestris*, Linnæus. Europe, Asia Minor, Caucasus, Siberia. See Vol. III. p. 571.  
 Branchlets shining, greenish. Leaves 2 to 3 in. long, glaucous blue, broad and flattened; resin-canals marginal; basal sheath  $\frac{1}{3}$  in. long.
46. *Pinus densiflora*, Siebold et Zuccarini. Japan. See p. 1125.  
 Branchlets glaucous. Buds  $\frac{1}{2}$  in. long. Leaves 3 to 4 in. long, dull green; resin-canals marginal; basal sheath  $\frac{3}{8}$  in. long, often ending in two long narrow filaments.
- \*\*\* *Buds resinous; points of the bud-scales appressed.*  
 † *Buds cylindric or spindle-shaped. Leaves 1½ to 3 in. long.*
47. *Pinus montana*, Miller. Mountains of central and southern Europe. See p. 1127.  
 Branchlets brown. Buds  $\frac{1}{4}$  to  $\frac{1}{2}$  in. long, very resinous. Leaves persistent 5 to 10 years,  $1\frac{1}{2}$  to  $2\frac{1}{2}$  in. long; resin-canals marginal; basal sheath  $\frac{1}{2}$  to  $\frac{6}{10}$  in. long.
48. *Pinus contorta*, Loudon. Western North America. See p. 1134.  
 Branchlets brown. Buds  $\frac{1}{2}$  in. long, very resinous. Leaves persistent 3 to 8 years, twisted,  $1\frac{1}{2}$  to 3 in. long; resin canals median; basal sheath  $\frac{1}{4}$  in. long.  
 †† *Buds ovoid. Leaves<sup>1</sup> 3 to 6 in. long.*
49. *Pinus resinosa*, Solander. Eastern Canada; United States, Minnesota to Massachusetts. See p. 1140.  
 Branchlets orange-brown. Buds pale brown,  $\frac{1}{2}$  to  $\frac{3}{4}$  in. long. Leaves 5 to 6 in. long; resin-canals marginal; basal sheath  $\frac{7}{8}$  in. long.
50. *Pinus Thunbergii*, Parlatore. Japan. See p. 1143.  
 Branchlets brown. Buds  $\frac{1}{2}$  to  $\frac{3}{4}$  in. long, whitish. Leaves 3 to 4 in. long, rigid, sharp-pointed; resin-canals median; basal sheath  $\frac{1}{2}$  in. long, ending above in two long filaments.
51. *Pinus Laricio*, Poiret. Southern Europe, Caucasus, Asia Minor. See Vol. II. p. 407.  
 Branchlets brown. Buds  $\frac{1}{2}$  to 1 in. long, light brown, tinged with white. Leaves 4 to 6 in. long; resin-canals median; basal sheath  $\frac{1}{2}$  in. long.
52. *Pinus leucodermis*, Antoine. Bosnia, Herzegovina, Montenegro. See Vol. II. p. 424.  
 Branchlets glaucous. Buds  $\frac{1}{2}$  to 1 in. long, dark brown. Leaves 2 to 3 in. long, rigid, sharp-pointed; resin-canals median; basal sheath  $\frac{1}{2}$  in. long.

(A. H.)

<sup>1</sup> They are sometimes only 2 in. long in *P. leucodermis*, No. 52.