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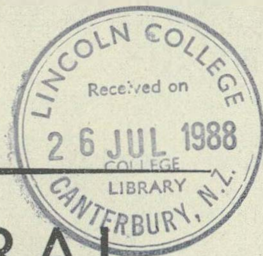

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CONIFERS

UNIVERSITY OF NEW ZEALAND

CONIFERS

L. W. McCaskill

(Continued)

2. *C. obtusa* (blunt). Hinoki or Hinoki cypress.

This plant can be recognized by the larger cones, and the blunt leaves which are dark, glossy green above, with dense white markings below.

Hinoki is a native of Japan where it has long been sacred to the Shinto faith, being cultivated near temples and used to build the palace of the Mikado in Kyoto. The timber is probably the best of all conifers for high-class work such as joinery, ceilings, panelling, furniture and cabinet work.

It is light, strong, very durable, fragrant and easily worked.

Horticulturally it is interesting for the number of attractive varieties including the well known var. *crippsii*, a beautiful golden form with the branchlets in dense, flattened sprays. Hinoki is one of the plants used by the Japanese in producing dwarf trees.

3. *C. pisifera* (pea bearing). Sawara cypress.

This is a native of Japan where the wild form grows to a height of 120 feet with a girth of 12 feet. It has long been cultivated by the Japanese and has given rise to numerous varieties all of which grow readily from cuttings. Many nurserymen sell them under the generic name of *Retinospora*. The three main varieties are:—

(i) *C.p.* var. *filifera* (slender). A bushy shrub with spreading branches and long slender branchlets undivided except towards the tips. The leaves are awl-shaped, only one-eighth of an inch long and white on the inner surface.

(ii) *C.p.* var. *plumosa* (feathery). A dense shrub of conical habit with crowded, overlapping branchlets. The leaves are awl-shaped but soft. Occasionally a branch will bear adult leaves.

(iii) *C.p.* var. *squarrosa* (spreading). A dense shrub with very handsome, glaucous foliage. The leaves are a quarter of an inch long, linear, white on both surfaces and soft to the touch.

All these three varieties have various forms which vary in colour, shape and size. They are used largely in rock gardens.

4. *C. nootkatensis.* Nootka or Alaskan cypress.

This is a native of Alaska, British Columbia, Washington and Oregon where it grows as a large forest tree. It is seen occasionally in large gardens in New Zealand where

it is often confused with Lawsoniana. The reason for mentioning it here is that it is one of the parents of the Hybrid Cypress described below.

Cupressocyparis

Cupressocyparis leylandii. Hybrid Cypress.

This is a natural hybrid between plants of two genera, the parents being *Cupressus macrocarpa* and *Chamaecyparis nootkatensis.* The first plants known came from seed collected in 1888 at Leighton Hall in England, from an Alaskan cypress growing near a macrocarpa. Although the resulting trees grew well, little notice was taken until 1911 when seed was raised from a cone collected on the macrocarpa tree which this time had been pollinated by the Alaskan cypress. Twigs were sent to Kew in 1925 and the new hybrid was officially named and described. It grows readily from cuttings and is becoming increasingly popular in New Zealand. Plants grown from cuttings form a good leader and are unusually hardy, a character inherited from the Alaskan cypress. The very rapid growth may make this tree useful for farm shelter in New Zealand.

Thujopsis

(From Thuja, the arborvitae and opsis, likeness.)

Thujopsis dolabrata (axe-shaped). Hiba.

There is only one species. It is native to central Japan but is now widely distributed in cultivation. It is an important forest tree in Japan where the timber is used for railway sleepers, bridges and house building. It is grown in New Zealand in large gardens, usually in the variegated form. The branchlets are much broadened and frond-like, arranged in horizontal planes with the axe-shaped leaves in opposite pairs, made conspicuous by the broad, white band of stomata on the under surface. The cones are up to three-quarters of an inch long. The scales are wedge-shaped and leathery with a peculiar, triangular, pointed boss or umbo near the apex.

Libocedrus. Incense Cedars.

(From libas, drop or tear, and kedros, cedar; from the resinous character.)

The plants of this genus are all evergreen trees with a fragrant smell, often extremely strong. They differ mainly from *Thuja* (see below) in the smaller number of scales in the cone and in the seeds which have unequal wings; and by the fact that the leaves, which occur apparently in whorls of four, run for a long way down the stem.

1. *Libocedrus bidwillii* (after Bidwill, a farmer botanist). N.Z. cedar. Pahautea.

This and the next species and the kauri are the three trees native to New Zealand which have woody cones. The branchlets are four-angled, distinguishing it from the next species in which they are flat. The leaves are small and scale-like, triangular, sharp-pointed, and very tightly pressed against the branchlets.

This tree grows from Te Aroha and Mount Egmont south, usually at an altitude of 1,000 to 4,000 feet. It seldom grows more than 50 feet high, but the trunk of such a tree may be as much as three feet through at the base. In the sub-alpine belt or where the soil is peaty, it may be reduced to a bushy shrub. The bark is stringy and papery and falls off, or may be pulled off, in long ribbons.

Male and female flowers are normally found in different parts of the same plant; occasionally trees may be of separate sexes. The pollen flowers are like a minute male pine cone, only about one-quarter of an inch long. The female flower consists of a small, green, woody cone about one-third of an inch across. It is made up of four scales each with a sharp, curved spine at the back. Only two seeds develop in each cone.

The wood is red in colour and remarkably straight in the grain. It splits so easily into thin laths that it makes ideal shingles and palings. Though lacking strength, it is even more durable than totara. Because of this durability it was formerly much used for bridges, piles, house blocks, fence posts, rails, sleepers, weather boards and small telegraph posts.

2. *L. plumosa* (feathery). North Island cedar. Kawaka. (In some books this tree is listed as *L. doniana.)*

The discovery of the kawaka goes back to 1833 when Richard Cunningham arrived from Australia in H.M.S. Buffalo which had been sent by the Admiralty to obtain a cargo of kauri spars for experimental purposes. He spent five months travelling through the Bay of Islands, Whangaroa, and Hokianga districts finding many new plants including kawaka.

This tree is found in forests from Mangonui southwards to Hawke's Bay and Taranaki. It also occurs in the north-west of the South Island between Collingwood and West Wanganui.

At one time, trees might be found 100 feet high and five feet in diameter but it is doubtful if any such specimens exist today. Old trees can be recognized by the way the bark falls away in long, thin flakes or ribbons. In the young stages the plant is extremely handsome. The leaves vary considerably in form and arrangement according to the stage of growth. In young plants they are all similar, up to half an inch long and spreading; in older stages they

have two forms arranged in four rows. The two side rows consist of flattened, acute leaves, about one-fifth of an inch long; the upper and lower rows consist of minute scales. In the mature tree the leaves are still in four rows but more similar in size and shape.

The male flowers form short catkins at the tips of the branches. The female flower develops into a small woody cone, less than half an inch long. It consists of four spreading scales each with a sharp, curved spine at the back. As with pahautea there are normally only two seeds in each cone.

The timber is fine-grained, dark red in colour and often beautifully marked. Being easily split, it made excellent rails, palings and shingles in the early days of settlement. It is very durable in contact with the ground but the little that is now available is used mainly for ornamental inlays in cabinet work.

There is no more handsome conifer for the small garden than kawaka. It is easy to grow if purchased as a pot-grown plant and given a little shelter from drying winds.

3. *L. decurrens* (running down—applied to the leaves which are prolonged below the point of insertion.) Incense cedar.

This tree is a native of Oregon and California but it is commonly grown in New Zealand parks where its rich green foliage and columnar habit give it an arresting appearance. On an old tree the bark is up to an inch thick, cinnamon-red in colour and deeply furrowed. The fragrant foliage consists of scale-like leaves which cover the branchlets completely. A small resin-gland on each leaf is responsible for the pungent, aromatic odour when the leaf is crushed. The cones are almost cylindrical and up to half an inch long. There are six scales, the lowest pair being very short. Only one or two seeds occur on each scale, each seed having an oblique wing about threequarters of an inch long and a rudimentary second wing. The seeds contain glands which exude a clear, red, pungently-odorous resin.

The wood is fine-grained, very straight, light and very durable under water or in the ground. It is aromatic like the rest of the plant and is used to make cedar chests for clothes in the belief that it keeps moths away. The wood is used also for cigar boxes, railway sleepers, shingles, door and window frames, and pencils. To make pencils, logs are specially selected for clean, straight timber, cut up into various sizes and finally to pencil slats the right size to make seven pencils. At the pencil factory they are surfaced and grooved on one side, the leads (of a composi-

tion of graphite and clay) are placed in the grooves between two slats and the pair glued together. Only then are the individual pencils separated.

Thuja. Arbor-vitae

(From Thuon, a sacrifice, because the resin was used as incense in the East).

All the arbor-vitaes are commonly known, incorrectly, as cedars. They are allied to *Libocedrus* but have six to nine cone scales as against four. The foliage consists of minute, overlapping, scale-like leaves, conspicuously flat, on short side branchlets. The branchlets are arranged in one plane, forming a flat spray. The very light wood has a characteristic aromatic odour. Male and female flowers are borne on the same tree, usually on different twigs. The small, solitary cones mature in the first season. The cones, bent back on the branchlets are light, russet-brown and usually have eight thin scales arranged in pairs. The two or three middle pairs which are larger than the others, bear two seeds under each scale. The small seeds have narrow wings and minute aromatic resin-cells in the seed coats.

1. *Thuja plicata* (plaited). Western red-cedar. Red cedar. Canoe cedar.

Red cedar grows naturally from Alaska to northern California where it is found at elevations from sea-level in the north to 7000 ft. in the northern Rocky Mountains. There the magnificent proportions of the coastal tree are reduced to those of a small wind-blown bush. In the lowland forests, trees up to 150 feet high and eight feet in diameter are common; odd ones reach to 200 feet with a diameter of 18 feet.

On young trees the slender limbs curve upwards; with age they swing downward in a long graceful curve. The small, scale-like, bright-green leaves are glossy above with white triangular spots beneath. They have a pleasant smell, greatly intensified when crushed.

The bark, though thin, is so tough that the American and Canadian Indians peel strips up to 30 feet long for making baskets, rope and fishing lines. Early settlers used it for the roof and walls of their first shacks. At one time the Indians took advantage of the long straight trunks and of the ease with which the wood can be worked to make their great canoes. The largest would be upwards of 70 feet long, six feet in beam and four feet deep. Such a canoe would carry at least 50 warriors and equipment. Split trunks were used for the construction of Indian lodges. Outside would be erected the totem poles, also of red cedar. A totem pole was an heraldic device indicating the clan to which certain people belonged and also

something of their history. The clans were usually designated by some animal, fish or bird such as the bear, the salmon and the eagle clans.

The effect of the totems was emphasised by painting in bright colours and using inlays of shells for eyes and similar features. Carved hands usually have three fingers and are folded across the breast. The size of the totem was limited only by the size of available logs and the energy and ambition of the native craftsmen. Some are nearly 100 feet high.

The wood of red cedar is one of the lightest of all conifers, weighing as little as 24 pounds per cubic foot. Much has been exported to Japan where it is valued for its resistance to the attacks of ants. When freshly cut, the wood is reddish brown, becoming dull brown on exposure. It is strongly aromatic. Because it works easily and scarcely warps or shinks, it is much used for the exterior of houses. Shingles are much used in American houses for gables and roofs, and red cedar supplies three-quarters of the shingles so used. Properly laid, and fastened with a non-rusting nail, they are long-lasting, warm, tight in all weathers, economical in cost and artistic in appearance.

Other uses for red cedar include boat building (especially racing shells), posts, piles, cigar boxes, pattern stock and telegraph and electric transmission poles. Great durability under all sorts of exposure is an important commercial quality. Large logs have lain half-buried in wet ground for over 50 years with little sign of decay in the heartwood. Paints, varnishes and lacquers adhere well and it glues readily.

Red cedar thrives best in New Zealand where there is a high rainfall or where it is sheltered by the contour from dry winds. It is being used for underplanting in cut-over native bush and occasionally for shelter belts instead of Lawsoniana. It makes a handsome lawn tree for the park or large garden, especially if the lower branches are not pruned.

2. *T. occidentalis* (western). American arbor-vitae.

This tree is widely distributed in eastern North America and inland to Minnesota. It differs from *T. plicata* in the leaves which are smaller, pale green, and not white on the lower surfaces, and in the cones which have only four fertile scales. A decoction of the leaves was used in the early days of settlement for coughs, rheumatism and even scurvy.

The wood is soft, brittle, coarse in the grain and durable, even in contact with the ground. It has been used widely for sleepers, posts, poles, shingles, boats and canoes.

Although not grown as a timber tree in New Zealand, it is widely grown in gardens especially the horticultural varieties which exist in every imaginable colour and form.

3. *T. orientalis* (eastern). Chinese arbor-vitae.

The leaves are smaller than those of the other species, distinctly grooved on the back, green on both surfaces, and giving off a resinous odour when bruised. The branches are erect, often as long as the main stem; the branchlets are also erect with the secondary ones arranged obliquely. The cones are somewhat egg-shaped, usually with six scales which are thick, woody and with a strong, recurved hook on the boss.

For thousands of years the Chinese and Japanese have planted this tree in their cemeteries. The timber was once much used to make the coffins of high officials.

This plant is often grown in New Zealand gardens as an evergreen shrub. There are several ornamental varieties.

PINACEAE. The Pine Family.

This is by far the largest family of conifers. For instance, *Abies* has 25 species, *Picea* 35, and *Pinus* more than one hundred. The nine genera may be distinguished by the following key. It should be remembered that in the group with the leaves in clusters, there may be solitary leaves scattered along the branches.

Key to Pinaceae

1.	Leaves needle-like in clusters or whorls	2
	Leaves not in clusters	5
2.	Not more than five leaves to a cluster	*Pinus*
	More than five leaves to a cluster	3
3.	Leaves stiff, evergreen	*Cedrus*
	Leaves soft, deciduous	4
4.	Bud scales long, slender; cone scales deciduous	*Pseudolarix*
	Bud scales short, appressed; cone scales persistent	*Larix*
5.	Cone upright	6
	Cone reflexed or pendulous	7
6.	Cone scales persistent, leaves keeled above	*Keteleeria*
	Cone scales deciduous, leaves grooved above	*Abies*
7.	Bracts exserted, conspicuous; branchlets not roughened by leaf bases	*Pseudotsuga*
	Bracts not exserted; branchlets roughened by leaf bases	8
8.	Leaves flattened, with stomata below, 4-angled	*Tsuga*
	Leaves quandrangular, if flattened then with stomata on upper surface	*Picea*

Pinus. True pines

The true pines are widely distributed in the northern hemisphere, often occurring as large forests. Many of the

species are grown specially for timber, for shelter, or for ornament in gardens.

The leaves are of three kinds: (a) seedling leaves, solitary, spirally arranged, linear and toothed; (b) scale leaves bearing the short shoots in their axils; these are triangular and are soon deciduous, except at the base;

(c) adult leaves, needlelike, persistent for two or more years, borne in clusters of two, three, or five. The margins are often minutely toothed. The cross-section is semi-circular in the two-leaved species, triangular in the others. The leaves when bruised give off a penetrating odour due to an oil rich in turpentine.

Male and female flowers occur on the same tree. The male flowers are yellow or reddish, produced in large groups of cylindrical cones at the base of the young shoot. The anthers are two-celled, without stalks and produce large quantities of pollen. Some idea of the amount may be obtained by placing a few of the male cones on paper under a glass or jar. The female flowers are usually at or near the tips. They consist of two series of scales, very minute bracts which disappear later, and large "ovuliferous" scales each of which has two pendulous ovules.

The scales on the female cones open to receive the wind-carried pollen and close immediately afterwards. Actual fertilization of the ovule does not usually occur for nearly a year when the cone increases rapidly in size and ripens at the end of the second or third year. The mature cones vary considerably in outline and are a great help to identification. The exposed part of each scale is thickened with the apex having a scar or spike called the umbo which often has a prickle or hook. In some species the cones remain unopened on the trees for many years.

The seeds are nut-like, in many cases with a wing. In some of the species the kernels provide an important article of diet for native peoples.

In the timber the difference between spring and summer wood is well marked. Similarly, heart and sap wood are very distinct. The timber is used for a great variety of purposes including all types of construction above ground. When used in contact with soil the timber of all species must be creosoted or otherwise preservatised.

Several species, when tapped, yield a resin which on distillation yields turpentine and rosin. One American species, *P. palustris*, from one cord of wood (128 cubic feet) has yielded seven gallons of turpentine, two gallons of pine oil, 32 gallons of tar oils, 41 gallons of tar and pitch, and 39 bushels of charcoal.

The following key should assist the identification of most of the pines likely to be found in New Zealand.

Key to Pines

1.	Leaves in fives	2
	Leaves not in fives	3
2.	Leaves 7-13 cm.	*P. strobus*
	Leaves 15-30 cm.	*P. torreyana*
3.	Leaves in threes	4
	Leaves in pairs	7
4.	Points of bud scales appressed	5
	Points of bud scales free	*P. canariensis*
5.	Leaves more than 15 cm. long	6
	Leaves less than 15 cm. long	*P. radiata*
6.	Branchlets glaucous	*P. coulteri*
	Branchlets not glaucous	*P. ponderosa*
7.	Buds not resinous	8
	Buds resinous	9
8.	Leaves 5-10 cm.	*P halepensis*
	Leaves 12-15 cm.	*P. pinaster*
9.	Bud scales free at apex	*P. sylvestris*
	Bud scales appressed	10
10.	Buds cylindrical or spindle-shaped	11
	Buds ovoid	12
11.	Leaves 10-15 cm.	*P. muricata*
	Leaves not more than 8 cm.	*P. murrayana*
12.	Leaves flexible	*P. laricio*
	Leaves rigid	*P. austriaca*

1. *Pinus radiata* (rayed). Also known as *P. insignis* (remarkable) Monterey pine.

This tree was discovered by D. Don and described by him as *P. radiata*. It was introduced to England by Douglas as *P. insignis* in 1833 and went into cultivation under that name. The name *P. radiata* is the correct botanical name and the only one that should be used. A good common name is "Radiata pine."

Monterey pine, as it is called in America is unique in its isolated, sea-coast habitat, on the coast at Monterey, some 90 miles south of San Francisco. In sheltered places it may grow up to 100 feet but near the coast it is not more than 60 feet. Quite close to the coast, usually sheltered a little by *Cupressus macrocarpa*, it dwindles to distorted, flat-topped dwarfs. It is not grown for timber in America, but is widely used in California as a windbreak. It has also been used in breeding work to try to develop early maturity in other pines.

Needles will be found normally to be in bundles of three, but two-needled bundles may be found. Each leaf will be from three to six inches long, tough in the old leaves, very soft in the new. Ripe cones are hard, woody and brown, broad near the base and abruptly tapered. They vary in length from three to six inches and remain strongly attached to the branches and with closed scales for up to ten years. If removed and kept in warm sun they soon open and shed the winged seeds.

Introduced into New Zealand among dozens of other species in the early days of settlement, *P. radiata* soon proved ideal for shelter in a great variety of conditions of soil and climate. Seed germinates well and seedlings are easy to raise and transplant. No other tree can produce the yield of timber per acre in so short a time. This ease of production has tempted us to plant a vast area in this quick-growing pine. In many places it would probably be wise to replace it by other slower-growing but better-quality species. At the same time, we must remember that unless we had planted *P. radiata* so freely 30 years and more ago, we might have had a timber famine today. We would certainly have had to destroy much greater areas of our native forests than we have actually done.

At one time it was thought that the timber was of little use for anything but firewood. If properly seasoned it has proved excellent for all kinds of uses, from house-building to cases and boxes of all kinds. Practically all our fruit is marketed in pine cases and much of our export produce travels in containers of this pine. New uses recently developed have been interior panelling, both with boards and with plywood.

2. *P. ponderosa* (heavy-wooded). Western yellow-pine.

Next to *P. radiata* there has been a bigger area of this tree planted in New Zealand than any other pine. It is identified by the large, long leaves, three in a cluster; the young shoots which have a strong smell of orange when broken; and the basal scales left attached to the branch when the cones drop. The cones are from four to eight inches long, originally bright-green or purple and erect. As they ripen they turn reddish-brown and turn down as the scales open.

In America *P. ponderosa* is the most widely-distributed pine. It is found in southern Canada, in northern Mexico, and in all the states west of the Great Plains. Not only is its range more extensive, but it grows in a greater variety of habitats and accommodates itself to greater extremes of temperature and rainfall. It grows, too, from sea level to 12,000 feet and reaches its greatest development in the Yosemite National Park where trees have grown 210 feet high with a diameter of eight feet.

Well-grown trees have few rivals for symmetry and shapeliness. The narrow, columnar crowns of young trees form slender spires that shoot upwards on trim, straight trunks. Even in old age they retain this perfection of form to a remarkable degree, although the crowns flatten with the development of large, horizontal, upper limbs. Until the trees are 80 to 100 years old, the bark is some-

what smooth or narrowly furrowed, and dark brown to nearly black in colour. Then it becomes divided into irregular scales with cinnamon or yellow tints. Trees only 50 years old in New Zealand may show the yellow colour on the scales.

The timber, as milled in American forests, is fine-grained, light and with very little resin. It is much used for interior finish and makes excellent sashes and doors. It is used extensively in the making of fruit cases. Although it grows much more slowly in New Zealand than Radiata pine, *P. ponderosa* can grow at much higher altitudes. The timber is also better than Radiata.

3. *P. muricata* (warted). Prickle-coned pine.

This is a native of the coastal regions of California and it occurs with *P. radiata* at Monterey. The leaves, which last three of four years, are in twos, up to six inches long but usually much shorter, and stiff to the touch. When the cone develops, the scales on the outer side develop, much more than the others, resulting in a lop-sided cone. It is smaller than the cone of *P. radiata* and is further distinguished by the sharp prickles on the scales. New season's cones may open and shed their seeds in the autumn but usually they remain closed for up to 30 years. A fire which will kill the tree may leave the cones uninjured.

Grown in New Zealand, *P. muricata* forms a bushy tree with a dense crown. It is not such a fast grower as *P. radiata,* but makes better shelter along the coast where it is subject to salt gales. It is particularly suitable for planting on the seaward side of plantations being established on sand dunes. It should not be planted for timber.

4. *P. murrayana* (Murray's). Lodgepole pine.

This is one of the hardiest pines imported to this country and it will grow at altitudes and under frost conditions where other pines cannot exist. It produces cones at a very early stage, the seed is usually fertile, and it establishes readily in grassland even if stock are grazing. It has adapted so successfully to New Zealand conditions that in some areas it already has become a serious weed. Further plantings should be made only after detailed consideration.

The leaves are in pairs, bright yellow-green in colour and, on average, only two inches long. The cones are glossy, light yellow-brown, three quarters of an inch to two inches long, and often occur in clusters of half a dozen or more. Each thin scale is armed with a slender, recurved prickle. The cones may hang on the branches for years before opening and seeds from cones 40 years old have been known to germinate.

The thin, scaly bark of the trunk is pale brown with a greyish tinge and irregularly divided by vertical and cross

fissures into small, oblong plates. The inner bark has been used as food by Indians. They still use it to make baskets.

In America the timber is used for house building, either as logs or sawn timber.

5. *P. torreyana* (Torrey's). Torrey or Soledad pine.

In its native state, this tree is confined to a small strip of the coast in San Diego county, California, and to Santa Rosa Island. Exposed to sea winds, it is a low, crooked, sprawling tree only a few feet high. Away from the sea it has a straight, clean trunk up to 60 feet high. This is how we see it in parks and gardens in New Zealand. It is recognized by the needles being in clusters of fives, and by their length, up to ten inches or more. The cones are large, egg-shaped, over five inches long and nearly the same through at the base. The seeds are large (over half an inch) with an oily, sweet, edible kernel.

This tree, like *P. radiata,* has shown much better growth in New Zealand than in its natural home, but it has not been much planted on account of the limited seed supply and the difficulty of handling young trees which do not produce suitable transplanting roots.

6. *P. coulteri* (Coulter's). Big-cone pine.

Although a smaller tree, big-cone pine resembles in general appearance a *P. ponderosa* from which its stiff much heavier foliage, stouter twigs, and huge cones distinguish it. The leaves, three in a bundle, may sometimes be 12 inches long but average about nine inches. The cones are normally from 9 to 14 inches long, weighing three to four pounds. The scales are thick, woody, over two inches long, one and a half inches broad, ending in a strong curved hook or claw. Specimens of this tree grow in various parts of New Zealand, the unopened cones being prized as souvenirs. As with other cones they can be preserved in the unopened state by coating with clear varnish.

7. *P. strobus* (pine-cone, referring to the conspicuous cone). Northern white pine.

Though one of the most important trees of North America, this pine is not much used in New Zealand. Specimens are occasionally seen in parks and large gardens. It may be identified by the blue-green needles, three to five inches long, in bunches of five, and the very long, drooping cones often curved and pointed at the apex and extremely resinous.

8. *P. canariensis.* Canary Island pine.

This tree, used only for ornamental planting in New Zealand, can be distinguished from other three-leaved pines by its yellow shoots, the fringed bud scales, the long slender leaves (up to 12 inches in length), and the large cones (often nine inches long by three inches broad). It is a native of the Canary Islands where it grows on dry

slopes exposed to the wind. There it produces excellent timber of very durable quality.

9. *P. halepensis* (from Aleppo). Aleppo pine or Jerusalem pine.

This tree grows naturally in most countries bordering the Mediterranean. It can be identified by the short, slender, twisted leaves with stomatal lines on both surfaces, the shining, reddish cones and the ashy-grey colour of the branches and branchlets.

Although the timber is not of high quality, it was the main timber used by the ancient Greeks and today is used for boxes, mine-props, poles, fuel and charcoal. Large forests in Algeria are tapped for resin. Because it resists drought better than most trees it has been widely used for windbreaks and to check soil erosion in hot, dry regions round the Mediterranean. The usual method of establishment is to sow seed in cultivated ground and to cover with light brush as a protection against animals, sun and wind.

10. *P. pinaster.* Maritime or sea-coast pine.

This is a native to most countries bordering the Mediterranean and to Portugal. It was widely planted in the early days of settlement in New Zealand. Old trees are easily recognized by the deeply-fissured reddish-brown bark from which the outer layers can be easily scaled off. Leaves are in pairs, stout, curved, up to six inches long, ending in a hard horny point. The cones are up to seven inches long, bright-brown in colour and shiny. Branches clean naturally from the main trunk and most old trees in New Zealand are bare for the greater part of their length.

Though not used commercially in New Zealand, this tree has long been of great importance in Europe. The timber is only third-grade as compared with that of other pines but has been widely used for coarse carpentry, inferior buildings, pit-props and, when preserved, for poles, railway-sleepers, and street paving. The most important product is resin and vast areas of the tree are tapped, especially in France. Young trees which will be removed at thinning are tapped freely until exhausted; older trees are tapped annually for four or five years and then spelled for a year.

P. pinaster thrives near the coast and on sand and it will stand prolonged exposure to salt winds. For this reason it has been the main tree used in reclaiming moving sand dunes over an area of 3,000,000 acres in France and Portugal. In the Scilly Islands it has been used with *Cupressus macrocarpa* to provide shelter for the famous Tresco gardens where so many natives of New Zealand are successfully grown.

11. *P. sylvestris* (wood). Scots pine. Deal.

This is the typical pine of northern Europe where it still exists in huge forests. It has been said to cover wider areas than any other forest tree. It is the only pine native to Britain.

The leaves, in bundles of two, are up to four inches long, very slender, grooved above and convex beneath. They are glaucous with well-defined lines of stomata on the upper surface, green with interrupted lines of stomata on the lower surface. The cones are somewhat egg-shaped, tapering to a point which is often curved. They are usually in clusters of three and reach a length of two to three inches. The bark on the lower trunk is split into long, irregular plates and is reddish-brown or greyish-brown in colour.

Being the native pine of Britain it was quite widely planted in New Zealand by the early settlers but only in a few places does it seem to be really at home. There it has grown into fine trees, produced good timber and reproduced itself from seed.

European timber is easily worked, produces a smooth finish, holds nails well and is readily glued, polished and painted. It is widely used for house-building (beams, rafters, window-frames, floor-boards, doors, and weatherboards), ship-building, masts, poles, pit props and, if creosoted, railway sleepers and street paving.

12. *P. laricio* (larch-like). Corsican pine.

This should probably be known now by the name *P. nigra* (black).

This is widely distributed in central and southern Europe and in Asia Minor. The leaves, two in a bundle, are up to six inches long and flexible. The cones are tawny-yellow, two to three inches long, the scales having a transverse keel near the apex, often ending in a prickle. The tree grows very slowly but the wood of mature trees is suitable for all the purposes for which Scots pine is used.

Because it is hardier than *P. radiata*, Corsican pine has been widely planted in New Zealand in districts above 2000 feet.

13. *P. austriaca* (Austrian). Austrian pine.

This is usually looked on as a poorer variety of Corsican pine.

14. *P. pinea* (pine). Stone pine. Umbrella pine.

A native of the Mediterranean countries, this tree is in many respects similar to *P. pinaster*. It may be recognised by its peculiar umbrella-shaped crown, its reflexed bud-scales, and its large, rounded, symmetrical cones often with 100 seeds. It has been widely planted in many countries for ornament and may be seen in parks in New Zealand.

The seed is a large nut which has a sweet, oily kernel which has been an article of diet from the earliest times. These kernels were carried by Roman legions as an "iron ration" for use in emergency and the preserved outer cases are still dug up in old Roman encampments in Britain.

15. *P. patula* (spreading). Mexican pine.

Whereas all other pines mentioned are too large or lack sufficient beauty to be planted in the average garden, Mexican pine is small enough and graceful enough to compete with all other evergreens. It is a native of the temperate parts of central and eastern Mexico. It is easily recognised by its soft, slender, drooping foliage; the leaves are in threes (occasionally fours and fives) and may be up to nine inches long. The cones are in clusters of two to five, three to four inches long, pale brown and shiny.

Cedrus. The Cedars

The word comes from the Arabic kedron, power, in reference to the majestic appearance, or possibly from the Greek kedros, the name for a coniferous tree. The name "cedar" is applied to various members of other genera but none of these so-called cedars has rosette-like clusters of needles. Of all the cone-bearing trees, only cedars and larches have these rosettes of needles and in larches they are deciduous. The branchlets are of two kinds; long, terminal shoots (the new growth), bearing scattered, single leaves, and short, spur-like shoots which bear the rosettes of leaves. The cones are large (two inches and more long), erect, barrel-shaped, resinous, on short stalks. The bracts are very small or absent and the scales are woody, closely overlapping, fan-shaped with a basal stalk-like claw. Each scale supports two seeds, each with a large, membranous wing. The seed has nine or ten cotyledons which give the seedling also a most graceful appearance. The green or ripe cone of a cedar is one of the most beautiful of plant structures and well deserves the name given by J. Arthur Thomson of "Nature's masterpiece of symmetry."

When the cone is ripe, the cone scales fall out allowing the winged seeds to disperse on the wind. The central axis remains as a spike sticking up from the branch and may remain on the tree for years.

The wood of cedars is oily and sweet-scented. It is very durable and is used in a great variety of ways.

Three kinds of cedar are commonly grown in New Zealand; although they are given separate botanical names, the differences between them are so trivial, that it is reasonable to suppose the trees are just geographical races of the one species.

Key to Cedrus

1. Leading shoot stiff, upright or spreading
   A. Branchlets numerous, spreading, glabrous or almost so. Leaves $\frac{3}{4}$-$1\frac{1}{4}$ in. long. Cones barrel-shaped 3-$4\frac{1}{2}$ in. long, 2-$2\frac{1}{2}$ in. wide. ...... *C. libani.*
   B. Branchlets as above—often glaucous. Cones smaller 3 in. long, 2 in. wide. .... *C. atlantica*
2. Leading shoot and ends of branchlets pendulous. Leaves up to $1\frac{1}{2}$ in. long, green or glaucous green. Cones barrel-shaped 3-5 in. long by 2-$3\frac{1}{2}$ in. wide. .... *C. deodara*

A fairly accurate but simple key refers to the way in which most of the branch tips point.

Ascending	*C. atlantica*
Level	*C. libani*
Descending	*C. deodara*

1. *Cedrus libani* (Lebanon). Lebanon cedar.

This species is now rare in the Lebanon mountains but is still reasonably plentiful in the Cilician Taurus. No other trees have been so bound up with the development of ancient civilisation as were these cedars and no other trees are so frequently mentioned in ancient literature. Some of the finest imagery in the Old Testament is drawn from "the trees of Jehovah, planted by his right hand, crowning the great mountains." Early writing was often done on cedar tablets.

The fate of the famous forests of Lebanon is initially bound up with the rise of the Phoenicians. The basis of their economy was trading cedar timber for food supplies and other necessaries, largely with the Egyptians who valued cedar above all for building boats and making the pillars and doors of their temples. But trade in cedar was also carried on with all the countries from the Nile to the Euphrates. Its fragrance and durability made it sought after for the construction of royal palaces. Abraham, the first timber-buyer on record, paid 400 shekels for the field of Ephron, "and all the trees that are in the field."

But to readers of the Bible, the name of the Lebanon cedars will be mainly associated with Solomon and his temple. Solomon sent to Hiram, King of Tyre, saying: "Now therefore, command that they hew me cedar trees out of Lebanon." The contract provided that Hiram's men should do the logging in the mountains, float the logs to Tyre or Sidon, tow them in rafts to Jaffa, where Solomon took over and set about transporting the logs 22 miles to Jerusalem. We read of "80,000 hewers of wood and 70,000 bearers of burdens". These figures, even admitting that labour efficiency was low, would suggest that the forests were of vast extent even in 1,000 B.C.

By the time of the Roman occupation, the forests evidently had decreased greatly in area. The Romans realised the great value of cedar and, from inscriptions on

stones still legible today, we read that a considerable area was protected against excessive cutting. Traces of works designed to conserve soil and water indicate that the Romans fostered ideas of conservation that would be up-to-date today. It is probable that they also had some ideas on rotational cutting.

The Arab invasion of 630 A.D. meant the beginning of the end, because the Arab brought his goat which grazed the forest floor and prevented regeneration. And, as elsewhere, the Arab and his goat brought about destruction of vegetation and all the problems of soil erosion.

The last period of tree slaughter commenced with the arrival of the Turk. From 1516 onwards he made full use of the stands of timber with no thought of their conservation. The British blockade of Turkey in the 1914-18 war deprived her of coal. She kept her railway engines fired with priceless Lebanon cedar. Today, the slopes of the mountains are rocky, denuded of soil and barren. The only groves now left in Lebanon owe their existence to the care of the priests of the Maronite sect who have enclosed the trees with a stone wall to keep out the goats. Under this protection regeneration is slowly taking place and young trees once again are growing up to take the place of the few remaining giants.

It has been claimed that the Cross was made of Lebanon cedar from a log which had been buried by Solomon on the spot where the pool of Bethesda later appeared. About the time of the crucifixion it was said to come to the surface.

"Old specimens of Lebanon cedar are among our most handsome evergreens; their massive trunks and symmetrical heads of widely-spreading branches lend an aspect of dignity and beauty to our parks and gardens." The quotation applies to Britain; it applies equally to several parks in New Zeaalnd.

2. *C. atlantica.* Atlas or Atlantic cedar.

The native home of Atlas cedar is the Atlas Mountains in Algeria and Morocco. It is very hardy and makes good permanent shelter belts on farms. The var. *glauca*, which has leaves of a handsome blue-grey, is one of the loveliest of all conifers for large gardens. It is propagated by grafting.

3. *C. deodara.* Deodar or Himalayan cedar.

This tree is widely distributed throughout the Western Himalaya from Afghanistan to Garhwal. There it likes a rainfall of over 70 inches but grows well even where it is as low as 30 inches. It has a range in altitude from 4,000 to 10,000 feet. Deodar has long been a sacred tree of Hindus in northern India and the fragrant wood is burned as

incense in religious ceremonies. The timber is extensively used for building, railway sleepers, furniture and general carpentry. In some of the forests, the branches are lopped right to the top before the trees are felled so that damage to young trees is reduced to a minimum.

Deodar is widely used as a lawn specimen in large gardens in New Zealand. Several horticultural varieties are available. It is being used increasingly for farm shelter. Planted in single rows, 12 feet apart, it produces dense shelter close to the ground and requires a minimum of side trimming.

Pseudolarix. False larch

Pseudolarix amabilis (pleasing). Golden larch.

The only species of the genus, this tree is a native of China, where it may grow to 130 feet and up to eight feet in girth. The leaves are bright green turning to rich gold in autumn. They are spirally arranged on the younger shoots, in clusters of up to 30 on the short branchlets. The cones are egg-shaped, erect, up to three inches long and two inches wide and with deciduous cone-scales. (This tree is easily distinguished from the true larch by the short shoots which have annual rings and persistent scales, by the wide leaves and by the deciduous cone-scales). It is occasionally grown in New Zealand in parks and large gardens. Seed is difficult to obtain.

Larix. The larches

The word comes from the Celtic lar, fat, and probably has reference to the appearance of the resinous juice. Only two species are commonly found in New Zealand. They are distinguished from cedars by their soft, deciduous leaves and by the small cones with persistent scales.

1. *Larix decidua* (deciduous). European larch.

In spite of its common name this tree is also found in parts of Asia. It was first introduced into Britain about 1600 and is so widely distributed there that it appears to be a native. It eventually makes a tree up to 150 feet high and 15 feet in girth. The young shoots are grey or yellowish and slightly furrowed; shoots of the second year are roughened by the bases of leaves of the previous year. The leaves on young shoots are single, long and narrow; on the shorter, older shoots the leaves occur in clusters of 30 to 40, narrower and blunter than the others. Although needle-like, the leaves differ from those of most other conifers in being soft, almost silky to the touch. The short shoots, when they cease to form needles, persist on the twigs as small, scaly lumps.

In most conifers, the flowers though interesting enough, lack colour. This cannot be said of those of larch. Many pollen catkins, bright yellow in colour, are scattered along the twigs. Most striking are the seed flowers, rounded, about half an inch in diameter, and made up of numerous soft scales, carmine or rose red in colour. Each scale is smoothly rounded and softly frilled on the tip. Larch "roses" is the name given to these flowers in parts of Britain. It was Tennyson who wrote:

"When rosy plumelets tuft the larch."

The ripe cone is made of brown, thin, papery scales turned downwards at the tips. At the base of each are two winged seeds. Years after the seeds have dropped, the empty cones may persist on the branches.

In Britain and Europe larch is a very important timber. There it is used for pit props in mines, railway sleepers, telegraph poles and house building. Being fairly durable under water, it has often been used for the piles of small wharves, while many of the houses in Venice are supported on piles of larch. The famous Venetian turpentine is obtained from the larch trunk. Holes are bored and pipes inserted to allow the turpentine to drip into buckets. Larch has another connection with Italy, in that some of the great masters, Raphael among them, painted some of their pictures on thin panels of the wood.

In New Zealand, larch was widely planted up to 50 years ago. At first it grows rapidly and then slows up. It has done particularly well in the high country of the South Island, not so well on the plains. It came into disfavour because of its slow growth and lack of durability in contact with the ground but the recent establishment of creosoting plants by the New Zealand Forest Service has resulted in large quantities of larch being used for posts and poles.

2. *L. leptolepis* (slender scaled). Japanese larch.

This tree is distinguished from European larch by the glaucous shoots, the wider, blue-green or glaucous leaves, and the broader cones in which the scales are bent backwards at the tips. It is similar in other respects, including use of the timber, to the previous species.

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