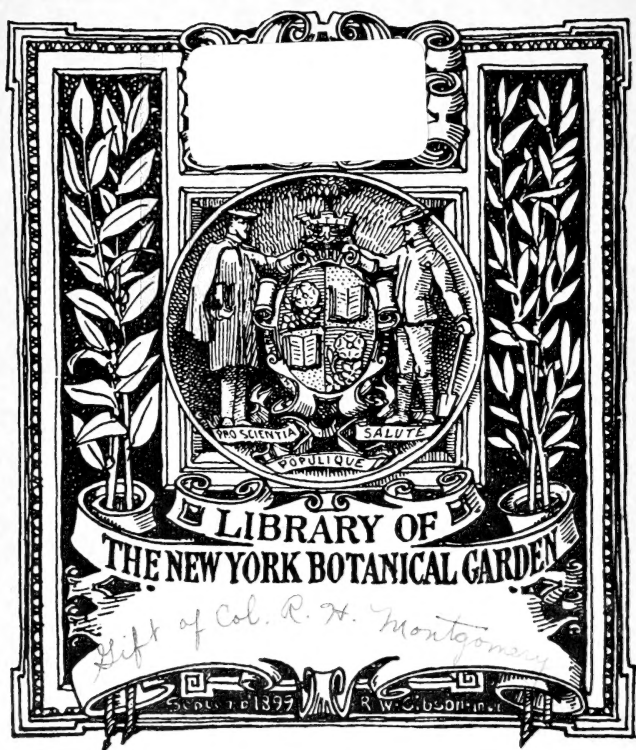
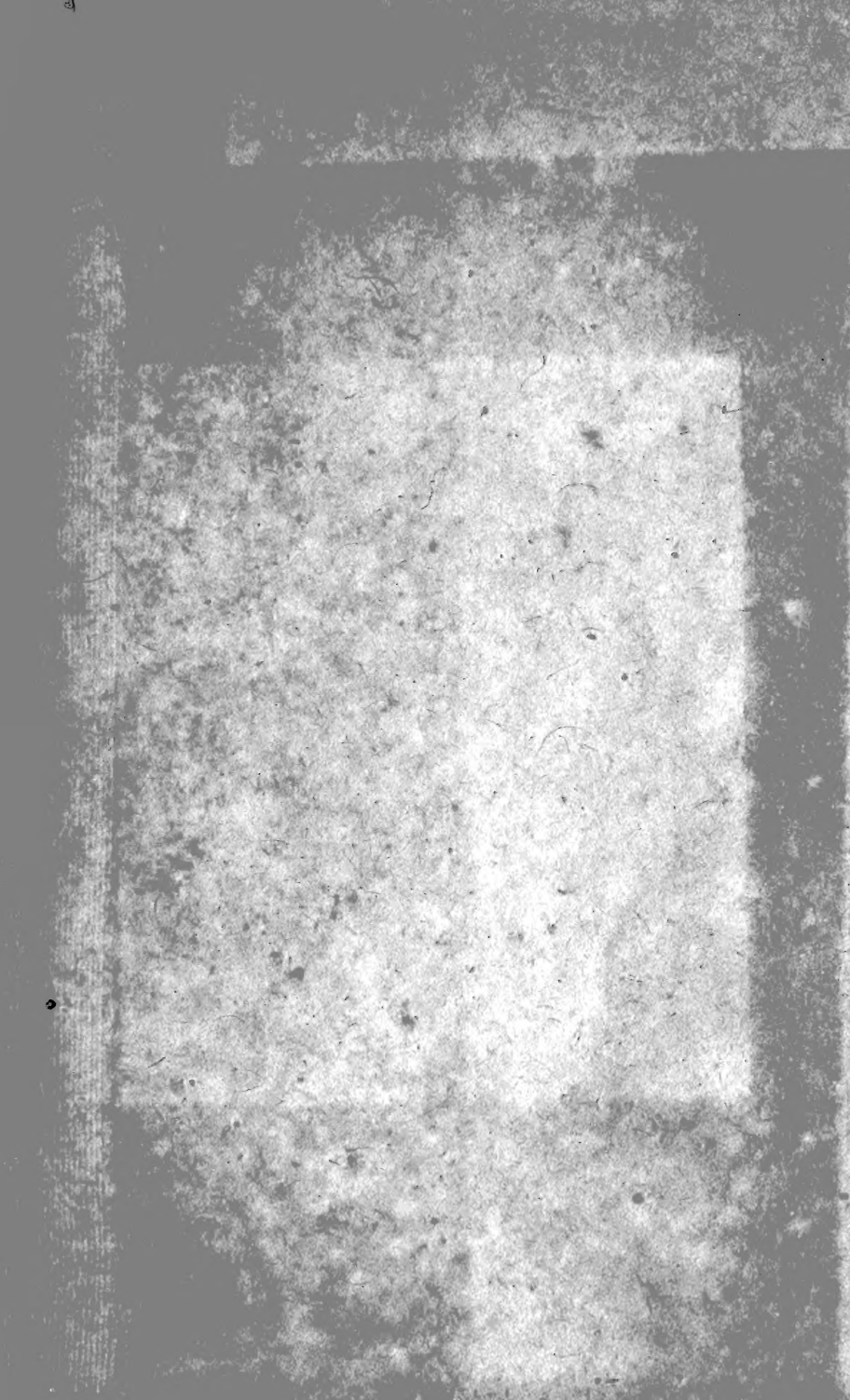


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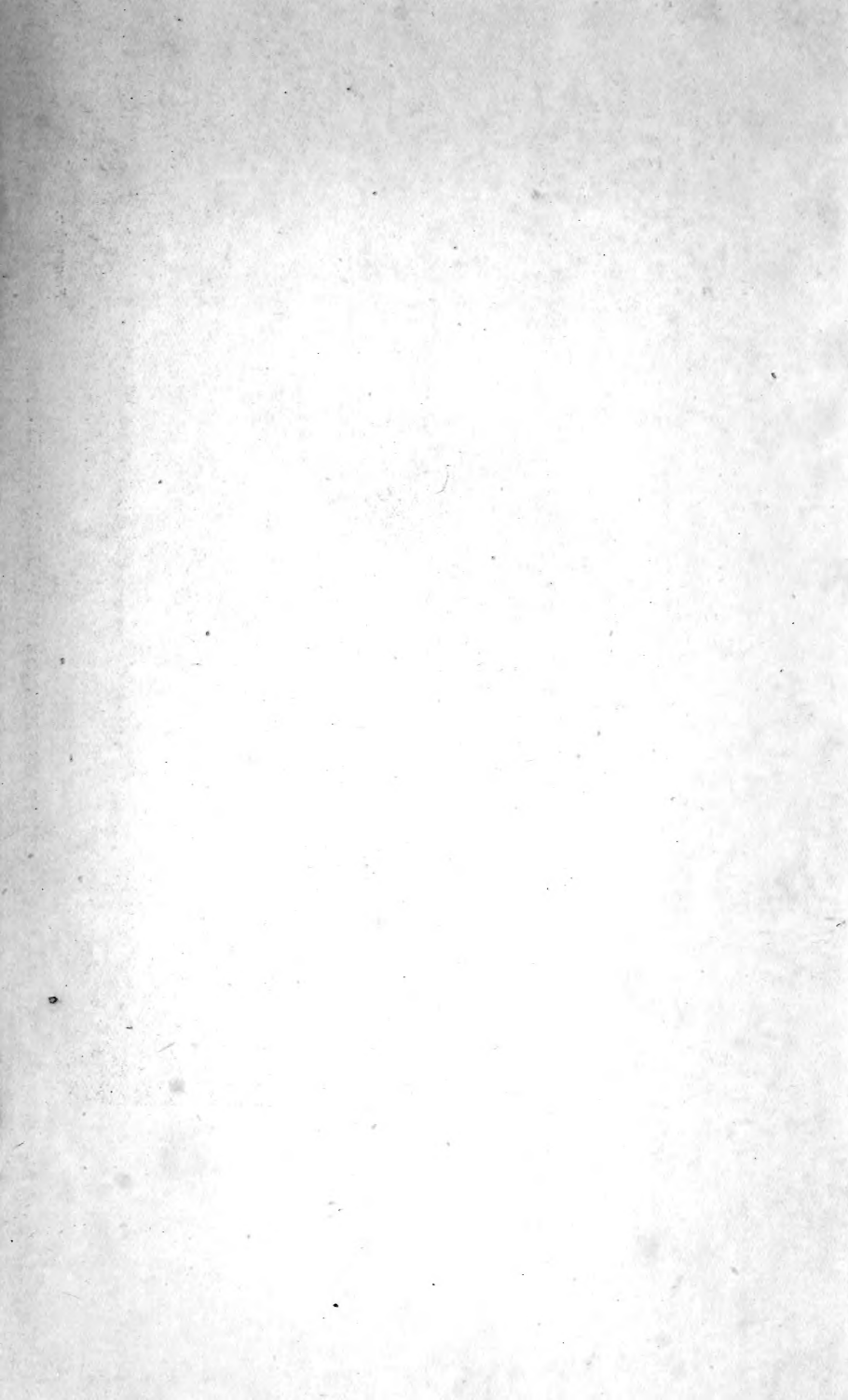






CONIFEROUS TREES







Frontispiece.

CEDAR OF LEBANON AT WOBURN ABBEY.

CONIFEROUS TREES

FOR PROFIT & ORNAMENT

BEING A CONCISE DESCRIPTION OF EACH SPECIES AND VARIETY, WITH THE MOST RECENTLY APPROVED NOMENCLATURE, LIST OF SYNONYMS, AND BEST METHODS OF CULTIVATION

WITH CHAPTERS ON

“THE COMMERCIAL ASPECT OF CONIFERS”

“QUALITY AND VALUE OF BRITISH-GROWN CONIFEROUS TIMBERS”

“CONIFERS FOR VARIOUS SOILS AND SITUATIONS”

“CONIFERS OF DIFFERENT CHARACTERISTICS”

“PROPAGATING CONIFERS,” “ENEMIES OF CONIFERS”

Etc.

BY

A. D. WEBSTER

AUTHOR OF

“PRACTICAL FORESTRY” (5 EDITIONS), “THE FORESTER’S DIARY” (16 EDITIONS)

“HARDY ORNAMENTAL FLOWERING TREES AND SHRUBS” (3 EDITIONS)

“TREE WOUNDS AND DISEASES,” “TOWN PLANTING,” “SEASIDE PLANTING”

“BRITISH-GROWN TIMBER AND TIMBER TREES,” ETC.

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PREFACE

THE importance of coniferous timbers will be realised when it is stated that in 1913 our imports reached the enormous figure of £30,000,000. Since the war commenced, vast quantities of home-grown wood have been utilised, while there has been a corresponding demand for information regarding coniferous trees and their timber, particularly with reference to the best kinds to plant from a purely commercial point of view, and the value of timber produced.

The following notes on these trees, which have been compiled as opportunity offered during the past thirty years, are taken in the main from specimens cultivated in the grounds at Penrhyn Castle, Woburn Abbey, and other places of which the writer has been in charge. To the owners of several well-known Pineta and nurseries throughout the country and on the Continent I am indebted for specimens and information regarding some of the rarer species and varieties.

Numerous articles, monographs, and essays on hardy Conifers have, at various times, been contributed by the author to *The Gardeners'*

NOV 6 1947
GIFT OF R.H. MONTGOMERY

Chronicle and Transactions of the Royal Scottish Arboricultural Society, and from which Professor Hansen in *The Pinetum Danicum*, Nisbet in the last edition of *Brown's Forester*, Ravenscroft in *The Pinetum Britannicum*, and other writers, have done me the honour of quoting. Condensed notes from some of these papers are included in the present work.

As regards general nomenclature, I have followed the now almost universally adopted plan of Bentham and Hooker, while the synopsis of tribes and genera and lists of synonyms are mainly from Masters' *List of Conifers and Taxads*.

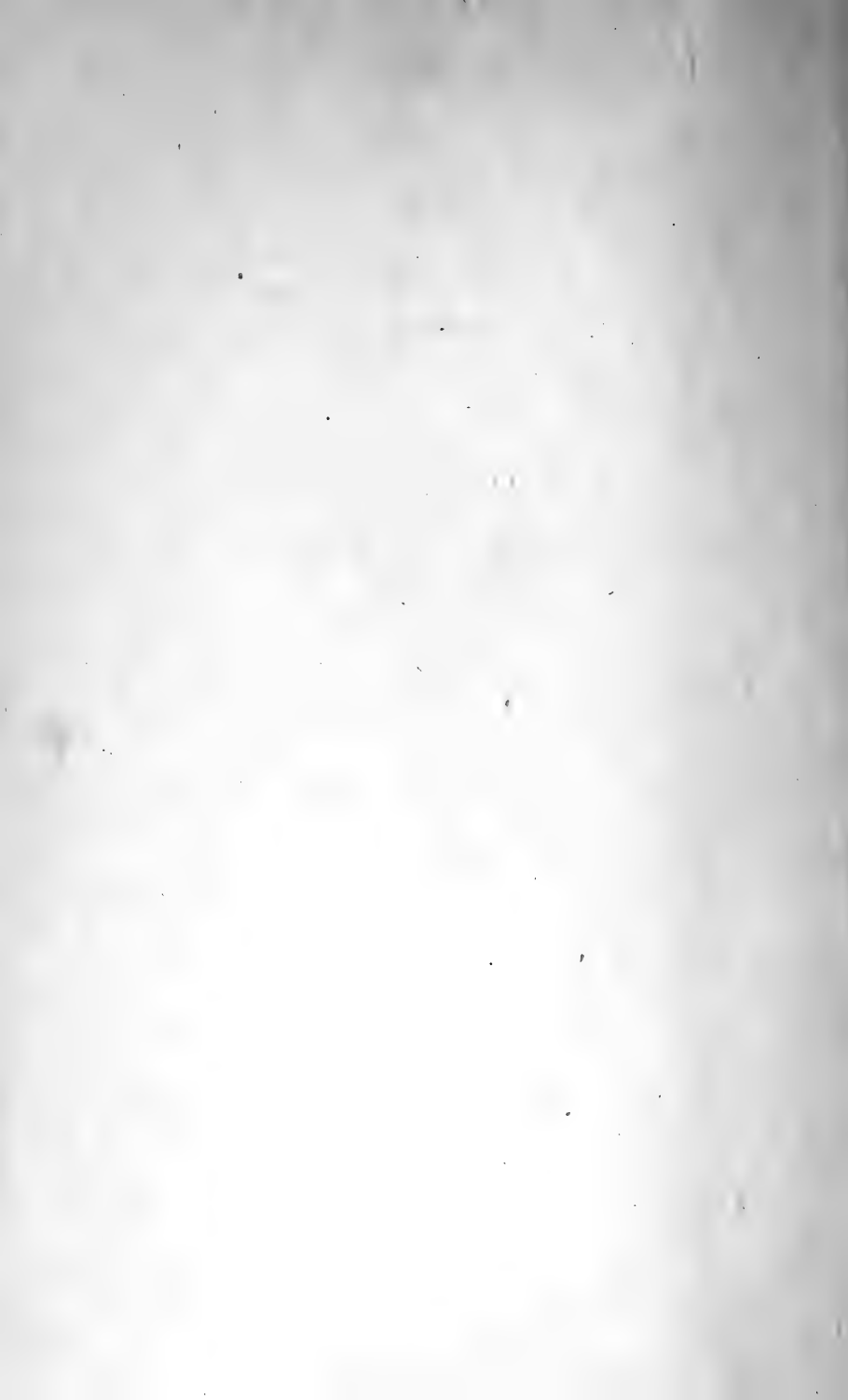
The generally accepted names of both species and varieties have received special prominence, and are printed in conspicuous type, while the lists of synonyms have been made as inclusive as possible, owing to many of these being still in common use.

In order to facilitate reference, the arrangement of both genera and species is alphabetical throughout the work.

The chapters on "Conifers for Economic Planting" and "Quality of British-grown Coniferous Timbers," as well as Introductory Remarks on the Commercial Aspect of Conifers, should all prove useful at a time like the present, when the afforesting of large areas of land is receiving attention.

This book being mainly intended as a cheap, handy, and concise popular guide to hardy Conifers

as cultivated in this country, the descriptions are necessarily brief, but nevertheless comprehensive ; while, as far as is consistent with a full and clear explanation of each species, technical terms have been avoided. Mr. A. Bruce Jackson has very kindly revised the proofs as they passed through the press. The illustrations are mainly from special photographs of the Conifers at Woburn Abbey which His Grace the Duke of Bedford has kindly allowed me to make use of for this work. That of the home nursery at Woburn, which was laid out and planted by the writer in 1893, is particularly interesting.



CONTENTS

	PAGE
PREFACE	v
INTRODUCTION	xv

CHAPTER I

HARDY CONIFEROUS TREES

CLASSIFICATION AND DESCRIPTION

NATURAL ORDER *CONIFERÆ*

- I. CYPRESS TRIBE (*CUPRESSINÆ*).—Including Juniperus, Cupressus, Fitzroya, Libocedrus, Thuya I
- II. TAXODIUM TRIBE (*TAXODIÆ*).—Including Athrotaxis, Cryptomeria, Sciadopitys, Sequoia, Taxodium I
- III. FIR TREE (*ABIETINÆ*).—Including Abies, Cedrus, Larix, Picea, Pinus, Pseudolarix, Pseudotsuga, Tsuga, Keteleeria 2
- IV. ARAUCARIA TRIBE (*ARAUCARIÆ*).—Including Araucaria, Cunninghamia 2

NATURAL ORDER *TAXACEÆ*

- I. SALISBURIA TRIBE (*SALISBURIÆ*).—Including Ginkgo, Cephalotaxus, Torreya 2
- II. YEW TRIBE (*TAXEÆ*).—Including Taxus, Dacrydium 2
- III. PODOCARPUS TRIBE (*PODOCARPEÆ*).—Including Podocarpus, Prumnopitys, Saxegothea 2

CHAPTER II

PROPAGATING CONIFERS

	PAGE
From seed—Table of weights of coniferous tree seeds—From cuttings—By grafting—By layering	204

CHAPTER III

CONIFERS AND SOILS

For chalky or calcareous—For gravelly and sandy—For peaty—For clayey	214
--	-----

CHAPTER IV

CONIFERS FOR VARIOUS POSITIONS

For avenues—For the seaside—For exposed situations—For smoky localities—For confined spaces—For hedge purposes	218
--	-----

CHAPTER V

CONIFERS OF DIFFERENT CHARACTERISTICS

Weeping conifers—Fastigate conifers—Variegated conifers—Conifers of low-spreading habit—Pigmy conifers	222
--	-----

CHAPTER VI

CONIFERS FOR ECONOMIC PLANTING	226
--	-----

CHAPTER VII

QUALITY OF BRITISH-GROWN CONIFEROUS TIMBERS	242
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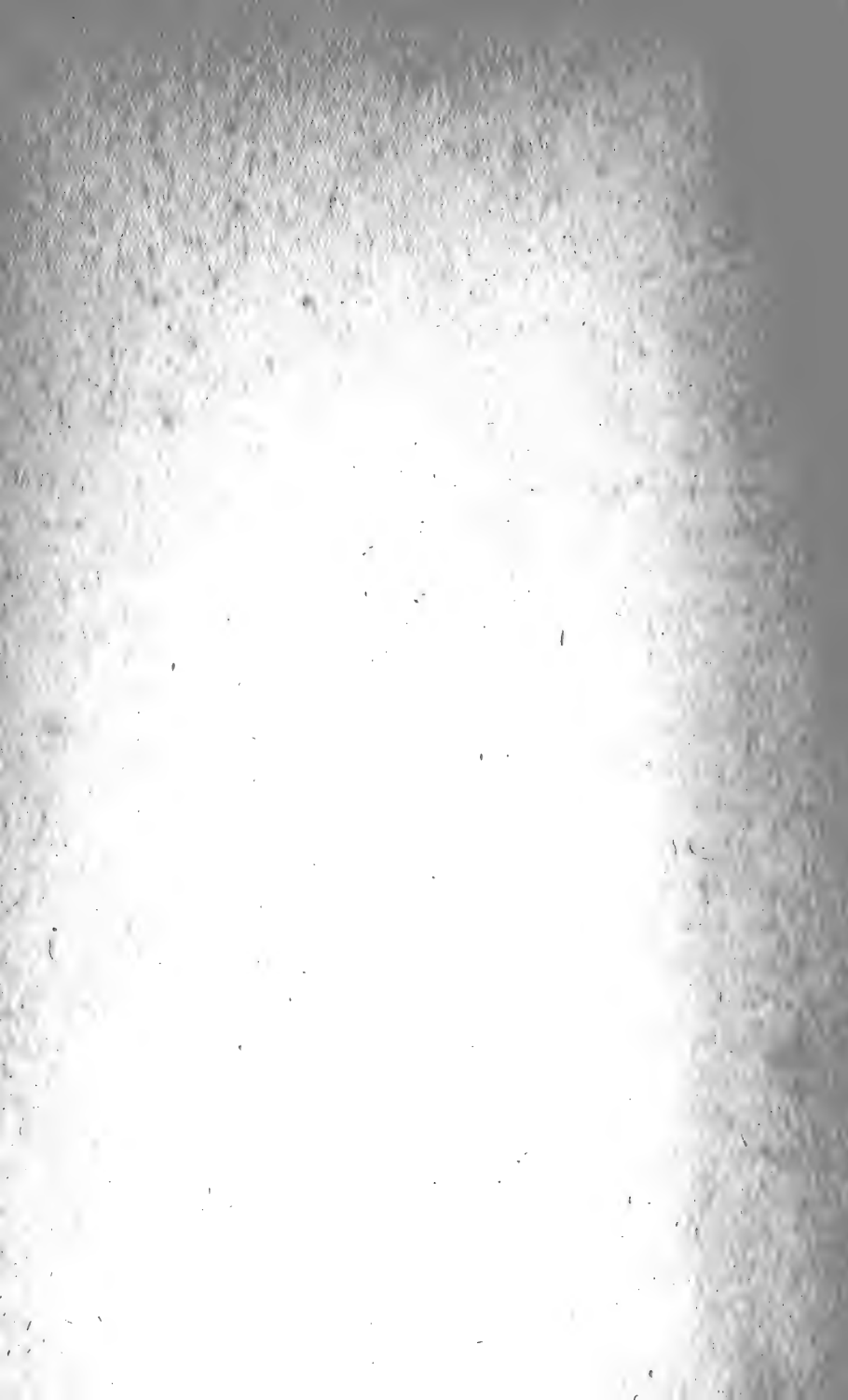
CHAPTER VIII

ENEMIES OF CONIFEROUS TREES

	PAGE
INSECTS.—Pine beetle—Pine weevil—Bostrichus typographus —Pine shoot moths—Pine sawfly—Wireworms—Larch miner—Larch sawfly—Wood wasps—Sprucegall aphid— Pissodes notata	256
FUNGI	267
ANIMALS.—Hares and rabbits—Squirrel—Rat—Mouse—Vole	277
BIRDS.—Blackgame—Crossbill—Bullfinch—Capercaillie .	277

CHAPTER IX

VARIABILITY OF CONIFEROUS TREES	284
INDEX	289



LIST OF ILLUSTRATIONS

	FACE PAGE
Cedar of Lebanon at Woburn Abbey	<i>Frontispiece</i>
<i>Abies firma</i>	10
<i>Abies Lowiana</i> at Woburn. Planted 1881. Height, 71 feet	16
<i>Abies Veitchii</i>	26
<i>Araucaria imbricata</i>	28
<i>Cedrus atlantica</i>	32
<i>Cedrus atlantica glauca</i>	34
<i>Cedrus Deodara</i>	36
<i>Cephalotaxus pedunculata fastigiata</i>	42
<i>Cryptomeria japonica</i>	46
<i>Cupressus Lawsoniana Milfordensis</i>	58
<i>Cupressus torulosa</i> at Woburn	70
<i>Larix pendula</i> at Woburn	100
<i>Libocedrus decurrens</i> at Orton Longueville	102
<i>Picea excelsa inverta</i> in Woburn Nursery. Planted 1893	108
<i>Picea Omorica</i>	114
<i>Picea orientalis</i>	116
<i>Pinus Cembra</i> at Woburn	126
<i>Pinus monticola</i> at Murthly Castle. Height, 85 feet	142
<i>Pinus muricata</i> at Claremont	144
<i>Pinus ponderosa</i> at Dropmore	150
<i>Pinus Strobus</i>	154

	FACE PAGE
Scotch Pine Plantation	156
<i>Pseudolarix Fortunei</i>	162
<i>Sequoia gigantea</i> at Woburn	168
Yew, Fisher's Golden Hybrid	178
<i>Tsuga Albertiana</i> at Murthly Castle	196
Tree Nursery at Woburn. Laid out and planted by the writer in 1893	204

INTRODUCTION

WHEN viewed in an economic or commercial sense, the various species of *Coniferæ* are perhaps the most useful and valuable of all trees to mankind. Regarding their utility, it may truly be said that from the time we get up in the morning till we retire at night, from the cradle to the grave, we are daily availing ourselves in one way or another of the products of coniferous trees. For general utility the timber is not surpassed by that of any other trees, and possesses qualities that render it peculiarly suitable for building and general constructive purposes, while, being obtainable in such vast quantities, the price is comparatively cheap. Before the war our imports of coniferous or soft-wooded timbers were as follows :

Conifer woods, logs and sawn . . .	£23,000,000
Conifer wood, pitwood . . .	4,500,000
Conifer wood, wood-pulp . . .	5,500,000

The arts and manufactures also are largely indebted to coniferous trees for many of their staples—tar, pitch, petroleum, turpentine, resin, balsams, spirits, paper pulp, etc. Tar, which at present is largely imported from the Baltic ports and Southern United States of America, is

obtained principally from *Pinus palustris*, *P. Pinaster*, and *P. sylvestris*. Turpentine comes from incisions made in the stems of several species of *Pinus*, principally *P. Tæda*, *P. sylvestris*, and *P. palustris*. The famous Strasburg turpentine is obtained from the common Silver Fir (*Abies pectinata*), while the Larch is the source of the Venice turpentine of commerce. Larch bark contains a large quantity of tannin matter, and this may also be said of that of the Canadian Hemlock Spruce (*Tsuga canadensis*), which is, however, inferior in quality to that of the larch. From spruce branches that well-known beverage, spruce beer, is principally obtained, while in the manufacture of gin the much-esteemed flavour and aroma are mainly due to our Common Juniper. In New England the sapling pines are made into pasteboard, and the fibre threads of the wood into cloth. That valuable product coniferin is obtained from several species of *Abies* and *Pinus*; an oil largely employed in veterinary practice from *Juniperus Oxycedrus*; while the common Savin (*Juniperus Sabina*) is much appreciated in medicine.

Remarkable properties are possessed by the secretions of the Lebanon Cedar.

Articles of clothing, as also mats, sails, and ropes, are made from the inner bark of the giant Arborvitæ (*Thuja plicata*), while in some parts of Italy the leaves of *Pinus halepensis* are used instead of straw for bedding horses and cattle. Even pine sawdust is largely utilised for several economic purposes.

It may not be generally known that the seeds

of certain coniferous trees, particularly the genus *Pinus*, not only enter into the making of confectionery in this country, but are the staple food of, and form an article of commerce amongst, several of the American and Asiatic hill tribes. Even on the Continent the large and deliciously flavoured seeds of the Swiss Stone Pine (*Pinus Cembra*) are eaten by the peasantry, while they are also largely employed as an article of diet throughout Russia and Siberia. In Italy those of the Stone Pine (*P. Pinea*), two of which are contained beneath each scale of the large, shining brown cones, are much valued by the peasantry, they being considered a great delicacy, especially when roasted. The Italian cooks also use them largely in their soups and ragouts, and in the Maritozii buns of Rome. In the vast pine woods which lie along the Portuguese seaboard, the filbert-like cone kernels of the same species are also largely used as food. In passing, it may be of interest to state that both the above species thrive well in this country, and have produced seeds that are quite equal in point of flavour and size to those sent from abroad. The sweet and highly nutritious seeds of the Nut or Digger Pine (*P. Sabiniana*) are particular favourites of, and much relished by, the North American Indians, forming, as they do, their chief food resource for nearly half the year. Climbing the trees, the men and boys beat off the cones with heavy sticks, or, failing to reach them in that way, cut off wholesale the branches on which they are most plentifully produced. Owing to the hard, bone-like character of the cones, the seeds can

only be readily extracted by means of fire, and an interesting sight it is to see the squaws seated by the bright camp fire roasting the cones until the hard scales fly open with a crackling noise and liberate the seeds. The cones are truly noble objects, one now before me produced in southern England being fully 6 inches long by nearly the same in greatest width, of a pleasing rich chocolate colour, and composed of sharply hooked and downward-bent scales. The seeds are large, only thirty being included in one ounce weight.

Amongst the Afghan villagers of the Himalayas, the seeds of *P. Gerardiana* are highly prized, while they are regarded as a rare delicacy by the poorer residents in northern India; and in Nepaul and Bhotan those of the beautiful *P. longifolia* are much in request. The peculiarly interesting *P. monophylla* produces small cones, hardly more than 3 inches long, but the seeds, which are wingless and produced two beneath each scale, are a rare delicacy amongst the hill tribes of the Sierra Nevada Mountains, and also form an important article of commerce amongst several of these Indian communities. *P. edulis* also produces large and very palatable seeds, though the cones are but small, and in New Mexico and Colorado they are extensively used as food by the native Indians of these parts. The well-known *Araucaria imbricata* produces, even in this country, immense globular cones about 9 inches in diameter, each containing upwards of two hundred seeds. These are large and edible, and used as food—raw, roasted, and boiled—by the natives of Chile, particularly the Arau-

carian Indians of the South. To the English palate they are not very agreeable, whether raw or cooked, the flavour being decidedly resinous. This, however, to a great extent, is got rid of by boiling the seeds.

It is hardly likely that pine nuts will ever find much favour in this country, although the comfits supplied by Messrs. Fuller, of the Strand and Regent Street, and which consist of the kernels embedded in sugar, are both toothsome and enjoyable.

As regards stature, some coniferous trees, as the *Sequoia*, which attains to over 350 feet in height, can only be approached by the *Eucalyptus* of Australia; while amongst dwarf forms we have some of the Junipers which only rise a few inches from the ground, and a New Zealand *Dacrydium* that is smaller than an arctic willow. As to antiquity, the first traces of the Order occur in the Devonian and Carboniferous series, the earliest Conifers of which geologists tell us being the *Ginkgo*, *Araucaria*, and members of the pine family.

Conifers pass through several stages of growth, for after the seed leaves have been formed comes the particularly interesting transition period, when leaves of a shape differing on the one hand from the seed leaves and on the other from that of the adult foliage are produced. By examining some of the Junipers and *Retinisporas*, which latter have no separate existence as a genus, two distinct forms of leaves may be found on the same branch.

As ornamental trees the Conifers rank high. In point of colour we have every shade, from the

delicate pea-green of the Larch and Deciduous Cypress to the dark sombre hues of the Black Spruce and our native Yew ; and what amongst tree growth can surpass in foliage colouring a well-grown specimen of *Picea pungens glauca* or *Cedrus atlantica glauca*? The spring buds are marvels of beauty, not less so the male catkins, which are of the richest hues of golden yellow, the brightest of crimson, or the deepest of purple.

CHAPTER I

HARDY CONIFEROUS TREES

CLASSIFICATION AND DESCRIPTION

Natural Order CONIFERÆ

THE Conifers (cone-bearers), one of the most important families of the vegetable kingdom, are for the most part evergreen, resin-bearing trees or shrubs. They belong to the Gymnosperms, or naked seeded plants, the ovule being naked on the face of the ovary. The male and female flowers are separate, either on the same tree or on different trees. Stamens in catkin-like masses; female flowers in cones. Seed furnished with a hard, crustaceous covering. Wood resinous, with the ligneous tissue marked with circular discs.

This Order may, for convenience, be subdivided as follows :

I. CYPRESS TRIBE (CUPRESSINEÆ)

- | | | |
|---------------|----------------|-----------|
| 1. Juniperus. | 3. Fitzroya. | 5. Thuya. |
| 2. Cupressus. | 4. Libocedrus. | |

II. TAXODIUM TRIBE (TAXODIÆ)

- | | | |
|-----------------|-----------------|---------------|
| 6. Athrotaxis. | 8. Sciadopitys. | 10. Taxodium. |
| 7. Cryptomeria. | 9. Sequoia. | |

CONIFEROUS TREES

III. FIR TRIBE (ABIETINÆ)

- | | | |
|-------------|------------------|------------------|
| 11. Abies. | 14. Picea. | 17. Pseudotsuga. |
| 12. Cedrus. | 15. Pinus. | 18. Tsuga. |
| 13. Larix. | 16. Pseudolarix. | 19. Keteleeria. |

IV. ARAUCARIA TRIBE (ARAUCARIÆ)

- | | |
|----------------|-------------------|
| 20. Araucaria. | 21. Cunninghamia. |
|----------------|-------------------|

Natural Order TAXACEÆ

With one exception, Ginkgo, these are evergreen trees or shrubs. Flowers unisexual, mostly axillary and dioecious. Male flowers in catkins; females naked, solitary, or rarely in twos. Fruit more or less drupaceous, the seed coat being either dry or eventually fleshy. This Order may be subdivided as follows:

I. SALISBURIA TRIBE (SALISBURIEÆ)

- | | | |
|-------------|-------------------|--------------|
| 22. Ginkgo. | 23. Cephalotaxus. | 24. Torreya. |
|-------------|-------------------|--------------|

II. YEW TRIBE (TAXEÆ)

- | | |
|------------|----------------|
| 25. Taxus. | 26. Dacrydium. |
|------------|----------------|

III. PODOCARPUS TRIBE (PODOCARPEÆ)

- | | | |
|-----------------|------------------|-----------------|
| 27. Podocarpus. | 28. Prumnopitys. | 29. Saxegothea. |
|-----------------|------------------|-----------------|

ABIES, *Linnæus*

SILVER FIRS

Pre-Linnean botanists distinguished the genera *Picea* and *Abies*, placing the Spruce in the former and the Silver Fir in the latter genus. Linnæus, however, reversed the terms, and the confusion in botanical nomenclature has continued to the present time. In accordance with the universally adopted plan of Bentham and Hooker, the silver firs are here included under *Abies*, and the spruces under *Picea*.

Flowers monœcious; male catkins scattered, axillary amongst the upper leaves.

Cones erect, cylindrical or nearly so, maturing the first year, terminal.

Scales falling off when ripe from the persistent cone-axil.

Bracts free from the scales except at their base, and longer or shorter than these.

Seeds somewhat triangular, with a large usually wedge-shaped inseparable wing.

Cotyledons leafy, entire, flat, and from four to eight in number.

Leaves flat, solitary, more or less in two rows, silvery below, leaving a circular indentation on the branch when they fall.

Large-growing trees, with erect cones, and the branches usually arranged in horizontal tiers.

ABIES AMABILIS, *Forbes*. Red Fir. (Synonyms: *Pinus amabilis*, *Douglas*; *P. grandis*, *Don*; *Picea amabilis*, *Loudon*; *Abies grandis*, *Murray*; *A. grandis densiflora*, *Engelmann*; *A. magnifica* of some gardens.) Fraser River Valley to Oregon. 1830.—This handsome tree is by no means common in the British Isles, probably owing to the confusion which, until recently, existed respecting the identity and nomenclature of this and others of the North American Firs. As an ornamental tree it is second to no other conifer, the easily arranged and semi-decumbent branches with the flattish shoots given off nearly at right angles, and great wealth of intense bluish green fragrant foliage, rendering it as unique as it is beautiful. The leaves, which are nearly of equal length, and about an inch long, are densely arranged on the upper side of the branches. They are of a dark glossy green above, with two broad glaucous lines beneath. The cones are very beautiful, being of a rich, deep purple, $4\frac{1}{2}$ inches long by about half that in width; while the broadly bell-shaped

scales are nearly double the length of the abruptly pointed bracts. The pretty pale pink male catkins are quite a feature of the tree in spring. From the nearly allied but perfectly distinct *A. grandis*, it may at once be distinguished by the more crowded, darker and usually shorter leaves, and particularly by the deep purple cones. When planted in suitable soil (the finest specimens I have seen are growing in reclaimed peat bog on an estate in the north of Ireland) this tree is of rapid growth, one specimen in particular, growing under very favourable conditions, having for several consecutive years made a leading growth of 15 inches.

A. BALSAMEA, *Miller*. Balsam Fir. (Synonyms: *Pinus balsamea*, *Linnæus*; *Picea balsamea*, *Loudon*.) Canada and North-East United States. 1697.—In a young state, and when grown under favourable conditions, this is by no means an inelegant species, but before the age of twenty years the lower branches have usually given way, and, in consequence, the tree wears a scraggy and bare appearance. It appears to be a short-lived tree and of little or no horticultural value. Unfortunately, too, it has the tendency to form early growths, which are not infrequently destroyed by frost. It is of medium height, and slender growth, with flat regularly arranged leaves, about $1\frac{1}{4}$ inches in length, and purplish or violet cones, each about $2\frac{1}{2}$ inches long, by fully 1 inch in diameter, the bracts varying much, both in shape and length. The rate of growth is slow in this country, although instances have been recorded in which fully 1 foot has annually been added to the height for nearly fifty years; and a specimen

in Haddingtonshire, when swept away by the great flood in the Tyne, in 1891, was nearly 70 feet high, and contained fully 140 feet of timber. It succeeds best in damp, rich soils, and where the atmosphere is comparatively still, and charged with moisture. The well-known Canada balsam is the resin which exudes from the bark of this tree. It was formerly used in medicine and is now chiefly employed in mounting microscopic objects.

A. BALSAMEA HUDSONIA, *Engelmann*, is a dwarf and sterile form, found at high elevations, but is of no particular interest as an ornamental shrub.

A. BRACHYPHYLLA, *Maximowicz*. Nikko Fir. Short-leaved Japanese Fir. (Synonyms: *Pinus brachyphylla*, *Parlatore*; *Picea brachyphylla*, *Gordon*; *Abies Veitchii* and *Picea Veitchii*, *Hort.*) Saghalien and Japan. 1870.—This is well worthy of attention, being of free growth, highly ornamental, and perfectly hardy. It is handsome in habit, having regular whorls of somewhat rigid, horizontally placed branches, with densely arranged short leaves that are deep green above and intensely silvery beneath. The purplish cones are cylindrical, $3\frac{1}{2}$ inches long by $1\frac{1}{4}$ inches wide, and smooth, by reason of the non-protruding bracts. The stem grows stout and straight, and when the tree is planted in light, dampish soil and a sheltered site, the upward rate of growth is from 18 inches to 24 inches a year. There cannot be a doubt that in the present species we have a highly ornamental tree and one that will yet turn out of value for forest planting, and every year it seems to improve and become a greater favourite with lovers of hardy conifers. The largest tree

I have seen it growing at Claremont, in Surrey. It was planted by H.R.H. Princess Beatrice on 7th April 1883.

A. BRACTEATA, *Nuttall*. Santa Lucia Fir. Bristle Cone Fir. (Synonyms: *Pinus venusta*, *Douglas*; *P. bracteata*, *D. Don*; *Picea bracteata*, *Loudon*; *Abies venusta*, *C. Koch*.) California, 1853.—Too much can hardly be said in favour of this comparatively rare tree, for, with its long and thick deep green leaves, somewhat erect habit and pleasant contour, it is beyond doubt one of the handsomest of the many conifers with which California has enriched our empire. Even the cones are so distinct from those of any other species that recognition of the tree by these alone is by no means difficult. In this country the lower branches of the tree have a somewhat decumbent habit of growth, while those farther up are horizontal or ascending. The leaves are of a distinct and beautiful dark green colour, and average about 2 inches in length, while the cones are 3 inches long, with the bracts developed into 2-inch long, leaf-like, linear spines and usually covered with globules of resin. The largest, best furnished, and healthiest specimens that I have seen are growing in soil that is largely composed of peat, or to which a quantity of rich sandy loam was added at time of planting. After becoming established, the upward rate of growth is fairly rapid, the annual addition to the height of the specimens referred to for five consecutive years averaging $13\frac{1}{2}$ inches. The tree is found in many collections of conifers, but is by no means common in cultivation. Two of the finest in England are at Eastnor Castle,

Hereford, the tallest being about 80 feet high. They were planted in 1865. The tree at Highnam was 64 feet high by 6 feet 2 inches in girth when measured in 1908. This fir is very rare in a wild state, occurring only in a few isolated groves on the western ridge of the Santa Lucia Mountains in California. William Lobb was responsible for its introduction, and it is from seeds obtained by him in 1854 that all the oldest trees of *Abies bracteata* have originated.

A. CEPHALONICA, *Loudon*. Mount Enos Fir. (Synonyms: *A. Apollinis*, *Link*; *A. panachaica*, *Heldreich*; *A. Reginae-Amaliæ*, *Heldreich*; *Pinus Abies cephalonica*, *Parlatore*; *Picea cephalonica*, *Loudon*.) Cephalonia, Greece. 1824.—This handsome fir is well adapted for general use in our country, and whether planted singly on the lawn, for which its well-furnished stem and wide spread of branches render it peculiarly suitable, or mixed with other trees in the woodland, it is at all times a pleasing object, and well worthy the attention of planters. Unfortunately, in certain soils, and when planted in unsuitable situations, young trees are apt to suffer from late spring frosts. This, however, should be no drawback to its extended use, as, by a proper selection of soil and site, success in the cultivation of this tree is by no means difficult, and already specimens from 70 to 80 feet high are plentiful in various parts of the country. As a forest tree this species is also likely to attract attention, its behaviour when subjected to close order of growth being highly commendable, and which, coupled with its rapidity of growth and value of timber produced, shows that it may be

used as a forest tree with at least fair prospects of a profitable result. A stiffish soil, such as a good clayey loam, and a northern or western aspect, will be found most suitable for this species, as these considerably retard early growth, the great evil to which the tree is susceptible in our clime. As an ornamental conifer this tree is of considerable importance, the long and lithe branches being well clothed with dark olive-green foliage, while the whole contour is remarkably distinct and pleasing. Usually the lower branches have a wide spread in proportion to the height of the trunk, and are retained in a perfectly healthy condition when the tree is growing in the open. They are thickly covered with stiff, dagger-shaped leaves, each an inch in length, that terminate in a sharply pointed prickle. The cylindrical cones are from 5 inches to 6 inches long, about $1\frac{1}{2}$ inches in diameter, and with the bracts exceeding the scales in length. Resin exudes freely from the surface of the cones when these are arriving at maturity. Timber of home-grown trees, which I have used experimentally for several purposes, appears to be of good quality, and very durable, and the results tend to prove that when of mature age the wood will be of value for outdoor purposes. It is very resinous and firmly packed.

Under favourable conditions the rate of growth of the tree is about 10 inches a year; three specimens of fifty years' growth which I measured were, on an average, 38 feet high each, thus showing an annual increase in height of 9 inches since they were planted.

For a full account of this tree, with measure-

ments of the original specimens at Blairadam, in Scotland, raised from seed sent home by General Napier in 1824, see my article in *The Garden*, vol. xxviii., 1885.

A hybrid between this species and *A. Pinsapo* has been raised by Monsieur H. Vilmorin. It resembles *A. cephalonica* more than *A. Pinsapo* in habit and general appearance, while the cones showing distinctly the points of the bracts are likewise more in keeping with those of that species. Though otherwise an interesting cross, the hybrid possesses no striking distinction as an ornamental tree.

A. CEPHALONICA APOLLINIS, *Boissner*, differs from the type in the more crowded arrangement of the leaves, which are thicker and broader.

A. CILICICA, *Carrière*. (Synonym: *Pinus cilicica*, *Parlatore*; *Picea cilicica*, garden.) Cilician Taurus. 1855.—Though not generally hardy in this country, the appearance of specimens that I have seen in widely different localities causes the tree to be included here. It is much after the style of the common Silver Fir, but allied to *A. nordmanniana*. Both branches and foliage are more slender and usually less plentifully produced. The leaves vary in length, according to their position on the branches, being shortest above and largest and usually curved on the under sides. Not generally to be recommended.

A. CONCOLOR, *Lindley and Gordon*. Colorado White Fir. (Synonyms: *Pinus concolor*, *Engelmann*; *Picea concolor*, *Gordon*; *P. lasiocarpa*, of gardens.) Colorado, Utah, and Arizona. 1851.—Although much confusion has existed between this and other allied species, yet the present

conifer is easily distinguished by the irregular leaf arrangement, and by the upper and under sides of these being nearly the same colour ; hence the specific name *concolor*, of similar or like colour. The leaves vary according to position from 2 to $2\frac{1}{2}$ inches in length, are of a greyish white hue, changing as they grow old to a soft, pale green. The cones, which are usually produced singly, are about 4 inches long, and the seeds larger and more weighty than those of the nearly allied *A. grandis*.

As an ornamental tree, the present species must be considered as a decided acquisition, the general outline being symmetrical, but without the accompanying stiffness which so readily distinguishes several members of this family. The spread of branches in young and healthy trees being wide in proportion to the height, warns intending planters that sufficient space should be given for perfect development. In fairly exposed situations it would seem to thrive best, and, considering that on low-lying ground it has suffered from frost in spring, the elevated positions are to be recommended.

A. CONCOLOR VIOLACEA, *Masters*.—The dense bluish green glaucescence with which the leaves of this variety are covered renders it one of the most distinct and pleasing of ornamental conifers. It is quite hardy, free of growth, and deserves to be widely known and appreciated.

A. CONCOLOR WALLEZI is a desirable and distinct variety that is worthy of culture. The silvery yellow colour is not retained the whole of the season.

A. FIRMA, *Siebold and Zuccarini*. (Synonyms : *Pinus firma*, *Antoine* ; *Picea firma*, *Gordon* ;



Face page 10.

ABIES FIRMA.

A. bifida, *Siebold and Zuccarini*.) Japan. 1861.

—For the great variability of its foliage this tree is remarkable, and to which fact may be attributed the list of synonyms with which it is encumbered. The somewhat stiff, deep, glossy green foliage and partially erect habit of growth, as seen in the few specimens that are to be found in this country, render the tree of some value for ornamental planting. The leaves range from under to considerably over an inch in length, some being flat and given off at right angles to the shoot, while others are short and upcurved. The cones are cylindrical, about 5 inches long, with imbricated scales and upward-pointing bracts, which terminate in sharp angular points.

It seems to be grateful for shelter from cold draughts of wind, and evidently thrives best in light, rich loam. In the younger stages of growth the leaves are distinctly cleft at the tips, hence the name *bifida*, but with age this gradually gives way.

A. FRASERI, *Poivet*. (Synonyms : *Picea Fraseri*, *Loudon* ; *Pinus Fraseri*, *Parlatore*.) Mountains of Carolina and Pennsylvania. 1807.—This tree has little to recommend it, whether for ornament or utility, when planted in these islands. It bears considerable resemblance to *A. balsamea*, and is in consequence often confounded with that species ; but, in the absence of fruit, which is a speedy method of recognition, the structure of the leaves will always determine the difference. The more slender and upright growth, and smaller dark green, thickly arranged leaves, are also differences that might be pointed out in connection with the present species and *A. balsamea*. The cones are oval in

shape, with conspicuous reflexed bracts. This is the tree which caused the mountains on which it is found to be designated the Black Mountains, giving, as it does, the sombre hue for which they are justly remarkable. In this country the tree succeeds well on peaty soils, especially where a small quantity of loam has been added previous to planting. Rarely, however, is it a satisfactory species unless in a juvenile state.

A. GRANDIS, *Lindley*. Tall Silver Fir. (Synonyms: *Pinus grandis*, *Douglas*; *Picea grandis*, *Loudon*.) Vancouver Island to California, near the coast; western slopes of Rocky Mountains. 1831.—This is a truly handsome conifer, and one that is well adapted for ornamental planting, the soft rich green foliage, densely branched stem, and symmetrical habit being recommendations that are rarely so well combined in one species. The branches of *A. grandis* are usually arranged in flat, horizontal tiers, with the tips slightly upturned, and are, more particularly the branchlets, glabrous, and of a light, pleasing green. The leaves are of unequal length, arranged on the lower branches in double, and those near the top in treble rows, the lower series of leaves being longer than the upper, or from $1\frac{1}{2}$ inches to fully 2 inches in length. They are usually bifid at the ends, but this I have noticed is more particularly the case in the foliage of the branches near the top of the tree, channelled above, and with two silvery lines beneath. The cones are bronzy green, 4 inches long by $1\frac{1}{2}$ inches in diameter, almost cylindrical, usually in pairs, and seated close to the stem, or, in other words, devoid of foot-stalks. This is, however, not

always the case, and I have noticed the cones in clusters of from five to seven in number. An excellent drawing of a cluster of five cones, from specimens sent by me from Penrhyn Castle to the Editor of *The Gardeners' Chronicle*, will be found in the *Linnean Society's Journal*, vol. xxiii. The cone bracts are entirely hidden by the overlapping scales. The bark is smooth, and of a dull green when young, but becomes dark grey and rough when the tree has advanced in age, and filled with receptacles of clear, highly fragrant resin. The timber produced in this country is of excellent quality, being weighty, resinous, and the concentric rings firmly packed. The largest specimen which I have had cut down was, exclusive of the broken top, 72 feet in height, measured 26 inches in diameter at the butt end, and contained 73 cubic feet of timber.

On measuring some of the annual rings near the bark I found them to average fully 1 inch in thickness, which speaks highly of the tree as a rapid timber producer. When felled and stripped of its branches, the balsamic fragrance, from the quantity of resin the tree contained, was perceptible for a considerable distance—farther than I have ever noticed even with the Douglas Fir—and the circumstance was commented upon amongst the woodmen employed in removing it.

The average annual rate of growth of *A. grandis* in this country is 17 inches, while the quantity of timber produced in fifty years by the large specimen just referred to gave an annual average of nearly $1\frac{1}{2}$ cubic feet. When cut into boarding, the wood resembled in appearance that of the

common Silver Fir, but was perhaps darker, of greater specific gravity, and of firmer texture.

It works well and takes a good polish; but from the rapid rate of growth, the graining is rough, though perfect in delineation. When compared with foreign timber from British Columbia at the Colonial and Indian Exhibition, that produced in this country revealed but small differences, and nothing more than might be expected between that of a partially developed and a mature tree. Taking into consideration the quantity and quality of wood produced by *A. grandis*, as also its highly ornamental appearance and undoubted hardihood, it must be placed in the first rank for extensive planting in this country. It grows well on poor soils, the largest specimens in this country having been planted in rather light gravelly loam. At the Cairnies, Perthshire, it is 80 feet high, with a stem girthing 8 feet 6 inches. For a full illustrated account of the tree, see my article in *The Garden*, vol. xxxvii., 1885.

A. LASIOCARPA, *Nuttall*. (Synonyms: *A. (Picea) bifolia*, *Murray*; *A. subalpina*, *Engelmann*.) Alaska, British Columbia, Oregon to Colorado.—This tree bears some resemblance to the better-known *A. balsamea*, but it is of larger growth, with thin, whitish, smooth bark, which becomes cracked and ashy grey with the advance of years. Leaves notched on sterile, and pointed on fertile branches, in many rows, and with two glaucous bands on the under sides and stomata above as well. The cones are from 2 inches to $3\frac{1}{2}$ inches long, by 1 inch to $1\frac{1}{4}$ inches diameter, with the scales rounded or almost square, and

the bracts remarkably short and quite concealed from view. This species does very well when planted in cool, rather moist soil; indeed, the finest specimens I have seen are growing in loamy peat. Great diversity of opinion has existed as to the specific limits of *A. lasiocarpa*, *A. lowiana*, and *A. concolor*. After careful and lengthened observations of living specimens cultivated in this country, I have come to the conclusion that for garden purposes at least the extreme forms of each should receive specific identity.

A. LASIOCARPA ARIZONICA, *Arizona*.—A beautiful variety with silvery foliage and thick, corky, cream-coloured bark.

A. LOWIANA, *Murray*. (Synonyms: *Picea lowiana*, *Gordon*; *Abies lasiocarpa*, *Masters*; *Picea Parsonsiana*, *Barron*; *A. concolor*, *Veitch*; *A. lasiocarpa*, *Beissner*; *A. grandis lowiana*, *Masters*.) Western slopes of the Sierra Nevadas, North California, Oregon. 1851.—A handsome and, in this country, fast-growing species, that is readily distinguished by its light and airy appearance, as well as comparatively long leaves, these frequently reaching 3 inches in length. They are generally of a pale glaucous tint, and so thinly arranged as to expose the shoots. The cones are oblong-cylindrical, and from 3 inches to 5 inches long, with crescent-shaped scales and minute bracts. Undoubtedly this is one of the most beautiful of the Californian firs, and when seen under favourable conditions in this country, with its long and peculiarly incurved foliage, which is silvery-green beneath, and regularity of branch arrangement, combined with its wonderful vigour

and perfect hardihood, it may well rank with the choicest of ornamental conifers.

A. MAGNIFICA, *Murray*. Stately Silver Fir. Red Fir. (Synonyms : *A. campylocarpa*, *Murray* ; *Picea magnifica*, *Gordon*.) North California. 1851.—Though rather stiff of growth, yet when seen under the most favourable conditions, this is truly a beautiful and magnificent tree. The branches are horizontally arranged, with dense foliage, crowded more above than below, each leaf being about $1\frac{3}{4}$ inches long, glaucous olive-green above, and marked with two silvery lines on the under side. The cones are cylindrical, 5 to 7 inches long, by from 2 to 3 inches in diameter, the scale edges incurved, and the bracts included, but protruding in the var. *xanthocarpa*, *Lemmon*, and terminating in a tail-like appendage. In its younger stages, the whole tree wears a whitish silvery appearance, as if coated with hoar frost ; but this beautiful colouring is most noticeable when the specimens are growing under unusually favourable conditions. As an ornamental tree, the present species is of great value, while the growth is rapid, one specimen of which I kept a record having attained to the height of 25 feet in a little over twelve years. It thrives vigorously in reclaimed peat-bog at Churchhill, in the north of Ireland, where in this country the first cones were produced, but it also does well in rich loam.

A. MARIESII, *Masters*. Mountains of Japan. 1878.—This is likely to turn out a useful conifer for ornamental planting. It is remarkable in that the foliage resembles some of the Tsugas,



Face page 16.

ABIES LOWIANA AT WOBURN.

Planted 1881. Height, 71 feet.



while the large purple cones, often 5 inches long and cylindrical in shape, decide it to be a true *Abies*. The leaves are only three-quarters of an inch long, many being much shorter, for the most part erect, and evenly disposed around the stem, and of a dull green colour. Being quite hardy in this country, it is to be hoped that it will soon get widely disseminated, while it grows with a fair amount of freedom, and in soils of ordinary quality.

A. NOBILIS, *Lindley*. Noble Silver Fir. (Synonyms: *Pinus nobilis*, *Douglas*; *Picea nobilis*, *Loudon*.) Washington, Oregon, and California. 1825.—This tree is one of the hardiest and handsomest of the group, and is probably more common than any other of the recently introduced species. Amongst the silver firs it is certainly one of the most conspicuous and beautiful, the deep silvery glaucous foliage, regularly and neatly disposed branches, and not too stiff outline being points of special interest and recommendation. The leaves are crowded on the upper sides of the branches, varying in length from 1 to $1\frac{1}{4}$ inches, rigid, obtusely pointed, and with two glaucous bands beneath. The brownish purple cones are very handsome and conspicuous, being often 6 inches long, perfectly cylindrical, obtuse at both ends, and with conspicuously recurved bracts. The first cones produced in this country were at Churchhill, in the north of Ireland, and were sold at a guinea each, and young plants realised as much as twenty guineas. Few trees are less particular about the quality of soil in which they are planted than that in question, but it certainly prefers that of not too light nor too dry a

description. It grows rapidly, the average annual increase in height of several specimens that I measured being 20 inches for a period of twenty-five years. The production of wood is likewise rapid, as will be learnt from the following: A tree of this kind was planted in good loamy soil and a moderately sheltered situation in 1854, it at that time being a robust growing specimen of 3 feet in height. In 1884, or thirty years afterwards, it had attained to a height of 55 feet, when it was found to contain 61 cubic feet of wood, this giving an average annual increase of fully 2 feet per year. The quality of home-grown timber is not such as to be recommended, it being soft, easily worked, and clean of graining, and from this I do not consider that the tree will be of any special value for afforesting purposes.

A. NOBILIS GLAUCA.—Though not of constant character as regards foliage colouring, yet, in certain specimens the glaucous tint is so well pronounced and distinct as to merit the attention it has received. It is equally robust as the type.

A. NORDMANNIANA, *Spach*. Nordmann's Silver Fir. (Synonyms: *Pinus nordmanniana*, *Steven*; *Picea nordmanniana*, *Loudon*.) Caucasus, Greece, and Asia Minor. 1848.—This must be considered as one of the finest and most valuable of the European or Asiatic species of silver fir. As a park and lawn tree, it can scarcely be surpassed, the regular and handsome outline, rich glossy green foliage, and stately habit rendering it a decided acquisition for ornamental planting. The leaves are rigid and horizontal, deep glossy green, about 1 inch long, and the cones ovoid and

nearly 6 inches long. The timber produced in this country is, judging from many specimens that I have had the opportunity of examining, of excellent quality, being hard, close-grained, and lasting. The tree succeeds well in every part of the country, and has an advantage over the common Silver Fir that, owing to starting into growth later in spring, it is less apt to be injured by unseasonable frosts. Few trees, too, are less particular as to soil, it succeeding well in reclaimed peat-bog, stiff loam, decomposed vegetable matter, and that of a chalky or limestone formation. In warm, sandy, or gravelly soils, it is apt to suffer from the attacks of a species of aphis. As a forest tree, it is certainly well worthy of attention. A monograph on Nordmann's Silver Fir, by the present writer, will be found in the *Transactions of the Royal Scottish Arboricultural Society*, vol. ix., 1879.

A. NUMIDICA, *De Lannoy*. (Synonyms: *Pinus Pinsapo*, *Parlatore*; *Picea numidica*, *Gordon*; *A. Pinsapo baborensis*, *Cosson*.) Algerian Mountains. 1861.—As yet, this species is by no means common in the British Isles, but from its undoubted hardihood and pleasing green foliage is sure to receive attention. It is of neat, rather pyramidal habit, with sub-erect branches, short, crowded leaves, each about 1 inch long, and rich deep green above, often with a silvery patch near the apex and two faintly marked silvery lines beneath. Being of free and bold growth, succeeding well even in poor gravelly soils, where many of its fellows refuse to grow, and perfectly hardy, this tree is to be recommended for general use through-

out Britain. In order to show off the neat habit of growth, an open though not too exposed site is to be recommended.

A. PECTINATA, *De Candolle*. Common Silver Fir. (Synonyms: *Abies alba*, *Miller*; *A. vulgaris*, *Poiret*; *A. Picea*, *Lindley*; *Picea pectinata*, *Loudon*; *Pinus pectinata*, *Lamarck*; *Pinus Abies*, *Duroi*; *Pinus Picea*, *Linnæus*.) Central and Southern Europe. Sixteenth century.—As an ornamental tree this is only of secondary importance; but for the great quantity of fairly valuable timber produced, it is well worthy of attention, although its merits in this particular have been rather overrated. Both branches and branchlets stand out horizontally, the deep green leaves, which are two-rowed on the juvenile, but pectinate on the adult species, are marked by two distinct silvery white lines beneath. They vary on the same twig from three-quarters to fully $1\frac{1}{4}$ inches in length. The cones are cylindrical, usually about 6 inches long by fully $1\frac{1}{4}$ inches in diameter. The timber is of fair quality and well adapted for rough outdoor carpentry. It is elastic, somewhat irregular in graining, soft, apt to shrink, and decays speedily on exposure. For temporary buildings, such as tool-sheds and cattle shelters, it is to be recommended. In connection with sluices and dams of streams and rivers, to prevent the sides being washed away, I have found it to be peculiarly suitable. The tree itself will grow well beneath the shade and drip of others, produces a large quantity of timber, and is not over-exacting as to soil.

A. PECTINATA FASTIGIATA. The Upright Silver Fir.—This is a very distinct form, the branches

of which have a decided upright inclination, with the branchlets, particularly the tips, falling backwards. It varies a good deal, however, and specimens quite unworthy of the name, though departing considerably from the normal form, are in cultivation. In the best fastigate variety the leaves differ considerably from the species, being smaller, more slender, and slightly up-curved. The largest tree I have seen is growing at Emmetts, near Sevenoaks, and is fully 45 feet high.

A. PECTINATA PENDULA. The Weeping Silver Fir.—This rare variety of the Common Silver Fir is at once the most remarkable of the several forms of this well-known tree. Neither in the *Kew Hand-list of Conifers* nor in the *Pinetum Danicum* (where varieties have received special attention) is the Weeping Silver Fir referred to. (It is in *Masters' List of Conifers*, in *Gordon's Pinetum*, and in *Beissner's Enumeration*.) Gordon says that *P. pectinata pendula*, Godefroy, is of French origin, with the branches and twigs drooping. Whether or not this is the particular variety at present under notice, matters little; one thing is certain, that the specimen which furnished material for this note is not only well worthy of the name, but is, in all probability, the largest tree of its kind (if, indeed, there be any others, which I have not heard of) in the British Isles. It is growing in rather an obscure position hard by the lawn at Emmetts, a beautifully situated property on Ide Hill, at Sevenoaks, and in company with giant specimens of *Thuja plicata*, *Abies nobilis*, and hosts of other conifers. The

tree is 42 feet high, the branches being so pendulous that no part of their spread exceeds 4 feet in diameter, while they hang down parallel to the main stem for from 3 to 5 feet in length. The leaves are much shorter than those of the species, rarely more than from one-half to three-quarters of an inch long, but are characterised by the same silvery bands on the under and deep green on the upper surfaces.

A. PINSAPO, *Boissier*. Spanish Silver Fir. (Synonyms: *Pinus Pinsapo*, *Antoini*; *Picea Pinsapo*, *Loudon*.) Southern Spain. 1839.—The short and prickly foliage, extreme density and rigidity, combined with compact growth and a unique appearance, at once distinguish this from all other silver firs. When favourably situated, few trees are more ornamental and effective; but to see it in its beauty it must be planted singly, or sufficiently apart from others so that the branches may have room for full development. It is most attractive during late spring or early summer, for then the young growths make a striking contrast with the older foliage, the whole forming a regular and compact cone of the finest colour. There is also a stately and dignified air about this tree that one cannot help admiring, and which is further enhanced by the regularly whorled branches, as well as the brightly tinted rigid leaves, which are short, sharp or blunt, and thickly arranged all round and at right angles to the stem. The numerous beautiful purplish green, ovate-cylindrical cones stand well out and are often fully 5 inches long. The latter constitute a striking feature of the tree. In so far as the economic

value of the timber is concerned, it might be pointed out that on comparison with that of the Silver Fir, it is harder, closer grained, and better suited for the finer constructive works.

Under favourable conditions, the rate of growth annually of *A. Pinsapo* for fully twenty years was about 14 inches, while in one case, at least, I have known it to produce 30 feet of timber in a like number of years. For planting on chalky ground, this tree is certainly an acquisition. At High Elms, Lord Avebury's Kentish property, where are some of the largest and healthiest trees of its kind in the country, I have oft been struck by its rapid rate of growth, and that, too, where only a small quantity of loam overlies the chalk. It is perfectly hardy, and succeeds well when planted on exposed ground.

At High Elms several species of *Abies* and other coniferous trees have attained to noble dimensions. The late Lord Avebury told me that the choice of trees, selection of sites, and planting were carried out under the supervision of Loudon.

A. PINSAPO GLAUCA well merits attention as a distinct and desirable variety with leaves of a pronounced glaucous tint.

A. PINSAPO HAMONDII, of which there is a fine specimen near Hemel Hempstead, in Herts, is a curious form, giving one the idea of having been beheaded, and the branches, in consequence, much lengthened and supple. It forms a dense mass of foliage, of the same colour as the parent, but the leaves are individually smaller. As a lawn bush when planted on the greensward, it is both interesting and distinct.

A. PINSAPO VARIEGATA.—From the yellowish green tint of the branch tips, this variety is somewhat interesting, but it can hardly be considered an acquisition.

A. RELIGIOSA, *Schlechtendal*. (Synonyms : *Pinus religiosa*, *Humboldt*; *Picea religiosa*, *Loudon*; *Abies hirtella*, *Lindley*.) Mountains of Mexico and Guatemala. 1838.—This species has not proved generally hardy, though in Ireland and southern England, particularly near the sea, fair specimens are to be met with occasionally. It is a tall tree with dark glossy green leaves, each about $1\frac{1}{2}$ inches long, and pretty, deep blue cones, about 5 inches in length, and half that in diameter, and with the whitish bracts more or less protruding, the acuminate points being reflexed. Specimens over 70 feet high may be seen in the south of Ireland.

A. SACHALINENSIS, *Masters*. Saghalien Fir. (Synonym : *A. Veitchii sachalinensis*, *Schmidt*.) Sachalin, Yezo. 1878.—From what little is known of this species it would seem to be an undoubted acquisition, and though nearly allied to the better-known *A. Veitchii*, yet the foliage has a certain resemblance to that of *A. sibirica*. The small blunt-pointed leaves are crowded spirally around the stem, and are about 1 inch in length; while the cones are 3 inches long by 1 inch in diameter, with projecting and reflexed bracts. It has proved quite hardy in this country.

A. SIBIRICA, *Ledebour*. (Synonyms : *A. Pichta*, *Forbes*; *Pinus Sibirica*, *Turezaninoro*; *Picea Pichta*, *Loudon*.) North and eastern Russia and Siberia. 1820.—This cannot be called a desir-

able tree for planting in these isles, it usually wearing a shabby, starved appearance, being thin of foliage and the branch tips cut back and arrested by cold winds and frost. The leaves are dark green above and silvery beneath; but the whole aspect of the tree greatly reminds one of a stunted specimen of the Common Silver Fir. The best specimens in this country are growing in stiff, dampish, clayey loam, on the northern side of a sharply rising hill.

A. VEITCHII, *Lindley*. (Synonyms: *Picea Veitchii*, *Hort.*; *Pinus selenolepis*, *Parlatore*; *Abies nephrolepis*, *Maximowicz*.) Mountains of Japan. 1879.—This is a tree of neat and spiral growth, and is so far the most rapid grower of the Japanese species. In several ways it is a very desirable conifer, the narrow grass green leaves, with two silvery white lines on the under sides, and well-branched trunk, rendering it very distinct and pleasing. The tree is usually slender in outline, the branches short and irregularly disposed, and the leaves, some of which are bifid at the tips, fully three-fourths of an inch long. The cones, which have been produced in this country, are about 3 inches in length, oval-shaped, and with the acuminate bracts projecting beyond and bent downwards over the scales. It has been found perfectly hardy in several parts of the country, and is truly an alpine species of rare beauty, that is yet destined to an exalted place in our parks and woods. Specimens planted under favourable conditions have attained to a height of 10 feet in ten years, the branch spread being fully as much as the height.

A. WEBBIANA, *Lindley*. Webb's Silver Fir. (Synonyms: *Picea Webbiana*, *Loudon*; *Pinus Webbiana*, *Wallich*; *Abies chiloensis*, of gardens.) Eastern Himalayas. 1822.—This is one of the handsomest denizens of the Himalayan forests; but, unfortunately, it is not well suited for the climate of this country, being what is usually termed "spring tender." By careful choice of soil and situation, many fine specimens have, however, been reared, principally in seaside parts of the country, and these have amply rewarded the trouble taken to suit their particular wants by their stately grandeur and distinct appearance. The leaves are deep glossy green above, with two broad and very conspicuous silvery bands beneath, very variable in size and arrangement, usually bifid, and about 2 inches long. The cones, before becoming ripe, and when they have attained to full size, are highly ornamental, and remarkably weighty from the great quantity of resin they contain. They are about 7 inches long, of a deep purple colour, and generally several occur on the same branch; indeed, with their number and weight, I have more than once seen large branches broken off the trees. So strikingly different in general appearance is this tree that no mistake can ever occur in confusing it with any other species. Where it does well, the growth is long and stout, but too frequently the tips of the branches are bitten by frost in early spring, and when this has occurred several times the tree wears a by no means pleasing appearance. Usually the tree does well and escapes frost-bite when planted in cold and stiffish soil and facing north



Face page 26.

ABIES VEITCHII.

or east ; but the finest specimen I have seen, and from which these notes were compiled, was growing in damp alluvial deposit and within sea influence. Both this species and the variety have attained to large dimensions at Penrhyn Castle, North Wales. The collection of coniferous trees in the park at Penrhyn is particularly rich, including large specimens of *Cunninghamia sinensis* (now removed), *Cephalotaxus pedunculata fastigiata*, as well as many of the rarer species of *Abies*, *Picea*, and *Pinus*. It had attained to a height of 58 feet in thirty-two years, and contained fully 37 feet of timber. On several occasions I have examined home-grown timber of the tree in question, but it was soft, and did not last long when used out of doors.

A. WEBBIANA PINDROW, *Brandis*. (Synonyms : *Abies* Pindrow, *Spach* ; *Picea* Pindrow, *Royle* ; *Pinus* Pindrow, *Royle* ; *Picea* Pindrow, *Loudon*.) Eastern Himalayas. 1837.—This cannot be included as a perfectly hardy tree, for even in warm situations by the sea-coast it not unfrequently wears anything but a robust and healthy appearance. The stem is tall and straight, with short, spreading branches, and leaves that are very variable both in size and arrangement. In adult trees the leaves are arranged in two rows, and are from $2\frac{1}{4}$ to $2\frac{1}{2}$ inches long, while on young specimens they are thickly and regularly disposed on all the branches, and about 1 inch long. They are usually bifid, blackish green above, and with two greyish white lines beneath. Cones usually oval, $4\frac{1}{2}$ inches long by $2\frac{1}{2}$ inches diameter, and for the greater part produced singly on the three top tiers of

branches. They are, when of full size, of a deep purple colour, and highly ornamental to the tree.

The leading shoot, which is frequently $1\frac{1}{4}$ inches in diameter, readily yields to finger pressure, and is welted or thickly covered with longitudinally arranged raised surfaces like whipcord. The buds are remarkably large and prominent, oval in form, resinous and scaly. In the younger stages of growth this tree presents an unusually stiff, sturdy, and unyielding habit of growth. By careful choice of soil and site, the latter in particular, spring tenderness may to a great extent be obviated, the conditions being that a northern or eastern aspect be chosen, also a cool, late soil and fairly sheltered situation. A full account of this variety, with illustrations, by the writer, will be found in *The Garden*, vol. xxx., 1886.

ARAUCARIA, *Jussieu*

Flowers usually dioecious.

Female cones large, globular, or ovoid; males cylindrical.

Scales spirally arranged, deciduous, united with the bracts.

Seeds, one to each scale, inverted, and more or less attached to the scales.

Leaves spirally arranged, closely imbricated, and widest at the base.

The *Araucaria* differs from the true pines and firs in having the sexes usually on different trees, in the cone scales being one-seeded, and the seed more or less attached to the scales.

ARAUCARIA IMBRICATA, *Pavon.* Chile Pine. Southern Chile. 1795.—Though of somewhat stiff outline, there is something remarkably pleasing and distinct about a well-grown and well-furnished specimen of this *Araucaria*. Unfortunately, however, the opinion entertained regarding the value



Face page 28.

ARAUCARIA IMBRICATA.

of the tree for general planting in this country years ago does not hold good to-day, and a great change in its culture has in consequence been brought about. In the younger stages of growth, the *Araucaria* is, no doubt, one of the most distinct of all coniferous trees, but with the advances of age, it usually begins to show signs of decay, the lower branches dying off one by one, when the whole tree presents a very unsightly appearance. The branches are somewhat drooping, with up-turned tips, the ovate lanceolate leaves stiff, leathery, and sharply pointed, each about 1 inch long, by half that in width, and bright green in colour. Seed-bearing cones spherical, or nearly so, and 7 inches in diameter, while the thickly arranged, bract-like appendages, each 1 inch long and standing erect, impart to these a curious hedgehog-like appearance. The male cones are cylindrical, fully 3 inches long, by half that in diameter, and usually produced in quantity. They frequently remain wholly or in part intact for several years. The *Araucaria* is not always dioecious as stated by some writers. At Cudham Hall, in Kent, the property of the Earl of Derby, as also at Downe Court in the same county, I have seen large numbers of both male and female cones produced on the same tree, specimens of which were sent to the late Duke of Argyll, who was sceptical on the matter.

ATHROTAXIS, *Don*

THE CROWDED-SCALED CYPRESSES

Flowers monœcious, occasionally dioecious, solitary; males in terminal spikes.

Cones globular, with the scales spirally arranged.

Seeds, from three to six under each scale, free, pendulous, and winged.

Leaves spiral, without petioles, scale formed.

Evergreen trees of small growth, natives of Tasmania, and remarkable for the jointed appearance of the shoots.

ATHROTAXIS CUPRESSOIDES, *Don.* Tasmania.—When seen growing under favourable conditions, this is a neat and very distinct small-growing conifer, with thick and spirally arranged coriaceous leaves, which are of an intense glossy green colour. It delights in a cool and quiet situation; and the finest specimens I have seen were growing on a dampish mossy bank in a forest break. It is a species that is well worthy of culture, and should be included in every selection of coniferous plants.

A. LAXIFOLIA, *Hooker.* (Synonym: *Athrotaxis Doniana*, *Maule et Gordon.*) Tasmania.—To a great extent this resembles the previous species, but the foliage is less thickly arranged, or not so closely appressed, longer and pointed, and the tree is of slower growth, this being particularly noticeable when the plants are growing side by side, and under exactly similar conditions. The cones are terminal subglobose, three-quarters of an inch in diameter, and composed of about sixteen spirally arranged scales, and roundish, deeply winged seeds. This is a neat little tree, of slow growth, and remarkable for the bright and cheery tint of the foliage. It has attained to a height of 15 feet in southern England.

A. SELAGINOIDES, *Don.* Tasmania. About 1847.—This is the hardiest, best-known, and most accommodating of the species. From the others it may readily be distinguished by its twiggy

growth, flat, scale-like leaves, which are closely appressed to the branches, and grass green colour. The cones are globular, about three-quarters of an inch in diameter. This species does remarkably well in peat-bog, and the largest specimen I have seen was growing in the open portion of a larch wood, and amongst loamy peat, rather damp, and where sunshine rarely gained admission. Growing under favourable conditions, this specimen attained to a height of 12 feet in fifteen years.

CEDRUS, *Loudon*

THE CEDARS

Flowers monœcious, stamens in short catkins.

Cones oval, flattened at the ends, erect, smooth, on the upper sides of the branches.

Scales overlapping, closely placed, rounded on the outer margin.

Seeds in pairs under each scale, furnished with a persistent membranous wing.

Cotyledons leafy, mostly nine in number.

Leaves scattered, or tufted, needle-shaped, stiff, and persistent.

Large-growing evergreen trees, with the leaves either arranged singly on long shoots or in bundles on short spurs.

CEDRUS ATLANTICA, *Manetti*. The Atlas Cedar. (Synonyms : *Abies atlantica*, *Lindley and Gordon* ; *Pinus Cedrus atlantica*, *Parlatore* ; *Cedrus africana*, *Gordon*.) Algeria, Morocco. 1843.—In a young state particularly this is hardly recognisable from the better-known *C. Libani*, although after a few years' growth its erect habit and rigid branches are sufficient means of identification. As an ornamental tree, it cannot compare with the Lebanon Cedar, although as a forest tree it may be pre-

ferable, producing more valuable timber and having less inclination to ramify into stout and unwieldy branches. For the latter reason alone it is valuable, for while the branches of the Lebanon Cedar suffer much from wind and snow, those of *C. atlantica* remain unharmed, their less length and weight, as also upward inclination, freeing them from injury.

In exposed situations, and where the soil is naturally stiff, the Mount Atlas Cedar makes a sturdy growth, and for this reason it is now much sought after for planting on bleak and exposed park grounds. Little is yet known regarding the value of the timber as produced in this country, too short time having elapsed since the introduction of the tree for this to have approached maturity. That it is superior to wood of the Lebanon Cedar in trees of equal age I am, however, convinced, and there can be little doubt that in years to come, when maturity has been nearly attained, it will be found of some value for constructive purposes. Generally throughout this country it does well, and specimens fully 70 feet high are now to be seen. Rarely if ever does the African Cedar throw weight into the branches, it being far more inclined to rush up straight, and expend its energy in the building up of a clean and well-balanced stem. The branches, too, are short and lithe in comparison with those of the Lebanon tree, and well covered with shorter and more spiny foliage. The cones are ovate and depressed at the ends, nearly 3 inches long, and when ripe are of a chocolate brown colour. It grows more rapidly than the Lebanon, and is destitute of the flat or table-



Face page 32.

CEDRUS ATLANTICA.

headed appearance that is so characteristic a feature of that tree. Owing to its having a small branch spread in proportion to the height, it is also more valuable as a forest tree than that species, grows on poorer and more exposed land, and is an excellent seaside tree.

The general points of recognition of the Mount Atlas Cedar are the comparatively short and less flat branch arrangement, the dense, short, and prickly leaves, and erect leading shoot, while the branch tips are straight and stiff.

C. ATLANTICA AUREA is a distinct and ornamental form in which the young foliage has a golden tint, which, however, does not appear in all cases to be constant.

C. ATLANTICA GLAUCA.—This is one of the most distinct and ornamental of hardy conifers ; indeed, it is a gem that arrests the attention of every one. Little or no difference, except in foliage tint, is discernible between the glaucous African Cedar and the typical or parent plant as usually seen, for the same rigid and irregular mode of growth is noticeable in both species and variety. The foliage colouring is, however, both distinct and remarkable, the deep grass or blue-green of the normal tree giving place to a most enticing silvery hue in the glaucous variety, and which renders it as distinct and pretty a conifer as could well be desired. The branches are sturdy and stiff-pointed, of various lengths at the same height, and rounded rather than flat. Two of the largest specimens I have seen are growing on the estate of High Elms, the late Lord Avebury's property. These trees are as stately as they are beautiful, being nearly

61 feet in height each, and regularly clothed with foliage, which at a short distance away has more the appearance of burnished silver than anything else I can recall to mind. Cones have been produced, and these, when fully developed, but before becoming ripe, are of an intense bluish green colour. *Cedrus atlantica glauca* has grown rapidly at Chigwell House, Pinner. The largest tree, which was planted twenty-three years ago, is 43 feet high and with a stem girth of 40 inches at 3 feet from the ground. It is a beautiful specimen in which the silvery glaucous tint of foliage is prominently revealed. Another tree of the same kind is 40 feet high, with a stem which girths 38 inches at a yard from the ground. Many rare and beautiful conifers are included in the collection at Chigwell House.

C. DEODARA, *Loudon*. The Deodar. Indian Cedar. (Synonyms: *Pinus Deodara*, *Roxburgh*; *Abies Deodara*, *Lindley*; *Larix Deodara*, *C. Koch*; *Cedrus indica*, *Chambray*; *C. Libani Deodara*, *Hooker f.*) Himalayas. 1831.—This tree stands almost unrivalled in the grandeur of its lithe and beautifully pendulous branches; indeed, it is open to question whether a more distinct and graceful hardy conifer has yet found its way into this country. Few trees are more accommodating as to soil than the present species, but it is not well adapted for cold and exposed sites. In a young state the Indian Cedar is rendered highly ornamental by reason of the decidedly pendulous leader and gracefully drooping branch tips, abundantly supplied with glaucous green foliage of the richest and most delicate description. The male or pollen



Face page 34.

CEDRUS ATLANTICA GLAUCA.

cones, which are from 2 to 3 inches long and standing erect, are produced in such quantity that they are quite a feature of this tree; while the seed-bearing cones are cylindrical, 3 to 4 inches long, and depressed at both ends. They are usually produced on the upper sides of the stout top branches. The rate of growth is rapid, 70 feet in height having been attained by specimens in England in fifty years. Timber produced in this country is fine-grained, but soft, and not at all durable.

C. DEODARA CRASSIFOLIA is altogether a less ornamental tree than the species, the thick short branches being pendulous at the tips to only a very small extent. The leaves are short and stout when compared with those of the parent.

C. DEODARA ROBUSTA.—In the best forms of this variety the leaves are stout and long, and more distinctly silvery than in the species. There seem, however, to be many worthless forms in cultivation under the name.

C. DEODARA VIRIDIS has the foliage of a rich and deep green, more resembling that of *C. atlantica*, and seems quite constant in character.

C. LIBANI, *Loudon*. Lebanon Cedar. (Synonyms: *Pinus Cedrus*, *Linnæus*; *Larix Cedrus*, *Miller*; *Abies Cedrus*, *Poiret*; *Larix patula*, *Salisbury*; *Cedrus patula*, *C. Koch.*) Syrian Mountains, Cyprus. About 1666 to 1680.—With its massive and well-clothed trunk, far-spreading and flatly pendulous branches, and deep glaucous green foliage, this is beyond doubt one of the grandest and most majestic as well as distinct and easily recognised of all trees. When wanted

as a purely ornamental specimen, the Lebanon Cedar must have plenty of room for perfect development of root and branch, as when crowded with other trees in the forest the appearance is miserable, from the dying back of the branches and branch tips. The branches are usually arranged horizontally, and are quite flat, generally in distinct tiers, but sometimes scattered irregularly over the trunk, and long in proportion to the height of the tree ; while the foliage is deep grass-green, thickly set, each leaf 1 inch long, and sharply pointed.

Cones are abundantly produced, each being 4 inches long by about half that in diameter. The timber, though not much in demand in this country, is excellent in quality, and stands the changes from damp to drought in rather a commendable manner. This, however, is dwelt on at length in the chapter devoted to the timbers of coniferous trees. In a very interesting history of Enfield, published in 1873, it is stated that the oldest Cedar in England is undoubtedly that still flourishing in the Palace Garden of Enfield, which was planted by Dr. Uvedale between 1662 and 1670. The next in age were those planted in the Chelsea Physic Garden, by Sir Henry Sloane, which, when measured by Sir Joseph Banks in 1784, were fast going to decay, and were then far behind the Enfield Cedar in life and beauty. The largest was blown down in the autumn of 1853, when the interior was found to have almost entirely perished.

C. LIBANI ARGENTEA, *Antoine*, is certainly a distinct and desirable variety, with foliage of



CEDRUS DEODARA.

Face page 36.

silvery whiteness ; but several specimens that I have examined under this name should really be assigned to the glaucous form of the Mount Atlas Cedar.

C. LIBANI BREVIFOLIA, *Hooker f.*, has shorter leaves than the species, but in my opinion it is a decidedly inferior tree in point of ornament. Introduced from Cyprus in 1881.

C. LIBANI DECIDUA, *Carrière*, is one of the most interesting and remarkable of the many varieties of the tree. Though the whole of the foliage is not shed at the same time, still sufficient is to warrant the use of the name deciduous, and some curious errors have been made by supposing the tree to be dying off or in a bad state of health. The largest specimen I have seen is growing on Lord Derby's Holwood property, in Kent, and where for many years I noticed the late autumn shedding of the foliage, curiously bare appearance of the tree in winter, and shooting forth of the young leaves in spring. Further than the annual casting of the leaves, I could detect no difference between the species and variety either in the male or female cones, or in the length or colour of foliage ; generally, however, the leaves are shorter, and the cones sparsely produced, when compared with the ordinary run of the Lebanon Cedar. The specimen referred to is in perfect health, and about 65 feet high.

C. LIBANI NANA, *Loudon*.—This is of very dwarf growth, specimens upwards of twenty years old being only 4 feet in height, and about the same in branch spread, obtusely cone-shaped, and abundantly supplied with dark green foliage.

The flattened, horizontally arranged branches readily reconcile it with the species, the only difference being that these are so thickly produced one above the other that the hand cannot be passed between any two, this giving the plant a dense, somewhat stiff appearance, that is further augmented by the almost uniform length of the branches. There is no perceptible difference in the foliage from that of the species; perhaps generally the leaves are shorter and decidedly sharper, and average between three-quarters of an inch and 1 inch in length.

This must be considered as a real dwarf form, and as it is of neat growth, and with foliage of a pleasing dark bluish green tint, its propagation and dissemination is more to be desired than is that of many so-called pigmy conifers. Growing in grounds near Hemel Hempstead, in Herts, are good examples of this dwarf and interesting Cedar.

C. LIBANI PENDULA, *Knight*.—Considering how very distinct and beautiful this variety is, one can only wonder that it is not more common. The branches are gracefully pendent, and the drooping tips hang over each other in the easiest possible manner. A fine old tree, bearing cones in abundance, may be seen in the village of Dulwich.

C. LIBANI SARGENTI PENDULA.—A handsome prostrate form with trailing branches which rarely rise more than a foot from the ground.

CEPHALOTAXUS, *Siebold et Zuccarini*

THE CHINESE AND JAPANESE YEWS

Flowers diœcious, in globular heads.

Fruits several, drupaceous.

Seed solitary, almond-like, with no true aril, enclosed in the fleshy cup.

Leaves linear, alternate, in two rows.

Evergreen trees or shrubs, with the leaves arranged alternately in two rows. Natives of China and Japan.

CEPHALOTAXUS DRUPACEA, *Siebold et Zuccarini*.

Plum-fruited Cephalotaxus. Japan. About 1829. —This is here seen as a low shrub, of rather irregular growth, with flattened, horizontally arranged branches, and short, stiff branchlets. The leaves, which are arranged in two opposite rows on the upper sides of the branches, are, particularly towards the branch tips, upturned, or so nearly erect that they form a triangular-shaped trough. Towards the branch extremities the leaves are $1\frac{1}{4}$ inches long, about half that nearer the stem, distinctly keeled, and of a deep green above, and with two broad silvery bands on the under side. For nearly the entire length they are one-eighth of an inch wide, and abruptly pointed. The damson-like fruit, produced usually in threes on the under sides of the branches, are ovoid in shape, but much narrowed at the base, about $1\frac{1}{4}$ inches long by three-quarters of an inch in greatest diameter, and placed on short, stout footstalks. Each berry contains a solitary hard-shelled, nut-like seed, about three-quarters of an inch long, enclosing an almond-like kernel. The smell emitted by the fruit when bruised is highly offensive, resembling that of

dubbin. Although quite hardy in most parts of the country, yet the finest specimens I have seen were in southern England and Ireland. The situation should not be draughty or too exposed, and the soil about equal parts of loam and peat or leaf soil. As an ornamental species, the present shrub is well worthy of culture, the by no means stiff habit of growth and plentifully produced deep green leaves, often greenish yellow at the tips, with the curious purplish, plum-like fruit, rendering well-grown specimens both distinct and interesting.

C. FORTUNEI, *Hooker*. Fortune's *Cephalotaxus*. North China. 1849.—For general planting this would seem to be a more desirable species than the previous one; at least it succeeds at a greater number of stations in this country. The comparatively long and slender branches are horizontally arranged, and rather sparsely supplied with long, acute-pointed leaves, that are bright and glossy green above and silvery beneath. They are about 3 inches long, almost fleshy, and arranged in two opposite rows. The fruit is elliptic in shape, tapering to both ends, $1\frac{1}{4}$ inches long by three-quarters of an inch in greatest diameter, and produced usually singly, but occasionally in twos and threes. In light, peaty soil, where shelter is provided, it forms a neat ornamental and highly interesting specimen, and is worthy of greatly extended culture. For planting in shady positions it is likewise valuable.

C. PEDUNCULATA, *Siebold et Zuccarini*. (Synonym: *Taxus Harringtonia*, *Knight and Perry*.) 1829.—This is a distinct and free-growing

species of small and rather spreading growth, the branches being for the greater part whorled, and the branchlets flattened and horizontal. Leaves about 2 inches long and one-quarter of an inch wide, distichously arranged, bright green on the upper and with two distinct glaucous lines on the under sides. It is probably a hybrid between *C. Fortunei* and *C. drupacea*.

The male and female plants vary greatly in appearance, the foliage of the latter being generally shorter and of a paler green colour than that of the former. The fruit is oval in shape, and usually three in a cluster, each being $1\frac{1}{8}$ inches long by fully three-quarters of an inch in length. Male flowers oval-shaped on short footstalks, one-eighth of an inch long, and pendent from the axils of the leaves. This is an excellent shrub for planting in shady positions.

C. PEDUNCULATA FASTIGIATA, *Carrière*. (Synonym: *Taxus japonica*, *Hort.*)—This distinct and well-marked variety resembles in growth the upright yew, the branches being perfectly erect and the foliage somewhat spirally arranged. Usually, however, some of the branches, particularly those near the ground, have the horizontal growth of the species, while upwards they are strictly fastigate. The largest specimen in this country is at Penrhyn Castle, and which I had transplanted from the home nursery to a favourable site some years ago. In this specimen the peculiarity of growth is particularly noticeable, for at 3 feet and 5 feet from the ground several branches are growing in a perfectly horizontal manner, or almost at right angles to the main stem, while both above and below these

the branches are strictly fastigate. The leaves on the horizontal branches are distichously arranged, or in two opposite rows, while those on other parts of the tree are irregularly scattered or nearly spiral by their closeness along the shoots. As this *Cephalotaxus* is little known, the following description of the distinguishing characteristics may be useful: In habit and foliage it nearly approaches the Irish Yew, but the branches are rarely so erect and adpressed, nor the leaves of such a deep green as in those of that tree, while it rarely rises to more than 8 feet in height. The leaves are bluntly falcate, or more usually sabre-shaped, less than 2 inches long, by one-eighth inch broad, thick and fleshy, and for the greater part furnished with short footstalks. Above they are of a deep glossy green, with a distinctly raised narrow midrib, while beneath two rather indistinct silvery bands run along their full length. Both branches and branchlets have a peculiar channelled or ridged and furrowed appearance, caused by the long decurrent base of the leaves; these, in most instances, reach one-half an inch in length, and are persistent after the removal of the foliage. For a full account of this interesting shrub, see article by the present writer in *The Garden*, vol. xxx., 1886.

I was agreeably surprised a short time ago to find no fewer than eight specimens of this uncommon shrub in an old Hertfordshire garden. They had in all cases attained to full dimensions, were in robust health, and showed the peculiar character for which this conifer is remarkable—the lower tiers of branches horizontally arranged



Face page 42.

CEPHALOTAXUS PEDUNCULATA FASTIGIATA.

with the leaves in two rows, while those farther up are strictly fastigiate with spirally arranged foliage. In several of the specimens the lower branches covered a spread of from 10 feet to 12 feet in diameter, the foliage being of an intense and healthy green hue. Pollen catkins were produced plentifully on several of the plants, and on both the fastigiate and horizontal branches. The soil is a stiffish loam on chalk, and as showing how well adapted this *Cephalotaxus* is for planting in the shade, I might mention that several of the specimens got little or no direct sunshine. I am now almost convinced that there are not three species of *Cephalotaxus*, *C. Fortunei*, *C. pedunculata* (?), and *C. drupacea* being identical. There are, however, wide differences in the male and female plants.

C. PEDUNCULATA SPHAERALIS, *Masters*.—This differs principally in the fruit being almost spherical in shape, instead of oval as in the species. They are produced freely on a goodly-sized specimen growing on the Churchhill estate, North Ireland, far more freely than is the case with the species alongside which it is planted. The fruit is clustered, sometimes upwards of a dozen together, each berry being fully three-quarters of an inch in diameter, and containing an oval-shaped seed. The habit is more open than that of the species, and the foliage usually shorter.

From Wiston Park, Steyning, I have received fruiting specimens from several bushes of the above, which conclusively prove that as regards shape of fruit this is a very variable species. The form, with round or spherical berries, *C. pedun-*

culata sphaeralis, Masters, is one of the most distinct and remarkable, and is justly entitled to the name that has been bestowed upon it. In northern Ireland I have seen a tree bearing fruit in every respect similar to that of the Wiston Park specimens, thus proving that the variety is constant and widely distributed. There are, however, intermediate forms, in so far as shape of fruit is concerned, between the typical species, in which the berries are decidedly of oval shape, and the variety *sphaeralis*, which bears round or spherical fruit. Another very curious form has been sent to me in which the unusually small berries are of a clear yellow when ripe, at which stage they greatly resemble the small Californian grapes that have been sent into this country in such quantities during the past summer.

CRYPTOMERIA, *Don*

THE JAPAN CEDARS

Flowers monœcious; males in axillary spikes; females solitary, spherical and terminal.

Cones globular, prickly when ripe.

Scales palmately divided at the edge, wedge-shaped and loose.

Seeds four or five under each scale, with a slight membranous wing.

Cotyledons flat, leafy, from two to four, but mostly in threes.

Leaves linear, alternate (often heteromorphic), sickle-shaped, usually in five rows.

Large-growing evergreen trees, natives of China or Japan. In some of the varieties the primordial leaves are retained for an indefinite period of time.

CRYPTOMERIA JAPONICA, *Don*. (Synonyms: *Cupressus japonica*, *Linnaeus f.*; *Taxodium japoni-*

cum, *Brongn.*; *Cryptomeria Fortunei*, *Otto and Dietrich.*) China and Japan. 1842 and 1844.—Delighting and thriving most luxuriantly in cool, damp soils, the humid atmosphere of the British Isles is peculiarly suitable for the successful culture of this handsome and hardy conifer. Cold, draughty, and exposed situations it, however, cannot bear, so that in planting this fact should be borne in mind, while at the same time few coniferous trees can surpass the present species for thriving where the soil is stiff or cold and in a sunless situation. When seen under favourable conditions, the Japan Cedar is a tall, portly tree, of somewhat broadly conical shape, with a clean, straight stem, horizontally spreading branches, often slightly drooping, with upcurved tips, the lateral ones divided into numerous frondose branchlets, thickly covered with dark bluish green foliage. The rigid leaves are fully one-half an inch long, incurved or awl-shaped, slightly quadrangular, turned towards the stem, and indistinctly marked with two glaucous lines underneath. Both male and female cones are abundantly produced, the latter being almost globular, about three-quarters of an inch in diameter, usually singly and erect, with the scales serrated at the edges, so that the fully developed cone is rough and prickly. Quite a feature of the tree are the male catkins, which grow thickly in axillary spikes in the leaf axils, usually towards the branch extremities. A peculiarity of the cones is that in some instances the axes elongate and produce foliage leaves at their apices, thus imitating in a marked degree those of *Cunninghamia sinensis* and several

species of *Picea*. When favourably situated, the rate of growth is rapid, one specimen that I measured having reached the height of 74 feet in forty-two years. Home-grown timber of this tree is very light in proportion to the bulk, and bears a marked resemblance to that produced in its native country. It is white, or rather inclined to yellowish white, soft, easily indented, and pleasantly perfumed. For a full description of *Cryptomeria japonica*, see my article in *The Journal of Forestry*, vol. xi., 1886.

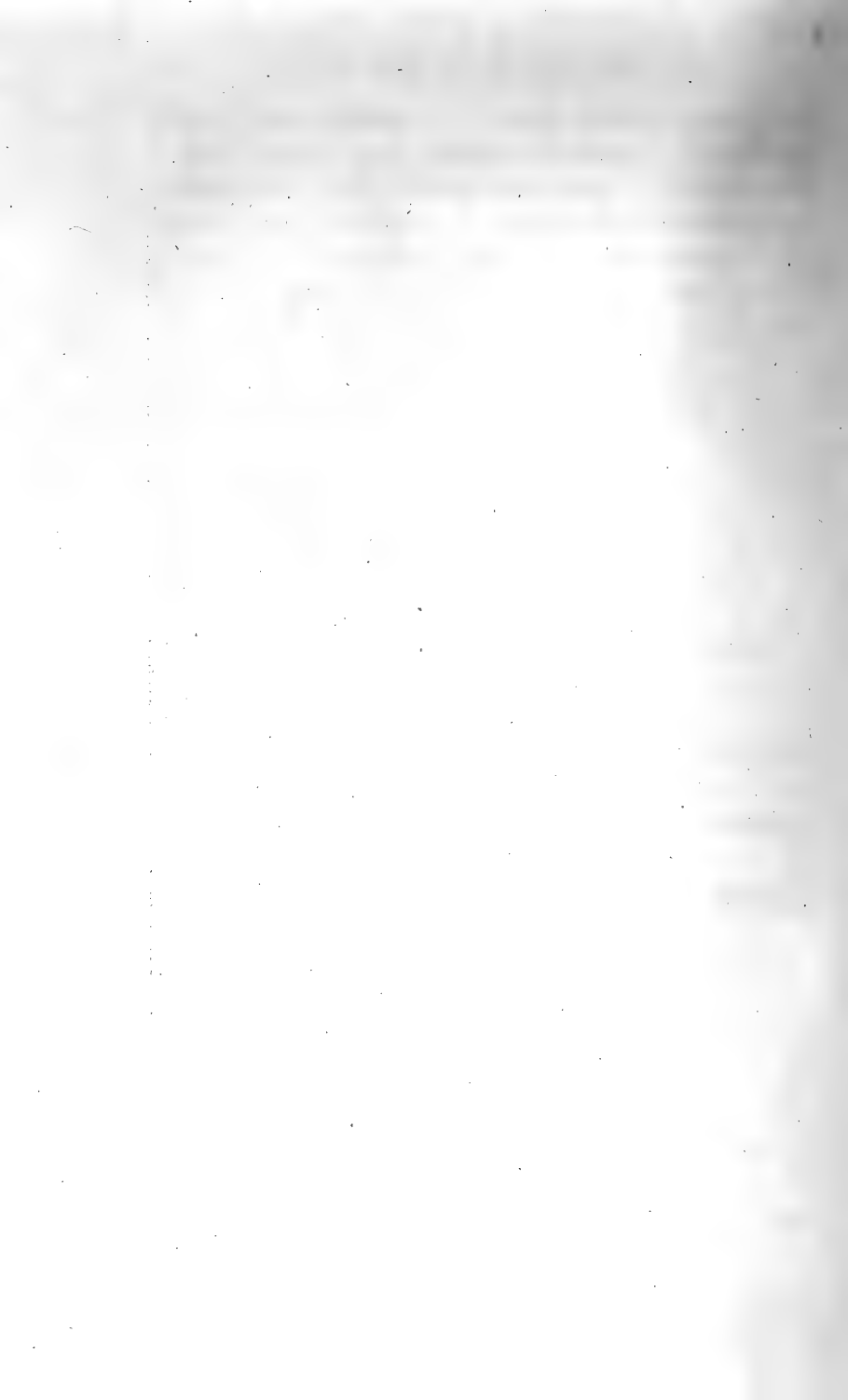
C. JAPONICA ARAUCARIOIDES.—This is a small-growing and neat-habited shrub with short, regularly arranged leaves, and slender almost undivided branches. The foliage being thickly arranged, causes the plant to have a dense, massive character, while the colour in healthy specimens is a dark bluish green. From dried specimens of *C. japonica lycopodioides*, Carrière, that have been sent me, I am inclined to believe that the two varieties are identical.

C. JAPONICA ELEGANS, *Veitch*. 1861.—This differs greatly both in habit and appearance from the species, and produces cones very sparsely, these, however, being indistinguishable from those of the species. It is unquestionably one of the most desirable and beautiful of hardy conifers; the remarkable change in colour from the bright green of the warm season to the bronzy crimson of the winter and early spring months, combined with the elegant outline and perfect hardihood, places this variety in the front rank of useful and ornamental trees of medium proportions. It stands exposure better than the species, and, like



Face page 46.

CRYPTOMERIA JAPONICA.



that tree, will grow on cold, stiff soils where only a limited number of conifers could subsist. In a young state it is apt to form several leading shoots, and sometimes ungainly side branches, which should be removed by timely and well-directed pruning. The cones are five-eighths of an inch long; and the leaves, in which the primordial shape is retained for an indefinite period, rather longer than the cones, flattish, velvety in texture, and abundantly produced. Cones were produced at Holwood, in Kent, in 1917.

C. JAPONICA ELEGANS NANA.—This should not be confused with the dwarf form of the species, which is also known under the varietal name of *nana*, the present plant retaining its coppery tint during the winter and early spring months. It is of small growth, thickly branched and foliaged, the branchlets being shortly pendulous.

C. JAPONICA LOBBI, *Veitch*. 1853.—Compared with the species, this forms a tree of narrower and more compact outline, the leaves also being of a brighter and more vivid green colour and shorter. It is equally vigorous as the species, and in this country has attained to stately dimensions, with a straight, well-formed trunk that is furnished throughout with bushy, thickly foliaged branches, the spread of which is usually less than one-third of the height.

C. JAPONICA NANA is of dwarf growth with thickly arranged branches and foliage.

C. JAPONICA SANDERSII, which originated in Cork, is of dense habit, with very distinct foliage.

C. JAPONICA SPIRALIS.—Though quite distinct and noteworthy, this cannot be described as an

ornamental variety. The branches are lithe and weak, irregular as to length and arrangement, and having short, closely incurved leaves of a dull green colour, and so thickly and shortly set as to appear in a spiral manner throughout the entire length.

C. JAPONICA VIRIDIS is of a much darker green than the typical form.

CUNNINGHAMIA, *R. Brown*

Flowers monœcious.

Cones globular or ovoid; sometimes with the axis elongated into a leafy shoot.

Scales without bracts, acute-pointed.

Seeds, three under each scale, winged, pendulous.

Leaves lanceolate, flat.

Cotyledons, two.

A medium-sized evergreen tree from China, nearly allied to *Araucaria*.

CUNNINGHAMIA SINENSIS, *R. Brown*. (Synonyms: *Belis jaculifolia*, *Salisbury*; *Pinus lanceolata*, *Lambert*.) Southern China. 1804.—This tree is of too tender constitution for the climate of Britain generally, still in certain favoured localities, particularly within the influence of the sea, it does very well, and forms a handsome specimen, which for distinct appearance and beauty of foliage has few equals amongst coniferous trees. In no other conifer with which I am acquainted is there so diverse an appearance of foliage, the pleasant pale green of the younger foliage affording a striking contrast to the deep, almost yew-green of the older leaves.

As an ornamental tree of very unusual appearance, the *Cunninghamia* should find a well-chosen

spot in every collection, for although somewhat tender in unfavourable districts, yet in many places it has stood perfectly unharmed through our most severe winters, when other so-called hardy conifers were badly injured by the frost. The branches are horizontally arranged, rather tortuous, and covered with smooth, dark brown bark, as in a young *Sequoia*.

The leaves are various in colour, the oldest being brownish green, while those produced during the past five years are of all shades, from dark green to the lightest and freshest of pea-green, with two distinct silvery lines above, and two rather indistinct lighter-coloured bands on each side of the prominent midrib beneath. They are lance-shaped, $1\frac{1}{2}$ inches long, and slightly serrulated on the edges. The cones are terminal, sub-erect, $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, and usually borne singly, and about three on each branchlet. They are formed of about thirty-six imbricated, persistent scales, with three seeds beneath each, the whole cone thus containing about one hundred seeds. A peculiarity of the cones of this tree, and which, according to Sir Joseph Hooker, sometimes occurs in spruces, is that after being fully formed, the axis continues to elongate, and produces leaves which are in no way different from the ordinary foliage. Stranger still, but this has not been noticed in any other conifer, the elongated portion throws out buds and produces twigs in the usual manner, the cone gradually disappearing when, after the third year, no trace of it can be detected, and the branch has elongated to 6 or perhaps 8 inches. This conifer throws up suckers from the base of the stem.

The finest specimen I have seen, and from which these notes were compiled, was growing in the flower garden at Penrhyn Castle, North Wales, and attained to the noble height of fully 50 feet. At Claremont, in Surrey, I have also seen a well-developed specimen. The timber is clean, firm, and of a desirable mahogany colour, and polishes nicely. At the Surveyors' Institution, London, a large slab of home-grown timber of the *Cunninghamia*, which I sent there from Esher Place in 1895, shows well the quality and graining of the wood. Sandy loam, with a free admixture of decayed vegetable matter, suits the *Cunninghamia* well.

C. SINENSIS GLAUCA is well explained by the name, the foliage having a decidedly glaucous tint, which appears to be constant.

CUPRESSUS, *Linnæus*

(Including *Retinispora* and *Chamæcypris*)

THE CYPRESSES

Flowers monœcious; males spiked, cylindrical; females rounded.

Cones woody, globular, or oblong, and with numerous seeds to each scale. They vary from one-quarter to nearly 2 inches in diameter.

Scales peltate, from six to ten, terminating in a more or less curved point.

Seeds numerous, winged, inserted on the upper interior surface of the scales.

Cotyledons leafy, mostly two.

Leaves scale-like, closely imbricated, never, in two ranks, but generally four-rowed.

Branches irregularly arranged along the stem.

Buds not scaly.

After a careful and lengthened study of *Retinispora* and *Chamæcypris*, under almost every phase of cultivation in this country, I have followed others in including both under *Cupressus*, the general habit, foliage, and fruit clearly pointing out that they have no claim to separate generic positions.

CUPRESSUS ARIZONICA, *Greene*. Arizona Cypress. California, Arizona, New Mexico. 1891.—This recently introduced conifer is of bushy, compact habit, with wide-spreading branches, and closely imbricated silvery glaucous foliage. The cones are nearly spherical, with a small umbo to each scale. The handsome form and colour and the neat disposition of its foliage will gain for this species many admirers once it becomes better known. It has been referred to *C. Benthami*, a tree of very uncertain identification.

C. CASHMERIANA, *Royle ex Carrière*. (Synonyms: *C. funebris glauca*, *Masters*; *C. torulosa Kashmeriana*, *Kent*.)—This elegant tree, with its remarkably pendulous habit and bluish green foliage, is certainly the most beautiful of all the Cupresses, but it is unfortunately not hardy in our climate, except perhaps in a few favoured spots in the south-west of England and in Ireland. It was formerly considered to be a well-marked variety of *C. funebris*, but it differs from that species in having more numerous seeds and is probably, therefore, more nearly allied to *C. torulosa*, and indeed may be a seminal variety of that species. There is no evidence that this cypress has ever been found in a wild state. The only specimen of any size in this country was the one formerly cultivated in the Temperate House at Kew, but this was cut down two or three years ago.

C. FORMOSENSIS (Giant Cypress of Formosa).— This recently introduced species is only to be recommended for planting in the warmer southern and western parts of England and Ireland. At Tortworth Court, in Gloucestershire, it survived the winter of 1916–17, though killed outright in other parts of the country.

It is of distinct appearance, greatly resembling *Cupressus pisifera* in foliage and bark colouring. The foliage is of a beautiful green tint, and the bark, especially of the young shoots, of a pleasing cinnamon brown colour. The tree is of open habit. In Formosa this conifer attains an enormous size. A tree growing on Mount Ari, which measures 125 feet in height and 67 feet in girth, is figured in Mr. Clinton-Baker's *Illustrations of Conifers*.

C. FUNEBRIS, *Endlicher*. (Synonyms: *C. pendula*, *Staunton*; *C. amœna*, *Karl Koch*.) China, Sikkim. 1846.—This is, unfortunately, a conifer that cannot be depended on in point of hardihood for indiscriminate planting in any but the more favoured and maritime parts of the British Isles. It is remarkable in presenting striking changes in its aspect during the various stages of growth; and at the same time needle-like leaves resembling those of some forms of the so-called *Retinispora*, and scale-like, closely appressed foliage may be found on the same tree. When young it is usually of compact and upward growth, but with advancing years it becomes gradually gracefully drooping. On young trees the leaves are distant, linear, and decidedly glaucous, whereas in older specimens they are oval, and closely imbricated,

usually in four rows, or both forms may occur at the older stages. The cones are spherical and half an inch in diameter. It succeeds well by the sea-coast in several parts of southern England, the largest specimen I have measured being in the grounds at Walmer Castle, which was planted by Lord Granville in 1868.

This tree is 30 feet high with a branch spread of 18 feet, the stem girthing 2 feet 7 inches at a yard from ground level. It is well furnished with branches, the tips of which hang down in some instances for 2 feet, when they present an unusual and beautiful appearance. Cones are plentifully produced, and the tree, judging from present appearance, has not suffered in the least during the past unusually severe winter. It may be of interest to state that this Cypress and other rare trees at Walmer Castle were supplied by Masters, nurseryman, Canterbury, father of Dr. Maxwell T. Masters the recognised authority on coniferous trees.

C. GOVENIANA, *Gordon*. Gowen's Cypress. (Synonyms: *C. californica*, *Carrière*; *C. cornuta*, *Carrière*.) California. 1846.—When seen in a flourishing condition, which, unfortunately, is not often the case in this country, *Cupressus Goveniana* is at once one of the most interesting and beautiful of the hardy, or rather half-hardy, Cypresses. I have just had an opportunity of examining probably the largest, certainly the healthiest, specimens of this tree in the country, and of comparing it with the not very widely distributed *C. cornuta*, which by some authors has been elevated to specific rank. The two are in every respect identical, the bright green, fragrant, scale-like

leaves and curious horn-like projections at the scale-tips of the cones being well pronounced in both. Like the Chinese Juniper, one of the greatest points of attraction in *Cupressus Goveniana* is the pollen-cones, they being so thickly produced as to impart to the specimen a very unusual and beautiful appearance. The seed-cones, too, are freely produced, and are of the most harmonising tints of dark and light brown, and rendered distinct from every other species by the curious projections at the scale-tips, each of these being half an inch long. To the casual observer, *Cupressus Goveniana* looks like a dwarfed, globose specimen of the better-known *C. macrocarpa*; indeed, it is always bushy and dense of habit. The finest specimens of this and many other cypresses that I have seen are throughout Ireland, both north and south; and one of *C. Goveniana* only thirty miles from Belfast is nearly 40 feet high and fully half that in branch spread. It occupies no sheltered situation, and yet the foliage is green as a leek, and thickly and equally arranged on every side of the tree. The soil is moist loam.

C. GOVENIANA GLAUCA is, for ornamental purposes, superior to the species, the hoary, glossy blue foliage-tint reminding one of that of the Tamarisk-foliaged Juniper. This pretty variety is rare in cultivation, but it should not remain so long if the batch of young plants that I saw are to be placed on the market.

C. LAWSONIANA, *Murray*. The Lawson Cypress. (Synonyms: *Chamæcyparis Lawsoniana*, *Parlatore*; *C. Boursierii*, *Carrière*.) North California (Shasta), Oregon. 1854.—A thoroughly

hardy, free-growing, and beautiful tree, and one that combines the useful with the ornamental in a high degree. It has been planted largely in every part of the British Isles and in soils and situations that are widely different, yet it is rare to find a diseased or unhealthy specimen.

As an ornamental tree it is, perhaps, superfluous to say one word in favour of this cypress, its qualities in this particular being well known and justly appreciated. We may, however, refer to its cheerful and desirable shade of green all the year and to the gracefully recurved and feather-like branchlets, neither of which is surpassed by any other conifer. It is of columnar habit, but not formal in outline, as it is relieved by the drooping spray and elastic leading shoot, the latter being just sufficiently tilted to one side to impart a pleasing finish to the tree. The branchlets are slender and flattened, the decurrent leaves arranged thickly in alternately opposite pairs, while the usually solitary roundly compressed cones are about the size of peas, each composed of seven scales and about nineteen seeds. The male catkins are bright red and very conspicuous. The timber is of a pleasing yellow colour, remarkably close of grain and takes a nice smooth polish. It has been used for panelling and furniture with good results, but out of doors it has not proved so lasting. The rate of growth is somewhat rapid, specimens of which I have kept a record having attained to the height of 43 feet in twenty-seven years. It may be of interest to state that I have seen self-sown plants of the Lawson Cypress along the margins of boggy woodlands in northern Ireland.

C. *LAWSONIANA ALBO-SPICA* is not a very desirable variety, though perhaps less unhealthy in appearance than other patchy variegated conifers. The whitish branch tips turn almost the normal green with the advent of winter.

C. *LAWSONIANA ALLUMI* is of strict growth, with distinct and very pleasing bluish green foliage. It is a neat and interesting variety, and worthy of culture where ground space is confined.

C. *LAWSONIANA ARGENTEA* is of moderately compact growth, and rarely rises to a great height. The foliage is extremely pleasing, being of a decided silvery grey tint and constant in character.

C. *LAWSONIANA BOWLERI* is a close and compact growing mass of semi-pendulous deep green branches and a good supply of branchlets.

C. *LAWSONIANA CÆRULESCENS* is a dwarf, bushy variety, growing about 3 feet high, and with numerous and much divided branches plentifully supplied with bluish green foliage, faintly marked on the upper sides with silvery grey bands. It is a decidedly worthy variety and should have a chosen spot in the ornamental grounds.

C. *LAWSONIANA DENSA*, which originated in the Bagshot Nurseries, is of compact growth and remarkable for the attractive appearance of the foliage.

C. *LAWSONIANA ELEGANTISSIMA*.—This is, perhaps, the best variegated variety of the Lawson Cypress. It is of vigorous growth, of good habit, and with the bark and leaves of a delicate yellowish green tint.

C. *LAWSONIANA ERECTA VIRIDIS*.—This is one of the commonest varieties in cultivation, of taper-

ing outline, with the branches closely set on and appressed to the stem. The foliage is of the brightest green the whole season through. Excellent for planting in confined spaces, but too formal of growth for general use.

C. *LAWSONIANA FILIFERA* is of easy spreading growth, but taller than broad, and remarkable for the long and slender branchlets, the tips of which are tasselled, and of a semi-pendulous character.

C. *LAWSONIANA FLEETI*.—This is quite distinct, the growth being very stiff and erect, and the foliage of a pleasing bluish grey glaucous hue.

C. *LAWSONIANA FLETCHERI*.—A very neat pyramidal conifer that grows only about 15 or 18 inches high, and is of sturdy, compact habit. It grows densely, and is of elegant appearance, and should prove a very useful shrub for large rock gardens and for grouping in the pleasure-grounds near the house. F.C.C., Royal Horticultural Society, May 20. Messrs. Fletcher Bros., Ottershaw Nurseries, Chertsey.

C. *LAWSONIANA HASKIN'S VARIETY* is certainly one of great merit, the young shoots being of a delightful orange yellow colour, and quite distinct from anything we have before us. It originated as a seedling at the Branksome Nursery, Bournemouth.

C. *LAWSONIANA INTERTEXTA*.—This has no particular merit when compared with the species, the branch growth being very robust, while, owing to the branches being far apart, the plant has a rather untidy and open appearance. The partially drooping branch tips are a redeeming quality.

C. *LAWSONIANA LUTEA* is of compact habit, the

branch tips being golden yellow, but the variegation is inconstant, and varies much in depth of tint with the particular specimen.

C. LAWSONIANA LYCOPODIOIDES has growths which resemble some of the Club mosses.

C. LAWSONIANA NANA is only suited for rock work or ornamental gardening. It rarely exceeds 2 feet in height, and is of rounded and close-growing habit.

C. LAWSONIANA POTTENSI is one of the neatest and most elegant of the Cypresses. It is of distinct and pleasing outline, forming an attenuated pyramid, and is of dense habit with slightly glaucous foliage, which is soft to the touch. A desirable variety.

C. LAWSONIANA MILFORDENSIS is of neat, compact habit with distinctly glaucous foliage. It is a desirable form that is well suited for planting where space is confined. From Fisher, Son and Sibray, who supplied the illustration.

C. LAWSONIANA STEWARTII would appear to be a greatly improved form of *lutea*, but of stronger growth and preferable for garden purposes.

C. LAWSONIANA STRICTA, as the name denotes, is another of the upright growing kinds, but it is less tapering of growth than most, and probably not distinct from *C. Lawsoniana erecta viridis*.

C. LAWSONIANA TRIOMPHE DE BOSKOOP is a capital variety of shrubby growth and valuable as a pot plant.

C. LAWSONIANA WISSELI is a most desirable small-growing, columnar variety that is valuable for the rock garden or other confined spaces.

C. LUSITANICA, *Miller*. The Cedar of Goa.



Face page 58.

CUPRESSUS LAWSONIANA MILFORDENSIS.

(Synonyms: *C. Lindleyi*, *Klotzsch*; *C. glauca*, *Lamarck*; *C. pendula*, *L'Héritier*.) Mexico.—This is a beautiful species—indeed, may well be described as one of the most distinct and graceful members of the family to which it belongs. The trunk is well clothed with somewhat pendulous branches, the foliage being scale-like and closely imbricated. Fruit is produced in great quantity, the individual cones being about the size of those of The Lawson Cypress, but with a distinct hooked appendage on the outer side of each scale. Both fruit and leaves are covered with a beautiful glaucous bloom. In maritime situations it succeeds best; and by far the finest trees I have seen are throughout Ireland generally.

C. LUSITANICA BENTHAMI, *Endlicher*.—This variety, often grown in gardens under the name of *C. Knightiana*, may generally be recognised by its flattened regularly pinnate branchlet systems, the pinnæ being all disposed in one plane. The cones are not so conspicuously glaucous as in the type which has the ultimate divisions of the branchlets arising at different angles. Probably the best specimen in the British Isles is the beautiful tree on Fota Island, Ireland, now about 75 feet high by 7 feet 4 inches in girth.

C. MACNABIANA, *Murray*. (Synonyms: *C. glandulosa*, *Hooker*.) California, Mount Shasta. 1854.—Although this is a very beautiful and distinct species, it has never found much favour with the British tree planter. This is certainly to be regretted, as the low compact habit of growth and deep bluish green glandular foliage render it a very distinct and desirable species.

C. MACROCARPA, *Hartweg*. Monterey Cypress. (Synonyms: C. *Lambertiana*, *Carrière*; C. *Lambertiana fastigiata*, and C. *Hartwegii*, *Carrière*.) Monterey, California. 1848.—There is something remarkably pleasing about this tree, especially when seen at its best within the influence of the sea—the graceful spreading habit, plentiful supply of branches, which are well furnished with dark grass-green foliage, and stately form of growth, rendering it as unique as it is desirable.

The branches are very closely arranged, but heavy and massive, with an upward inclination, although the flat, Cedar-of-Lebanon-like appearance characterises certain specimens, and are longest at about midway up the stem. It is readily distinguished from other species by the large size of the cones, these averaging 2 inches long, by fully 1 inch broad. They are of a light brown colour, and usually borne in clusters of three or four. For a full account of *Cupressus macrocarpa*, illustrated, see my article in *The Garden*, vol. xxix., 1886.

C. MACROCARPA FASTIGIATA, *Masters*.—This is a well-marked variety, in which the erect branches closely press on the main stem, the diameter of spread in a specimen 50 feet in height being only 16 feet. It is well, however, to remember that intermediate gradations between the spreading and pyramidal forms are by no means uncommon. The foliage in both trees is of the brightest green; and the long whip-like shoots, with the conspicuous reddish bark, impart a peculiar grace to healthy specimens. As an adjunct to our somewhat limited list of seaside conifers, this cypress

is of undoubted value, flourishing better in maritime than in midland parts of the country. It grows freely in the Orkney Islands. Home-grown timber is of excellent quality, being very beautifully grained, while it is of a deep yellow outwards and red towards the centre.

C. MACROCARPA GUADELOUPENSIS. Guadeloupe Cypress. (Synonym: *Cupressus gaudeloupenensis*, *Watson*.)—Judging from young specimens that I have seen, this will yet turn out to be a useful conifer for ornamental planting, should it be found hardy enough to withstand our insular climate. The branches are slender, and the foliage of an intense glaucous green colour, and which is a ready means of identification. The cones are much smaller than those of the species, being only 1 inch in diameter, and almost globular, each scale being provided with a projecting umbo. It occurs in Guadeloupe Island, off the coast of Lower California.

C. MACROCARPA LUTEA, *Dickson*.—Thanks to Messrs. Dickson, of Chester, no brighter or in every way more desirable conifer has, for many years at least, been brought before the public than the subject of this note. The habit is graceful, the colouring rich and subdued, while the striking difference in tint between the bright cinnamon of the bark and soft golden hue of the delicately fragrant foliage still further adds to the value of the cypress for strictly ornamental purposes.

There are an upright and a spreading form of the Monterey Cypress in cultivation, and evidently this golden variety has been raised from the former,

the habit of growth being just sufficiently strict to impart a neat and pleasing outline, the stiffness and formality usually attending fastigiate conifers being quite lost sight of in the lithe, slender, and finely divided branches and branchlets.

In certain golden conifers the foliage colouring is too glaring and pronounced, and several have fallen into disuse on this account—a fault that can certainly not be found with the present plant, which, though strikingly distinct, is yet of a decidedly rich and subdued tone. There is nothing patchy about the foliage colouring, the whole being regularly suffused with the warm golden tint for which the plant is so remarkable, this extending not only to the leaves but to the bark of the young wood as well. Being of good habit, perfectly hardy, and retaining the lower branches intact, it makes an excellent pot plant, and stands long-continued drought and neglect in a wonderful manner.

The Royal Horticultural Society awarded a First-Class Certificate to this conifer, but a further proof of its popularity is the rapid rate at which it is being propagated in some of the London and suburban tree nurseries. *Cupressus macrocarpa lutea* has grown rapidly and attained to large dimensions in the grounds at Chigwell House, Pinner, where some of the specimens are 40 feet high, with stems which girth 26 inches at a yard from the ground. They are in perfect health and show off to perfection the lovely golden hue of the thickly produced foliage.

C. NOOTKATENSIS, *Lambert*. Alaska Cypress.

(Synonyms: *C. nutkaensis*, *Hooker*; *Chamæcyparis nutkaensis*, *Spach*; *Thujopsis borealis*, *Carrière*.) Vancouver Island, Oregon, British Columbia. About 1850-1853.—This is a fine, spreading branched tree, with an exterior resemblance to *C. Lawsoniana*, but certainly inferior to that species in point of ornamental appearance. It is somewhat stiff and rigid in outline, the main branches having a partially upright tendency, with numerous drooping branchlets, thickly clothed with small, closely imbricated, sharp-pointed leaves, of a rich dark green above, slightly glaucous beneath, and emitting a pungent odour when crushed. The cones are nearly spherical in shape, each half an inch in diameter, composed of four scales with, on an average, eleven seeds. The male catkins are sulphur yellow.

For economic planting, this cypress is well worthy of attention, it being of undoubted hardihood, and producing valuable timber which is of a pale yellow colour, light in proportion to the bulk, and very durable. Trees of twenty years' growth are, from a great number of measurements I have taken, usually about 19 feet high, rarely more, while the taper in the trunk is greater than in any other of the species.

That there is a great exterior resemblance between *Cupressus Lawsoniana* and *C. nootkatensis* cannot be denied, and in consequence one frequently does duty for the other. The differences are, however, markedly characteristic, for if the strong pungent smell of the foliage of *C. nootkatensis* were not sufficient, even in the dark, the more pendulous branches, larger cones with

distinctly reflexed scale protuberances and sulphury yellow catkins should render recognition by no means difficult. It may be well to add that the cones of *C. Lawsoniana* are almost smooth, or only with a film-like appendage, and the pollen catkins usually bright red. The cones of *C. nootkatensis* have four scales and eleven seeds, those of *C. Lawsoniana* seven scales and nineteen seeds; while of the former 112,000 seeds go to the pound weight, as against 105,000 of the other. Unfortunately, for its value as a forest tree, the stem of *C. nootkatensis* is invariably carrot-shaped—thick at the base with a rapid tapering upwards—and this is noticeable everywhere throughout the country.

C. NOOTKATENSIS ARGENTEA-VARIEGATA differs only in having some of the branches spotted with, or wholly, creamy white.

C. NOOTKATENSIS AUREA-VARIEGATA is a beautiful and distinct variety for which we are indebted to Messrs. Waterer of the Bagshot Nurseries. It is clearly and regularly variegated.

C. NOOTKATENSIS COMPACTA is characterised by a dwarfer and more compact habit of growth than the type, and is valuable where space is limited, or for variety.

C. NOOTKATENSIS LUTEA, of which there is a large specimen at Penrhyn Castle, in Wales, is far more ornamental than the typical tree, the branch tips being of a light and pleasing yellow colour. In this variety the branchlets, being pendulous, and hanging limp and easy for fully 1 foot in length, render the trees both distinct and desirable.

C. NOOTKATENSIS PENDULA is remarkable for the graceful pendulous branchlets, which remind one of those of the weeping-willow. It is a very distinct form from the Milford Nurseries, Godalming, but, so far as I know, is not yet generally cultivated.

C. (RETINISPORIA) OBTUSA, Koch. (Synonyms: *Chamaecyparis obtusa*, Siebold et Zuccarini; *Retinispora obtusa*, Siebold et Zuccarini; *Thuja obtusa*, Masters.) Mountains of Japan and Formosa. 1861.—Although of rather stiff habit, the outline being regularly conical, dense growth and deep green hue, there is something remarkably pleasing and distinct about a well-grown specimen of this Japanese conifer. In this country the tree has attained, in some few instances, to nearly 40 feet in height, with crowded branches and flattened, frond-like branchlets, well supplied with small scale-like, sub-acute dark green leaves, which have distinct silvery white Y-shaped markings on the under surface. The cones are quite round, about half an inch in diameter, and composed of from eight to ten scales, having an umbo on their outer surface. *C. obtusa Crippsi* is a very ornamental variety in which the long, pendent, thread-like growths vary from pale sulphur to golden yellow in colour. It is of slender and less dense growth than most of the forms.

C. OBTUSA FILICOIDES, when seen in good form, is a desirable variety in which the equally arranged fern-like branchlets, furnished with the brightest green foliage, which is of a silvery tint beneath, are points of recognition. The leaves are imbricated in four rows, and the cones are rounded and

fully one-fourth of an inch in diameter. It is of denser and dwarfer habit than the parent.

C. OBTUSA FILIFERA is rendered distinct from every other variety by reason of the long, pendulous, thread-like branchlets, often terminated by tufts of finely divided shoots. The leaves are subulate, distinct, and of a pleasing shade of green; while the cones or strobiles are about the size and shape of a small pea. It is one of the most distinct and desirable of ornamental conifers.

C. OBTUSA FILIFERA LUTEA is a distinct and highly ornamental variety in which the pendulous terminal growths are of a light, clear yellow. It is one of the most pleasing and desirable of hardy conifers.

C. OBTUSA LYCOPODIODES is a well-known dwarf variety, with curiously flattened branch tips, and of rather loose and ungainly growth. It frequently fails to grow in a satisfactory manner. The foliage is deep green in colour. Introduced in 1861.

C. OBTUSA NANA is another dwarf-growing form, but in point of beauty is hardly comparable with the previous variety.

C. OBTUSA PYGMÆA is a useful miniature conifer for planting amongst dwarf-growing plants on the rock-work or in the shrubbery. Rarely is it found more than 15 inches in height, but the spread is wide proportionately, and flattish, while the foliage does not lose one bit of its rich green hue the whole season through. Of all the miniature conifers, this Selaginella-like variety is one of the prettiest and most interesting.

C. OBTUSA TETRAGONA AUREA is shrubby in habit, with tufted branchlets, the ultimate ones tetragonal. The young shoots are golden in

colour which changes later on to green. Originated at the Elvaston Nursery in 1873.

C. (RETINISPORA) PISIFERA, *Koch.* (Synonyms: *Chamæcyparis pisifera*, *Siebold et Zuccarini*; *Retinispora pisifera*, *Siebold et Zuccarini*; *Thuya pisifera*, *Masters.*) Mountains of Japan. 1861. —This is readily distinguished from *C. obtusa* by its open habit of growth, and by its more slender and usually longer branches and feathery foliage. The branches are somewhat irregular of arrangement, though the outline of the tree is informally pyramidal, the leaves scale-like, four-rowed, and of a dark bright green, with two glaucous lines beneath. Fruit about the size of a pea, and borne in clusters of from two to ten.

C. PISIFERA PLUMOSA is a distinct and well-known variety, with numerous sub-erect branches, furnished with deep green, awl-shaped leaves. The feathery branchlets and rich colour render it a very desirable garden conifer. Introduced in 1861.

C. PISIFERA PLUMOSA ARGENTEA has silvery tinted foliage, and is highly ornamental.

C. PISIFERA PLUMOSA AUREA is even a more ornamental plant than the parent, with thickly set branches, the greater portion of which is of a desirable golden yellow colour. It is one of the best and most valuable of the small-growing ornamental conifers. Cones have been freely produced at Stanmore, in Middlesex.

C. PISIFERA SQUARROSA.—This is of bush-like growth, thickly arranged both in branches and branchlets, and with needle-shaped, silvery white leaves. Introduced in 1861.

C. PISIFERA SQUARROSA DUBIA is a compact

little bush, but varies a good deal both in shape and density of branches. The colour of foliage nearly approaches that of the previous variety but individually the leaves are stouter and longer. The cones of all these varieties are identical with those of *C. pisifera*.

C. SEMPERVIRENS, *Linnaeus*. (Synonyms: *C. fastigiata*, *De Candolle*; *C. pyramidalis*, *Tozzett*.) Levant, Himalaya.—This is of distinctly pyramidal growth, the branches usually heavy, and thickly beset with tiny branchlets, covered with smooth, imbricated, yellowish green leaves. The cones are plentifully produced, and, being of a light brown colour, contrast strangely with the heavy masses of foliage. Each cone is fully 1 inch in diameter, nearly round, and composed of convex angular scales, with a raised point in the centre of each. There is a noble clump of these trees at Penrhyn Castle, North Wales.

C. SEMPERVIRENS HORIZONTALIS, *Gordon*, differs only from the species in the spreading or horizontal branches and smaller cones, but it is by no means common in cultivation.

C. THURIFERA, *Humboldt*, *Bonpland et Kunth*. Mexico. 1836.—Recent investigations have shown that two distinct plants have been confused under this name. In 1817 Humboldt, Bonpland, and Kunth described *Cupressus thurifera* from specimens found in several Mexican localities. Endlicher, thirty years later, pointed out that the cultivated plant was really a true Cypress, while that of Humboldt is a *Chamæcyparis*, giving the name *Cupressus Benthami* to the garden plant. The cones of a plant sent home by Botterl from Mexico

as *C. thurifera* were found to have wingless seeds and non-peltate cone scales, characters which exclude it from *Chamæcyparis* and identify it as a plant belonging to the *Biota* section of the genus *Thuya*. Since identified as *T. orientalis Mexicana*.

C. THYOIDES, *Linnæus*. (Synonyms: *Chamæcyparis sphæroidea*, *Spach*; *Retinispora ericoides*, *Gordon*.) Eastern States of North America. 1736.—At all stages of its growth, and when in the flush of health this cypress is a tree of beauty, the evenly spreading, flattened, fan-shaped branches, rich glaucous foliage, and dense pyramidal outline being its chief characteristics. The leaves are closely appressed, and the small, glaucous cones the same shape and size as peas.

It delights in a dampish, loamy peat, and it will even put on its best form in pure but partially reclaimed peat bog; indeed, by far the finest specimen I have seen was growing by the margin of a mixed pine and birch wood in Ireland in the latter class of soil. At Kew there are several trees of this kind 25 feet high. It has not been widely planted.

C. THYOIDES HOVEII is the most remarkable deviation from the species of any of the varieties. The branchlets are here and there of quite a tufted appearance, owing to the number and closeness of the slender terminal twigs. It is of no particular value. It originated in a French nursery in 1850 and was sent out about 1861.

C. THYOIDES LEPTOCLADA, *Masters*, is of low shrubby growth and strict habit, with closely arranged branches which terminate in flattened branchlets, with foliage of two distinct kinds—scale-like and awl-shaped—and bluish grey

of colour. Raised in a French nursery about 1850.

C. THYOIDES NANA is a dwarf and pretty form with bright, shining green foliage, especially when planted on damp soils.

C. THYOIDES VARIEGATA has some of the branch tips of a golden yellow, but the amount of variegation differs considerably with the particular specimen.

C. TORULOSA, *Don.* (Synonym: *C. Tournefortii*, *Tenore.*) Temperate Western Himalaya. 1824.—For planting where space is confined, few trees are better adapted than the one in question, the easy though columnar habit of growth, slender branchlets, and bright glaucous foliage being all desirable acquisitions. It prefers a mild climate such as prevails in the western and south-western counties. The branches, which are thickly produced, have a decided upward tendency, but are, nevertheless, not painfully so, as is the case with some conifers, for the tufted branchlets, with their easy arranged foliage, deprive it entirely of all stiffness and formality. The cones are globose, from 1 to $1\frac{1}{4}$ inches long, produced in dense clusters, and composed of about ten scales with seventy seeds. In cutting up the timber of a specimen that had attained to 43 feet in height, I found it hard, close-grained and fibrous, of a pleasing purplish yellow colour, and very fragrant, the latter being distinctly recognisable even when the tree was being felled.

C. TORULOSA CORNEYANA, *Carrière*, is of dwarf and more spreading growth than the species, and with the branches more lithe, slender, and drooping.



Face page 70.

CUPRESSUS TORULOSA AT WOBURN.

DACRYDIUM, *Solander*

THE HUON PINE

Flowers dioecious.

Fruit erect and fleshy.

Seed with a hard shell investing the kernel, and partially surrounded by an outer cup-shaped aril.

Leaves variable, scale-like, or needle-shaped.

These are evergreen trees, with variable foliage. Only one species has been found sufficiently hardy for outdoor culture in this country.

DACRYDIUM FRANKLINI, *Hooker f.* The Huon Pine. South and west shores of Tasmania.—Though usually branded with the title of “half-hardy,” and fought shy of by cultivators in consequence, yet this is by no means generally the case, for healthy and well-furnished specimens may be met with in many counties from Edinburgh southwards—specimens that have stood unscathed through the most severe winters we have experienced for many years back. As seen in this country, the Huon Pine is usually of pyramidal contour, the branch spread being very restricted when compared with the height. The trunk is erect and straight, the branches shooting off horizontally from the stem, and the crowded branchlets slender, pendulous, cypress-like, and imparting an elegant weeping habit of growth to the tree. The foliage is of a bright grass-green, almost pea-green, the leaves being small, scale-like, and closely packed together. The male catkins are solitary at the branch tips, and the fruit is small and fleshy. Soil would not seem to be a very important factor in the cultivation of the

tree, but situation must be attended to. Preferable, perhaps, is soil of a peaty loam or rich alluvial deposit, the latter particularly if a certain proportion of sand is present. Situation is evidently of far more importance, and this should always be sheltered and free from cold draughts, else the tree soon assumes a wretched and meagre appearance. It has attained to nearly 50 feet in height in various parts of Great Britain. The timber produced in its native country is highly valued, and good examples of it may be seen in the museum at Kew.

FITZROYA, *Hooker fil.*

Flowers diœcious.

Cones solitary, terminal, globose or star-shaped, and consisting of nine scales.

Seeds winged, three under each fertile scale.

Leaves usually three-ranked, flat, stalkless, and loosely imbricated.

An evergreen tree or shrub found on the Patagonian Mountains. In this country it rarely exceeds 18 feet in height.

FITZROYA PATAGONICA, *Hooker fil.* Mountains of Western Patagonia, Chile, Valdivia. 1849.—Though this tree thrives well in certain places and becomes a decidedly ornamental conifer, yet it is not to be recommended for general planting unless in the more favoured and warmer parts of the country. When seen, however, under favourable conditions, it is both distinct and ornamental, the deep green of the long whipcord-like branchlets, which are usually arranged in irregular semi-drooping masses, rendering fair-sized specimens different in appearance from almost every other conifer. It forms no permanent leader, but rather

several aspiring shoots, most of which are tilted over gracefully, and with the drooping side-shoots form the chief characteristics of the species. The leaves are whorled, usually in threes, sometimes in decussate pairs, deep grass-green above, and with a silvery glaucous tint beneath. The cones produced in this country are small globose bodies consisting of about three rows of whorled scales. The largest specimen I have seen is growing in a sheltered site on a steeply sloping bank on the Churchhill estate, County Armagh, Ireland; but there are many fine examples in this country from Gordon Castle, Banffshire, southwards. The soil in which the Irish tree is growing is loamy peat, with plenty of free, not stagnant, moisture. This specimen, with its long whipcord-like branch tips, is decidedly ornamental, and makes one wish that the species was more commonly planted.

GINKGO, *Linnæus*

THE MAIDENHAIR TREE

Flowers diœcious; males in umbellate pendulous spikes; females in terminal clusters or long pedicels.

Fruit drupaceous, and enclosed at the base in a fleshy cup.

Seeds erect, ovoid, and covered with a hard, bony shell.

Leaves deciduous, stalked, fan-shaped, and furnished with radiating nerves.

Cotyledons two.

A handsome, large-growing, deciduous tree, with fan-shaped eaves that are either tufted on short spurs or scattered on the longer growths.

GINKGO BILOBA, *Linnæus*. Maidenhair Tree. (Synonym: *Salisburia adiantifolia*, *Smith*.) Northern China. 1754.—There are many beautiful

specimens of this tree in almost every part of the British Isles, thus showing its general adaptability to the climate of this country. The glossy green fan-shaped leaves, cut up like some of the species of *Adiantum*, impart to this noble tree a distinct and remarkable appearance; indeed, in the light and open aspect, peculiarly shaped deciduous leaves, and stately dimensions we have in the Ginkgo one of the most distinct and pleasing of hardy trees. It is of rather spiry growth, with smooth fan-shaped, yellowish green leaves, both sides being of the same colour, and marked by parallel lines. Fruit oval, about the size of a walnut and enclosing a marble-sized kernel. Usually the male and female trees differ in appearance, the former being of more rampant and spreading growth than the latter.

G. BILOBA AUREA is decidedly an acquisition, the leaves being a beautiful sunny golden colour. It does not grow so quickly as the species.

G. BILOBA MACROPHYLLA differs in the much larger leaves, which are deeply divided into three or five lobes, these again being subdivided, and often toothed on the margins.

G. BILOBA PENDULA. Weeping Maidenhair tree.—As seen growing in the grounds of the Constitutional Club at Hythe, in Kent, this is at once one of the most distinct and beautiful of coniferous trees. The specimen in question is 28 feet high, with a branch-spread of 30 feet in diameter, the main stems—for there are two—girthing 4 feet 2 inches and 3 feet 10 inches respectively, at a yard from ground level. It is in every respect a perfect specimen, being well furnished with branches, the

tips of which hang down for a length of 4 feet, and impart to the tree an easy and graceful appearance. The probabilities are that it was planted by Masters, a nurseryman at Canterbury, who disseminated the funeral Cypress and many other rare conifers throughout that part of Kent. It is of Continental origin.

JUNIPERUS, *Linnæus*

THE JUNIPERS

Flowers diœcious, but frequently monoœcious; males in spikes; females short, axillary, and bracteated at the base.

Fruit a globular cone or berry, composed of from three to six fleshy scales.

Seeds erect, from one to four, mostly three in each fruit.

Leaves opposite or ternate, scale-like, the primary ones pointed, and linear or needle-like.

Cotyledons two.

These are evergreen trees or shrubs, and may be readily recognised by the berry-like fruit, which, when ripe, is for the most part deep purple, black, or reddish brown, and wingless seeds. Both foliage and fruit when crushed emit a pleasant resinous odour.

JUNIPERUS BERMUDIANA, *Linnæus*. Bermudas.
—In this country the situations are few where the present juniper can be said to succeed, and for this reason it is rarely met with in cultivation. In the north of Ireland, and in southern and western England, it succeeds fairly well, and on the sandy soil of Surrey I have seen a well-furnished and healthy specimen. It is thickly branched and of tapering outline, with scale-like imbricated leaves on the adult tree, those on the young plant being needle-like, and each about half an inch long.

The berries, which are usually produced singly at the branch tips, are smaller than those of our native species. The wood is readily worked, highly fragrant, and, when more plentiful than it is at present, was largely used in the manufacture of lead pencils. A free and light soil and half-shady situation suit it best.

J. CALIFORNICA, *Carrière*. (Synonyms: *J. tetragona osteosperma*, *Torrey*; *J. tetragona*, *Cooper*; *J. occidentalis*, *Gordon*.) Utah, Arizona, California. 1839.—According to soil and situation this species varies considerably, sometimes occurring as a far-spreading, bush-like specimen, while at others it ascends to nearly 30 feet in height. The foliage, too, at different stages of growth, varies greatly, the leaves on the younger plants being usually sharp-pointed, and arranged in threes, whereas in after years they are short, blunt, and imbricated. It grows best in sandy soil. In the absence of fruit it is difficult to distinguish the present species from the better-known and more generally cultivated *J. occidentalis*. The berries of the latter are not unlike those of our native species, while in *J. californica* they are larger, the berry being dry and containing only one seed, the stony coating of which is harder than that of any other species of my acquaintance. It is of tree-like growth, with thickly arranged branches and silvery greyish leaves, but it has no special recommendation for ornamental planting. The growth, even under the most favourable conditions, is remarkably slow.

J. CALIFORNICA UTAHENSIS is of low-spreading growth, with stout short branchlets, and an easy

and pleasing habit. It has not generally succeeded under cultivation in this country.

J. CEDRUS, *Webb*. Mountains of the Canaries.—Though little known and perhaps only hardy in the milder maritime parts of this country, the Mountain Cedar should be cultivated wherever conditions are suitable. In Cork it is quite hardy and has attained to a height of fully 20 feet. It should be planted in poor, dry soil, and where fully exposed to the sun its cedar-like habit and distinct beauty will increase with age. The leaves, which are thinly and equally arranged around the shoots, are awl-shaped, half an inch long and of a uniform dull green, relieved on one side by two rather indistinct silvery lines. The bark is of a dirty brown colour.

J. CHINENSIS, *Linnaeus*. Chinese Juniper. (Synonyms: *J. japonica*, *Carrière*; *J. flagelliformis* and *J. Reevesiana*, *Hort.*) Himalaya, China, Japan. 1804.—This is probably the most beautiful and accommodating of the several species of juniper. There are two forms—male and female—though occasionally I have seen both sexes present on one and the same specimen. The male or pollen-bearing plant is by far the most ornamental, and especially so during the spring months when laden with the conspicuous golden flowers. The habit is strictly erect, especially in the upper half, the foliage acicular, and of a pleasing bright green tint, though occasionally the leaves are scale-like and imbricated, particularly towards the top of the specimen. The conspicuous orange-yellow male flowers are in many cases so thickly produced that the branches are weighed down in consequence.

In the female plant the habit is far more spreading, the leaves are for the greater part scale-like and overlapping, and the berries small and purplish violet in colour. A most useful ornamental conifer of medium size.

J. CHINENSIS ALBO-VARIEGATA has many of the branchlets almost white in colour, the green portions also appearing of a brighter tint than that of the species. It is of dwarf, spreading growth.

J. CHINENSIS AUREA is surpassed by no other conifer of this class as a bright, golden foliaged shrub. It is of free, upright growth, with a plentiful supply of branches and foliage, and stands full exposure in a commendable way.

J. CHINENSIS (Japanese form). (Synonym: *J. japonica*, *Hort.*) This is a dwarf, spreading form of dense growth, with either acicular or scale-like foliage. On the adult plant the leaves are for the greater part ovate, blunt, and closely imbricated; while on the juvenile specimen they are generally straight, stiff, and tapering to a sharp point. The berries are sparsely produced, and usually singly at the branch tips; they are oval in shape, small, and of a glaucous purple colour. In Japan this form is most commonly to be met with. The dimorphous foliage, and size, composition, and arrangement of fruit have caused me to place this as a variety of *J. chinensis*.

J. CHINENSIS AUREA (Japanese form) is somewhat in the way of a dwarf plant of the golden Chinese variety, but the colour is not so deep nor so long sustained as in that well-known form.

J. CHINENSIS AUREO-VARIEGATA (Japanese form) differs from the preceding in having only a few

of the branch tips suffused with a golden yellow colour.

J. COMMUNIS, *Linnæus*. Common Juniper. Greater part of the Northern Hemisphere, Britain. —Whether as regards height, shape, or arrangement and colouring of foliage, this must be described as a very variable species. Altitude and elevation have no doubt much to do with this marked dissimilarity in appearance, but certainly not all, for even on our low-lying commons and downs the variety afforded by these wild junipers is something remarkable. In height we find them of all sizes, up to as much as 24 feet, some tall, straight, and tapering gradually throughout, others with rounded tops and nearly equal diameter from base to tip, while others again assume the spreading habit of growth, often forming broad, dense masses of not more than a couple of feet in height. Usually the female or berry-bearing plant is of lower growth and with more brightly tinted silvery foliage than the male or pollen-bearing one. The colouring of foliage is at all times beautiful, though varying greatly in different plants—sometimes a rich greenish brown, relieved here and there by silvery tones, at others a uniform greyish green, the dainty and delicate leaders alone being of a rich, warm brown. The leaves are awl-shaped, stout, sharp, and thickly arranged, varying in length and width, each being about three-eighths of an inch long, green or greyish brown on one side, and of a beautiful and distinct silvery tone on the other. Berries are produced very freely, in some cases constituting dense masses, the colour varying with age from

green, through purplish olive to a deep, glossy black, and each about the size of a pea. Both fruit and foliage emit a pleasant myrtle-like aroma when bruised.

J. COMMUNIS CANADENSIS. (Synonyms: *J. alpina*, *S. F. Gray*; *J. canadensis*, *Loddiges.*)—In habit and general outline this bears a great resemblance to the Savin (*J. Sabina*), while the leaves are stiff, narrow, and sharp-pointed, grey-green in colour, with a silvery band on the upper side. The growths are very irregular in length, thus causing the plant to have a straggling, and by no means pleasing appearance.

J. COMMUNIS COMPRESSA must be considered as the dwarfest of all hardy conifers, it rarely exceeding a few inches in height. It is of compact conical habit, a specimen of 5 inches in height being about 2 inches in diameter of branch-spread, the branchlets being slender and growing close together in an upward direction. The foliage is thickly produced, the individual leaves short and bright green, changing in severe winters to a dull brown. The rate of growth, even under the best cultivation, is remarkably slow, yet the plant never wears a dumpy or cushion-like appearance, as is the case with the majority of pigmy conifers.

Many years ago I had a specimen of the above sent to me by a botanical friend, it being then 4 inches high, and as pretty a miniature conifer as could be desired. To-day it is hardly one inch taller, very little wider in spread, and of as beautiful a blue-green as when originally received. Considering that it has been growing in the richest of leaf soil for several years and has hardly in-

creased in size, one cannot but wonder at the thickly produced foliage remaining so fresh and healthy. For rock-work it is a gem.

J. COMMUNIS CRACOVIA, *Loddiges*. Polish Juniper.—A decidedly ornamental variety, with an easy, half-pendulous, though upright mode of growth. The foliage is plentifully produced, and of a light green colour, but varies with the quality of soil in which the specimen is growing. In rather dampish loam, and where partial shade is afforded, it grows very freely, the foliage being thick and bright, and the branch tips gracefully pendulous, particularly those on the upper half of the specimen.

J. COMMUNIS HEMISPHERICA.—This is a distinct variety, and one that keeps constant in character. It only rises a short distance from the ground in a compact, almost globose mass, the leaves stiff, thickly produced, and of the same tint as those of the species, though not much over half as long. For rock gardening it is valuable, the rate of growth being slow, the outline compact, and the foliage pleasantly glaucous.

J. COMMUNIS FASTIGIATA. Irish Juniper. (Synonyms: *J. hibernica*, *Gordon*; *J. suecica*, *Miller*.) A well-known and widely dispersed variety of strictly columnar habit, the branches and branchlets being rigid, close set, and of decidedly upright growth. But not only in habit does this variety depart widely from the parent, for the foliage is also strikingly distinct, being shorter and of a deeper green, freely intermixed with silvery glaucous tints. This handsome and distinct form is said to have originated in Ireland,

but I have also found similar upright-habited forms wild at Keston, in Kent, and on some of the commons of Hertfordshire, particularly near Boxmoor. It also occurs in Sweden.

J. COMMUNIS NANA.—A neat little shrub, of spreading growth, the leaves being short, and so sharp and needle-like that it is difficult to handle the plant uninjured. The colour of foliage is greyish green beneath, and more glaucous above. Though rarely rising to a greater height than 8 inches from the ground, yet on the Snowdon range of hills I have seen it spreading to 5 feet in width. It transplants freely, and is useful for covering dry gravelly and chalky banks where little else would grow.

J. COMMUNIS NEABORIENSIS is a distinct and desirable variety of pyramidal growth, and remarkable for the stiff and very sharp-pointed leaves, which are of a shining glaucous green. It succeeds well under ordinary treatment, and forms a neat and pleasing specimen of upward growth.

J. COMMUNIS OBLONGA. (Synonym: *J. oblonga*, *Bieberstein.*)—This is a striking and beautiful form when seen in a thriving condition, which, unfortunately, is not always the case in this country. In shape it varies considerably, some specimens being decidedly procumbent, while others shoot up narrow and compact. It is, however, always pleasing, from the rich bright green of the foliage and the dainty grace of the slender branchlets. For a cool, porous soil it is a good subject.

J. DRUPACEA, *Labillardière.* The Syrian Juniper. (Synonym: *Arceuthos drupacea*,

Antoine et Kotschy.) Northern Syria, Crete. 1854. —In several respects this species must be considered as one of the most interesting of the junipers. It is of bold, upright growth, with a well-formed tree-like stem, and produces large plum-like fruit, quite distinct from any other of the family. The Syrian Juniper is often said to be of slow and small growth, but in this country, at least, such is not always the case, for a specimen that has long been under my observation has, in thirty years, attained to a height of 21 feet, the stem girthing 25 inches at one yard from the ground. Perhaps the worst fault of this species of juniper is the early loss of the lower branches after a height of 12 feet or thereabouts is reached, and this loss of branches is general, and it was noticeable in every specimen that I know of. Usually the habit of the Syrian Juniper is upright, not stiffly so, but just sufficient to impart a neat appearance to the tree. The branches incline upwards and the branchlets slightly droop; the foliage is thickly produced — crowded, in fact. The leaves vary much in length, according to their position, but they are, for the greater part, three-quarters of an inch long, stiff, sharp-pointed, and of a uniform grey-green colour, and quite wanting in the various tints of silver or frosted appearance possessed by many species of juniper. The fruits are sparingly produced even on old specimens; but when in any quantity, the tree has a beautiful appearance from contrast between the large blue-black berries and the light green foliage. The fruits are almost spherical, except at the apex, which is deeply cleft or indented, are fully three-quarters of an inch in

diameter, and often become suffused with a glaucous bloom just before they ripen. For ornamental purposes, in sheltered spots and in stiff soils, I would recommend *Juniperus drupacea* to be planted, as being a tree of robust and stately growth.

J. EXCELSA, *Bieberstein*. (Synonyms: J. taurica and J. religiosa, *Hort.*) Levant, Himalaya, Afghanistan to Sikkim. 1806.—This is usually found as a pyramidal bush or tree, with numerous slender rigid branchlets, the peculiarly glaucous leaves imparting a greyish appearance to the whole. Berries have been abundantly produced both in England and Ireland. They are smooth of surface, fully three-eighths of an inch long and nearly round. Where it thrives this juniper is a distinct and ornamental species.

When raised from seed in this country, the appearance of all the young plants is wonderfully alike, which is rather singular when we consider the wide range of the plant from Greece to Afghanistan.

J. EXCELSA STRICTA partakes of the neat, upright habit of the species, probably when young in an advanced degree, with still more glaucous foliage.

J. MACROCARPA, *Sibthorp*. Mediterranean Coast.—Although not generally recommended for cultivation in this country, yet that it does succeed well in certain places is evident from the beautiful specimen that is growing but a short distance from the race-course at Sandown Park. It much resembles our Common Juniper, only the leaves are longer, and the fruit larger, while the more compact

and better furnished appearance is strikingly pronounced in the specimen in question, which is 10 feet high and fully 7 feet through. The diameter of branch-spread is the same, or nearly so, from base to tip. Light sandy loam of great depth suits it well.

J. OCCIDENTALIS, *Hooker*. (Synonyms: *Chamaecyparis Boursieri*, *Decaisne*; *Juniperus pyriformis*, *Lindley*.) North-Western America, British Columbia to Sacramento. 1839.—A very variable species, whether as regards outline or foliage. In young plants the leaves are sharp-pointed and brightly tinted, whilst in adult specimens they are of a sombre hue and closely imbricated. It usually wears a shabby appearance under cultivation in this country.

J. OCCIDENTALIS MONOSPERMA, found on low hills of southern New Mexico, becomes a low-growing tree, or rather medium-sized shrub.

J. OXYCEDRUS, *Linnæus*. (Synonyms: *J. rufescens*, *Link*; *J. Marschalliana*, *Steven*.) Southern Europe, the Levant.—A bushy, freely branched, and wide-spreading shrub, the branchlets neatly drooping, and well clothed with needle-like leaves. It may be considered as the representative of our native Juniper throughout the districts in which it is found. Unless in seaside situations, it is rarely of satisfactory growth in this country.

J. PACHYPHLÆA, *Torrey*. Chequer barked Juniper. New Mexico and Arizona. 1873.—Owing to the intense glaucous hue of its foliage, this species is one of the most distinct and interesting of hardy junipers. The difference in colour

between the old and young foliage is likewise remarkable, that of the young shoots for at least half the year being so intensely glaucous that it appears as if coated with hoar-frost, while the older is of a soft bluish green.

Generally the habit is irregularly upright, rarely formally so, the branches comparatively short and erect, and the scale-like leaves broad and short, stiff and sharp to the touch, and very closely arranged. The berries are produced in twos and threes, and resemble greatly, both in shape and colour, those of our common juniper, but they are twice as large, or fully half an inch in diameter, and in the young stage suffused with the same silvery glaucous hue for which the foliage is so remarkable. This juniper is quite hardy, but has, with several other species, the unfortunate drawback, for ornamental purposes at least, that the lower branches give way even in specimens that are freely exposed to light and air. Not perhaps hardy in every part of the country, this species has succeeded well both in the north and south of Ireland as well as in the southern English counties. It prefers a light, warm soil and sunny situation, where the young growths are ripened early and thus rendered more proof against frost.

It is a most desirable species of which there are several well-marked varieties, including *ericoides*, with heath-like foliage, *striata*, *elegantissima*, a beautiful form, and *conspicua*.

J. PHŒNICEA, *Linnæus*. (Synonyms: J. *bacciformis*, *Carrière*; J. *tetragona*, *Mænch*.) Mediterranean region, Azores, Madeira. 1683. — A

well-known, shrubby-habited species, with much-divided branches clothed with scale-like, bright green leaves, but which are quite wanting in the silvery tint that overlies the foliage of many members of this family. The globose fruit, which is usually produced in plenty, is of a yellowish brown colour, each of pea size, and takes two years to ripen. The finest specimens that I have seen were growing on mossy ground on the slate rock in Wales, where partially sheltered, and near the sea-coast, and at Rostrevor it has attained to a height of over 13 feet. The variety *turbinata* has ovoid and sharply conical fruit.

J. RECURVA, *Buchanan-Hamilton*. Weeping Indian Juniper. Himalayas, Cashmir to Sikkim. 1830.—This is one of the most distinct, beautiful, and valuable of the many species of the genus. Although perfectly hardy, it is somewhat fastidious and difficult to manage, and like many others of its Chinese relatives, has its likes and dislikes, both as regards soil and situation, but these being favourable, no more easily cultivated tree or shrub will be found in the whole range of coniferous trees. The branches are somewhat irregular of growth, the branchlets recurved, pendulous, and feathery, and well supplied with loosely imbricated bluish or greyish green foliage. The fruit or berries are oval-shaped, with one seed in each, are of a pretty, dark purple colour, and shown off well by the lightly tinted foliage. The tree is not, as stated by Gordon, Veitch, and others, diœcious, but frequently produces male and female flowers on the same twig. Three crops of berries are commonly found on the tree at one and the

same time, some being green, others suffused with a bronzy tint, and the full ripe ones an enticing purple.

It likes a moderately shady and sheltered situation, or where, all day long, it will not be exposed to direct sunshine. Cool, loamy peat would seem to be the soil in which it does best. The largest and healthiest specimens that have come under my own notice are growing close to the Abbey at Woburn, and in front of the dwelling-house at Hafodunos, away amongst the Welsh hills. For a full account of *Juniperus recurva*, see my article in *The Garden*, vol. xxix., 1886.

J. RECURVA SQUAMATA, *Parlatore*. (Synonym : *J. densa*, *Gordon*.) A much-branched, decumbent variety, with stiff, unyielding branches, and very glaucous, rigid, sharp-pointed, scale-like leaves. It is of little value as a decorative shrub.

J. RIGIDA, *Siebold et Zuccarini*. Mountains of Japan, 1861.—I much fear that the specific name of this Japanese conifer is responsible for its absence from many of our parks and gardens. It should, however, be remembered that the name *rigida* has nothing whatever to do with the habit or outline, but directly refers to the stiff, sharp-pointed leaves, which render the plant almost as difficult to handle as a bush of furze. It is at once one of the most distinct, hardy, and beautiful of the many species of Juniper—indeed, I much question whether any other can surpass as a standard specimen a well-grown healthy bush of *J. rigida*. It has a warmth of foliage tint, and a gracefully irregular habit, shapely without formality, that render it one of the most pleasing of

small or bush-like conifers. Usually it forms a bush of about 12 feet in height, with the diameter of branch-spread almost equal from base to tip, the branches slightly ascending, and the branchlets and young shoots gracefully pendulous. A peculiar habit of this species is that some of the branches project farther than others, but curiously enough, such branches are so regularly spread over the specimen, that any irregularity of habit is quite lost sight of, and this is further aided by the weeping tips, which hang limp and free for several inches in length and constitute an unusual and distinctive charm. Very beautiful, too, is the silvery sheen of the foliage that is brought about by the conspicuous glaucous furrow that is present on the upper side of the leaves. Each leaf is half an inch long, narrow, and very stiff, and terminating in a sharp point. At no period of growth is *J. rigida* more beautiful than during the months of June and July, for then the light green (almost of a yellowish tint) of the young growths contrasts markedly with the deep, bright green of the older foliage, which later on assumes a warm brownish tint.

For ornamental planting I would place this only second to the better-known *J. recurva*, but it has the advantage over that popular species in that it succeeds well in the very soil where the other becomes rusty and infested with red spider. By far the finest specimen that has come under my notice is growing in deep sandy soil near the race-course at Sandown Park ; it is 13 feet high and nearly 5 feet through, and is as perfect a specimen conifer as could be desired.

J. SABINA, *Linnaeus*. The Savin. Central and Southern Europe, Caucasus, Siberia, North-Eastern America. Prior to 1548.—Though hardly worthy of special remark as an ornamental shrub, yet the Savin juniper has been put to good use for rock-work decorations, and for planting as game covert around the margins of woodlands. In Woburn Park it is extensively used for the latter purpose. It is usually of irregular habit, portions of the shrub being dense and compact of growth, and others jutting away into long, almost erect shoots. The leaves are small and scale-like, while the partly concealed berry is of pea size and purplish brown in colour. Useful for smoky localities.

J. SABINA TAMARISCIFOLIA, *Aiton*, is one of the neatest and prettiest varieties in cultivation, and in small gardens is worthy of a far larger share of attention than it has hitherto received. One must see healthy specimens to witness the intense bluish green colour, suffused with a silvery tint, that pervades the whole foliage. For ornamental planting, this Spanish Savin is far more desirable than the species, being of neater and more procumbent growth, and the foliage tint much more bright and cheerful. Even under favourable circumstances, it rarely rises more than 15 inches from the ground, is oftener 9 inches high, and is wanting usually in the long, extended twigs which so mar the appearance of the typical plant. It makes a capital edging or carpeting shrub, a use to which I have successfully put it on various occasions. The branches when pegged down take root freely, and soon form breadths of the most pleasing green foliage.

J. SABINA VARIEGATA has no particular merit to recommend it, the yellowish variegation being spotty and irregular. It has the same habit as the species.

J. SPHÆRICA, *Lindley*. Northern China. 1846.—This is a distinct species of tidy outline, rather inclined to be conical, but relieved of formality by the extending, tufted, and finely divided branchlets. The foliage is of a bright and pleasant green; while the fruit, which is irregularly produced, is oval.

J. SPHÆRICA GLAUCA, *Gordon*. (Synonym: J. Sheppardi, *Hort*.) As seen in cultivation has a winter attraction that renders it of value where low-growing and bright-foliaged shrubs are in demand. The leaves are silvery white, rather stiff and sharp-pointed, while the branches and branchlets are numerous, and impart a dense, spreading habit to the specimen.

J. THURIFERA, *Linnæus*. Incense Juniper. Spain, Algiers. 1752.—This can hardly be generally recommended, as I have known well-established specimens to suffer much from frost. When seen at its best it is highly ornamental, and of distinct habit of growth, from the lower branches being spreading, while those farther up have an erect growth. The leaves are greyish green and scale-like.

J. VIRGINIANA, *Linnæus*. Red Cedar. North America, Hudson's Bay to Florida, and on the west side of Colorado and Vancouver Island. 1664.—This is the largest-growing of any of the junipers in this country—the largest not only as regards height, but as regards bulk of stem as well. The timber is of excellent quality and used

in the making of lead pencils. Growing in deep, free soil, it has in Surrey attained to a height of nearly 50 feet, and with a stem girthing $7\frac{1}{4}$ feet at 3 feet from the ground. At Mill Hill, planted by Peter Collinson, the red cedar is 55 feet high with a stem girth of 6 feet 11 inches at a yard from the ground. Although varying a good deal in shape and tint of foliage, the typical plant in England is of pyramidal form, with partially ascending branches and mossy, deep green and very varying foliage. The leaves are usually short and pointed, but often scale-like and imbricated, and both forms occur on the same twig. Berries are usually produced sparsely in this country, resemble large hemp seeds in size, oval-shaped, bluish black in colour, and have one seed in each. Both male and female flowers occur on the same tree. From seed it varies to a wide extent, the following being the best of the numerous varieties :

J. VIRGINIANA ARGENTEA has the foliage here and there irregularly variegated with a silvery tint, but this, in the specimens I have seen, is neither constant nor distinct.

J. VIRGINIANA AUREO-VARIEGATA is irregularly tinted, particularly at the branch tips, with light yellow. Some forms of this tree are very ornamental, others not worth cultivating.

J. VIRGINIANA BEDFORDIANA, *Knight*. (Synonyms: J. gracilis, *Hort.*; J. Gossainthaneana, *Loddiges.*)—This variety does well when planted in light, rich, sandy soil, soon forming a neat and attractive specimen. It differs greatly from the species in shade of foliage-colouring, and

particularly in the longer and more slender drooping branchlets. It is highly ornamental.

J. VIRGINIANA GLAUCA, *Carrière*, differs from the species in being of finer growth, and in having the foliage decidedly glaucous, almost of silvery whiteness during spring.

J. VIRGINIANA PENDULA, *Carrière*, exists in several forms, but that of deep green colour is by far the most desirable. It is extremely graceful, the branchlets being decidedly pendulous and the tree in consequence highly ornamental.

J. VIRGINIANA SCHOTTI, *Gordon*, differs in being quite erect and compact of growth, with the foliage a bright green instead of the black green of the species.

J. VIRGINIANA TRIPARTITA.—This resembles the common Savin in habit, being dwarf and spreading in growth. It is of very dense habit, with short, sharp-pointed leaves of a glaucous green colour.

KETELEERIA, *Carrière*

Male flowers in tufts or umbels.

Cones erect, lateral.

Scales partially persistent.

Bracts shorter than scales.

Seeds angular, winged.

Leaves flat, more or less two-ranked.

Branches horizontally arranged; branchlets drooping.

An evergreen tree, with spruce-like cones and long persistent scales.

KETELEERIA FORTUNEI, *Carrière*. (Synonyms: *Abies Fortunei*, *Murray*; *A. jezoensis*, *Lindley*; *Picea Fortunei*, *Murray*; *Pinus Fortunei*, *Parlatore*.) Eastern China. 1844.—This is a distinct

and interesting species, but one about which much difference of opinion exists, owing to the presence of certain characteristics which we associate with the spruce and the silver firs. Unfortunately the tree has not been found well suited for cultivation in this country, it wearing, even in very favourable situations, a by no means prepossessing appearance. The branches are stiff and horizontally placed, the branchlets subpendulous, and the foliage rather sparsely produced and irregular of arrangement, sometimes scattered, sometimes two-ranked or spirally arranged. Each leaf is broad, flat, sabre-shaped, 1 inch long, deep green above, and lighter beneath. The cones are produced singly at the branch tips, stand half erect, are 6 inches long by $1\frac{1}{4}$ inches wide, cylindrical or tapering somewhat from base to apex, and with long-persistent scales, the bracts being shorter than these.

LARIX, *Miller*

THE LARCHES

Flowers monœcious; male catkins egg-shaped; females erect, solitary, ovate.

Cones globose to cylindrical.

Scales leathery, persistent, and undulated.

Bracts mostly lanceolate, longer or shorter than the scales.

Seeds without resin canals, with a leathery covering, and furnished with an oblong membranaceous wing.

Cotyledons five to eight, three-cornered, flat.

Leaves deciduous, tufted or singly, linear, soft.

Large-growing deciduous trees, with the leaves arranged either singly on long shoots or in bundles on short spurs.

LARIX AMERICANA, *Michaux*. Tamarack or

Hackmatack. (Synonyms: *L. microcarpa*, *Desfontaines*; *L. laricina*, *Koch.*) Newfoundland and Labrador to Virginia, but always on the eastern side of the Rocky Mountains. Previous to 1739.—Even in its native country this is a tree of moderate size, 40 to 80 feet high, usually considerably under 2 feet in diameter, and having the trunk covered with small scales. The young shoots are glaucous, turning pale yellow brown the second year and always smooth. Leaves slender, three-cornered, with a few stomata above, two lines of them on each of the lower faces, and averaging 1 inch in length. The cones are egg-shaped, from slightly under to slightly over half an inch long, and made up of 10 to 13 scales, which cover most or occasionally all of the bracts.

This larch has often been confused with the hybrid, *L. pendula*, from which it is distinguished by its slightly shorter leaves and much smaller cones. Indeed, no other larch has such small cones as *L. americana*. Though the second species of larch to be introduced, it has never been extensively planted, and has no recommendations for the production of timber in this country. Nor does it possess the beauty of the European Larch. As it sometimes occupies wet or swampy ground in America, it might be planted in places that are too wet for *L. europæa* in this country, where it has attained a height of 50 to 70 feet. Lovers of conifers would be interested in the profusion of small cones it produces.

L. DAHURICA, *Turczaninow*. Dahurian Larch. (Synonym: *L. davurica*, *Trautvetter.*) Siberia. 1827.—Neither in an ornamental nor economic

sense can this be recommended for planting at all extensively. It does not thrive well, the growth usually being short, and the tree having a starved and stunted appearance.

L. EUROPEA, *De Candolle*. Common Larch. (Synonyms: *Pinus Larix*, *Linnæus*; *Larix decidua*, *Miller*; *Abies Larix*, *Poiret*; *Larix pyramidalis*, *Salisbury*.) Central Europe and Northern Asia. Prior to 1629.—Too well known to require description, at least for purposes of identification. As a hardy and valuable timber-producing conifer the larch is surpassed by no other tree that has been introduced to this country. The wood is very durable and strong, light in comparison with the bulk, and easily worked. As an ornamental tree it is certainly neglected, for in the spring months when the young leaves are bursting from the bud the decided golden green colour is almost unique in foliage tint amongst coniferous trees. The cones, which are produced in great quantity, average $1\frac{1}{2}$ inches in length, with leathery scales, many of the bract-tips exceeding these in length. Unfortunately of late years the larch has become subject to disease, and to such an extent that the planting of the tree in anything like its previous quantity is much to be doubted.

The following note is interesting, and will show to what an immense size the larch will attain in this country: After a life of one hundred and seventy years it has been found necessary to remove one of the parent larches situated near Dunkeld Cathedral. The uprooting of this magnificent tree is the more regretted when it is remembered that it was considered the finest

specimen of larch in existence. Brought from the Tyrol by Mr. Menzies of Culdees with a few other specimens, this tree, with another, was planted at the west end of Dunkeld Cathedral in 1738. Five of the trees he left at Dunkeld, and eleven at Blair Atholl, for Duke James, the grandfather of "The Planting Duke," as he was familiarly called. Two of the five at Dunkeld were felled by Duke John in 1809, and one had been cut down by mistake about twenty years before. Of the two felled in 1809 one contained 147 cubic feet of timber, the other contained 168 cubic feet. Though originally treated as greenhouse plants, the trees proved so hardy as to be long recognised the best and largest specimens that exist, although they are closely approached by those grown at Monzie, near Crieff. In 1888 the measurements of both were taken and recorded on boards placed at the foot of each tree. The record of the larger of the two, which has just been cut down, is as follows :

Planted in 1738.	Measured in 1888.	
	Ft.	In.
Total height	102	4
Circumference at 3 ft. from ground	17	2
" 5 ft. "	15	1
" 17 ft. "	12	10½
" 51 ft. 2 in. "	8	8
" 68 ft. "	6	1
Contains 648 cubic feet with bark.		
Contains 532 cubic feet without bark.		

After the tree was cut down the measurements were found to be practically the same as twenty years ago. The tree, which was struck by lightning two years ago, was allowed to stand to see

if it would come round. The size of the tree and the difficulty of its removal may be to some extent understood when it is mentioned that some of the roots cut off measured 9 feet in circumference.

The Duke of Atholl, the Marquis of Tullibardine, and the Earl of Mansfield visited the place and expressed great regret that a tree with such a history should have to be removed.

L. EUROPEÆA PENDULA, *Lawson*, is a distinct and very handsome variety, having the branchlets hanging down almost at right angles to the branches and for often a couple of feet in length. It reaches to almost the height of the parent tree, and should not be confused with the American species—the Tamarack or Hackmatack—which never attains to anything approaching such a size, but is of weeping habit. There is a large specimen of the weeping larch by the side of the avenue leading to Churchhill House, County Armagh, Ireland.

L. GRIFFITHII, *Hooker fil.* (Synonyms: *Pinus Griffithii*, *Parlatore*; *Abies Griffithiana*, *Lindley et Gordon*.) Eastern Himalayas. 1848.—This bears a great resemblance to the weeping form of the European larch, but it rarely exceeds 40 feet in height, and in this country it does not succeed at all satisfactorily. The branches are long, lithe, and sparsely foliated, while the cones are larger than those of any other species, and furnished with conspicuous persistent bracts. So far the tree does not promise well in this country, and is not to be recommended for any but the most favourable situations.

L. LEPTOLEPIS, *Endlicher*. (Synonyms: *Abies leptolepis*, *Siebold et Zuccarini*; *L. japonica*,

Carrière.) Japan. 1861.—This is a beautiful species, and from what is already known of it, seems to be well suited for planting as an ornamental tree in this country. It is of slower and smaller growth than our common species, with longer leaves, and smaller and differently shaped cones, they being ovate, and less than 1 inch in diameter. The long leaves make this species appear far more light and airy than the common form; while the young foliage is of a glaucous green, but this soon gives place to the darker colour of the mature specimen. In loamy peat it thrives well, but is usually of slow growth, although in south-western Scotland I have known fully 2 feet to be added to the height for several successive years. At Brocklesbury Park the average annual growth for seventeen years was $2\frac{1}{2}$ feet.

L. OCCIDENTALIS, *Nuttall*. West American Larch. (Synonym: *Pinus Nuttallii*, *Parlatore*.) British Columbia, Oregon. 1881.—In its native country this is a large-sized tree, the timber of which is said to be of great economic value, being largely used for fencing and railway ties. The thick, coarse bark is a peculiarity of the tree, that has the protective merit of long resisting forest fires. Young trees grow freely in this country when planted in good fresh loam. The foliage is light and feathery, and the cones, judging from specimens that have been forwarded to me for comparison, are longer than those of either our common species or the American Black Larch. On loose, dampish ground the Western Larch has attained to nearly as large a size as our common species, but the timber is not considered

to be of such good quality and is liable to twist and warp.

L. PENDULA, *Salisbury*. Hybrid Larch. (Synonyms: *L. dahurica*, *Hort.* non *Turczaninow*; *L. americana pendula*, *Loudon*; *Pinus pendula*, *Solander*.)—This interesting larch, now considered by Professor Henry to be the result of a chance cross between *Larix americana* and *L. europæa*, has been confused with *L. dahurica*, the Wild Larch of Eastern Asia. The original tree from which Solander drew up his description grew first at Peckham, but was afterwards removed to Mill Hill by Peter Collinson, a well-known cultivator of trees, about 1739. This tree, which was cut down in 1800, was remarkable for its extraordinary vigour, bearing great quantities of cones with ripe seed every year.¹ All the trees of *Larix pendula* now in cultivation are believed to be descendants of the original tree at Mill Hill, being hybrids of the second, third, and fourth generations, and, as is the case with such descendants, are not identical in appearance with the original first cross, but exhibit every possible combination of the parental characters. Some are like *L. europæa*, others resemble *L. americana*, and others are intermediate in character. Seedlings raised from trees of *L. pendula* appear to be equally variable. An old tree in the Pinetum at Woburn is believed to be the finest specimen of *L. pendula* in Great Britain, being now over 90 feet high and

¹ A branch from this tree with flowers and cones is figured in Lambert's work on *Pinus* and also in the Pinetum Woburnense, and the specimens from the tree at Mill Hill on which Solander founded his original description of this larch are still preserved at the Natural History Museum.



Face page 100.

LARIX PENDULA AT WOBURN.
Showing the smooth and fine-scaled bark.

7 feet 6 inches in girth. As will be seen from the illustration, it has a remarkably smooth and fine-scaled bark, which closely resembles that of the American Tamarac, one of the assumed parents. The great variation in the size of the cones is very noticeable, some of these being as small as *L. americana* and others as large as the common larch. The statement by the earlier writers on conifers that *Larix pendula* was a native of North America has never been confirmed by any competent observer on existing specimens, and only one specimen of larch, the Tamarac (*L. americana*), is known to exist on the eastern side of the Rocky Mountains. For much valuable information regarding this, and species of American larch, I am indebted to Mr. Buchanan of Ontario. At Boynton, the property of Sir C. W. Strickland, both the Black and Red American Larches have, in certain situations, done well and attained to large dimensions.

LIBOCEDRUS, *Endlicher*

THE INCENSE CEDARS

Flowers monœcious; male catkins cylindrical or nearly so; females solitary, globular.

Cones oblong, woody, and composed of from four to six scales, of which the middle pair alone is fertile.

Scales leathery in texture, face to face in opposite pairs, and furnished with a terminal incurved point.

Seeds unequally two-winged, singly or in pairs under each scale.

Cotyledons two.

Leaves flattened, decussate, in four imbricated rows.

Large evergreen trees, with flattened branches and scale-like leaves.

LIBOCEDRUS CHILENSIS, *Endlicher*. (Synonym : *Thuya chilensis*, *Don.*) Chilian Andes. 1847.— Although not to be relied upon as perfectly hardy generally throughout this country, yet the present species is well worthy of culture in suitable situations in our southern or western counties. It is highly ornamental, forming in a young state a very distinct and graceful plant of pyramidal outline, the habit of growth being neat and pleasing, and with glaucous, deep green pointed leaves, which are of a silvery tone beneath. The cones are oblong, and three-eighths of an inch in length. Cool, rather moist soil and partial shelter are necessities to its successful cultivation.

L. DECURRENS, *Torrey*. (Synonyms : *Thuya Craigiana*, *Murray* ; *Thuya gigantea*, of gardens.) Mountains of North-Western America. 1853.— As seen in this country, where it has long been confused with *Thuya gigantea*, this is of dense columnar habit, with short frondose branches, and deep green foliage, which colour is retained throughout the winter. Cones erect, oblong, 1 inch in length, and composed of usually two pairs of scales. The stem is usually carrot-shaped in this country, and the bark a rich brown, that gleams out here and there between the tiers of thickly matted branches. The outline of the tree is rather stiff and columnar for ornamental planting ; and though the timber is valuable, the rate of growth is too slow to allow of its being cultivated for profitable purposes in this country. It succeeds best on deep moist loams, the foliage being paler and the lower branches apt to die off when the tree is growing in sandy or gravelly



Face page 102.

LIBOCEDRUS DECURRENS AT ORTON LONGUEVILLE.

soils. There is a variety named *L. decurrens glauca*.

L. DONIANA, *Endlicher*. (Synonym: *Thuja Doniana*, *Hooker*.) New Zealand. 1848.—Though usually described as tender, there are, in certain parts of the country, well-furnished and beautiful specimens of this tree to be seen. In the north of Ireland it forms a handsome specimen, with foliage of the richest description; while in southern and especially western England, I have seen well-grown plants. It presents a perfect pyramid of flattened, fern-like branchlets, thickly covered with beautiful foliage of a deep, unchanging green, and with little or no silvery markings on the under sides.. It is readily distinguished from *L. chilensis* by the more closely arranged leaves and by the absence of the silvery line on the under sides of these, as also by its richer and brighter green colour.

L. TETRAGONA, *Endlicher*. (Synonym: *Thuja tetragona*, *Hooker*.) Patagonia and Chile. 1849.—By the Chilians this is justly valued as one of the most important trees of their country, the timber being of great value for constructive purposes. In this country, unless in very favourable situations, it does not succeed well, and many specimens have died out prematurely. Where it does thrive it is certainly a distinct and beautiful tree, of somewhat broadly pyramidal habit of growth, the branches being stiff, stout, and horizontally arranged, with the tips upturned. The leaves are bright green, broadly decurrent at the base, and about a quarter of an inch long. Cones smaller than those of any other species. I have seen this interesting conifer

growing freely amongst decayed vegetable matter, and where the maritime situation was fairly sheltered.

PICEA, *Link*

THE SPRUCES

Flowers monœcious; male catkins axillary or terminal; females terminal and solitary.

Cones generally pendent, solitary, and remaining intact for a long time.

Scales persistently attached to the axis, not falling away from each other as in the silver firs, broadly rounded, and with the edges undulated.

Seeds small, oblong, winged, and with a bony shell.

Bracts free from the scales except at the base, and not projecting.

Cotyledons three-sided, and six to ten in number.

Leaves four-sided, pointing in every direction, and with circular projections at the base.

Evergreen trees or shrubs, with four-sided leaves, but partly flattened in some species, and usually pendent cones with persistent scales. As stated under *Abies*, the now universally adopted plan of calling the spruces *Picea* is here adopted.

PICEA ALBA, *Link*. White Spruce. (Synonyms: *Abies alba*, *Michaux*; *A. canadensis*, *Miller*; *Pinus alba*, *Lambert*; *Abies rubra cœrulea*, *Loudon*; *A. cœrulea*, *Forbes*; *Picea nigra glauca*, *Carrière*; *Abies arctica*, *Seeman*.) Arctic North America, and south to New England. About 1700.—For planting in this country the so-called White Spruce cannot be recommended, it being at the best short-lived, not very ornamental, and of no value as a timber producer. Growing in cool yellow loam, I have, however, seen a small number of specimens thriving nicely; but it should be stated that these were under fifteen years planted. It is of

neat, conical outline, well branched, and the foliage like our common spruce, but much lighter in colour. Cones are produced freely, these being dull brown when ripe, $1\frac{1}{2}$ inches long and cylindrical in shape. There is a variety *P. alba cœrulea*.

P. ALCOCKIANA, *Carrière*. (Synonyms: *Abies Alcockiana*, *Veitch*; *Picea bicolor*, *Mayr*; *A. acicularis*, of gardens.) Mountains of Japan. 1861.—The appearance of young trees, sent from a reliable source under the present name, is certainly different from that of *P. hondoensis*, the leaves being more needle-like, four angled, far more prickly, and the colour not so decided a silvery tint. The leaves have usually two lines of stomata on the uppermost faces, and four to seven lines beneath. It grows quite freely, and has formed a dense specimen of regular outline, except for the upper branches, which project here and there beyond those further down, and the plurality of leading shoots. The young shoots of the present tree are flattish on one side, while those of *P. hondoensis* are rounded or cylindrical. *Mayr's* name of *P. bicolor* is adopted by some authorities for this species.

P. BREWERIANA, *S. Watson*. Brewer's Weeping Spruce. North Carolina, Siskiyou Mountains. 1897.—This is one of the most locally distributed of all the spruces. It differs from every other in the long pendulous branchlets, which hang thin and flexible from the main branch to a great length. The bark becomes of a warm reddish tinge with the advance of years; and the leaves, which resemble those of the Norway spruce, but

of a lighter green, are scarcely 1 inch long, blunt, thick, and rounded. The cones are remarkably thin for their length, which is usually about 3 inches. Jepson, in his *Silva of California*, regarding *P. Breweriana*, says that it varies a good deal in height, for mature specimens are met with from 20 to 95 feet high, with a trunk diameter of from 6 inches to 3½ feet. A peculiarity of this tree is its pendent branchlets, which are said to hang down from 2 to 4 feet. Young specimens do not, however, exhibit much of this character. Nathaniel Lord Britton, in his *North American Trees*, refers to it as the rarest and probably most beautiful of the American spruces. He also says that the wood is of good quality, but, owing to the rarity of the tree and its inaccessibility, it has not been applied to any economic use.

P. ENGELMANNI, *Engelmann*. (Synonyms: *Pinus commutata*, *Parlatore*; *Abies Engelmannii*, *Parry*.) Rocky Mountains of Montana, Oregon, south to Arizona. 1864.—This tree resembles the Black Spruce of Eastern America, for which it was mistaken by all botanical travellers in the Rocky Mountains, until Dr. Parry detected its specific distinctions, and dedicated it to the distinguished botanist whose name it bears. In this country it forms a neat specimen of broadly conical outline, the branches being stiff, and the long foliage sharply pointed and dull green of colour. The cones nearly resemble those of the better-known *P. sitchensis*, and are about 2 inches long.

P. ENGELMANNI GLAUCA is, in so far as ornamental properties are concerned, a far more desir-

able tree than the species. It is undoubtedly one of the most beautiful of all the spruces, the general habit being that of the parent, but the foliage, instead of being of a dull green, is glaucescent almost to silvery whiteness. It is very hardy, and in the younger stages slow of growth, with dense, stiff, horizontal branches, and stout, sharp-pointed leaves, which in their shade of silvery green vary to a great extent. In many collections *P. pungens glauca* does service for the present variety.

P. EXCELSA, *Link.* Common Spruce. (Synonyms: *Abies excelsa*, *De Candolle*; *Abies Picea*, *Miller*; *Pinus Abies*, *Linnæus*; *Picea vulgaris*, *Link*; *Pinus excelsa*, *Lamarck*.) Mountains of Northern and Central Europe. Prior to 1548.—Whether as a hardy, shelter-giving tree, or for the quantity and quality of timber it produces, the Common Spruce must ever rank high in the list of exotic conifers that have been found suitable for culture in this country. It is well adapted for general forest planting, luxuriating at high altitudes, and not only acting as a capital nurse tree, but producing a fair quantity of valuable timber. When clean grown, the timber is valuable for temporary roofing and fencing, pit props, flooring, packing-boxes, etc. As an ornamental tree the fine proportions and well-clothed trunk render it very effective, which are further enhanced by the intense green of the thickly produced foliage. It wants rich, moist soil.

P. EXCELSA AUREA is a beautiful variety, of robust growth, and justly remarkable for the bronzy tint which pervades the golden foliage, this

being most pronounced at the branch tips. This seems to be identical with the continental variety named *P. excelsa magnifica*, but of which I have only seen dried specimens.

P. EXCELSA BREVIFOLIA.—A plant of this sent to me certainly well bears out the name, the leaves being nearly one-half shorter than those of any other known variety. The growth is remarkably slow, and the plant dwarf and compact in habit. It is not well known.

P. EXCELSA CLANBRASSILIANA is a dwarf variety that is useful for certain positions. The short and slender branches are densely packed with needle-shaped leaves, each a quarter of an inch long, and of a light glaucous hue.

P. EXCELSA ELEGANS attains to 8 feet in height, and is chiefly remarkable for its compact and fragile mode of growth and greyish slender leaves, which have an erect tendency.

P. EXCELSA FINEDONENSIS has the young shoots of a bronzy or brownish yellow colour; but this gradually gives place with age to a bronzy green tint. It is highly ornamental.

P. EXCELSA GREGORYANA is of neat and very dwarf growth, rarely being found more than 2 feet high. The foliage is of a pleasant green shade, short, stiff, and arranged thickly on the branches.

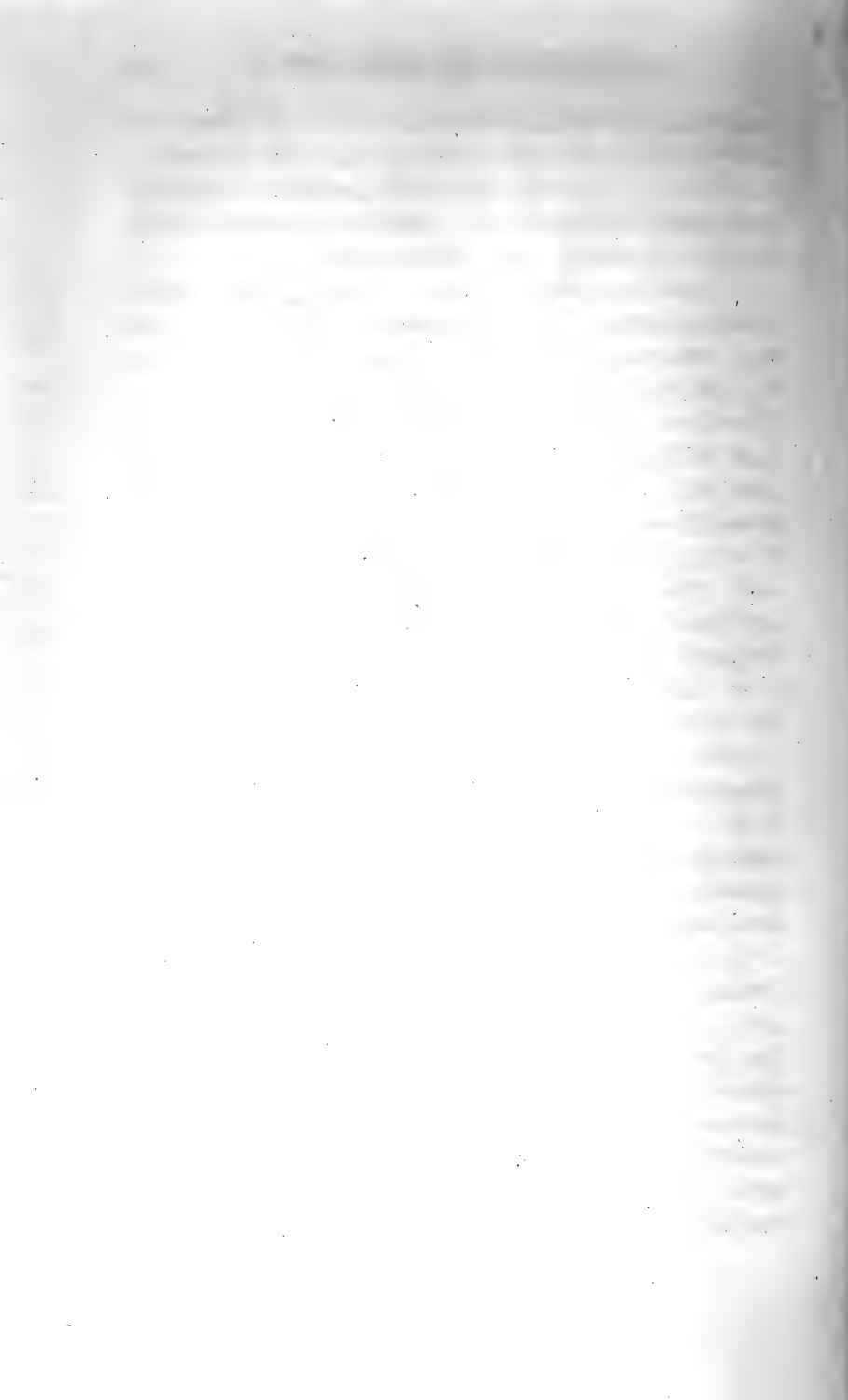
P. EXCELSA INVERTA cannot be described as at all an ornamental variety, but it is highly curious and interesting, owing to the branches hanging down almost close to the main stem, and thus imparting to the tree a strange and striking appearance. Of the weeping or inverted Spruce, the largest trees I know of are those at Ide Hill, Seven-



Face page 108.

PICEA EXCELSA INVERTA IN WOBURN NURSERY.

Planted 1893.



oaks, and in the Crawley Nursery at Woburn, the latter having been planted by the writer twenty-four years ago. The Ide Hill specimen is 30 feet high, with many of the branches hanging down close to the stem for 7 feet in length.

P. EXCELSA MAXWELLI.—A very neat, dwarf-growing form of the Common Spruce has been sent out under the above name. Unlike several of our well-known pigmy varieties, the shrub in question remains at all times as hemispherical as if it had been trimmed by the shears, and never juts into irregular growths, as do many of the dwarf forms that are at present widely cultivated. It only grows 2 feet high, but is full and rounded, and fully 1 yard in spread. It is said to have originated in a New York nursery, and is rare in cultivation in this country.

P. EXCELSA PYGMÆA is the dwarfest form of the Common Spruce, rarely rising to more than 1 foot in height, but spreading laterally in a disproportionate manner.

P. EXCELSA STRICTA is of neat and quite compact growth, with glaucous green leaves. It is of unusual erect habit, but strikingly distinct and ornamental.

P. GLEHNI, *Masters*. (Synonym: *Abies Glehni*, *Schmidt*.) Island of Sachalin.—Little is yet known regarding this species, which was found by Glehn, who accompanied F. Schmidt in his travels in Sachalin and Amoorland. From the specimen that I have seen, the plant may be described as of rather dense growth, with four-sided, curved, and sharply pointed leaves, each half an inch long, these being thickly arranged on

the branches. The cones are dull brown and about $1\frac{1}{2}$ inches in length. Scales wedge-shaped, and with the bracts much shorter than these.

P. HONDOENSIS, *Mayr.* (Synonyms: *Picea ajanensis*, *Hort.*; *Abies ajanensis*, *Veitch.*) Amoor Land, Mountains of Japan. 1861.—This is a distinct and beautiful conifer, of sturdy growth, and non-exacting as to soil. It is certainly one of the handsomest of the family, and even in mid-winter the beautiful glaucous foliage and curiously white streaked stem have a striking appearance. When planted in an open space, for which it is peculiarly suitable, the plant usually assumes a pyramidal style of growth, the branches being well furnished with small branchlets or twigs, and all densely clothed with the pretty and attractive foliage. Usually the branch-tips have a distinct upward inclination, thus revealing glimpses here and there of the silvery or blue white under-sides of the leaves, and which afford a striking contrast to the darker tint of the upper and exposed sides. The leaves, which are fully half an inch long and abruptly acute, are of a deep, pleasing shade of green above and silvery white beneath, the latter being more pronounced and beautiful in this than almost any other member of the family. Both male and female cones are plentifully produced, the latter when fully grown, but before becoming ripe, being of a beautiful purple colour, and adding quite a charm to the specimen. It is rendered, by its undoubted hardihood, freedom of growth, and beautifully furnished habit, a particularly choice species for planting as a standard specimen. The healthiest and largest tree of this kind that I have

seen is nearly 50 feet high, and growing at Ochertyre, in Scotland. Also known as *P. Alcockiana*.

The collections of coniferous trees at Ochertyre, Murthly Castle, and several other estates in Perthshire are particularly rich; while the individual specimens have a more robust and healthy appearance than I have noticed in almost any other part of the British Isles. *P. ajanensis microsperma* is a distinct variety. It is doubtful whether the true *P. ajanensis* is in cultivation.

P. MAXIMOWICZII, *Regel.* (Synonym: *Abies Maximowiczii*, *Hort.*)—This is a dull and unattractive species, and one that has not succeeded well generally in this country. The branches are short and stout, the leaves four-sided, half an inch long, stiff and sharp-pointed, spreading almost at right angles to the stem, and of a uniformly dull green colour. The cinnamon tint of the young shoots is pleasing.

P. MORINDA, *Link.* (Synonyms: *Pinus Smithiana*, *Lambert*; *Picea Smithiana*, *Boissier*; *Pinus Khutrow*, *Royle*; *Abies Khutrow*, *Loudon*; *A. Smithiana*, *Forbes.*) Himalayas from west to east. 1818.—As a handsome tree this beautiful spruce undoubtedly stands in the front rank, while its hardihood, rapidity of growth, and ease of culture even claim for it from planters a greater share of attention than it has yet received. The gracefully pyramidal habit of the tree is rendered strikingly beautiful by the slender terminal and lateral branches, which hang down free and easy for often fully a yard in length. The horizontal branches are well supplied with branchlets, which are slender and drooping, and furnished with

rigid, incurved, deep green leaves, that average $1\frac{3}{4}$ inches in length. Cones cylindrical, $5\frac{1}{2}$ inches long, $1\frac{3}{4}$ inches in diameter at thickest part, and shining brown when ripe. The russety brown tint and large size of the cones impart quite a feature to the tree, while the numerous pollen cones are in early spring very showy and attractive. The cones ripen in February of the following year after they have been produced, and then fall to the ground, many, indeed the larger portion, of the seeds being retained intact, owing to the compactly arranged scales. The tree will not flourish when planted on light, sandy, or gravelly soils, the best appearance being put on in rather dampish yellow loam, but not in such as is surcharged with moisture. The timber is of no special value, and is dealt with in the chapter on coniferous woods in the present volume. A detailed account of *P. Morinda* by the present writer will be found in *The Garden*, vol. xxx., 1886.

P. NIGRA, *Link.* Black Spruce. (Synonyms: *Pinus Mariana*, *Duroi*; *Pinus nigra*, *Aiton*; *Abies Mariana*, *Miller*; *Abies nigra*, *Poiret*; *Abies denticulata*, *Michaux.*) Canada and North-East America to Carolina. About 1700.—This tree, commonly known as Black Spruce, is readily recognised by its regular conical outline, slender, very gradually tapering stem, dark bluish green foliage, and usually plentiful supply of small, ovate, purplish cones. Some of the largest specimens I have seen are growing close to the London and North-Western Railway, near Bangor Station, in Carnarvonshire. These trees range from 40 to 55 feet in height, with stems averaging 15 inches

in diameter near ground-level, the taper throughout the entire length being very gradual, and is all the more pronounced on account of the trunks being branchless usually for three-fourths of their length. These trees are growing not in swampy soil, as is generally associated with the Black Spruce, but in a shallow layer of vegetable mould resting on coarse gravel, and in company with probably the greatest number of the largest specimens of *Pinus Laricio* that are to be found anywhere in this country—nine trees growing in a space of 20 square yards averaging 70 feet in height, the stems being $5\frac{1}{2}$ feet in girth at a yard from the ground.

Owing to the lank, naked appearance of the Black Spruces, a large number were some years ago removed from amongst the *Pinus Laricio*, those around the margins of the plantation, which were the best furnished, being left as permanent standards. The timber was yellowish white, sometimes quite white, very light in proportion to the bulk, long-grained, and readily indented. It is of little value for constructive purposes when used out-of-doors, but for panelling it has stood well.

The stem of the Black Spruce is usually straight, with roughish, light brown bark, the branches slightly ascending, and getting gradually shorter as we pass from the lower to the upper whorls, thus giving to the tree a regularly conical outline. The plentifully produced leaves are somewhat quadrangular in shape, half an inch long, and persist for about five years. The cones, produced in great abundance, are oblong ovate in shape, 1 to $1\frac{1}{2}$ inches long, and purplish in colour before

maturity, but changing to dark brown when fully ripe.

P. OBOVATA, *Ledebour*. (Synonyms: *Abies obovata*, *Loudon*; *P. Maximowiczii*, of gardens.) North-East Europe and Northern Asia.—This closely resembles the Common Spruce, and is by some botanists ranked as a variety of that species. The cones are, however, very different from those of the Common Spruce, being only 3 inches long, egg-shaped, and the scale-edges smooth. The branches have a curiously warted appearance, which forms another point of difference.

This species is by no means commonly cultivated, the climate of our country, save in a few upland situations, seeming unsuitable to its requirements. It is hardy enough, coming from Siberia, yet it has generally a miserable and starved appearance, which is probably owing to our mild and humid climate. I have seen a good specimen growing in an open, airy, though sheltered position, on high-lying ground; but, indeed, neither in an ornamental nor useful capacity is the tree worthy of culture. It is somewhat after the style of the Common Spruce, but altogether lighter and with lithe branches and drooping branchlets. Cones are freely produced, these being sub-erect and just half the length of those of the Common Spruce, or about 3 inches. They are nearly egg-shaped, or obovate, the scale-edges being quite smooth, as opposed to those of the Common Spruce, which are crenulated or wavy. Unless for planting as a botanical specimen in the pinetum, I would not suggest that *Picea obovata* be procured.

P. OMORICA, *Bolle*. Servian Spruce. (Synonym:



PICEA OMORICA.

Face page 114.



Pinus Omorica, *Panic.*) Mountains of Servia.—This nearly approaches *P. orientalis*, from which, however, it may be distinguished by the longer flat leaves and shorter cones. The growth is slender and branch-spread narrow and symmetrical, while the leaves are from half to three-quarters of an inch long, with two glaucous lines on the upper surface. The cones are $1\frac{3}{4}$ inches long by fully three-quarters of an inch in diameter, and of a warm, reddish brown colour. It is rare in cultivation, but can succeed well in poor soils, where it has made an annual growth of nearly 18 inches per year. The Servian Spruce is better suited for suburban planting than any other of its kind. It was introduced in 1875, and in its native country grows 100 feet high, and is of narrow, pyramidal habit. From the Common Spruce it is readily recognised by its softer, flat leaves, which are glossy green above and grey beneath. The growth in this country is fairly fast, and the narrow, pyramidal habit is retained.

P. ORIENTALIS, *Carrière*. (Synonyms: *Abies orientalis*, *Poiret*; *Pinus orientalis*, *Linnaeus*; *Abies Wittmanniana*, *Hort.*) Mountains of the Taurus and Caucasus. 1839.—Although of no particular value in an economic sense, yet for ornamental purposes or for planting on poor gravelly soils, where perhaps no other member of the family could for long survive, this species is well adapted. The habit is dense and somewhat formal, though the branches ramify considerably, and usually the appearance of fair-sized specimens is irregularly pyramidal. Of a glossy dark green and slightly paler beneath are the thickly arranged

leaves, these being stiff and three-eighths of an inch in length. Cones pendent, $2\frac{3}{4}$ inches long, by three-quarters of an inch in diameter at thickest part, ovate oblong, and tapering gradually to a point. They are, in a young state, thickly covered with resin, so much so that both the shape and size are quite lost to view, this, however, ultimately disappearing. This tree suffers much from stem-pruning; indeed, more so than almost any other of its tribe, resin oozing in quantity from the wound long after amputation of a branch has taken place. The timber is of fair quality, and resembles that of the Norway Spruce; but the rate of growth is slow, a height of 50 feet having only been attained under very favourable conditions in forty-three years. The tree being very sturdy and hardy, is well suited for standing alone, even in exposed situations where many other conifers would suffer considerably.

P. ORIENTALIS AUREA has many of the branch-tips suffused with greenish yellow. It is a worthy variety.

P. ORIENTALIS PYGMÆA, *Ohlend*, is of dwarf neat growth, and makes an excellent border or rock shrub.

P. POLITA, *Carrière*. (Synonyms: *Abies Torano*, *Siebold*; *A. polita*, *Siebold et Zuccarini*.) Mountains of Japan. 1861.—This is one of the handsomest and hardiest of the Japanese conifers. The branches are stout and horizontally arranged, the leaves long, curved, and four-sided, broad at the base, tapering to a stiff point, and pale green in colour. Cones $3\frac{1}{2}$ inches long by $1\frac{1}{4}$ inches broad, at first erect and pale green, but afterwards pendent



PICEA ORIENTALIS.

Face page 116.

and ruddy brown in colour. The cone scales are fan-shaped with two seeds beneath each. A distinguishing characteristic is the large, globose, reddish brown buds. The tree is of slow growth when young, but after the age of about ten years it shoots away freely and is then a distinct and handsome specimen for the lawn or park.

In this country *P. polita* must be regarded as a rare species, though it is certainly one of the most distinct and beautiful of the Spruces, and when once seen is not apt to be forgotten or confused with any other. Though stiff in habit of growth, yet the branches, being irregular of length, cause the tree to be of informal outline. It does not grow rapidly, and is therefore suitable for rather confined spaces. Some of the largest and best-furnished specimens in this country are growing in peaty soil.

P. PUNGENS, *Engelmann*. (Synonyms: *Picea Parryana*, *Sargent*; *P. commutata*, of gardens; *Abies* or *Picea Engelmanni*, of gardens.) Mountains of Wyoming, Utah, and California.—This is a very accommodating species, and one that has been found well suited for ornamental planting in every part of the country. It is of somewhat stiff outline, owing to the rigid and horizontally arranged branches and branchlets, while the stout, sharply pointed leaves still further add to the appearance. The leaves are in colour much like those of the Douglas Fir, and the cones are fully 2 inches long.

P. PUNGENS ARGENTEA, *Hort.*, is certainly the handsomest of the spruces, while it is of good habit, though bold and shapely of growth. The

pronounced silvery tinted leafage is the main characteristic for which this variety is so justly remarkable.

P. PUNGENS GLAUCA differs only in the rigid, sharp-pointed foliage being of a beautiful, bluish grey tint. It is a highly interesting and choice variety, and being very hardy and free of growth, can be recommended for planting where less hardy conifers would not exist.

P. SITCHENSIS, *Trautvetter*. Sitka Spruce. (Synonyms: *Abies Menziesii*, *Lindley*; *Pinus sitchensis*, *Bongard*; *P. Menziesii*, *Douglas*; *Abies sitchensis*, *Lindley et Gordon*.) Alaska to California. 1831.—Planted in cool, moist loam and not subjected to long-continued cold winds, this valuable conifer thrives well; whereas when the soil is light and warm the foliage usually becomes meagre in appearance, affected by red spider, and almost semi-deciduous. When well grown, the appearance of the tree is both distinct and desirable, the stiff and rather irregularly disposed branches being thickly beset with vivid bluish green foliage. Individually the leaves are remarkably stiff and sharp-pointed, bluish grey above, with two silvery lines on the under side. When ripe, the cones are russety brown, nearly cylindrical, 3 inches long by 1 inch diameter, and invariably bent or curved. The male catkins are pendulous, and plentifully produced about the first week of April, when they impart a most interesting and beautiful appearance to the trees on which they are borne in quantity. The timber produced in this country has, perhaps, no special claims to distinction though of good quality and fairly

durable both in and out of doors. According to the soil and site so will be the growth of the tree, and I have known a specimen that was planted under exceptionally favourable conditions to attain the height of 43 feet in twenty years. Specimens both in England and Scotland exceed 120 feet in height. In a letter received from the Hon. Mark Rolle, *P. sitchensis*, *P. morinda*, and several other species have, judging from the measurements given, done well, and attained to large size at Bicton, in Devonshire. At Murthly Castle, Perthshire, the Sitka Spruce, planted in 1845, is 126 feet high, the stem at 5 feet up girthing 13½ feet. This is a valuable tree for afforesting purposes.

P. SPINULOSA, Henry. Sikkim Spruce. (Synonyms: *P. morindoides*, Rehder; *Abies spinulosa*, Griffith.) Eastern Himalayas.—This tree differs from the other flat-leaved spruces with glabrous branchlets by the radial arrangement of the leaves which are distinctly keeled on both surfaces, and end in a sharp point. The leaves are like those of *P. sitchensis*, but in that species the leaf arrangement is in two lateral sets like those of the common spruce. This spruce was discovered in Northern Bhutan by Griffith in 1849, and described by him as a new species of *Abies* under the name of *A. spinulosa*; but Hooker subsequently confused it with the common *P. morinda*. Many years afterwards it was found in the arboretum of M. Allard at Angers, France, by M. Rehder, who redescribed it in 1902 as *Picea morindoides*. It has since been discovered in a number of English and Irish gardens, including Castlewellan, Leonardslee, near Horsham, and

Menabilly, Cornwall. Its semi-pendulous habit renders it an elegant species well worthy of cultivation. In the Eastern Himalayas it sometimes attains to an immense size, and trees up to 200 feet high have been recorded. The cones are much smaller than those of *P. morinda*, rarely exceeding 3 inches in length by 1 inch in diameter.

PINUS, *Linnæus*

THE PINES

Flowers monœcious; males in catkins; females solitary and terminal.

Cones woody, conical in shape, usually ripening in the second year.

Scales persistent and imbricated.

Seeds with a hard, bony covering, oval in shape, and usually furnished with an ample wing, or wingless.

Cotyledons entire, variable in number.

Leaves in tufts, persistent, and in sheaths of two, three, or five in number; seldom only one.

Evergreen trees or shrubs, with the leaves in tufts of two, three, or five.

PINUS ALBICAULIS, *Engelmann*. (Synonyms: *P. flexilis*, *Balfour*; *P. cembroides*, *Newberry*; *P. Shasta*, *Carrière*; *P. flexilis albicaulis*, *Engelmann*.) Coast ranges of British Columbia, Sub-Alpine belts of the Rocky Mountains and Sierras. 1852.—In a young state this is a neat-growing tree of rather pronounced conical outline, with the lower branches horizontal and the upper ascending. The appearance of the foliage is like that of *P. Cembra*, being in colour a dark, rather sombre green, each leaf fully 2 inches long, but in this as well as size of

cone it varies to a wide extent. Usually the cones are 4 inches long, but I have seen other specimens from old and stunted trees that were not half that length. It is of no particular value for ornamental planting in this country, the oldest and largest trees usually wearing a curiously distorted appearance, that is mainly brought about by the long, lithe, and twisted branches.

P. AYACAHUITE, *Ehrenberg*. Mexico, Guatemala. 1840.—This is a distinct and beautiful species, reminding one, except in its longer foliage and cones, of the better-known *P. Strobilus*. The branches are whorled and evenly arranged on the stem, while the leaves, which are five in a sheath, and of a desirable glaucous blue tinge, are about 5 inches long and produced plentifully. The cone is strikingly handsome; that now before me, a British-grown specimen, being 12 inches long and $2\frac{1}{2}$ inches in diameter at the widest part. It is cylindrical in shape, produced on a half-inch-long foot-stalk, and of a warm, brownish yellow colour. The scales are ovoid, sharply pointed with the tips recurved. I am now fully convinced, after seeing specimens in various parts of the country, that the present species is far more hardy than is generally supposed; indeed, the localities and conditions under which it at present succeeds so well in this country are not such as would impress one as being extra well suited for the cultivation of tender plants.

P. BALFOURIANA, *Jeffrey*. California, Mountain in Siskiyou County. 1852.—Although a distinct and in many ways a remarkable species, yet, as far as my own observations have extended, this

must be considered as comparatively rare throughout Britain. It is quite hardy, but of slow growth, about mid-way in habit between upright and spreading; and owing to the thickly arranged short tufts of leaves being closely appressed to the branches and only towards the tips, these present a curious cylindrical or bottle-brush appearance. The short, falcate leaves, five in a sheath, are each not much over 1 inch in length, and of a soft shade of green, the inner face alone having a silvery tone. The cones vary in length, but are usually in the home specimens fully $2\frac{1}{4}$ inches, with protuberant, slightly hooked scales, and when quite ripe are of a dark cinnamon brown; this also being the colour of the bark on the older portions of the tree. In this country the tree is of neat growth, and though the annual increase in height is quite slow, yet the leading shoot is preserved, and the branches are regularly arranged for the full length of the bole.

P. BALFOURIANA ARISTATA, *Engelmann*, 1863, growing alongside the former tree, is somewhat distinct, especially in the uniform light green of the leaves and in the spiny cones, these being for the greater part longer than those of the species. The same arrangement of foliage is common to both. There is a well-developed specimen growing at one of the entrances to Welbeck Abbey, which has produced cones freely.

In no other Pine of my acquaintance are the needles so thickly produced, so persistent, and so closely appressed to the stem and branches as in *P. Balfouriana*. It is thus rendered very distinct from every other, which is still further enhanced

by the open habit, long snake-like branches, and conspicuous light brown cones, which usually stand erect and near to the tips of the branches.

The tree is hardy, but of rather slow growth, the annual increase in height of half a dozen specimens I have examined, and which were favourably situated, being rather more than 6 inches. The leaves, which number five in a sheath, greatly resemble those of *P. Cembra*, are more or less appressed to the branches, from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches long, dark green on the outer and distinctly silvery on the inner surfaces. The cones are nearly cylindrical, 3 inches long by fully 1 inch in diameter, and consist of obliquely diamond-shaped light brown scales, each terminating in a stiff, upward-pointing, dull purple sharp point nearly a quarter of an inch long. The cones are invariably produced singly, are very uniform in shape and size, and give forth resin in great abundance. The seeds are small, with a wing three-eighths of an inch long. Pollen catkins are plentifully produced, they being dull purple of colour, ovate, and frequently $1\frac{1}{2}$ inches long.

P. Balfouriana aristata has the same arrangement of the needles, but these are usually longer, and to a great extent wanting in the silvery sheen for which the inner sides of the leaves of the species are so justly remarkable. The appearance of the tree is more shaggy, less refined, if I may use the expression, owing to the longer leaves and to their not being so closely appressed to the stem.

The species and its variety succeed in loamy soils that are retentive if the subsoil is porous and the exposure to the sun is good. The variety

appears to be infested with insects owing to specks of resin on the leaves. Buds are frequently formed in the centre of the tufts of leaves.

P. BANKSIANA, *Lambert*. (Synonym: *P. hudsonica*, *Parlatore*.) North-Eastern United States and eastern slopes of Rocky Mountains.—This is somewhat after the style of the better-known *P. montana*, forming in this country a low, straggling tree rarely more than 20 feet in height. It forms no continuous trunk, but instead a number of thickened, gnarled, and twisted branches, the branchlets being sparingly supplied with light green leaves, arranged two in each sheath. This tree succeeds well in stony or rocky ground, for covering which it has been found of value.

P. BUNGEANA, *Zuccarini*. North China. 1848.—Where medium-sized conifers are desirable the present is certainly one of the most interesting and distinct in character, and, when well grown, it is a species of by no means unornamental appearance. In a young state it is of narrow outline, but with age gradually becomes more spreading, the lower branches lengthening out. The latter are, however, very apt to die off in restricted situations. The bark is light grey in colour, and peels off at stated intervals, this being a peculiar characteristic of the tree. The leaves are arranged three in a sheath, are perfectly rigid, not more than 4 inches long, and, owing to their being tufted with a considerable space between each of the tufts, an unusual but very distinctive appearance is thus imparted. They are of a bright and pleasant green. The cones are ovoid, 2 to 2½ inches long, with flattish-topped scales, terminated by a small-

hooked prickle. The finest specimens that I have seen are growing in peaty soil in the open portion of a woodland in Ireland and at Kew.

P. CEMBRA, *Linnaeus*. Swiss Stone Pine. Mountains of Central Europe, Siberia. 1746.—This is a beautiful tree of neat growth, perfect hardihood, and one that succeeds in many soils and situations. There is a good deal of difference in the habit of various trees, some being of upright growth and others more spreading, but the usual type has the branches short in proportion to the height, somewhat tortuous, and decidedly erect and appressed. Usually the leaves are five in a sheath, though sometimes four or six, stout and flexible, serrated at the margins, and nearly 3 inches long. Cones erect, of a beautiful bluish purple when of full growth but before becoming ripe, and varying much in size, but usually from 3 inches to 4 inches long, and about half that in diameter, with large wingless seeds. The most suitable soil is that of a deep rich loam on a porous subsoil, but the tree is indifferent in that respect, for many fine specimens are to be found on gravelly and sandy loam if not too hot and dry, as also on chalky soils.

Although British-grown timber is excellent in quality, yet the rate of growth of the tree is too slow in this country for it to be used at all extensively for afforesting purposes. For a full account of *Pinus Cembra* and the variety, illustrated, see article of mine in *Woods and Forests*, March 1885.

P. CEMBRA PUMILA (Kamtschatka and the Kurile Islands) is of small, compact, and neat growth, as usually seen in cultivation, and the foliage is more silvery than in the type. The

leaves are thin, $1\frac{1}{2}$ inches long, and the cones remarkably neat, being $1\frac{1}{4}$ inches long by 1 inch diameter. For confined spaces or rock-work this variety is to be recommended, the height rarely exceeding 4 feet.

P. CEMBROIDES, *Zuccarini*. (Synonyms: *P. Llaveana*, *Schlectendal*; *P. osteosperma*, *Engelmann*.) Arizona. 1839.—This is of no great value for the purpose of ornament, and less so for timber. As generally seen, it is of contorted and dwarfed appearance, with irregularly arranged branches, well furnished with nearly erect-growing, stiffish leaves, each fully $1\frac{1}{2}$ inches long and bright green. The cones are small, neat, and dull brown, each about $1\frac{1}{2}$ inches long.

P. CLAUSA, *Vasey*. (Synonym: *P. inops clausa*, *Engelmann*.) Florida.—This bears a great resemblance to the better-known *P. inops*, which in this country forms a low bushy tree of 16 feet, or thereabout, in height, the branch-spread being nearly as much. The leaves of *P. clausa* are short and glaucous, arranged in twos, while the plentifully produced prickly cones are persistent on the stem and branches for many years; indeed so persistent are they that I have frequently seen them partially embedded in the wood of the branches on which they were growing. It grows in sandy barrens, and would no doubt be worthy of trial for planting in similar places in this country.

P. CONTORTA, *Loudon*. (Synonyms: *P. Bourrieri*, *Carrière*; *P. Bolanderi*, *Parlatore*.) North-West America, Alaska to California along the coast. 1831.—Amongst medium-sized pines, and for planting where ground-space is at all cramped,



Face page 126.

PINUS CEMBRA AT WOBURN.



this species is valuable. The habit is irregularly conical, the lower branches having no decided mode of growth, but being short and spreading in almost every direction. In general appearance and foliage the tree bears some resemblance to *P. insignis*, but is of duller foliage-tint, the leaves arranged in twos, and thickly on the branches. Cones are produced freely, they being ovoid-conical, $2\frac{1}{2}$ inches long, and greyish brown in colour. The scales are formidable, the umbo being prolonged into a long, awl-shaped point. The tree varies a good deal in this country, and I have seen specimens which, from their depth of foliage colouring and neat narrow pyramidal habit, were highly prized by their owner. It seems most at home when planted in rough, stony, or rocky ground, under which conditions I have known the annual rate of growth to be 2 feet for several consecutive years.

P. COULTERI, *Don.* (Synonyms: *P. macrocarpa*, *Lindley*; *P. Sabiniana Coulteri*, *Loudon.*) California. 1832.—This can hardly be classed as even a second-rate ornamental conifer in Britain, the shabby, meagre, tufted appearance of the foliage and the betrayal of bare branches being out of keeping with our ideas of a beautiful tree. Generally such is the appearance of this species, although at times one may find passable specimens. The leaves are usually arranged in threes, but I have found them in fours and fives on the same tree, though rarely; stiffish, sharp-pointed, and 10 inches long. They are greyish green, and for the greater part in clusters at the branch-tips. The cones are remarkable, being of huge size and

rich colour, those from a home-grown tree being each 8 inches long by fully 5 inches diameter at widest part, and weighing about 2 lbs. They are conical-oblong, hard as wood, and of a pleasing and warm yellowish brown tint. For many years they remain closed, even when kept in a warm room, the hooked scales, which are nearly 1 inch in length, adhering firmly together. The tree is comparatively hardy in this country, and stands exposure well, as the fine specimen at Southborough, in Kent, clearly shows. Probably the largest tree of the *Pinus Coulteri* that has ever been produced in this country was one at Highnam Court, which was blown down in the spring of 1916. The trunk measured 80 feet in length and contained 109 cubic feet of timber. Cones, many 12 inches long, had been freely produced, and some were persistent on the branches for many years. Another tree at Hoddesdon, Herts, was 80 feet high and 9½ feet in girth in 1908, and bore 20 large cones in that year. It was planted in 1857.

P. DENSIFLORA, *Siebold et Zuccarini*. Japan. 1854.—This is a distinct tree of massive and rounded contour, the upward-pointing branches being thickly set, the foliage reminding one of the bright bluish green of certain forms of the Scotch Pine, and to which, especially in a young state, it bears a marked resemblance. The leaves are two in a sheath, fully 3 inches in length; and the cones, which are often produced in small clusters, are 2 inches long, and of a light grey colour. This pine cannot long succeed when planted on cold or stiff soils, even although thoroughly drained, and I have known several healthy specimens to die

out from this cause. Shelter, but not too close confinement, and light sandy loam have been productive of the finest specimens in this country.

P. EDULIS, *Engelmann*. (Synonyms: *P. cembroides*, *Zuccarini*; *P. edulis*, *Voss*.) New Mexico, Colorado, Texas. About 1848.—In this country *Pinus edulis* forms a bush-like tree, as wide as it is high, which in a specimen at Penrhyn Castle in Wales is 16 feet. The trunk is short, with the main branches striking out at a height of 4 feet, these again being much subdivided. The leaf arrangement is somewhat irregular, but usually there are three in a sheath, though sometimes two, each about $1\frac{1}{2}$ inches long, and of a peculiar greyish green colour. Cones oblong-globose, 2 inches long by $1\frac{1}{2}$ inches wide, and borne mostly in clusters of two, three, or five; the wingless seeds, which are half an inch long, closely resembling those of *P. Cembra*. The cone-scales are hard, thick, and persistent, of a warm chocolate brown colour, and each provided with a five-sided umbo, which imparts a rough and uneven appearance to the cones. Rarely seen growing in this country, but from its neat bushy habit, when planted amongst rocky debris and in not too exposed situations, it certainly merits attention. Probably it would succeed best at the seaside.

P. EXCELSA, *Wallich*. Temperate Himalaya. 1823.—This commonly cultivated species is readily recognised by its wide-spreading branches and wealth of long, pendulous, silvery green leaves. The branch-spread is wide in proportion to the height of the tree, and with its pendulous foliage and pale grey bark, a well-grown specimen has a

striking and pleasing appearance. The leaves are five in a sheath, 6 inches long, slender and limp, the edges rough, and of a silvery bluish tinge. The cones are remarkable, being produced freely even by young specimens, and owing to their great length and open character when ripe, and also to their peculiar yellowish brown colour, they give to the tree a decided character. They are often as much as 8 inches long, by 3 inches diameter, and usually curved. For planting in rich, damp loam, and where shelter is afforded, this pine is valuable, but in too light soils and in exposed sites it wears anything but a pleasing appearance.

P. FLEXILIS, *James*. Eastern slopes of Rocky Mountains, Montana to New Mexico, Texas, Utah, Nevada, Arizona. 1851.—Not generally cultivated in this country. When young, the tree has a *Cembra*-like appearance, but is far less symmetrical in branch arrangement, these being long, slender, and of upward growth, the latter a distinguishing characteristic of the tree. The leaves, five in a sheath, are fully 2 inches long, glaucous green, and plentifully arranged on the lithe and thin branchlets, those towards the extremities adpressed to the branches and pointing forward; while the cones are comparatively blunt, 3 inches long by nearly 2 inches through at the widest part. This species has attained to nearly 30 feet in height on gravelly soil at Kew. According to Murray, who saw it wild on the Rocky Mountains and the Sierra Nevada, it varies greatly in stature and habit. High up on the mountains, where it is exposed to the coldest blasts, "it is," he says, "reduced to a trailing shrub 1 or 2 feet high,

wandering over the ground, and with its foliage so densely packed that a man could almost walk over it." At lower altitudes, and under more favourable conditions, it attains the size of the Scotch Pine in this country. The specimens at Kew are quite erect, clean grown, and symmetrical.

P. GERARDIANA, *Wallich*. (Synonym: *P. Gerardi*, *Forbes*.) North-Western Himalaya. 1839.—Though not generally hardy in this country, yet the fact of several fine healthy specimens existing at various places should be encouragement for a fair trial to be given to this interesting species. Its pale grey bark peels off in long flakes as in *P. excelsa*. The leaves are about 5 inches long, and stiff, while the cones are nearly globose and $4\frac{1}{2}$ inches in diameter. The largest specimens that I have seen are on Sir William Verner's property, in North Ireland; and any one seeing these would at once be impressed with their distinctive characteristics and general hardihood.

P. GLABRA, *Walta*. South Carolina, Florida.—In this rare species the branches spread horizontally and the branchlets are numerous, thus imparting a dense habit to the tree. The leaves are arranged three in a sheath, are slender, and from $2\frac{1}{2}$ inches to $3\frac{1}{2}$ inches long. Cones ovate-oblong, 2 inches long by 1 inch diameter at thickest part, and with relatively short foot-stalks. They are generally solitary. The bark is reddish brown and furrowed lengthwise.

P. HALEPENSIS, *Miller*. Aleppo Pine. (Synonyms: *P. maritima*, *Lambert*. Mediterranean, Caucasus, Levant, Afghanistan. 1683.—Though seldom seen in these Isles, yet there are many

maritime estates where this distinct species would thrive well and form a handsome specimen.

In this country the tree is of rather ascending growth, and well supplied with long slender branches and short branchlets. The leaves are silvery grey, arranged two in a sheath, and about 2 inches long. Cones rounded at the base, ovate, 3 inches long by $1\frac{1}{4}$ inches diameter, and placed on stout foot-stalks nearly 1 inch long. This pine has a light and airy appearance, caused by the branches being rather scantily furnished with leaves, more especially on the inner and lower portions, but this does not give a meagre or unhealthy appearance, but rather that of a refined and unusual aspect. The rate of growth in this country is by no means slow, the tree from which this description was taken having reached a height of 45 feet in thirty years. For planting in sandy soil by the sea-coast it is a valuable tree, as has been proved both in Wales and Ireland. An article of mine, with illustrations of the Aleppo pine, will be found in *Woods and Forests*, November 1884.

P. HARTWEGI, *Lindley*. (Synonym: P. Montezumæ Hartwegi, *Engelmann*.) Mountains of Mexico. 1839.—Generally this is not hardy throughout Britain, though here and there, particularly in Ireland, healthy specimens are to be met with. I have seen it doing well planted in an open field surrounded by woodlands and in free loamy soil. It is very ornamental, owing to the beautiful glaucous green, almost silvery leaves, which are arranged in tufts of five.

P. INOPS, *Solander*. Scrub Pine. (Synonyms: P. virginiana, *Miller*; P. variabilis, *Lambert*.)

North-Eastern United States.—In this country, at least, the present species cannot be ranked as an ornamental tree, the stout and twisted branches, and generally unfurnished and straggling appearance being the reverse of beautiful. The leaves are greyish green, produced plentifully, and two in a sheath. The glaucous shoots are very characteristic. A rather peculiar appearance is given to the tree by the prickly and thickly produced cones, which are often found in whorls far back on the branches, where they persist for many years. One of the largest specimens I have seen is growing on broken slaty rock with decayed vegetable matter, near the Penrhyn Slate Quarries in Wales.

P. INSIGNIS, *Douglas*. Remarkable Pine. (Synonyms: *P. radiata*, *Don*; *P. tuberculata*, *Don*.) California. 1833.—A handsome, fast-growing conifer, but unfortunately one that in point of hardihood cannot everywhere be depended upon. The ornamental character of this species is universally admitted; indeed, it might well be described as the greenest and most dainty of all pines, while it is probably the most rapid in growth. The leaves, three in a sheath, are slender and thread-like, of a bright, clear green, and 5 inches long; while the cones are the same length, $2\frac{1}{2}$ inches in diameter, and of a shining chocolate colour. It is certainly unfortunate that so noble and beautiful a tree has not been found generally hardy in these islands, and that it is, in consequence, but seldom planted except in the south and west. It also suffers from wind-waving, the head of foliage being heavy and the root-spread narrow. Too much coddling should be dispensed with in

the cultivation of *Pinus insignis*, as, being apt to start early into growth, it suffers from our prevalent frosts in early May. A plantation composed entirely of the tree has done well on cold, slate soil, and where freely exposed, in Sussex.

P. JEFFREYI, *Greville*. (Synonym: *P. deflexa*, *Torrey*.) California. 1852.—A noble-growing tree, with stiff, short branches, placed far apart, and beautifully glaucous leaves, about 10 inches long, arranged three in a sheath. The cones are of a warm brown colour, 8 inches long, the bracts closely packed, and each terminating in a blunt spine. There is much general agreement in appearance between this species and *P. ponderosa*, particularly in the arrangement and length of branches; but close examination will show that in the *P. Jeffreyi* both leaves and cones, the latter in particular, are considerably longer. It is quite hardy, free of growth, and succeeds well on limestone or chalky formations.

P. KORAIENSIS, *Siebold et Zuccarini*. Korea, Kamtschatka, Japan. 1861.—This is a handsome and compact-growing tree, that forms a neat lawn or garden specimen in a short space of time. The branches are dense and short, the leaves glossy green above, and averaging 4 inches in length. Cones 5 inches long, almost of equal diameter— $2\frac{1}{2}$ inches—throughout, and with the rich brown scales turned well back at their points. For ornamental grounds this species is well worth cultivating, the beautiful foliage tint and neat habit being special recommendations. In this country it does well in not too heavy nor damp yellow fibrous loam.

P. LAMBERTIANA, *Douglas*. Sugar Pine. California, Oregon. 1827.—With its giant proportions, distinctly glaucous green foliage, and large and beautiful cones, this species must be considered as one of the most ornamental of the genus. In England it has not usually succeeded well, although there are numerous beautiful specimens of it. It is of erect growth, the trunk being heavy and well formed, while the branches have a distinctly horizontal, or, perhaps more correctly, downward tendency in growth, with the tips upturned. The slender leaves, arranged five in a sheath, are about 4 inches long, of a distinct shade of green, and for the greater part tufted near the branch tips. The cones are strikingly handsome, being in home-grown specimens from 12 inches to 14 inches long, cylindrical, and with the bracts loosely arranged. Two seeds are beneath each scale, these being three-quarters of an inch long. The bark is light grey in colour, resembling, as indeed does the whole tree, the better-known *P. Strobus*.

P. LARICIO, *Poivet*. Corsican Pine. Dalmatia, Servia, Thessaly, Crimea, Asia Minor, Caucasus. 1759.—Whether in an ornamental or an economic sense this must be considered one of the most valuable of all the pines that are cultivated in this country. It is of rapid growth, succeeds well in many classes of soils, even in that of gravelly composition, and produces a large quantity of excellent timber. In point of ornament this pine occupies a front rank, the finely rounded and perfectly straight trunk and thickly clothed branches being different to almost every other species. The

leaves are glaucous green, about 4 inches long, and produced in twos; while the light yellow cones are $3\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches in diameter, and taper quickly to the point. The upright habit, narrow branch-spread, and finely formed trunk, are points of special recognition, and which make this species so well suited for general forest planting. For monograph on the Corsican Pine and its value for afforesting purposes, by the present writer, see *Transactions of the Royal Scottish Arboricultural Society*, vol. xii. part ii., 1886. There are many varieties, the following including the best known and most useful:

P. LARICIO NIGRICANS, *Parlatore*, Austrian Pine (Synonym: P. austriaca, *Hæss*), is readily distinguished by the prominent light grey buds, shaggy dark green foliage and well-branched stem, the diameter of branch-spread being often nearly equal to the height of the tree. The leaves are stiff and sharply pointed, fully 4 inches long, and produced thickly in pairs. In most respects the cones resemble those of the species, but they are usually larger and of lighter colour. For the purpose of shelter this is a valuable tree, and when given plenty of room for branch-development it soon assumes a broadly conical mass of dark, almost yew green foliage. The timber is rough in comparison with that of the species, due mainly to the weighty branches, and contains a great quantity of resin. It is an excellent seaside tree, and grows with great vigour on chalky soils. Introduced in 1835.

P. LARICIO PALLASIANA (Synonym: P. Laricio karamana) is of large growth, broadly pyramidal

in habit, and with stiff, bristling foliage, and large cones. This is a far more distinct and valuable forest tree than is generally supposed, although in the latter respect it cannot compare with the species in the production of straight clean timber, as it branches more freely, and these are proportionately heavier and larger, and produced down almost to the ground-level on trees growing in the open—a rare occurrence with the species. I measured a short time ago one of the largest specimens of *P. L. Pallasiana* growing in this country, which was fully 75 feet in height, the spread of branches nearly as great, with a stem girth at 3 feet of fully 9 feet. The tree is growing on light sandy loam in a Surrey park, and it is certainly a very handsome specimen, the long, sweeping branches, much-divided trunk, and deep green bristling foliage rendering it peculiarly distinct and ornamental. Introduced about 1790.

The number of cones produced by *P. L. Pallasiana* is remarkable, compared with the species, nearly every branchlet bearing three. The cones are much bigger than those of *P. Laricio* proper, being from 3 to 4 inches long by $1\frac{1}{2}$ to 2 inches at widest part, and of a pleasant yellow-ochre colour. Even the lower branches bear cones freely.

But the reason that I wish particularly to bring this variety under notice is for its now justly acknowledged value for planting in peaty soils that are not very dry or well drained. A curious example of this was brought under my notice recently, where a Larch plantation formed on peat bog turned out a failure owing to drainage not having received sufficient attention. The ground

certainly had been drained after a fashion, but too few water-channels had been cut, and the consequence was that, owing to excessive dampness, all the trees, excepting such as had been planted by the ditch-sides, became covered with a lichen, and gradually would have died out had they not been removed. A number of fresh drains were cut, the original ones cleared out and deepened, the heather, bilberry, and other shrubby growth cleared away, and the ground replanted with the common Scots Pine and the present variety, *P. Laricio Pallasiana*. These trees are now models of beauty and health, the foliage being of the brightest and healthiest description, and the rate of growth rapid—all pointing out that they are peculiarly suitable for peaty soil and a fully exposed situation.

P. LARICIO PYGMÆA is of dense, compact, and quite dwarf growth, but of no particular value for ornamental planting. The leaves are short and tufted, and of a greyish green colour.

P. LONGIFOLIA, *Roxburgh*. Himalaya.—This species is rarely found in collections of conifers in the British Isles, it being tender, unless in the most-favoured localities. There are good specimens at Penrhyn Castle, North Wales, and at Churchhill, in the north of Ireland, thus showing that at least in certain districts its hardihood can be relied upon. The trees that I have seen are sparsely branched, probably from the distances apart at which the various trees were grown, thus showing off the trunk, the bark of which is of a light and warm colour. The leaves are, however, very beautiful and remarkable, being 16

inches long, of a silvery green tint, and hang in plumes from the branch-tips. When viewed from a distance, this pine has a striking and very unusual appearance, from the great length and disposition of the leaves. In favourable places I have noted the upward rate of growth to be 10 feet in as many years.

P. MITIS, *Michaux*. (Synonyms: *P. variabilis*, *Pursh*; *P. echinata*, *Miller*; *P. Tæda variabilis*, *Aiton*.) Eastern United States to Florida and Texas. 1739.—This species has no particular value here, whether for ornament or the quality of timber produced; though in the latter respect it is one of the most valuable of the North American pines. After the first ten years this tree seems to start and make headway in these islands, but even then it cannot be called either beautiful or distinct. The leaves are dark and dull of colour, 3 inches long, and arranged two in a sheath. It produces the “yellow pine” of commerce.

P. MONOPHYLLA, *Torrey*. (Synonym: *P. Fremontiana*, *Endlicher*.) Sierra Nevada, Utah. 1848.—For planting in grounds of small extent this tree has several valuable qualifications. It is of low growth, never more than 20 feet high, strictly pyramidal when young, but becoming loose and rather straggling with age, the foliage being thickly produced and of an unusual and decidedly pleasing glaucous tint. Even in the reddish, scaly bark it is something out of the common with pines in general. The leaves are solitary and rounded, very rarely in pairs, and when so, semi-cylindrical and adherent for the greater part of the length, nearly 2 inches long, and of an oily or shining

green tint. Contrasting markedly with the glaucous green foliage are the reddish brown cones, each about $2\frac{1}{2}$ inches long, with stout, thick scales, and large wingless seeds. The seeds are delicately flavoured, and supply the Indian tribes of the Sierra Nevada with an important article of food. In this country, where the tree is quite hardy, the finest specimens are growing on gravelly soil.

In the Cheshunt Nurseries a specimen of *P. monophylla* has attained to a height of 18 feet in twenty-five years.

P. MONTANA, *Miller*. (Synonyms: *P. Pumilio*, *Hænke*; *P. Mughus*, *Scopoli*; *P. uncinata*, *Ramond*.) Sub-Alpine districts of Central and Southern Europe. 1779.—In gardens, under the above synonyms, the mountain pine is freely distributed, but as the so-called species and varieties are much alike, they are here classed under the present collective title of *P. montana*. The habit in this country is that of a wide-spreading and much-branched bush of rarely more than 16 feet in height, many of the branches shooting out from the main stem at only a short distance from ground level, but with an upward inclination.

A distinctive feature of the tree is the very prominent ruddy buds, as also the rich tint of the ample foliage, which is of a very dark and pronounced shade of green. Each leaf is fully 2 inches long, very stiff and stout, and closely arranged. Cones are only sparsely produced in this country even by old and well-established specimens, they being $1\frac{1}{2}$ inches long, and greatly resembling those of the common Scotch Pine. Being quite hardy and very accommodating, this

species has been largely used in the formation of game coverts, and for planting rocky, almost soil-less ground where few other shrubs could succeed. For such purposes the spreading procumbent growth and thick, massy nature of the foliage render the tree peculiarly suitable. For illustrated article of mine on *P. montana*, see *The Garden*, vol. xxx., 1886.

P. MONTEZUMÆ, *Lambert*. (Synonyms: *P. occidentalis*, *Humboldt*, *Bonpland et Kunth*; *P. Devoniana*, *Lindley*; *P. Russelliana*, *Lindley*.) Mexico. 1839.—A rare and beautiful species, and one that varies much in almost every particular. As seen in this country, it is broadly pyramidal in habit, well branched even to the ground, and furnished liberally, particularly towards the branch tips, with bluish green foliage, arranged in tufts of five. By reason of the great length of the leaves, 6 inches, and unusual shade of blue green, a particularly striking aspect is imparted, and the tree cannot well be confused with any other species. The cones, which vary greatly in dimensions, somewhat resemble those of *P. halepensis* both in shape and size, they being $3\frac{3}{4}$ inches long by $1\frac{1}{2}$ inches diameter, and nearly smooth, or without an extension of the scale beyond the limits of the cone. As showing the variability in the size of the cone, I might mention that home-grown specimens fully 4 inches long have been forwarded to me. It is to be regretted that so distinct and beautiful a species is not generally hardy in this country, for, except in the south and west, it rarely succeeds. *P. Montezumæ* may be seen in vigorous growth, and about 40 feet high, both at Fota Island, Cork,

and in the Isle of Man. The late Mr. Farrant, from the latter place, furnished me with much useful information regarding such rare species as *Pinus patula*, *Picea religiosa*, and others that succeed well in that favoured spot.

The so-called species, *P. macrophylla*, with longer leaves and spiny cones; *P. Lindleyana*, with shorter leaves and smaller cones; *P. Winchesteriana*, *P. Gordoniana*, and *P. Grenvilleæ*, can only be recognised as forms of this very variable species.

P. MONTICOLA, *Don*. Vancouver Island, British Columbia, Oregon to California. 1831.—A distinct and beautiful hardy pine, that is well distinguished by its narrow branch-spread and silvery green foliage. In a specimen of 80 feet in height the branch-spread is only 18 feet, though ample space has been allowed for development. The leaves are about 3 inches long, arranged in fives, rather rigid and rough on the margin. Cones are produced plentifully all over the tree, and resemble greatly those of *P. Strobis*, but they are smaller generally, being 5 inches long, nearly 2 inches in diameter, and cylindrical. They are usually bent or curved. A peculiarity of the bark is that it splits into square plates, but is never ragged or untidy, and is of a pleasing ash grey colour on the younger, and darker on the older portions. It produces timber rapidly, a specimen at Esher in Surrey having attained to fully 70 feet in height in forty years, with a clean and well-rounded bole that girths 7 feet at a yard from the ground. In dampish, loamy, or sandy soil it grows well.

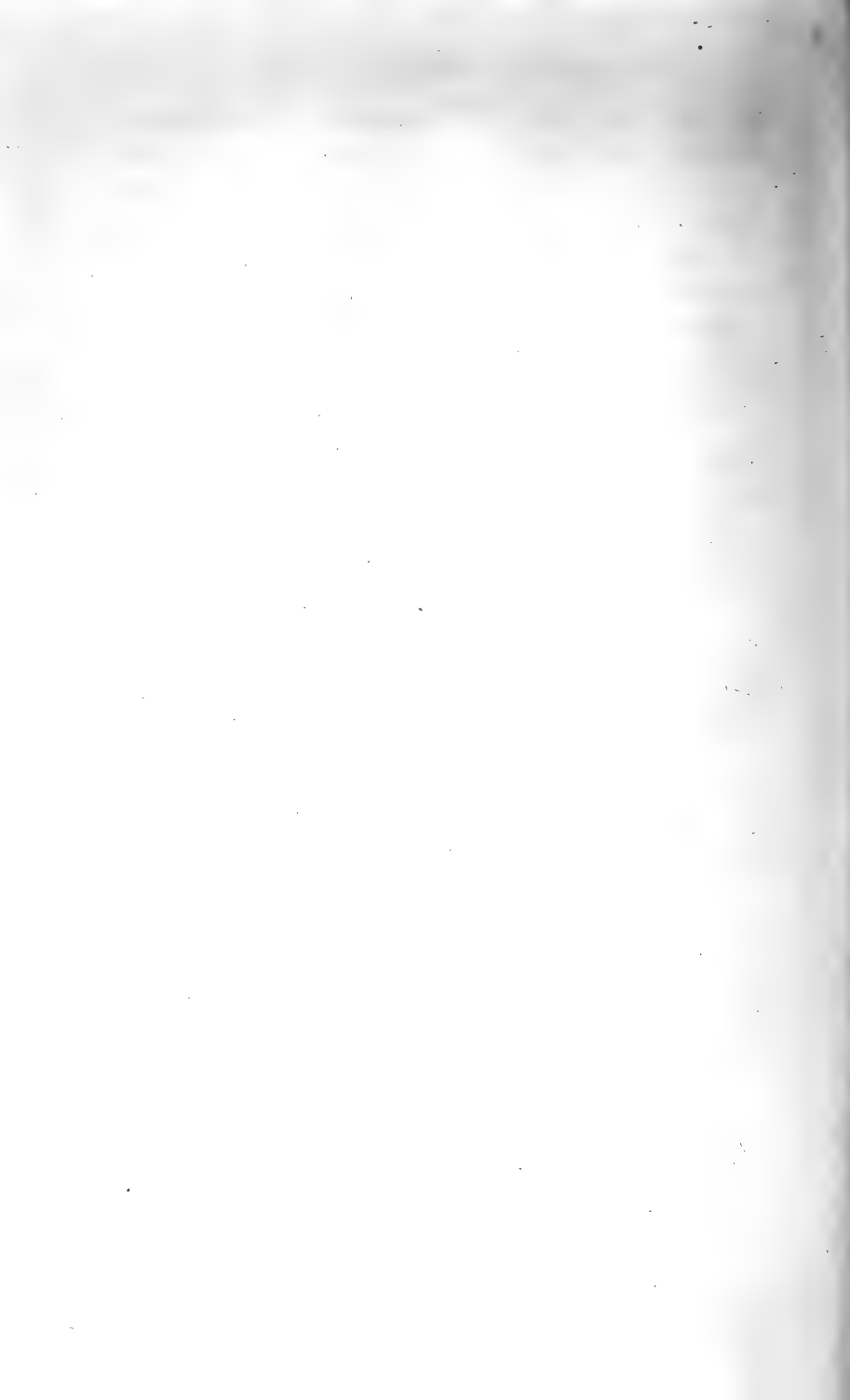
As a timber-producing tree *P. monticola* is likely



Face page 142.

PINUS MONTICOLA AT MURTHLY CASTLE.

Height, 85 feet.



to attract attention, the quality of that produced in two widely different parts of this country being such as to warrant us in speaking highly of it. The tree is very hardy, several of the healthiest specimens I have seen being in the environs of Edinburgh. A variety with stouter and broader leaves and having the young cones purple instead of pale green as in the species, has been named *P. monticola porphyrocarpa*, Murray.

P. MURICATA, *Don*. (Synonym: *P. Edgariana*, *Hartweg*.) California. 1846.—This is a very distinct tree, not only from the massive well-rounded top, but on account of the large and uniformly arranged branches, which in most specimens break out from the main stem at a few feet from ground level. The thickly clustered, prickly cones, which adhere so firmly to the stem and branches that a good knock is required to free them, are unlike those of almost any other species, and form a speedy means of identification. They persist for many years, and being arranged in whorls around both stem and branches, have a very unusual and curious appearance. The leaves are fully 4 inches long, bluntly pointed, and slightly serrated on the margins. For planting on rocky ground or even on poor sandy soils, this pine is valuable, but it wants protection from rough winds, as it is apt to get uprooted, the head being heavy in proportion to the height and root-spread.

P. OOCARPA, *Schiede*. (Synonyms: *P. oocaroides*, *Lindley*; *P. Skinneri*, *Hort*.) Mexico, Guatemala. 1838.—This is a beautiful species, much after the Mexican *P. Montezumæ*, but unfortunately it is not sufficiently hardy to withstand

the rigours of our climate, unless in the south and west, where good specimens of both are occasionally to be met with. The present species is of rather broadly pyramidal habit of growth, with the top wide, owing to many leading growths shooting up, and it is well branched down to the ground. The leaves are five in a sheath, rather harsh and rigid, and of a pleasing but not very bright shade of green. The cones are small and oval or egg-shaped.

P. PALUSTRIS, *Miller*. (Synonym : *P. australis*, *Michaux*.) Southern States of U.S.A. and Texas. This is the species, the timber of which, under the name of "pitch pine," is so largely imported to this country. Unfortunately it is not a suitable tree for cultivating in these islands. It is of upright growth, but straggling and meagre in appearance, with long deep green leaves, arranged three in a sheath. Planted in dampish, well-drained loam, and under unusually favourable circumstances, a few specimens have done fairly well both at Penrhyn Castle and Woburn Abbey.

P. PARVIFLORA, *Siebold et Zuccarini*. Japan. 1861.—As a perfectly hardy, free-growing, and decidedly ornamental Pine, the above species is certainly not sufficiently recognised in this country. It is of comparatively low and spreading growth, with flexible, upcurved branches that are well supplied with foliage. The leaves are in bundles of five, about 2 inches long, slightly twisted, bluish green on the exposed, and distinctly silvery on the inner, sides. Cones are freely produced, usually several together, each from 2 to 2½ inches long by 1¾ inches diameter at the widest part, and com-



Face page 144.

PINUS MURICATA AT CLAREMONT.

posed of hard, brown, widely wedge-shaped scales. Two seeds are contained beneath each scale, these being three-eighths of an inch long with a broad wing of the same length, 2800 being included in 1 lb. weight. The bark is of a light greyish green colour. In early spring the beautiful yellow male catkins render the tree highly conspicuous. I have seen beautiful examples of this pine in the north of Ireland, where they were growing fully exposed on light gravelly loam.

P. PATULA, *Schlechtendal et Chamisso*. Mexico. A soft and lovely tree, quite wanting in stiffness or formality, the long and gracefully pendulous foliage rendering it distinct from every other member of the family. It cannot be planted wholesale, as the experience of past winters has convinced us that, unless in the milder parts of these islands, its hardihood cannot be relied upon. Usually the branches ramify much, the branchlets being long and lithe, but even this does not cause the stem to look naked or bare, as the long, soft, delicately green leaves hang gracefully downwards for from 8 to 12 inches in length. The arrangement of the leaves is usually irregular, sometimes three and sometimes four being contained in one sheath. I have noticed that on the outer or exposed sides of the shoots the leaves are usually in three, while on the inner they are in fours. The cones, which closely resemble those of the Austrian Pine, are generally arranged in whorls of four, are $2\frac{1}{4}$ inches long by $1\frac{1}{4}$ inches diameter, incurved, and usually pointing downwards. The bark of the branches is fawn colour, that of the stem leaden grey; while an unusual appearance is presented in spring

by the long, sharp-pointed, and fluffy buds. This pine has succeeded from Edinburgh southwards, but the finest specimens I have met with are those in Cornwall and the Isle of Man. Both at Menabilly and Carclew, in Cornwall, many of the rarer coniferous trees grow freely, and from the latter estate I have been sent fruiting specimens of the rare and beautiful *Pinus patula*. Unfortunately this handsome Mexican species has suffered much by the frosts of our late winters. The Carclew specimen is fully 45 feet in height.

P. PATULA MACROCARPA has distinctly larger cones than the type, but otherwise the trees are much alike.

P. PEUKE, *Grisebach*. (Synonyms : *P. excelsa*, *Hooker* ; *P. excelsa peuce*, *Beissner*.) Macedonia. —This might well be described as a dwarf form of the better-known *P. excelsa*, but under cultivation in this country the differences between the two are so well defined and constant that it is preferable to consider them as specifically distinct. In this country the tree is of neat form, with abundant foliage, each leaf 3 inches long, the pendent, quickly tapering cones being about 3 inches in length by $1\frac{1}{2}$ inches diameter at thickest part. From this description it will readily be perceived that in size, length of foliage, and dimensions of cones, *P. peuke* differs sufficiently from *P. excelsa*.

P. PINASTER, *Solander*. Cluster Pine. (Synonyms : *P. maritima*, *Lamarck* ; *P. syrtica*, *Thore*.) Mountains and sea-coast of Southern Europe, the Levant, etc.—For shelter-giving purposes, for planting amongst pure sand on the sea-coast, and on shingly gravel inland, this is one of the most

valuable species. It is a tree of giant proportions, with huge, unwieldy branches, ponderous trunk, covered with rough scaly bark, and usually a well-rounded head of intense green foliage. The leaves are stout and stiff, 8 inches long, and produced in pairs. A distinguishing characteristic of this pine is the large and densely clustered cones; they frequently occur in groups of from 8 to 20, or more. Each cone measures 6 inches in length, and is of a warm cinnamon tint, similar to portions of the freshly exposed bark. The timber is of little value, but my experiments with it are recorded fully in the chapter on timbers at the end of this volume.

P. PINASTER HAMILTONII, *Gordon*, is a very distinct variety, but has escaped the notice of planters to a very great extent. The well-branched stem, rounded head, and distinct shade of green that pervades the foliage are all points of distinction that cannot be lost sight of when comparing the variety and species. The leaves are shorter and broader, and the cones smaller and ovate rather than truly conical. A refined *P. Pinaster*, in which the massive, easy appearance of that tree is substituted by a formal and dressy aspect, explains well the character of this variety. It withstands long-continued storms with almost perfect impunity. Common along the Belgian sand dunes.

P. PINASTER LEMONIANA, *Loudon*, differs in the small erect cones being for the greater part produced singly. The cones are hardly 2 inches long by $1\frac{1}{4}$ inches diameter, with unarmed or nearly smooth scales. Usually the tree is of small growth, with short leaves 3 inches long.

P. PINASTER PROLIFERA.—This is not only a

distinct but very remarkable form of the Cluster Pine, while at the same time, even under the very best cultivation, it cannot otherwise be described than as an ugly, wretched-looking, and ungainly tree. Some of the oldest specimens I have observed were growing near the remote village of Pentir in Carnarvonshire; but which, although ample room for development has been allowed them, are no ornament to the position they occupy, and in consequence several have already been removed. The largest hardly exceeded 30 feet in height, and all were remarkable for their contorted and half-dead appearance, caused by the stout, tortuous branches having died back, and yet remained in position for fully half the height of the tree. The immense clusters of small cones adhering to the long dead branches further added to the weird appearance of these pines; and in several instances I counted fully 60 cones in a single cluster of not more than 1 foot in length. In some of the cottages these huge clusters of cones were used as ornaments, that portion of the branch on which they grew being inserted in a wooden stand, and the whole varnished over. I counted 65 cones, each fully 2 inches long, in one of these ornamental clusters. Even in colour and shape the cones are exact miniatures of those of the type; the leaves are only about half as long, and the bark is of a very dark brown colour and flaked.

P. PINEA, *Linnaeus*. The Stone or Umbrella Pine of Europe. (Synonym: P. maderiensis, *Tenore*.) Mediterranean region, Madeira, Canaries.—As usually seen in this country, the Stone Pine forms a low-growing tree, the trunk dividing into

numerous large branches at 5 feet or so from the ground, the extremities being thickly beset with foliage, the contour assumed being a bushy head of rounded form. The leaves, two in a sheath, are $4\frac{1}{2}$ inches long, and of a warm, rich olive-green colour. Three years are required for the full maturity of the cones, which are then of a light reddish colour, 4 inches long by 3 inches in diameter. The cone scales are stout, remarkably hard, and with two large wingless seeds beneath each, these being three-quarters of an inch long, and containing a sweet and agreeable kernel. In the younger stages of growth the tree is somewhat tender. Sandy or gravelly soil suits it well. From samples of the wood of *P. Pinea* that I have had cut up, both at Penrhyn Castle and Woburn Abbey, it appears to be of fairly good quality, being light, from the small quantity of resin it contains, and in colour resembling the Yellow Pine of commerce.

P. PONDEROSA, *Douglas*. (Synonyms: *P. Benthamiana*, *Hartweg*; *P. brachyptera*, *Engelmann*; *P. Beardsleyi*, *Murray*; *P. Craigiana*, *Murray*; *P. Parryana*, *Gordon*.) British Columbia, south and east, to Texas. 1827.—As an ornamental tree much cannot be said in favour of this species, the rather lax and tortuous branches, long foliage, and generally gaunt appearance imparting to it more of the picturesque than the beautiful. The leaves, which are almost wholly confined to the branch extremities, are somewhat rigid, varying in length from 8 inches to 12 inches, and of a dark glaucous green colour. Cones small and ovoid, about 5 inches long, and the scales terminating in short stiff spines. Generally hardy.

P. PSEUDO-STROBUS, *Lindley*. Mountains of Mexico.—Not hardy unless in very warm and maritime districts. It is a handsome species of large and spreading growth, not unlike *P. Strobis*, but more silvery in appearance.

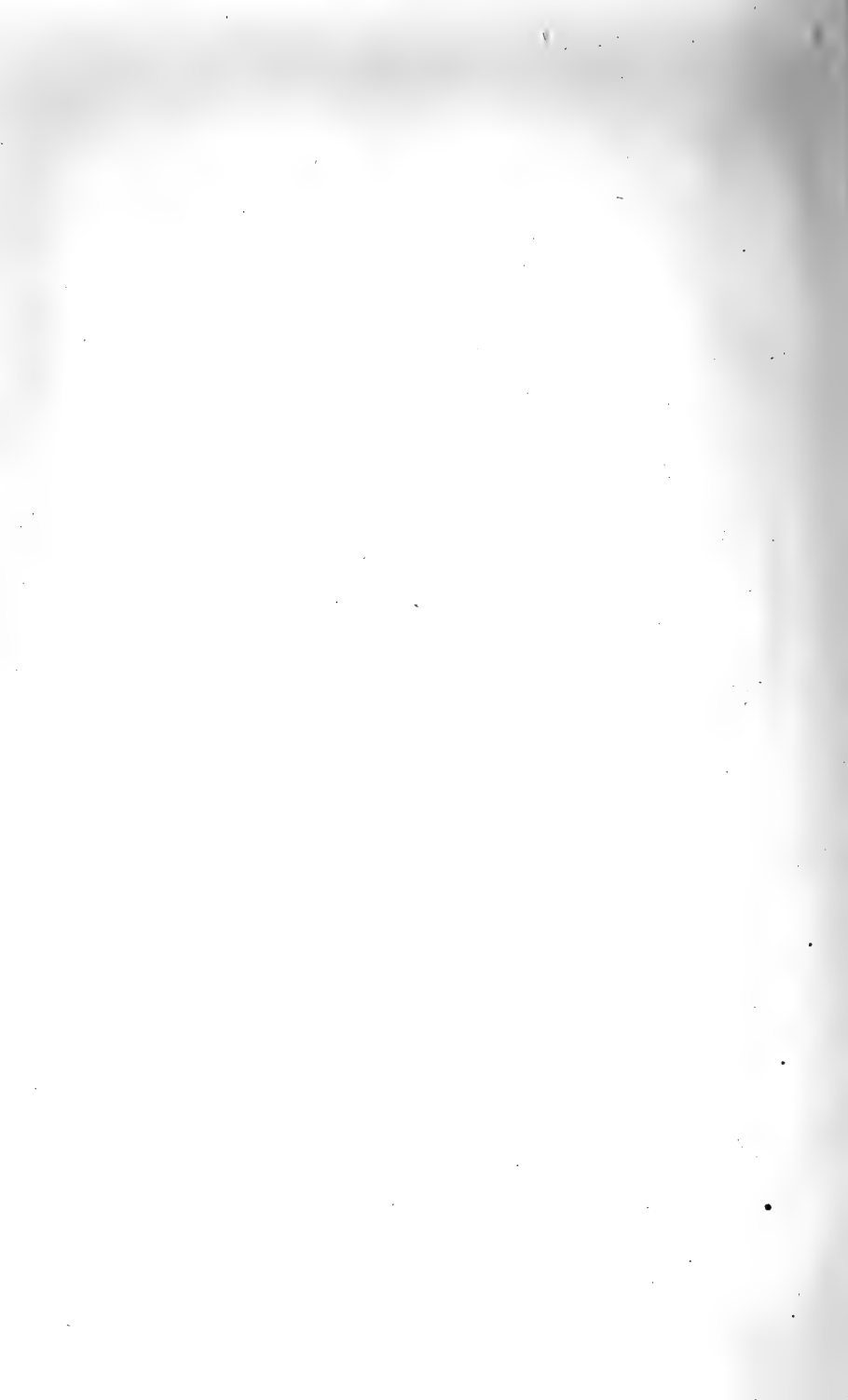
P. PUNGENS, *Lambert*. Virginia, Carolina, and Pennsylvania. 1804.—The whole contour of this tree is irregularly spreading, with pale yellowish green leaves, each $2\frac{1}{2}$ inches long, placed thickly on the branches. The cones give a very unusual as well as formidable appearance to the trees, these being yellowish brown, and arranged in whorls around both stem and branches. They are without foot-stalks, 4 inches long, by 3 inches diameter at the base, and tapering quickly to a sharp point. The scales are hooked. At only a few stations in this country have I known *P. pungens* to do at all well.

P. PYRENAICA, *Carrière*. (Synonyms: *P. Brutia*, *Tenore*; *P. Loiseleuriana*, *Carrière*.) Mountains of Southern Europe, Asia Minor, the Levant, etc. 1834.—As seen generally in this country, the present species cannot be ranked as ornamental, while it is frequently confused with the totally distinct and far more valuable *P. Laricio pyrenaica*. The largest specimens of the true *P. pyrenaica* that I have seen, and from which these notes were taken, are growing on the Churchhill property, in the north of Ireland. They are of untidy, informal appearance, with long and lithe branches, deep green, wavy leaves, $4\frac{1}{2}$ inches long, and smoothish oblong cones, the scales of which do not project much beyond the general outline. By the sea-coast it does well, and puts



PINUS PONDEROSA AT DROPMORE.

Face page 150.



on a healthier and more clothed appearance than is the case when cultivated inland. The specimens above referred to were growing in black moory soil.

P. RADIATA, *Don.* (Synonyms: *P. insignis macrocarpa*, *Hartweg*; *P. insignis* of some.) Upper California. 1829.—Though this tree bears some resemblance to the better-known *P. insignis* yet the two are widely different, *P. radiata* being a much hardier tree when planted in inland situations. The foliage, too, is stouter, shorter, and of a duller green, while the cones are much larger and more persistent than those of *P. insignis*.

When well grown it is a distinct and beautiful tree with a massive, well-rounded top and usually clothed with branches to the ground-level, the diameter of branch-spread equalling the height in many of the home-grown specimens.

The largest *P. radiata* that I have measured is growing on the lawn in Cooper's Hill Park, which is 65 feet high with a branch-spread of 63 feet and a stem-girth of 12 feet 7 inches at a yard from the ground. The cones are produced in great abundance usually in circles around the branches as well as on the stem where they persist for many years. As many as twenty-five whorls of cones may be seen on some of the branches.

Another fine specimen is growing on a hillside on the Churchhill Estate in North Ireland, and it is remarkable how like in appearance is this tree and the one at Cooper's Hill. The soil on which both trees are growing is gravelly and the situation elevated. When most of the established trees of *P. insignis* along the coast were injured or killed

by the severe frost last winter, *P. radiata* was quite unharmed in inland situations.

P. RESINOSA, *Solander*. (Synonym: *P. rubra*, *Michaux fil.*) Newfoundland, Canada, to Pennsylvania. 1756.—This species thrives in a fairly satisfactory manner generally throughout the British Isles. It is of open character, the branches being long, and with a naked appearance, from the leaves being collected in tufts at their tips. The leaves are in pairs, dark green, and nearly 6 inches long; while the warm, cinnamon-tinted cones are each 2 inches long, and ovate-conical. For planting on thin, gravelly soils, this is a useful pine, and has, in this country, been found well suited for mixing with such species as *P. Laricio*, *P. sylvestris*, and *P. Pinaster*. The timber is highly prized in Canada, where it is known under the name of the Red Pine; but in this country the lasting properties of home-grown wood have not yet been satisfactorily tested.

P. RIGIDA, *Miller*. American Pitch Pine. (Synonym: *P. Tæda rigida*, *Solander*.) North America. 1759.—A highly ornamental and useful conifer in this country, and one that is singularly devoid of the stiffness and formality for which many species are so remarkable. The outline of the tree, as generally seen in England, when allowed room for development, is somewhat after the style of our native species, the branches being arranged in no regular way, some assuming a spreading and others a pendulous mode of growth, thus showing off the warm and pleasantly tinted bark. The leaves are arranged three in a sheath, are from $3\frac{1}{2}$ inches to 4 inches long, stiffish, and

rich green in colour. In this country there are considerable differences in the length and colour of foliage in different trees, due mainly, I have noticed, to the soil and situation in which the particular specimens are growing. The cones, which are produced in groups up to seven and eight, are 3 inches long by $1\frac{1}{2}$ inches wide, and with the scales terminating in small sharp-hooked spines. The tree is useful for growing on poor sandy or gravelly soils where only a very limited number of species could subsist.

P. SABINIANA, *Douglas*. Digger Pine, California. 1832.—This species can hardly be said to be quite hardy, the healthiest and best-grown specimens occurring either in Ireland or on the south or west coast of England. It is a beautiful tree, but wears a bare and naked appearance, from the fact of the foliage being mostly in tufts at the branch tips. The peculiarly graceful manner in which the tufts of leaves are arranged rarely fails to attract notice, for they grow almost upright for several inches, and then with the easiest grace fall backwards and outwards almost in a circle from the point where they originated, and for sometimes 10 inches in length. This imparts a weeping and airy appearance to the tree that is by no means readily explained, the foliage being of a rich bluish green hue. The cones are justly remarkable, for in the home-grown specimens now before me they are not unlike large, fully ripe pine-apples both in size and shape. Each cone is 8 inches long by fully 6 inches diameter at widest part, hard as yew wood, and the scales terminating in hooked points. They are of a light brown colour,

and contain nearly 300 seeds, which are large and edible.

Light warm soils and well-sheltered situations must be chosen for this handsome species.

P. STROBUS, *Linnæus*. The Weymouth Pine. Canada, Northern United States, and southwards to Georgia. 1705.—Both as an ornamental tree and for the quality and quantity of timber produced in this country, the Weymouth Pine has received a considerable share of attention. It is perfectly hardy, free of growth, and not over-exacting as to the quality of soil in which it is planted. At a distance the tree is readily recognised by its light grey, feathery appearance and smooth ashen grey bark. The leaves, arranged five in a sheath, are nearly 5 inches long, very slender, and of a pleasing, soft, silvery green tint; while the cones are from 6 inches to fully 8 inches in length, usually bent or curved, and when growing exude resin freely. In some of the woods at Woburn Abbey the Weymouth Pine has reproduced itself from seed in large numbers, and these seedlings have been taken advantage of and utilised as forest trees. For afforesting purposes this is a valuable tree.

P. STROBUS NANA grows to 5 feet in height, and is of dense globular habit when young, but apt to lose the lower branches with advancing years, and then assumes a less compact and pleasing appearance. The branches and branchlets are short and slender, and the leaves 2 inches long, and produced thickly at the branch extremities.

P. SYLVESTRIS, *Linnæus*. Scotch Pine. (Synonyms: *P. rubra*, *Miller*; *P. rigensis*, *Desfontaines*;



PINUS STROBUS.

Face page 154.

and many others.) Northern Europe and Asia, Britain.—A well-known species of very variable habit. The young tree is usually formal, the stem straight, and the branches regularly arranged; but in old age, with the loss of the lower branches and increase in size of those near the top, the tree often presents a decidedly picturesque appearance, which is still further enhanced by the warm cinnamon brown of the bark. In the juvenile specimen the leaves are longer and more silvery in appearance than when the tree becomes advanced in growth. They vary in length from 2 inches to 3 inches, and are arranged two in a sheath. The cones vary greatly in size and shape, but are usually from 2 inches to 3 inches long, and 1 to $1\frac{1}{4}$ inches at widest part. Both as an ornamental tree and for the value of timber it produces, the Scotch Pine will ever rank high with planters. It is, further, of undoubted hardihood, a good shelter-tree, and succeeds well on the thinnest and poorest of sand and gravel. The timber is greatly affected by climate, and that produced in northern Scotland is superior to what is grown either in England or Ireland.

P. SYLVESTRIS ARGENTEA, *Steven*. The Silver-leaved Scotch Pine.—This varies much in variegation, and many specimens have only a tinge of the silvery whiteness for which the best variety is so much appreciated. The leaves of the young shoots in particular are creamy white, but this to some extent gives way with the approach of winter.

P. SYLVESTRIS AUREA. The Golden Scotch Pine.—Amongst the many varieties of the Scotch Pine none can equal the present either for free healthy

growth or the beautiful golden tint which pervades almost every part of the foliage. The variegation is not inconstant, as is generally supposed, but is markedly distinct the whole year through; but that there are worthless forms offered by nurserymen is well known. This Golden Pine is beyond doubt one of the most ornamental conifers we have, the deep bluish green of the normal foliage offering a marked and pretty contrast to the rich golden yellow of the variegated leaves. It grows freely, a specimen that I have often examined having for several years kept pace with the species alongside which it was planted.

P. SYLVESTRIS MONOPHYLLA.—This must be ranked as a very distinct, curious, and constant variety. At first sight it may be readily recognised as a form of the Scotch Pine, the habit of growth being exactly similar, but the thin, open, and airy appearance at once strikes one as out of the common. This is due not to the leaves being produced singly, as the name would indicate, but to the majority of the pairs of leaves being united for almost their entire length, this imparting a more open aspect to the specimen. The cones are sparsely produced, and decidedly more globular (shorter and thicker) than those of the species. The tree stands exposure well, the largest specimen I have seen growing in quite an open situation near Hemel Hempstead, in Herts.

P. SYLVESTRIS PYGMÆA is a very dwarf, rounded bush, with thickly arranged branches and comparatively short leaves.

P. THUNBERGII, *Parlatore*. (Synonyms: *P. Massoniana*, *Siebold et Zuccarini* (not *Lambert*);



Face page 156.

SCOTCH PINE PLANTATION.

P. sylvestris, *Thunberg*; *P. rubra*, *Siebold*.) Japan. 1861.—This is a rare tree in Britain, though in Cornwall and other warm maritime places, as also at Kew, good examples may be seen. The leaves are 5 inches long, rather tortuous, and deep green in colour. The cones, both in shape and size, resemble those of our common larch.

P. THUNBERGII AUREA.—This has justly been recognised as the best of Golden Pines, the primrose-yellow colour of the leaves being sharply defined, and the contrast with the bright green very marked. A great advantage that it possesses over many other coloured conifers is, that the yellow tint becomes all the more pronounced on trees fully exposed to sunlight. As a specimen lawn tree this variety is of great value. Grafted on the common Scotch Pine, it does well.

P. TUBERCULATA, *Gordon*. Oregon and west side of Californian coast ranges. 1847.—Amongst hardy or tolerably hardy species the present should be included, for in many parts of the country it has succeeded admirably, though in others it has failed to become established. Usually it forms a specimen of fully 20 feet in height, with a well-rounded and thickly branched head, the lower portion of the trunk being destitute of branches, these after about twelve years' growth gradually, with a portion of the foliage, giving way. The leaves are bright green, nearly 6 inches in length, and the cones 5 inches long by 2 inches diameter at thickest part. The cones are produced in clusters, but sometimes straggling singly on both stem and branches, and persist for many years,

those on a specimen at Penrhyn Castle having remained in position and quite intact for fifteen years. The appearance presented by the annually increasing cones is very singular and curious. The cones never open unless the branch is killed or injured by animals or fires. The seeds, which are arranged like other conifers, are then distributed to a considerable distance when they germinate and grow. *P. pungens* has the same peculiarity.

PODOCARPUS, *L'Heritier*

Flowers dioecious, rarely monœcious.

Fruit drupaceous.

Seeds hard, covered with a bony shell.

Leaves differing greatly in shape and arrangement on individual trees—opposite, alternate, or scattered; and linear or oblong.

Cotyledons two, leafy.

Trees or shrubs with leathery dark green leaves, but exhibiting great diversity of foliage. Natives of the temperate zones of Asia, Africa, and America.

PODOCARPUS ALPINA, *R. Brown*. The Alpine Podocarp.—Conifers from the Antipodes are not generally hardy in this country, but at the present time this distinct and very interesting Tasmanian conifer may be seen in excellent condition in several gardens in the neighbourhood of London, where it has stood unharmed for many years. It is of low-spreading growth, with little inclination to retain a leading shoot, the branches weak and pendulous, and the foliage thickly produced, yew-like in appearance, each leaf about half an inch or 1 inch long, and dark green in colour. The prominent rib along the under side of the leaf is

always present. The fruit is about the size of a cherry, with a single, bony-shelled seed within.

A very neat specimen of this conifer has been brought about by side-pruning and tying the main leading shoot to a support, and as it bears pruning well the method is to be recommended when the flat-spreading habit is wished to give place to that of more upright growth. Young plants are readily reared by laying the side branches in light sandy peat.

The Alpine Podocarp does very well when planted in light warm soil, but must not be exposed to cold winds, as the foliage then seems to suffer and become thinner and thinner on the branches.

P. CHILINA, *Richard*. (Synonym: *P. salignus*, *Hort.*) Andes of Chile. 1853.—This species is perfectly hardy in southern England at least, and many fine examples may be seen from London southwards. Though rarely exceeding 10 feet in height, it is of robust hardy growth, usually taking the form of a dense bushy shrub of pyramidal outline. Near the ground the branches are horizontal, but farther up they have a tendency to point skywards. They are well furnished with branchlets, and these with leaves, each being nearly 4 inches long by a quarter of an inch wide, and of a dark glossy green above, somewhat paler beneath. As a pot plant, and for town planting, it is particularly desirable, and has stood for many years in a smoky London garden. In many collections it is known under the name of *P. salignus*; and is a decidedly ornamental and useful conifer for confined positions.

P. MACROPHYLLA, *D. Don.* Japan. 1804.—In situations similar to those described for the latter this species forms a pretty and interesting shrubby specimen. It is of rather strict growth, the branches formally arranged, and the thinly produced foliage of a light greyish green colour. Each leaf measures 4 inches in length, and is distinctly marked with two raised lines along the margins.

PRUMNOPITYS, *Philippi*

PLUM FRUITED YEW

Fruit drupaceous in a loose spike, ovate, and greenish yellow in colour.

Leaves shining green, slightly channelled on the under surface, with a glaucous line on each side of the narrow mid-rib.

Branches numerous, irregularly disposed, and covered with brownish bark.

An evergreen tree of yew-like appearance. The first and best-known species has been referred to *Podocarpus*, but Professor Philippi, who should know best, has placed it in *Prumnopitys*.

PRUMNOPITYS ELEGANS, *Philippi*. (Synonyms: *Podocarpus andina*, *Poeppig*; *Stachycarpus andina*, *Van Tieghem*.) Chile. 1860.—Though usually branded with the title of “half-hardy,” yet in England at least such can hardly be applied, for the numerous fine specimens that are to be found around London prove beyond a doubt that this coniferous shrub may be planted with every chance of its succeeding well and forming in a few years a desirable and interesting specimen. For planting where ground space is limited, this conifer has proved to be exceedingly useful, the slow rate of growth, neat, usually pyramidal habit, and

adaptability to the pruning knife, all rendering it of value for such situations. It also thrives satisfactorily when planted in smoky and dusty localities, and may sometimes be seen potted up and offered for sale in Covent Garden market. It makes a neat and effective pot plant, and one which, unlike many other conifers, does not change colour with the advent of winter. The leaves are thickly produced, almost yew-green above, slightly silvery on the under sides, flattened, fully half an inch long, and sub-distichously arranged. In the fruit we have something out of the usual way of coniferous trees, for these are bigger than sloes, ovate, almost transparent, and with the kernel contained in a hard cherry-like stone. The largest specimen I have seen was 18 feet in height.

PSEUDOLARIX, *Gordon*

THE FALSE OR GOLDEN LARCH

Flowers monoecious; males in umbellate pendulous tufts.

Cones pendent, and composed of divergent scales like the head of the common artichoke.

Seeds with a soft, thin coating, and more or less enclosed by the wing.

Leaves soft and deciduous, scattered singly on the young shoots, but collected in bundles on the adult plant.

Cotyledons seven.

A beautiful deciduous tree, differing from the larch in the male flowers, being in umbellate tufts, and in the cones having deciduous scales with divergent points.

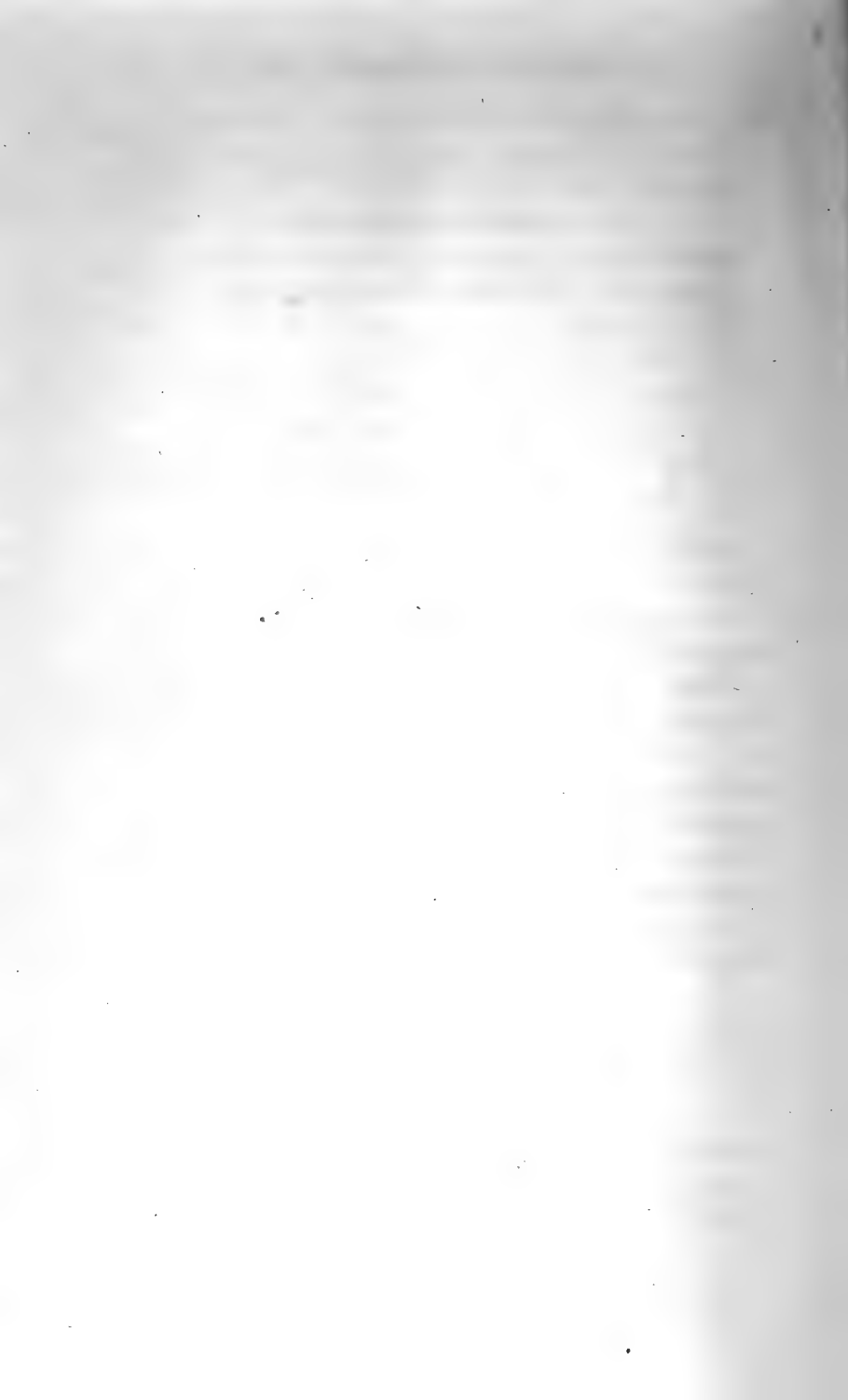
PSEUDOLARIX FORTUNEI, *Maye*. The Golden Larch. (Synonyms: *Larix Kaempferi*, *Carrière*; *Pinus Kaempferi*, *Lambert*; *Abies Kaempferi*,

Lindley; *Pseudolarix Kaempferi, Gordon.*) Northern China. 1853.—This is a rare and beautiful tree, which, from the midland counties southwards, is perfectly hardy. It is a distinctly ornamental conifer, and that at three different periods of the year—early spring, when the long and tender green leaves are unfolding; autumn, when they put on the lovely golden colour; and during the leafless period, when the yellowish green or golden brown bark of the younger branches shows off to perfection, and renders the trees distinct from almost every other in cultivation. In this country the largest specimens have the stems well furnished with semi-pendent branches. The leaves vary in length according to their position on the tree, but are usually from $1\frac{1}{2}$ inches to 2 inches long. From home-grown specimens of the cones that have been forwarded to me, the average size would be about 2 inches long by $1\frac{1}{4}$ inches broad; but with the age of the cone and opening out of the scales the measurements vary much. They are composed of a number of diverging scales, each 1 inch long and half that in width, which, after the ripening of the cone, soon fall apart. The tree succeeds well in not too stiff loamy soil or that of a peaty composition. Dampish situations suit it best, and it is by no means impatient either of shelter or shading.



PSEUDOLARIX FORTUNEI.

Face page 162.



PSEUDOTSUGA, *Carrière*

THE DOUGLAS FIRS

Male flowers like those of *Picea*.

Cones pendent, persistent, ripening the first year.

Scales persistent.

Bracts long, two- or three-pointed.

Cotyledons varying in number from five to twelve.

Leaves stiff, flattish, bright green, and more or less acuminate.

Branches whorled; bark on young shoots glabrous.

This genus was founded for the Douglas Fir, the habit and foliage being nearly that of the Silver Firs, and the male flowers like those of *Picea*.

PSEUDOTSUGA DOUGLASII, *Carrière*. The Douglas Fir. (Synonyms: *Abies taxifolia*, *Poiret*; *Pinus taxifolia*, *Lambert*; *Pinus Douglasii*, *Sabine*; *Pseudotsuga taxifolia*, *Britton*; *Abies Douglasii*, *Lindley*; *Picea Douglasii*, *Link*; *Tsuga Douglasii*, *Carrière*.) British Columbia to Colorado, Texas and Mexico. 1827.—Whether planted singly or in clumps, this tree is highly effective, the giant proportions, easy and graceful outline, and thickly foliated branches, of the deepest and richest green, being special points of attraction. Although perfectly hardy everywhere in this country, yet the Douglas Fir cannot stand exposure to hard-blowing winds, the leader and upper branches under such conditions suffering greatly, and in many instances becoming almost destitute of foliage. The production of timber goes on at a rapid rate, and in this respect the tree is surpassed by no other grown in this country, fully 5 cubic feet per year having been produced over a period of fifty years. The timber, too, is of good quality, and the results of

numerous experiments which I instituted for the purpose of testing this have been very satisfactory, and will be found in the chapter on Timber of Coniferous Trees. When standing alone, the tree has a tall, straight, and very gradually tapering trunk, the branches, which are horizontally arranged and decreasing in length upwards, being retained in a healthy condition down to ground level. The leaves vary in length from 1 inch to $1\frac{1}{2}$ inches; while the freely produced cones are pendent, 3 inches long by half that in width, and the scale bracts protruding for fully half an inch. With regard to soil, the largest specimens in the country are growing on gravelly loam. A Douglas Fir has recently been discovered in Japan, at an elevation of about 2000 feet. It is described as of erect growth, with horizontally arranged branches.

See *Tokyo Botanical Magazine*, February 20, 1895, for description and figure of the Japanese Douglas Fir.

A monograph on the Douglas Fir, by myself, will be found in the *Transactions of the Royal Scottish Arboricultural Society*, vol. xi. Part II., 1886.

P. DOUGLASII BREVIFOLIA has comparatively short, stiff leaves, and being very distinct under cultivation is to be recommended for planting in collections of coniferous trees.

P. Douglasii Fletcherii is a pigmy form of our giant tree, and is recommended as a curiosity for the rock garden.

P. DOUGLASII PENDULA has the strictly drooping branches too stiff and straight to be classed as ornamental. It is, however, a very curious and interesting variety.

P. DOUGLASII STAIRII is a beautiful variety in which the colour is constant and well diffused, while the constitution is robust and the rate of growth rapid. Generally the tree is of a light yellow colour in spring, the young growths, for a time at least, quite hiding the darker tints of the older foliage. In no other respect does this variety differ from the type. This variety was raised at Castle Kennedy by Mr. Fowler.

P. DOUGLASII TAXIFOLIA is a decidedly distinct form of smaller and hardier growth, and so far likely to turn out a more useful tree for general forest planting in this country than the type. The tree is of sturdy and much slower growth than the parent, while the foliage is of a darker green and more massive. To be recommended for afforesting purposes.

SAXEGOTHEA, *Lindley*

PRINCE ALBERT'S YEW

Flowers monœcious; male flowers in stalked cylindrical spikes; females in globular heads, terminal.

Fruit composed of thickened scales, formed into a somewhat fleshy cone.

Seed inverted, and springing from a cavity towards the middle of the scales.

Leaves resembling those of the yew.

An evergreen shrub of yew-like appearance.

SAXEGOTHEA CONSPICUA, *Lindley*. Prince Albert's Yew. Southern Chile. 1849.—This is a somewhat tender shrub, of low-spreading and irregular growth, and only suited for planting among light rich soil and in fully sheltered situations. It resembles the common yew except in

the colour of foliage, which is much lighter, being in well-grown plants a greyish green or silvery hue. The leaves are thickly produced, point forwards, each 1 inch long, and marked with two silvery lines beneath. One of the healthiest specimens I have seen was growing in light moory soil, and in a situation sheltered from cold winds.

SCIADOPITYS, *Siebold et Zuccarini*

THE UMBRELLA PINE

Flowers monœcious; male spikes terminal; anther lobes, two.

Cones solitary, elliptic or cylindrical, and obtuse at the ends.

Scales and bracts united into a lobulated mass, leathery, thin, and imbricated.

Seeds arranged in seven to nine under each scale, two-winged, with a leathery covering.

Leaves twenty to thirty in a whorl, of peculiar structure.

This genus is remarkable for the leaves, which are arranged in umbrella-shaped whorls.

SCIADOPITYS VERTICILLATA, *Siebold et Zuccarini*. The Umbrella Pine of Japan. Japan. 1861.—An interesting and highly ornamental tree that has done well, when planted in suitable soil, in almost every part of the country. Its special requirements are leaf soil or peat and an abundance of moisture that can pass away freely. In this country the rate of growth is slow, but this is to a great extent counterbalanced by the strong though short shoots annually formed, and which become well ripened off before winter sets in. The form of growth is conical, the branches stiff and twiggy, with tufts of deep green foliage near the tips. Leaves arranged in double whorls, each

leaf being $3\frac{1}{2}$ inches long, leathery in texture, and with two ribs. The cones vary in size up to 4 inches in length by fully half that in width. This is a distinct and desirable conifer, one that is hardy everywhere, and which well merits extended culture, from an ornamental standpoint at least.

SEQUOIA, *Endlicher*

THE REDWOODS

Flowers monœcious; males in terminal, stalked, oblong heads.

Cones ligneous, sub-globular, and small.

Scales and bracts united, and forming a woody, wedge-shaped mass.

Seeds from three to nine under each scale, winged.

Leaves scattered, appearing in two rows, especially in *S. sempervirens*.

Large-growing evergreen trees from California and North-West America.

SEQUOIA GIGANTEA, *Torrey*. The Wellingtonia or Mammoth Tree. (Synonyms: Wellingtonia gigantea, *Lindley*; Sequoia Wellingtonia, *Seemann*.) Western side of the Sierra Nevada Mountains. 1853.—Although of stiff and formal appearance, yet from its massive proportions and brightest of green foliage the Mammoth Tree ranks high amongst ornamental conifers. As a timber tree it is not likely to attract attention in this country, it being ill fitted for withstanding cold winds, and in consequence unsuitable for entering into the composition of any but the most sheltered woodlands.

The tree has been in past years planted largely in parks and gardens for ornamental effect, but

with advancing years the aspect becomes less and less pleasing, and in consequence large numbers have been cut down and their places filled by other and more suitable kinds.

The trunk is straight, usually carrot-shaped, with brownish, stringy bark, and well supplied with slightly drooping branches and branchlets, the whole contour being sharply conical. Usually the leaves are spirally arranged and loosely imbricated. The cones are obtuse, and vary much in size, but are usually about 2 inches long.

S. GIGANTEA AUREA is a distinct variety, but unfortunately, one that cannot be relied upon to retain its colour, the beautiful golden yellow of the branch-tips of the juvenile plants gradually giving way with advancing age. I have seen several very beautiful specimens of this golden *Wellingtonia*, and if the character was constant the tree would be well worth cultivation for purely ornamental purposes. The best form I have seen was sent to me by Mr. Baylor Hartland, from Cork.

S. GIGANTEA PENDULA. — This cannot be described as ornamental, at least when of large size, though young specimens are sufficiently curious and distinct to warrant more than a passing notice. As seen from a distance against the skyline, old trees have a very singular appearance, the long, pendulous, and irregularly produced branches imparting an outline such as one rarely sees, unless associated with an isolated specimen that has been stranded on an exposed mountain side. Young trees are far more shapely and pleasing in outline, and though they cannot be



Face page 168.

SEQUOIA GIGANTEA AT WOBURN.

described as ornamental, yet they are so distinct that their presence in the park or garden is quite desirable. In all the specimens I examined the branches spring out directly at right angles to the main stem for a distance of about 3 inches, then turn abruptly downwards parallel and close to the stem for, in many instances, a length of 4 feet. The foliage is quite normal, and the cones are $1\frac{1}{2}$ inches long, by fully 1 inch wide, and on a stout foot-stalk, hardly three-quarters of an inch long. A specimen about 30 feet in height may be seen at Berkhamstead, in Herts.

S. SEMPERVIRENS, *Endlicher*. The Redwood of California. (Synonym: *Taxodium sempervirens*, *Lambert*.) 1846.—A noble tree that, when suitably placed, produces a large quantity of valuable timber in this country. Like the former species, it requires a certain amount of shelter, else the foliage becomes thin and the tree stunted and starved in appearance.

When seen under favourable circumstances the Redwood is of informal pyramidal outline, with a well-formed trunk covered with thick, spongy, reddish brown bark. In young trees the leaves are long and linear, while in those of older growth they are usually closely appressed, and of as deep a colour as the yew. The cones are about half the size of those of *S. gigantea*.

In deep and rich soils, and where shelter is afforded, the Redwood in this country is of truly noble growth, many specimens being over 100 feet in height, with trunks over 4 feet in diameter. Unlike the generality of coniferous trees, the Redwood sends up suckers from the base of the stem,

and in consequence has been planted for coppice wood in southern England.

S. SEMPERVIRENS ADPRESSA.—This is a distinct variety, with short, thick, and closely appressed leaves, which are of a very conspicuous shining bluish green colour.

S. SEMPERVIRENS ALBO-SPICA has many of the branch-tips of a yellowish white tint, but it is patchy, and of no particular value.

TAXODIUM, *Richard*

THE DECIDUOUS CYPRESSES

Flowers monœcious; males in branched catkins; females two or three together near the base of the spike of male flowers.

Cones globular, with thick peltate scales.

Seeds two at the base of each scale, erect, angular, and wingless.

Leaves deciduous, in two rows, flat, and linear.

Cotyledons from four to nine in number.

Large-growing, swamp-loving trees, with deciduous foliage.

TAXODIUM DISTICHUM, *Richard*. The Deciduous Cypress. (Synonyms: *Cupressus disticha*, *Linnaeus*; *T. microphyllum*, *Brongniart*; *T. adscendens*, *Brongniart*.) Southern States of America. About 1640.—This is a tree of great beauty, the soft, feathery foliage, which during summer is of a cheerful pea green, slowly changing as autumn advances to a deep red, rendering it distinct from every other conifer in cultivation. Even during winter, when leafless, the tree is very attractive, for the highly coloured bark of the branches and twigs is resplendent in the evening sunshine, and

seen at a short way off appears as if all aglow. It is specially adapted for planting in swampy ground, by the lake or pond side, or on small islands, thriving under such conditions in a manner that is quite surprising. The habit of growth differs with the age of the specimen, young trees up to 25 feet in height keeping to the almost strictly pyramidal, while in many old specimens throughout the country the spread of the head is equal to, if not surpassing, that of the height. The foliage is always of a light and airy appearance, the pinnate leaves being arranged in horizontal rows on each side of the mid-rib. They vary in length even on the same twig, but are usually fully half an inch long, closely arranged, and somewhat arching, with the convex side outwards. The cones are not freely produced, but home-grown specimens that I have collected are three-quarters of an inch long, nearly the same in greatest diameter, and bearing small three-sided seeds. The Deciduous Cypress is remarkable in producing root protuberances, known as cypress knees, these sometimes in this country reaching to 2 feet in height, particularly when the tree is growing in a swampy situation.

T. MUCRONATUM, *Tenore*. (Synonyms: T. *Montezumae*, *Decaisne*; T. *mexicanum*, *Carrière*; T. *distichum mexicanum*, *Gordon*.) Mexico.—This tree is amply distinct in cultivation from the hardier and more widely grown *T. distichum*, but with which it is often confused. It is of far more refined growth than that species, if I may use the expression, the branches and branchlets being shorter, more slender, horizontally arranged, and

the foliage less abundant, and of a fresher green. The tree, too, is of much smaller growth, far more uniform in its branch arrangement, and with a very narrow spread in proportion to the height, this latter being a distinguishing characteristic. It is when the two species are growing side by side that the differences can best be detected, and this is markedly the case both at Penrhyn Castle, North Wales, and Holwood Park, in Kent.

TAXUS, *Linnæus*

THE YEWS

Flowers usually diœcious; stamens in shortly stalked heads; anther scales peltate.

Fruit solitary, one-seeded.

Seed erect, and borne in a fleshy open cup.

Leaves two-ranked, linear, and decurrent.

Cotyledons two, flat and leafy.

Evergreen trees or shrubs, with two-ranked leaves, and the seed borne in a pulpy cup or aril.

TAXUS BACCATA, *Linnæus*. The Yew. Europe and Northern Asia, Britain.—This is a native tree, of about 40 feet in height, with a short, thick, and deeply fluted stem, and a spread of branches often exceeding the height. It is a very accommodating tree, unusually large specimens being found growing where hardly a couple of inches of loam overlies the chalk formation, on rocky soils, shingly gravel, but best of all on good, sound, dampish loam, and on which latter it attains to largest dimensions. In the formation of evergreen hedges or for planting beneath the shade and drip of larger growing trees, the Common Yew is of particular value, and

notwithstanding its rather gloomy appearance, is at the same time a decidedly ornamental evergreen tree, and one that imparts a rich and warm aspect to the landscape wherever it is used. Being of unusually slow growth, the annual layers of wood are comparatively thin and closely arranged, thus rendering the graining remarkably fine, which, coupled with the deep reddish tint of the wood, causes it to be largely employed for constructive purposes. When grown in the open, the tree is usually well furnished with branches almost to ground level, the branches being much subdivided, and the ramifications well furnished with dark green leaves arranged in two lateral double rows. The leaves vary in length, but are usually about 1 inch, with a prominent mid-rib, and tapering to an acute point. Fruit bright scarlet, oval or rounded in shape, and enclosing partially a small brownish seed. Whether when covered with the pollen-bearing receptacles in spring or the bright ruddy fruits in autumn, the tree is highly attractive and ornamental. There are no traces of extensive plantations of the Yew, but many solitary trees of large growth are to be found in our churchyards, and why planted there is a subject of much controversy. The largest number of Yews growing in one spot will be found at Kingly Bottom, near Chichester (about 200); the trunks of the largest vary from 12 to 20 feet in circumference at 3 feet from the ground; their greatest height about 40 feet, and their extreme spread 60 feet in diameter. They are supposed to be nine hundred years old. The following are the most distinct and desirable varieties.

T. BACCATA *ADPRESSA*, *Carrière*.—One of the most distinct of the many varieties, the broad and short leaves rendering recognition by no means difficult. It is of spreading growth, with short, sub-horizontal branches, and very dark green leaves, arranged in double rows, and inclined upwards and forwards. Each leaf is about half an inch long, and obtusely pointed, while the fruit is vermilion red, the cup usually only half covering the ovoid seed. By many authors this has been described as a species, but, although very distinct both in leaves and fruit, yet the fact that certain specimens have come under my notice bearing both branches of the type and *T. b. adpressa*, clearly proves the parentage.

In reply to a letter of mine, the late Mr. F. Arthur Dickson, of the Chester Nurseries, wrote as follows regarding the present shrub: "This yew was discovered by my father, the late Mr. Francis Dickson, somewhere about 1838. It was growing in a bed of seedlings of the common English Yew. It is therefore undoubtedly a seedling sport. Being of slow growth, it was necessarily slow of propagation, and it took many years to get up a stock upon the grounds of the then firm of F. & J. Dickson, of which my father was the head. I well remember the value my father set by this plant, and his chagrin and vexation when, on his return home after a few days' absence, he learned that a representative of the late firm of Knight & Perry, nurserymen, Chelsea, had, in looking over the nurseries, purchased and taken away with him some half-dozen good-sized plants, as the result of negotiation with an inexperienced

salesman, who was presumably ignorant of the value of the plants. This enabled the Chelsea firm to propagate the plant, and, if I remember rightly, the specific name *adpressa* was given to it by Knight & Perry, but my father always adhered to the name he had originally given it—*brevifolia*." In order to avoid confusion, I have retained the name by which this distinct variety is commonly known. This variety has attained to large dimensions in the grounds at Walmer Castle, Kent, the largest specimen covering an area of 24 feet in diameter, the height being 15 feet.

T. BACCATA ADPRESSA STRICTA differs from the preceding only in being of partially erect growth.

T. BACCATA ADPRESSA VARIEGATA is a valuable variety, in which many of the branch-tips are of a silvery golden tint.

T. BACCATA AUREA is one of the most striking of the many varieties, it being always bright and effective. The leaves for the greater part are of a bright golden yellow, and especially so during the growing season. It is of free growth, and admirably suited for planting in clumps in front of darker foliaged subjects.

T. BACCATA CHESHUNTENSIS is of partially upright growth, with small closely arranged leaves, that are dark green above, glaucous beneath, and long-pointed. It is a graceful variety, of strict but informal growth, and was raised from seed of the Irish Yew.

T. BACCATA DOVASTONI, *Carrière*.—This is a remarkable creeping variety, the branches being long and partially horizontal, with the branchlets gracefully drooping. The leaves are relatively

larger, more curved, and of a deeper shade of green than those of the type. *T. baccata Dovastoni aurea variegata* is well described by the name.

T. BACCATA ELEGANTISSIMA is of dense, upright growth, with whitish or pale yellow thickly produced leaves. The neat habit and constant variegation render it a desirable and ornamental variety.

T. BACCATA ERECTA, *Loudon*.—A not very elegant variety, having erect-growing slender branches and small glossy green leaves, arranged for the greater part in two rows.

T. BACCATA ERICOIDES (*T. b. empetrifolia*) is of neat and small growth, the branches slender and close set, and the leaves very small and closely arranged. The reddish bark of the branches showing here and there through the deep green foliage has a pleasing effect.

T. BACCATA FASTIGIATA is a well-known and justly popular variety that originated in Ireland—hence the popular name, Irish Yew. The habit is strictly fastigate, the branches short, stout, and close-growing, and the leaves of a deep green, and scattered around the branchlets. Regarding the origin of the Irish or Florence Court Yew, the Earl of Enniskillen furnished the following in 1880 :

“ I beg to state that the two original plants were found more than a century ago on a rock in the mountain above Florence Court, called Carricknamaddow, or ‘ the Rock of the Dog,’ by Mr. Willis, tenant of the then Earl of Enniskillen. He planted one specimen in his garden, and the other he brought down to Florence Court. The first died about fifteen years ago. The second one—

the parent plant of all the Irish yews—is still alive at Florence Court. Its height is only about 18 feet, and its circumference 17 feet, having been greatly damaged by the number of cuttings taken from it for propagation, which have been forwarded to all parts of Europe and America.

“The late Earl of Enniskillen gave the first cuttings of this yew to Messrs. Lee & Kennedy, of Hammersmith. There are now at Florence Court several fine specimens, some of them being from 24 to 26 feet in height.

“I may add that the upright yew can only be propagated by cuttings, as, if the berry is sown, it produces a hybrid with the growth of the common yew and the foliage of the upright or ‘Florence Court’ Yew.”

In 1917 the original tree was 35 feet high and 30 feet across.

Fisher’s Golden Hybrid Yew is at once one of the most beautiful and desirable of the family. It is in every way an elegant shrub of symmetrical growth with beautifully variegated foliage. This desirable hybrid was raised at the Royal Nursery, Handsworth, Sheffield, and deserves to be widely circulated. The accompanying illustration is of a tree in the Handsworth Nursery.

T. BACCATA FASTIGIATA ARGENTEA differs principally in the yellowish white tint of the younger branch-tips and some of the leaves, but owing to its inconstant variegation has not been largely planted.

T. BACCATA FASTIGIATA AUREA, *Standish*, is a very desirable variety, in which many of the leaves are margined with golden yellow, or the young

shoots wholly suffused with the same colour. It is a useful and desirable variety.

T. BACCATA FRUCTU LUTEO (Yellow-berried Yew) is remarkable for the berries being yellow instead of red. It is a very ornamental variety, with divaricate branches, and rather short, sharp-pointed leaves, which are usually more or less curved. Being of vigorous growth, with pleasing green foliage and bright yellow fruit, this variety is worthy of extended culture. On slate rock at the Penrhyn slate quarries in Wales this variety thrives with remarkable vigour.

T. BACCATA JACKSONI is an interesting variety with curiously twisted leaves, which are altogether smaller than those of the species. It is of weeping habit, and forms a neat small-growing shrub with distinct light green foliage.

T. BACCATA NANA, *Knight and Perry*, as the name denotes, is of dwarf growth. The habit is compact and upright, dense, and the leaves comparatively smaller and darker in colour than that of the species. It is a useful shrub for many positions, and though rarely rising more than a yard from the ground, has a wide spread in proportion to its height.

T. BACCATA NEIDPATHENSIS.—This variety, as usually seen, is of columnar habit, with an inclination to become spreading at the head. The leaves are small, closely arranged, and of a bright, glossy green.

T. BACCATA NIGRA is remarkable for the dark green of the upper, and bluish green of the under sides of the leaves, the latter particularly rendering the shrub unusual amongst the numerous varieties



Face page 178.

YEW, FISHER'S GOLDEN HYBRID.

of the yew. It is of bold and rather upright growth, and has a decidedly ornamental though somewhat sombre appearance when viewed from a distance.

T. BACCATA PROCUMBENS, *Loddiges*, spreads to a wide extent, and is useful for covering bare or rocky ground. The foliage is bright green, and the bark usually of a dull cinnamon colour.

T. BACCATA SEMPERAUREA is a desirable variety, very compact, deep yellow, and a first-class rock shrub.

T. BACCATA WASHINGTONI has the foliage diffused with a bright bronzy gold tinge, which makes full-grown specimens very distinct and attractive. It is of free growth, and succeeds best when fully exposed to both wind and sun.

T. BREVIFOLIA, *Nuttall*. (Synonyms: *T. Boursieri*, *Carrière*; *T. Lindleyana*, *Murray*; *T. baccata canadensis*, *Bentham*.) North-West America, British Columbia, to California. 1854.—A very distinct species with foliage shorter, lighter in colour, and more feathery than that of our native yew. The leaves vary much in length, but are usually about three-quarters of an inch, stout, and rounded at the apex. In this country *T. brevifolia* takes the form of a spreading bush, the lower branches ramifying and extending to a distance disproportionate to the height. The branches are thinly produced when compared with those of the Common Yew, and this, with the shorter leaves and their yellowish green colour, render the tree by no means difficult to recognise. It should not be confused with the short-leaved variety of *T. baccata*.

T. CANADENSIS, *Willdenow*. (Synonym: *T. baccata canadensis*, *Gray*.) Canada and North-Eastern States of America. 1800.—A low-growing and far-spreading species, with smaller and lighter coloured leaves, and bearing berries that are much smaller than those of our native species. It is rare in cultivation.

T. CUSPIDATA, *Siebold et Zuccarini*. Mountains of Japan. About 1855.—An uncommon species, that is at once distinguished by its irregular and open outline, and broad, leathery leaves. It is of no special value for ornamental planting.

THUYA, *Linnæus*—including *Biota* and
Thuyopsis

THE ARBORVITÆS

Flowers monœcious; male catkins oval; females solitary and terminal.

Cones small, oblong or globular; scales thickened upwards, valvate, and from six to ten in number.

Seeds usually winged, in twos at the base of the lowermost or middle pair of scales.

Cotyledons two.

Evergreen trees or shrubs, with appressed leaves and usually oblong cones. The seeds are winged on both sides, except in the old genus *Biota*, in which this appendage is quite wanting.

THUYA DOLABRATA, *Linnæus fil.* (Synonym: *Thuyopsis dolabrata*, *Siebold et Zuccarini*.) Mountains of Japan. 1853.—For ornamental planting this conifer holds an important place, its distinctive characteristics and the readiness with which it may be cultivated being generally recognised. In this country it forms a handsome conical specimen, with vertical branches and drooping

branchlets, the latter numerous and much compressed. The leaves are flat and scale-like, regularly imbricated, of a rich, shining green above, and silvery beneath. The cones are sub-globose, and nearly three-quarters of an inch in diameter. It prefers rich moist loam or peaty soil, and does not object to grow where shaded and hemmed in by taller-growing trees. Shelter from cold winds is imperative.

T. DOLABRATA NANA. (Synonym: *Thuyopsis lætevirens*, *Lindley*.) The Dwarf Japanese Thuya. —This is a slow-growing, miniature bush, with comparatively small light green leafy twigs, more resembling a lycopod than a conifer. The average height of a large number of old specimens that I examined was only about 20 inches, while the spread of the branches was nearly 3 feet. All are remarkable for their tidy and uniform habit of growth, forming dense, compact specimens, yet not stiffly so, as is the case with many pigmy conifers. The affinity between the species and this variety is readily recognised, but the twigs of the latter are altogether thinner, more flaccid, of a much lighter and more silvery green than that of the parent. It is a useful shrub for the rock-work or confined border, and the silvery tinted foliage makes the plant remarkable and pleasing.

T. DOLABRATA VARIEGATA is a praiseworthy variety, and one that in point of vigour of growth surpasses the parent, while at the same time it is far less inclined to form a multiplicity of leading shoots. It is of upright growth, the branches regularly arranged, and the branch tips distinctly marked with a rich golden yellow.

T. JAPONICA, *Maximowicz*. (Synonyms: *Thuja Standishi*, *Carrière*; *Thuyopsis Standishii*, *Gordon*; *Thuja gigantea japonica*, *Franch. and Sav.*) Mountains of Japan. 1860.—This, in general appearance, resembles the common arborvitæ, but is of much greater value as a decorative tree. It is of free growth, less thickly branched than the American species, with stouter and more pendulous branchlets, which are flattened at the ends, and gracefully drooping. Upper side of leaves a shining green, under sides a distinct pea green. Cones seven-sixteenths of an inch long and composed of eight scales. In winter the foliage turns from the pale yellowish green of summer to a distinct bronzy tint, which is very pleasing and effective. With this species there is far less difficulty in getting a leader than is the case with many of the *Thuyas*.

T. OCCIDENTALIS, *Linnaeus*. Common or American Arborvitæ. Canada, the New England and Middle States. Prior to 1597.—A commonly cultivated and perfectly hardy shrubby species, but one that is of little value for ornamental planting. It is usually of irregular growth, but inclined to be pyramidal, with stout and lithe branches scattered over the trunk, the branchlets partly drooping, and well clothed towards the extremities in particular with the parti-coloured foliage, which is brownish green during the growing season, changing to brownish purple or a bronzy hue in winter. When bruised the foliage emits an unpleasant smell. The cones are small and oval-shaped or sharply conical, five-eighths of an inch long, each composed of nine scales and

nine seeds. The following are the most distinct varieties :

T. OCCIDENTALIS ARGENTEA is of neat, dwarf growth, and perfectly distinct from every other that I have met with. The foliage is of a deeper green than the species, many of the branch-tips being tipped with white. It is very hardy and attractive.

T. OCCIDENTALIS AUREA is a beautiful and distinct variety of one of the hardiest of all conifers. It grows robust and strong, with an upright inclination, the foliage being prettily suffused by rich golden yellow, changing in winter to a golden bronzy hue. It is a desirable form of ready culture, and quite constant.

T. OCCIDENTALIS CRISTATA.—A dwarf, curious variety, with the branches much subdivided at their extremities, thus causing a tufted or crested appearance, some of these ball-shaped crested masses being 3 inches in diameter. It is very interesting and pleasing.

T. OCCIDENTALIS ELLWANGERIANA is one of the neatest of the many varieties of the American arborvitæ, it being fairly dwarf, dense, and sub-erect. The branches are pendulous and slender, while the foliage is either scale-like or linear, and sharp-pointed. The late Mr. Ellwanger, of Ellwanger & Barry, Rochester, N.Y., has given me much useful information regarding this and other varieties.

T. OCCIDENTALIS HOVEII.—This well merits attention, being of dwarf, neat growth, with thickly arranged, brightly tinted twigs.

T. OCCIDENTALIS LITTLE GEM.—For Alpine gardening this is certainly a gem, its dwarf, neat

habit and rich shade of green rendering it a desirable acquisition for such a situation.

T. OCCIDENTALIS LUTEA. — Though at certain seasons of the year the present variety bears great resemblance to *T. occidentalis Vervæneana*, yet when the two varieties are growing in close proximity, and thus of ready comparison, the differences are readily ascertained. The variety *lutea* forms a more upright growing and densely branched specimen than *Vervæneana*, while the young shoots are of a bright orange colour as compared with the greenish yellow of *Vervæneana*.

T. OCCIDENTALIS PENDULA differs much in habit in several specimens, the usually recognised form having the branches recurved and the slender branchlets thickly arranged near the branch extremities. The best form is distinct and valuable.

T. OCCIDENTALIS PLICATA, *Masters*. (Synonyms: *T. Wareana*, *Booth*; *T. gigantea plicata*, *R. Brown*.) North-West America. 1796.—In this we have a small-growing tree of neat outline, but somewhat resembling the American *Arborvitæ*, from which, however, it may readily be distinguished by the shorter branches and less straggling habit of growth. The branchlets, being numerous, give to the tree, although the main branches are usually placed far apart, a well-furnished and neat outline, and these in turn are furnished with pairs of closely appressed leaves that are yellowish green in colour and very glandular. The cones are three-eighths of an inch long, with six scales, and three or four seeds towards the middle. It thrives well in cold and draughty situations where many conifers could not succeed. Though some-

times placed as a variety of *T. plicata* or *T. gigantea*, yet for garden purposes it is amply distinct, whether in habit, foliage, or fruit.

T. OCCIDENTALIS VERVÆNEANA well merits attention, the slender branches being of a deep and decided greenish yellow, darkening during early winter to a golden brown. The habit is very neat and erect.

T. OCCIDENTALIS WAREANA.—This is of dense, neat habit, with horizontal branches, and remarkable for the deep green of the foliage. It is decidedly preferable for ornamental planting to the parent, being more regular of growth, of deeper foliage tint, and with the branchlets clustered and compact at the ends of the branches.

T. ORIENTALIS, *Linnæus*. Chinese Arborvitæ. (Synonym: *Biota orientalis*, *Endlicher*.) China, Japan. 1752.—A well-known and valued species with brighter green foliage and denser habit than *T. occidentalis*. As usually seen in this country, it is of dense columnar appearance, both the branches and branchlets being of decidedly upright growth, and the latter well supplied with scale-like imbricated leaves, arranged in four rows. Cones half an inch long, composed of six scales, and of a dull brown when ripe. There are many forms, the following including the most distinct.

T. ORIENTALIS AUREA is one of the most distinct and popular of the many varieties, and is often met with under the specific name of *T. aurea*. It forms a dense globular bush, the growing foliage being golden yellow, this subsiding into a dull green with age and on the approach of winter.

T. ORIENTALIS DENSA. Whether for its neat

habit or pleasing colour, this dwarf conifer well merits attention; while it is quite distinct from any of the numerous small growing forms of the Chinese Arborvitæ. The usual habit is a dense conical mass of rather feeble branches, the foliage of the most pleasing glaucous green shade—a colour that is constant at all seasons of the year. Being of seedling growth, this marked characteristic is retained under cultivation.

T. ORIENTALIS ELEGANTISSIMA is of narrow pyramidal habit of growth, the foliage being of a constant golden green. It is more stiff in outline than *T. orientalis aurea*.

T. ORIENTALIS ERICOIDES (Synonym: *Retinospora ericoides*) is one of the neatest and dwarfiest of the tribe, it being usually seen as a dense, compact shrub not much over 1 yard in height. The change of colour of foliage from a light, clear green in summer to a bronzy violet in winter is both curious and beautiful. Both branches and branchlets are slender and numerous, while the primordial leaves are arranged in pairs, and distinctly glaucous beneath.

T. ORIENTALIS FALCATA has a rather irregular habit of growth, though of dense somewhat conical outline, and is well furnished with brownish green foliage. It is rendered distinct by reason of the cone-scales terminating in sickle-like spines. Some of the many forms of the Chinese Arborvitæ are by no means readily identified, but such will not apply to the subject of this note, for the curiously shaped cones render recognition both speedy and certain. The partly upright habit, too, might go far in determining the variety, but without fruit

such means of identification would be hazardous, so many partaking of the dense, conical habit of the shrub in question. The large deep green cones, of very irregular shape, and with the scales terminating in long hooked points, are different to those of any other. Each cone is fully three-quarters of an inch long, and composed of six scales and six seeds, two to each of the lower scales being the usual number. The seeds are wingless, and weightier than those of any other of the Thuyas—31,500 going to make up a pound weight; while in *T. occidentalis* and *T. plicata* the figures are 186,666 and 94,000. These figures are the average of four trials of each, with freshly collected cones. The largest specimens of *T. orientalis falcata* that I have seen are growing at Southend-on-Sea.

T. orientalis falcata is an excellent church-yard shrub, but for garden purposes it is too harsh, formal, and stiff; and, when old, it falls apart, being then top-heavy.

T. ORIENTALIS FALCATA LUTEA, *Webster*, is of neat, pyramidal habit, with comparatively short and slender branches, the colour of foliage being a rich, subdued yellow, which not only extends to the leaves in every part, but to the bark of the branches as well. The cones are fully an inch long, and rendered conspicuous by reason of the long appendage to each of the scales. The latter resemble nothing so much as the fangs of a tooth. This is an interesting variety, and for its neat habit, distinct colour, and curious cones is well worthy of culture. This was first described by the present writer in 1896.

The different varieties of the Chinese *Arborvitæ* are in a sad state of confusion—indeed, many are incapable of accurate identification. I have seen three totally distinct forms of the so-called *T. orientalis falcata*, and as these are growing in the same grounds, not 50 yards apart, and under similar conditions in every way, the chances of mistaken identification in this particular instance are very remote.

The first or normal form is of larger growth than any of the others, of upright but not appressed growth, and with large deep green cones that are twice the size of the species. Second comes a much smaller growing, perfectly taper-like shrub, the foliage of a different shade of green, and the cones similar in every respect to the latter; and, third, the most distinct and ornamental of any, a neat-habited shrub with yellowish green foliage that is quite uniform in colour all over the specimen, and with unusually large cones, many of these being fully an inch long, the sickle-shaped spines being very conspicuous.

So long are the spines in this particular form that they might well be likened to a molar tooth with the fangs intact. This is most noticeable when the cones have attained to full size, but before becoming ripe, for at the latter stage the shrinkage of the spines is very perceptible. This golden form is well worth cultivating, the neat habit and bright tint of both foliage and bark rendering it a very desirable garden shrub.

T. ORIENTALIS MELDENSIS.—This is a stage of growth in which the leaves are subulate, never scale-like as in the species. It has no particular

right to be included as an ornamental variety, the outline being irregular from the thin pliable branches bending about in many directions, though with an inclination towards the stem. The foliage is bluish green in summer, but assumes a bronzy tint with the approach of winter.

T. ORIENTALIS MEXICANA, *Drummer*. Mexico.—This differs from the type in having smaller and more globose cones, which are wanting in the horn-like dorsal process that characterises the species. It is frequent in cemeteries in Mexico. There has been confusion between this variety and *Cupressus thurifera*.

T. ORIENTALIS PENDULA. (Synonym : T. pendula, *Lambert*.)—Amongst pendulous-habited conifers this is certainly one of the most distinct and attractive, while at the same time it is perhaps the most fastidious in its requirements. It is very apt when growing under unfavourable conditions to lose the lower branches, and in consequence it wears a naked and miserable appearance ; but when seen in a healthy, thriving state it must certainly be ranked as one of the most pleasing and ornamental of hardy conifers. It differs much from the species, the flattened, freely divided branches being replaced by long, pendulous, cord-like branches, with but few ramifications. Planted singly and in suitable soil, it forms an ornamental, small-growing tree of regular outline ; while the long, filiform branchlets impart a grace and elegance to the specimen for which it is justly remarkable. The largest specimen I have seen is growing in deep, dampish, sandy soil at Esher Place, in Surrey, 16 feet high, 12 feet through,

and with many of the branchlets hanging gracefully downwards for 18 inches in length. From this specimen I have picked fruit, which was forwarded to the late Dr. Masters, similar in every respect to that of *T. orientalis*, proving conclusively that it is only a distinct and well-marked variety, and not a species as was at one time supposed.

T. ORIENTALIS SEMPERAURESCENS.—This is a neat and dwarf bush, which at no time loses its golden tinge, the bright hue of the foliage rendering it conspicuous and cheery even in winter.

T. ORIENTALIS ZUCCARINIANA.—Among small-growing, neat-habited, and bright-foliaged, shrubby or rather pigmy conifers, this is one of the best, and there are many purposes to which it may be applied, especially in grounds of limited extent. The branches are numerous and slender, forming a dense, globose mass, thickly furnished with bright green foliage, which colour it retains throughout the year. It is a cheerful, pleasing shade of green, and this, coupled with the neat outline, ease of culture and propagation, should tend to its increased cultivation.

T. PLICATA, *D. Don*. The Giant Arborvitæ. (Synonyms: *Thuya gigantea*, *Nuttall*. *Thuya Lobbi*, of gardens; *T. Menziesii*, *Douglas*; *T. Craigiana*, of gardens.) Alaska to California, and western slopes of Montana. 1853.—A handsome and useful timber tree in this country, and one that is perfectly hardy everywhere, and of the freest growth. The quality of timber produced in England warrants us in speaking highly of this conifer for afforesting purposes, it being light,

firm, and of good lasting quality ; but it is well to remember that many worthless slow-growing forms of the tree have of late years crept into commerce. The tree, too, is very non-exacting as to the quality of soil in which it is planted, and also succeeds well on exposed ground. As an ornamental tree it likewise deserves attention, the free growth and distinct shade of green which pervades the foliage lending to it a peculiarly distinct and pleasing appearance. The trunk is straight and of gradual taper, the branches evenly distributed, long and lithe, and the branchlets numerous and thickly supplied with dark green foliage. The cones are small, about three-quarters of an inch long, oval, and generally produced plentifully on the upper sides of the branches, where they stand almost erect. Usually the spread of branches is narrow in proportion to the height of the tree, while the long annual growth causes these to be placed far apart on the stem. For shelter-giving it is a valuable species.

Dr. Masters at a meeting of the Royal Horticultural Society exhibited specimens from Mr. A. D. Webster, illustrative of the confusion in the nomenclature of this genus. He observed that *T. occidentalis* grows in the Atlantic States of North America, and *T. gigantea* (*Lobbi*) on the north-western or Pacific side. A form originally named *T. plicata* was introduced at the end of the last century by Menzies from Vancouver. In *Donn's Catalogue of the Plants of the Botanic Gardens at Cambridge* this plant is recorded, but without description. As this is a western species, it is really synonymous with, or, at most, a variety

of what is now generally called *T. gigantea*. But the original *T. plicata* having probably died out, the name has now become transferred to a form or variety of *T. occidentalis* from the Atlantic side of the United States. Both species are represented by a *plicata* form. Specimens of the original *T. plicata* from Vancouver are in the Herbarium of the British Museum, so that it is a question whether, strictly speaking, the name *T. gigantea* should not be superseded by that of *T. plicata*. The western plant now bearing that name should then be called *T. occidentalis* var. *plicata*.

There are two varieties, *T. plicata compacta* and *T. plicata pendula*.

According to Masters the species and varieties of *Thuja* may be grouped as follows :

1. *T. OCCIDENTALIS*, *Linnaeus*
var. *plicata*—*T. plicata*, of gardens.
var. *Wareana*,
and very many more.
2. *T. PLICATA*, *D. Don*, in Lambert, *Pinus*
T. gigantea, *Nuttall*, and of gardens.
T. plicata, *D. Don* (without description).
3. *T. JAPONICA*, *Maximowicz*
T. Standishii, *Hort.*

TORREYA, *Arnott*

THE FETID YEWS

Flowers diœcious; males solitary; females in twos or threes.
Fruit drupaceous, one-seeded, fleshy on the outside, and about the size of a nutmeg.

Seed solitary in each fruit; albumen ruminant.

Leaves two-ranked, linear, and decurrent at the base.

Cotyledons two.

Small evergreen trees or shrubs, with two-ranked leaves and drupaceous fruit like a nutmeg. Both leaves and fruit emit an unpleasant odour when bruised, except in *T. grandis*.

TORREYA CALIFORNICA, *Torrey*. (Synonym: *T. Myristica*, *Hooker*.) California. 1851.— This is a beautiful species, that flourishes well in many parts of the country, but the finest specimens I have seen are growing in the mild, humid atmosphere of several parts of Ireland, particularly the south and west. In this country it forms a well-branched sturdy bush or small tree, with an inclination to form long and somewhat irregular lower branches, which it is well to keep in check by judicious pruning, an operation that it by no means resents. The foliage is of a fresh and distinct shade of green, each leaf being $2\frac{1}{2}$ inches long, flat, sharp-pointed, and with a sunken line on each side of the indistinct mid-rib. When bruised, the leaves emit a peculiar, unpleasant odour. The fruit, which is fleshy on the outside, like our common plum, and elliptic in shape, averages fully $1\frac{1}{2}$ inches long, and contains a nutmeg-like seed covered with a hard, bony shell. When seen in fruit the contrast between the long green leaves and curious plum-like fruit is remarkable. The soil that would seem to suit this species best is that mainly composed of peat, and where the situation is well sheltered. One of the largest specimens I know of, and from which I have received specimens, is growing, with many other

rare conifers, at Orton Longueville, in Huntingdonshire. It has borne fruit in abundance.

T. GRANDIS, *Fortune*. Northern China.—1855.—From the previous species this is readily distinguished by the shorter leaves and smaller fruit. It has not proved hardy in all parts of this country, although in more than one station I have been shown thriving plants, and a very fine specimen may be seen in the grounds at Churchhill, County Armagh, Ireland. The outline of this specimen is neat but spreading, the branches flattened, and furnished with dark green leaves, each about 1 inch long, the under side being rendered silvery by the two pale-coloured furrows which run for three-quarters the length of the leaf. The fruit is rounded, not elongated as in *T. californica*, and averages 1 inch in length.

T. NUCIFERA, *Siebold et Zuccarini*. Japan. 1818.—Unless under very favourable conditions, this species is rarely found as a thriving specimen in these Isles. When seen at its best it is of neat, compact growth, with spreading branches and numerous branchlets, that are well furnished with yew green foliage, each leaf being about 1 inch long. The fruit is about the same length as the leaves, and elliptic in shape.

T. TAXIFOLIA, *Arnott*. Western Florida. 1838.—Like *T. nucifera*, this cannot be depended upon in point of hardihood. Unless in the very warmest parts of the country, and under unusually favourable conditions, healthy specimens are rarely to be met with. It is of remarkably slow growth, and seldom makes a neat plant. The leaves are pale shining green, stiff, sharp-pointed, and fully

1 inch long, while the fruit is egg-shaped and 1 inch long. The branches have a yellowish appearance, owing to the colour of certain portions of the bark.

TSUGA, *Carrière*

THE HEMLOCK SPRUCES .

Flowers monœcious; males lateral; females terminal.

Cones terminal, pendent, almost spheroid, with persistent scales.

Seeds small, with obovate wing.

Leaves linear, flat, stalked, and proceeding from prominent cushions.

Cotyledons varying from three to six.

Evergreen trees or shrubs of great value for ornamental planting.

TSUGA ALBERTIANA, *Sénéclauze*. Western Hemlock. (Synonyms: *T. Mertensiana*, *Carrière*; *Pinus Mertensiana*, *Bongard*; *Abies Mertensiana*, *Gordon*; *A. Albertiana*, *Murray*.) Alaska, British Columbia, Oregon. 1851.—Under the name of Prince Albert's Fir (*Tsuga Albertiana*) this tree is most commonly to be found. The tree was introduced by the Oregon Association of Edinburgh through their collector Jeffrey, and named in honour of the patron of the Association—the late Prince Consort.

Probably no other species of *Tsuga* is better adapted for growth in this country, certainly none grows thicker or sooner forms a sturdy well-branched ornamental specimen. The habit of growth is both erect and spreading, the flexible leading shoot keeping well ahead of the long, lithe, and thickly produced branches which

are clothed throughout with distinctly pendulous and feathery branchlets. Some difference in the shade of colour is noticeable on different specimens, but usually this is of a dark green and nearly approaching that of the better known and more commonly cultivated Hemlock Spruce (*T. canadensis*). Both as an ornamental tree and for its rapid growth, this species can well hold its own with any other that has yet been introduced. It is of erect growth with a stout, leading shoot, that usually keeps well ahead of the branches, the latter being long, lithe, and of irregular lengths, while the branchlets are distinctly pendulous and feathery. The foliage is two-ranked, and spreads horizontally, or nearly so, each leaf half an inch long, and of a dark shade of green. Cones are plentifully produced in this country, resembling those of *T. canadensis*, but having more elongated scales and longer wings to the seeds. They are of a distinct russety brown when fully mature.

The tree, when favourably situated, is of rapid upward growth, the average of fifteen specimens that I measured being 15 inches a year. By far the finest specimen that I have measured is growing amongst the Welsh hills at Hafodunos, and which produced in thirty-five years 48½ feet of wood, or fully 1½ feet a year. I have experimented with the timber of twenty-five years' growth, and though it is hard, not heavy, and of a pleasing light brown colour, yet the lasting properties were not remarkable. The partial immaturity of the wood would, to some extent, account for this. This species is worthy of trial for afforesting purposes.



Face page 196.

TSUGA ALBERTIANA AT MURTHLY CASTLE.

Conspicuous amongst trees at The Cairnies, Perthshire, are the two magnificent specimens of the tree which bear the name of the late Prince Consort—*Abies Albertiana*. The seeds were sent to this country by Jeffrey in his first Oregon expedition of 1850, and some of the earliest cones were sown by Mr. Patton, of The Cairnies, in the following year. The tree was at first known under a variety of names, but on a photograph of the two best ones at The Cairnies being shown to Her Majesty, after they were a few years old, she expressed a desire that the tree might be called *Abies Albertiana*, in memory of the late Prince Albert—a name by which the tree is now universally known. The two at The Cairnies are not only grand specimens, but they are acknowledged to be the best trees of the kind in the country. Growing at an altitude of 660 feet on a poor, thin, moorish soil, with a subsoil of hard, retentive clay, and with a southern exposure, they have thriven amazingly, withstanding all the ravages of the late very severe winters. One of these trees, known as “The Victoria Tree,” was partly blown over about two years ago. It girths 5 feet 10 inches at 5 feet from the ground. At Craigo *A. Albertiana* is 94 feet high and 7 feet 9 inches in girth of stem at a yard up.

T. BRUNONIANA, *Carrière*. (Synonyms: *Pinus dumosa*, *Don*; *Pinus Brunoniana*, *Wallich*; *Abies Brunoniana*, *Lindley*; *Abies dumosa*, *Loudon*; *A. cedroides*, *Griffith*.) Eastern and Central Himalayas. 1838.—This may rightly be described as the handsomest of the genus, though,

unfortunately, it is not generally hardy. When seen in a thriving condition it forms a round-headed pyramid, the branches and branchlets gracefully drooping towards the points, and thickly furnished with leaves that are longer than those of any other member of the family, and of an intense silvery hue underneath. Each leaf is about 1 inch long, flat, and serrulated particularly towards the point. The cones are produced singly at the branch-tips, and are almost similar in size and shape to those of the better known *T. canadensis*. Being apt to suffer from frost after having started into growth in spring, this tree should always be planted in a position where vegetation generally is late in commencing growth. Winter frosts have little effect upon the tree; it is the immature shoots of last season or the present that suffer most. The rate of growth under favourable circumstances is nearly 1 foot a year. One specimen that I measured had attained to the height of 20 feet in nineteen years, and produced cones regularly.

T. CANADENSIS, *Carrière*. The Hemlock Spruce. (Synonyms: *Pinus canadensis*, *Linnaeus*; *Abies canadensis*, *Michaux*; *Picea canadensis*, *Link.*) North-East America. 1736.—This is the best known species, and is particularly suitable for cultivation in this country. It is of pyramidal habit until about half its height is attained, after which the top gradually assumes a flat or rounded form, the branches become more open, and the branchlets decidedly pendulous. The leaves are of a pleasant green above, half an inch long, silvery beneath, and thickly produced.

Cones are borne in great profusion at the branch tips, each being about 1 inch long, and composed of about twenty-five brownish, broadly wedge-shaped scales. Few evergreen trees can surpass the Hemlock Spruce for beauty and richness of foliage, or distinct and pleasing outline; and during spring and early summer the young drooping shoots, of a lively yellowish green, contrast nicely with the dark and sombre hue of the older foliage, and form a combination that for beauty of effect is certainly hard to match. The soil best suited for the growth of the tree is rather strong, damp loam: indeed, some of the finest trees that I have seen are growing by a lake-side, and where the roots must be partially submerged at all seasons.

T. CANADENSIS AUREA is, judging from the few specimens that I have had the opportunity of examining, no great acquisition, the colouring being both irregular and inconstant. In the juvenile state it is preferable to older trees.

T. CANADENSIS GLOBULARIS ERECTA is of dwarf, spreading habit, with thick, closely arranged branches, that are at first erect, but afterwards gracefully drooping. The leaves are closely arranged, smaller and narrower than those of the species, and of a much lighter green colour. It is of Continental origin.

T. CANADENSIS MACROPHYLLA.—Both in colour of foliage and habit of growth this is totally different from the parent. The habit is dwarf, the outline regular, but not stiffly so, and the compact masses of foliage are of the darkest and most decided shade of green, and greatly intensified

by their shining lustre, which is at all times both pronounced and pleasing. The leaves are comparatively broader than those of the species, but it is their dark shining green tint that offers such a contrast to the greyish green of the parent, and which, without the dwarf habit, would at once render simple the recognition of this valuable variety. It is certainly one of the most desirable of small-growing conifers, but requires to be layered or grafted in order to fully perpetuate its distinctive characteristics. The origin of this Hemlock is a little curious. It was picked up about 1860 in the nursery of King & Murray, of Flushing, from amongst some common Hemlocks sent to them by a Western firm.

T. CANADENSIS NANA is of very dwarf and spreading growth, with short branches and closely set tufted leaves. The specimens I have seen were 27 inches high, and fully 3 feet across.

T. CANADENSIS PARVIFOLIA is a very distinct variety that attracts attention by the small and deep green leaves. They are usually a quarter of an inch long, cuspidate, and appressed to the branches, these latter being lithe and slender.

T. CANADENSIS PENDULA. Weeping Hemlock Spruce.—This is a tree of great beauty, but, unfortunately, rarely met with. In no way does it differ from the commonly cultivated tree, save in the long, weeping spray, the branch-tips hanging gracefully downwards for, in most instances, a couple of feet. The finest specimen that I have seen is growing by the lake-side at Hollydale, the Earl of Derby's Kentish property. It is fully 20 feet high, and has borne cones abundantly.

T. CAROLINIANA, *Engelmann*. Mountains of North and South Carolina. 1881.—This nearly approaches *T. canadensis*, but from that species may at once be distinguished by its much longer, blunter-pointed, and glossier leaves. The cones are proportionally large, with wide, spreading scales of a dark brown colour. It is a beautiful little tree, of neat habit, slow growth, and succeeds well when planted in rich loamy peat, where not exposed to cold or cutting winds.

T. PATTONIANA, *Sénéclauze*. (Synonyms: *Abies Pattoniana*, *Balfour*; *A. Hookeriana*, *Murray*; *A. Williamsoni*, *Newberry*; *Pinus Pattoniana*, *Parlatore*.) Fraser River to South California. 1854.—A distinct and ornamental small-growing tree that is at once distinguished from any other species by the drooping branches and nearly erect thickly scattered leaves, which are not two-ranked and horizontally arranged as in most species. Each leaf is 1 inch long, and either keeled and convex or furrowed in the centre and either dark or bluish green. The cones are about $2\frac{1}{2}$ inches long, cylindrical-oblong, the scales becoming reflexed when quite ripe or after the cones have fallen from the tree; while the beautiful lilac catkins are produced in such quantities as to render the tree very conspicuous during early spring.

In this country *T. Pattoniana* is of slow growth, but neat and compact, and the foliage of a beautiful bluish green tinge. The tree usually seen under the name of *T. Hookeriana* (supposed by some botanists to be a distinct species, and by others to be a variety) seems distinct from *T. Pattoniana*,

the leaves being shorter, narrower, generally curved, irregularly arranged, bluish green above and silvery beneath, but they vary.

T. SIEBOLDI, *Carrière*. (Synonyms: *Pinus Tsuga*, *Antoine*; *Abies Tsuga*, *Siebold and Zuccarini*.) Japan. 1853.—This is of neat and elegant habit, slow of growth, and valuable for planting where space is rather confined. At a distance it bears a striking resemblance to the Canadian Hemlock, but on close examination the Japanese species will be found to have stouter, broader, and longer leaves, many being notched at the point, and with a deeper green upper and more silvery under surface. The cones are abundantly distinct, being nearly globular, 1 inch in diameter, and the scales rounded. It is of dense growth, spreading out widely on all sides, and would appear to thrive on much lighter soils than other members of the same genus. It succeeds well in block moory soil in the home nursery at Holwood, in Kent.

T. SIEBOLDI NANA is of dwarf, neat, and graceful growth, rarely growing to more than 4 feet in height, and with small and thickly produced leaves, that are both bright and effective. Being of small, compact growth, and with beautiful silvery foliage, there are many places suitable for the growth of this dwarf form. Most, if not all, the specimens under this name are *T. diversifolia*, Masters.

T. YUNNANENSIS, *Masters*. (Synonym: *Abies yunnanensis*, *Franchet*.) Yunnan. 1891.—This species was first described by Franchet in the *Journal de Botanique*, 1891, p. 258, from speci-

mens collected by Father Delavay in Yunnan. By Delavay and other collectors it has been met with at an altitude of from 3000 to nearly 9000 feet, consequently its hardiness ought to be assured. Seeds were sent home by Mr. E. H. Wilson when collecting in Hupeh, and strong plants have been raised at Coombe Wood. To a casual observer the tree bears a strong resemblance to *T. Sieboldi*, but the cones are larger than in that species. The branches are spreading, and clothed with small, entire, sessile leaves with slightly revolute margins. The upper surface is channelled, and the under surface glaucous; the apex is very slightly notched. As is the case with the other Asiatic *Tsugas* this one is likely to form an ornamental bush or small tree.

CHAPTER II

PROPAGATING CONIFERS

NATURAL REPRODUCTION FROM SEED.—Conifers are propagated or increased by one of four different methods—seed-sowing, grafting, layering, or the insertion of cuttings. Seed-sowing is to be recommended, but when seed is difficult to obtain, as is not unfrequently the case with many conifers, propagation from cuttings, by layers or grafting, is usually resorted to. Unless in the case of our native conifers—the Scotch Pine, the Yew, and the Juniper—self-sown specimens have rarely been detected. There are, however, several exceptions to this rule that have at various times come under my notice. At Woburn Abbey both the Weymouth and Bhotan Pines (*Pinus Strobus* and *P. excelsa*) have reproduced their kind freely, particularly the former, which in one of the pine woods has grown so plentifully from seed that advantage has been taken of these young plants to utilise them as forest trees.

At Holwood Park, in Kent, the property of the Earl of Derby, some of the most promising young specimens of Lebanon Cedar are such as were lifted from beneath one of the old trees, said



Face page 204.

TREE NURSERY AT WOBURN.

Laid out and planted by the writer in 1893.

to have been planted by the great statesman, William Pitt, when he owned the property. But at many other places, as well as Holwood, the Lebanon Cedar has reproduced itself from naturally sown seed.

I have only noticed one instance of any of the species of *Abies* other than *A. pectinata* growing naturally from seed, and that was in the case of *A. Nordmanniana* at Penrhyn Castle, in Wales. The tree had produced an unusual quantity of cones, containing good, fertile seeds; many of these germinated freely on the ground where shed, and were carefully lifted and taken to the home nursery, where they grew into fine specimens. In a gravelly woodland where the Cluster Pine (*P. Pinaster*) was the main crop, I have seen several self-sown trees spring up, but these, curiously enough, were always lank and weak of growth.

In Ireland, near the shores of Lough Neagh, young specimens of the Lawson Cypress and Douglas Fir may be seen growing on the sloping banks of the ditches that were opened for the drainage of the bog-lands; these, of course, were the produce of trees that had been planted in an adjoining wood. The common Silver Fir in certain places reproduces its kind, so does the Larch, while plentifully enough, seedling Scotch Pines spring up wherever the conditions of soil are at all favourable. Both the Yew and Juniper grow freely from self-sown seeds, but here again the conditions of soil play an important part. Around an old specimen of the upright or Irish Yew I have seen numbers of seedling plants—not all true, for a large percentage revert to the species.

Amongst the spruces, *Picea excelsa*, *P. sitchensis*, *P. nigra*, and *P. orientalis* have reproduced their kind in this country, the latter two only occasionally. *Thuja occidentalis* is often seen growing in a truly naturalised condition, and that it does frequently sow itself I have had ocular demonstration. The above are the only instances of self-sown coniferous trees in this country that have come under my notice.

Seedling conifers may either be raised in pots or boxes placed in a close frame, or in the open border. The former method is, however, to be recommended, as they can then more readily be protected from heavy rains, sudden changes of atmosphere, or the depredations of rats, mice, and birds. With the rarer conifers, and when seeds are very limited in quantity, pot-sowing is to be preferred ; but when large numbers are to be raised, sowing either directly in the frame or in shallow boxes placed therein will be found the most convenient. Spring or early summer is the best time to sow seeds of coniferous trees. The pots, pans, or boxes should be clean, thoroughly drained, and filled three-fourths their depth with a mixture of loam, leaf-mould, and silver sand. Well press down the soil, thoroughly water, and sow on the following day. In sowing spread the seeds evenly and not too thickly over the prepared surface, and cover with light sandy soil, avoiding too deep covering, otherwise the seedling plants would fail to come through the soil or germinate.

A slight watering should then be given, and the frame closed down, and when the seed-bed is not exposed to direct currents of air and sunshine, sub-

sequent heavy waterings will not be required. Probably the most critical period in connection with the raising of seedling conifers is the time that they are pushing through the surface of the ground, and any indiscretion in the way of shading or watering at that point of culture usually proves disastrous. Keeping the surface rather dry than otherwise is, however, to be recommended. A free current of air may be admitted after the seedlings are well through the ground; and in two years after germination they may either be pricked out in the open border, in pans or boxes, or potted singly. With such hardy, free-growing conifers as the Larch, Spruce, Silver Fir, Scotch and Corsican Pines, the seeds should be sown in well-prepared beds of light, free soil out of doors. The seed-beds may be 4 feet wide, and the soil rendered light and free if necessary, the covering to be proportionate to the size of the seed. Branches of spruce laid over the beds are useful as guards against excessive sunshine and the depredations of birds.

The following table will show at a glance the approximate and relative number of seeds contained in 1 lb. weight of each of the following species:

Name of Tree.	Number of Seeds contained in 1 lb. weight.
Abies amabilis	5,400
„ balsamea	71,100
„ brachyphylla	52,500
„ cephalonica	9,000
„ grandis	23,500
„ nobilis	19,400
„ Nordmanniana	9,900
„ pectinata	14,900
„ Pinsapo	10,800

Name of Tree.	Number of Seeds contained in 1 lb. weight.
<i>Abies Veitchii</i>	52,500
<i>Cedrus atlantica</i>	7,600
„ <i>Deodara</i>	9,900
„ <i>Libani</i>	10,800
<i>Cephalotaxus pedunculata</i>	893
<i>Cryptomeria japonica</i>	182,400
<i>Cupressus Lawsoniana</i>	105,000
„ <i>nootkatensis</i>	112,000
„ <i>obtusa</i>	280,000
„ <i>pisifera plumosa</i>	350,000
<i>Juniperus excelsa</i>	1,800
„ <i>Sabina</i>	2,200
„ <i>virginiana</i>	22,000
„ <i>communis</i>	7,200
<i>Larix europæa</i>	68,000
<i>Picea hondoensis</i>	350,000
„ <i>alba</i>	154,500
„ <i>excelsa</i>	68,800
„ <i>sitchensis</i>	453,300
„ <i>Morinda</i>	24,900
„ <i>orientalis</i>	72,500
„ <i>obovata</i>	40,800
<i>Pinus Balfouriana aristata</i>	140,000
„ <i>Cembra</i>	2,592
„ <i>Coulteri</i>	1,360
„ <i>excelsa</i>	10,800
„ <i>insignis</i>	19,900
„ <i>Lambertiana</i>	2,000
„ <i>Laricio</i>	41,200
„ „ <i>nigricans</i>	49,000
„ <i>parviflora</i>	2,800
„ <i>patula</i>	46,660
„ <i>Peuke</i>	12,200
„ <i>Pinea</i>	520
„ <i>ponderosa</i>	9,900
„ <i>rigida</i>	82,000
„ <i>Sabiniana</i>	480
„ <i>Strobus</i>	31,700
„ <i>sylvestris</i>	90,600
„ „ <i>monophylla</i>	70,000
<i>Pseudotsuga Douglasii</i>	95,200
<i>Sequoia gigantea</i>	143,800

Name of Tree.	Number of Seeds contained in 1 lb. weight.
<i>Sequoia gigantea pendula</i> . . .	113,000
<i>Taxodium distichum</i> . . .	8,600
<i>Taxus baccata</i> . . .	6,125
„ „ <i>adpressa</i> . . .	7,546
„ „ <i>fastigiata</i> . . .	5,444
<i>Thuya plicata (gigantea)</i> . . .	93,330
„ <i>occidentalis</i> . . .	186,600
„ „ <i>plicata</i> . . .	245,000
„ <i>orientalis</i> . . .	31,500
„ „ <i>falcata</i> . . .	35,000
<i>Tsuga canadensis</i> . . .	210,000

It should be stated that the weights of many coniferous tree seeds vary greatly according to the age of the specimen producing them, and situation in which it is growing. In compiling the above table, three lots of seeds of several species, collected from different trees, were weighed, and the averages are recorded. Newly collected seeds were invariably used in compiling the table.

FROM CUTTINGS.—An objection to the raising of certain species, at least of coniferous trees from cuttings, is that they are tardy to produce leading shoots, many naturally upright-habited trees when propagated in this way assuming a creeping habit of growth, with little or no inclination to start away freely with a single leader. Small growing conifers, such as the various forms of *Cupressus*, *Juniperus*, *Thuya*, and *Taxus*, are, however, readily increased by inserting cuttings in previously prepared soil about the end of August. The cuttings, of rare species at least, are usually inserted in pots or boxes of suitable soil, while such as are hardier and more readily procured strike root freely enough when placed in the open border,

preferably in a sheltered spot under a north wall. Thorough preparation of the soil in which the cuttings are to be inserted is a point of consideration, and this should be composed of nearly equal proportions of peat, loam, and sharp sand thoroughly consolidated. The choice of cuttings is an equally important point, these being always taken from the outer and exposed branches, those from the interior and shady portions being avoided as difficult to strike, and apt to damp off, this also applying to the succulent portions of the leading shoots and branch-tips. The cuttings may be from 4 inches to 6 inches long, should be of the current season's growth, with a "heel" or shoulder of old wood at the base. In preparing the cutting for inserting in the ground, the lower 2 inches should be made clean of leaves (unless such as are scale-like) or shoots by means of a sharp knife, stripping off the leaves by the fingers being decidedly objectionable. Place the cuttings about 3 inches deep in the prepared soil, making this quite firm around them, sprinkle a little silver sand over the surface, and moisten lightly. In raising trees from cuttings two points should be borne in mind—first, to insert early enough so that the cuttings may be callused before the winter; and second, to prevent direct sunshine from striking on them when forming roots in spring. These instructions are equally applicable to cuttings, whether placed in pots, pans, or boxes in an unheated frame. The soil should be kept in a uniform state of moisture, and the lights tilted for an hour or two every morning to prevent too humid an atmosphere, and the

cuttings from damping off. Neither the species of *Abies* nor *Picea* are successfully raised from cuttings, though *Cupressus* and *Thuyopsis* take readily.

BY GRAFTING.—Unless carefully performed on sound principles, conifer grafting is not to be recommended. The operation may be performed either early in spring or about the middle of August. Preferably the stock used should be from two to three years old, as it is all important that both stock and scion be of nearly similar size. The stocks generally employed in grafting conifers are, for the *Picea* tribe, the Norway Spruce (*P. excelsa*); for the *Abies*, the common Silver Fir (*A. pectinata*); for the Hemlock Spruces, *Tsuga canadensis*; and for the different Taxads, the Common Yew (*Taxus baccata*). For the Cypress tribe, *Cupressus Lawsoniana* is used; for the Thuyas, *Thuja orientalis* and *T. occidentalis*; and for the Junipers, *Juniperus communis*. It may be well to remember that the Eastern Arborvitæ (*Biota*) will not take on the Western *Thuja occidentalis*, the Douglas on the Silver Fir, or the Golden Larch on the common species. *Picea pungens* and its variety *glauca* do well on the Common Spruce, while quite a number of *Abies* and *Picea* are unsatisfactory as grafted plants.

Usually the stocks are grown in 3-inch pots placed in a cool and nearly air-tight frame. There are several methods of grafting, but with most conifers ordinary side grafting is to be recommended. This consists in making a clean cut downwards in the stem for three-quarters of an inch in length, a transverse cut being made at the

termination thereof, and sufficient of the wood and bark removed to allow of the insertion of the graft. The scion should be prepared by cutting the end square across, and by shaving a piece from one of the sides of similar length to the cut in the stock—in fact, the scion should as nearly as possible replace the portion cut from the side of the stock. About 4 inches is a good length for the scion, which should, after being prepared as above directed, be tied securely in its place by grafting cotton, and this covered over either with clay or grafting wax. The frame containing the pots of grafted conifers should be kept close and shaded from too powerful light by mats or screening; but at the same time condensed moisture should be allowed to pass away by opening the lights for a short time in the morning.

In from a month to six weeks many of the grafts will have taken, and after a complete union is effected the head of the stock may be gradually shortened back to the point where grafting took place. The graft should be placed low on the stock, or so as not to be noticeable above ground level.

BY LAYERING.—Several species of *Picea* and other conifers may be increased by layering the lower branches, but this system is rarely carried out and is open to objections. It consists in bending the branch down to ground-level amongst previously prepared soil of a sandy, open nature, where it is kept in position by means of a hooked peg until roots are emitted. After becoming rooted the branch is severed between the peg and the main stem, and the offshoot allowed to

remain in the same position for another year, after which it may be carefully lifted, and either planted out permanently or transferred to the nursery. Erect-growing plants are rarely obtained by layering.

CHAPTER III

CONIFERS AND SOILS

MANY, in fact most coniferous trees, will thrive in any soil of fairly good quality ; but it is likewise a well-known fact that certain species will only succeed satisfactorily when planted under peculiar conditions, whether as to soil and site or the amount of dampness that is present in the ground.

Thus, *Sciadopitys verticillata* will only succeed when planted in dampish peaty ground or decomposed leaf soil, while *Picea sitchensis* requires heavy retentive loam ; it soon becomes unhealthy when planted in that of a light and dry nature. Again, *Abies Pinsapo* grows with unusual luxuriance when planted on chalk or limestone, and the same remark applies to *A. cephalonica* and *A. numidica*, both of which do better on chalk or limestone than they do in the loamy soils that are so well adapted for many other species of *Abies*. *Pinus Laricio nigricans* also succeeds best on chalky or calcareous soil.

P. Pinaster, *P. halepensis*, and *P. rigida* do best when planted on pure sand on the sea-coast ; whilst *P. sylvestris* and *P. Laricio* grow nowhere

with greater vigour or produce more valuable timber than when planted on rather poor or thin gravelly soils. On the other hand the Common Larch if planted on warm, gravelly soils gets 'pumped' or rotten at the core.

Again, *Taxodium distichum*, *Tsuga canadensis*, *Picea nigra*, *Cupressus thyoides*, and *Thuja occidentalis* will thrive where the roots are at times, or constantly submerged, and are therefore well suited for planting in damp or marshy ground. In the following lists the principal coniferous trees that have been found to succeed in the particular class of soil with which they are associated are arranged in alphabetical order.

CHALKY OR CALCAREOUS

Abies amabilis.	Larix europæa.
„ cephalonica.	„ leptolepis.
„ magnifica.	Picea excelsa.
„ nobilis.	Pinus Cembra.
„ numidica.	„ excelsa.
„ Pinsapo.	„ Laricio.
Cedrus atlantica.	„ „ austriaca.
„ Deodara.	„ Pinaster.
„ Libani.	„ Strobis.
Cupressus Lawsoniana.	„ sylvestris.
„ macrocarpa.	„ tuberculata.
Ginkgo biloba.	Pseudolarix Fortunei.
Juniperus communis.	Taxus baccata and
„ chinensis.	varieties.
„ Sabina.	Thuja plicata.
„ „ tamarisci-	„ occidentalis.
folia.	

GRAVELLY AND SANDY

Cupressus Lawsoniana.	Juniperus Sabina.
„ nootkatensis.	„ „ tamarisci-
Juniperus communis.	fol]a.

Pinus halepensis.	Pinus montana.
„ Laricio.	„ tuberculata.
„ „ nigricans.	Taxus baccata and several
„ Pinaster.	varieties.
„ rigida.	Thuya plicata.
„ sylvestris.	

PEAT SOIL

When planted in reclaimed peat bog many conifers grow with a luxuriance that is entirely wanting when they are seen under other conditions as regards soil. By far the largest and healthiest specimens of the rare and interesting *Pinus Bungeana*, *Cephalotaxus Fortunei* and *C. drupacea*, *Fitzroya patagonica*, various species of *Podocarpus*, and *Torreya* that I have seen are growing in deep peat bog to which a quantity of road-scrappings was added at time of planting. The Larch does nowhere better or is more free from disease than when growing in peaty soil, while *Pseudotsuga Douglasii*, *Picea sitchensis*, *Abies sibirica*, *Cryptomeria japonica*, and *Sequoia sempervirens* are all at home on deep peat bog. The following is a list of the most suitable :

Abies bracteata.	Cephalotaxus Fortunei.
„ concolor.	„ pedunculata.
„ nobilis.	Fitzroya patagonica.
„ Nordmanniana.	Pinus excelsa.
Cedrus Deodara.	„ Bungeana.
Cryptomeria japonica.	„ Laricio nigricans.
Cupressus Goveniana.	„ pyrenaica.
„ Lawsoniana and	„ sylvestris.
„ varieties.	Pseudolarix Fortunei.
„ macrocarpa.	Sequoia sempervirens.
Juniperus chinensis.	Sciadopitys verticillata.
„ recurva.	Taxus baccata.
Larix europæa.	Thuya plicata.
Cephalotaxus drupacea.	„ occidentalis.

CLAYEY SOIL

For planting in stiff, clayey soils I have found *Cryptomeria japonica* and its variety *elegans*, *Thuja plicata* and *T. occidentalis*, to be by far the most useful ; while where ironstone and coal are present, nothing excels *Cupressus Lawsoniana*, *Juniperus communis*, *Larix europæa*, *Pinus Cembra*, and *P. montana*.

CHAPTER IV

CONIFERS FOR VARIOUS POSITIONS

FOR AVENUES.—As avenue trees, several species of conifers have been widely recommended in books and catalogues, especially *Araucaria imbricata* and *Sequoia gigantea*, but that these two, at least, have sadly belied the hopes of the planter is now generally acknowledged. The avenue at Coombe Wood was composed of the *Araucaria* and *Sequoia* planted alternately, but the former trees have all been removed, while the latter look anything but promising; and at Woburn Abbey almost every *Araucaria* has been cut down. *Thuja plicata* or *Abies brachyphylla* are much better suited, and several avenues that have recently been planted with these species will, no doubt, in years to come, give every satisfaction. In fairly sheltered situations *Cupressus Lawsoniana* and *Cedrus atlantica* make good avenue trees.

FOR THE SEASIDE.—Many species of conifers do well in maritime situations, and particular notice should be taken of *Cupressus macrocarpa* and *C. nootkatensis*, *Pinus Pinaster*, *P. Laricio*, *P. Laricio nigricans*, *P. halepensis*, *P. rigida*,

P. muricata, *P. sylvestris*, *P. insignis*, *Thuja plicata*, and *T. orientalis*.

FOR EXPOSED SITUATIONS.—Nearly twenty years ago I formed a plantation for shelter-giving purposes on one of the spurs of the Snowdon range of hills, and amongst many species of coniferous trees that were tried the following have done best: *Pinus Laricio* and *P. Laricio nigricans*, *P. rigida*, *P. sylvestris*, *P. montana*, *Thuja plicata*, *Taxus baccata*, *Larix europæa*, *Juniperus communis*, and *Picea sitchensis*.

FOR SMOKY LOCALITIES.—Few coniferous trees succeed well when planted in the smoke and fumes of the larger centres of industry. The best are *Thuja plicata*, *Ginkgo biloba*, *Juniperus Sabina tamariscifolia*, *Cupressus pisifera plumosa aurea*, *Prumnopitys elegans*, *Taxus baccata*, *Cupressus Lawsoniana erecta viridis*, and *Cryptomeria japonica* with its variety *elegans*. These all do well in the impure atmosphere of several of our largest cities, but as we recede from these centres of death to tree and shrub life generally, many other species can be planted.

FOR CONFINED SPACES.—The list of coniferous trees that are of small and neat habit of growth, and, therefore, suitable for planting in small grounds, or where space is confined, is rather a long one, and would include, amongst others, the following:

Cephalotaxus Fortunei.	Cupressus nootkatensis.
„ drupacea.	„ obtusa.
Cryptomeria japonica elegans.	„ pisifera.
Cupressus Lawsoniana stricta.	„ thyoides.
	Juniperus chinensis.
	„ „ aurea.

Juniperus communis.	Pinus contorta.
„ fastigiata.	„ parviflora.
„ recurva.	Sciadopitys verticillata.
„ rigida.	Taxodium mucronatum.
„ Sabina.	Taxus baccata adpressa
„ thurifera.	stricta.
„ virginiana.	Taxus baccata fastigiata.
Picea Alcockiana.	Thuja dolabrata.
„ Engelmanni.	„ „ variegata.
„ „ glauca.	„ occidentalis.
„ orientalis.	„ orientalis.
„ polita.	„ „ pendula.
Pinus Bungeana.	Torreya grandis.
„ Cembra.	

FOR HEDGE PURPOSES.—Several species of conifers are well adapted for the formation of ornamental hedges or for garden divisions, but they should not generally be planted in positions to which farm stock have access. The following are to be recommended :

Cupressus Lawsoniana.	Taxus baccata.
„ „ stricta.	Thuja plicata.
„ nootkatensis.	„ orientalis.
Juniperus virginiana.	„ occidentalis.
Picea excelsa.	

In many parts of Scotland the Common Spruce (*Picea excelsa*) has been, and is, extensively employed in the formation of farm hedges or wind-screens, and for which purpose its growth, perfect hardihood, and shelter-giving properties render it eminently adapted. Bearing pruning well, it can be cut into almost any desired shape, while topping is productive of greatly increased bottom growth and additional shelter. The American Arborvitæ (*Thuja occidentalis*) succeeds satisfactorily as a hedge and screen on several of the islands along

the mainland of Scotland, and where it is highly valued as a hardy, storm-resisting, and free-growing tree. *Thuja plicata* is also to be recommended, particularly for planting on exposed ground. There are several beautiful coniferous hedges at Chigwell House, Pinner.

CHAPTER V

CONIFERS OF DIFFERENT CHARACTERISTICS

WEEPING CONIFERS

WHEN planted with discretion in suitable positions, many of the pendulous or weeping conifers are highly ornamental, and constitute a distinguishing feature of the park or grounds in which they are used. The following list includes some of the best :

Cedrus Deodara.	Juniperus phœnicea.
Cryptomeria japonica elegans.	„ recurva.
Cupressus Lawsoniana.	„ virginiana.
„ „ filifera.	Larix pendula.
„ „ pendula.	Picea Morinda.
Cupressus macrocarpa.	Taxodium distichum pendulum.
„ nootkatensis pendula.	Taxus baccata pendula.
Fitzroya patagonica.	Thuya occidentalis.
Ginkgo biloba pendula	„ „ pendula.
Juniperus chinensis.	„ orientalis pendula.
„ communis.	Tsuga Brunoniana.
„ excelsa.	„ canadensis.
	„ Albertiana.

FASTIGIATE CONIFERS

Cephalotaxus pedunculata fastigiata.	Cupressus Lawsoniana erecta viridis.
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Cupressus macrocarpa fastigiata.	Juniperus drupacea.
Cupressus nootkatensis compacta.	„ excelsa stricta.
Cupressus sempervirens.	„ thurifera.
„ thyoides.	Pinus Cembra.
„ torulosa.	Taxus baccata erecta.
Juniperus communis fastigiata.	„ „ fastigiata.
	Thuya occidentalis Vervæneana.

COLOURED AND VARIEGATED CONIFERS

Cedrus atlantica glauca.	Juniperus Sabina variegata.
„ Libani argentea.	„ virginiana aurea.
Cupressus Lawsoniana albospica.	Picea Engelmanni glauca.
Cupressus Lawsoniana albo-variegata.	„ excelsa finedonensis.
Cupressus Lawsoniana argentea.	Pinus sylvestris aurea.
Cupressus Lawsonia argenteo-variegata.	„ ponderosa aurea.
Cupressus nootkatensis argenteo-variegata.	„ Massoniana aurea.
Cupressus nootkatensis aureo-variegata.	Pseudolarix Fortunei.
Cupressus pisifera plumosa aurea.	Pseudotsuga Douglasii Stairii.
Cupressus pisifera plumosa argentea.	Sequoia gigantea aurea.
Juniperus chinensis aurea.	Taxus baccata aurea.
	„ „ elegantissima.
	„ „ fastigiata aurea.
	Taxus baccata fastigiata argenteo-variegata.
	Taxus canadensis variegata.
	Thuya dolabrata variegata.

CONIFERS OF LOW-SPREADING HABIT

There are many uses to which dwarf-spreading conifers can be put, such as for undergrowth, covering banks and rock-work, or in forming dense, far-spreading masses in the open or around the margins of woods and plantations. For such purposes the following are most to be recommended :

Abies balsamea Hudsonica.	Juniperus Sabina tamariscifolia.
Cedrus Libani pendula Sargentii.	Juniperus Sabina prostrata.
Cryptomeria japonica nana.	„ procumbens.
Cupressus Lawsoniana densa.	„ squamata.
Juniperus communis canadensis.	Picea excelsa Clanbrasiliiana.
Juniperus communis compressa.	„ „ Remonti.
Juniperus Sabina.	Pinus montana.
	Taxus baccata cuspidata.
	„ „ ericoides.
	„ „ Dovastoni.

PIGMY CONIFERS

Several varieties of coniferous trees are of remarkably dwarf and prostrate habit, and therefore well suited for cultivating in beds or on rock-work. The smallest would include *Juniperus communis compressa*, a neat and miniature plant that rarely exceeds 6 inches in height; *J. communis nana*, which on the Scotch and Welsh hills spreads to a considerable distance, though hardly 6 inches high; and *J. Sabina tamariscifolia*, with bright bluish green foliage and of very dwarf and procumbent habit, as is also the variety *prostrata*.

Pinus Strobus nana, *P. Cembra pumila*, *P. Laricio pygmæa*, *P. sylvestris pygmæa*, and the Japanese table Pine, *P. Tanyosho*, are all very compact dwarf forms of their several species, none of which rise to a greater height than about 4 feet.

Amongst the spruces there are several very interesting and neat pigmy forms, the best of which would include *Picea excelsa pygmæa*, *P. excelsa Clanbrasiliiana*, *P. excelsa pumila*, *P. excelsa Gregoryana*, and *P. nigra Doumetti*. These are generally of dwarf-spreading growth, from

2 feet to 5 feet in height, and decidedly interesting and useful for the purposes already referred to.

Cryptomeria japonica nana and the dwarf form of the variety *elegans* are also neat and useful conifers of small growth; and the same applies to *Thuya dolabrata nana*, *T. orientalis pygmæa*, and *T. orientalis nana*.

Several varieties of *Cupressus* are of small and pleasing growth, such as *C. Lawsoniana nana*, *C. Lawsoniana Wisselli*, *C. Lawsoniana nana glauca*, *C. obtusa nana*, and *C. obtusa aurea nana*. *Taxus baccata nana* is a dwarf-spreading variety of the common Yew, that rarely rises more than 3 feet from the ground; and *T. baccata ericoides* is likewise usually of low growth, and furnished with small heath-like foliage. *Thuya occidentalis*, "Little Gem," is a neat small-growing conifer; so are *Retinispora plumosa Sanderi*, *Pinus sylvestris globosa* and *Cupressus Lawsoniana tamariscifolia*.

These include the smallest-growing varieties, but there are others of slightly taller habit, which would, however, hardly come within the scope of such as are suitable for the rock-garden or flower-bed.

CHAPTER VI

CONIFERS FOR ECONOMIC PLANTING

LARCH (*Larix europæa*).—Amongst coniferous trees the Larch, from a purely commercial point of view, is by far the most valuable of any cultivated in this country. When we combine its great aptitude to suit itself to nearly all conditions of soils, altitudes, and diversities of climate, with its long-established value as a timber tree, rapidity of growth and ease of culture, it is clear that no other coniferous tree cultivated in this country can be ranked on a par with the Larch.

The durability of the wood of the Larch is generally admitted, and this peculiarity is noticeable when the timber is of only a few years' growth and in a comparatively immature condition. It is almost twice as durable as that of other coniferous timbers, such as the Scotch Pine, Spruce, or the Douglas Fir. For mining and railway purposes the durability of the timber makes it much sought after, this being further enhanced by its extreme lightness, a cubic foot when seasoned only weighing 34 lbs. Larch, especially in a young state, is specifically lighter than either Corsican or Scotch Pine of similar age. It takes a good polish, works

readily under the tools of the carpenter, but is a little liable to twist or warp. Substitutes for the Larch as a timber-producing tree have often been recommended ; but, in the true sense of the word, none can be accurately termed substitutes. Doubtless some of those timbers whose claims have been set forth might reflect one or more of the valuable qualities of the Larch, but this is the most that can be said.

The uses to which Larch timber is applied are many and varied, but the supply by no means equals the demand. For fencing posts and rails, railway sleepers, telegraph poles and in shipbuilding, it is largely employed. It is of a yellowish white colour, clean-grained, tough, strong, and possesses exceptional lasting qualities, even in a young and immature state.

The Larch is not less valuable from an ornamental point of view than as a timber producer, though it is esteemed more for its utility and profit than for its beauty in the landscape. The soft pea-green foliage with its sweet fragrance in early summer, the graceful form of the tree, which seems never out of position, and the sweep of the branches, sometimes erect, sometimes pendulous, are special traits for which the Larch is valued.

Though the Larch is a tree that is peculiarly suitable for planting alone, yet the premature, high death-rate of the tree, owing to disease and insect attacks, forbids such a course of cultivation. Of late years, the Larch has suffered much from an insidious canker disease, which has spread over the country at such an alarming rate, resulting in the spoliation of so many plantations, that it

is little short of a national calamity. The planting of hard-wooded trees, such as the Beech, along with the Larch is to be recommended as assisting to keep the cankerous disease in bounds. On warm gravelly soils the Larch is apt to become "pumped" or rotten at the core. Larch timber when old is of a reddish brown colour towards the heart, the sapwood being yellowish white. It is tough and strong, but is apt to shrink and with a tendency to warp.

As before stated, the demand for Larch timber is greater than the supply, and since the war started the price has materially increased. For that of the best quality 1s. 6d. per cubic foot is obtained, but the average price realised would work out at about 11d. per foot.

SCOTCH PINE.—This is the only pine indigenous to Britain, and from the fact that its chief native habitat is the Northern Highlands, the name of Scotch Pine has been derived. From the remains of this tree that are found in the peat-bogs of Scotland and Ireland, it is probable that in early ages the greater part of Britain was covered by pine forests. Be that as it may, no forest tree of our acquaintance adapts itself more readily to different soils and climatic conditions; and though named the Scotch Pine, it is by no means peculiar to Scotland. It has a wide geographical range throughout the northern part of the Eastern Hemisphere.

In lowland districts, where it is much used as a nurse tree, forests composed entirely of the Scotch Pine are rarely found, whereas in the northern parts, up to 1500 feet altitude, planta-

tions of this tree are not uncommon. The valleys of the Spey and Dee are the famous districts in Scotland where the tree is found at its best and in greatest abundance; and at Braemar, Abernethy, Rothiemurchus, Glenmore, Monymusk, and Glentanner, large areas of the Scotch Pine are to be found. The famous Ballochbuie Forest at Invercauld, which is owned by the King, is now considered to be one of the most valuable pine forests in Scotland. As to the soil in which this tree does best and in which it produces the most valuable timber, that of a light gravelly or sandy loam, on a granite formation and with a northern aspect, is preferred. Though the Scotch Pine will grow up to an altitude of nearly 2000 feet, it has been found that the perfect development of the tree takes place at a lower level, say, from 500 to 700 feet. The Scotch Pine may be well placed next to the Larch for economic planting.

From a purely commercial point of view the timber of the Scotch Pine is of considerable value, being largely utilised for many constructive purposes. The quality of wood, however, varies greatly, the best being close-grained, hard, and resinous, as it is found in the Northern Scottish forests, and those of Russia, Germany, Norway, and Sweden. In England as a whole, the wood is inferior to that produced in Scotland. Under the names of Red Fir and Yellow Fir, or following the name of the port of shipment—Memel, Riga, and Danzig—the timber of the Scotch Pine is imported to this country in large quantities. The uses to which it is applied are various, including

pit-props, palings, builders' laths, staves, and fencing. When planked out of large trees the timber is used for house joinery, railway sleepers, boarding under slates, outside buildings of a temporary kind, headings for barrels, boxes, and packing-cases. For war purposes Scotch Pine timber has been much in request by the Government for the making of packing-cases, with the result that the price has risen considerably. For first-quality timber the price is now about 1s. 2d. per cubic foot, but plenty may be had at from 8d. to 1s. of smaller size and inferior quality.

The WEYMOUTH PINE, though curiously erratic in the quality of timber produced in this country, is in certain situations a most useful, fast-growing tree ; and where conditions are favourable, should enter into the composition of our woods and plantations. At Gwydyr Castle, in Wales, the Weymouth has done excellently on loose, shaly rock ; and on an elevated plateau near the old chapel, trees containing upwards of 200 feet of timber, with straight, clean boles, some of which rise to 90 feet in height, may be seen. Five of these trees which we measured lately, contained fully 1200 feet of timber and girthed from 9 to 10 feet at a yard up the stem. On warm, gravelly soils at Penrhyn Castle, also in Wales, many of the Weymouths, which averaged 55 feet in height, were " pumped " or rotten at the core, thus showing that the tree is not adapted for such soils. In Surrey the Weymouth has done remarkably well, a plantation of seventy years' growth having yielded a profit of over £69 per acre.

The timber is light, clean, and easily worked,

and a comparison of home-grown wood of a tree that contained 90 feet with timber sent from abroad revealed but little difference. Under the name of White Pine, the timber is largely imported to this country and used for a variety of purposes in connection with building. In some of the woods at Woburn Abbey the Weymouth Pine reproduces its kind freely from seed, and advantage has been taken of this method of reproduction to stock open portions of the woodlands.

From a purely ornamental point of view the Weymouth Pine is a valuable tree—the light, almost silvery, appearance of the feathery foliage and ashen grey bark being particularly effective. The price of the timber is similar to that of Scotch Pine of equal size, at least, such was obtained for a large number of the trees during the past season on an estate in Kent. For Scotch and Weymouth, growing in the same plantation and of equal age, 10d. per foot was the price obtained.

The CORSICAN PINE (*Pinus Laricio*) is another conifer of great value for profitable planting in this country, and one that I feel certain will yet be largely used in the formation of coniferous plantations. It is of very rapid growth and well suited for planting even in the most exposed and wind-swept situations; a non-fastidious subject as to soil, and withal a most valuable timber-producer. Having as yet been tested to no great extent for timber-producing purposes, it may, perhaps, be premature to speak too loudly in support of its qualities in that respect; but as I have cut up and utilised in various ways some of the biggest logs that have been grown in this

country, I may be allowed to venture at least the remark that the timber is of excellent quality, and peculiarly well suited for constructive purposes. Speaking of trees of fully fifty years' growth, I have found the wood strong, tough, elastic, very resinous, and readily worked. I have experimentally used home-grown *Laricio* wood for many purposes, and always with very satisfactory results—some of the largest planks employed in this way being fully 27 inches wide and cut from trees that girthed 9 feet at a yard from the ground. Planks that were used for several purposes both in and out of doors have stood a test of fully twelve years, in such a manner as to give one the impression that few of our home-grown coniferous woods can surpass that of the pine in question. In summing up, it may be said that the Corsican Pine is perfectly hardy everywhere in these isles, a tree that will thrive well and produce large quantities of timber on poor gravelly soils, one that is readily and cheaply raised from seed—all qualities of the highest value, and such as are rarely so well concentrated in any other species. The rate of growth is rapid under favourable circumstances. After being planted for five years the average annual rate of growth for the next ten years is, in specimens I have measured, as much as 30 inches in height. Stem bulk is, likewise, well carried on with this increase in height, and quite recently I examined a plantation of thirty-two years' growth in which *Pinus Laricio* had attained to 65 feet in height, and with many of the stems girthing from 5 feet to fully 6 feet at a yard from the ground. Standing alongside

one of the largest trees, I counted around me no less than nine others whose average stem girth was 5 feet 4 inches and the height 65 feet.

Regarding the rate of growth and cubic contents of timber of the Corsican, Austrian, Weymouth and Scotch Pines, and the Larch, the following will be interesting.

Twenty-five years ago, at the instigation of the then Earl of Derby, the writer formed several plantations on the Holwood Estate in Kent. At the outset, it may be well to state that these plantations were not formed with the object of producing valuable timber, but rather for the purposes of ornamentation and privacy. The trees used were the Scotch, Corsican, Austrian, and Weymouth Pines, the Larch, and several species of hardwoods; and as all have succeeded well under exactly similar conditions, the following notes as to the rate of growth and production of timber, both of which are unusually great, during a period of twenty-five years may be instructive.

Previously to being planted, the land, which may best be described as a hungry loam on a gravelly subsoil and sheltered, was let out for rough grazing and the cultivation of strawberries and other fruit. The cost per acre of forming these plantations was :

Pitting, 2722 at 1s. per 100	.	.	£1	7	2
Planting	.	.	.	1	1
Trees, at 40s. per 1000	.	.	.	5	8
				<hr/>	
				£7	16
				<hr/>	

This price may appear both high and low,

but in connection with the former, it should be explained that the coniferous trees, when planted, were about 16 inches high, the others about 3 feet, all being placed 4 feet apart. Owing to the land having been recently cultivated, and to labour being at that time cheap in the district, the opening of pits was carried out by contract at quite a nominal rate, the size of each being 12 inches square and 9 inches deep. After being planted the trees required little attention for the first six years, at the end of which period they averaged 8 feet in height; and the shade occasioned by the branch-spread had killed out most of the grassy undergrowth.

As the plantations were primarily intended for ornament and shelter, the retention of the lower branches of the trees, at least along the margin, was imperative, and in order to ensure this, early thinning was carried out at regular intervals up to the present time, always bearing in mind to allow the boundary trees plenty of room for branch development, those inwards, in order to induce clean growth, being left much closer on the ground. Though in the latter case the quantity of timber produced is comparatively less than along the margins, yet it is of greater value owing to the trees being straight and clean-stemmed, the only exception being the Corsican Pine, which, even when isolated, has little inclination to form stout side branches.

The soil being light and resting on gravel was peculiarly suited for the growth of the pines, none of which suffered from disease or insect attack, though the Weymouth had occasional patches of the aphis by which it is usually attacked

in London. The Larch was practically free from canker.

During recent thinnings, a good opportunity was afforded of taking the actual measurements when felled of the various species of trees, these being as follows :

Austrian Pine, average height,	46 ft. ;	cubic contents	9 ft.
Corsican Pine	„ „ 51 ft. ;	„ „	11 ft.
Scotch Pine	„ „ 45 ft. ;	„ „	8 ft.
Weymouth Pine	„ „ 42 ft. ;	„ „	6 ft.
Larch	„ „ 47 ft. ;	„ „	8 ft.

It will thus be seen that the Corsican Pine has surpassed all the others, both in height and in the quantity of timber produced.

In viewing the plantations from a distance, the leaders of the Corsican Pines soar quite 6 feet above those of their neighbours. The Austrian comes next in the quantity of timber produced, but not in height ; and the Larch and Scotch are of about equal size, the Weymouth being equal to the latter in height but not in bulk of stem. But the Larch beats all in value of timber, for, while that of the various species of Pine was difficult to sell at a remunerative figure, the Larch-wood was readily 'disposed of at a fair valuation.

My experience is that previous to the war timber merchants fought shy of purchasing any of the Pine family excepting the Scotch. This may be owing to prejudice or want of knowledge as to the value of timber produced by the Corsican or Austrian ; but, whatever the cause may be, the fact remains that the timber of both these species

is difficult to dispose of at any but firewood rates. That of the Scotch, being better known, finds a ready market at about half the price of Larch, which latter, after all, is the most useful and profitable of any of the coniferous trees planted in this country, as the demand for this always exceeds the supply.

The DOUGLAS FIR (*Pseudotsuga Douglasii*) is in certain situations a valuable timber-producing tree; but to grow it to perfection good soil and sheltered valleys are quite a necessity. Had we the cañons and deep hilly gorges of some of the North American States, there can be little doubt that the Douglas Fir, from its suitability to our climate generally, would be one of the most valuable timber-producing trees that we could plant. In this country, under peculiarly favourable circumstances, I have known the Douglas Fir to produce 240 feet of timber in fifty years, or nearly 5 feet per year for half a century. In taking the average size of the trees in a plantation formed twenty-two years, the dimensions were as follows: height, 76 feet; girth of stem at 24 feet, 4 feet; cubic contents fully 50 feet; thus giving an annual increase in wood of $2\frac{1}{4}$ feet. The average cubic contents of each tree in another wood, mainly composed of the Douglas Fir, was nearly $2\frac{3}{4}$ feet per annum for thirty-five years. By way of experiment I had several large trees cut up, and utilised for estate purposes — fences, door-posts, boat masts, etc., and with fairly satisfactory results. I do not want to say one word against this my favourite fir, but the truth must be told, and my own experience, gained principally on a

low-lying, maritime estate, which favoured the growth of most trees, is, that the Douglas Fir must occupy a sheltered situation if either ornament or utility be considered as points of importance; indeed, a lengthened experience gained on an estate where it is, perhaps, grown in greater quantity than on any other, has now fully convinced me that the Douglas Fir, when planted in this country, is only to be recommended for sheltered valleys.

The SILVER FIR (*Abies pectinata*), which is a naturalised exotic tree, attains to an immense size in this country and produces large quantities of timber of second-rate quality. Sometimes it is difficult to dispose of the big, unwieldy trunks of Silver Fir, which in many instances when full grown will contain 200 cubic feet of timber. When thoroughly seasoned—and it should never be used in a green state—the wood is useful for temporary purposes such as fencing, shed-building, and in the making of boxes and packing-cases. The price is low, usually less than that of either Spruce or Scotch Pine, and we have sold large, clean trees at the round sum of 10s. or 20s. according to accessibility. The expense of removal is often considerable in the case of large logs of the Silver Fir, and this, as well as the second-rate quality of the timber, has lessened the value of the tree. The wood is light, with no great quantity of resin, and the tree when young is apt to be injured by frost in the spring. It is unsuited for high-lying, exposed situations, succeeding best in mixed hardwood plantations on low lands where the soil is rich, deep, and damp.

The COMMON OR NORWAY SPRUCE (*Picea excelsa*) has been extensively cultivated in this country for upwards of three hundred years. For shelter, game coverts, and for imparting a distinctly pleasing appearance when associated with hardwooded trees, the Spruce is of value; while the timber, which it produces quickly and in quantity, is valuable for many purposes—few, perhaps, of a permanent character.

Although, as a marketable commodity in many parts of the country, the timber does not attain a high place, yet when clean grown, it is well adapted for pit-props, fencing rails, soles for drain-pipes, and when of large size it is used in the construction of outside sheds, joists, and rough flooring. For packing-cases it is also in demand, and on the farm Spruce is useful on many occasions when the employment of timber is necessary. We have used Spruce timber thoroughly seasoned and of large size for indoor work, and after forty years it appears quite sound. In fencing, too, this timber will last quite as long as that of the Scotch Pine. In Ireland, the timber is largely used by farmers in fencing, for shed-cleaving, and, being lighter than Larch, in the making of ladders.

The usual price of Spruce is rather lower than that of Scotch Pine, though often, when lotted together, it is similar. It varies according to locality and local demand from 5d. to 9d. per cube foot. Since the war commenced, double the normal price has been obtained for Spruce timber; and in Buckinghamshire we saw splendid trees that had been purchased by one of our railway companies at the previously-unheard-of price

of 1s. 4d. per foot where felled. This timber was to be utilised for many purposes, amongst others for railway sleepers and fencing.

The date of introduction of the Spruce is not known, but it is mentioned by writers as early as the sixteenth century.

THE GIANT ARBORVITAE (*Thuja plicata*).—Whether for utility or ornament, we have in this species a valuable addition to our forest trees, and it is the opinion of those who are most competent to judge that it will be one of the trees of the future in this country. After a fair and impartial trial on my own part I have found it to be quite hardy, even at high altitudes, a fast grower and rapid timber-producer, a non-fastidious subject as regards the quality of soil in which it is planted, and one of the easiest managed and most accommodating of trees.

From my note-book I find that the average annual rate of growth of twenty-six specimens growing under dissimilar conditions is 22 inches. The timber of thirty years' growth that I had cut up and converted was of good quality, but much better results may be expected from more fully matured wood. As barely three-quarters of a century has elapsed since the introduction of the tree, we must be careful in sounding its praises; but so far our experiments with both the tree and its timber are highly encouraging. It may be well to mention that there are several forms of this tree, some quite valueless for economic planting.

Valuable for shelter and afforesting purposes generally.

The SITKA SPRUCE (*Picea sitchensis*), the timber of which is so valuable in the making of aeroplanes, has been found to be well suited for cultivation in this country, where several specimens are over 100 feet high. For general afforesting purposes it is to be recommended, and succeeds best in dampish loam.

NOOTKA CYPRESS (*Cupressus nootkatensis*) is likely to turn out a useful forest tree, it being very hardy, free of growth, and producing fine and clean-grained timber. The production of timber is somewhat slow even when the tree is growing on rich soil, while the appearance of the tree in our woodlands is anything but ornamental owing to the loss of the branches consequent on close planting. The stem is usually "carrot-shaped" or with a quick taper from the ground upwards.

LAWSON CYPRESS (*C. Lawsoniana*).—For forest planting this cypress might be included, its great hardihood, ease of culture, and quality of timber produced being special recommendations. Growing in soil of good quality, I have noted the upward rate of growth to be 43 feet in twenty-seven years, but this is rather unusual. Home-grown timber is clean, light, easily worked, and of a pleasing yellow colour. For indoor work it is well suited, and fencing posts made of the wood are lasting well.

REDWOOD (*Sequoia sempervirens*) is rarely recommended for profitable planting, but from experiments I have undertaken, and measurements made, it would seem to be a more valuable tree than is generally supposed. It must, however,

be grown in good, rich soil and where shelter is afforded, preferably, too, in maritime situations. The rate of growth under such conditions is rapid, and the timber of good quality. In one instance I have known the tree to reach a height of 84 feet in twenty-nine years.

MOUNT ATLAS OR AFRICAN CEDAR (*Cedrus atlantica*).—This tree has several good qualities for economic planting. It grows well on cold stiff soils, stands exposure in an almost remarkable manner, and produces valuable timber.

LARGE-FRUITED CYPRESS (*Cupressus macrocarpa*) is one of the most valuable species for planting in exposed maritime situations, and its value in economic planting lies in its affording a great amount of shelter, and growing where few other species could succeed. The timber I have cut up is of excellent quality.

TSUGA ALBERTIANA may yet turn out a valuable tree for afforesting purposes. It grows rapidly in this country, and produces a large amount of timber, which seems little inferior to, and not unlike that of, the Larch. It is fine-grained, works readily, and of a yellowish white colour.

LEBANON CEDAR (*Cedrus Libani*) has several good qualifications to rank as a forest tree. It grows rapidly, stands exposure well, and produces a large quantity of fairly valuable timber. The lasting properties of the timber are dwelt upon in the following chapter.

CHAPTER VII

QUALITY OF BRITISH-GROWN CONIFEROUS TIMBERS

WITH the object of testing the quality of the timber of the various species of coniferous trees cultivated in this country, I have lost no opportunity for many years either of collecting specimens or conducting experiments. This, I need hardly add, has been attended with considerable difficulties, and it has not been easy to procure home-grown specimens of a suitable age and size to render the experiments thoroughly trustworthy. Fortunately for the carrying out of such experiments, I have had the management of parks and woodlands where numbers of the rarer conifers had to be removed in the ordinary course of thinning, while the wind has, on not a few occasions, acted as a kind friend in procuring specimens that would not otherwise have been obtainable.

As will be seen from the measurements given throughout the following notes, probably the largest and oldest specimens in this country of *Pinus Laricio*, *P. Laricio nigricans*, *P. ponderosa*, *P. Pinaster*, *P. Strobilus*, *Cedrus Libani*, *Cupressus macrocarpa*, *C. Lawsoniana*, *Cunninghamia sinensis*,

Araucaria imbricata, *Abies grandis*, *A. nordmanniana*, *Picea Morinda*, *P. sitchensis*, *Sequoia gigantea*, *Cryptomeria japonica*, *Thuja plicata*, and *Juniperus virginiana* have been cut down, and portions of the converted wood used in various ways by way of experiment in testing their quality.

Whilst carrying out these experiments, few things have surprised me more than the way in which the timber of certain species of coniferous trees is affected by the particular quality of soil on which it is produced; indeed, the difference between immature and nearly fully matured timber is trifling when compared with the quality as affected by soil. One or two instances may be cited as examples: In thinning a plantation composed of *Pseudotsuga Douglasii*, *Pinus Strobus*, and *Picea Morinda*, fifty-three out of seventy-one specimens of *P. Strobus* were pumped or rotten at the core, and utterly unfitted for use in any way. The trees were growing on sandy loam, had been planted twenty-six years, and contained, on an average, 25 feet of wood each. Now, having felled trees of the same kind on various other qualities of soil, and found the timber perfectly sound, deductions will not be difficult to make. A still more curious example of how coniferous timber is affected by the soil on which it was grown was illustrated a few years ago on an estate in Ireland. A large number of fencing poles, Larch and Scotch Pine, were being cut from two neighbouring plantations of the same age and size, but growing on widely different soils—peaty and gravelly. The Scotch Pine timber from the peaty soil was soft, spongy, and nearly white in colour,

while that from the gravel was hard, firm, and of a bright yellow colour. So pronounced was the difference in the quality of the two timbers that the woodmen, in carrying the poles to the hard road adjoining the plantation, had not the slightest difficulty in stating from which wood the particular poles had been brought, that from the gravelly soil having a sharp ring like metal when thrown from the shoulder, whilst that grown on peat had a soft, dull thud. Larch timber grown on gravelly soil is usually pumped or rotten at the heart, and in a remarkable instance with which I had to deal, every Larch had to be removed from a large mixed plantation of twenty-six years' growth, growing on soil of this description. Such facts as these are very significant, and show how careful we must be in condemning any coniferous tree when judged from the quality of the wood as produced on any particular class of soil, and that, with certain species at least, the observations must be extended over a fairly wide field of investigation. In the following notes I have been careful not only to give the age of the tree from which the timber has been cut, but also the nature of soil on which it was grown; and it may be well to add that in the case of experiments, none of less than seven years' standing have been recorded. Greater attention, too, has been bestowed on such species as produce timber of sufficient size and of the best quality for economic purposes. The arrangement is alphabetical:

ABIES CEPHALONICA.—Age, 33 years; cubic contents, 27 feet; soil, gravelly loam. Timber of good quality, and where it has been used in out-

door work for eleven years seems at present in an equally good state with Scotch Pine of the same age. The wood is yellowish white, firm, medium in weight, and, owing to the quantity of resin it contains, works smoothly, and takes a good polish. Used for forming sides of temporary shed.

A. GRANDIS.—Age, 49 years; cubic contents, 73 feet; soil, gravelly loam, with a foot-thick coating of decayed vegetable matter. Timber of excellent quality, very weighty, resinous, and the concentric rings closely packed. Used as boarding both in and out of doors for many years, and given general satisfaction. The balsamic fragrance from the beautiful yellowish white wood was, at the time of felling, distinctly perceptible for many yards away, and was commented upon by the woodmen engaged in felling and removing the specimen. I think the timber is quite equal to that of the Silver Fir of similar age, but more resinous, and weightier.

A. NOBILIS.—Age, 42 years; cubic contents, 47 feet; soil, rich alluvial deposit. Timber of fair quality, and for indoor work, at least, is to be recommended. It is light, but hard and compact, and of a creamy brown colour, though the latter varies greatly according to soil, that produced on gravel at higher altitudes being reddish yellow, and much harder, though equally light in proportion to the bulk. I am pleased with the quality of the timber of this tree, and consider that it is quite equal to that of the Silver Fir, but the quality and colouring are evidently greatly affected by soil and site.

A. NORDMANNIANA.—Oldest tree 53 years, but

others of 23 years and 18 years have been tested ; soil in first instance clayey loam, in second peaty ; cubic contents, 47 feet and 22 feet respectively. Timber, reddish yellow, fine and close-grained, and of excellent quality. Used for many purposes both in and out of doors, where it has been proved superior to that of the Silver Fir of even age. Specimens of the timber from boggy land in Ireland are remarkably hard and fine-grained, clearly proving that the tree is of great merit for afforesting peat bogs. From the experiments of many years' standing, I am confidently expecting that the Nordmann Fir will prove a valuable timber-producing tree in this country.

A. PINSAPO.—Age, 53 years ; cubic contents, 47 feet ; soil, sandy loam resting on gravel. Timber of no great value, being brittle, and soon apt to decay, and hard to convert on account of the usually knotty stem. It resembles that of the Silver Fir in appearance.

ARAUCARIA IMBRICATA.—Age, 47 years and 52 years ; cubic contents, 38 feet and 51 feet ; soil in both instances loam or gravel. The timber of these trees was of a beautiful yellow colour, closely grained, firm, and worked and polished readily. My experiments prove that the timber is not well suited for outdoor work, but when manufactured into household furniture it lasts well, ten years not seeming to have changed the wood in the least. The timber of young trees is notorious for its speedy decay.

CEDRUS LIBANI.—Age of trees 99 years and 130 years ; soil in both cases inclined to be gravelly ; cubic contents, 153 feet and 231 feet

respectively. Timber, reddish white, brittle, though long-grained, light, easily worked, and susceptible of a good polish. I cannot agree with those who state that the timber is by no means durable, for my own experiments demonstrate that it is in this respect of considerable value. It is certainly apt to snap short, and is extremely brittle, but for all that it is of good lasting quality, as shown by the following: A trough for washing sheep was formed of this wood, and after being subjected to drought and damp alternately for eighteen years, for it was sunk in the soil, the boarding when removed was perfectly sound, though dark in appearance. The tree from which the boards were cut was close upon a hundred years old, having been planted by the great statesman, William Pitt, when he owned the Holwood property, in Kent. The boards were fully 2 inches thick, and of various widths up to 2 feet, and the trough 12 feet long by 4 feet wide. The position in which the timber was placed was one of the most trying, for, being sunk in the soil, and only filled with water during the sheep-shearing season, the vicissitudes of drought and damp were very considerable, and well fitted to test the quality of wood. The timber lasts well when converted into furniture. In some of the unusually large specimens which have been converted at Woburn Abbey, I consider the timber very near to that of the Larch, both in appearance and quality, but it is not so elastic.

CRYPTOMERIA JAPONICA.—Age, 43 years; cubic contents, 47 feet; soil, black, dampish loam, in a low-lying and well-sheltered situation. Timber,

remarkably light, nearly white, soft, and easily worked. When kept dry it has remained sound for thirty years. Compared with foreign planks, those produced in this country differ but little.

CUNNINGHAMIA SINENSIS.—Age, uncertain, probably 34 years; cubic contents, 27 feet; soil, rich black loam. Timber of a beautiful light mahogany colour, firm, clean-grained, and taking a good polish. That of a specimen cut at Esher Place, Surrey, planted fully thirty years, and 37 feet high, was of good quality, and the colouring rich, though not equal to that of the first-mentioned tree. It was growing on deep sandy soil, but was shabby of appearance, and this was the reason for its removal. A portion of the trunk which I sent to the Surveyors' Institution, London, shows well the beautiful colour and graining of the timber.

CUPRESSUS LAWSONIANA.—Age, 27 years; cubic contents, 19 feet; soil, gravelly loam. Timber of a pleasing yellow colour, very close-grained and hard, and works well under the tools of the carpenter. Fencing posts made from the wood have stood a seven years' test satisfactorily; but for household carpentry the wood is evidently best suited. It is sweetly scented and very elastic.

C. MACROCARPA.—Age, 38 years; cubic contents, 43 feet; soil, good yellow loam. Timber of first-rate quality, being remarkably hard and very close-grained. It is barberry yellow in colour, but towards the centre reddish yellow, very compact and close-grained, and it works smoothly under the tools of the carpenter. The lasting qualities, both in and out of doors, are quite satisfactory.

I consider the timber of this cypress superior to that of most of our home-grown woods.

C. *NOOTKATENSIS*.—Age, 43 years; cubic contents, 29 feet; soil, gravelly loam. Timber excellent, even in the immature specimen to which I refer, of a pleasant light yellow colour, and agreeably scented. It is light, close-grained, and, being clean, works and polishes smoothly, but is rather brittle. When tested out of doors, the results were favourable, more so than was expected from the immature specimens at my disposal.

JUNIPERUS *COMMUNIS*.—Wood of a beautiful yellowish brown colour, hard, but readily cut, and very aromatic. Made into ornaments, it seems to stand well, there being no perceptible difference in thirty-eight years. From a tree 25 feet high.

J. *VIRGINIANA*.—Probably the largest and finest specimen of this somewhat rare tree that has ever been felled in Britain was cut down to make room for building operations in the pretty village of Esher, in Surrey. The tree was of unusual proportions, with a beautifully clean and well-rounded stem, which was destitute of branches for 33 feet in length, and contained fully 51 feet of timber. This is the wood used so largely in England in the manufacture of “cedar pencils,” and that of the tree in question is of excellent quality and beautifully grained, the heartwood being of a fine red colour with a band of deep yellow around the margin. The fragrance of the wood is remarkable, and in the case of the Esher specimen could be distinctly detected at a distance of about 20 yards. The soil which produced

this perhaps unique tree is deep sandy loam, and the position might be said to be partially sheltered at least.

LARIX EUROPEÆ PENDULA.—Age, about 32 years; cubic contents, 18 feet; soil, light, deep loam. Timber dark brown towards the centre, lighter, almost white, outside; heavy, hard, strong, not so fine in the grain as the common Larch. Have only cut up the wood, but not used it in any experimental way.

PINUS EXCELSA.—Various ages, from 30 years to 60 years; cubic contents of largest, 42 feet; soil, good rich yellow loam. Timber highly fragrant and resinous, compact, but easily indented, and nearly white in colour. Out of doors it soon decays, but when kept as a plank sample the period of fifteen years since it was cut does not seem to have affected it to any appreciable extent. For purely economic planting I do not consider that the tree will ever be valuable in this country.

P. LARICIO.—Nearly all ages up to 85 years; cubic contents of largest, 77 feet; soil, gravelly. Timber of excellent quality, and well suited either for out- or indoor work. It is yellowish white in colour, very resinous, tough and elastic, easy to work, and planes smoothly.

Some years ago I instituted a number of experiments with the wood of the tree cut from a specimen, 18 feet of the butt of which contained 30 feet of timber, some of the planks being 27 inches wide. For fencing-posts, rails, shed-cleaving, and such like, the timber was used, and with very promising results. In 1910 I examined the timber, and was surprised to find it so sound and

well preserved, and in the case of that used indoors it has certainly hardened with age. Unlike the wood of several other species of pine, which get hollowed between the annual growths, owing to the loss of resin and shrinkage, that of the Corsican Pine remains perfectly smooth, the beautiful longitudinal dark yellow resin-containing portions being quite intact after eleven years' wear. The timber does not splinter readily, but wears uniformly and well when subjected to the almost constant bumping and rough usage consequent on railway travelling, as a large box which has been through many parts of England and Scotland since the Edinburgh Forestry Exhibition bears ample testimony. I consider the timber next to that of the Larch for lasting qualities, at least amongst such conifers as have been found of sufficiently rapid growth to warrant their recommendation for forest planting in this country.

P. LARICIO NIGRICANS.—Ages ranging from 40 years to 63 years; cubic contents of largest, 61 feet; soil, gravelly. Timber very resinous, rough, owing to the branching stem, remarkably strong and tough, and coarse of grain. Fully ten years have now elapsed since the timber was cut up and used for fencing, for supporting the bank of a rapid-flowing river, and for indoor carpentry. In every case the results have been satisfactory, and prove that when compared with the Spruce and Scotch Pine the wood is equal in lasting properties. The timber becomes lighter with age, but owing to its generally rough, knotty nature, will never rank very high for constructive work.

P. PINASTER.—Age of several trees cut up,

130 years; cubic contents, 110 feet; soil, gravelly, with a little loam. A goodly specimen that was straight as an arrow, and contained 99 feet of wood, was partly uprooted during a storm three years ago, and advantage was taken of the opportunity to have the timber converted in various ways, so that its value for estate purposes generally could be determined. Owing to the great quantity of resin present in the timber, the tree was weightier for its bulk than any other species that had come under my notice, with the exception, perhaps, of *Abies grandis*. A great part of it was sawn into boards of 2 inches in thickness, and as many of these boards were fully 3 feet wide, their value for constructive purposes, had the timber been of good value and worthy of conversion, would have been great. The wood works beautifully and clean, taking a smooth glossy surface under the tools of the carpenter, and several of these 3-foot wide boards were cut into 6-foot lengths, and planed smoothly for preserving as samples of the wood. The remaining boards were applied to various uses, but one instance of their lasting quality will be sufficient. Fully thirty were placed as boarding for the floor of a dry-faggot shed or barn—a well-built structure, though not thoroughly ventilated. On examining these boards a few weeks back, it was found that they were one and all perfectly rotten and falling to pieces, after they had been in position not more than about eighteen months. Every board had to be removed, having become permeated with dry-rot to such an extent that when dropped on the ground it fell to pieces. This was all the more strange as the boards had

been partially seasoned. They were not nailed down or carefully placed side by side, but simply laid down with the double object of seasoning and to form a temporary wooden floor beneath the dry faggots. When we take into consideration the size and age of the tree from which the planks were cut, as well as the great quantity of resin present, and which rendered the log so weighty in transit, the case seems all the more remarkable. But it has long been known that the timber of this pine is of no great value, and even for firewood purposes it comes in about third-rate.

P. PONDEROSA.—Age, 74 years; cubic contents, 84 feet; soil, good loam. Timber heavy and saturated with resin, of a reddish colour, but not particularly durable. The strong resinous smell of the wood is remarkable, and the veining is much admired.

P. STROBUS.—Age unknown; cubic contents, 93 feet; soil, vegetable mould, or shaly rock. Timber of good quality, clean, and easily worked, but much affected both by soil and site. British-grown timber revealed but small difference when compared with that sent to the late Colonial and Indian Exhibition, where excellent opportunities were afforded me by Professor Macoun, of Ottawa, Canada, for comparing many specimens of our home-grown coniferous woods with those sent to the Exhibition. I consider this a valuable forest tree for parts of these Isles that are not too exposed; but it does not succeed well on too light or poor soils, though on the Surrey heath it has done well.

PSEUDOTSUGA DOUGLASII.—Age from 55 to 85 years ; cubic contents of latter, 107 feet ; soil, gravelly. Timber, when young, soft, and liable to insect attacks and sudden decay ; when older, of a desirable yellow colour, hard and firm, and susceptible of a high polish. It gets darker with age, hard, brittle, and difficult to work. For fencing-posts, boarding, and boat-masts outdoors, and in temporary work where not exposed to the weather I have used the timber extensively, and in every case the result has been quite satisfactory. I do not, however, consider the timber equal in lasting properties to that of three other Conifers, whose merits, as regards quantity of timber produced and fitness for culture in this country, place them higher in the rank of such as are suited for economic planting. The production of timber by the Douglas Fir is ahead of that of any other coniferous tree in this country of which I have kept a record, viz. 240 feet in fifty years, or nearly 5 feet per year for half a century.

SEQUOIA GIGANTEA.—Age, 53 years ; cubic contents, 93 feet ; soil, loam or gravel, sheltered. Timber very beautiful, the groundwork being yellow, marked with deep red bands longitudinally. It is light in proportion to the bulk, compact, and works readily. I had the butt of the above specimen cut into 2-inch thick boarding, for the purpose of hut-making for charcoal burners, and was, with every one else who saw it, astonished at the deep, rich colouring and shading of the wood. The lasting qualities are not very remarkable, although the timber darkens with age, and the outdoor experiments were not very encourag-

ing. For indoor work of various descriptions the wood is well adapted.

S. SEMPERVIRENS.—Age unknown ; cubic contents, 92 feet ; soil, alluvial deposit ; sheltered valley. Timber of excellent quality, of a pleasing brick-red colour, very finely and closely grained, and susceptible of a high polish. It cleaves into long lengths, and is unusually free from knots and general timber defects. Not used to any extent out of doors.

CHAPTER VIII

ENEMIES OF CONIFEROUS TREES

THESE are many and include the attacks of animals and birds as well as of insects and fungi.

INSECTS

Pine Beetle (*Hylesinus* (*Hylurgus*) *piniperda*) is a dread enemy to not a few species of *Pinus*, but particularly to *P. sylvestris*, *P. Laricio*, *P. L. nigricans*, and *P. Strobus*. The injury done by this beetle consists in its destruction of the leading shoots of the tree it attacks. It enters by boring a hole into the side of the shoot until it reaches the pith, after which the course is directed upwards, and an exit made at the terminal bud. This tunnelling of the shoot so weakens it that frequently during stormy weather it is broken across at the point where the beetle entered. Not only are unhealthy trees attacked by the Pine Beetle, but young and robust-growing specimens frequently fall a prey to its insidious depredations. June, July, and August are the months when it is most commonly found. The only remedy is collecting and burning the affected shoots—work that requires to be done with the utmost care to

prevent the escape of the wary insect. Burning all brushwood in plantations is a great preventive.

Wherever Scotch Pines are grown the beetle is usually abundant, and at Bostal Wood, in the Metropolitan area, its attacks on these trees have been persistent and severe for many years.

On the Woburn estate, the writer had to cut down about seventy acres of a Scotch Pine plantation in order to assist in getting rid of this troublesome beetle.

Pine Weevil (*Hylobius abietis*) is another destructive insect, and differs from the former in waging its attacks against the buds of the leaders and branches, as also eating patches of the bark here and there on the stems and branches. The various species of *Abies* suffer most, but the pines occasionally are attacked as well. It is always most destructive in young plantations growing on the margins of old woods, and equally bad amongst trees that have been planted on the site of a former pine plantation. The beetle is about half an inch long, and nearly black. One remedy, probably the best, is to place fresh pieces of pine bark on the ground, beneath the infested trees, and, by shaking the trees and examining the traps the following morning, many may be destroyed.

Bostrichus typographus is another pest of our woodlands, and may frequently be seen, like fine white wool, spreading over the stems and branches of the silver and other firs. It spreads with terrible rapidity, first appearing in small patches here and there on the bole, and particularly on the under sides of the branches. The infested tree soon

becomes unhealthy, and frequently dies off prematurely. Trees growing in low-lying, heavy ground would seem to fall a ready prey to this insect. *Bostrichus laricis* is nearly allied to the former, but its devastations, which are, however, not very deadly, are principally confined to the Larch. It is usually known as the "larch blight." Spraying with Bordeaux mixture has been successful.

Pine Shoot Moths (*Retinia buoliana* and *R. turionella*) would seem to be more plentiful in this country than is generally supposed. Quite lately we visited a large plantation of young Scotch Pine, the terminal buds of which were greatly injured by the caterpillars of these elaborately coloured moths. The moth lays its eggs at the base of the buds, and into these the caterpillars enter by hollowing out the centre, thus destroying the vitality and causing them to take on a withered appearance, and to feel soft and empty to the touch. Trees infested by this insect resemble greatly, in their stunted shoots and exudations of resin, such as have become a prey of the Pine Beetle; only in the latter case it is the fresh young shoot and not the bud that is attacked. The *Retinia* would seem, from notes and observations, to be most abundant in what might be termed neglected pine plantations, that is, where the trees have suffered from overcrowding, and if growing under unfavourable conditions as to soil, etc., and particularly when the wood is composed entirely of one species. There is no method of dealing with large infested areas, for the attacked trees have repeatedly been cut over and removed

without any seeming diminution in the numbers of the insect. One experiment with a small infested area has been rewarded with good results by lighting a fire to windward, and causing the smoke of coal-tar to pass amongst the trees. This might be worth trying in the case of fruit-trees infested by particular insects.

Pine Sawfly (*Lophyrus pini*).—Fortunately, this insect is not abundant in the British Isles, though on the Continent the damage it does in the pine forests is by no means inconsiderable. The insect may readily be recognised by its wide, flattish body, and usually dark appearance. Having attained to full size in the trees, they form cocoons among the foliage or on the stems, and remain in this condition until the following spring, when, in April or May, the perfect insects make their appearance. The male is considerably smaller than the female, while the full-grown caterpillar, which is of a greenish yellow colour with a row of black spots on either side, is about 1 inch long. The remedial measures are not at all easy, especially when a large number of trees are attacked; but single specimens may be entirely cleared by shaking the caterpillars into a sheet placed beneath the tree.

Wireworms.—These occasionally do a great amount of damage in beds of seedling trees, particularly conifers, and in some instances they attack and destroy the seeds before germination. In the case of young conifers they are gnawed completely through just above or at the ground level, the beds in many instances being strewn with the débris. Seedlings of *Abies nobilis* and

A. nordmanniana suffer to a great extent, and in the case of a newly formed nursery or freshly made-up seed-beds the attacks of the wireworms are always most pronounced. In the case of fresh nursery ground, paring off and burning a couple of inches of the top soil in the autumn has been attended with excellent results, as has also dressing the ground with gas-lime. When seedlings are attacked, trapping with sliced carrots, mangold, or potatoes, varied with pieces of oil-cake as a bait, is to be recommended.

Cockchafer (*Melolontha vulgaris*) is usually pretty abundant, and does most damage by eating the leaves of the sycamore, beech, oak, cherry, and many other trees. It will also eat the roots of most young trees, but those of pines in particular. The insect is about 1 inch long, and of a chestnut brown colour on the upper part of the body, while the head and sides are of a bronzy green, and thickly covered with yellowish white hairs.

In April and May the eggs are laid in a hole in the ground about 5 inches deep, and the grubs are hatched in July. They are of a dirty white colour and much wrinkled. In this state they, however, do but little harm; but, after having changed their skins and remained in a torpid state during winter, come to the surface in spring and eat the roots of almost any plant that comes in their way. They burrow deeper at the approach of winter, coming to the surface again in spring, and, when full-grown, are about $1\frac{1}{2}$ inch long, and almost three-eighths inch in diameter. The perfect insects do not live more than about

twelve days, and are easily known by their heavy, awkward flight towards the evening.

Larch Miner (*Tinea (Coleophora) laricella*).— Few, other than those specially interested in tree diseases, have the remotest idea that the yellow, withered appearance of many English larch plantations is due to the larvæ of the above tiny moth. It usually attacks young trees, say, from five to twenty years old, and although it may not kill them outright, yet the repeated onslaughts year after year tend to keep the trees in an unhealthy condition, and so render them liable to other and more deadly diseases.

Unfortunately, the attacks of the Larch Miner are by no means confined, as is usually supposed, to trees growing under unfavourable conditions, for we have during the past season noticed, in an unusually healthy, fast-growing plantation in Sussex, that almost every tree was more or less affected. Certainly in another large extent of larch in Gloucestershire which was examined a short time ago, and where nine-tenths of the trees were being ruined by *Dasyscypha calycina*, also known as *Peziza*, the Larch Miner was very abundant; but it is probable that young trees, whatever be the state of health, suffer alike, although, where hard-wooded species form a portion of the crop, the larch certainly suffers less than when grown in pure woods. The moth lays its eggs at the end of June on the needles of the larch; the caterpillar, mining into and feeding upon the interior of the needle, causes it to turn faded and yellow. It lives in the tube thus formed during the winter, changing to a pupa, and ulti-

mately to a moth. It is a most difficult matter with this insect—as, indeed, with all others that are fairly abundant—to suggest a remedy, and we have looked over and examined larch plantations that are differently situated in many respects to find out under what conditions the attacks are most persistent, but with little or no success—healthy and unhealthy, native or Tyrolese, suffering alike when grown as a pure crop.

Where the larches are intermixed with hardwooded trees—sycamore, oak, and beech—the attacks are certainly less frequent, and this we have now noticed in a number of cases. Trees growing at high altitudes do not seem to suffer less than those at only a few feet above sea-level, and to this point particular attention has been paid. Whether the wounds caused by this insect will serve as a nidus for the spores of *Peziza Willkommii* has yet to be determined, but special importance should be attached to all larch-feeding insects, and their depredations minimised to as great an extent as possible.

Pine-tree coccus.—The Weymouth pine (*Pinus Strobus*) suffers severely from a species of coccus which of late years has spread with terrible rapidity in almost every part of the country. In certain instances the trees have been so badly infested that whole woods have been cut down and burnt.

Spraying with a fairly strong solution of soft soap and paraffin at intervals during the winter and spring months has been attended with good results, but such treatment can hardly be extended to a whole plantation of the tree. The attacks are worst where the pine is growing in

close woodland, and admitting plenty of light and air to the tree is attended with beneficial results. Other species of *Pinus* suffer greatly from attacks of the coccus.

When growing on light gravelly soil, the stem of this pine is apt to become "pumped" or rotten at the core, for which disease only a change to suitable soil can be recommended.

Larch Sawfly (*Nematus Erichsonii*).—Of late years, in northern England especially, larch plantations have suffered considerably from the ravages of this insect. The larvæ, which are about three-quarters of an inch long, with twenty feet, resemble those of the Pine Sawfly, and Gooseberry and Currant Sawfly, and feed on the leaves of the larch. An attacked tree can readily be detected by its partially leafless condition. It would be well, so as to keep this recent importation in check, that a sharp outlook should be kept on young larch plantations during July and August.

Larch Shoot Moth (*Argyresthia atmoriella*).—Judging from the specimens that have been forwarded for identification, the Larch Shoot Moth would appear to be widely distributed over England and southern Scotland. It is, however, only of late years that the insect has appeared in quantity, or that its depredations have caused serious loss in larch plantations. Fortunately, where the larch trees are in a healthy condition attacks are perceptibly restricted, whereas on low-lying ground and on gravelly soils the appearance and rapid spread of the insect are confirmed. The attacks are, however, curiously erratic, the trees in one portion of a plantation suffering

severely, whereas in an adjoining section, and apparently under similar conditions, not a vestige of the pest can be detected.

It is a small dark grey moth, less than a quarter of an inch long; while the caterpillar is about the same length, of a dirty yellow colour, the head being black. The larva burrows beneath the bark of the younger shoots, and finally works its way to the centre of the stem, causing the death of the affected part. Several preventive remedies have been tried in the case of single trees, such as spraying in early May, at which time the eggs are deposited on the young shoots, with petroleum emulsion. Smoke from burning branches has been successful in restricting the attacks of the insect, but in the case of a whole plantation such remedies are out of the question. In thinning a plantation, removal of as many injured trees as possible is recommended, and in the nursery pruning off affected shoots has had good results.

Tree Wasp or Giant Sirex (*Sirex gigas*) is one of the most persistent and injurious of boring insects, attacking the Scotch Pine and sometimes the Larch. It is a beautiful insect, 1 inch long, of a black colour relieved by golden bands. Generally, felled trees, or such as are somewhat sickly, are chosen by the female in which to lay her eggs. These are deposited beneath the bark by means of the powerful ovipositor, and in course of time the whitish cylindrical maggots make their appearance. The maggots feed in the solid wood, making holes that are about a quarter of an inch in diameter by means

of their powerful jaws. We have known not only the Scotch Pine and Spruce to be attacked by this formidable insect, but quite a number of larch planks were forwarded to us from northern England that were rendered worthless as timber owing to the attacks of the Giant Sirex. Prevention is better than cure in dealing with this insect, and fallen and felled trees should be removed from the woodlands as quickly as possible. Weakly or damaged trees and old stumps should also be dealt with. The Tree Wasp is common on the outskirts of London, and its boring may be seen on some of the old and diseased Scotch Pines on Hampstead Heath. Owing to the borings or holes being perfectly circular in section and the edges sharply defined, they are readily distinguished from those of any other timber-destroying insect.

Wood Wasps are by no means uncommon in the British Isles, and have been found on the Larch, Spruce, Silver Fir, and Cedars. They are formidable and splendid insects—*S. gigas* being black and yellow, like the common wasp, while *S. juvencus* is of a shining steel-blue, with reddish markings on the male. The larvæ are stout white grubs, which bore obliquely towards the heart of the tree, and often the galleries are in such numbers that the tree is killed thereby, and the timber rendered useless in consequence. I have found *S. juvencus* very plentiful on the Scotch and Cluster Pine, in Kent. Where Wood Wasps abound, dead and dying trees should be removed before the imagos appear in summer.

Spruce-gall Aphis (*Chermes abietis*).—The

attacks are confined principally to the Common Spruce (*Picea excelsa*), but I have also known *P. orientalis*, *P. sitchensis*, and *P. nigra* to be severely damaged by the same insect. The attacked trees are rendered very unsightly by reason of the cone-like excrescences that are formed by the insect on the shoots. It is brought about by the female aphid piercing with her beak or sucker one of the buds, and drawing off the sap, the consequence being an unnatural growth at that part. The only known remedy is to collect the cone-like excrescences and have them destroyed.

Pissodes notata attacks young trees of several species of *Pinus*, but principally such as are growing under unfavourable conditions. The eggs are laid on pine trunks, and the larvæ feed under the bark.

Abies nobilis, *A. amabilis*, and *A. lasiocarpa*, particularly *A. amabilis*, are subject to the attacks of an insect nearly allied to that which causes the American blight on apple trees. The attacked portions, generally the buds or base of the leaves, present gouty, usually cup-shaped swellings, and which, with the growth of the shoots, increase proportionally in size. When cut into, the swollen portions are of a spongy appearance, and these unsightly deformities not only tell badly on the health of the trees affected, but render them utterly valueless from either an ornamental or commercial standpoint. An application of fir-tree oil has been found useful at the initial stage of the disease.

FUNGI

Red-rot Fungus (*Fomes annosus* or *Trametes radiciperda*) attacks the roots of several species of pine, particularly the Scotch, Corsican, and Weymouth, as also the Spruce and Silver Fir. It is probably the most destructive of the family, attacking living roots and spreading rapidly from tree to tree. The trees, when affected, quickly turn sickly and die, the wood becoming spongy and of a brownish colour, with distinct black spots. The only remedy is to take out affected trees, and burn them root and branch, replanting the ground with beech or elm. Though one of the most destructive fungi in coniferous woodlands, yet its attacks are by no means confined to such; it is also found on the roots of several hard-wooded species, such as the filbert, hazel, birch, and beech. Quite recently a nut plantation in Kent suffered severely from the attacks of this fungus, whole lines of trees being killed out before the cause was detected. It spreads quickly underground from tree to tree, and unless eradicated, which is easily done by uprooting affected trees and carefully destroying the mycelium, much damage may be the result.

Larch Canker or Blister Fungus (*Dasyscypha calycina* or *Peziza Willkommii*) has proved by far the most destructive of any in our woodlands; in fact, the amount of damage done by this wound parasite may be considered as little short of a national calamity. Whole plantations in every part of the country, Ireland now included, have suffered severely from its attacks, and in many

instances the trees have been cut down and others planted in their stead.

Usually the attacks take place in young plantations, say, between the age of ten and fifteen years; but it must be remembered that at no period of its existence is the larch immune, though in old trees the difficulty of the disease spreading, probably owing to harder bark and wood, has caused less dread of infection. Soil would not appear to count, for trees growing on chalk, gravel, deep loam, and vegetable mould have all become a prey to this fell disease. Low-lying, badly-drained land is certainly the home of the disease, and especially where mists and frosts prevail; but the moist climate of Britain generally favours the spread of the fungus. At one time, some dozen years ago, it was thought that larch growing on the Irish peat-bogs were exempt from the disease, but unfortunately this is not the case.

The first indication of the larch disease is a gouty swelling on the stem or branch, which quickly splits open and causes the resin to flow copiously, giving a dark, glistening appearance to the affected parts. Gradually the wound becomes larger, pieces of dry, hardened bark peel off, and the whole has a dark, scurfy appearance. The fungus in itself is small and cup-shaped, in colour bright yellow, with a greyish margin, and is widely propagated by means of the abundantly produced spores.

Though we have known instances in which cankerous trees have partially recovered, yet it is generally accepted that, once a tree has fallen a prey to this insidious disease, it rarely attains its

wanted vigour, and in any case the timber is almost valueless in a commercial sense. Remedies are almost out of the question in the case of a plantation of larch becoming affected, but isolated specimens may be successfully treated by carefully cutting out the diseased portions of wood and bark and painting with tar. In order partially to avoid the disease, plantations of pure larch should not be established, mixing with hard-wooded species such as the beech and sycamore being recommended. Cleanliness of a plantation goes far in warding off the Larch Canker, and for this reason all dead and diseased trunks and branches should be removed or burnt, and the trees individually given a fair amount of room, crowded plantations in low-lying, close situations being first attacked.

Tree Root Rot (*Armillaria mellea* or *Agaricus melleus*).—This is one of the commonest fungi on old stumps, and is popularly known as the Tree Root Rot. It has no particular host, being found alike on coniferous and hard-wooded trees, and on both root and stem. Known as the honey fungus and edible, this toadstool is about 3 inches in diameter, and of a yellowish brown or rusty colour, with greyish scales near the top. It spreads with great rapidity both in the soil and between the bark and wood of the affected tree. The only remedy is digging out and destroying the fungus, and, in the case of healthy young trees, collecting and burning the mycelium.

Dry Rot (*Merulius lacrymans*).—This is caused by attacks of a too common fungus, usually known by the name of the "dry-rot fungus." It is

abundant everywhere, both in living and dead wood, the latter principally. The use of immature timber in buildings, aided by imperfect ventilation, is the main cause of attack. Carbolic acid applied to the attacked timber is to be recommended, and painting with carbolineum produces excellent results.

Fungi do not, as a rule, thrive on dusty, dry wood, but the present species is an exception, as, when once established, it produces, by respiration, water in sufficient quantity to render the infected timber either moist or sodden. The decay in mining timber, especially in coal-pits, is due in a great measure to dry rot, and in Westminster Hall the oak beams were found to be in many instances attacked by this fungus in conjunction with one of the boring beetles. In the Yorkshire and Midland coal-pits, treating the timber with creosote, carbolineum, or other antiseptics is regularly resorted to.

Peziza resinaria.—The Spruce in southern England is occasionally infested with this fungus, the attacks being nearly similar to those of the Larch Canker. It is a wound parasite, and mainly induced by frost cracks, excessive or bad pruning, or by leaving injured branches or snags on trees.

Leaf-shedding Fungus or Pine Leaf Cast (*Lophodermium pinastri*) is a well-known and widely distributed species, and is usually found on the Scotch and Austrian pines. The leaves, when attacked, wither suddenly and fall off, the fungus being most prevalent after unusually dry weather, or in early spring after a frosty winter. It occurs both as a saprophyte on dead pine leaves and as

a parasite on the living foliage. We have been most successful in combating the attacks and preventing the spread of the pest by spraying the affected parts with "Bordeaux mixture." Young trees under ten years of age are most commonly attacked, and when this occurs in the nursery borders, the plants should be rooted out and burned. On several Scottish and English estates thousands of Scotch Pines have been killed by the attacks of the leaf-shedding fungus.

Pine Cluster-cups (*Peridermium pinicicola*).—Next to the Larch Canker, one of the most destructive diseases of forest trees is caused by attacks of the Bladder-rust or Cluster-cups. It is a wound fungus and attacks almost every species of pine, the Scotch in particular, and especially when the trees are growing on light, poor soils. Young trees up to, say, twenty years old, are most commonly attacked by this fungus, which appears like blisters, emitting bright reddish-coloured spores. Rooting up and burning all affected trees is the best remedy.

Sclerotinia.—In the life-history of this fungus there are several distinct stages, that known as *Botrytis* being by far the most injurious to trees, and causing the now well-known and much-dreaded leaf-shedding of certain coniferous trees.

Young trees whilst in the seed-bed or nursery stage of growth are most commonly attacked, though instances are on record of the foliage on tender shoots of old trees being damaged by this parasitic fungus. Few of the commonly cultivated coniferous trees would appear to come amiss to the attacks of the *Botrytis*, the Larch, owing no

doubt to the quantity in which it is grown in this country, suffering most. Two-, three-, and four-year-old seedlings are the favourite host of the fungus ; and it attacks not only the Common and Japanese Larch, but Scotch, Austrian, Mountain, and other pines, the Silver Fir, Douglas Fir, Common and Weeping Spruce, the Deciduous Cypress, and Wellingtonia. In affected seedlings the first indication of the attack is a sickly appearance of the leaves, followed by contortions of the shoot ; though, curious to state, the lower portion of a stem may only be attacked, as if the infection proceeded direct from the soil. The diseased leaves fall off prematurely, as do also the tips of affected shoots ; and though the attack may not at once kill the tree, repeated onslaughts render young plants worthless for planting out.

As the spores of this fungus have been found to grow freely on weeds and other plants, its rapid distribution is readily accounted for. When the fungus has made its appearance in nursery ground, all fallen twigs and leaves should be carefully collected and burnt. Spraying with Bordeaux mixture, or a solution of copper sulphate, 4 lbs. to 100 gallons of water, is recommended.

Blueing in coniferous timbers is due to the fungus *Ceratostoma piliferum*. It is common in Scotch pine wood.

Mosses and Lichens.—In damp and shady situations, and particularly when the trees are not in vigorous growth, both coniferous and hardwooded trees are often attacked by mosses or lichens, or both. Though the attacks are rather an indication of unsuitable environment than

actual disease, being merely epiphytal, yet, when mosses and lichens abound, the health of the tree is injured and the affected branches die off gradually. In some cases that have been brought to my notice, large numbers of trees have fallen a prey to their attacks. To combat them drainage and the admission of light and air should be attended to.

How far does the growth of mosses and lichens affect the health of trees? On what species, and under what conditions, do they grow most? These are questions more readily asked than answered. Both epiphytes prevail more on the west than the east coast, owing no doubt to the greater rainfall, and several species seem to grow alike either on stones or trees. The larch suffers most in the south and south-west of England, and in Devon and some of the adjoining counties the common grey lichen is plentifully distributed on many hard-wooded trees. Probably, the fact that neither mosses nor lichens penetrate into the tissue of the wood, will explain why they commit less damage than is generally supposed.

“Beard Mosses” (*Usnea barbata*), so commonly distributed, are usually found where the atmosphere is constantly damp. In order to get rid of moss and lichen on trees, fresh powdered lime should be sprinkled on these during damp weather; or, better still, scrape off as much of the moss and lichen as possible, and then thoroughly scrub the bark with limewash made from fresh lime, so thin as to give a slightly white appearance when dry. Sulphate of iron in the proportion of one pound weight to a gallon of water will also destroy these

epiphytal plants, but care in its application is recommended.

Not only are growing trees affected by fungi, but both converted and unconverted timber, particularly such as is in an unsound or immature condition, quickly fall a prey to the attacks of these decay-inducing organisms.

Wood is largely composed of lignin and cellulose with some stored starch, the special food of some fungi, and unless these are rendered incapable of sustaining the life of saprophytes, decay is sooner or later bound to come about. As a preventive against both insect and fungus attacks, creosote and carbolineum have been found particularly valuable, and not only so, but, by shutting up the pores of the wood and displacing air and water, the lifetime of the timber is greatly increased. Other substances, such as corrosive sublimate and copper sulphate, have been used, but nothing, either on account of efficacy or cheapness, can surpass carbolineum or creosote.

In the case of young thinnings of pine plantations, the trees, if used as fencing, will, in the case of Scotch Pine, last about five years, and of Larch eight years ; whereas, if treated with creosote and fungoid attacks prevented, the lifetime will be extended to nearly treble the period.

The Common Juniper (*Juniperus communis*) and the Savin (*J. Sabina*), the former in particular, suffer severely from the attacks of species of well-known fungi, *Gymnosporangium juniperinum* and *G. sabinæ*. This fungus produces the peculiar woody, knob-like swellings which so distort and kill out numbers of specimens of the juniper on

our English commons and downs. In spring, soft gelatinous spore masses are produced on these knobs. It spreads with great rapidity, and would seem to have been on the increase of late years, as in the midland and southern English counties, large extents of juniper have been almost totally destroyed by its ravages during the past twelve months. When badly attacked with the fungus, the plants wear a rusty, meagre appearance, and gradually die off with the increase of the disease. I have counted as many as seven of these woody swellings on a branch only 4 feet in length, and on a single bush hardly exceeding 8 feet in spread I counted thirty-seven. To the Irish Juniper (*J. communis fastigiata*) the disease likewise extends. By cutting off the affected shoots, and dressing those on the main stems with fir tree oil, much good has been brought about.

Several species of *Pinus*, particularly *P. Pinaster*, *P. Strobus*, *P. excelsa*, *P. sylvestris*, and *P. montana*, are attacked by *Trametes radiciperda*, the mycelium of which causes the roots and other attacked portions rapidly to decay. In replanting ground from which diseased trees have been removed, the greatest care should be exercised that every portion of the old stump and roots are taken from the ground, the mycelium traveling very rapidly from root to root. The Alaska cypress (*Cupressus nootkatensis*) has been killed outright by the mycelium of *Trametes*, the disease not only affecting the roots, but the stem and branches. In one particular case the cause was distinctly traced to a piece of plank that by mistake had been left in the soil, and with which

one of the larger roots of the cypress had come in contact. The plank was completely enveloped in the mycelium of the fungus. When attacked, the cypress was a healthy vigorous tree 18 feet high, the first indications of disease being the drooping, sickly appearance of the branch tips. Similar instances of the death of *Sequoia gigantea* and *Araucaria imbricata* by the above fungus could be given.

Some species of *Peridermium* attack and cause much damage to *Pinus insignis*, *P. halepensis*, *P. Strobus*, and *P. montana*. The disease not only causes an inordinate secretion of turpentine, but the cambium of the wood is destroyed, and the branches frequently die off in consequence. Pruning and burning the injured portions of the attacked trees is to be recommended.

Peridermium columnare has of late years been very destructive to the Silver Fir (*Abies pectinata*), less so to the Cephalonian Fir (*A. cephalonica*) in several parts of Ireland and elsewhere. When attacked, both the branches and leaves wear a peculiar and conspicuous rusty appearance. Too close growth of the trees is the main cause of attack, and judicious thinning has, in several instances, put a speedy end to the spread of the fungus.

Cedrus Deodara I have known to be completely killed by the presence in great quantities of a species of *Polyporus*; and at Ampthill, in Bedfordshire, an unusually large *Cedrus Libani* was badly infested throughout with a similar fungus, and had to be felled in consequence.

The twiggy growths known as "witches'

brooms" are caused by the mycelium of *Æcidium elatinum*. They are found on *Abies nordmanniana*, *A. pectinata*, *A. Pinsapo*, *A. balsamea*, *Pseudotsuga Douglasii*, and other conifers. Pruning off and burning affected branches is to be recommended.

When growing in too damp soil, I have known *Cryptomeria japonica*, *Sequoia gigantea*, and *Cupressus macrocarpa* to have their roots badly injured by the mycelium of a species of *Hymenomycetes*; whilst, again, when planted in unsuitable soils, *Picea Morinda*, *Pinus excelsa*, and our Common Larch, suffer severely from both *Agaricus (Armillaria) melleus* and *Polyporus sulphureus*.

I have known a nursery brake, containing 60,000 one-year-old larches, entirely denuded by the mycelium of a fungus which undoubtedly had been imported in the leaf-mould and decaying woody matter that had been used for top-dressing, thus showing with what care manures should be added to the soil in which young trees are to be planted.

ANIMALS AND BIRDS

Though not considerable and usually of local occurrence, yet the amount of damage done to trees by animals and birds should receive attention. Red deer, hares, rabbits, squirrels, rats, and mice are amongst animal foes; whilst under destructive birds might be included the ptarmigan, grouse, pigeon, woodpecker, crossbill, starling, and various species of finches.

Buds of most coniferous trees are freely eaten

by the blackcock and grouse ; the pigeon feeds largely on acorns and beech-mast ; while finches and the crossbill devour and destroy quantities of tree seeds, the latter favouring those of the Scotch Pine, Spruce, and other coniferous trees. The bullfinch preys on the early tender shoots of the Larch, and is particularly destructive to the buds of the currant and gooseberry.

The great woodpecker will attack healthy as well as diseased trees, and encircle the stems with rings of holes, which are arranged horizontally. When the trees are badly pierced with lines of holes arranged shelf-like, one above the other, the trunk frequently snaps across during stormy weather, and several such cases were observed in a Kentish plantation during the past season. In the same woodland, however, unhealthy and insect-infested trees of the Scotch and Cluster Pines were also attacked, and telephone and telegraph poles by the roadside. The holes are usually 2 inches in diameter, and extend inwards according to the depth at which insects are to be found. In some cases the timber of the attacked tree has been entirely removed by the woodpecker, leaving only the bark intact.

Although hurtful by picking holes in living tree stems, it would appear that the utility of the woodpecker, in destroying injurious beetles in unhealthy trees, outweighs any harm it may do in attacking healthy specimens.

Birds undoubtedly do much injury, but the amount of good they do in the way of destroying insect pests far outweighs the evil.

Starlings are at times quite a nuisance, especially

when they congregate in huge flocks at roosting time and foul the ground with their droppings. In several cases the coniferous trees in the plantation where these birds roost have either been killed outright or rendered unhealthy by their presence, especially when the birds remained for a lengthened period in the same locality. Two instances have of late come under my notice in which quite a number of average-sized trees and their underwood have been killed by the too pressing attention of this otherwise valuable bird. Though in certain cases the trees may not have been killed, yet many of the branches have died off, and the whole frequented part of the woodland wears a decidedly unhealthy appearance. Frightening the starlings by shooting, or lighting some of the material used for smoking out rabbits beneath the trees on which they roost, are the only remedies.

The heron does almost similar damage to trees, and in a heronry in the north of Ireland, as also in Epping Forest, coniferous and other trees have suffered greatly, and in some instances been killed outright, by the fouling of these birds.

Squirrels commit damage by eating the buds of coniferous trees, while young larch and other plantations suffer much in the way of bark-peeling and gnawing of the tender wood. The Larch and Scotch Pine are most frequently attacked, and whole plantations in Ireland and Scotland have at times suffered severely from repeated onslaughts of this animal. Not only is the bark peeled off, but in the case of young larch plantations the top shoots at a distance of

6 to 8 feet from the crown of the trees are often irreparably damaged by the gnawing of the squirrel.

The bark around the stem is gnawed and peeled off, with the result that all above the attacked part dies off, and is readily broken across in stormy weather. In the case of injured tops, it is advisable to have them carefully cut back to the sound bark, and the strongest side branch substituted as a leader.

Squirrels are particularly fond of the flower-buds of the horse-chestnut and many coniferous trees, while cones of the latter are by no means exempt from their attacks. Preventive measures are by no means readily adopted, and shooting or trapping has in many aggravated cases been reluctantly resorted to. Standard, isolated trees of the Pine family and other species may be preserved from attack by tying a band of gorse round the stem, but where there are many trees in close proximity such a method of preservation is out of the question. For nesting purposes bark from the stem of the Redwood and branches of decayed lime trees is often employed.

Rats and mice sometimes damage the bark of both young trees and seedling plants, though their attacks are somewhat local. The vole or water-rat is undoubtedly the most to be dreaded, as it will attack not only seeds and seedlings, but the bark of many species of hard-wooded and coniferous trees. We have known whole plantations by a river-side to suffer from stem barking, and trees by the lake or pond side are most liable to attack. At one time the vole threatened the destruction of the New Forest and Forest of Dean by its

ravages, large numbers of oak, chestnut, and holly being barked, and in some instances killed outright by the attack.

In Wales a young plantation of larch suffered greatly from rats biting off the leading shoots, which were carried in hundreds to their holes close by. Conifers growing by a lake or pond side are sometimes attacked, and in certain instances large breadths of the bark have been stripped off by these rodents. We have seen the scarlet oak, white poplar, purple beech, Atlantic Cedar, and three other coniferous trees barked by rats along a stream-side in northern Ireland. Trapping or poisoning is to be recommended in such cases. Both rats and mice attack seed-beds and destroy seedling plants. Mixing the seeds, before being sown, with a small quantity of white lead, 1 lb. to 10 lbs. of seed, will ward off attacks.

Regarding the attacks of red deer, hares, and rabbits, little need be said except that these animals are most injurious to young plantations, from which they should be shut out by means of wire-netting or other fencing, according to the circumstances of the case.

In park and paddock horses injure trees by gnawing the bark and branches. The stems of attacked trees should at once be protected by suitable wood or iron fencing. Wire-netting, if placed tightly around the trunk, will offer some protection; but there is danger of the horses' shoes getting entangled in the meshes, especially when the netting is brought too near to the ground. Several compositions, such as tar, creosote, and carbolineum, have been recommended as pre-

ventives against the gnawing of horses ; but the only effectual remedy we have found is to paint the tree stems with liquid clay and asafœtida in the proportion of a teaspoonful of the tincture to half a bucketful of clay dissolved in water.

Buds of the lilac and plane, as also flowers of the pink hawthorn, suffer much from attacks of the pigeon, and during the spring of 1916 the depredations in the case of the lilac and hawthorn were so considerable in the Metropolis that special preventive measures had in some cases to be adopted.

The crossbill feeds on the seeds of several coniferous trees, principally those of the Scotch Pine and Spruce, and when large flocks of the bird appear the injury done is considerable. In pine plantations in the north of Ireland the crossbill committed such an amount of damage some years ago that reduction of their numbers had to be resorted to by shooting. Comparatively speaking, the crossbill is a rare bird and of local distribution.

The capercailzie, blackcock, and moorfowl or ptarmigan are all inhabitants of secluded heathery moors and pine plantations. They feed on the buds and shoots of the Scotch Pine and other coniferous and hard-wooded trees, and frequently whilst these are in the nursery border. Both the blackcock and the red grouse feed largely where the heather and whortleberry abound, and when food is scarce they devour the buds of coniferous and other trees, and catkins of the birch, alder, and hazel.

The Hawfinch.—On account of its extremely

shy and retiring habits, the hawfinch is rarely seen, but it is fairly common in the southern English counties. Though its favourite food is the seed of the hornbeam, yet it will also eat those of the juniper, beech, elm, ash, and service tree.

CHAPTER IX

VARIABILITY OF CONIFEROUS TREES

FEW facts in connection with coniferous trees have impressed me more than their extreme variability, whether when growing under the same or different conditions as to soil, aspect, or situation. I have repeatedly known foresters, and other persons who were deeply interested in coniferous trees, quite at a loss to recognise at sight, on one estate, species with which they were perfectly familiar in other parts of the country; and very often it has happened that specimens sent for the purpose of recognition have, owing to a variety of causes, been wrongly named by good authorities. In the latter case I refer directly to foliage, the fruit forming an unerring guide to identity.

The Common Scotch Pine (*Pinus sylvestris*) varies to a wide extent in general aspect, foliage, and size and shape of cones; and the same may be said, though in a greatly increased manner, of the Corsican Pine (*P. Laricio*) and its numerous forms. Until quite recently, *P. Laricio nigricans* was ranked as a distinct species, but along the margins of a single plantation at Penrhyn Castle,

North Wales, every link between the typical *P. Laricio* and the so-called *P. nigricans* or *P. austriaca* can be seen. How greatly different trees of *P. Strobis* vary in length of foliage and size of cone—a remark that applies with still greater force to the Mexican *P. Montezumæ*. *P. massoniana*, and *P. parviflora* are other examples of extreme variability, both in aspect and colour of foliage. Specimens of these, growing near the shores of Lough Neagh, in Ireland, are as widely different from what one sees in the English parks as could well be imagined.

To see *Abies Pinsapo* growing on chalk at High Elms, in Kent, or *Tsuga canadensis* by the margins of the Drakelow Lakes at Woburn Abbey, their identification with other specimens of the same species, as usually seen, would be a by no means easy task for the amateur. No one, even an expert, would readily reconcile two specimens of *Juniperus communis* collected from one of the Hertfordshire or Kentish commons. Whether in habit, shape, length of leaves, or general foliage tint, different specimens would appear to be widely separated and hardly recognisable unless by the person who studied them on their native downs. But amongst all coniferous trees none would appear to vary more than the familiar *Cupressus Lawsoniana*. I have often noticed in a bed of these plants raised from seeds collected from one and the same tree that the variability in general character is truly remarkable. Some are strict and others of decidedly pendulous growth, some are of a dark sombre green as compared with the silvery hue of others, while some are giants and

others dwarfs. Both *Abies nordmanniana* and *A. grandis* vary greatly under cultivation, and some specimens of the former that have been brought under my notice are hardly distinguishable from the Common Silver Fir (*A. pectinata*). Then the bifid foliage of certain stages of growth of *A. firma* has caused much uncertainty and considerable differences of opinion as to the specific rank of this and other nearly allied species.

A. bracteata, *A. nobilis*, *A. amabilis*, *A. cephalonica*, *Pseudotsuga Douglasii*, *Sequoia sempervirens*, *Pinus densiflora*, *Tsuga Albertiana*, *Cupressus goveniana*, *C. lusitanica*, and various species of *Torreya* and *Cephalotaxus* all wear a remarkable tint of green when growing in Ireland, and which I attribute solely to the humid atmosphere combined with suitable soil.

The wide and marked differences that exist between the juvenile and adult foliage of certain forms of *Juniperus*, *Cupressus* (including *Retinispora* and *Chamæcyparis*), and *Thuja*, have in many instances led to increased, confused, and erroneous nomenclature. Fortunately, of late years, many doubtful points have been satisfactorily cleared up, and we are now enabled to refer correctly certain previously acknowledged genera to their proper rank of species, and species to that of variety. Notable examples of this kind include *Cryptomeria japonica elegans*, in which only the primordial leaves are produced; the so-called *Retinispora ericoides* and *Biota meldensis*, which are only undeveloped forms of the Chinese arborvitæ (*Thuja orientalis*), in which the scale-like

foliage is separated into awl-shaped or linear leaves; *Thuya ellwangeriana*, a form of *T. occidentalis* bearing both adult and juvenile foliage; *Retinispora leptoclada*, *R. squarrosa*; and some little-known forms of *Cupressus torulosa* and *Juniperus virginiana*.

Generally speaking, the origin of these forms may be accounted for by the fact that amongst the cypresses, junipers, and arborvitæ, the foliage of seedling plants is long and needle-like, and in many instances, but at indefinite periods, succeeded by scale-like leaves. At what period of their growth this change of foliage may take place is very uncertain, and that, too, I have frequently noticed with different conifers from the same batch of seedlings, some assuming the adult foliage at an early date, while others remain in the primordial condition for an almost indefinite period. *Cryptomeria japonica elegans* is an example of the latter kind, the primordial or juvenile character having been retained for thirty years, at present no signs of breaking away from the seedling stage being visible in a specimen of that age. *Retinispora ericoides* (properly *Thuya orientalis ericoides*) is simply an undeveloped form of the Chinese Arborvitæ, the fruit, as I have seen, differing in no way from that of the species.

By continual propagation from the juvenile stage a fixed character may therefore be established, and many forms so obtained are highly ornamental and of great value for ornamental purposes; so that this practice amongst conifers is certainly to be recommended. Of *Cupressus*

torulosa and *Juniperus virginiana*, some interesting forms will soon be offered for sale; but the most curious and interesting of any are two pines that would puzzle any conifer lover to define their parentage.

INDEX

Synonyms are indicated by italics

- Abies, 2
 acicularis, 105
 ajanensis, 110
 alba, 20, 100, 104
 Albertiana, 195
 Alcockiana, 105
 amabilis, 3
 Apollinis, 7
 arctica, 104
 atlantica, 31
 balsamea, 4
 hudsonia, 5, 224
 bifida, 11
 bifolia, 14
 brachyphylla, 5
 bracteata, 6
 Brunoniana, 197
 campylocarpa, 16
 canadensis, 104, 198
 cedroides, 197
 Cedrus, 35
 cephalonica, 7, 244
 Apollinis, 9
 hybrid, 9
 chiloensis, 26
 cilicica, 9
 Clanbrassiliana, 108
 cærulea, 104
 concolor, 9, 15
 violacea, 10
 Wallezi, 10
 denticulata, 112
 Deodara, 34
 Douglasii, 163
 dumosa, 197
 Engelmannii, 106
 excelsa, 107
 finedonensis, 108
 firma, 10
- Abies *Fortunei*, 93
 Fraseri, 11
 Glehnii, 109
 grandis, 3, 12, 245
 densiflora, 3
 Lowiana, 15
 Griffithiana, 98
 hirtella, 24
 hondoensis, 110
 Hookeriana, 201
 Hudsonia, 5
 indica, 34
 jezoensis, 93
 Kaempferi, 161
 Khutrow, 111
 larix, 96
 lasiocarpa, 9, 14, 15
 Arizonica, 15
 leptolepis, 98
 Lowiana, 15
 magnifica, 3, 16
 Mariana, 112
 Mariesii, 16
 Maximowiczii, 111
 Menziesii, 118
 Mertensiana, 195
 Morinda, 111
 nephrolepis, 25
 nigra, 112
 nobilis, 17, 245
 glauca, 18
 nordmanniana, 18, 245
 numidica, 19
 obovata, 114
 orientalis, 115
 panachaica, 7
 Parsonsiana, 15
 Pattoniana, 201
 pectinata, 20, 237

- Abies pectinata fastigiata*, 20
pendula, 21
Picea, 20, 107
Pichta, 24
Pindrow, 27
Pinsapo, 22, 246
Baborensis, 19
glauca, 23
Hamondii, 23
variegata, 24
polita, 116
Reginæ Amaliæ, 7
religiosa, 24
rubra cærulea, 104
sachalinensis, 24
sibirica, 24, 216
sitchensis, 118
Smithiana, 111
spinulosa, 119
sub-alpina, 14
taxifolia, 163
Torano, 116
Tsuga, 202
Veitchii, 5, 25
sachalinensis, 24
venusta, 6
vulgaris, 20
Webbiana, 26
Pindrow, 27
Williamsoni, 201
Wittmanniana, 115
Yunnanensis, 202
Æcidium elatinum, 277
Agaricus melleus, 269, 277
 Animals injurious to Conifers, 277
 Antiquity of Conifers, xix
Aphis, Spruce gall, 265
Araucaria, 28
imbricata, 28, 246
Arborvitæ, 180
Arceuthos drupacea, 82
Argyresthia atmoreiella, 263
Armillaria, 269, 277
Athrotaxis, 29
cupressoides, 30
Doniana, 30
laxifolia, 30
selaginoides, 30
 Austrian Pine, 136
 Avebury, Lord, and Conifers, 23, 33
 Avenues, Conifers for, 218
 Bedford, Duke of, and illustrations, vii
Bells jaculifolia, 48
Biota, see *Thuya*, 180
 Birds injurious to Conifers, 277
 Black game injurious to Conifers, 282
 Blueing in Conifers, 272
 Bordeaux mixture, 271
Bostrichus typographus, 257
laricis, 258
Botrytis, 271, 272
 Bullfinch injurious to Conifers, 278
 Capercaillie injurious to Conifers, 282
 Carbolineum and creosote, 270, 274
Cedrus, 31
africana, 31
atlantica, 31, 241
aurea, 33
glauca, 33, 223
Deodara, 34
crassifolia, 35
robusta, 35
viridis, 35
indica, 34
Libani, 35, 241, 247
argentea, 36
brevifolia, 37
decidua, 37
Deodara, 34
nana, 37
patula, 35
pendula, 38
Sargenti pendula, 38, 224
Cephalotaxus, 39
drupacea, 39, 216
Fortunei, 40, 216
pedunculata, 40, 216
fastigiata, 41
sphæralis, 43
Ceratostoma piliferum, 272
Chamæcyparis, see *Cupressus*, 50, 65
Chermes Abietis, 265
 Chigwell House, Conifers at, 34
 Chile Pine, 28
 Chinese Juniper, 77
 Churchill, Conifers at, 17
 Cockchafer, 260
Coleophora laricella, 261
 Confined spaces, Conifers for, 219
 Conifer products, xv
 Coniferin from conifers, xvi

- Coniferous trees, enemies of, 256
 timber of, 242
 variability of, 284
- Conifers, antiquity of, xix
 and soils, 214
 classification and description
 of, 1
 commercial aspect of, xv
 edible seeds of, xv
 enemies of, 256
 fastigiata, 222
 for avenues, 218
 chalky and calcareous, 215
 clayey soils, 217
 confined spaces, 219
 economic planting, 226
 exposed situations, 219
 gravelly and sandy soils, 215
 hedge purposes, 220
 ironstone and coal, 217
 peaty soils, 216
 smoky localities, 219
 the seaside, 218
 variegated, 223
 various positions, 218
 from cuttings, 209
 seed, 204, 207
 grafting, 211
 layering, 212
 of different characteristics, 222
 of low, spreading habit, 223
 pigmy, 224
 propagating, 204
 table of weights of seeds, 207
 weeping Conifers, 222
- Corsican Pine, 135
- Crossbill injurious to Conifers,
 282
- Cryptomeria, 44
 japonica, 44, 247
 araucarioides, 46
 elegans, 46
 nana, 47, 225
 Fortunei, 45
 Lobbi, 47
 Lycopodioides, 46
 Sandersi, 47
 spiralis, 47
 viridis, 48
- Cunninghamia, 48, 248
 sinensis, 48
 glaucua, 50
- Cupressus, including *Retinispora*
 and *Chamæcyparis*, 50
- Cupressus *amœna*, 52
 arizonica, 51
 Benthami, 59
 Boursieri, 54, 85
 californica, 53
 Cashmeriana, 51
 cornuta, 53
 disticha, 170
 ericoides, 69
 fastigiata, 68
 formosensis, 52
 funebris, 52
 glaucua, 51
 glandulosa, 59
 glaucua, 59
 Goveniana, 53
 glaucua, 54
 guadeloupensis, 61
 Hartwegii, 60
 japonica, 44
 Knighiana, 59
 Lambertiana, 60
 fastigiata, 60
 Lawsoniana, 54, 240, 248
 albo-spica, 56, 223
 Allumi, 56
 amœna, 52
 argentea, 56, 215, 223
 variegata, 215
 Bowleri, 56
 cœrulescens, 56
 densa, 56, 224
 elegantissima, 56
 erecta viridis, 56, 222
 filifera, 57, 214, 222
 Fleeti, 57
 Fletcheri, 57
 Haskin's variety, 57
 intertexta, 57
 japonica, 44
 lutea, 57
 Lycopodiodes, 58
 Milfordensis, 58
 nana, 58, 225
 glaucua, 225
 pendula, 222
 pottensi, 58
 Stewartii, 58
 stricta, 58, 220
 Triomphe de Boskoop, 58
 Wisselii, 58, 225
 Lindleyi, 59
 lusitanica, 59
 Benthami, 59

- Cupressus lusitanica glauca*, 56
Macnabiana, 59
macrocarpa, 60, 241, 248
 fastigiata, 60
 guadeloupensis, 61
 lutea, 61
nootkatensis, 62, 240, 249
 argenteo-variegata, 64, 215, 223
 aureo-variegata, 64, 223
 compacta, 64, 223
 lutea, 64
 pendula, 65
nutkaensis, 63
obtusa, 65
 Crippsi, 65
 filicoides, 65
 filifera, 66
 lutea, 66
 lycopodiodes, 66
 nana, 66
 pygmæa, 66
 tetragona aurea, 66
pendula, 52, 59
pisifera, 52, 67
 plumosa, 67
 argentea, 67
 aurea, 67, 219
 squarrosa, 67
 dubia, 67
 plumosa Sanderi, 225
pyramidalis, 68
sempervirens, 68
 horizontalis, 68
sphæroidea, 69
thurifera, 68, 189
 Mexicana, 69
thyoides, 69, 215
 Hoveii, 69
 leptoclada, 69
 nana, 70
 variegata, 70
 torulosa, 70
 Corneyana, 70
 Kashmeriana, 51
 Cypresses, 50

Dacrydium, 71
 Franklinii, 71
Dasyscypha calycina, 267
 Deciduous Cypresses, 170
 Deer, red, 281
 Derby, Earl of, and trees, 204
 Diseases of Conifers, 267

 Douglas Fir, 163
 Dry rot, 269

 Enemies of Coniferous trees, 256
 Exposed situations, Conifers for, 219

 Fetid Yews, 192
 Finches, injury from, 277
Fitzroya, 72
 patagonica, 72
Fomes annosus, 267
 Fungi injurious to Coniferous trees, 267
 Fungus, red rot, 267

Ginkgo, 73
 biloba, 73
 aurea, 74
 macrophylla, 74
 pendula, 74
 Golden Larch, 161
 Golden Scotch Pine, 155
 Grouse injuries, 277
 Gymnosporangia injuring Conifers, 274

 Handsworth Nursery, yew in, 177
 Hares injuring Conifers, 281
 Hawfinch, 282
 Hedges, Conifers for, 220
 Hemlock Spruces, 195
 Heron injurious, 279
 High Elms, trees at, 35
 Holwood Park, 204
 Horse injurious, 281
 Huon Pine, 71
Hylobius abietis, 257
Hylurgus piniperda, 256
 Hymenomyces, 277

 Index, 289
 Indian Juniper, 87
 Insects injurious to Conifers, 256
 Irish Juniper, 81
 Irish Yew, 176
 Ironstone and coal, 217

 Jackson, A. Bruce, and reviews, vii
 Japan Cedar, 88
 Junipers, 75
Juniperus alpina, 80
 bacciformis, 86
 barbadensis, 92
 bermudiana, 75

- Juniperus californica*, 76
 utahensis, 76
 canadensis, 80
Cedrus, 77
 chinensis, 77
 albo-variegata, 78
 aurea, 78
 chinensis (Japanese form), 78
 aurea (Japanese form), 78
 variegata (Japanese form), 78
communis, 79, 249
 canadensis, 80
 compressa, 80
 cracovia, 81
 fastigiata, 81
 hemispherica, 81
 hibernica, 81
 nana, 82
 neaboriensis, 82
 oblonga, 82
 suecica, 81
 densa, 88
 drupacea, 82
 excelsa, 84
 stricta, 84, 223
 flagelliformis, 77
 Gossainthaneana, 92
 gracilis, 92
 hibernica, 81
 japonica, 77, 78
 macrocarpa, 84
 Marschalliana, 85
 oblonga, 82
 occidentalis, 76
 occidentalis, 85
 monosperma, 85
 osteosperma, 76
 Oxycedrus, 85
 pachyphlæa, 85
 conspicua, 86
 elegantissima, 86
 ericoides, 86
 striata, 86
 phœnicea, 86
 turbinata, 87
 procumbens, 224
 pyriformis, 85
 recurva, 87
 squamata, 88
 Reevesiana, 77
 religiosa, 84
 rigida, 88
 rufescens, 85
- Juniperus Sabina*, 90
 tamariscifolia, 90
 variegata, 91
 Schotti, 93
 Sheppardi, 91
 sphærica, 91
 glaucæ, 91
 squamata, 224
 suecica, 81
 tamariscifolia, 90
 taurica, 84
 tetragona, 76, 86
 osteosperma, 76
 thurifera, 91
 virginiana, 91, 249
 argentea, 92
 aureo-variegata, 92
 Bedfordiana, 92
 glaucæ, 93
 pendula, 93
 Schotti, 93
 tripartita, 93
- Keteleeria*, 93
 Fortunei, 93
- Larch miner*, 261
 canker, 267
 sawfly, 263
 shoot moth, 263
- Larches*, 94, 226
- Larix*, 94
 americana, 94
 pendula, 100
 cedrus, 35
 dahurica, 95, 100
 davurica, 95
 decidua, 96
 Deodara, 34
 europæa, 96, 226
 pendula, 98, 250
 Griffithii, 98
 japonica, 98
 Kaempferi, 161
 laricina, 95
 leptolepis, 98
 microcarpa, 95
 occidentalis, 99
 patula, 35
 pendula, 100
 pyramidalis, 96
- Leaf-shedding fungus*, 270
- Libocedrus*, 101
 chilensis, 102

- Libocedrus decurrens*, 102
 glauca, 103
 Doniana, 103
 tetragona, 103
 Lichens on Conifers, 272
Lophodermium pinastri, 270
Lophyrus Pini, 259
- Maidenhair tree, 73
Melolontha vulgaris, 260
Merulius lacrymans, 269
 Mice injuring Conifers, 280
 Moor-fowl injurious, 282
 Mosses and lichens, 272
- Natural reproduction of Coniferous trees, 204
Nematus Erichsonii, 263
- Paper pulp, xv
 Penrhyn Castle, Conifers at, v
Peridermium columnare, 276
 pinicola, 271
Peziza Willkommii, 267
 resinaria, 270
- Picea*, 104
 ajanensis, 110
 microsperma, 111
 alba, 104
 cœrulea, 105
 Alcockiana, 105
 amabilis, 3
 balsamea, 4
 bicolor, 105
 brachyphylla, 5
 bracteata, 6
 Breweriana, 105
 canadensis, 198
 cephalonica, 7
 cilicica, 9
 commutata, 117
 concolor, 9
 Douglasii, 163
 Engelmanni, 106, 117
 glauca, 106
 excelsa, 107, 238
 aurea, 107
 brevifolia, 108
 Clanbrasiliana, 108, 224
 elegans, 108
 finedonensis, 108, 223
 Gregoryana, 108, 224
 inverta, 108
- Picea magnifica*, 108
 excelsa Maxwelli, 109
 pendula, 105
 pumila, 216
 pygmæa, 109, 224
 Remonti, 224
 stricta, 109
 firma, 10
 Fortunei, 93
 Fraseri, 11
 Glehnii, 109
 grandis, 12
 hondoensis, 105, 110
 lasiocarpa, 9
 Lowiana, 15
 magnifica, 16
 Maximowiczii, 111, 114
 Menziesii, 118
 Morinda, 111
 morindoides, 119
 nigra, 112
 glauca, 104
 Doumetti, 224
 nobilis, 17
 nordmanniana, 18
 numidica, 19
 obovata, 114
 Omorica, 114
 orientalis, 115
 aurea, 116
 pygmæa, 116
 Parryana, 117
 pectinata, 20
 pendula, 21
 Pichta, 24
 Pindrow, 27
 Pinsapo, 22
 polita, 116
 pungens, 117
 argentea, 117
 glauca, 118
 religiosa, 24
 sitchensis, 118, 240
 Smithiana, 111
 spinulosa, 119
 Veitchii, 5, 25
 vulgaris, 107
 Webbiana, 26
- Pigeon, attacks by, 282
 Pine beetle, 256
 cluster-cups, 271
 sawfly, 259
 shoot moth, 258
 timber, 250

- Pine nuts as food, xvii
 in comfits, xix
 Pine tree coccus, 262
 weevil, 257
 Pines, 120
 Pinus, 120
 Abies, 20, 107
 Cephalonica, 7
 alba, 104
 albicaulis, 120
 amabilis, 3
 Antoine, 202
 australis, 144
 austriaca, 136
 Ayacahuite, 121
 Balfouriana, 121
 aristata, 122
 balsamea, 4
 Banksiana, 124
 Beardsleyi, 149
 Benthamiana, 149
 Bolanderii, 126
 Bouvieri, 126
 brachyphylla, 5
 brachyptera, 149
 bracteata, 6
 Brunoniana, 197
 Brutia, 150
 Bungeana, 124
 canadensis, 198
 Cedrus, 35
 atlantica, 31
 Cembra, 125
 pumila, 125
 cembroides, 126, 129
 cilicica, 9
 clausa, 126
 commutata, 106
 concolor, 9
 contorta, 126
 Coulteri, 127
 Craigiana, 149
 deftexa, 134
 densiflora, 128
 Deodara, 34
 Devoniana, 141
 Douglasii, 163
 dumosa, 197
 echinata, 139
 Edgariana, 143
 edulis, 129
 excelsa, 129
 excelsa, 107, 146, 250
 firma, 10
 Pinus flexilis, 130
 flexilis, 120
 albicaulis, 120
 Fortunei, 93
 Fraseri, 11
 Fremontiana, 139
 Gerardi, 131
 Gerardiana, 131
 glabra, 131
 Gordoniana, 142
 grandis, 3, 12
 Grenvilleæ, 142
 Griffithii, 98
 halepensis, 131
 Hamiltonii, 147
 Hartwegii, 132
 hudsonica, 124
 inops, 132
 clausa, 126
 insignis, 133
 macrocarpa, 151
 Jeffreyi, 134
 Kaempferi, 161
 Khutrow, 111
 koraiensis, 134
 Lambertiana, 135
 lanceolata, 48
 Laricio, 135, 250
 austriaca, 136
 Karamana, 136
 nigricans, 136, 251
 Pallasiana, 136
 pygmæa, 138, 224
 Larix, 96
 Lindleyana, 142
 Llaveana, 126
 Loiseleuriana, 150
 longifolia, 138
 macrocarpa, 127
 macrophylla, 142
 maderienseis, 148
 Mariana, 112
 maritima, 131, 146
 Massoniana, 156
 aurea, 223
 Mats, sails, etc., xvi
 Menziesii, 118
 Mertensiana, 195
 mitis, 139
 monophylla, 139
 montana, 140
 Montezumæ, 141, 285
 Gordoniana, 142
 Grenvilleæ, 142

- Pinus Montezumæ macrophylla*,
 142
 Wincesteriana, 142
 monticola, 142
 porphyrocarpa, 143
Mughus, 140
 muricata, 143
 nigra, 112
 nobilis, 17
 nordmanniana, 18
 Nuttallii, 99
 occidentalis, 141
 omorica, 115
 oocarpa, 143
 oocarpoides, 143
 orientalis, 115
 osteosperma, 126
 palustris, 144
 Parryana, 149
 parviflora, 144, 285
 Pattoniana, 201
 patula, 145
 macrocarpa, 146
 pectinata, 20
 pendula, 100
 peuke, 146
 Picea, 20
 Pinaster, 146, 251
 Hamiltonii, 147
 Lemoniana, 147
 prolifera, 147
 Pindrow, 27
 Pinea, 148
 pinsapo, 19, 22
 ponderosa, 149, 253
 pseudo-Strobus, 150
 Pumilio, 140
 pungens, 150
 pyrenaica, 150
 radiata, 151
 radiata, 133
 religiosa, 24
 resinosa, 152
 rigensis, 154
 rigida, 152
 rubra, 152, 154, 157
 Russelliana, 141
 Sabiniana, 153
 selenolepis, 25
 Shasta, 120
 sibirica, 24
 sitchensis, 118
 Skinneri, 143
 Smithiana, 111
- Pinus Strobus*, 154, 230, 253
 nana, 154
 sylvestris, 154, 228
 argentea, 155
 aurea, 155
 monophylla, 156
 pygmæa, 156, 224
 syratica, 144
 Tæda rigida, 152
 variabilis, 139
 Tanyosho, 224
 taxifolia, 163
 Thunbergii, 156
 aurea, 157
 tuberculata, 157
 uncinata, 140
 variabilis, 139
 venusta, 6
 Virginiana, 132
 Webbiana, 26
 Wincesteriana, 142
- Pissodes notata*, 266
Plum-fruited Cephalotaxus, 39
Podocarpus, 158
 alpina, 158
 andina, 160
 chilina, 159
 macrophylla, 160
 salignus, 159
Polyporus sulphureus, 277
Prince Albert's Yew, 165
Propagating Conifers, 204
Pruknopitys, 160
 elegans, 160, 219
Pseudolarix, 161
 Fortunei, 161
 Kaempferi, 161
Pseudotsuga, 163
 Douglasii, 163, 236, 254
 brevifolia, 164
 Fletcherii, 164
 pendula, 164
 Stairii, 165
 taxifolia, 163
 taxifolia, 165
- Rabbits injuring Conifers*, 281
Rats injuring Conifers, 280
Redwoods, 167
Retinia buoliana, 258
 turionella, 258
Retinispora, see *Cupressus*, 50
 ericoides, 69, 186, 287
 filifera, 57

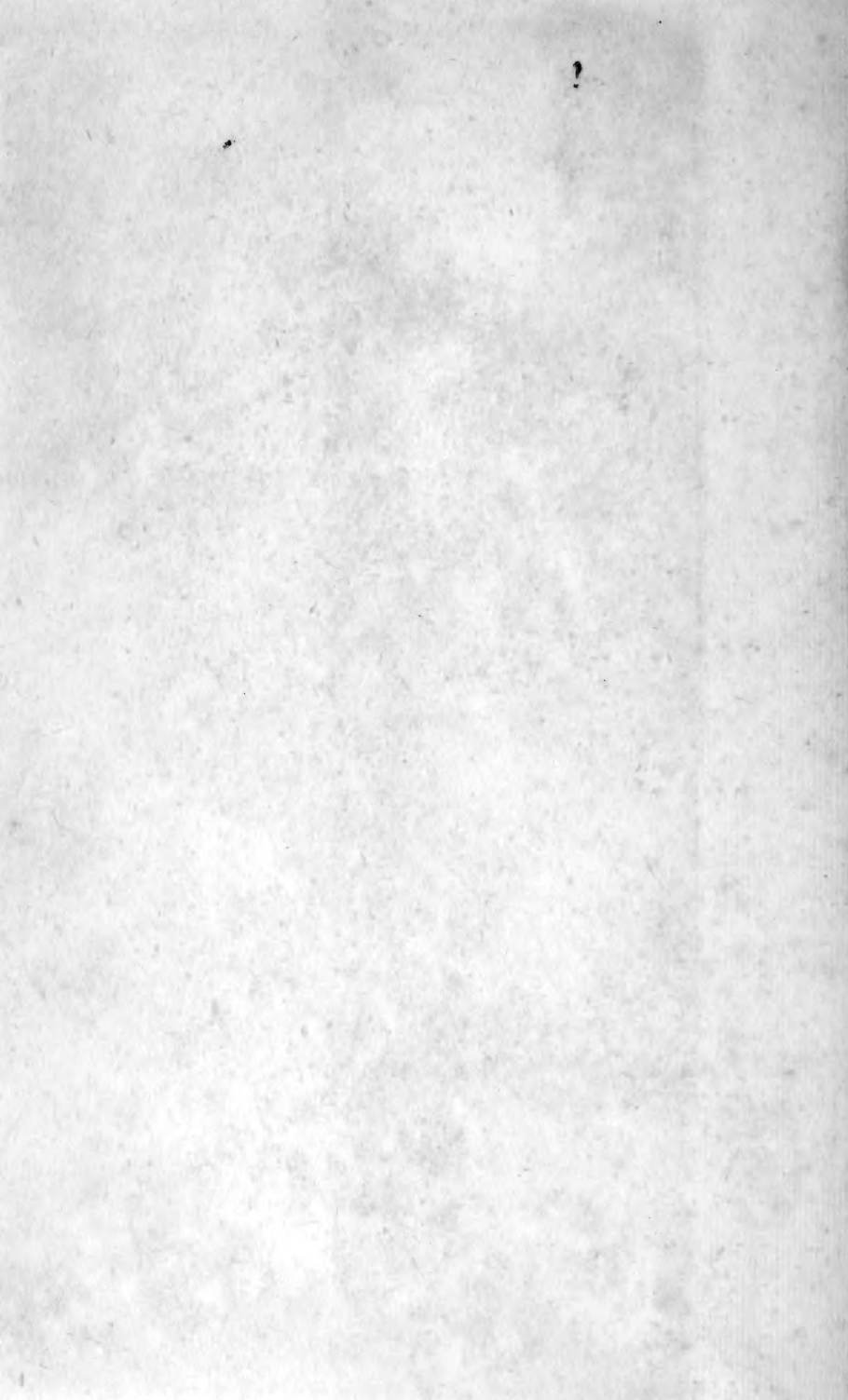
- Retinispora leptoclada*, 287
lycopodiodes, 66
meldensis, 285
obtusata, 65
ptisifera, 67
plumosa, 67
squarrosa, 67, 287
tetragona aurea, 66
- Rust fungus, 275
- Salisburia adiantifolia*, 73
- Savin Juniper, 90
- Saxegothea, 165
conspicua, 165
- Sciadopitys, 166
verticillata, 166
- Sclerotinia, 271
- Scotch Pine, 154, 228
- Seaside, Conifers for the, 218
- Seeds of Coniferous trees, weight
of, 207
- Sequoia, 167
gigantea, 167, 254
aurea, 168
pendula, 168
sempervirens, 169, 240, 255
adpressa, 169
albo-spica, 169
Wellingtonia, 167
- Silver Firs, 2
- Sirex *gigas*, 264
juvencus, 265
- Sitka Spruce, 118
- Smoky localities, Conifers for,
219
- Spruce Firs, 104
- Spruce gall aphid, 265
- Squirrels injurious to Conifers,
279
- Stachycarpus andina*, 160
- Starling injurious, 278
- Strasburg turpentine, xvi
- Tar and pitch from wood, xv
- Taxaceæ, 2
- Taxodium, 170
adscendens, 170
distichum, 170
mexicanum, 171
japonicum, 44, 45
mexicanum, 171
microphyllum, 170
Montezumæ, 171
mucronatum, 171
- Taxodium sempervirens*, 169
adpressa, 170
albo-spica, 170
- Taxus, 172
adpressa, 174
baccata, 172
adpressa, 174
stricta, 175, 220
variegata, 175
aurea, 175, 223
Bourserii, 179
canadensis, 179, 180
cheshuntensis, 175
Dovastoni, 175
aurea, 175
elegantissima, 176, 223
erecta, 176
ericoides, 176
fastigiata, 176
argentea, 177
aurea, 177, 223
fructu luteo, 178
Jacksoni, 178
japonica, 41
nana, 178
Neidpathensis, 178
nigra, 178
pendula, 222
procumbens, 179
semper-aurea, 179
Washingtoni, 179
brevifolia, 179
canadensis, 180
variegata, 223
cuspidata, 180
Harringtonia, 40
Lindleyana, 179
Washingtoni, 179
- Thuya, including *Biota* and
Thuyopsis, 180
aurea, 185
chilensis, 102
Craigiana, 102, 190
dolabrata, 180, 220
latevirens, 181
nana, 181, 225
variegata, 181, 220
Doniana, 103
Ellwangeriana, 287
gigantea, 102, 190
japonica, 182
plicata, 184
japonica, 182
Lobbi, 190

- Thuja meldonensis*, 286
Menziesii, 190
obtusata, 65
occidentalis, 182
 argentea, 183
 aurea, 183
 crispata, 183
 Ellwangeriana, 183
 Hovei, 183
 Little Gem, 183
 lutea, 184
 pendula, 184, 222
 plicata, 184
 Vervæneana, 185, 223
 Wareana, 185
orientalis, 185
 aurea, 185
 densa, 185
 elegantissima, 186
 ericoides, 186, 287
 falcata, 186
 lutea, 187
 meldonensis, 188
 Mexicana, 189
 nana, 225
 pendula, 189, 220
 pygmaea, 225
 semperaurescens, 190
 tetragona, 103
 Zuccariniana, 190
pendula, 189
pisifera, 67
plicata, 190, 222, 239
 compacta, 192
 pendula, 192
Standishii, 182
tetragona, 103
Vervæneana, 184
Wareana, 184
Thuyopsis, see *Cupressus* and
 Thuja, 180
 borealis, 63
 dolabrata, 180
 latevirens, 181
 Standishii, 182
Timber of various Conifers, 242
Tinea (Coleoptera), 261
Torreya, 192
 californica, 193
 Torreya grandis, 194
 Myristica, 193
 nucifera, 194
 taxifolia, 194
Trametes radiciperda, 267, 275
Tree-root rot, 269
Tree wasp, 264
Tsuga, 195
 Albertiana, 195, 241
 Brunoniana, 197
 canadensis, 198
 aurea, 199
 globularis erecta, 199
 macrophylla, 199
 nana, 200
 parvifolia, 200
 pendula, 200
 Caroliniana, 201
 diversifolia, 202
 Douglasii, 163
 Hookeriana, 201
 Mertensiana, 195
 Pattoniana, 201
 Sieboldi, 202
 nana, 202
 Williamsoni, 201
 yunnanensis, 202
Umbrella Pine, 166
Usnea barbata, 273
Variability of Coniferous trees, 284
Voles injuring Conifers, 280
Wasp, tree, 264
Wellingtonia, see *Sequoia*, 167
Weymouth Pine, 154, 230
Wireworms, 259
Witches' brooms, 277
Woburn Abbey, Conifers at, v
 Nursery, 204
Woodpecker, 278
Wood-wasps, 264, 265
Yew, Fisher's Golden Hybrid, 177
 Irish, 176
 Yellow-berried, 178
Yews, 172









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