

TREATISE
ON FOREST TREES

OR

**THE NATURAL HISTORY AND DESCRIPTION OF NATIVE OR
NATURALIZED TREES WITH TRUNKS BETWEEN THIRTY AND ONE
HUNDRED TWENTY FEET HIGH THAT ARE USED IN CIVIL
CONSTRUCTION AND SHIPBUILDING**

BY M. JAUME SAINT-HILAIRE.

WITH A GUIDE TO THE CULTIVATION OF TREES,

BY M. THOUIN,

PROFESSOR AT THE KING'S GARDEN,

and illustrated with figures printed in color and retouched with brushwork.

Translated By Julian B. Fleischman
In collaboration with Missouri Botanical Garden
Saint Louis, Missouri

2011

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THE AUTHOR'S HOME, 3 RUE FURTEMBERG

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1824

[Translator's note: caption under the portrait of Henri-Louis Duhamel Dumonceau]:

Henri-Louis Duhamel Dumonceau,

Born in Paris in 1700; died August 23, 1782.

Author of The Natural History of Trees, Treatise on Trees and Shrubs, and of many other works that are both practical and scholarly.

PREFACE.

Duhamel's Treatise, which appeared in 1755, went a long way toward spreading knowledge about trees and a desire to cultivate them. But since then we have naturalized a number of foreign trees in France. Some excellent observations on their cultivation have been published by M. Thouin in his instructions and by M. Dumont-Courset in his *Botanist-Cultivator*. I believe, as I had suggested in a paper published in 1814 ⁽¹⁾, that under the present circumstances with the government engaged in planting along major highways, a treatise on forest trees would be useful. Consequently I've selected from my collection of plants of France the descriptions of those native or foreign trees with trunks between thirty and one hundred twenty feet high that are used in civil construction and shipbuilding.

⁽¹⁾ Report on the administration and management of forests by M. Jaume-Saint-Hilaire, Paris, at Égron, rue des Noyers, n° 37; two pages printed in 8°.

PREFACE.

Several of these trees, such as the bald cypress, the pagoda tree, etc., already are in parks around Paris. They can be successfully planted in areas where our native trees never have succeeded.

A royal order in August of this year established a school for training those who will be employed in forest management. Let me remind you of what I wrote on this topic in 1814 in the report referenced above: "Everyone knows that for bridges and highways and in engineering, artillery, mining, architecture, etc., preliminary studies and examinations are required for placement in entry-level positions. But through some unimaginable oversight, positions in forest management, even the most important ones, often are given to those who are totally unfamiliar with the matters on which they have to order and direct their subordinates. One who believes that the knowledge of woodlands can be achieved without a lot of effort and preliminary study would be vastly mistaken. Even men such as Duhamel, Buffon, etc., whose great skills are undeniable, devoted themselves to the subject for most of their lives. When they died they left behind many uncertainties and problems still to be clarified and resolved."

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I subsequently proposed that only those who could demonstrate a knowledge of botany, the natural history of plants, mathematics, etc., may enter into forest administration. I asked that schools like those in Prussia, in Russia, etc., be established to train students able to carry out the duties of a well-informed forester. Now that my wishes are fulfilled, I have in mind to publish a work that will be of some use to those who will take positions in forest management.

I could have included in my treatise more trees that have recently arrived from North America. But besides the fact that the characteristics of their wood still aren't well known, I didn't want to create a massive work with a price too high for those for whom it was intended. At the moment in France we have only thirty-seven species of trees with trunks greater than thirty feet tall; only eighteen of these make up the major part of our forests. My treatise will include the natural history and depiction of ninety species.

I've chosen the main format in 8^o, because over the years there have been complaints that works whose one and only purpose is practicality have almost always become extravagant objects,

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and that books intended to be used by growers and landowners are found only in the libraries of aristocrats and wealthy individuals. I wanted to avoid this criticism and still provide detailed individual descriptions for each species and a set of figures that are precise and carefully colored.

This work should be suitable for those who, by their position or inclination, are engaged in planting and will say, as did the octogenarian de Lafontaine:

Let us plant.

Our descendants will be in our debt for the shade.

For thirty years egotism and greed have marked the destruction of our ancient forests. It's time that well-intentioned people work to correct this fault and to put off the inevitable moment, unfortunately not far off, when we will have to import all our wood needed for construction and shipbuilding.

[*Translator's Note:* The following lengthy introduction to this book was written by André Thouin, 1747-1824. (The identical introduction also appears at the beginning of Jaume Saint-Hilaire's *Traité des Arbrisseaux et des Arbustes*.) Thouin was a distinguished French botanist and a pupil of Bernard de Jussieu. At age 17 he succeeded his father as chief gardener at the King's Garden in Paris (now the Jardin des Plantes) and enlarged it considerably. He became a member of the Academy of Sciences and of the Institut de France and professor and administrator of the Museum of Natural History in 1793. A street in Paris is named after him. His introduction is dated August 18, 1824, barely two months before his death on October 27.

Thouin's introduction stresses the need for conservation and for the replacement of trees and woodlands to compensate for their destruction by the expanding population in France. It is a commentary on and a practical guide to planting and growing trees and shrubs. Though written in 1824, it seems remarkably contemporary in its concern for conservation and for the environment. It's notable that careful forest management already had begun in Europe long before it had in the United States.]

A GUIDE

TO THE SOWING, PLANTING, AND CULTIVATION OF TREES

GENERAL CONSIDERATIONS.

In countries with a small population, the growth of woodlands occurs naturally and is sufficient for society's needs. This is still the case in Russia, in America, and in several Oceanic islands. It was also true in Gaul at the time of Julius Caesar's conquest. He found wood suitable for construction in the Marseille region, and as his army advanced, impenetrable forests where Druids worshipped peacefully and which provided a secure refuge for those who sought to evade the conqueror's yoke. But this has not been the case for a long time. The many generations that followed consumed wood to such an extent that impenetrable forests no longer are found in France, and the vicinity of Marseille offers nothing more than stones and dry sand.

Natural growth has been inadequate for a long time. There have been attempts to make up for it by sowing and planting, but today it seems quite certain that the supply of

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usable wood, particularly that produced by our forests or by cultivation, no longer provides for the daily needs of our population. It is urgent that the authorities remedy this situation, or soon we will be obliged, as are the English, to get our supplies from abroad. While waiting for promises made long ago by well-meaning individuals to materialize, we believe that it is now in the best interest of landowners to plant woodlands and to propagate good varieties of oaks, elms, beeches, maples, etc., both domestic and foreign. And to realize as well that the constantly increasing price of usable wood offers those not influenced by misguided selfishness, nor hurried by their needs of the moment, an opportunity to undertake the most advantageous cultivation possible. Woodlands appear in many dry areas that are of little value for other plants; at the same time they are a lovely embellishment to country estates. Their foliage cools the air during the heat of summer and covers the ground with fertilizing material at the approach of winter. Countries with tall timber forests are less vulnerable than are others to blasts of the north wind. It's an established fact that the tops of large trees attract clouds which, as they turn to rain, water the countryside and create and feed its springs and streams.

PROPAGATION OF TREES.

Trees and shrubs are propagated by planting seeds, and by root suckers, layering, and cuttings. Wherever possible, the first method is the safest and most advantageous.

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Seeds of trees destined to create forests especially need to be sown on location. As a result, timber trees become more securely rooted in the ground, more beautiful, and more vigorous; the trees are healthier for it, they live longer, and their wood is of the best quality. All of these benefits derive from the fact that trees sown in one spot retain their taproot. It penetrates deeply into the soil, supports the tree against the force of the wind, and gathers nourishment from afar that it then restores in greater measure to the entire plant economy, bringing it health and vigor.

Trees that have begun their life in a particular soil are better adapted to it than are those transplanted from nurseries for yet another reason. This is the natural way that large plants reproduce. Seeds dispersed by the wind, distributed by birds, or water-borne, will germinate when the conditions are right. Their taproots push down deeply and their tops reach to the sky. By copying nature's ways, we can hope to achieve the level of perfection that we're capable of.

SEED PLANTING.

Tree seeds are planted 1) by scattering, 2) in furrows, and 3) one by one. Before planting, one must make certain that the seeds are of good quality. This can be done by obtaining seeds in season from trees that have achieved their maximum strength. Seeds that are full, heavy, intact, quite clean, that don't smell of mildew or are rancid, nor show evidence of insect damage, should be considered good and usually are the best.

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Soaking, an acclaimed touchstone, is of doubtful value. Seeds already depleted of reproductive energy won't do any better under water.

Many seeds whose germ is enclosed in a hard capsule, like those of the Rubiaceae, lose their ability to germinate shortly after they ripen. Others that contain natural oils that spoil readily and react with the germ, such as those in the laurel and myrtle family, have a similar problem. There are still others like buckthorns whose seeds are very hard and that further harden while drying, so that if one waits until spring to plant them, their germination will be delayed for a whole year. These difficulties can be overcome by planting or stratifying such seeds immediately after they are fully ripe.

STRATIFICATION.

Stratification consists of placing the seeds one wishes to preserve in sand or in earth beds within containers. The earth or the sand in this case should not be too dry nor too moist. If too dry, it will absorb moisture from the seeds; if too moist, the seeds will rot or germinate at an inopportune time for the growth of the young plant. Stratification is performed shortly after the seeds ripen; the containers holding them should be sheltered from rain and hard frosts. At the onset of spring, the seeds are removed from their containers and placed in the ground.

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SEED SCATTERING.

After the last hard frost, when the ground becomes workable during the rainy season, is the time to plant most seeds for trees in open country. To scatter the seeds, a prudent person carries the seeds he wishes to sow in a tray fastened at the hip and will cover the field he is sowing at a regular pace. With each step, he takes a handful of seeds and distributes them as uniformly as possible over a specified area. If the seeds are too fine to hold in his hand, he can mix them with dry soil or sand and distribute the mixture together. Sowers (machines that can distribute seeds very uniformly) have been invented; but they're not used either because they don't fully accomplish their purpose, are too expensive, or because custom resists it. [*Translator's note: The Industrial Revolution came later to France than it did to Britain. At the time this book was published, there still may have been considerable opposition to the use of machinery in French agriculture.*]

SOWING IN FURROWS.

Sowing *in furrows* is widely used for trees in nurseries. It consists of laying out a furrow in a recently worked field - its width and depth depends on the kind of seeds one intends to plant in it - distributing the seeds in it as uniformly as possible, and covering them with fine soil at a suitable depth. The soil at the bottom of the furrow is then firmed with the back of a rake and covered with leaf mold or other fertilizer as the situation requires.

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This method has the advantage that it keeps the seeds fresher, and that it subsequently provides earth for the saplings while they need it during their growth. Earth banked up next to furrows is steeply sloped; it slides down readily, and ensuing rainfalls soak it and progressively wash it to the bottom of the furrows.

PLANTING SEEDS ONE-BY-ONE.

Large seeds, such as those of oaks, chestnuts, walnuts, horse-chestnuts, almonds, peaches, and others like them that have been stratified since the autumn and that are germinating or about to do so, are planted one-by-one in rows a fixed distance apart. If the trees from these seeds are to grow permanently in the same location, the seeds are planted with the radicle intact. The trees will become larger and prettier, and they are less susceptible to being uprooted by the wind. But if the saplings are to be transplanted, it's best to clip the end of the radicle with a fingernail, so that the taproot, instead of growing straight down, will branch out and divide into several roots that spread out at ground level. The trees thus will be more certain to take root again when transplanted.

This method is used for planting small groves of oaks, beeches, and chestnuts. In country gardens it's also used to plant sturdy wild stocks among trees on an espalier for later grafting of the desired species when they begin to show signs of withering.

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Since several species of seeds don't germinate either in the first or in the second year, one never should be in a hurry to change a seed planting.

ROOT SUCKERS.

Root suckers are long roots that run several inches underground and emerge to give rise to shoots that form new plants. Suckers are separated from the parent root when they have enough root hair to ensure that they will take root on their own. For deciduous trees, the best time for this is when they are at rest, namely at the end of autumn and at the beginning of spring. For evergreens, the safest time for separating suckers is when the sap is rising, either in spring or in autumn. The planting of suckers differs little from that of seedlings; they are put in open ground in the same way. But note that trees derived from suckers don't grow as high or have as pretty a shape and are less vigorous than those grown from seeds.

There are several ways to propagate trees from roots - here's the easiest and safest: The roots are severed from the tree, but instead of removing them, they are left in place in the ground. The cut end can simply be lifted up and pulled out of the ground an inch or two. The roots, which have not been moved, are equipped with many passages for nutrients. They will transport sap to the part of the root above the ground, form a protrusion at that point, and will soon put out new shoots. The young trees are lifted the following year, completing the propagation.

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LAYERS.

[Translator's note: Two kinds of layering are described. The first is the easier method of earthing up a cluster of stems or of shoots growing from a tree stump and allowing the branches to grow roots. The second method is the more familiar one of bending branches down to the ground so that they take root.]

Layering means inducing attached branches to grow roots by manipulation and special cultivation. When the roots are sufficient to nourish the layered branches, the branches are severed and they will form new trees.

The purpose is to propagate certain woody plants that don't retain their useful or pleasant qualities when grown from seeds, those that never produce good seeds, and lastly those that take much longer to bring pleasure when grown from seeds than from layers.

The entire rationale for this procedure is to make the layered branches grow roots and produce new trees endowed with all the qualities of their parent stock, by means of moisture, temperature, proper soil, incisions, or ligatures.

It's based on many experiments proving that branches of woody plants can grow roots and, similarly, that roots can give rise to branches.

Trees and shrubs differ in the ease or difficulty with which they can be propagated from layers, which requires growers to use various methods and a variety of techniques.

The easiest way to layer is to heap up a mound of earth around a cluster of stems of trees or shrubs planted in open ground.

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To make such a mound, rather thick muddy earth is used that will readily take up moisture and retain it for a long time. The mound should be pyramid-shaped with a twenty to twenty-four inch base and approximately the same height. It is pressed around the young branches, and the surface is firmed up so that it is less likely to crack and will keep fresh longer.

If the layerings need looser soil and more moisture, and if one is counting a lot on their success, a bottomless box of four boards, twenty inches long by eight to ten inches wide, is placed around the cluster. It's filled with suitable soil, covered with a two-inch thick layer of moss, and watered as needed.

The end of winter, when the ground is thoroughly wet, is the most appropriate season for this kind of layering. No further steps are required. No additional care is needed other than occasional watering during the hottest parts of the summer. In the autumn, it's a good idea to verify that the buried branches have grown sufficient roots so that they can be separated from the stock. If the root ball is substantial, the layers are cut and set in place. If the roots aren't sufficient to nourish the new shrubs, one must wait until the next year to separate them from the parent stock.

Propagation by layering also is used for some trees and shrubs whose stems are harder than those described above; but these need an additional step in order to grow roots.

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It consists of bending the branches down into the ground instead of leaving them upright and heaping them up with earth, as in the layering method above.

This method is used to fill in clearings in copsewoods that are not too large; it's one of the easiest and least costly ways to accomplish this important objective. If there are trees with young, flexible, and vigorous branches located at the edge of or inside a clearing, small trenches about ten inches wide and a foot deep, and long enough to accommodate the branches, are dug in the ground. The branches are then carefully bent so as not to break them off of their stocks. They are laid down in these small trenches. Their upper ends should be straight and extend about six inches out of the ground. About half an inch should be clipped from the top of the branch to stop the flow of sap and to get it to generate roots. The laid-down branches should be embedded in grass, leaf mulch, and topsoil, and the rest of the trench refilled with the original soil. The soil is compressed to firm it up around the branches and to retain moisture favorable for root development. Vertical branches must not be left in a cluster where most of the other branches have been laid down. Sap from the main stock has a strong tendency to rise straight up, rather than to circulate into bent-over branches; it will fail to go into them and instead will flow mainly into the vertical ones, and the layers will be lost. So it's essential to get rid of the vertical branches.

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To keep new ones from growing up before the layers have taken root, it's best to cover the cluster with a four or five inch mound of earth. However, this does not apply to weaker shrubs that often die when all their branches are covered.

Layers like these often require two years, sometimes more, to take root. When they do, they are separated from their clusters. The earth that had covered the clusters is removed, and the clusters will waste no time generating healthy branches to replace the ones that had been layered.

Once again, this method is a good one for filling in clearings of approximately twenty square yards. It's better than planting new trees. The latter would only deteriorate in a confined space where the roots of nearby trees have already taken hold. Layers get the nourishment they need from the roots of their own stock, and they are much better protected while they are young from depredation by nearby trees. But if there are large clearings that need to be filled in, layering takes too long and is often inadequate; one has to resort to seed planting.

Trees for nurseries also are propagated by layering. Here's how to do it: The parent stocks are set in an area especially designed for the purpose. Stocks, whose main stems or largest shoots have been cut off at ground level, make sturdy bases for trees and shrubs. When the stocks have grown a lot of young vigorous shoots two to three feet high, they are laid down eight to ten inches deep into the ground all the way around the parent stock.

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The stock itself is covered with a conical mound of earth six inches high, and arranged so that rainwater flows over it and collects in the trenches around it. For this purpose, a circular rim of earth is formed against which the ends of the laid-down branches are arranged. For small trees and shrubs, the ends are nipped off to stop the sap and to promote more timely growth of the roots. They will grow enough to live on their own during the course of the year, and they can be lifted the following autumn and put in a nursery.

PLANTING.

[*Translator's note:* This last long section calls to mind the long rows of planted trees that were in vogue in the 18th and 19th centuries and still are seen in the formal parks and gardens of France.]

When the above methods of propagation can't be used due to special circumstances, one can turn to saplings. Those with the longest, healthiest, and liveliest roots must be selected, and they are not to be trimmed as severely as usual. Care must be taken that the roots are not bruised, scraped, or torn, which happens all too often. They are to be protected from exposure to air, and especially from frost, from the moment they are lifted until they are re-planted.

The stems of the saplings, however, have to be cut close to the ground, sometimes repeatedly, so it is of little importance that they be healthy and vigorous.

Having chosen the right kind of tree for the location and prepared the soil, one proceeds with the planting. A light plough on a base, minus ploughshare and mold board

and guided by marker staves, traces longitudinal lines, while others, crossing at right-angles, lay out the transversals. Each intersection marks the spot where a tree will be planted. Workers prepare the ditches, more or less deep, depending on the type of soil and the saplings. Next, planters line up along sections of the lines, place the tree roots at the intersections, and plant them there. The distances between the trees depend on their nature, the terrain where they will be, and the purpose of the planting. If one intends to plant a copsewood in mediocre soil the saplings are set five feet apart. If, on the other hand, the soil is rich and deep, they are placed six feet apart. If the plan is to grow trees to be harvested for timber, individual trees are planted five feet apart. About the tenth or fifteenth year, when the trees start to obstruct each other, every other one is cut in each direction. The trees are then ten feet apart. About the twenty-fifth or thirtieth year, each intermediate tree is again cut down, and the remaining trees are then twenty feet apart. They can continue that way until the timber is harvested.

It's a pity that foreign trees are hardly used for planting forests. Yet several hundred different kinds have come to France and already are well adapted here. They could be used successfully to replenish areas that have been abandoned as unproductive. [*Translator's note: in the 17th and 18th centuries, French explorers and botanists pioneered the introduction of trees and plants from distant lands into Europe. Thouin himself acclimatized many new varieties for growth in France.*]

Saplings are also planted on location for hedgerows, palisades, and groves.

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Lifting them doesn't require the same care as for saplings intended for timber. They are usually chosen from saplings two, three, or four years old. The trees include hawthorns, thorny plums, small elms for hedges, hornbeams, common maples, privets, and the like. The ones for hedgerows are planted in small ditches dug to a shovel's depth. The sapling's taproot is cut off and the stem is cut down to three to six inches above the ground. The individual saplings are placed next to one another, three to five inches apart, arranged in a single line.

Saplings for palisades in gardens are planted closer together. They are cut back to a height of fifteen to twenty inches, or even higher if one wants to enjoy them sooner, and if they're strong and in good ground. They are also planted by lines in ditches between three and seven inches apart.

Groves are created in gardens with all kinds of trees, shrubs, and bushes. The way they now are planted in Paris and its surroundings is truly a disaster. It's costly, offers only brief enjoyment, and is regretted afterwards. Different species of trees of the same age are crowded together pell-mell; some will grow into large trees, while others remain mere bushes. And they're all placed less than four feet apart!

For the first two or three years, these trees live well together;

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the grove is full, and it looks fine. But soon the more vigorous trees take over and choke the others. The planting continues to deteriorate and the pleasure of it is lost. To create plantings of this kind that are pleasant and that provide lasting enjoyment, saplings of big trees should be planted fifteen or twenty feet apart from one another, small trees from eight to ten feet, and shrubs about three feet apart. Furthermore, the largest ones must be placed in the interior of the grove, and the smaller ones graded toward the edges. If one wishes to fill out the space early in the planting, clumps of lilacs, privets, or other shrubs that don't mind a lot of shade may be planted at wide intervals. It's easy to do, not much trouble, and one can enjoy them for several years without losing them.

When only one kind of tree is planted in a wooded grove, the trees can be planted close together, about eighteen to twenty inches apart. The problem described above doesn't arise because the saplings are the same age, they are present under the same conditions, and grow the same way. But plantings of this kind offer no special beauty, and if you've seen one tree in the grove, you've seen them all. Variety, the main feature that captures the eye, the very "soul" of a garden, is lost to one's enjoyment. But such uniform groves are allowed even in tasteful gardens. They're the ones that will hold the earth on steep slopes and cover it with greenery. Privets, small elms, boxthorns,

and others like them are used for this purpose. Saplings of these small trees can be planted six inches apart from one another and cut to an inch above the ground. When trimmed as closely as possible each year, they will accomplish the goal perfectly. Several such groves can be seen at the Paris botanical garden. One, planted with small elms fifteen years ago, densely covers a steep slope exposed to the broiling sun, where no lawn could have survived.

Saplings to be planted in nurseries need to be treated a bit differently from other trees. Since they only need to stay there until they are strong enough to be permanently transplanted, they are set in rows in patches or square beds according to the needs or type of the tree.

Saplings of large trees intended to form avenues, to border highways, to form quincunxes, and to create groves, can be set in rows and spaced fifteen to thirty inches apart, keeping in mind that they will have to stay in a nursery for a while, and especially in a spot where they can be lifted without damaging the roots of other trees.

Bushes and shrubs are also planted in rows, but in a bed about five feet wide separated by paths fifteen inches wide. Depending on their strength and the time that the saplings need to stay in the nursery, they are spaced in a line from six to fifteen inches apart from one another.

It's customary to cut off the taproots of seedlings to be placed in nurseries and to trim their lateral roots. This practice poses no threat to their safety or to their taking root

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afterward, provided it's done moderately. It's even beneficial for the successful growth of the young trees after planting. The severed taproot is replaced by branching roots that tend to go deep into the ground, but they don't have the strength of a taproot and they take a different course. Lateral roots that have been trimmed bifurcate, branch out, and generate lots of root hair. All these roots and root hair increase the number of passages for nutrients for the young tree and make it grow more vigorously. A second advantage is no less important when the time comes to lift the sapling from the nursery and transplant it to its destination. Equipped with a lot of roots and root hair, it lifts up better and is more certain to take root again than a tree whose roots haven't been treated this way. Generally, the tops of saplings of large trees ought not to be cut when planting them in a nursery, but rather left at full length. Only the lateral branches should be pruned to reduce the load on the young tree and to lessen the likelihood of it being caught by the wind.

Small trees, shrubs, and bushes without defined trunks can be trimmed and their stems cut back in proportion to the quantity, and especially the condition, of their roots. If the roots are fresh and plentiful, and if planting is done at the right time, the stems are pruned long. If, on the other hand, the roots are sparse because they've dwindled and the season is well along, the stems should be pruned quite short, about four to five inches above the ground.

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The end of autumn is the best season for saplings of large trees from nurseries to take root in friable soil and in warm climates. Planting at the end of winter is more appropriate in hard or in wet soil and in northern climates. Nonetheless, the timing will vary with the kind of tree, the amount of moisture in the soil, and with a number of other local conditions. More precisely, such trees can be planted after they've shed their leaves and up until the time that new buds are just developing and leafing out. The right soil for this type of planting can't be specified; it has to vary with the type of tree to be planted in it. As a rule, it ought to be loose, penetrable by roots, free of large stones, and at least three or four feet deep. It must be protected from domestic animals and particularly from wild animals that can irreparably damage the young trees.

Several species of trees that already have had their taproots cut off when moved from the seed bed to a nursery no longer need to undergo the same operation on their roots when they're lifted for permanent planting. If the trees have been lifted carefully, with their roots intact, it's enough just to trim the ends. But often the haste and clumsiness with which they are pulled up requires two further operations that spoil both the trees' health and the planters' enjoyment of them. The first is *dressing* the roots; i.e. cutting back to where

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the sap flows those roots that had been split, torn, or bruised when the tree was lifted. If, to correct a flaw, a root had to be pruned on one side of the tree, then, in the interest of symmetry, roots of the same length on the opposite side also must be pruned, even though it's harmful to the tree. In the end, roots excessively shortened this way don't extend enough to hold the tree in place. Above all, they are insufficient to provide necessary nourishment, and the tree itself must be cut back. This second operation, an inevitable consequence of the first, is no less disastrous. The branches are cut to the same extent that the roots were; and sometimes not even one is left. And that's not all. Those who are not content just to get rid of branches often even top the trees. This perverse principle is so widely accepted among so many growers that it's become a maxim that "if a gardener were to plant his father, he would have to cut off his head and feet". Even though the results are different, they are no less injurious to plants that have been submitted to this cruel operation.

A topped tree whose roots have been shortened grows more vigorously than one planted with its top during the first years after planting; but it almost always contracts a disease that shortens its life, decreases the value of its wood, and distorts its appearance. The disease, usually called *la goutière*, is a form of decay that decomposes the heart of the wood. It's caused by rainwater penetrating through cracks that inevitably form in the scar left behind after topping the tree.

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The water is not drained off by sap vessels. It gets into the pith of the tree and rots it. The decayed pith eats away the layers of wood around it, and with time the whole inside of the tree rots. The disease progresses much more quickly in trees that are regularly topped, such as elms, ash trees, oaks, mulberries, and especially willows. It happens equally to trees that have been topped only once, except for those planted very young. To remedy this very serious problem, and so that proponents of this type of planting can't get away with it unnoticed, they should take care to trim the scar almost perpendicular to the horizontal, at an angle of at least sixty to seventy degrees. Furthermore, the cut is made to face north so that it is less exposed to the sun. Lastly, some cover the cut with *unguent of Saint-Fiacre* or with a compound of wax and pitch called *plaster of W. Forsyth*. What an effort to cover up a bad job, and often without getting the desired result! Why not do it in a simpler and more natural way, where experience has yielded more satisfying results? All the trees planted for the last thirty years in the Garden of the Museum of Natural History in Paris, some twenty five thousand, and more than three hundred species and varieties, both domestic and foreign, were planted with their tops and with as many roots as possible. The method is quite simple and it is based on physical principles. At the outset, the trees in the nurseries were dug up carefully.

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The roots were lifted out cautiously so as not to split, tear, or bruise them. They were taken at their full length; the trees were transported right after digging them up, with the necessary care to avoid cramming them into the carts that carry them and bruising or breaking their roots. Upon arrival, they were planted after gently trimming the ends of broken roots. The whole live root-ball had been saved or merely trimmed at the edges. The tops of the trees were scrupulously preserved, pruning only the side branches. To relieve the roots of the burden and difficulty in supplying sap, and to protect them from too much wind, holes and trenches had been opened up well in advance so that the soil was properly prepared by exposure to the air, rain, and sun. Lastly, when planted, the roots were placed in their natural position, covered with loose soil carefully filled in to leave no empty spaces between them, attached with lead to hold them down well, and finally watered as needed. This is the way the trees along the great avenues in the new area of this garden were planted. Even though at that time the trees had trunks six to eight inches in diameter and were more than eighteen feet high, not a single one has died. Fifteen years after they were planted they have grown most beautifully and are in the best of health. This procedure is without a doubt more expensive than the usual one; there are increased costs for lifting,

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transport, and above all for making longitudinal trenches instead of holes. But the usual method actually turns out to be even more costly, if one takes into account the large number of trees that have to be replaced during the first three or four years after planting. Furthermore, what a loss to have to delay the outcome and to miss out on enjoying it! So, all things considered, there is pleasure and profit in planting at a price, loss and distress in planting cheaply.

Trees lined up in rows are planted ten to thirty feet apart from one another, depending on their nature. The largest, those that grow sixty to one hundred and twenty feet high, can be planted thirty feet apart; medium sized trees that grow thirty to sixty feet need twenty feet between them. Lastly, small trees that rise fifteen to thirty feet are planted ten feet apart.

It's well known, needless to say, that the type of ground and the kinds of trees will make a difference in these distances - they should serve only as approximations. The type of soil appropriate for trees in rows also must vary with the trees' ability to grow in it and with their preference for certain soils over others. In general, trees can be divided into three large groups: those of mountains, plains, and swamps. Those are the keys that indicate the right location for them; observation and experience determine the rest. If the saplings must be planted before winter in dry terrain and in a warm climate,

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the above precautions are especially necessary for trees that are to be planted in rows. In northern countries, it's only in cases where water flows in or the soil is submerged that this could be harmful.

Planting resinous trees presents some notable differences that deserve attention.

Firstly, pruning of any sort is harmful and should be carefully avoided; neither roots nor branches ought to be cut, and the tops of these trees especially must be spared. The time to plant them is not the same as that for other trees. The latter are planted during winter when the sap is resting and the trees are inactive. Resinous trees on the contrary need to be at the beginning of active growth to be transplanted successfully.

Resinous trees are planted at two different periods of the year: while they are active both in autumn and in spring. The best time is when they've already put out terminal buds about an inch long. They are lifted together with clods of earth as much as possible. If the planting site is more than a day's travel by road from the nursery, the trees are first planted in small wicker baskets that are put in the ground with them at their destination.

It's appropriate to lift them from the nursery with all their roots. If some of the roots don't have earth on them, instead of cutting them off, they should be carefully preserved and laid out in their original positions during planting.

Transplanted trees should not be too old nor too large. They will do well only if they're not past their fifth year and they're not more than ten feet high. As soon as they are

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permanently planted, it's useful to fasten the trunks to strong props to prevent them from being shaken by the wind. Without this precaution, many trees would be lost because the motion caused by the wind can break growing roots and this repeated disruption can kill the trees.

Resinous trees also can be planted with bare roots without earth on them, but as very young seedlings to be put in a nursery. In this case it is essential to keep their roots at full length and to shelter them carefully from contact with air. They're normally wrapped in fresh moss, which does the job perfectly. If the roots were left exposed to air, they would soon lose all their moisture, and they would become dry and brittle. In comparison with deciduous trees, resinous trees are more difficult to transplant. This has led to planting them in pots and bending the taproot around, which is usually pretty long, to avoid having to cut it off. The pots are then buried in a bed facing north and they can be changed as the trees become stronger. This procedure is still used for rare and delicate species. It's worthwhile following, and it completely accomplishes its purpose.

When evergreens four or five feet high are transported a long way, and it would be too costly to move them in earth, a little-known method is used that works perfectly. Before lifting the trees from the nursery,

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muddy soil, cow dung, and water are mixed in a tub and made into a pulp that is not too runny nor too thick. As lifting proceeds, the roots are soaked in the mixture right up to their base. They are left to dry a little in the air so that the blend adheres to them well, after which they are soaked a second time in the same mix, left to dry again, and soaked afresh. By virtue of these three successive immersions, a thick crust of the blend forms both on the roots and on the root hair. It protects them from the air and keeps them fresh and in good condition. When the trees are planted, the mixture washes off in the fresh soil and supplies the young roots with a nutritious humus that makes no small contribution to their taking hold again and to their vigor. Thirteen coastal pine trees prepared this way traveled for eleven days and were planted on the hill of the Museum's garden. They are still vigorous thirty years later.

This method ought to be used for many delicate trees that have a hard time taking root again; it can't help but be effective.

The distance apart that the trees are planted, their aspect, their proper site, and the type of soil vary with different species. Some like clayey and wet ground; others prefer sandy and dry soil. Some live on high mountains, and yet others in muddy swamps. Their sizes range all the way from a bush to the tallest tree. You'll find the necessary information for growing each one of them in this book.

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For large-scale cultivation of resinous trees, it's by all accounts more advantageous to sow them as seeds, rather than to transplant them.

Non-resinous evergreens like holly, laurel, *phillyrea*, alatern, etc. also have a hard time taking root after transplanting. For this reason they're almost all grown in pots, and the roots are planted with the earth on them. Trees raised this way can be planted all year, except during frost. If they've grown up in open country, they should be lifted with earth on them, planted in wicker baskets, and allowed to take root in a shady spot. After it's certain that they've rooted again, they're planted at their final location. The most favorable season for planting evergreens in baskets is mid-spring, when the sap begins to rise. If they're transplanted before or after this period, the young trees remain inactive for a long time and a large number often perish. The less their roots and branches are cut, the better. For the trees to grow successfully, it's advantageous to avoid planting them when they're too old; it's hard for aging trees to take root again. Ordinarily, one chooses healthy trees six to eight years old and four to six feet tall, with trunks not more than three inches in diameter at the base. But this rule has exceptions. Trees like the holly take root best when they're about the size of one's lower leg, but this is most unusual.

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Lastly, some evergreens, despite all the care taken during transplanting, will still only take root with difficulty, perhaps only one in ten. It's preferable to sow seeds for these kinds of trees at their permanent location. To be on the safe side, one could stratify the seeds and plant only those that have germinated well.

Paris, August 18, 1824

A. THOUIN,

Professor at the King's Garden.

SERVICE TREE.

[28]

Family: ROSACEAE.

Reproductive system: ICOSANDRY, DIGYNY.

The broad-leaved service tree, *Cratægus latifolia*, Lam. [*Translator's note*: now *Sorbus latifolia*] is a tall tree that grows wild in the forest of Fontainebleau. It has grayish bark and hard, white wood. The leaves have short petioles; they're wide, rounded-oval, and angular with dentate margins. Their upper surface is green; the lower surface is whitish and cottony. The flowers are white and form corymbs. The corolla has five rounded petals. A large number of stamens insert into the calyx, which is adherent to the ovary. The fruit is a small apple that's yellowish-red and has a sharp, bitter taste. The seeds within it are gristly.

The common service tree, or whitebeam, *Cratægus aria*, Linn. [*Translator's note*: now *Sorbus aria*] is a large shrub in cultivated areas; On mountains it grows naturally as a not very tall bush tree. The leaves are oval, petiolate, somewhat stiff, dentate on the margins, green above, whitish underneath and cottony as are the petioles and the calyx. The flowers are white, form corymbs, and have branching peduncles. Their petals are rounded, there are numerous stamens, and the ovary is adherent. The fruits when mature are small red berries that contain gristly seeds.

FLOWERS: in May and June.

RANGE: France and part of Europe.

NOMENCLATURE. *Cratægus* is derived from a Greek word meaning *strength* because of the hardness of the service tree's wood. *Aria* is a name used by Theophrastus to denote an unknown tree.

Colloquial French, *l'alouche of Burgundy, le dreuillier, le sorbier des Alpes*. German, *der mehlbeerbaum*. Danish, *axelbær*. English, *white beam tree*. Italian, *il sorbo peloso*. Russian, *bieloi bojaryschnik*.

The American service tree, *Crataegus arbutifolia*, Lam., is a shrub acclimatized in parks and springtime gardens. The leaves are pointed, oval with dentate margins, smooth and green on top, cottony and whitish underneath. The flowers are white and arranged in corymbs. They're succeeded by shiny, deep black berries.

FLOWERS: in May.

RANGE: North America.

USES. The wood of the first two species is hard, white, and fine-grained. It's used in wheelwright's work and is highly prized by lathe-workers and carpenters. Both of these species, as well as the one from America, enhance our parks with their flowers in springtime and the different colors of their fruit in the autumn.

CULTIVATION. Service trees thrive in all areas, but they prefer loose soil and open sites with a southern exposure. They are propagated with seeds, by grafting, and by layering, but seed planting is the most favorable. It yields plants in the greatest abundance as well as the best-looking ones. The seeds often germinate only in the second year.

KEY TO PLATES.

561. Broad-leaved service tree. 1. Longitudinal section of calyx with stamens and pistils. 2. Fruit, natural size.

562. Common service tree. 1. Calyx, stamens and pistil.

563. American service tree. 1. Cross section of fruit.

ALDER.

Family: AMENTACEAE. [*Translator's note: now BETULACEAE*]

Reproductive system: MONOCY, TETRANDRY

The common alder, *Alnus glutinosa*, Gaertn., is a tree that grows forty or fifty feet high. The bark on its trunk is thick, brown, and fissured. The leaves are petiolate, oval, blunt, more or less truncate at the tips, crenate on the margins and sticky when they're young. The flowers are monoecious. The male flowers, in pendent cylindrical catkins composed of scales, are three at a time underneath each scale, with a calyx of four lobes and four stamens. The female flowers are in rounded catkins composed of blunt wedge-shaped scales that are persistent and spaced apart when mature. The flowers are two by two underneath each scale. The fruit is a pericarp with two lobes and two seeds and no membranous wing on the edge.

FLOWERS: in February and March.

RANGE: France, along streams and in damp areas.

NOMENCLATURE. German, *die erle, orle*. English, *the alder-tree*. Italian, *ontano*. Spanish, *aliso*. Dutch, *etzeboom*. Russian, *olcha*. Polish, *olsza*. Hungarian, *eger-fa*.

USES. The wood of the alder tree has a reddish hue shortly after it's been cut down, but that color soon fades. It remains light pink, bordering on yellow when it's dry. It weighs about eighteen kilograms a cubic foot. It's uniformly and finely grained. Lathe workers and cabinet-makers put it to a variety of uses. A feature of the wood is that it can be kept in water for centuries without alteration, which makes it most suitable for building underground water conduits out of its trunk and for use as pilings. Very handsome chairs are made in Scotland out of wood from the tree's roots, which is attractively veined.

A decoction made of its bark, mixed with ferruginous solutions, yields a black color.

The glaucous alder, *Alnus glauca*, Mich., is a tree of the United States, remarkable for the color of its leaves. It grows about twenty feet high. The bark is very dark brown. The leaves are oval, bidentate, green above and bluish underneath. The male flowers form long slender catkins. The female catkins are rounded, almost sessile, two or three together. Their peduncle has two large stipules at its base.

FLOWERS: in February and March.

RANGE: North America, acclimatized in our gardens.

CULTIVATION. Alders are very hardy. They grow rapidly in wet areas and proliferate abundantly via seeds. To plant the seeds, the cones are collected around mid-October. When the scales begin to open, they're spread out in a very dry place. When spring arrives and the time for planting is at hand, the cones are put in a sack and shaken vigorously to release the seeds.

KEY TO PLATES.

Common alder. 1. Leaf, natural size, seen from below. 2. Male catkin. 3. Cross section of female catkin showing insertion of seeds. 4. Detached scale of female catkin. 5. Seed.

Glaucous alder. 1. Female catkin. 2. Scale of female catkin. 3. Ovary.

TREE OF HEAVEN.

Family: TEREBINTHACEAE [*Translator's note*: now SIMARUBACEAE].

Reproductive system: MONÆCY, POLYANDRY

The Tree of Heaven, *Ailanthus glandulosa*, Desf. [*Translator's note*: now *Ailanthus altissima*], is a tall tree with grayish bark. The leaves are large, winged, and consist of five or six pairs of leaflets plus an unpaired one. The leaflets are oval-lanceolate, pointed, with one or two teeth at the base and a gland underneath each tooth. The flowers are arranged in straight terminal panicles. They're dioecious or polygamous. The male flowers have a calyx with five teeth, five concave petals with central veins, and ten stamens. The female or hermaphroditic flowers additionally have a lateral style, a broad stigma, and five superior ovaries that turn into five compressed fruits. The fruits are membranous, oblong, narrow at both ends, indented on one side, and contain an osseous seed at the center of the pericarp.

FLOWERS: at the beginning of summer.

RANGE: China. Acclimatized in parks and ornamental gardens in a large part of Europe. The seeds were sent from China by Father d'Incarville around 1751 [*Translator's note*: Pierre Nicolas Le Charon d'Incarville, 1706 - 1757, Jesuit missionary and botanist].

NOMENCLATURE. At first this tree was believed to be the Japanese *fasī-no-ki* and the *rhus vernix* of Linnaeus. But after it flowered and yielded fruit in Europe, it became clear that this tree is different from the lacquer tree of Japan [*Translator's note*: now *Rhus verniciflua*, a sumac], and that they couldn't even be included in the same genus. A dissertation on this subject by M. Desfontaines can be found in the Proceedings of the Academy of Sciences of 1786.

USES. The tree's wood is white with a very fine grain. In 1810 I cut one down in my garden. In 1819 its trunk provided wood for a writing desk that was as white as that of our linden tree but with a more compact and satiny texture.

It would be worthwhile to promote cultivation of this tree in our forests because it grows quite rapidly and its wood is sturdy, especially if it's allowed to dry out before using it.

The trunk of my Tree of Heaven provided an opportunity for an experiment on the preservation of wood. After cutting it down in 1810, I divided the trunk into three portions. One was buried three feet down, a second was placed in an open shed sheltered from the sun and rain, and the third was left on a garden path exposed to all the seasonal changes in weather. Three years later I cut these three pieces of the Tree of Heaven open. The buried one had the heaviest wood per volume; it was the most solid and had the finest grain. The one that had been lying in the garden yielded the worst wood. Nevertheless that's the way that our most valuable wood for shipbuilding is often stored.

CULTIVATION. The flowers emit an unpleasant odor. The roots spread widely like those of the sumacs. The tree is readily propagated from suckers and even from root sections.

KEY TO PLATE.

660. Tree of Heaven. Flower prior to opening. 2. Male flower, open and intact.

BIRCH.

Family: AMENTACEAE. [*Translator's note: now BETULACEAE*].

Reproductive system: MONOCY, TETRANDRY.

The white birch, *Betula alba*, Linn., is a large tree when it's in good soil, but it's a smaller one on high mountains. Its trunk is covered with smooth white bark. The branches are slender, pendent, and have smooth light green leaves that are oval, almost triangular, with serrate margins. The male flowers form cylindrical catkins that consist of overlapping scales and have twelve stamens. The female flowers form oblong catkins with three-lobed scales. They have two ovaries that turn into two capsules with a monospermous seed compartment, since one compartment fails to develop. The seed has a membranous margin like that of the elm.

FLOWERS: in July.

RANGE: Europe, in the worst of terrains. It's found in the Alps above the tree line, but it's small and stunted.

NOMENCLATURE. *Betula* is derived from *betu*, Celtic for birch. German, *birke*, *birkbaum*. Dutch, *berk*. English, *the birch tree*. Italian, *maio*. Russian, *beresa*. Hungarian, *nyir-fa*. Tatar, *kain*. Lappic, *sake*. Greek, *symyda*.

USES. The sap of this tree, obtained via incisions made in the trunk toward the end of winter, formerly was touted as a good remedy for pulmonary consumption and for obstructions and disorders of the urinary tract. But nowadays it's gone out of favor, just as its leaves and bark, which had been given for intermittent fevers.

Birch wood has a number of commercial uses. It has a very fine grain and polishes well.

A cubic foot weighs about twenty-four kilograms. It's used by carpenters, in cabinetry, and by makers of wooden shoes. It burns rapidly with a clear flame. Because trees are scarce in Lapland, the birch tree is a great resource for Laplanders; they use the bark for tanning leather, making ropes, lines, coats, and even shoes.

The black birch, *Betula nigra*, Linn., is a tree fifty to sixty feet high. Its trunk grows very large. The leaves are wide, doubly serrate, pointed, downy underneath and entire at their base.

FLOWERS: in July.

RANGE: Virginia; acclimatized in our large gardens.

USES. The wood of this tree is put to better use than that of the white birch. The inhabitants of Canada use the bark to make baskets, portfolios and light canoes that can be portaged by one person from one river to another.

CULTIVATION. Birches prefer rich and somewhat cool soil. They're propagated by seeds, layering, grafting, and even by cuttings. The seeds should be sown as soon as they are mature. A black birch bud shield grafted on a white birch succeeds very well.

KEY TO PLATES.

White birch. 1. Male and female catkins. 2. Scales of the male catkin. 3. Stamens. 4. Scale of the female flower. 5. Seed.

Black birch. 1. Catkin of male flowers.

CEDAR.

Family: THE CONIFERS [*Translator's note*: now PINACEAE].

Reproductive system: MONOECY, MONADELPHY

The cedar of Lebanon, *Pinus cedrus*, Linn., [*Translator's note*: now *Cedrus libani*] is one of the most remarkable trees in nature. Its longevity, great height, and the magnificence of its foliage made it famous in remotest antiquity. Its trunk is straight, the boughs are arranged in tiers and are covered with numerous fine, closely-set evergreen leaves. The top or summit of the tree always points and is inclined toward the north. It's about a hundred feet tall; the trunk sometimes is thirty feet in circumference. Nevertheless it grows slowly during its first eight or ten years, but afterwards it grows very rapidly. Duhamel Dumonceau planted a cedar at Denainvilliers [*Translator's note*: his family estate, about 80 km. south of Paris] in 1743. In 1753 the circumference of the tree measured no more than two feet four inches. When I measured that same tree in 1822, its circumference was nine feet eight inches. The flowers are monoecious; the male flowers form sessile catkins made up of scales. On their undersurface there are two sessile anthers in one compartment. The female flowers are arranged in an oval catkin that turns into a cone made up of thin scales that cover two monospermous seeds, each terminating in one wing. The fruits or cones are positioned vertically on the branches.

FLOWERS: in May.

RANGE: The mountains of Lebanon, Syria, and mountains in Armenia.

NOMENCLATURE. Some authorities believe the word *cedrus* is derived from two Greek words that mean *to burn* and *fragrant*, because the wood emits a pleasant aroma when it burns.

Others think that it comes from *Cedrea*, a town at the foot of the Taurus mountains on which this tree grows. German, *zeder*. English, *cedar*. Russian, *kedr*. Polish, *cedr*. Hungarian, *tzedrus-fa*. Arabic, *serbin*. Hebrew, *acres* [*Translator's note: the common Hebrew word for cedar is erez*].

USES. This is one of the most beautiful trees that could possibly be used to decorate parks and large gardens. But it looks best when it stands alone - it's not well situated in a grove. The wood is reddish, aromatic and said to be resistant to decay. It's believed to be suitable for construction and shipbuilding. A resinous substance exudes naturally from its trunk and branches.

CULTIVATION. The trees are propagated by planting seeds at the beginning of April in pots or in frames filled with very finely divided compost mixed with sand, being careful to keep them only lightly covered. The seedlings are watered occasionally during dry periods and protected from direct sunlight. They're not permanently planted until they're about five or six years old. Springtime is the preferable season. Great care must be taken not to break or damage the tops. As a rule this tree is extremely delicate during its early years. To the greatest extent possible it must be planted sheltered from south and east winds. It grows quicker and much better in poor soil that's chalky and sticky than it does in good earth.

KEY TO PLATES.

Cedar of Lebanon. 1. Detached scale from male catkin. Same, front view and stamens.

Fruit of Cedar of Lebanon. 1. Scale separated from the fruit, external view. 2. Same, inside view showing the two seeds. 3. Detached seed.

HORNBEAM.

Family: AMENTACEAE [*Translator's note: now BETULACEAE*].

Reproductive system: MONOECY, POLYANDRY.

The common hornbeam, *Carpinus betulus*, Linn., is a tree with a trunk twenty-five to thirty feet high in our forests. Its bark is smooth and gray, spotted with white. The leaves are oval, smooth, veined, and unevenly dentate on the margins. The flowers are monoecious. The male ones form pendent cylindrical catkins with sharp concave scales; each scale covers eight to fifteen stamens. The female flowers form loose catkins with sharp, trilobed lanceolate scales enclosing two ovaries crowned by a calyx of four or six sections. The fruit is a monospermous nut, since one compartment fails to develop.

FLOWERS: in March, April, and May.

RANGE: the forests of France and Europe.

NOMENCLATURE. *Carpinus*, from two Celtic words meaning *wood suitable for making yokes*. German, *hagebuche*. Danish, *avenbög*. English, *the horn beam tree*. Spanish, *carpe*. Russian, *grab, grabina*. Bohemian, *habr*. Hungarian, *gyorttyan-fa*.

The hop hornbeam, *Carpinus ostrya* [*Translator's note: now Ostrya carpinifolia*], is a tree resembling the one above. Its leaves are oval, wrinkled, with sharp uneven teeth on the margins. The flowers are monoecious. The female catkins are cone-shaped, quite similar to the fruit of the hop, and consist of flattened capsules.

FLOWERS: in May.

RANGE: Italy; cultivated in France for a long time.

USES. Hornbeam wood is highly prized for heating, and it's often used for artwork because of its durability. It's used for making mill wheels, levers, tool handles, mallets, etc. A cubic foot weighs about fifty pounds.

Hornbeams are planted to cover garden walls. With its numerous branches and its ease of transplantation the tree lends itself to being fashioned in any way one would wish.

CULTIVATION. Hornbeams often are propagated from suckers, but seed planting is the preferred way. In this case the seeds must be sown as soon as they are mature, in gentle, natural well-loosened soil and kept somewhat in the shade. The young hornbeams are placed in a nursery around their second year and permanently located about the third or fourth year.

KEY TO PLATES.

1. Common hornbeam. 2. Male catkin. 3. Scales and stamens. 4. Intact fruit. 5. Detached capsule.

1. Hop hornbeam.

CHESTNUT.

Family: AMENTACEAE. [*Translator's note: now FAGACEAE*].

Reproductive system: MONOECY, POLYANDRY.

The cultivated chestnut tree, *Castanea vesca*, WILLD. [*Translator's note: now Castanea sativa*], is one of the large trees of our oldest forests. Its trunk grows to an extraordinary size. One on Mt. Etna, for example, is about fifty feet in circumference. The leaves are oblong, pointed, and have serrate teeth that are set apart. The male flowers and the hermaphroditic flowers are separate on the same plant. The male flowers form very long, cylindrical yellow catkins. The flower has a calyx in six sections and twelve to twenty stamens. Two or three hermaphroditic flowers combine in an involucre of four sections bristling with branching spines. Their calyx has five or six sections and is situated on top of the ovary. The stamens are sterile and are concealed inside a thick cottony material. There are six cartilagenous styles. The ovary is inferior. It has six compartments with two ovules in each. The fruit is a pointed nut without valves and contains one or two seeds.

FLOWERS: in July and August.

RANGE: France and Europe.

NOMENCLATURE. *Castanea*, because the tree appears to originate to have come from the region of the town of *Kastanéea* in Thessaly, located near the Pineós river. German, *der kastanienbaum, kestenbaum*. English, *chestnut-tree*. Spanish, *castano*. Russian, *keschtan*. Polish, *kasztan owoc*. Hungarian, *gestenye-fa*. Chinese, *lie tsu*.

USES. The wood of the chestnut tree is very useful in civil construction. It's supple, heavy, and resilient. It makes very durable joists, beams and rafters.

Groves of chestnut trees are a useful asset, especially in wine country. They supply wood for hoops for vats and barrels, vine props, and lattices for fences.

The fruit of the chestnut tree is a source of food for the inhabitants in several parts of France during much of the year. Chestnuts are eaten boiled, roasted, or ground into flour to make very nutritious pancakes. The large sweet chestnut, the *marron*, differs from the wild one only in size, roundness, and in quality, depending largely on the soil where the tree grows. Those from Luc en Provence and from Dauphiné that are sold in Paris under the name *marrons de Lyon* are highly regarded.

CULTIVATION. Duhamel believes that flute grafting is the best way to propagate good varieties of *marron* chestnuts. Chestnut trees are propagated by planting seeds in the autumn. They're either left to stay in the ground where they had been planted, or they're transplanted after four or five years into holes a meter wide by a meter deep that had been dug ahead of time. The saplings must be carefully pruned and the grove tilled every year just as for young grapevines.

KEY TO PLATE.

1. Cultivated chestnut tree.
2. Male flower and stamens.

OAK.

Family: AMENTACEAE. [*Translator's note: now FAGACEAE*]

Reproductive system: MONOECY, POLYANDRY.

The oak tree is the finest adornment of our forests with its thick foliage and majestic bearing. It has always been a symbol of strength. Our ancestors the Gauls called it the tree *par excellence*, because the sacred mistletoe that they revered was found on its trunk or on its branches. The Greeks had consecrated the oak tree to Jupiter, the most powerful of the gods. The Romans awarded a crown of oak leaves to whomever had saved a citizen's life.

In France there are several species of oaks that are difficult to tell apart because their leaves and fruit vary with the quality of the soil. Furthermore, a knowledgeable professor, M. Desfontaines, points out that most authors who have written about oak trees have them confused, mistaking varieties for species and true species for varieties. Several oaks from North America and from the Levant do very well in France. I've seen some of them at Rambouillet and in several other large parks that yield fruit as well as they do in their native lands. But in this article I'll discuss only those that are indigenous to our own forests. They can be divided into two sections: those with deciduous leaves, i.e. that lose their leaves in winter or in spring, and those with evergreen leaves.

SECTION ONE

OAK TREES WITH DECIDUOUS LEAVES

The oak tree with sessile acorns, [*Translator's note: the common, English, or European oak*], *Quercus robur*, Linn., is a tall tree with a smooth trunk when it's young, but rough and grayish when it's old. The leaves are petiolate, oval-oblong, wavy on the margins, pinnatifid, with blunt lobes. The flowers are monoecious. The males ones form

loose, pendent catkins. Their calyx is divided and contains five to ten stamens. The female flowers have an involucre consisting of several overlapping scales that form the cupule of the acorn. The ovary is adherent to the calyx; it has three compartments with six seeds contained in three ovules, two of which regularly abort. It becomes a unilocular monospermous nut set into the cupule, forming an acorn as in all the other species of the same genus.

Several oak trees with distinct names should be thought of as belonging to this same species. For example, the oak with indented leaves, the black oak of Fontainebleau, which has larger acorns and leaves that are downy underneath, the *chêne à crochets* whose fruit is grouped in clusters, and the hillside oak, which grows in dry, rocky areas. It has sessile acorns and leaves that are slightly downy above and velvety underneath.

USES. The wood of the common oak is used in almost all of our civil construction and no less so in shipbuilding. It's made into beams, rafters, keels for ships, the gates for locks, etc. Duhamel's writings list the many benefits derived from the oak tree and its cultivation. The bark of this species, like that of several others, is used for tanning leather. It's also used medicinally, and it's believed to be one of our best native tonics. Cullen extols the effects of a decoction of the bark for mild swelling of the mucous membranes of the pharynx, and it frequently has stopped the onset of recurrent fevers.

The oak tree with pedunculate acorns, *Quercus pedunculata*, Hoffm., often had been confused with the preceding tree. [*Translator's note: Quercus robur and Quercus pedunculata now are often described as the same species*]. It differs from it in that its acorns are borne on a fairly long peduncle, its leaves are wider at the tip, and the lobes are less deeply indented. Its wood weighs only twenty-four to twenty-five kilograms a cubic foot. In any case, forest rangers call the latter tree *gravelin*, *merrain*, or female oak. They've observed that its wood is less knotty

than that of the common oak, and it's more easily split. Thus it's preferable for slats, wood flooring, furniture, and various other kinds of carpentry. Both species grow to a great height and their trunks become enormously large, although that depends on the soil in which they grow. The common oak prefers slightly gravelly soil; the other one likes fertile soil with some depth.

Since the two species often have been mistaken for one another, and consistently still are, the following properties can apply to either of them.

FLOWERS: in May and June.

RANGE: France and part of Europe.

NOMENCLATURE. In Celtic the tree is called *derw*, from which the name *Druides*, or priests of the oak tree, seems to have originated. Greek, *drys*. German, *die eiche, eecke, steineiche*. Dutch, *eik*. Danish, *eeg*. English, *the oak*. Italian, *quercia, rovero*. Spanish, *roble, carballo*. Russian, *dub*. Hungarian, *toly-fa*. Tartar, *éman*. Turkish, *mesché*. Kalmuk, *chara-modou*.

USES. Acorns over time have been used for food. They were resorted to during the famine of 1709 [*Translator's note:* the winter in Europe was extremely cold that year; crops failed and many lives were lost]. But historians report that as food they caused serious complications. There also have been attempts to use them medicinally, especially for recurrent fevers and for consumption, but apparently the results were unsatisfactory. Aqueous decoctions or powders of oak bark are administered in doses of an eighth of an ounce in preserves or in honey. The decoction is prepared by boiling an ounce of the material in about a pint of water.

Several kinds of animals, such as pigs, sheep, and wild animals eat acorns and derive nourishment from them during part of the winter.

During my visit to England, I noticed that they made a great case for the English oak, and they considered its wood to be superior to that of all the European oaks. This preference is simply a result of their national prejudice for everything English. However, their view is not entirely groundless,

because the wood of the English oak has been compared only with that used by the royal navy, which usually comes from Danzig. That wood is soft and doesn't withstand extended service in seaports. But if English oak wood had been compared with that of our own southern provinces, there would be a difference in favor of the latter even greater than that between the former and oak from northern Europe. I'm convinced that the best ships of the English navy were built in Toulon or in Spain.

The pyramidal oak, *Quercus fastigiata*, Lam. [*Translator's note*: now classified as a variety of *Quercus robur*; the cypress oak]. This species resembles the oak tree with sessile acorns in its quite deeply indented leaves and the other tree in its pedunculate acorns. But it differs from these two species in its short, almost absent petioles, in the arrangement of its branches that form a very acute angle with the trunk, in its slender, pyramidal habit, and in its leaves that fall off at the beginning of winter. In the other two species the dry leaves remain on the tree until spring.

Range This oak tree is found in the Pyrenees, in lower Navarre, and in the vicinity of Bordeaux. It's thought to have come from Portugal.

Uses. Its slender shape, like that of the Italian poplar tree, makes it suitable for the enhancement of large parks and country gardens. In our nurseries it's grown from seeds, and it's successfully grafted on the sessile acorn oak tree and on the pedunculate acorn oak tree.

The Turkey oak, *Quercus cerris*, Linn., is a tree eight to ten meters high. Its trunk generally is knotty and twisted. The leaves are oblong, almost smooth, whitish and slightly downy underneath, and are indented with somewhat pointed lobes. The fruit is small, sessile, and half covered with a bristly cupule.

The oak tree called *crinite* [*Translator's note*: i.e. like horsehair] because its cupule is covered with long shaggy hair, seems merely to be a variety of the Turkey oak, as is the Burgundy oak, which differs only in its straighter and less knotty trunk, its leaves covered underneath with white hair, and its pedunculate fruit close together in pairs.

The acorns, like those of the Turkey oak, remain on the tree for two years.

The Angoumois oak, [*Translator's note*: a former province in west central France], *Quercus tauza*, Desf., [*Translator's note*: or *Quercus toza*] has very firm pinnatifid leaves. The lobes often are uneven, whitish and cottony underneath and very downy on top. The acorns are on axillary peduncles, and their cupules are not at all bristly.

This oak tree grows twenty to twenty-four meters tall. Its wood, which is hard and knotty, can't be used for slitwork but it's valuable for construction and for heating. The new branches, supple and flexible, are used to make hoops for vats and barrels. The acorns are sought after for pig food. M. de Secondat believes that this was the true oak tree of antiquity.

Range The moorlands of Bordeaux and several other parts of France.

"The brush oak, in the vicinity of Angers, doesn't differ from the Angoumois, or *tauzin* oak" says M. Desfontaines. "Nor does a small stunted oak tree that's very common in the moorlands of le Temple near Nantes that some botanists have mistaken for a separate species". It's easy to be convinced that this observation is correct when the different branches of these varieties of oak trees preserved in that professor's herbarium are compared. Besides, the size of the *tauzin* and the shape of its leaves vary depending on the soil in which it grows. It has the advantage that it can be grown on dunes and can fertilize arid and uncultivated terrain.

SECTION TWO.

OAK TREES WITH EVERGREEN LEAVES

The holly oak, *Quercus ilex*, Linn., is a medium sized tree, twisted and very branchy. Its wood is heavy; the bark on its trunk is thin, smooth or slightly cracked. The leaves are petiolate, oval-lanceolate, entire

or dentate on the margins, smooth and sleek on top, often downy underneath. Their shape generally is very variable.

Flowers: in May and June.

Range. This tree grows naturally all over southern France. It's also found in Noirmoutiers [*Translator's note:* an island off the Atlantic coast of France, south of St. Nazaire].

Nomenclature. The name *yeuse* comes from *iw*, a Celtic word meaning green, because the leaves are evergreen. It's even called quite simply *green oak*. German, *die grüne eiche*. Dutch, *groeneik*. Danish, *grøn eeg*. English, *the evergreen oak-tree*. Italian, *elce, elcina*. Spanish, *encina*. Portuguese, *azinheiro*.

Uses. The wood of the holly oak is very compact and long-lasting. It's used to make axles, levers, pulleys on ships, etc. The bark is used for tanning leather. The tree grows slowly, but it lives for several centuries. Pliny claims that there was one on the Vatican hill [*Translator's note:* a hill outside Rome, formerly an Etruscan community, now the site of Vatican City] that was older than the city of Rome.

Cultivation. The holly oak is propagated by planting the acorns right after they fall in the autumn. The tree must be transplanted when it's very young because it takes root with difficulty when it's more than three or four years old. In northern France it's vulnerable and is often damaged by cold in harsh winters.

The cork tree, *Quercus suber*, Linn., is ten or twelve meters high. Sometimes its trunk is very large in diameter. The bark is extremely thick, spongy, and cracked. The leaves are oval-oblong and most often dentate, especially at the tip. They're a glaucous green on top, whitish and downy underneath. The acorns are oblong and are two thirds covered with a conical tuberculate cupule.

Flowers: in May.

Range: southern Europe and the southern departments of France.

Nomenclature. Some scholars say that *suber* is derived from *sub*, which means *underneath*, because women in antiquity used it for the soles of their shoes. According to Vossius, it comes from a Greek word meaning *bark*.

Furetières says that it comes from the Latin *levis*, i.e. light, which in Italian became *liève*, and in French *liège*. German, *korkeiche*, *korkbanne*. Dutch, *korkboom*. English, *the cork-tree*. Italian, *suvero*. Spanish, *alcornoque*. Portuguese, *sovereiro*.

Uses. The wood of the cork tree is very compact and extremely strong. It's used by wheelwrights and for various kinds of lathe-work. Everyone is familiar with the uses for its bark. It's made into cork stoppers, soles for shoes, floats to support fish nets, life vests for swimmers, etc. According to Duhamel, the bark is only suitable for making corks when the tree is twenty-six to thirty years old. He claims that a cork tree stripped of its bark every eight or ten years can survive another hundred and fifty years. July and August are the preferred months for this procedure. The bark is cut longitudinally at intervals down to the root collar using an axe with a handle that has a wedge at the end. A circular incision then is made at each end of the cuts. The bark is struck to loosen it, and it's lifted off by inserting the handle of the axe between the bark and the wood, taking care to leave behind a few layers of sapwood without which the tree will inevitably die. When this job is done, the cork is divided into strips, its surface is scraped smooth, and it's flamed to contract the pores. Good quality cork is firm, supple, springy and has a reddish color. Cork was known in antiquity and according to Pliny it was used in the same ways. Regrettably we have neglected the cultivation of cork here, but it can't be otherwise as long as the government allows the importation of cork stoppers from abroad. Our growers in the south won't do anything to promote the growth of the trees and augment the amount of their bark.

Cultivation. The tree is propagated from seeds as is done with other species, but in open ground it does well only in our southern departments. In Paris it must be kept in a conservatory.

The kermes oak, *Quercus coccifera*, Linn., is a small branchy twisted tree. The leaves are oval, small, smooth, shiny, and bordered with spiny teeth that are quite similar to those on holly leaves.

The small fruit is set quite deeply into a cupule that bristles with stiff, open woody points.

Flowers: I've seen it flowering in May in the south of France.

Range: southern France. I've seen it used to make a living hedge to separate fields from the highway between Avignon and Vaucluse.

Nomenclature. The name *coccifera* comes from *coccus* [*Translator's note:* the Latin word *coccum* refers to the berry of the scarlet oak, *Quercus coccifera*] and from *fero*, to bear, because from this small oak tree insects were gathered called *scarlet seeds* because of the colored dye extracted from them [*Translator's note:* one of the oldest dyes known]. The Arabs call it *qermez*, meaning *a little worm* in Arabic, and *qermezy*, the red color that it produces, which is where we get our word crimson. The word even was pronounced *kermezy* in former times. Our word vermilion comes from *vermiculus* [*Translator's note:* a little worm], the name the Romans gave to this insect. The kermes oak tree in German is called *die kermeseiche*. Dutch, *kermesboom*. Italian, *elce*, *elcina*. Spanish, *encina*, *encina verde*. Portuguese, *azinheiro*, *azinho*.

Uses. In certain regions of the south of France the bark of the kermès oak is used for tanning leather. The insect that gives this species of oak tree its distinction, (*Coccus ilicis* [*Translator's note:* now also *Kermes ilicis*]) attaches itself to the young branches from which it derives its nourishment. When fully grown it's shaped like a little brown ball the size of a pea and covered with a white powder. The insects are collected as such and are sold to pharmacists who make the kermes syrup that's used medicinally as a tonic. The kermes insect also is tossed into vinegar, left to die, and later taken out and dried. It yields a red dye that becomes very bright when it's developed with alum. It's also very substantial, and it can be spread on fabric.

The bites of certain insects cause a particular kind of swelling that's called *gallnut* on several species of oak tree. This material formerly was thought to be a valuable cure. Hippocrates used it externally for disorders of the womb, and Galen cured recurrent fevers by administering it in a dose of an eighth of an ounce. Nowadays it's rarely used in medicine

except as an astringent and as a strong support to hold together ruptured tissues.

Gallnut is widely used in dyeing, both in Europe and in the East Indies.

CULTIVATION. Oak trees are propagated by acorns, which must be planted immediately or very shortly after they mature. The trees never should be pruned unless they have dead or broken branches. They must be left to grow on their own, and they will get larger and grow much taller. Nevertheless, when the trunk is large and the top has formed, the lower branches can be cut back without harm. But the trunk never should be laid bare by using a billhook. Dumont-Courset says "If in the district where I live our oak trees are no longer growing, we need only blame that on the relentless pruning that they undergo at the hands of the country folk who do it to get fuel to keep themselves warm. Each year the sap then is diverted to produce new shoots on the trunk, and only a very small amount reaches the top of the tree, which soon perishes for lack of sustenance and the strength to withstand strong gales. Besides, nature does not form limbs and branches on the trunk without reason. They provide storage for the sap, which then moves up to make the top of the tree grow."

It also can be noted that the roots of trees constantly interact with the branches. Reducing the latter impedes the origin and development of new roots that continually give trees their vigor and their means of growth.

Evergreen oak trees are very susceptible to cold in the north of France. Wherever possible, a location that's sheltered from the north wind and that has loose, slightly sandy soil must be chosen for them. When they're still young and they feel the cold very acutely, it's best to cover the base of the tree with litter and even to protect the trunk with straw matting.

KEY TO PLATES.

473. Oak tree with sessile acorns.

- 474. Oak tree with pedunculate acorns.
- 475. Pyramidal oak.
- 476. Turkey oak.
- 477. Angoumois oak.
- 478. Holly oak.
- 479. Cork tree.
- 480. Kermes oak.

CYPRESS.

Family: THE CONIFERS [*Translator's note: now CUPRESSACEAE*].

Reproductive system: MONOECY, MONADELPHY.

The common cypress tree, *Cupressus sempervirens*, Linn., grows fifteen or twenty meters high in our southern provinces. In one variety the branches are close to the trunk, but in another they spread out. This has led some authorities to believe that these are two distinct species. The leaves are smooth, green, persistent and imbricate on four rows. The male and female flowers are separate but both are always on the same tree. The male flowers form oblong catkins with membranous imbricate scales. The anthers are sessile beneath each scale. The female flowers join together into spheres consisting of woody, persistent scales and are borne on pedicels. The fruit is formed by scales joined together, beneath which are small monospermous seeds. It consists of a single compartment without valves.

FLOWERS: in May.

RANGE: The Levant. Naturalized in our southern provinces where I've often seen the seeds disseminate on their own.

NOMENCLATURE. According to some authorities the name comes from *Cyparissus*, a young lad who according to legend was transformed into a cypress tree. German, *der cypressenbaum*. English, *cypress tree*. Russian, *kiparisnoe derewo*. Polish, *cyprys drzewo*. Arabic, *alhama*.

USES. The wood is fragrant, hard, fine-grained, uniform, with a beautiful red color. It's virtually resistant to decay. The Egyptians preserved almost all of their mummies in cypress coffins. Thucydides says that the Athenians chose it for coffins for their heroes because it was long-lasting.

M. Fougereux observed that posts of this wood placed by Duhamel around a melon bed at Denainvilliers in 1709 remained quite intact after sixty years of use,

whereas those made of oak or of any other kind of wood had to be replaced every ten or twelve years.

In remotest antiquity the cypress was consecrated to the god of the dead. It was customary to enclose a cypress branch in the tomb of the deceased and to wrap the remains in its leaves. The cypress always has symbolized sadness and mourning. Ovid said in the words of the oracle of Apollo: [*Translator's note*: referring to Cyparissus, *Metamorphoses* 10, 126-142]

*We will mourn together now,
and you will mourn for others together with them in their grief.*

The pendent cypress, *Cupressus pendula*, Lhérit., [*Translator's note*: now possibly *C. lusitanica*] is a small tree with pendent limbs and branches. The leaves are small with sharp points and imbricate on four rows. The fruit is round.

FLOWERS: in May and June.

RANGE: Asia. Introduced into Portugal and from there to France.

NOMENCLATURE. Commonly, *cedar of Bousaco* [*Translator's note*: Buçaco (or Bussaco), an ancient forest in north central Portugal], Goa cypress.

CULTIVATION. These two cypress trees, especially the one from Portugal, are very vulnerable in northern France, but they withstand winters in our southern provinces. They're propagated by seed planting. They must be protected from cold when they're young, especially in the vicinity of Paris. Very few trees tolerate the sun's heat better than the Portugal cypress.

KEY TO PLATE.

454. Pendent cypress. 1. Opened fruit. 2. Seed.

455. Common cypress. 1. Male flower. 2. Scale and stamens. 3. Female flower. 4. Fruit, longitudinal section. 5. Seed.

CYPRESS.

Family: THE CONIFERS [*Translator's note: now TAXODIACEAE*].

Reproductive system: MONOECY, MONADELPHY.

The bald cypress, *Cupressus disticha* LINN , [*Translator's note: now Taxodium distichum*] is a very tall tree with a trunk that attains a large diameter. In 1822 I measured those at le Monceau planted by Duhamel in 1760 [*Translator's note: near his family estate at Denainvilliers*] alongside a small stream. Just a foot above the ground the trunks were eight feet in circumference. Dupraz, in his natural history of Louisiana, claims that he measured some that were twelve *brasses* around [*Translator's note: one brass is approximately 1.62 meters*]. Exostoses, or protuberances that look much like posts, grow up from their roots. The leaves consist of linear pointed leaflets that are distichous and close together. They're renewed every year. The male flowers are in catkins that are separate from the female ones. They have sessile anthers beneath each scale. The female flowers form a rounded or an oblong cone consisting of a shield of scales that cover the ovaries. The fruit is angular with no valves and with a single compartment.

Among the plantings in the garden at Rambouillet I've observed two noteworthy varieties of this tree, one with round fruit and the other with oval fruit. The latter is distinguished by its finer and more elegant foliage, which has long been known and illustrated. Both trees originated from seeds sent from America by Michaux Sr.

FLOWERS: in May.

RANGE: North America; acclimatized in our large parks for a long time.

NOMENCLATURE. *Disticha*, because of the placement of the leaflets. English, *deciduous cypress tree*.

USES. This tree ought to be propagated in the marshy woodlands of France where many of our native trees don't thrive. It would be greatly beneficial because the wood is suitable for a variety of uses. The residents of Louisiana make furniture and household utensils from the protuberances that grow from the roots.

CULTIVATION. The tree can be planted in damp and peaty areas; it's very common in the swamps around the Delaware River estuary. Those at le Monceau form an avenue alongside a small stream, and their roots extend into the water. The seeds of the tree come to us from America. They need to be sown in March in heath compost in a shaded area, taking care to water them frequently. Sometimes they won't come up until the second year. The seedlings should be protected from the sun and covered up in winter. The tree also can be propagated by layering, and it will grow again from the base after being cut.

KEY TO PLATES.

Bald cypress with round fruit. 1. Branch and new fruit. 2. Ripe fruit.

Bald cypress with oval fruit.

MAPLE.

Family: THE MAPLES. [*Translator's note: now ACERACEAE*]

Reproductive system: POLYGAMY, MONÆCY

Maples make up a very numerous genus, and they are widely distributed in both the old and new world. North America in particular has several species, some of which produce sugar. The limitations of this volume prevent me from describing them all. I will discuss only the most common and useful ones in our climate.

The common maple, *Acer campestre*, Linn., is a tree that grows twenty-five to thirty feet high on a trunk with hard, cracked bark. The leaves are opposite and are borne on long petioles. They have five lobes that are blunt at the tip and at their indentations. The flowers are small, yellowish, and are arranged in panicles. I've seen both hermaphroditic and male flowers on the same tree. The calyx has five deep indentations and the corolla has five petals. Eight stamens are inserted on a glandular circle surrounding the base of the ovary, which is surmounted by a style and two stigmata. The fruit is a capsule or samara with two compartments equipped with two widely spread wings.

FLOWERS: in April and May.

RANGE: France and Europe.

NOMENCLATURE. *Acer* comes from a Latin word meaning hard, because of the sturdiness of its wood. German, *der feldahorn*. Danish, *navr*. English, *the common maple*. Italian, *acero commune*. Russian, *klen*. Polish, *klon*.

The sycamore maple, *Acer pseudoplatanus*, Linn., is one of our beautiful forest trees. Its trunk is covered with a slightly reddish bark. The branches spread out and have opposite leaves that are broad and have five pointed lobes with blunt uneven teeth. The leaves are a beautiful green above

and are pale and glaucous underneath. The flowers form long pendent clusters. The eight stamens insert on a downy disk. The fruit has two wings that are very close together.

FLOWERS: April and May.

RANGE: France, in large parks and in forests.

NOMENCLATURE. German, *der bergahorn*. English, *the great maple*. Italian, *acero di montagna*. Tatar, *oerga*.

The striped maple, *Acer pennsylvanicum*, Linn. is remarkable for its decorative bark. The trunk is about thirty feet tall. It's straight, and it's green mottled with white. The leaves are large, terminate in three points, and are unevenly denticulate on the margins. The flowers form long pendent clusters. There are eight stamens that have short filaments. The fruit has two wings that are somewhat spread apart and are slightly convex.

FLOWERS: in April and May.

RANGE: North America; acclimatized in almost all of Europe.

The ash-leaved maple, *Acer negundo*, Wild., is a tree that grows about forty feet high. It has bushy foliage, and its bark is smooth when the tree is young. The leaves are winged. They have five oval leaflets that are pointed and dentate. The flowers are dioecious. The female flowers are grouped in pendent clusters. The male flowers have four, sometimes five stamens and are borne on long peduncles. The capsules or samaras are small.

FLOWERS: in April.

RANGE: North America; naturalized in France and in England.

NOMENCLATURE. German, *der aeckenahorn*. English, *the ash-leaved maple*.

The Montpellier maple, *Acer monspessulanum*, Linn., is a very branchy, not very tall tree with reddish bark. The leaves are small, opposite, divided into three pointed lobes and are most often entire. The flowers are clustered, numerous and not very decorative. The capsules have two straight wings that are not very far apart.

FLOWERS: in May.

RANGE: the south of France.

The Italian maple, *Acer opulifolium*, Villars, is a tree fifteen to twenty feet high with brown bark. Its wood is yellowish and veined when dry. The leaves are divided into three or five not very deeply indented lobes that are rounded and edged with blunt teeth. The flowers are pendent and are borne on long peduncles. The fruit has two wings that are almost parallel.

FLOWERS: in April and May.

RANGE: the vicinity of Grenoble, the les Baux regions in Dauphiné, where it's known as *ayart*.

USES. Maples are cultivated for the beauty and elegance of their foliage and for the benefit of their wood. The common maple has fine-grained wood. It's in demand by cabinet-makers and by lathe workers. The sycamore maple provides excellent wood for heating; it's white in color, marbled, and can be beautifully polished. It's used in several kinds of cabinetry and carpentry work. Sycamores are planted in rows and in groves. The striped maple makes a picturesque sight in large parks with its veined bark of green and white. Its wood is hard, white, and brittle. The ash-leaved maple reaches its maximum height in fifteen or twenty years. Its wood is saffron-colored with a light purple tint. M. de Cubières reports that the English make tables for instruments out of it. It can be used successfully for different kinds of marquetry, paneling, wainscoting, etc. The Montpellier maple is cultivated for decorating groves. Its trunk sometimes grows very big. The leaves fall only at the beginning of winter, and the fruit is tinged with a beautiful purple color before it matures.

The Italian maple provides excellent wood for wheelwright's work; a cubic foot weighs about eighty pounds.

CULTIVATION. Maples are propagated via their seeds that are sown as soon as they are mature. If one waits until spring to sow them, they won't come up until the second year. Maple saplings can be left in the seed beds for two years. After that they're placed in a nursery. In forests they most often will propagate on their own. All kinds of soil suit them, as long as it's not clayey and too difficult to penetrate.

KEY TO PLATES.

719. Common maple. 1. Cluster of flowers. 2. Male flower (enlarged). 3. Hermaphrodite flower, *same*. 4. Half of a capsule opened to reveal the seed.

720. Sycamore maple. 1. Cluster of flowers. 2. Flower enlarged and seen from below. 3. Stamens and pistil. 4. Half of capsule, natural size.

721. Striped maple in fruit. 1. Cluster of flowers. 2. Complete flower. 3. Part of the capsule and seed.

722. 1. Leaves of the ash-leaved maple. 2. Cluster of male flowers. 3. *Same*, female flowers. 4. Leaf of Montpellier maple. 5. Capsule. 6. Leaf of the Italian maple. 7. Cluster of flowers.

HONEY LOCUST.

Family: LEGUMINOSAE.

Reproductive system: POLYGAMY, DIOECY.

The honey locust, *Gleditsia tricanthos*, Linn., is a tree that grows thirty or forty feet high. The trunk is straight and is covered with a grayish bark. The leaves are winged with no unpaired ones. The leaflets, about eighteen of them, are oblong, dentate, blunt, and a beautiful green. Close to their insertion there are large ligneous reddish thorns, each one equipped with two smaller lateral spines. The flowers are dioecious, greenish, and form lateral catkins. The calyx has three or four sections in three or four parts with four or five stamens in the male flowers. In the hermaphroditic flowers the calyx has three sections. The corolla has four or six petals. The ovary is surmounted with a style, and it turns into a flattened pulpy polyspermous pod.

FLOWERS: in June and July.

RANGE: Virginia, Canada, and Louisiana.

NOMENCLATURE. This genus is named for Gleditsch (Jean Gottlieb), a botanist born in Leipzig and a member of the Berlin academy [*Translators note:* Jean Gottlieb Gleditsch, 1714-1786, was the director of the Berlin botanical garden]. He originated a classification system based on the positions of the stamens and wrote a manual entitled *des Fungus*. English, *the tree [sic] thorned acacia*. In America it's called *honey locust*.

The Chinese honey locust, *Gleditsia sinensis*, Lam., is a tree distinguished by its long sturdy branching thorns. Each one bears three or four lateral barbs that are always alternate. The leaves are doubly winged with none unpaired. Each branch of the petiole has five or six pairs of smooth blunt elliptical crenate leaflets that are broader than those of other species.

FLOWERS: in June and July.

RANGE: China; naturalized in our parks.

USES. Up until now honey locust trees have been used to

decorate parks and gardens. When they're pruned and kept from growing too tall, they could be used to form enclosures around fields and dwellings. The wood is firm, supple, and veined with red with a fine close grain. M. Desfontaines suggests that it would be useful to propagate them in forests. Cabinet makers and carpenters then could harvest them very profitably. The wood is reputed to keep for a long time in water without deteriorating and to be very good for making pilings.

CULTIVATION. Honey locusts thrive very well everywhere in France. They withstand the harsh winters. But in the north the young plants have to be sheltered until they're strong enough to tolerate the frosts. The trees are propagated in April by planting their seeds in compost in trays or in pots out in the open air. They have to be planted in loose earth; they will only decline in clayey soil.

KEY TO PLATES.

647. Honey locust. 1. Intact male flower. 2. Same, opened showing stamens.
648. Chinese honey locust. 1. Complete opened flower. 2. Detached thorn.

ASH.

Family: JASMINE family [*Translator's note*: now OLEACEAE].

Reproductive system: POLYGAMY, DIOECY.

The common ash, *Fraxinus excelsior*, Linn., is one of the largest trees in our forests. Its trunk is grayish and smooth; it grows up to thirty or forty meters high. The branches are opposite and have pinnate leaves that are somewhat dark green on top. They're composed of nine to thirteen finely dentate oblong-oval leaflets and terminate in an unpaired one that's larger than the others. The flowers are greenish, unisexual, and lack petals. There are two stamens. The ovary turns into a compressed capsule or oblong samara terminating in a small tongue strip with a slightly oblique point. It contains a single seed, since one compartment fails to develop.

Several varieties of the tree are cultivated, namely: the ash with marbled wood, one with gravelly wood, the golden ash, the ash with torn leaves, and especially the parasol ash, which is remarkable for the disposition of its branches that hang down toward the ground. Likewise the horizontal ash, whose branches extend horizontally instead of bending. The ash with simple leaves is thought to be a separate species by some growers.

FLOWERS: in April and May.

RANGE: the forests of France and Europe.

NOMENCLATURE. German, *gemeine esche*, *aschbaum*. English, *ash*, *ash-trees* [*Translator's note*: i.e. ash-tree]. Italian, *frassino*. Spanish, *fresno*. Russian, *jas*, *jasen*. Polish, *jesion*. Hungarian, *koros-fa*.

The flowering ash, *Fraxinus ornus*, Linn., is a tree with a trunk fifteen or twenty feet high. Its leaves are pinnate and are composed of finely toothed pointed oval-lanceolate leaflets. The flowers form white panicles. They have a small calyx, a corolla of four petals, and two stamens. The fruit is a capsule or samara somewhat blunter than that of the common ash.

FLOWERS: in May and June.

RANGE: France and Italy.

NOMENCLATURE. This tree is definitely not the *ornus* of the ancients as Linnaeus believed. That one was the *Fraxinus excelsior* that was called *ornus* by the Romans and *boumelia* by the Greeks. German, *die bluhende esche*. English, *the flowering ash*.

USES. The common ash is a valuable tree because of the suppleness and elasticity of its wood. Wheelwrights, lathe workers, armorers, etc., use it a great deal. Among all of our native types of wood it's the one that supports the most weight without breaking. A dry cubic foot weighs about fifty pounds. It's no good for heating. The bark is antipyretic; before the discovery of cinchona it frequently was used in medicine. A decoction of the bark while it's still green yields a lovely green apple color. The leaves are a very good purgative and appear to possess the same attributes as manna.

The flowering ash is an elegant tree that deserves a place in groves and parks. Manna apparently is produced by this species of ash tree as well as by one or two others, but only in Sicily. In our climate it yields none at all, or only extremely little. Nevertheless M. Desfontaines has collected some particles of this material on flowering ash trees and on leaves of the mastic tree [*Translator's note:* also known as the lentisc tree, *Pistacia lentiscus*] grown in the King's Garden.

CULTIVATION. Ash trees are propagated via their seeds, which are planted immediately after they mature. At the end of the autumn of their second year, the saplings are lifted and placed in a nursery. They can be transplanted permanently when their trunks are two or three centimeters thick. Beautiful avenues are formed with the common ash, but the trees must be kept away from dwellings because they attract cantharides. The tree prefers good quality and rather cool natural soil.

KEY TO PLATES.

Common ash. 1. Intact fruit. Same, transverse section.

Flowering ash. 1. Flower panicle. 2. Detached flower, enlarged.

JUNIPER.

Family: CONIFERS [*Translator's note: now CUPRESSACEAE*].

Reproductive system: DIOECY, MONADELPHY.

The junipers are trees or shrubs with monoecious or dioecious flowers. The male flowers form small catkins made of scales widened at the tip with two or four anthers at their base. The female flowers are composed of thick scales, arranged in four rows, with an ovary underneath each one. The scales become fleshy and fuse together to form a rounded berry containing three or more pits.

The eastern red cedar, *Juniperus virginiana*, Linn., is a large tree from North America naturalized in our parks and large gardens. Generally it has a pyramidal branched habit that sometimes is uneven and spread out. The bark on its trunk and branches is reddish. The leaves are imbricate, closely appressed, and very small. It blooms in May and June.

The Phoenician juniper, *Juniperus phœnicea*, Linn., is a shrub that grows about two meters high and has a pyramidal habit. The leaves are very tiny, oval, convex and adhere to the branch like those of the cypress tree. The fruit is spherical, reddish yellow, and is the size of a large pea. There's a cultivated variety with bigger fruit that is brown in color. It grows in the southern provinces of France, and it blooms in April.

The common juniper, *Juniperus communis*, Linn., most often forms an extremely thick bush. Sometimes it grows into a tree a few meters high. The bark is reddish brown. The leaves are narrow, stiff, prickly, and concave on one side. The fruit is blackish blue. This juniper grows on dry barren hills in France and Europe.

NOMENCLATURE. German, *wegbaum*. English, *juniper tree*. Italian, *il ginepro*. Russian, *moschewelnik*. Polish, *jalowiec*.

USES. The eastern red cedar, or Virginia juniper, so named because of the color of its wood, is a tree with an elegant and picturesque form. It reaches a height equal to that of the tallest pine trees. In America it's used to make slats, battens, furniture, and wainscoting. Kalm [*Translator's note:* Pehr Kalm (1716-1779) or Matthias Kalm (1793-1833), Finnish botanists] says that it's the best one for making dugout canoes. They can last for twenty years.

The fruit of the common juniper is used in many practical ways. Laplanders make a decoction of it as tea. In England they make gin out of it, which is simply a grain liqueur redistilled with juniper berries. A kind of home liqueur made from it is a good stomach tonic. Additionally, the berries are burned to purify the air in sickrooms, but for this purpose, vegetable acids are preferable. In medicine, a tea-like infusion is successfully prescribed to stimulate perspiration and the activity of organs that secrete urine. Rai claims to have cured several patients afflicted with renal colic caused by kidney stones by making them take a daily decoction of juniper berries in wine. In pharmacies an extract prepared from them is an ingredient in several medications.

CULTIVATION. Junipers are propagated from root suckers, cuttings, and seeds which only come up in the second year. They have to be planted in the shade where it's cool, in compost mixed with sand.

KEY TO PLATES.

- 608. Eastern red cedar. 1. Male flower catkin. 2. Stamens and scale. 3. Fruit. 4. Same, cross-section. 5. Seed.
- 609. Phoenician juniper. 1. Male flower catkin. 2. Fruit. 3. Same, opened. 4. Section of pit. 5. Seed.
- 610. Common juniper. 1. Branch with male flowers. 2. Male catkin. 3. Stamens and scale. 4. Cross-section of fruit. 5. Seed. 6. Same, cross-section enlarged.

BEECH.

Family: AMENTACEAE [*Translator's note: now FAGACEAE*].

Reproductive system: MONOECIE, POLYANDRY.

The common beech, *Fagus sylvestris* [*Translator's note: now Fagus sylvatica*], Linn., is one of the most beautiful trees in our forests. It has a straight trunk covered with smooth gray bark. I've seen some in parts of Normandy and in the cool mountainous regions of Provence that are eighty and a hundred feet tall. The tree is crowned with a broad, bushy rounded top. The leaves are oval, wide, somewhat dentate, bright green on top and slightly downy underneath. In autumn they take on red and yellowish colors that make an exceptionally picturesque impression. Some gardens have a cultivated variety with leaves that are a deep purple from the time that they come out. The flowers are monoecious. The male catkins are pendent and composed of flowers with six not very indented lobes and eight stamens. The female flowers are arranged in pairs and are enclosed in an involucre with four lobes covered with soft spines. The unusual calyx has six sections. The style has three stigmata, and the ovary has three compartments with two ovules in each one. Two of the compartments usually fail to develop; the third contains a smooth triangular nut with a single compartment. It's covered with a tough skin and contains one or two angular seeds.

FLOWERS: in May.

RANGE: France and a part of Europe. It mainly prefers mountain slopes and limestone hills.

NOMENCLATURE. *Fagus* is from a Greek word meaning to eat, because its fruit is nutritious. From *Fagus* came the words *fau*, *fayard*, and *fâines* for its fruits. German, *die buche*, *der buchbaum*. Dutch, *bukeboom*. English, *the beech tree*. Italian, *il faggio*. Russian, *buk*. Hungarian *bik fa*. Tatar, *biuk*.

USES. Beech wood splits and warps easily, nevertheless it's very widely used. It's made into barrows, gun carriages, shovels, screws, etc. The shavings are used to clarify wine. In England it's used for planks on ships. It's very good for heating, but it burns quickly. Enormous amounts of beech wood are consumed in making wooden shoes. The bark often substitutes for cork on fish nets.

The fruit of the beech tree, called *faîne*, tastes very much like hazelnut. Pigs, wild animals, squirrels, dormice, etc. feed on it. An edible oil is extracted from it. The oil also can be burned in lamps and can be stored for several years.

CULTIVATION. Beech trees prefer clayey soil mixed with sand and with lots of depth. Its seeds are planted in springtime and in the autumn. However, spring is the better choice, because field mice are very fond of them. So the seeds should be stored in sand during the winter. Beech trees aren't easily transplanted, so it's best to place them permanently.

KEY TO PLATE.

750. Common beech. 1. Branch bearing both male and female flowers. 2. Cross-section of fruit.

HOLLY.

Family: NERPRUNÉES [*Translator's note: now* AQUIFOLIACEAE].

Reproductive system: TETRANDRY, TETRAGYNY.

The common holly tree, *Ilex aquifolium*, Linn., has a straight, grayish cylindrical trunk that will grow to tree height if it's not cut. The leaves are alternate, oval, undulate, firm, and evergreen. They have stiff, spiny teeth. The flowers are small and are located at the axils of the leaves. The calyx has four sections, the corolla four petals, and the stamens also number four. They develop into pulpy bright red fruit with a sweet but unpleasant taste.

FLOWERS: about the middle of spring.

RANGE: France and Europe.

The Madeira holly, *Ilex maderiensis*, Lam., is a tree naturalized in our gardens. Its trunk is straight and very branchy. The leaves are large, oval and entire on the margins, which have a few sharp teeth. The flowers and fruit are like those of the common holly.

FLOWERS: in April and May.

RANGE: native to Madeira.

NOMENCLATURE. Greek writers called the common holly *agria*, meaning *rustic*, *wild*. That became *agrifolium* and *aquifolium* in Latin. Modern botanists called it *ilex* because its leaves resemble those of *Quercus ilex* [*Translator's note: the holly oak*], which is actually the *ilex* mentioned in Virgil. German, *die stechpalme*, *steclaub*, *der hulse*. Danish, *mare torn*. English, *the holly*, *hollytree*. Italian, *alloro spinoso*. Portuguese, *azevinho*. Russian, *waesoscheld*, *ostrokrof*, *padub*. Polish, *ostokrzew* *krzewina*.

USES. The wood of the common holly is hard, solid, and heavy. It takes on black color better than any other kind of wood because its grain is fine and compact. Cabinet-makers make very beautiful furniture out of it. The best birdlime for trapping birds is made from the interior bark of this tree. It's ground up well to form a paste, which is then put in a pot to decompose and buried in a cellar. When the paste has fermented sufficiently, the woody fibers are taken out of it, and the lime then consolidates into one batch.

The best-formed of the new stalks are cut to make switches and whip handles.

Holly can be used to make live hedges, which are very attractive because of their enduring greenery. However, since they thin out at the base, it's best to plant gooseberry bushes along with them. As a result, the hedges will become impenetrable and will combine attractiveness with practicality.

CULTIVATION. The trees are propagated readily from seeds or through young plants that grow naturally on the old ones. They're not fastidious about the soil, but they prefer slopes and clefts in rocks with northern exposure and the shade of large trees. Several varieties of variegated holly are carefully cultivated. They're all diverse and appealing. They're only maintained by grafting, as we know. They now number more than thirty. Even more could be added by noting differences that appear on a few individual branches among a large number of holly trees and then grafting them onto the common holly.

The Madeira holly suffers from severe cold in the north of France. It thrives very well in gardens in Paris and in the south.

KEY TO PLATES.

1. Common holly. 2. Calyx. 3. Intact flower. 4. Cross-section of fruit.

1. Madeira holly. 2. Calyx. 3. Intact flower. 4. Berry. 5. Detached seed. 6. Same, split longitudinally.

YEW.

Family: CONIFERS [*Translator's note: now TAXACEAE*].

Reproductive system: DIOECY, MONADELPHY.

The common yew, *Taxus baccata*, Linn., is a tree with a trunk fifty or sixty feet high. Its evergreen foliage has a melancholy look. The trunk is reddish, and its rough gray bark seems to be peeling off. The leaves are linear, pointed, dark green, yellowish only on new growth. They're arranged in quincunx and are turned up in a way that gives the branch a winged appearance. The flowers are axillary, sessile, dioecious or monoecious, and surrounded by scales instead of a calyx. The male flowers have eight or ten stamens. Their filaments merge into a cylinder, and the anthers form a shield with six, seven, or eight compartments that open underneath. The female flowers have one ovary with a concave stigma. The receptacle that supports it enlarges when mature and forms a small red berry with a sweet, mucilagenous taste. The pit contains a single fleshy and slightly bitter seed.

FLOWERS: in February, March, and April.

RANGE: the Jura, the Alps, and mountains in the Auvergne.

NOMENCLATURE. *Taxus*, according to Vossius, comes from a Greek word that means *arrow*, because the fruit of this tree was used for poisoning them. German, *libenbaum*, *eife*, *etc.* Danish, *laxtræ*. English, *yew-tree*. Italian, *nasso*, *albero della morte*. Spanish, *tejo*. Russian, *tis*. Hungarian, *tissa-fa*.

USES. Observations and experiments by modern physicians have partly disposed of the mistaken notions handed down to us by the ancients about the poisonous properties of the fruit of the yew tree. M. Percy has shown that it has no harmful effects. On the contrary, it acts as an emollient, a cough suppressant, a laxative and a purgative when taken in large amounts.

A syrup and a jelly made from its juice have proven useful for catarrhal disorders, hemorrhoidal pain with constipation, and for painful afflictions of the kidneys and bladder.

The bark and the leaves of the yew, or these same parts of the tree when dried and administered as a powder, appear to be harmful. At a dose of two eighths of an ounce they produce nausea, vomiting, diarrhea and drowsiness. When thrown into stagnant water they paralyze or even kill the fish. The ancients believed that the shade of the yew tree was fatal. This clearly is wrong. But there is reason to believe, in agreement with recent experience, that too long a stay beneath its branches can bring on headaches and a kind of intoxication.

Formerly yews were planted in all large gardens with the intent to prune them or rather mutilate them in a hundred different ways. This perverted practice is over with, at least in France. Nowadays they're left on their own, but they've become scarce. The wood of the yew tree is one of the most beautiful native woods used by cabinet-makers for veneer and inlaid work. It can even be colored a very bright purple-violet, more like the beautiful wood of the Indies. The trick is to immerse very thin slabs of it, that cabinet-makers call leaves, in a basin of water for several months. This process brings out the color. It works even better when the submerged wood has all of its sap.

CULTIVATION. The yew tree is propagated by layering and by cuttings. Both take root easily. The latter procedure is done in February in gentle soil and in the shade. Yew trees prefer good quality slightly cool soil and a moderately shaded site.

KEY TO PLATE.

571. Common yew. 1. Branch of male flowers. 2. Male flowers, enlarged. 3. Anther, enlarged. 4. Pit containing a seed.

HORSE CHESTNUT.

Family: ACERACEAE [*Translator's note: now HIPPOCASTANACEAE.*]

Reproductive system: HEPTANDRY, MONOGYNY.

The HORSE CHESTNUT, *Aesculus hippocastanum*. Linn. is a large tree with digitate leaves consisting of six or seven digitations or oval leaflets, wider near the tip and dentate on the margins. The flowers, are speckled with pink spots on a white background. Arranged in a pyramid, they make a lovely sight. The calyx has four or five lobes. The corolla has four or five petals and there are seven stamens. The fruit is a leathery capsule bristling with small spines.

FLOWERS: in May.

RANGE: Asia.

NOMENCLATURE. German, *die roskastanie, rosskeste*. Dutch, *paardenkarstengeboom*. Swedish, *haskastagnier*. Italian, *castagne cavalline*. Spanish, *castano de Indias*. Russian, *kouskoi kastan*. Hungarian, *vad-gesztenye*.

USES. The wood is soft and has little value. Nevertheless, when used for underground water conduits, it's believed to last longer than many other harder woods. Battens and boards for packing cases are made out of it. The fruit, peeled and sliced, can be used to make a dough to feed and even fatten poultry. But it has to be soaked for two days beforehand in a wash solution made of one third slaked lime and two parts of ashes and then washed for ten days in pure water. Ashes of the horse chestnut yield a large quantity of potash.

It's been proposed to make bread, starch, etc. with this fruit, but the methods are too costly. As a result, they've largely been abandoned. The best possible use for it is to feed it to goats and sheep that relish it without disdain.

CULTIVATION. This tree is propagated by planting chestnuts in springtime that one has taken care to keep in sand during the winter. It grows well in almost all locations, but it prefers damp soil. According to M. Desfontaines, Lemonnier wanted to try to duplicate certain individual trees by cultivation. This would be a fine accomplishment for parks and large gardens, because they could be propagated with double flowers by grafting.

The first known horse chestnut tree in France was brought from Constantinople to Paris by a certain Bachelier and planted in 1615 in the garden of the Soubise mansion [*Translator's note:* Bachelier was a French botanist; the Soubise is a historic building in central Paris. It currently houses the National Archives and a museum of French history].

KEY TO PLATE.

Horse chestnut tree. 1. Complete flower.

LARCH.

Family: THE CONIFERS [*Translator's note*: now PINACEAE].

Reproductive system: MONOECY, MONADELPHY.

The European larch, *Larix europæa*, *Pinus larix*, Linn. is one of the most beautiful trees in our Alps, where it grows up to a hundred and twenty feet high. It's pyramidal in shape. When standing apart it has a very large number of branches. They bear thin narrow leaves that are bright green and are arranged in small rosettes. They fall at the onset of winter and reappear in spring. When fully open they appear solitary, forming a double spiral. The flowers are monoecious. The male ones, in rounded sessile catkins, are formed of scales. Beneath each scale there are two sessile anthers in one compartment. The female flowers form an oval catkin composed of thin, colored, somewhat loose bracts that are membranous at the edges and divided lengthwise by a green line with a point that extends beyond the tip. Between each bract a claw-shaped squamule supports two tiny ovaries. The bracts dry up and disappear, but the squamules persist and grow larger. They turn into as many concave tough scales, thinned out at the tip, each one enclosing two monospermous nuts that terminate in a wing. The scales merge to form the fruit or cone which points upward like that of the silver fir [*Translator's note*: *Abies pectinata*,].

FLOWERS: in March and April.

RANGE: France, Switzerland.

NOMENCLATURE. German, *larchenbaum*. Dutch, *lorckenboom*. English, *common white larch-tree*. Russian, *listweniza*. Polish, *modrzew*. Tartar, *tyt*, *tut*.

USES. This tree is the source of Venice turpentine, a clear fluid with a bitter taste and a strong unpleasant odor.

It's taken internally to relieve kidney pain and burning on urination. It's an ingredient in several ointments.

Before sunrise during May and June, small slightly sticky grains that are easily crushed between the fingers appear on the leaves of the larch tree. This is the manna of Briançon. Like that of Calabria, it's a purgative.

The wood of the larch is used in civil construction and in shipbuilding. It's made into water pipes, barrel staves, and beams for house construction. Planks and masts on boats that sail on Lake Geneva are made of larch wood. It's claimed that they last much longer than those made of oak. In Toulon [*Translator's note: the French Mediterranean port and shipbuilding city*] it had been well known that fine pieces of larch with few knots in them could be used for top-masts and even for constructing mainmasts. A cubic foot of the wood weighs twenty-five to twenty-six kilograms.

CULTIVATION. It's easy to propagate this tree from seeds; it transplants well and likes almost all kinds of soil. "My most beautiful larch tree" says M. Dumont-Courset, "is set in the worst soil. It's heavy earth, clayey, sticky, more suitable for making pottery, with white marl underneath."

KEY TO PLATE.

European larch. 1. Branch of male and female flowers. 2. Branch of leaves terminating in a new fruit. 3. Stamen. 4. Fruits or cones. 5. Scale, exterior view. 6. Same, inside view. 7. Detached seed.

NETTLE TREE.

Family: AMENTACEAE [*Translator's note: now ULMACEAE*].

Reproductive system: POLYGAMY, MONOECY.

In the south of France the European nettle tree, *Celtis australis*, Linn., is found along public promenades and in forests where it grows and propagates by itself. The trunk sometimes is two or three feet in diameter. It's straight, cylindrical, and covered with smooth grayish bark while the tree is young. It puts out large boughs and numerous smaller branches. The leaves are alternate, petiolate, oval-lanceolate, dentate and deep green. One side of their base is shorter than the other. The flowers are greenish, very small, and are located in small numbers in the axils of the leaves. Some are male; the others are hermaphroditic. The calyx is small with five lobes. There are five stamens that are almost sessile. The ovary is superior with two styles on top. It turns into a small rounded drupe, black when mature, and contains only one seed.

FLOWERS: in May.

RANGE: Provence and part of southern France. It's cultivated in the area around Paris.

NOMENCLATURE. German, *der sudliche lotusbaum*. English, *the European nettle tree*. Italian, *bagolaro*. Russian, *schelesnoi derewo*. Polish, *obroznica drzewo*. Tartar, *karkas*. Provençal, *fabrecoullier*, *fabregourier*, *fababriquier*. Commonly, *l'orme* [*Translator's note: elm*] *des Provençaux*, *le micacoulier*.

USES. In the south the fruit makes pleasant eating. It's sweet, but it has too little pulp to be nutritious. Still, children are very fond of it. Careful cultivation might improve it.

The wood is firm, compact, and very supple. It's highly valued for shafts of chairs and for binding-hoops for vats, which are very long-lasting. The leaves never are attacked by insects. Its wood is not at all affected by woodworm. After ebony and boxwood, it's preferable to all others in durability and strength. Young shoots of the tree provide whip handles, said to be from Perpignan, that are widely used, especially in southern France.

CULTIVATION. In the south of France the tree propagates on its own. Around Paris it's grown from seeds obtained from its native region that are planted in small frames or in deep trays. Some seeds come up in the first year, others in the second. They can be placed in a nursery in the autumn of the second or third year. But until they've reached a height of five or six feet, they should be covered with straw to protect them from severe frost.

KEY TO PLATE.

1. European nettle tree.
2. Green fruit.
3. Cross-section of fruit.

MULBERRY.

Family: URTICACEAE [*Translator's note*: now MORACEAE].

Reproductive system: MONOECY, TETRANDRY.

There are eight or ten species of mulberry trees of which three or four are cultivated for their utility. The same tree has male or female flowers, but they're on different catkins. In the male flowers the calyx has four leaflets, and there are four stamens. In the female flowers the calyx likewise has four persistent leaflets, and the ovary is surmounted with two styles. It turns into a berry formed by the persistent calyx. Several berries joined together form the fruit called the mulberry.

The white mulberry tree, *Morus alba*, Linn., is a medium-sized tree. The trunk, often very large, is covered with very rough bark. The leaves are petiolate, somewhat heart-shaped, dentate, thin, smooth and sometimes unevenly indented. The flowers are located in the axils of the leaves. The male flowers are in reddish catkins; the female catkins are yellowish during their early development. The fruit is small, yellowish, or sometimes red.

FLOWERS: in June around Paris and in April in Provence.

RANGE: China. Naturalized in France for several centuries.

The red mulberry tree, *Morus rubra*, Linn., is a tall tree with a trunk covered with blackish bark. The leaves are oval, heart-shaped at the base, entire, and dentate on the margins. The flowers are dioecious. The male ones form loose pendent slightly reddish clusters.

FLOWERS: in June.

RANGE: North America, naturalized in our gardens.

The black mulberry, *Morus nigra*, Linn., is a tall tree twenty-five to forty feet high. The bark on its trunk is thick and rough. The leaves are petiolate, alternate, heart-shaped, slightly dentate,

and rough to the touch. The flowers are small and greenish-yellow. The fruit is large, oblong, blackish and pulpy with a pleasant flavor.

FLOWERS: in April and May.

RANGE: Persia; naturalized all over France.

NOMENCLATURE. According to some authorities *Morus* comes from *mor*, the Celtic word meaning black. German, *maulbeerbaum*. English, *the mulberry-tree*. Spanish, *moral*. Russian, *schelkowiza*. Polish, *morwa drzewo*. Persian, *tut*.

USES. The leaves of the white mulberry are used to feed silkworms. If not available, black mulberry leaves are used. The bark from the trunk makes very good rope. The wood is yellow and polishes easily. The white mulberry is believed to have been brought to Constantinople by two monks during the reign of Justinian. From there it spread into Greece and Italy. Henri IV encouraged the cultivation of mulberry trees. Olivier de Serres claims that in 1601 eighty thousand were planted in the Tuileries garden, and that the king purposely had a large building constructed at one end of the garden to house everything necessary both for raising silkworms and for introducing the production of silk.

CULTIVATION. Mulberry trees are propagated from seeds and from cuttings. However, if large plantations are desired, it's preferable to plant by sowing the seeds. Silkworms fed with leaves from mulberry trees planted on somewhat higher ground yield finer silk. Leaves from mulberry trees grown in rich and fertile soil provide more plentiful food, but the silk isn't as highly valued.

KEY TO PLATES.

752. White mulberry. 1. New shoot with male and female catkins.

753. Red mulberry. 1. Male flower.

754. Black mulberry. 1. Ovary. 2. Calyx.

WALNUT.

Family: TÉRÉBINTHACEAE [*Translator's note: now JUGLANDACEAE*].

Reproductive system: MONOECY, POLYANDRY.

The common walnut tree, *Juglans regia*, Linn., is a tall tree whose branches have pinnate leaves with five or seven smooth oval entire leaflets. The flowers are monoecious and axillary. The male flowers are assembled in a catkin. A very large number of stamens on short filaments insert into a glandular disc with six sections. The female flowers are paired or are single inside small buds. They have a double calyx; the interior one is adherent and has six sections. The ovary is surmounted by two separated somewhat fringed styles. The fruit is an oval drupe containing a nut with two valves that has an irregularly sinuate kernel divided at the base into four lobes separated by membranous partitions. Seven varieties of the trees are cultivated: first, the Saint-Jean walnut tree, second, the one with large fruit, third, the two-season tree, fourth, the angular, fifth, one with lacinate leaves, sixth, with soft shell, seventh, with firm fruit.

FLOWERS: in April and May.

RANGE: According to Pliny, the walnut tree originated in Persia. It's been naturalized in France for a long time. Nevertheless its new leaves sometimes are burned by frost.

NOMENCLATURE. *Juglans*, short for *jovis glans*, the acorn of God, or of Jupiter, because of the good taste of this fruit compared to the common acorn. German, *wallnuss*, *nussbaum*. English, *common walnut tree*. Italian, *il noce*. Russian, *grezka orechi*. Hungarian, *olass-dio*. Chinese, *ho-tao*.

USES. The fruit is used medicinally in the composition of *three-nut water*, which is added to hydragogue potions at a dose of four to six ounces. The oil of the fruit, when fresh, can be used as a laxative and as an emollient.

The nutshells have a bitter, acrid taste that induces vomiting.

When steeped in water, they yield a brown dye used for staining white wood. When soaked in water and the water then is poured on earth with worms in it, the worms immediately come to the surface. This is a method that fishermen use to procure them. Very good preserves are made from walnuts picked before they're ripe, and the kernels are eaten green while they're tender.

The wood of the walnut tree is smooth, supple, and colored. It's one of our native woods that's in greatest demand by carpenters and makers of inlaid ware.

CULTIVATION. The tree is propagated from seeds planted on location or in special seed beds for transplanting. The former method is preferable where possible, because the trees are prettier and bear fruit much sooner. They must be placed in sand over the winter. Walnut tree like gentle, substantial, good quality soil. They don't thrive in groves. They do well in vineyards, in gardens, along plowed ground and make beautiful avenues.

KEY TO PLATE.

649. Common walnut tree. 1. Catkin of male flowers. 2. Detached male flower. 3. Female flower. 4. Ovaries and pistils. 5. Naked seed.

OLIVE.

Family: JASMINACEAE. [*Translator's note*: now OLEACEAE].

Reproductive system: DIANDRY, MONOGYNY.

The common olive tree, *Olea europæa*, Linn. is a large tree in the canton of Grasse in Provence, in Italy and in Africa. But in the vicinity of Aix, Avignon, etc., it's not very tall. When the tree is young the bark on the trunk is smooth; it roughens with age. The leaves are opposite, persistent, firm, dark green above, white underneath, lanceolate and entire. The flowers are set in small clusters in the axils of the leaves and are white in color. The calyx has four teeth. The corolla is monopetalous with a very short tube. The blade of the petal has four oval sections. There are two stamens that insert into the corolla. The ovary is superior. It turns into a drupe whose pit has two compartments and two seeds, but most often it's unilocular through failure of one to develop.

More than fifteen varieties of olive trees are cultivated in the southern provinces. I've illustrated the two that are the most noteworthy and widely cultivated: one with blunt leaves and the other with pointed leaves.

FLOWERS: in May.

RANGE: This tree was brought to Provence by the Phocians [*Translator's note*: inhabitants of a region in the central part of ancient Greece] about six hundred years before the Christian era. It has propagated there by itself for a long time and has produced wild stocks for grafting good varieties.

NOMENCLATURE. German, *der oelbaum*. Dutch, *olytboom*. English, *the olive tree*. Russian, *oliva, maslina*. Greek, *elaia*. Arabic, *sejtun*. Hebrew, *sajt*.

USES. Everyone is familiar with the everyday uses for olive oil. It's administered medicinally in doses from a quarter to one ounce in cough medicines for chest congestion and for acute attacks of catarrh. In large doses it's good for treating toxic reactions

brought on caused by corrosive minerals or by bitter and caustic plants.

The olive tree's wood is hard, veined, and takes on a fine polish. Occasionally its root is attractively marbled. It's valuable for cabinetry; the ancients used it to make statues. For further details on the uses of the olive tree, we refer the reader to the publication by M. Bernard [*Translator's note*: possibly Jean Bernard (1724-1792)] who was awarded the prize of the Academy of Marseille in 1783.

CULTIVATION. The olive tree thrives on hillsides and grows very well in rocky terrain. It does not do well far away from the sea and cannot withstand hard frosts. In northern France it must be housed in an orangery during the winter. In 1709 [*see Translator's note on p. [44]*] almost all of the olive trees in Provence perished. On January 11 and 12 in 1820 they suffered a fate almost as disastrous. Olive trees are propagated from root sections, suckers, cuttings, and seeds. They're usually grafted by crown and bud-shield grafts. Only very rarely are they propagated from seeds, because this method takes the longest. Nevertheless, olive pits definitely will germinate, at least in part, when they're planted in well-separated soil and covered by a layer of earth only about an inch thick.

KEY TO PLATES.

611. Olive tree with pointed leaves. 1. Flower prior to opening, enlarged.
2. Open corolla and stamens. 3. Calyx and pistil. 4. Intact fruit. 5. Same, transverse section showing the pit. 6. Pit opened to show the seed.
612. Olive tree with blunt leaves. 1. Calyx and pistil. 2. Corolla and stamens.

ELM.

Family: AMENTACEAE. [*Translator's note*: now ULMACEAE]

Reproductive system: PENTANDRY, DIGYNY.

The common elm, *Ulmus campestris*, Linn., is a large tree with a straight trunk. Its bark often is cracked and sometimes fungous like that of the cork tree. Its wood is hard, reddish yellow, but liable to warp if used before it's sufficiently dry. The leaves are oval, pointed, doubly dentate on the margins, and sometimes very small. The flowers are sessile and hermaphroditic; the calyx has four or five sections. There are five stamens; one variety has only four. The fruit is a smooth elliptical pericarp enclosed in a membrane and contains a seed at its center.

FLOWERS: in April and May.

RANGE: France and Europe.

NOMENCLATURE. German, *ulmbaum*, *ruster*. Dutch, *olm*, *olmboom*. English, *elm*, *elm-tree*. Russian, *ilim*, *ilina*. Polish, *ilm*. Hungarian, *szet-fa*.

USES. The wood of the elm tree is extensively used by wheelwrights because of its enduring resistance to air and water. It's made into axles, hubs and rims of wheels, screws for presses, etc. It makes excellent fuel for heating. In the north the bark is used to make mats. The leaves are used as feed for livestock. Elm trees are very common along public promenades and highways. Wood from the Tortillard elm [*Translator's note*: a variety with knotty, gnarled wood] is used to make screws for wine presses and rollers for copper-plate printers. It's highly valued because the fibers of this variety of elm are harder and more compact. Theophrastus and Pliny claim that the wood of the elm tree is the strongest next to that of the dogwood.

The medicinal properties that some authorities attribute to the sap or to the phloem of this tree are somewhat fanciful.

CULTIVATION. The elm tree prefers gentle, easily penetrable soil. It avoids earth that is compact, rich, and clayey. It's propagated by planting its seeds in ground that's well broken up and lightly covered with a mixture of compost and loam. It's propagated in several other ways as well: by layering and from shoots, suckers, and cuttings. But the first way is the best.

The elm tree's roots spread very widely in plowed ground and can damage crops. The tree tolerates pruning well; it can be maintained at shrub height after its first growth. It's planted on slopes where it's desirable to cover the surface and to prevent landslides.

KEY TO PLATE.

Common elm tree. 1. Branch with flowers. 2. Detached flower, stamens and pistil. 3. Fruit.

POPLAR.

Family: AMENTACEAE. [*Translator's note: now SALICACEAE*].
 Reproductive system: DIOECY, OCTANDRY.

The white poplar, *Populus alba*, Linn., is a tree in our forests that grows very tall. Its trunk is grayish and creviced, and its branches are covered with white down. Its leaves are dentate, slightly triangular, dark green above, white and cottony underneath. The flowers form oblong catkins. The male catkins have ten flowers with twelve to twenty stamens under each scale. In the female flowers the ovary bears four stigmata and turns into a capsule with two valves. There are very many seeds and they have a silken tuft.

FLOWERS: at the end of winter or in early spring.

RANGE: France and Europe.

NOMENCLATURE. *Populus*, the people's tree, because in ancient Rome public places were decorated with them. The white poplar was consecrated to Hercules, *Populus Alcidae gratissima*, Virg., etc., because he is said to have returned from the shores of the Acheron with his brow wreathed in a crown of white poplar [*Translator's note: the poplar in gratitude to the grandson of Alcaeus, an epithet of Hercules. The Acheron is one of the rivers that surround Hades*]. Crowns of poplar leaves were worn during bacchanalia. German, *pappel-baum*. English, *poplar-tree*.

The Italian poplar, *Populus fastigiata*, Poir., is a tree that grows in a pyramidal shape and is easy to distinguish by its habit which is very different from all of our other trees. Its leaves are almost triangular, dentate, smooth, and a beautiful green. The male flowers grow in pendent catkins. We have no female specimens, presumably because this tree, already very common, always has been propagated from suckers and from cuttings.

FLOWERS: in early spring.

RANGE: It was obtained from Italy, but since it's not very widespread

there and isn't found in the wild, there is reason to believe that it had been brought from the Orient.

The Carolina poplar, *Populus angulata*, Ait., is a tall tree remarkable for the size of its smooth, dentate, heart-shaped leaves. The branches and petioles bearing them are marked by deep grooves that make them crooked. The male flowers are in pendent catkins.

FLOWERS: in the spring.

RANGE: Carolina. It's been acclimatized in the parks and gardens of Paris for several years.

USES. White poplars are planted in avenues. They're used to border large bodies of water. The ancients cultivated them to serve as supports for grapevines. The wood is white, light, and soft; it's not good for heating. Nevertheless carpenters and box-makers make good use of it. Paper now is made successfully with fiber from its leaves. In Italy new branches are cut in October and left to dry together with their leaves to feed livestock during the winter. The Italian poplar creates a picturesque effect. In wet areas it helps dry out swamps because it draws a lot of moisture from the soil without blocking the air or sunlight. The Carolina poplar deserves a place in our parks for the beauty of its foliage.

CULTIVATION. Poplars like rich damp soil. They're easily propagated from shoots and cuttings, and they can be grafted on one another. Cuttings are made in February into fresh soil; shoots generally are transplanted in the autumn.

KEY TO PLATES.

755. White poplar. 1. Catkin of flowers.

756. Italian poplar. 1. Branch of male flowers.

757. Carolina poplar. 1. Branch of male flowers. 2. Male flower detached and enlarged.

PINE.

Family: THE CONIFERS. [*Translator's note: now PINACEAE*]

Reproductive system: MONOECY, MONADELPHY.

The LARICIO PINE, *Pinus laricio*, Poir., Enc. Bot., is one of the largest trees in nature. On the mountains in Corsica where it grows wild its trunk reaches forty or forty-five meters high and sometimes eight meters in girth. It's pyramidal in shape and divides into regular tiers. There are many elongated branches that almost always form an obtuse angle with the trunk. It's a more pleasant and less ashen green than most other pines. The leaves are quite similar to those of the maritime pine, but they're shorter and the cones are much smaller. The cones are pendent and are composed of brown scales that are thinner, narrow at the base, thick at the tip, only slightly or not at all crooked, and umbilicate. The two seeds underneath each scale have a transparent membranous wing.

FLOWERS: at the beginning of May. The fruits or cones ripen in March of the following year.

RANGE: the high mountains on the island of Corsica.

NOMENCLATURE. The name *laricio* is the one by which it's known in its native country. [*Translator's note: laricio denotes its resemblance to the larch (Larix)*].

USES. The wood of this tree is suitable as timber for civil buildings, for shipbuilding, and for tall masts. It's slightly heavier than that of the northern, or Riga pine, but since it has more resin than the latter, it's less brittle and more flexible.

The laricio pine is suitable for bordering lanes, forming groves, beautifying hillsides, and creating a most pleasing sight among plantings. Its tiered pyramidal form and its deep greenery give it a picturesque appearance. It can be regarded as one of the most beautiful evergreen trees in our climate.

CULTIVATION. The tree is propagated via seeds sown when hoar frost no longer need be a concern,

and in a twice-plowed field. The first tillage is performed in the autumn, the second at the onset of spring. When time is short planting can be done with a single tillage at the end of winter. The former method is more advantageous for successful planting. The seeds must be mixed with two parts of seeds that are used for planting cereals (rye, barley, oats, or wheat) to sow one hectare. The seed bed must be harrowed and rolled when the planting is completed.

In the third year of the planting the saplings must be cleared or spaced so that the individual plants are about sixteen centimeters apart and the spaces that are too open filled in. Two years later they're placed approximately five decimeters apart, and the poorly growing ones are replaced. The same care must be continued until the twentieth year to obtain a beautiful grove. The trees then are about three meters apart and they can be left to grow naturally into a forest grove. They grow for seventy to eighty years.

These woods are never clear-cut, but rather are selectively culled starting with the strongest and finest ones and those that are fully grown. The seeds that fall from the older trees are enough to maintain the forest and to make it last for several centuries. It's only necessary from time to time to clear the individual plants that grow poorly and those that are too close to one another. But care always must be taken not to clear them too much, so that the trees remain close enough together that they grow perpendicularly and don't put out lateral branches higher up that are too long.

KEY TO PLATE.

429. - Laricio pine, about one three-hundredth natural size.

430. 1. Bud and leaves, natural size. 2. Germination. 3. Fruit. 4. Same, open and releasing its seeds. 5. Scale from the fruit, exterior view. 6. Same, inside view. 7. One of the two seeds separated. 8. Same, transverse section.

PINE.

Family: THE CONIFERS. [*Translator's note: now PINACEAE*]

Reproductive system: MONOECY, MONADELPHY.

Pine trees by nature live in the mountains. They like high cold regions and rarely are found in warm countries. They grow among rocks and at the edges of cliffs. Their dark green foliage often adds to the ruggedness and solitude of the places where nature has put them. It's in these wild, often inaccessible spots that pine trees lift their venerable treetops to the sky and then simply die of old age because an ax never has been able to reach them. Plantations of pine trees occasionally seen in open country almost always are at the seashore where the air is more brisk and pure. Pines generally prefer loose, sandy soil. There are few trees more useful than the pine. During their lifetime they embellish parks and large gardens with their evergreen foliage and picturesque forms. They provide resin, tar, lampblack, edible fruit, and bark that's used to make a kind of bread. When cut they provide valuable material for civil construction and shipbuilding.

The Scotch pine, *Pinus sylvestris*, MILL., is one of the largest trees in our forests [*Translator's note: Scotch pine currently is a general name for the *Pinus sylvestris* species*]. When it grows in a grove, the trunk is straight and bare. When solitary it has branches from the base up. However it's variable in height, and in some inferior soils it's stunted and not very tall. The red, or Scotch pine is a distinct variety of the species. So too is the one from Riga whose trunk provides the fine masts that we get from the northern countries, which gives the tree the name

Pine of Riga, of Russia. The observations and experiments of Duhamel, Miller [Translator's note: possibly Philip Miller (1691-1771), British gardener], Fougereux de Blaveau, and Pallas [Translator's note: Peter Simon Pallas (1741-1811), German botanist, geographer, and naturalist] agree that all of these pines should be thought of as one and the same species even though they display distinct differences in the quality of their wood. The leaves originate in pairs and emerge from the same sheath. They're narrow, curved along the central vein, and pointed. The new growth is greenish in one variety and red in another. The flowers are monoecious; the male ones form terminal catkins consisting of imbricate scales that cover two anthers in a single compartment. The female flowers are in a cone composed of oblong club-shaped scales trimmed at their tips to a diamond-shaped point. At their base are two osseous monospermous seeds. In almost all of the varieties the cones hang downward. There is one, pointed out by Tournefort, in which they are upright.

FLOWERS: in February and March.

RANGE: the mountainous regions of France and Europe.

NOMENCLATURE. German, *kiefer*, *kyfer*. Dutch, *pynboom*. Danish, *furr*, *fyrre*. English, *wild-pine*. Russian, *sosna*. Polish and Bohemian, *sosna*. Tartar, *karagai*.

USES. This tree finds its greatest use in the north of Europe. The outer bark substitutes for cork on fish nets. The inhabitants use the pulverized inner bark mixed with rye flour for food. The wood is used to make torches for light at night and for constructing homes, ship masts, sledges, etc. The wood of the variety from Riga apparently is lighter, more supple, and preferred by the navy. M. Desfontaines says that it would be most useful to promote its cultivation. If it were planted in suitable soil, it might preserve its exceptional qualities.

This is a goal most worthy of the government's attention. It's hard to come by wood for masts during wartime. It's extremely costly even in peacetime, and the Lithuanian pine is becoming scarcer by the day. In France there are immense tracts of abandoned terrain where this tree could thrive. Even if it were unsuitable for masts on ships, it always would provide very worthwhile wood.

The maritime pine, *Pinus maritima*, LAM is quite a large tree that's very common in the sandy soil of our southern provinces. Its trunk is straight, and its branches spread out. The leaves are four or five inches long; they emerge in pairs from the same sheath and have a reflexed scale at their base. The fruits form cones four to six inches long, glossy yellow, widened at the base and terminate in a pyramidal shape. They're borne on short peduncles strongly adherent to the tree and frequently opposite in pairs.

FLOWERS: in March and April.

RANGE: the vicinity of Bordeaux and the shores of the Mediterranean. The cone in the illustration came from the forest of Esterel where I picked it in May of 1821.

USES. It's a very useful tree along the seashore because it resists onshore winds and protects the other trees. It also has been cultivated very enthusiastically in Guiana, Brittany, etc. In the Paris climate it suffers during harsh winters, whereas the Scotch pine is never harmed by the cold. The wood of the maritime pine has very many uses. It provides resin, pitch, tar, turpentine, lampblack, etc.

The stone pine, *Pinus pinea*, LINN., is a tall tree with a straight trunk dividing at its summit into several branches

that spread out to form an attractive top. The bark is reddish and rough. The leaves emerge in pairs from the same sheath. They are long, narrow, pointed, and a glaucous green. The fruits, or cones, are big and rounded oval. They're composed of thick scales, wide at their tip, that cover two big brown seeds with a kernel of white flesh with a pleasant taste.

FLOWERS: in April and May.

RANGE: southern France; common along the seashore between Fréjus and Cannes.

USES. In the south the kernels are served at the table. They're called *sweet nutmeats* [*Translator's note: also called pine nuts*]. They can be eaten fresh or dried, or a third of their weight can be extracted as a sweet oil. They have the same medicinal properties as pistachios and almonds.

The wood of this pine tree is white and less resinous than that of the others. It's made into barrels for pumps, boards, and bulwarks for ships.

The Weymouth pine, *Pinus strobus*, LINN., is a tree from Carolina and Canada, where its trunk grows a hundred feet tall. Its bark is gray and perfectly smooth. The leaves, in groups of five in the same sheath, are very slender. They re-grow each year in the spring. The fruits or cones are pedunculate, cylindrical, droop downward and are four or five inches long. Their scales are thin, separated, and cover seeds that are eaten like those of the above tree.

FLOWERS: in April.

RANGE: North America; acclimatized in the vicinity of Paris. The harshness of our winters doesn't bother them at all.

USES. This tree deserves to be more common in our parks. Its wood is highly valued for ships' masts. It's also used in framework and carpentry.

CULTIVATION. When pine trees are cut down they never re-grow, but they propagate in forests via their seeds. The fruits or cones are harvested from January until March. If one waits later than that, the heat of the sun will open them up and the seeds will scatter on the ground. The newly gathered cones are put in boxes or on cloths and left exposed to the dew during the night, and to the sun so that the scales separate from one another and allow the seeds to come out.

Duhamel recommends sowing pine tree seeds together with seven or eight times the amount of oats or broom seeds, which germinate at the same time as the pine trees and will protect them from the heat of the sun. They also can be sown successfully among clusters of ferns and of heather. When growing pine trees destined to be planted in parks the seeds must be planted in trays or in boxes filled with sandy and well-separated soil. They're transplanted when they're two or three years old. Spring is preferable to the fall for this procedure. Pruning pine trees reduces their vigor and slows their growth, however they can die if too many branches are cut off at once. They require at least eight or ten years to withstand this operation. It must be done in October or November because that's when the flow of sap stops and the secretion of resin is considerably reduced. In general these trees aren't very particular about the quality of the soil. They thrive very well in many places where other trees like oaks don't succeed.

KEY TO PLATES.

Scotch pine. 1. Male flowers. 2. Scale seen from above. 3. Same, seen from below. Fruit of the Scotch pine. 1. Intact cone. 2. Scale seen from above. 3. Same, seen from below. 4. Seed. 5. Same, transverse section. 6. Germination. 7. Cone of the Scotch pine. 8. Scale seen from above. 9. Same, seen from below. 10. Seed. 11. Same, transverse section. 12. Germination.

Maritime pine. 1. Branch of male flowers. 2. Detached flower. 3. Section showing anthers. Fruit of the maritime pine. 1. Cone, natural size. 2. Intact scale, exterior view. 3. Same, inside view. 4. Intact seed. 5. Same with wing removed. 6. Same, transverse section.

Stone pine. Same. 1. Reduced view. 2. Fruit, natural size. 3. Detached scale, exterior view. 4. Same, inside view. 5. Intact seed. 6. Transverse section.

Weymouth pine. Same, fruit natural size. 1. Scale, exterior view. 2. Same, inside view. 3. Intact seed. 4. Same, transverse section.

PISTACHIO.

Family: TEREBINTHACEAE [*Translator's note: now ANACARDIACEAE*].

Reproductive system: DIOECY, PENTANDRY.

The cultivated pistachio tree, *Pistacia vera*, Poir., is a tree with a trunk twenty or thirty feet high. Its spreading branches bear leaves with very long petioles; the leaves consist of three, four or five oval entire leaflets green on both sides and almost sessile. The male and female flowers are on separate trees. The male flowers have five stamens and no corolla. The female flowers are in loose clusters and have no corollas. They consist of an ovary with three styles that turns into a dry oval olive-shaped drupe that's creased, reddish on one side, and contains an oil-yielding kernel with a pleasant flavor.

FLOWERS: in April and May.

RANGE: Syria; it was brought to Italy around the end of the reign of the Emperor Tiberius. Since that time it has spread and has been naturalized in the woodlands of our southern provinces. Two varieties are cultivated in Montpellier and also in Paris in open ground.

NOMENCLATURE. Pistacia is a word derived from the Arabic name *foustuq*, *fistuk*. German, *pistazienbaum*. English, *pistachio-tree*. Spanish, *alfocigo*. Provençal, *petelin*.

USES. Pistachios are eaten just like sweet almonds. They're served at the table, and they are ingredients in all kinds of sugared sweets as well as in creams and ices. They formerly were utilized in medicine, but are not much used nowadays. They can be given either alone or together with pine nuts to consumptives and to those stricken with catarrhal ailments. They are prepared as emulsions of twelve to twenty of them in a pound of water.

The turpentine tree, *Pistachia terebinthus*, Linn.,

is a small tree in our southern provinces. But in the Orient it grows as big as an elm. The leaves consist of seven to nine shiny oval leaflets borne on a slightly winged common petiole. The flowers are dioecious; the male ones form axillary upright panicles. The stamens are a beautiful purple. The female flowers turn into a large number of small dry rounded drupes the size of a pea.

FLOWERS: in April and in May.

RANGE: I've found it in the vicinity of Grasse and the forest of Esterel.

NOMENCLATURE. Turpentine, strictly speaking, comes out of incisions made in the bark of this tree. The term has been extended to other resins of coniferous trees. German, *terpentinbaum*. English, *common turpentine-tree*. Russian, *skupidarnoe derewo*. Arabic, *butem*. Portuguese, *cornicabra*. Modern Greek, *stinos*.

USES. In the Levant a resinous fluid known commercially as turpentine of Chios [*Translator's note*: an island in the Aegean] exudes naturally from cracks in the tree's bark. It also is obtained in larger quantities by making incisions in its trunk and branches. This material is used medicinally. It's applied externally as an effective resolvent and internally as a tonic and as a stimulant for diseases of the urinary tract. It's also a successful treatment for *taenia* [*Translator's note*: tapeworm]. But since it's not very available commercially, it's almost always substituted for by turpentine from the larch, especially in pharmacies. It's prescribed as a pill of one to two eighths of an ounce. It's been noticed that those who take turpentine internally have an odor in their urine. Even working with varnishes that contain a lot of turpentine is enough to make the urine smell like violets. In Turkey the women continually chew

boiled turpentine to sweeten the breath and stimulate the appetite.

The mastic tree, *Pistacia lentiscus*, Linn., is a very common small tree in woodlands and in arid regions of southern Provence where it grows ten or twelve feet tall. Its leaves are alternate and consist of eight to ten firm smooth persistent oval leaflets borne on a common winged petiole. The male flowers are in loose purple spikes set in the axils of the leaves. The female flowers produce small red rounded drupes that turn brown or blackish as they ripen.

FLOWERS: in April.

RANGE: I've found the tree to be very plentiful close to Grasse and Draguignan.

NOMENCLATURE. *Lentiscus*, from *lentescere*, to be viscous, sticky. German, *mastixbaum*. English, *mastick-tree*. Portuguese, *aroeira*. In Constantinople, *xikudia*.

USES. Mastic is a resinous substance that exudes naturally, or from incisions made in the mastic tree, mainly in the Levant or on the island of Chios. The mastic trees of Provence produce less, or of a very much poorer quality, than do those of the Levant. Mastic formerly was widely used in pharmaceutical preparations, but nowadays it's rarely used. The Turks and all of the Levantines chew mastic almost continually to strengthen their gums and to make their breath sweeter and more pleasant. Tournefort reports that the fruit of the mastic tree yields an oil that the Turks prefer to olive oil for roasting, and that they also include it in their medications.

In some parts of the south the leaves of the mastic tree are used for tanning leather.

CULTIVATION. In the south of France all the pistachio trees are cultivated in open ground. But in the north care must be taken to provide them with good exposure,

not to transplant them until they're at least five years old, and to cover their bases with straw litter during the winter. They're propagated from seeds sown in pots and on compost in the spring. They also can be propagated by layering, but they take root with difficulty and never are as good as plants grown from seeds.

KEY TO PLATES.

Cultivated pistachio tree. 1. Cluster of fruit.

Turpentine tree. 1. Branch of male flowers. 2. Detached male flower. 3. Branch of female flowers.

Mastic tree. 1. Spike of male flowers. 2. Detached male flower, enlarged.

PLANE TREE.

Family: AMENTACEAE [*Translator's note: now PLATANACEAE*].

Reproductive system: MONOECY, POLYANDRY.

The oriental plane tree, *Platanus orientalis*, Linn., is a tree that grows very tall, especially when it's in good, fresh soil. Its trunk attains a considerable diameter, confirmed by Pliny's preserved record that a Roman consul spent the night with eighteen of his retinue inside one. The bark is ash-gray; it partly sheds and re-grows every year. The numerous thick branches bear alternate petiolate palmate leaves with five deeply indented lobes that are dentate and pointed. The leaves are smooth and flat. The flowers are monoecious. The males, separate from the females or on the same axis, insert into a rounded receptacle. The large number of stamens are clustered and are borne on short filaments. The female flowers are globose like the males and are formed from bristles and small fleshy bodies. The ovary is cylindrical and is surmounted by a slightly curved, hook-shaped style. It turns into a seed full of bristles and terminates in a point.

FLOWERS: in April and in May.

RANGE: Pliny says that the plane tree was brought from Asia to the island of Diomedes [*Translator's note: a Greek hero of the Trojan war*] to decorate that warrior's tomb. It then was transported to Italy, and from there it spread to all of Europe.

NOMENCLATURE. *Platanus*, from a Greek word meaning *full, wide*, because of the breadth of its leaves. German, *der morgenländische platanus*. English, *the oriental plane-tree*. Russian, *tschinar*.

USES. This tree for a long time has augmented the decoration of our parks and promenades. It can be planted in avenues and in borders around large bodies of water.

The ancients greatly valued this tree. The ones planted near the academy at Athens became famous for their size and beauty.

The wood of the plane tree has some resemblance to that of the beech tree. It's streaked with networks of multiple small veins. It's used by lathe-workers and cabinet-makers. Belon [*Translator's note*: probably Pierre Belon, 1517-1564, French naturalist] says that the inhabitants of Mount Athos hollow out the trunks of large plane trees to make dugout craft which are inexpensive and in which they cruise on rivers and on the sea.

CULTIVATION. The tree is propagated by cuttings and by layering. The cuttings, when placed in gentle, nourishing, shaded soil form trees that are ready to be permanently planted. The plane tree is quite hardy; it thrives well in almost all kinds of soil.

KEY TO PLATE.

Oriental plane tree. 1. Fruiting branch. 2. Fruit, transverse section.

HOP TREE.

Family: TEREBINTHACEAE. [*Translator's note: now RUTACEAE*]
Reproductive system: TETRANDRY, MONOGYNY.

The three-leaved hop tree, *Ptelea trifoliata*, LINN., is a large shrub native to North America [*Translator's note: the early colonists in Virginia named it the hop tree because its fruit resembled the old world hops used to make beer*]. It's been acclimatized in parks and even in forests for a long time. The trunk grows fifteen or twenty feet high; it has many spreading branches. The bark is smooth and gray. The leaves are on long petioles and consist of three large oval lanceolate leaflets that are smooth and pale green underneath. The flowers are numerous, greenish yellow, and are arranged in wide axillary clusters. The calyx has four or five sections, the corolla four or five petals, and there are four or five stamens. The ovary is superior, surmounted by a style and two stigmata. The fruit is a membranous orbicular capsule with two compartments and two seeds.

FLOWERS: in May and June.

RANGE: Virginia, Carolina.

NOMENCLATURE. *Ptéleá*, derived from the Greek name for the elm, because of the resemblance of its fruit to that of our elm tree.

USES. The tree's beautiful foliage and its broad clusters of flowers create a very lovely sight in parks and in gardens. But these components all emit a strong and unpleasant odor when they're crushed. The wood is white, soft and insubstantial. It can only be used for fuel.

CULTIVATION. The tree is easily propagated from seeds,

cuttings, and suckers. But since it's vulnerable to severe frosts when it's very young, it has to be in a sheltered location. It grows to be very beautiful in groves of greenery in parks and in gardens.

KEY TO PLATE.

Hop tree. 1. Intact flower, side view. 2. Same, front view.

LOCUST.

Family: LEGUMINOSAE.

Reproductive system: DIADELPHY, DECANDRY.

The locust or false acacia, *Robinia pseudacacia*, Linn., is a tree that grows about forty or fifty feet high. Its trunk is straight. The branches, with double spines at their base, have imparipinnate leaves. The leaflets are oval, entire, and are an attractive green color. The flowers are white, fragrant, and are arranged in pendent clusters. The calyx is bell-shaped with four small teeth. The corolla is papilionaceous. There are ten stamens, nine of which join in a tube around the style, which is hairy at the tip. The fruit is a smooth flat oblong pod containing several seeds.

FLOWERS: in June and July.

RANGE: Virginia. It was brought to France around 1600. Since that time it has been cultivated throughout the kingdom and has been naturalized in a number of provinces.

NOMENCLATURE. *Robinia*, after Jean Robin who lived during the reigns of Henri IV and Louis XIII and who was appointed *herbalist to the king* [*Translator's note:* the genus was named by Linnaeus in tribute to Jean Robin, 1550-1629. The herbalist was an official who specialized in medicinal plants]. His son Vespasien Robin first cultivated the *Robinia pseudacacia* with seeds that he got from America. Colloquial French, *common acacia*, *gardener's acacia*. English, *the common acacia*. German, *gemeine acacienbaum*.

The chamlagu acacia, *Robinia chamlagu*, Willd., [*Translator's note:* now *Caragana sinica*] is a shrub three or four feet high with crooked branches. The leaves are paripinnate with oval leaflets indented at the tip and often with a point. The flowers are quite large, yellow with a red spot at the tip, solitary on their peduncles that have two thorns at the base. The calyx is a tube with five small teeth at the top.

FLOWERS: in May.

RANGE: China. Cultivated in gardens for a long time.

The fierce acacia, *Robinia ferox*, [*Translator's note*: now *Caragana spinosa*] is a shrub about five feet tall with paripinnate leaves and oblong pointed leaflets that are close together. The thorns are stiff, slender, an inch long and sharp as steel. The flowers are yellow, solitary or infrequently paired, and almost sessile. The calyx forms a tube terminating in five small teeth.

FLOWERS: in April and May.

RANGE: la Daourie [*Translator's note*: possibly the Daurian forest steppe in Siberia and Mongolia]. Cultivated in gardens and in botanical institutes.

USES. The usefulness of the locust tree has made it a very common tree in all of France. Its wood is sought after by dealers in turnery because it has a fine grain, polishes well, and can be stained. But the tree is fragile and strong winds are lethal to it. The bark has a sweet flavor comparable to liquorice. It's an emetic.

CULTIVATION. The seeds of the locust tree come up very well in open ground. However in the north of France it's prudent to cover the seed beds during the first winter. Seeds of the other trees are planted in trays. The chamlagu suffers from the cold in northern France. It's appropriate to wait until the third year before setting it out in open ground. In general these trees prefer deep gentle soil, an exposure that's warmer rather than cooler, especially one that's sheltered from strong winds.

KEY TO PLATES.

- 638. Locust tree. 1. Calyx and stamens. 2. Pistil.
- 639. Chamlagu acacia. 1. Calyx and pistil.
- 640. Fierce acacia. 1. Calyx and pistil.

FIR.

Family: CONIFERS [*Translator's note*: now PINACEAE].

Reproductive system: MONOECY, MONADELPHY.

The Norway spruce, *Abies picea*, *Pinus abies*, Linn., is a large tree of our forests. It's found in the mountains of the Auvergne, in the Pyrenees, and in the Alps where it grows a hundred or a hundred and twenty feet high. Its foliage is a dark and very deep green. The branches, open and often pendent, bear angular leaves that are sharp, thin, close together, and green on both sides. The male flowers form catkins composed of scales that cover two sessile anthers. The female flowers likewise are in catkins. They're formed from bracts adherent to a central axis. Each scale has two ovaries that develop into two monospermous nuts terminating in a membranous wing and located on the upper side of the scale. The scales join to form the fruit or cone, which always points downward.

FLOWERS: at the end of winter.

RANGE: France and Europe, as far as Norway and Lapland.

NOMENCLATURE. *Picea*, producing pitch [*Translator's note*: Latin: *pix*]. German, *die fichte*, *fiech*. Dutch, *hartsboom*. English, *the pitch-tree*. Italian, *picea*. Russian, *jal*. Polish, *swierk*. Hungarian, *szomörke-fa*. Lapp, *guesa*. Colloquial French, *la pece*, *la pesse*, *le faux sapin*.

The red fir, *Abies rubra*, Lambert, is a not very tall tree from North America that has been naturalized in France and in England for a number of years. Its leaves are solitary and tetragonal. The fruit is oblong, blunt, red or reddish in color, formed of rounded scales entire on the margins and sometimes slightly indented at the tip.

RANGE: North America.

The black fir, *Abies nigra*, Lamb., or black spruce, is a tree from the United States only thirty or forty feet high. The leaves are straight, tetragonal, and slightly rough. The fruits or cones are brown tending to black, oval in shape and pointed toward the ground.

RANGE: North America. It's very common in our parks.

The silver fir, *Abies alba*, Lamb., or white spruce, so called because of the color of its bark. The leaves are glaucous, tetragonal, and slightly curved. The fruits or cones are oval-oblong, light reddish, and point downward. This tree grows very tall.

RANGE: New England and Canada. It's cultivated in our parks.

The hemlock-spruce, *Abies canadensis*, Lamb., is a tree from the same countries as the two above. It has flattened leaves arranged like a comb. The fruits or cones are very small and hang downward. The scales don't detach from the axis at all.

RANGE: North America, as yet not widely distributed in our parks, where it thrives very well. It was introduced into Europe in 1736 by Pierre Collinson [*Translator's note:* Peter Collinson, 1694-1768, English botanist and horticulturist].

The silver fir, *Abies taxifolia*, des *Pinus picea*, Linn., is a large tree that's quite common in several parts of France, especially in Normandy. It grows sixty or eighty feet high. Its trunk is straight and very elongated. The branches extend horizontally. The leaves are narrow, truncated at the tip, green above, whitish underneath, and arranged on the branches like teeth on a comb. The fruits or cones are upright, and the scales detach from their axis after the seeds mature.

FLOWERS: at the end of winter.

RANGE: France and Germany. It prefers hills and higher elevations where the earth is clayey.

NOMENCLATURE. German, *die tanne, silbertanne*. English, *the silver-tree*. Dutch, *denneboom*. Italian, *abete*. Russian, *pichta*. Hungarian, *fonnyo-fa*.

USES. The Norway spruce yields an abundance of *thick yellow pitch* or *Burgundy pitch*, especially when it's planted in rich fertile soil. To extract the pitch thin strips of the bark are peeled away down to the wood. The resin or pitch oozes from everywhere in the opening; it can be gathered from spring until fall, provided that one takes care to keep the cut open. The pitch seems to emerge only from the bark; none of it comes from the wood. Pitch collected during hot dry weather is better than that taken when the weather is damp and rainy. The tree can supply pitch for thirty years with just a single cut, but if the cuts are repeated it will die much sooner. Burgundy pitch is an ingredient in several ointments. Occasionally it's used alone, spread on the skin or on cloth to apply it to the areas afflicted by rheumatic pain. It's mixed with grease, and it's used to lubricate the axles of carriages to reduce friction. A thick resin is obtained by blending it with tar. The inhabitants of Lapland, which has little vegetation, use this tree to great effect. They make ropes out of the roots, as well as elegant baskets and chests of drawers that are sold in Sweden, and they build lightweight boats with the wood.

The red, silver, and black firs and especially the hemlock-spruce are used in the United States to prepare a wholesome and pleasant drink, according to Duhamel. I tried some in England. I agree that it might be healthy, but I always found it to be quite unpleasant as a drink. The barks of these different trees are used for tanning leather. Inhabitants of the Alps obtain a clear liquid turpentine from the silver fir that's used in the arts and in medicine. An extract or oil of turpentine, produced by distillation, has been used very successfully in England for a number of years as a treatment for tapeworm.

It's an ingredient in many ointments, balms, and salves. Veterinarians mix it into certain beverages administered to horned livestock. It's used by painters as a paint thinner and by varnishers for dissolving resins.

The wood of this tree is almost entirely cut and sold as lumber. It's used in civil construction and in shipbuilding. According to Varenne-Feuille a cubic foot when it's dry weighs about thirty-four pounds.

CULTIVATION. Several methods have been suggested for propagating fir trees, which are at once beneficial for their wood, their by-products, and for the picturesque appearance they provide in our parks and plantations. Consult Duhamel, Descemet [*Translator's note*: possibly Jean Descemet, 1732-1810], and the work of M. Desfontaines on this subject. The most certain method of propagation is to plant their seeds, raise them in pots, and to locate them permanently when they are three years old.

KEY TO PLATES.

767. 1. Branch and cone of the Norway spruce. 2. Scale, exterior view. 3. Same, interior view and seeds. 4. Detached seed. 5. Same, transverse section. 6. Same, transverse [*Translator's note*: probably longitudinal] section. 7. Branch of the red fir. 8. Scale, exterior view. 9. Same, interior view. 10. Detached seed.
768. 1. Branch of the black fir. 2. Scale, exterior view. 3. Same, interior view. 4. Branch of the hemlock-spruce. 5. Scale, exterior view. 6. Same, interior view. 7. Branch of the silver fir. 8. Scale, exterior view. 9. Same, interior view.
769. Silver fir. 1. Scale, exterior view. 2. Same, interior view and seeds. 3. Detached seed.

WILLOW.

Family: AMENTACEAE [*Translator's note: now SALICACEAE*].

Reproductive system: DIOECY, DIANDRY.

The white willow, *Salix alba*, Linn., is a tree about thirty feet tall. Its bark is gray, fissured, and a little rough. The bark on the branches is smooth and greenish. The leaves are lanceolate, finely dentate on the margins, smooth above with silky hair underneath. The flowers grow in catkins. In the male catkins there is a flower underneath each scale, which substitutes for the calyx. There are two stamens. On the female catkin the scale is hairy and the ovary is surmounted with a short style and two stigmata. The fruit is a bivalve capsule, polyspermous with one compartment. The seeds are small with a pappus.

FLOWERS: in April and in May.

RANGE: France and Europe.

NOMENCLATURE. German, *die weisseweide*. Dutch, *witte, wilg*. English, *the white willow*. Russian, *wetla*.

The rosemary-leaved willow, *Salix rosmarinifolia*, Linn., is a small tree that I've found to be very common along the banks of streams and small rivers of southern Provence. Its leaves are entire or sometimes lightly dentate with margins that curve downward. They are long, narrow, pointed, green above and whitish and cottony underneath. The male flowers are in oblong catkins borne on reddish branches. They develop before the leaves come out. The female flowers likewise form catkins, but they are much longer than the male ones. There are two stamens. The fruit is a small capsule with one compartment and two pointed valves.

FLOWERS: in March. Its capsules open in May.

RANGE: the banks of streams and rivers around Fréjus.

The almond-leaved willow, *Salix triandra*, Linn., is a tree seven or eight feet tall. The leaves are lanceolate, pointed, smooth, have toothed margins and two rounded stipules at their base. The male flowers are in long catkins and appear when the leaves first come out. The flowers have three stamens and a scale with down on it.

FLOWERS: at the onset of spring.

RANGE: sandy places on river banks in Dauphiné and in Alsace.

The early willow, *Salix præcox*, hort. par. is not a very tall tree, quite similar to the one above. The leaves are oval, oblong, and dentate. The male flowers form small rounded oval catkins with rounded reddish scales. Each flower has two stamens plus a large downy scale.

FLOWERS: I saw it in bloom on March 25, 1818.

The acuminate willow, *Salix acuminata*, Mill., is about the same height as the *marceau* willow. Its leaves are oval, oblong, with undulate or crenate margins, whitish and cottony underneath.

RANGE: France, in cool and damp regions.

The water willow, *Salix aquatica*, Willd., is a tree quite similar to the *marceau* willow. Its leaves are oblong oval with dentate stipules, green above, glaucous and downy underneath. The flowers form small catkins; each flower has two stamens.

FLOWERS: around the end of March.

RANGE: France, on dunes and in swamps.

NOMENCLATURE. The genus name, *Salix*,

according to M. de Théis [*Translator's note*: probably Alexandre Étienne Guillaume Baron de Théis, 1765-1842] stems from two Celtic words, *Sal*, near, and *lis*, water; a tree that grows near water. From *Salix* we get the French word *saule* [*Translator's note*: i.e. willow tree]. German, *weide*, *weidenbaum*. Danish, *pill*. Italian, *salcio*. Hungarian, *tüz-fa*. Polish, *wierzba*.

USES. The wood of the willow tree isn't very much in demand, but since the trees grow quickly, many are planted. The wood of the white willow is supple and sturdy. Hoops are made from its stout branches and ties from the slender ones. Willow boards are used for making crates and for light construction. Charcoal from the young branches is suitable for manufacturing gunpowder.

The bark of the white willow has a bitter taste. It's an astringent and an antipyretic. It's been used successfully to treat intermittent fevers. The bark of young branches two to three years old is the choice for this purpose. It's administered as a powder at a dose of an eighth of an ounce repeated four or six times during the intervals between outbreaks of fever.

CULTIVATION. Willow trees can be grown from seeds, but normally they're propagated from cuttings called slips that thrive especially well in damp soil. But it should not be flooded, because in that case trenches would have to be dug nearby and the earth put back at the bases of the trees to form an embankment.

The willows form a very large genus; there are more than a hundred and twenty species of them. Furthermore they're difficult to distinguish because they offer few conspicuous and consistent features. The soil and the climate can bring about such remarkable changes that even the most scrupulous observer would be very hard put to identify them. For example, as M. Desfontaines says, I've seen the downy willow of our Alps change its shape in a garden so much that it would have been impossible for even the most expert and practiced botanist to recognize it. It had lost its whiteness, the leaves had become much larger, and the tree, which in its native soil is always very small,

had within a year put out shoots nearly two meters long.

KEY TO PLATES.

White willow. 1. Female branch. 2. Capsule. 3. Seed.

Rosemary-leaved willow. 1. Male branch leafed out. 2. Same, in bloom.

3. Male flower. 4. Female branch. 5. 6. Capsule.

Almond-leaved willow. 1. Male flowers. 2. Same, detached.

Early willow. 1. Branch of male flowers. 2. Detached male flower.

Acuminate willow. 1. Branch of male flowers. 2. Stamens.

Water willow. 1. Branch of male flowers. 2. Detached flower.

PAGODA TREE.

Family: LEGUMINOSAE.

Reproductive system: DECANDRY, MONOGYNY.

The Japanese pagoda tree, *Sophora japonica*, LINN., is one of the most beautiful trees acclimatized in France during the last century. The seeds were sent here by Father d'Incarville in 1747 [*Translator's note*: Pierre d'Incarville, 1706-1757, Jesuit missionary and botanist in China]. Thirty years later one of the trees bloomed in the garden of M. de Noailles in Saint-Germain and another in the Trianon garden. Since that time the seeds have been collected and the pagoda tree has spread throughout Europe. There's a fine one in the Marbœuf garden and another in the King's Garden. But the most beautiful one that's been grown from seeds collected in France is in the garden of M. de Montessuy at Gros-Caillou.

The trunk grows sixty or eighty feet high. The bark is gray on the trunk and dark green on new branches. The leaves are pinnate and are composed of seven to eleven smooth, pointed, entire, dark green oval leaflets. The flowers are white and form wide open panicles at the ends of the branches. The calyx is a cup with five small teeth. The corolla is papilionaceous, and there are ten stamens. The ovary is superior; it turns into an oblong pod that looks like a string of beads and contains several seeds.

FLOWERS: toward the end of spring.

RANGE: China and Japan.

NOMENCLATURE. *Sophora*, derived from its Arabic name *sophera*. After it had been grown from seeds but before it bloomed it was known in France as *the unknown tree from China*.

USES. This tree is worth propagating in forests.

Its wood is compact, smooth and solid, and very suitable for carpentry and cabinetry. It's never attacked by insects. It's said that workers have had trouble sawing sections of the wood when it's still green, but when it's dry it can be worked on without difficulty. The Chinese extract a beautiful yellow dye from its leaves. It's said that the trees are grown only in the parks and gardens of the rich and of noble lords. The roots are sweet and slightly sugary.

CULTIVATION. This is a hardy tree. It weathers our winters well. However in the north of France it must be sheltered when it's still young. It's readily propagated from suckers and from seeds planted at the end of April and covered with a loose layer of earth. Also, one must take care to remove the seeds from their seed coats before planting them.

KEY TO PLATE.

Japanese pagoda tree. 1. Calyx, stamens, and pistil. 2. Corolla. 3. Pod.
4. Detached seed.

SERVICE TREE.

Family: ROSACEAE.

Reproductive system: ICOSANDRY, TRIGYNY.

The service tree, *Sorbus domestica*, Linn., is a tree that grows naturally in the woodlands of Provence and Piedmont where it grows about fifty feet high. Its trunk is straight and smooth; it forms a rounded top at its summit. The leaves are pinnate with oval-oblong leaflets that have dentate margins and are whitish underneath. The flowers are white and are arranged in corymbs. The calyx has five lobes. The five petals as well as a very large number of stamens insert into the calyx. The flowers are replaced by yellowish fruit in one variety and by brown fruit in another.

The cultivated service tree differs from the wild service tree in the number of its styles, of which there are three, and in the type of its seeds, which are cartilaginous.

FLOWERS: at the onset of spring.

RANGE: Provence. It's cultivated in almost all of France.

NOMENCLATURE. M. de Théis says that *Sorbus* is derived from the Celtic *sormel*, a combination of *sol*, meaning rough or harsh, and *mel*, apple. German, *der sperberbaum*, *spirling*. English, *the sorbetree*. Hungarian, *barkotza*.

USES. In several provinces the tree is cultivated for its fruit which is used to make cider, or for eating during the winter after ripening on a bed of straw. Its wood is reddish, hard, and weighs thirty-one kilograms per cubic foot. It's used to make nuts, screws for presses, handles for utensils, and furniture, since it polishes beautifully.

The mountain ash, *Sorbus aucuparia*, Linn., doesn't grow as tall as the preceding tree. Its leaves are oval-lanceolate, pointed, and dentate on their margins. The flowers are white and are grouped in broad umbels. They're succeeded by berries that when ripe are beautifully red

and have a bitter, astringent, and even nauseating taste.

FLOWERS: at the beginning of spring.

RANGE: the woodlands of France and northern Europe.

USES. The wood of this tree is hard, compact, and is used by lathe workers and cabinet makers. It's used to make tables, screws for presses, and handles for tools. It's very much like that of the domestic service tree and the wild pear. A cubic foot weighs twenty-three kilograms. This tree has been used for a long time to decorate parks and large gardens. It creates its best effect there, especially with its many clusters of beautiful red fruit toward the end of summer. Birds, especially blackbirds and thrushes, eagerly go for the fruit. It's said that the Swedes make cider and brandy from it, and that the inhabitants of Kamchatka eat it after sweetening it with jelly.

The oak-leaf mountain ash, *Sorbus hybrida*, Linn., differs from the two preceding trees by its cottony leaves pinnate only at their base. Also, the flower corymbs aren't as wide. Linnaeus and some other botanists saw it as a cross between two other trees. It's used to decorate groves in all seasons. According to Linnaeus the inhabitants of Gothland [*Translator's note:* a Swedish island in the Baltic Sea] eat its fruit.

CULTIVATION. The service tree self-propagates in forests. In gardens it's obtained by seed planting, and it's grafted successfully on the hawthorn. The other species are propagated the same way. To benefit from them sooner they can be grafted on the quince, pear, or hawthorn.

KEY TO PLATES.

- 739. Service tree with yellow fruit. 1. Fruit, transverse section. 2. Detached seed.
- 740. Service tree with brown fruit. 1. Fruit, transverse section. 2. Seed.
- 741. Mountain ash. 1. Intact fruit. 2. Same, transverse section. 3. Seed.
- 742. Oak-leaf mountain ash.

ARBOR VITAE.

Family: CONIFERS. [*Translator's note: now CUPRESSACEAE*]

Reproductive system: MONOECY, MONADELPHY.

The Oriental arbor vitae, *Thuia* [*Translator's note: now Thuja*] *orientalis*, Linn., is a tree about thirty feet high with flattened evergreen branches. The leaves form overlapping scales on young branches, but they're sometimes farther apart on the older ones. The flowers form catkins at the ends of the branches. The male flowers form an ovoid catkin consisting of opposite scales with four anthers at the base. The female flowers make up an oval cone formed from scales that terminate in a hook at the tip. Beneath each scale there are two ovaries surmounted with a very short style. The fruit is formed by the scales joining together and it contains several seeds.

FLOWERS: in March and April.

RANGE: China; naturalized long ago in the parks and gardens of France and Europe.

NOMENCLATURE. *Thuia*, derived from *thya*, a Greek word that means *sacrifice*, because when the wood burns it emits a pleasant aroma and a species of *Thya* was used for sacrifices. In our gardens the *Thuia* sometimes is called *tree of life*.

The white cedar, *Thuia occidentalis*, Linn., is a tree quite similar to the one above, but its foliage is shiny, not as thick, and it's much more fragrant. The fruits, or cones, have no points or hooks like those on the previous species.

FLOWERS: in February and March.

RANGE: North America. It was introduced into France and grown in the King's Gardens at Fontainebleau under François I.

USES. These two trees have helped decorate our groves for a long time. They provide excellent shelter to protect

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seed beds and young plants from north winds. The inhabitants of Canada believe that the wood of the white cedar resists decay. They use it to make stakes for enclosures and stockades for their forts. They make brooms from leafy young branches to scent the rooms in which they're used. This tree is just as workable with a chisel as is the yew. In a Zurich garden Malesherbes saw a very large arbor that contained several arbor vitae trees joined together to create an impenetrable cover against not only the sun's rays but even against rain.

CULTIVATION. Arbor vitae trees are very hardy. They do equally well in dry or in moist soil. They're propagated with seeds planted in a good exposure and in loose soil. After two years they're transplanted two feet apart; about the fourth year they can be situated permanently. They require no further special care. The white cedar grows extremely slowly. Arbor vitae trees also can be propagated by layering. Young branches are layered in the autumn. The plants that stem from them are then transplanted and treated as though they were cuttings. Some gardens cultivate a variety of the white cedar with variegated leaves.

KEY TO PLATES.

Oriental arbor vitae. 1. Male flower. 2. Fruit or cone. 3. Same, opened.

4. Intact seed. 5. Same, transverse section.

White cedar. 1. Fruit. 2. Same, opened. 3. Seed.

LIME TREE.

Family: TILIACEAE.

Reproductive system: POLYANDRY, MONOGYNY.

Our garden walks are almost all planted with broad-leaved lime trees, *Tilia platyphyllos*, VENT. Their trunks grow very tall, but the trees usually are trimmed so that their branches are denser and more numerous to provide better shade. The bark is thick and creviced down below. The leaves are petiolate, rounded in a heart shape, unevenly dentate on the margins and terminate in a point. They are soft and downy, especially on the veins underneath. The flowers are located at the leaf axils. Several of them are grouped together on a foliaceous membranous peduncle. The calyx is deciduous and has five sections. The corolla has five petals that are bare at the base. The stamens are very numerous. The ovary is superior, globular and surmounted by a filiform style. It turns into a top-shaped nut divided into five compartments with five protruding sides of thick hard material. Normally it contains only one or two seeds.

FLOWERS: in May and June.

RANGE: France, Sweden, and several other parts of Europe.

NOMENCLATURE. German, *der linde, der lindenbaume*. English, *the lime tree*. Spanish, *tilo*. Russian, *lipa*. Hungarian, *hars-fa*. Tartar, *djuga, Iuka*. Arabic, *uglamur*. Japanese, *badaisin*.

USES. The wood has several domestic uses. Sculptors prefer it to poplar because it carves better and is less susceptible to worm holes. Because it's very light it's used for charcoal, which is most suitable

for the manufacture of gunpowder. The flowers of the broad-leaved lime tree emit a pleasant fragrance. They're a headache medicine and often are prescribed for neurological disorders. The inner bark, soaked in water and retted, is used to make ropes for wells that last as long as those made from hemp.

During the last century Missa, a doctor at the Faculty of Medicine in Paris, ground the fruit of the broad-leaved lime tree together with a few of its flowers and obtained a buttery paste that he said was similar to chocolate. But, according to the findings of Margraff [*Translator's note*: possibly Georg Marggraff, 1610-1644, German naturalist], it appeared that this chocolate never could harden like that of cacao, and it was very different in consistency, flavor, and aroma.

CULTIVATION. The tree usually is propagated by layering, and it takes root very easily after transplantation. It's also propagated from seeds. It thrives quite well in all kinds of soil, but it prefers ground with a lot of depth.

KEY TO PLATE.

1. Broad-leaved lime tree.
2. Complete flower.
3. Pistil with several stamens.
4. Intact fruit.
5. Same, transverse section.

TULIP TREE.

Family: MAGNOLIACEAE.

Reproductive system: POLYANDRY, POLYGyny.

Upon his return from his travels in America around the middle of the last century Admiral La Galissonnière presented France with the yellow tulip tree, *Liriodendron tulipifera*, LINN., as well as with several other useful plants. At that time only a few specimens were available. Only two of them have survived: one planted by Duhamel at Monceau and one by M. de Cubières at Versailles. But several years later the elegance and greenery of the tree's foliage and the beauty and abundance of its flowers put it in great demand, and today it's very widespread. It's claimed that in its native country it grows to a hundred and thirty or forty feet in height, and the trunk attains a diameter of three feet. The leaves are smooth, alternate and are divided into three lobes with the middle one somewhat truncate. The flowers are located at the ends of the limbs and branches. They are yellow tinged with red and have a pleasant fragrance. The calyx has three deciduous sections. The corolla is bell-shaped and consists of six to nine petals. The stamens are very numerous and are surmounted with anthers that open outward. The ovaries also are extremely numerous and are superior. They change into the same number of capsules with a lanceolate wing at their top, distended at their base, and containing one or two seeds. They're arranged in a cone on a central axis.

FLOWERS: in June.

RANGE: Virginia and several other parts of North America.

NOMENCLATURE. German, *der tulpenbaum*.

Dutch, *tulpboom*. English, *the tulip tree*. Portuguese, *tulipeiro*.

USES. Until now the tulip tree has been regarded as just an ornamental tree. But it could turn out to be very useful. The wood is white, light, supple, and takes on a fine polish. It's made into furniture that resists infestation by worms. Canadians use the roots of the tree to alleviate the bitterness of spruce beer and to give it a lemony flavor. M. de Cubières claims that a very well known distiller in Martinique used the root bark to perfume her liqueurs and to give them a special flavor that has made them an outstanding choice.

CULTIVATION. The tree is propagated in the spring by planting seeds in heath mold and covering them lightly. Ordinarily the seeds are procured from America, because it's claimed that the ones from European tulip trees don't develop. Nevertheless at M. Bellart's in Cercey I've seen saplings grown from the seeds of a beautiful tulip tree that graces his park. During their first three or four years young tulip trees must be sheltered in winter and only transplanted permanently when they are five or six feet tall. The tulip tree thrives when it's apart on its own. It likes good quality fresh soil. The ground near it should not be tilled to avoid exposing and damaging the roots, most of which extend horizontally and are near the surface of the ground.

The tulip tree planted at Monceau in 1754 was five feet six inches in circumference when measured two feet above the ground in 1784. When I measured it in July 1822, it was six feet seven inches in circumference. It's claimed that there's yet another very beautiful tree close to Nantes.

KEY TO PLATE.

1. Yellow, or cultivated tulip tree.
2. Stamens and pistil.
3. Intact capsule.
4. Same, opened to reveal the seeds.