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Author(s): W. Dallimore

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XXXIX.—NOTES ON TREES SUITABLE FOR EXPERIMENTAL FORESTRY. II. AMERICAN BROAD-LEAVED TREES—*continued.*

W. DALLIMORE.

THE SUGAR MAPLE (*Acer saccharinum*, Wangenh.).—The important place occupied by this species amongst commercial timbers, warrants it a trial amongst possible timber trees in the British Isles, although it is of less vigorous growth than the Oregon and Norway Maples and the Sycamore. Hough, "American Woods," i, pp. 48-49, describes it as being one of the most useful trees of Canada, New England and the Middle States, its timber being employed for furniture, interior finish of houses, flooring, ship-building, shoe-lasts and wooden-ware. Further references to the uses of the wood are made in "Forest Planting Leaflet," Circular 95, U.S. Dept. of Agriculture, as follows:—"The wood of the sugar maple is heavy, strong, dense, and very hard, but not durable in contact with the soil. It is susceptible of fine polish and is used in large quantities for interior finish, floors, musical instruments, furniture, wooden ware, vehicles, cooperage, and novelties. The wood stands alternate wetting and drying well, and is therefore one of the best for the manufacture of washing machines. 'Curly' and 'Bird's-eye' maple obtained from this species, are desirable for finishing and cabinet work. The wood makes charcoal of unsurpassed quality, is a source of wood alcohol, and has a very high fuel value."

"The chief value of the sugar maple for economic planting is as a sugar producer. The sap contains from 2 to 3 per cent. of sugar. Three to 9 per cent. of the total sap content of the tree may be utilized for sugar-making without dangerously lessening the tree's vitality."

The species is of slow growth in America, its average height growth being about one foot a year for the first 30 or 40 years and less afterwards. It occurs in pure stands and also in mixed woods. Being a good shade-bearer, American foresters employ it for planting beneath light-demanding subjects when it is to be grown for timber, and recommend its association with such trees as red oak, hickory, and yellow poplar. It is said to be unadapted for poor, dry ground, and to be sensitive to severe frost and drought, but is reported to stand wind, snow and ice well. When grown for sugar production it is planted wide so that the crowns may have plenty of room for development. An account of the growth of the tree for sugar production is to be found in "Bulletin No. 59," of the Bureau of Forestry, U.S. Dept. of Agriculture.

The average height of American grown trees is given as about 80 feet and the trunk diameter as 3 feet. It sometimes, however, grows 120 feet high with a diameter of 5 or 6 feet. According to the above mentioned forest circular it often forms from 25 to 75 per cent. of the total forest stand in the northern pine belt of America. A great deal of timber is imported into the markets of the British Isles, some ready worked in the form of flooring blocks for factories, work-rooms, &c., mangle rollers and other articles, and some as trunks and planks.

A small plantation of sugar maple was made a year or two ago on the Earl of Plymouth's estate at St. Fagans in South Wales, but it is yet too young for an opinion to be formed as to how it is likely to succeed.

THE RED MAPLE (*Acer rubrum*, L.).—This is another species which provides a certain amount of the maple wood of commerce, and it is one which thrives in this country. It is found in Canada and the Eastern United States, as a tree up to 80 feet high with a trunk diameter of 4 feet. Its best proportions are attained along the banks of lakes and streams, where it often grows in ground of a swampy nature which is subject to occasional flooding. That it will grow on ordinary land is shown by the fine trees which are sometimes met with in this country, and growing in the hot sandy soil of Kew several trees of fair development are to be seen. A very fine tree is growing on the bank of the lake at Whitton Park, Hounslow.

Hough, "American Woods," iii., pp. 15-16, describes the wood as moderately heavy, hard and elastic, close-grained, compact and taking a very smooth polish. He adds that it is valuable for the manufacture of shovels, bowls, and small wooden-ware generally. The curly grain peculiar to the wood of *A. saccharinum* is sometimes developed in this wood also and such examples are esteemed for cabinet making. According to Hough, the bark also is of importance, for, by boiling it with sulphate of iron and alum a bluish-black dye is obtained. Boiled with alum alone the bark is said to produce a lasting cinnamon-colour dye.

THE HICKORIES (*Carya* spp.).—Hickory wood of commerce is furnished by several species of *Carya* which may be grown in certain parts of the British Isles. The hickories are closely related to the walnuts and share with those trees the character of producing edible nuts. In America, the nuts of some kinds are of such importance that plantations of trees are made solely for their production. Pecan nuts, the produce of *Carya olivaeformis*, are imported into the markets of this country and are used for dessert. Hickory wood has a high reputation for strength and elasticity and is used for many of the purposes to which ash is put, such as handles for axes and other tools and for agricultural implements. It is also in request for carriage building and is popular in America for the manufacture of trotting sulkeys. In fact for the latter purpose it is said to be better adapted than any other known wood (see "Garden and Forest," September 25, 1889, p. 460).

Although good trees of a few species are to be found in the British Isles and young examples make satisfactory progress at Kew, the hickories have not been planted freely enough to warrant extensive plantations prior to experimental work. They are included among the trees which are under trial at Avondale in Ireland but the plantation is only of recent formation. Elwes, "Trees of Great Britain and Ireland," iii., p. 616, doubts their suitability for forest planting in the British Isles and supports his opinion with observations on the behaviour of various species which have been tried on the Continent. As far as he is aware, none of the trials which have been made in France, where the trees were introduced on a large scale by Michaux, 100 years ago, have been

successful, and he could not hear that any of the trees which were planted near Paris are now alive. But, as we are faced with the fact that no systematic trials have been carried out in this country, the possibility remains that one or more species may form useful timber trees and enable us to grow timber which has now to be imported.

In American literature, the *Caryas* are usually referred to under the name of *Hicoria*, and in the "Silva of N. America," vii., the various species are described under that generic name.

The following species are worthy of trial :—

THE SHELL-BARK OR SHAG-BARK HICKORY (*Carya alba*, Nutt.).—The wood of this species is highly esteemed by manufacturers, and it is said to be one of the most valuable kinds of hickory. The common names of shell-bark and shag-bark refer to the habit which old trees have of shedding their bark in rough scales. This habit enables timber merchants to single out felled trees belonging to the species from amongst inferior kinds. Hough, "American Woods," ii., p. 26, refers to it as a very valuable wood for agricultural implements, the wheels and runners of vehicles, axe-helves, baskets, &c. He also says that its nuts are an important article of commerce and that most of the hickory nuts of the market are produced by this species.

Although rarely found as a pure forest, it covers an extensive area in America, for it is met with from the northern shores of Lakes Erie and Ontario, throughout the Middle States to Florida, N. Alabama, &c. Its associates, according to the "Forest Planting Leaflet," Circular 62, are other hickories, oaks, maples, ashes, chestnut, basswood, and yellow poplar. *Carya alba* grows best in a deep, rich and moist loam, and the above mentioned circular recommends that it should be planted in good soil in valleys and on fertile hill-sides. It is doubtful whether it would prove successful on shallow soil, for like other hickories, it is a deep-rooting tree. As it is a light-demanding tree, it should be planted as a pure plantation or be mixed with some shade-bearing subject such as beech, hornbeam, or sugar maple.

According to American reports it coppices well, and the young growths are used for splitting to make into baskets, barrel hoops, &c.

On account of young trees being difficult to transplant, it would be a good plan to sow the seeds where the trees are to grow, taking care first, to roll them in red lead to secure them from attacks by mice. If sown in a nursery, the young trees ought to be transferred to permanent quarters when not more than two years old. When planted as a mixture, the hickories might be placed about 8 feet apart each way. Attention to weeding will be required for two or three years after the formation of a plantation, for the young trees do not get on very fast in the early stages, and might easily be smothered by coarse vegetation.

One of the largest trees in the country is growing in the arboretum at Brocklesby Park, Lincolnshire. Its height last year was 79 feet, and its girth 4 feet 10 inches, at 5 feet from the ground. Other large trees referred to in "Trees of Great Britain and Ireland," iii, p. 603, are to be found at Botley Hill, Hants, and at

Boynton Hall, Bridlington, Yorks. At the former place a tree about 70 years old measures 75 feet in height by 5 feet 4 inches in girth, with a bole of 30 feet, while three trees on the latter estate are 50 feet by 7 feet, 40 feet by 4 feet, and 25 feet by 6 feet, respectively. Its average height in America is 70 to 90 feet, with a girth of from 6 to 10 feet, but trees have sometimes been found up to 150 feet high, with a girth of 15 feet.

THE BITTER-NUT (*Carya amara*, Nutt.).—Although the timber of this species is considered by wood-workers to be inferior to that of the shell-bark hickory, it is used for many of the same purposes. Hough, "Handbook of Trees of the Northern States and Canada," p. 53, says that it is less fastidious than other species with regard to soil, and that it is more uniform in distribution, and probably the most abundant representative of its genus. Its maximum dimensions are attained in southern New England, where it grows to a height of 100 feet, with a girth of 10 or 12 feet. Usually, however, it is found between 70 and 80 feet high, and up to 9 feet in girth. There appears to be no reason to doubt that it will succeed in England, for Mr. Elwes has recorded several well-grown examples in "Trees of Great Britain and Ireland," iii, p. 601. A tree at Bute House, Petersham, when measured, in 1903, was 76 feet high, and 7 feet 5 inches in girth. At Arley Castle, the tallest of five trees was 72 feet high by 4 feet in girth, while at Barton, Bury St. Edmunds, two trees measured, in 1905, 80 feet by 5 feet 4 inches, and 74 feet by 7 feet 6 inches, respectively. The nuts, on account of their bitter taste, are reputed to be valueless, and squirrels, even, are said to ignore them so long as other food is to be found.

THE PIG-NUT (*Carya porcina*, Nutt.).—This is considered to be one of the hardiest of the hickories, and it ought to prove a useful one for forest planting. Hough, "Handbook of Trees of the Northern States and Canada," p. 65, says that it is found at higher altitudes than any other hickory inhabiting the uplands and ridges of the Northern States. Its average height is from 80 to 100 feet, and its girth from 9 to 12 feet. Its timber is of good quality, and is used for many purposes where toughness and strength have to be combined with lightness. The nuts are not considered so important as those of other species in America, on account of their thick shells and small kernels.

A tree 73 feet high, with a girth of 6 feet 2 inches, at 5 feet from the ground, may be seen near the south end of the Temperate House at Kew. It fruits freely most years, but many of the nuts are not fertile. From the way in which this tree has grown in poor sandy soil, there can be little doubt about its success in ground of better quality, if planted under forest conditions. It is probable that its chances as a forest tree in England could be gauged most satisfactorily by planting it alongside a plantation of ash, under exactly similar conditions.

THE KING-NUT OR BIG SHELL-BARK HICKORY (*Carya sulcata*, Nutt.).—In many respects this species may be looked on as a counterpart of *C. alba*. It has the same peculiar habit of shedding its bark in long plates or strips, and the wood is of equally good quality. Attaining a height of 100 or 120 feet, with a diameter of from 3 to rarely 4 feet, Sargent, "Silva of N. America," vii, p. 159,

says that its best dimensions are attained on rich, deep, bottom lands which are inundated during several weeks each year. The orange colour of the young branches is given as a ready means of distinguishing the tree from other kinds. Hough, "American Woods," iii, p. 64, gives a description of the wood and refers to the nuts, which are said to possess a delicious flavour, and always to find a ready market. It might be tried under similar conditions to *C. alba*.

THE MOCKER-NUT HICKORY (*Carya tomentosa*, Nutt.) Like several of the other hickories this species produces timber of first-rate quality, whilst its nuts constitute such an important article of trade that it is grown for their production as well as for timber. It is found between 90 and 100 feet in height with a girth of from 9 to 12 feet, inhabiting the middle and southern States from the coast westwards to Nebraska and Kansas. Its maximum growth takes place in rich upland valleys and on gentle slopes; towards the more northerly parts of its range, it is confined to the neighbourhood of the coast. The best specimen at Kew may be seen near the Azalea Garden. It was planted in 1872, and is now 49 feet high, with a girth of 2 feet 5½ inches at 5 feet from the ground. The leaves of many of the *Caryas*, and of this one in particular, are very effective in autumn, for they assume a rich golden colour previous to falling. This desirable quality suggests them as good subjects for massing in places where landscape effect has to be studied.

AMERICAN OAK (*Quercus* spp.). Although some 50 or 60 species of *Quercus* are natives of N. America, very few are ever likely to enter largely into competition with British oaks in our woodlands, for, generally speaking, the wood is no better than English oak, if as good, and the same quality of land would be required to grow it as is necessary for the production of good English oak. The best American oak is produced by a number of species which are known collectively as "white oaks." White oak timber holds an important position amongst United States timbers, and a good account of its uses, &c., is to be found in "Forest Service Circular," 105, of the U.S. Dept. of Agriculture, "White Oak in the southern Appalachians." It is there stated that its annual cut is over 2,000,000,000 board feet, and that it forms 49 per cent. of the total annual cut of hardwoods in the southern Appalachian region. *Q. alba* is the most important tree in the group, which includes such species as *Q. macrocarpa* and *Q. bicolor*. The principal uses for white oak appear to be ship and waggon building, furniture, cross-ties for railroads and staves for barrels. White oaks, as a rule, grow unsatisfactorily in this country, hence the necessity for exercising caution in the formation of plantations.

Other classes of American oak are known as "red oak" and "black oak." Some of the species which produce these classes, grow satisfactorily in this country, but the timber is inferior to that of the white oak, and might be classed with that of the Turkey oak for quality, rather than with that of the British species.

The following species, however, deserve a trial in our woods.

THE BURR OAK (*Quercus macrocarpa*, Michx.). It is probable that this species will prove more satisfactory than others of the

white oak group for cultivation in this country, though in special places where the atmosphere is moderately humid, and the ground good and moist; the "white oak," *Q. alba*, L., and the "swamp white oak," *Q. bicolor*, Willd., may prove a success. The burr oak grows to a large size in Central N. America, its average height being from 80 to 90 feet, with a diameter of 3 to 4 feet, though under very favourable conditions specimens have been noted up to 170 feet in height, with a diameter of from 6 to 7 feet. "Forest Planting Leaflet," Circular 56, U.S. Dept. of Agriculture, deals with this species, and from it the following notes have been extracted. "The burr oak is one of the most valuable hardwood trees in North America. The wood is heavy, hard, very strong and durable. In the markets it is not, and need not be, distinguished from white oak, and it is used for the same purposes. The heartwood makes especially good fence posts and railroad ties, but the sapwood does not last long in the ground. It is best suited to deep, rich, river-bottom soils. It will maintain itself in poorer upland localities, but it is recommended for planting only where the soil is fairly good, moist, and well-drained, and where protracted droughts are infrequent. It is rather intolerant of shade, and will not thrive beneath the crowns of taller trees. The rate of growth, except under the best conditions, is somewhat slow, and is about like that of white oak. Neither grows so rapidly as red oak. The burr oak is subject to comparatively few pests or diseases." In America, regeneration takes place by growths from the stools of trees which have been carefully felled, and also from seeds which are often sown on the ground the trees are to occupy. A full description of this and other white oaks may be found in vol. viii. of the *Silva* of N. America.

THE RED OAK (*Quercus rubra*, L.).—This strong-growing species thrives in many parts of the country, increasing in size at about the same rate as the Turkey oak. Timber from British-grown trees is reddish in colour and of attractive appearance, but it lacks the strength of good English oak. American reports of the timber describe it as heavy, hard, coarse-grained, strong, and moderately durable. It is said to be inferior to white oak where great strength is required, and not to last so long in the ground, but to work easier and to be often preferred for interior finish and for cabinet work. As a rule it is considered to be better than other kinds of red oak, and the best qualities are not kept separate from white oak for many purposes. (See "Forest Service Circular," 58, U.S. Dept. of Agriculture.) In the sandy soil of Kew it makes satisfactory progress. When grown in the open the head is inclined to become very wide in comparison to the height and even in a thin wood the same thing is apparent, therefore, it is probable that the best results would be obtained by planting it thickly with beech or some other shade-bearing tree for a companion. The largest tree at Kew has a girth of 13 feet 10 inches at 5 feet, and is now about 55 or 60 feet high. It has, however, been lopped. Younger trees range up to 85 feet high with trunks up to 6 feet in girth. Two vigorous examples were noted recently in the gardens at Ancrum House, Roxburghshire, the residence of Miss Scott. The larger specimen was 55 feet high, and 7 feet 6 inches in girth at 5 feet from the ground.

With reference to the growth of red oak in America, the aforementioned circular gives the following information :—

“Red oak is best suited to porous, sandy or gravelly clay soils. In this requirement it is intermediate between the white oaks and several of the black oak group. It requires well-drained soil always, but does not do well where the air is very dry. The tree is intolerant of shade, except when very young, and must always be allowed to keep its crown free. Red oak surpasses all other oaks in the rapidity of its growth, and is therefore a good tree to plant where conditions are suitable. Like the other oaks, this species is not subject to disease nor to serious insect attacks, and is rarely overthrown by wind.”

Under normal conditions, *Q. rubra* grows from 70 to 90 feet high with a trunk diameter of from 2 to 4 feet, but it has been recorded up to 150 feet high with a diameter of 5 feet.

THE COTTONWOOD (*Populus monilifera*, Ait.).—The usefulness of the better grades of poplar wood for box-making and for paper pulp is such as to warrant extensive plantations of those kinds which grow rapidly and produce good timber. *P. monilifera*, or *P. deltoidea* as it is often called, is likely to prove one of the best of the species for it occupies an important place amongst American woods. “Circular 47,” of the Forest Service, U.S. Dept. of Agriculture, deals with the strength of packing boxes made from various kinds of wood, and of eight sorts mentioned for medium sized boxes and six sorts for large boxes, cottonwood was found to be the strongest. For small boxes cottonwood was second of eight. The kinds tried were cottonwood, red gum, yellow pine, New England white pine, Western hemlock, Western spruce, Michigan white pine, and North Carolina pine.

Populus monilifera is widely distributed from Quebec, southwards through the Atlantic States to western Florida and westward from Alberta, along the Rocky Mountains to New Mexico. Like other poplars it is of rapid growth when planted on moist ground, and is an excellent tree for low ground which is subject to flooding. Its average height is given as from 75 to 100 feet and the diameter of the trunk as from 2 to 3 feet. The United States “Forest Circular,” 77, refers to the economic uses of the wood as follows :—“Paper pulp, boxboards, backing for veneer, the unexposed parts of furniture, wagon boxes, interior woodwork and boarding, and fuel are the principal products for which the wood is used. The increased value which the tree is gaining for these uses, coupled with the ease and rapidity with which it can be grown, renders it one of the important species for commercial planting in the Middle West. Its fuel value in some regions is especially high, since it furnishes a greater amount of wood in a given time than other species. In proportion to volume, the relative heat-production is, however, low.”

P. monilifera would need to be planted as a pure stand, or with spruce, on moist ground. It would probably grow on high, dry ground, but it is doubtful whether it would ever prove a commercial success. Cuttings form the most satisfactory method of increase. These may either be dibbled into permanent positions or be rooted

in a nursery. Male flowering trees are preferable to female, for when the latter are fruiting, the cottony fibre which surrounds the seeds is apt to become objectionable.

Populus Eugenei, Simon-Louis.—Although there are several species of poplar which are, or may be, grown successfully in this country, experiments might well be directed towards ascertaining whether some of the hybrids, on account of more robust growth, would not be more profitable. Cultivated as ornamental trees they are certainly more vigorous than their parents and it is quite possible that they would produce a given amount of timber of equal or better quality in a shorter space of time. The hybrids are probably of natural origin, but, until recently, they have been considered to be varieties of certain species, or have been distributed as good species. Their identity has, however, been worked out by Henry and others, and they have been proved pretty conclusively to be hybrids between the European *P. nigra*, L. and one of the American species, *P. monilifera*, Ait., or *P. angulata*, Ait.

P. Eugenei is likely to prove one of the best of these hybrids for forest planting, for it is of sturdy, pyramidal habit, with a narrow head of small branches. It grows rapidly and will apparently arrive at a marketable age in 30 or 40 years from the time of planting. Growing in poor sandy soil at Kew, which often becomes very dry—by no means ideal conditions for poplars—a tree planted in 1888 is now 95 feet high, 7 feet in girth near the ground, and 4 feet 10½ inches at 5 feet high. It is a male plant and would of course have to be increased by means of cuttings. Pure stands on moist ground would doubtless be more economical than mixed woods and the trees might be planted from 3 to 4 feet apart each way. Like other poplars it is well adapted for the banks of lakes and streams, hence its suitability for plantations on marshy ground.

P. serotina, Hartig, *P. regenerata*, Hort., *P. marilandica*, Bosc. and *P. robusta*, Schneider, are other vigorous-growing hybrids, which, when grown in the open, develop wide-spreading heads of branches. Some of them are already in cultivation included under the general term of black Italian Poplar. All are worth trying in experimental blocks.

XL.—DIPENTODON.

A NEW GENUS OF UNCERTAIN SYSTEMATIC POSITION.

S. T. DUNN.

In 1898 Mr. Augustine Henry sent to Kew from Mengtze in Yunnan, where he was then stationed as Commissioner of Customs, specimens of the foliage and young fruits of a small tree growing in the forests which covered the mountains to the south of that town. The specimens exhibited such unusual floral characters that there arose some doubt, which further study failed to remove, as to what Natural Order or even as to what Series of the Dicotyledons could be expected to contain its allies. The material was, in fact, not sufficiently complete to enable the question to be decided until, among some specimens from the Province of