THESIS

Tree Studies

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T H E S I S.

T R E E S T U D I E S.

Michigan Agricultural College.

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H u g h P. B a k e r.

TREE STUDIES.

The purpose for which this thesis was undertaken was to make a thorough and careful study of the time of the leafing and flowering of our native Michigan trees, as found on the College campus, and to compare the results with similar studies made in previous years. Incidentally, also, to give a much needed familiarity with the families and genera of the trees.

As far as possible, average individual trees were selected for observations, and all data obtained during the season were taken from the same trees. While the characteristics of the individual tree are given, rather than of the species as a whole, yet this method seems a valuable one from the fact that it eliminates all variations which might be due to differences of soil and exposure.

In the attached "Calendar of Trees and Shrubs," the observations covering the years of 1885, 1886, and 1887 were taken from tables published by L. H. Bailey, in Bulletin No. 31, of the Michigan Experiment Station. In writing of the data which was taken in regard to the falling of leaves, Mr. Bailey says: "It is, of course, impossible to fix an exact date upon which the leaves of any

plant begin to fall. An occasional leaf may fall at any time. The first falling of the leaves designates the day when the first conspicuous fall, due to the maturity of the leaf, took place. In the instance of the Oaks, which usually hold a portion of their leaves during the winter, no date has been fixed to designate the entire bareness of the branches. Usually, the last leaves to disappear from most trees are those on the higher or younger shoots. These shoots mature last."

This "Calendar of Trees and Shrubs" forms a basis for a comparative study of plant life, as represented among the trees on the Campus, but will only be of much value as these observations can be compared with similar observations taken in other places.

In the thesis proper, the families of trees and shrubs are arranged according to "Sudworth's Check List of the Forest Trees of the United States," Issue of November, 1898. A large part of the botanical descriptions and notes in regard to the distribution of the species were adapted from Sargent's "Flora of North America." Also, many notes were taken from "Emerson's Trees and Shrubs of Massachusetts."

Only trees native to this vicinity have been described at any length. Many very interesting shrubs and foreign trees are growing upon the Campus, but it would be impossible to write of even a part of them in a thesis of this kind.

A Herbarium, containing specimens of nearly all the trees and shrubs on the College Campus, accompanies this thesis, and will be found in the Horticultural Department.

Family PINACEAE.

Genus PINUS. Linn.

Pinus strobus, Linn.

White Pine.

Leaves in 5-leaved clusters, slender, glaucous, 3 or 4 inches in length. Cones from 4 to 6 inches long.

A tree, under favorable conditions growing to height of 100 or 120 feet, with a trunk from 3 to 4 feet in diameter; exceptionally to a height of 250 feet, with a trunk 6 feet in diameter.

The White Pine ranges from Newfoundland westward to Valley of Winnepeg river; southward it extends through the northern states to southern Pennsylvania and southern shore of Lake Michigan, thence through central Iowa and along Alleghany mountains to Kentucky, Tennesee and Georgia. Sometimes on sandy drift it forms nearly pure forests, but more often is found in groves, a few acres in extent, scattered thorugh forests of deciduous-leaved trees.

The wood is light, soft, not strong, close, straight-grained, very resinous, easily worked and takes a good polish. The specific gravity of dry wood is 0.3854, a cubic foot weighing 24.02 pounds. The lumber is largely used for shingles, lath; for

construction and cabinet building.

A number of fine specimens of this tree are growing on the Campus. The soil seems well adapted to them, and where they are allowed free development are the most beautiful Pines we have, though in growing thus freely are of no value as timber.

Genus PINUS, Linn.

Pinus resinosa, Aiton.

(P. rubra, Michx.)

Red Pine. Norway Pine.

Leaves in 2-leaved clusters, slender, dark green, 5 to 6 inches in length. Cones ovate-conical, from 2 to 2 1/4 inches long, their scales slightly thickened, unarmed.

This tree usually grows 70 or 80 feet high, with a tall straight trunk 2 or 3 feet in diameter, occasionally attaining a height of 150 feet, with a trunk 5 feet through and stout spreading more or less pendulous branches which in youth clothe the stem to the ground.

The Norway Pine grows on light sandy loam or dry rocky ridges, usually forming groves, rarely more than a few hundred acres in extent, scattered through forests of other pines or deciduous-leaved trees. Ranges from Nova Scotia to shores of the Lake of the Woods. Common in northern New England

and New York. From Massachusetts it extends thro Pennsylvania, Central Michigan, Wisconsin and Minnesota.

The wood is light, hard, and rather close-grained. The specific gravity is 0.4854, a cubic foot weighing 30.25 pounds. Largely used in construction of bridges and buildings and for piles, masts and spars. In cultivation the Red Pine grows very rapidly.

But one good tree of this species is found on the Campus. This is young, hardy, and is growing very rapidly. It compares very well, here, with the Austrian Pine, for ornamental purposes.

Genus PINUS, Linn.

Pinus divaricata, Du Mont.

(P. Banksiana, Lambert).

Jack Pine. Scrub Pine.

Leaves in clusters of 2, stout, falcate, divergent, dark gray-green, from 3/4 to 1 1/4 inches in length. Cones oblong-conical, oblique, usually erect, incurved, from 1½ to 2 inches long, their scales furnished with minute incurved often deciduous prickles.

The Jack Pine frequently grows 70 feet high, with a straight trunk sometimes free of branches for 20 or 30 feet, and rarely exceeding 2 feet in

diameter, and long spreading flexible branches forming an open symmetrical head.

This tree ranges from Nova Scotia to valley of the Mackenzie river, where it is the only pine tree; southward ranges thro Maihe, Vermont to southern shores of Lake Michigan, and through Indiana and Illinois to central Minnesota. Abundant in central Michigan and Wisconsin, covering great barrnn tracts of land.

The wood is light, soft, not strong and close-grained. The specific gravity of dry wood is 0.476, a cubic foot weighing 29.67 pounds. Sometimes used for railroad ties and posts, largely for lath and for fuel. In northern Michigan, Wisconsin and Minnesota it forms a valuable nurse tree for the Red Pine.

A number of Jack Pines have been planted on the grounds but are still of small size. The sandy soil of this neighborhood seems to agree with them well, and it is probable that they will attain a large size.

Genus LARIX, Duham.

Larix laricina (Du Roi.) Koch.

(L. Americana, Michx.)

Tamarack. Larch.

Cones small, subglobose, the scales few, longer than their bracts.

A tree,from 50 to 60 feet high, with a trunk

18 or 20 inches in diameter.

The Tamarahh ranges from near the coast of Labrador to shore of Hudson's Bay andnorthwestward to Mackenzie river. Southward it spreads thro Canada and the northern states to northern Pennsylvania, Illinois, Indiana and central Minnesota.

The wood is heavy, hard, very strong, rather coarse-grained, compact and very durable in contact with the soil. The specific gravity of dry wood is 0.6236, a cubic foot weighing 38.86 pounds. Largely used for ship timbers, fence posts, telegraph-poles and railroad ties. Usually inhabits land saturated with water but the tree grows better in rich upland soils.

Some good specimens of the Tamarack are in the Arboretum, and a Tamarack swamp lies just north of the Campus. A tree bearing white cones in place of common red cones has been found in this swamp by Prof. Wheeler.

Genus PICEA, Link.

Picea mariana, Britton.

(P. nigra, Link.)

Black Spruce.

Cones ovate, incurved at the base,, persistent, their scales rounded, erose, or dentate. Branchlets pubescent. Leaves short, blue-green.

This spruce is usually 20 or 30, and occasionally 100 feet, high, with a trunk from 6 to 12

inches and occasionally 3 feet in diameter. Often small and stunted.

The Black Spruce inhabits sphagnum-covered bogs, and swamps and their borders, and at the north also well-drained bottom-lands and the slopes of barren stony hills. It ranges thro Hudson Bay country to valley of the Mackenzie river. Southward thro Newfoundland, eastern Canada and the northern states to Pennsylvania and Virginia, and westward to central Minnesota, Wisconsin and Michigan.

The wood is light, soft, and not strong. The specific gravity of dry wood is 0.5272, a cubic foot weighing 32.86 pounds. Rarely used for other purposes than manufacture of paper pulp.

One Black Spruce has managed to exist on the Campus tho quite a number are found in the swamp north of the College. The soil here seems poorly adapted to it and it is not doing well.

Genus PICEA, Link.

Picea parryana (Andre) Parry.

(P. pungens, Engelm.)

Blue Spruce.

Cones oblong-cylindrical, their scales rhomboidal, elongated, flexuose, rounded or truncate at the erose apex. Branchlets glabrous. Leaves rigid, spinescent, blue-green, or silvery white.

A tree, usually 80 to 100, but occaionally 150,

feet high with a trunk rarely three feet in diameter, and is occasionally divided into 3 or 4 stout, erect secondary stems.

This Spruce grows along the banks of streams and on first benches above them, singly or in small groves. Nowhere very abundant, generally scattered along mountain streams of Colorado and eastern Utah and Wyoming.

The wood is very light, soft, weak, and close-grained, with a satiny surface. The specific gravity is 0.3740,a cubic foot weighing 23.31 pounds.

A few introduced trees are doing very well on the Campus, tho they are yet quite small.

Genus PICEA, Link.

Picea canadensis, (Mill.) B.S.P.

(P. Alba, Link.)

White Spruce.

Cones oblong-cylindrical, slender, their scales rounded, entire. Branchlets glabrous. Leaves blue-green, strong-smelling.

A tree with strong-smelling foliage, sometimes 150 feet high, with a trunk 3 or 4 feet in diameter, but east of the Rocky mountains it is much smaller. The leaves are crowded on the upper side of the branches by the twisting of those on the lower side and point forward.

The White Spruce inhabits the banks of streams and lakes and the borders of swamps, in rich, moist, alluvial soil, ocean cliffs, and less commonly atthe north, the rocky slopes of low hills. It ranges from Labrador thro the Hudson Bay country nearly to the shores of the Arctic Sea. Southward it extends thro Maine, Vermont and northern New York, Michigan and Minnesota and the Black Hills of Dakota.

The wood is light, soft, not strong, and straight-grained with a smooth surface. The specific gravity is 0.4051, a cubic foot weighing 25.25 pounds. It is largely used for paper pulp, tho it is probably the only spruce cut in large quantities for lumber.

Some years ago a number of White Spruces were planted east of the Agricultural Laboratory, and these are doing fully as well as any of the planted Norway Spruces.

Genus TSUGA, Carr.

Tsuga canadensis, (Linn.) Carr.

Hemlock.

Cones ovate-oblong, pedunculate, their scales orbicular-oblong, nearly as wide as long.

A tree, usually 60 or 70 and occasionally 100 feet high, with a trunk from 2 to 4 feet in diameter, gradually and conspicuously tapering toward the apex.

The Hemlock ranges from Nova Scotia westward thro Ontario to eastern Minnesota, southward it ranges thro the northern states to Delaware, southern Michigan and central Wisconsin and along Appalachian mountains to Alabama. Often an inhabitant of rocky ridges and is scattered thro upland forests of White Pine and deciduous-leaved trees.

The wood is light, soft, not strong, brittle, coarse, crooked-grained, difficult to work, liable to wind-shake and splinter, and not durable when exposed tothe air. The specific gravity is 0.4239, a cubic foot weighing 26.42 pounds. The inner bark is largely used for tanning leather. Somewhat manufactured into coarse lumber for outside finish of buildings.

The Hemlock does not seem to thrive as well here as it does farther north. Perhaps due to poor exposure and poor sandy soil.

Genus ABIES, Duham.

Abies balsamea, Miller.

(A. Americana, Prov.)

Balsam Fir. Balm of Gilead Fir.

Bracts of the cone-scales oblong,emarginate and short-pointed at the wide serrulate apex, shorter or slightly longer than their scales. Leaves dark green and lustrous above, pale below. Obtusely

short-pointed and occasionally emarginate, and on fertile branches acute or acuminate.

A tree, 50 or 60 feet high, with a trunk usually from 12 to 18 inches in diameter, but occasionally 80 feet tall, with a trunk 30 inches in diameter.

This Fir ranges from Labrador to shores of Hudson's Bay and thro Manitoba. Southward thro Newfoundland, New England and thro northern New York, Michigan and Minnesota to northeastern Iowa. Alsothro Maine to Pennsylvania to southwestern Virginia. In the northern states grows on low swampy ground, and on well drained hillsides with Spruces, Hemlocks, Pines, Beeches, and Birches.

The wood is very light, soft, not strong, coarse-grained, and perishable. The specific gravity is 0.3819, a cubic foot weighing 23.80 pounds. Occasionally it is manufactured into cheap lumber. From the bark is made the Canadian Balsam.

The Firs on the Campus seem to be growing very slowly and are rather unhealthy. A large Silver Fir, Abies pecttinata, stands west of the parade grounds and is doing fully as well as the native Firs.

Genus TAXODIUM, Rich.

Taxodium distichum,(Linn) Rich.

Bald Cypress.

Anther-cells usually 4 or 5. Leaves dimorphic.

A tree, with tall lobed gradually tapering trunk, rarely 12 and generally 4 or 5 feet in diameter, above the abruptly enlarged, strongly buttressed and usually hollow base, and occasionaly-ly 150 feet high.

The Bald Cypress inhabits river-swamps, usual-ly submerged during several months of the year, low saturated banks of streams and wet depressions of sand barrens. It ranges from Delaware to Florida and westward to Texas, thro Louisiana, Arkansas to Missouri. Eastward to Mississippi and Tennesee, Kentucky, Illinois and Indiana.

The wood is light and soft, close, straight-grained, not strong, easily worked, durable in con-tact with the soil. The specific gravity is 0.4543, a cubic foot weighing 28.31 pounds. Used for rail-road ties, posts and fences, and for doors, sashes and rafters of glass houses.

Genus THUGA, Linn.

Thuga occidentalis, Linn.

Arborvitae. White Cedar.

Fruit small, with usually 4 fertile scales. Wood light yellow brown.

This is a tree 50 or 60 feet high, with a short

often lobed and buttressed trunk, occasionally 6 althousually not more than 2 or 3 feet in diameter, often dividing into 2 or 3 stout upright secondary stems.

The Arborvitae ranges from Nova Scotia thro Quebec and Ontario to mouth of Saskatchewan river. Southward from New Hampshire thro New York, Pennsylvania, central Michigan, northern Illinois and central Minneosta and along Allegheny mountains to southern Virginia. Frequently spreads over great areas of springy swamp-land or occupies the rocky banks of streams.

The wood is light, soft, brittle, and rather coarse-grained, very durable in contact with the soil. The specific gravity is 0.3164, a cubic foot weighing 19.72 pounds. Used largely for fence posts, ties, shingles and rails.

Many Arborvitae are growing here and our soil and climate seem well adapted to them. A number of horticultural varieties of this species have been planted and are doing exceedingly well.

Genus CUPRESSUS, Linn.

(Chamaecyparis, Spach.)

Cupressus thyoides, Linn.

(Chamaecyparis sphaeroidea, Spach.)

White Cedar.

Branchlets slender, compressed. Leaves dark blue-green, often conspicuously glandular.

A fragrant tree, 70 or 80 feet in height, with a tall trunk usually about 2 but occasionally 3 or 4 feet in diameter and slender horizontal branches which form a narrow spire-like head.

The White Cedar inhabits the cold swamps of the Atlantic and Gulf coast plains which are usually immersed during several months of the year. Frequently dense pure forest at the north or at the south mingling with the Bald Cypress. It ranges from Maine to Florida and westward to Mississippi.

The wood is light, soft, not strong, close-grained, easily worked, and very durable in contact with the soil. It seasons rapidly and perfectly without warping or checking. The specific gravity is 0.3322, a cubic foot weighing 20.70 pounds. Largely used in boat-building and cooperage and for telegraph and fence posts and ties and shingles.

Our soil is too dry and sandy for the proper growth of the White Cedar and the few trees growing on the Campus are not thriving as they would in a more moist and fertile soil.

Genus JUNIPERUS, Linn.

Juniperus Virginiana, Linn.

Red Cedar, Savin.

Fruit small, subglobose; seeds 1 to 4. Leaves opposite, acute or rarely obtuse, glandular. Branchlets slender.

This cedar is a tree, occasionally 100 feet tall, with a long straight trunk 3 or 4 feet in diameter which is often lobed and eccentric, and frequently buttressed toward the base. Usually much smaller, averaging 40 or 50 feet high.

The Red Cedar is the largest and most valuable of the American Junipers and is the most widely distributed coniferous tree of North America. It ranges from Nova Scotia southward to Florida, westward to the Dakotas, central Nebraska and Kansas, the Inidan Territory and Texas. In Nebraska and Kansas it grows usually on dry sandstone river bluffs.

The wood is light, soft, coarse-grained, brittle,and not strong. It is easily worked and extremely durable in contact with the soil. The specific gravity of dry wood is 0.4826, a cubic foot weighing 30.70 pounds. Largely used for posts, sills, railroad-ties, and for cabinet making and pencils.

The Banks of the Red Cedar river,in many places, are covered with this tree, and it seems to be doing well in other dry places on the Campus.

Family JUGLANDACEAE.

Genus JUGLANS, Linn.

Juglans cinerea, Linn.

Butternut. Oilnut.

Leaflets 11 to 17, oblong-lanceolate. Fruit oblong, acute, racemose; nut 4-ribbed at the sutures, deeply sculptured into thin ragged plates, 2-celled at the base.

The Butternut is occasionally 100 feet high, with a tall straight trunk 2 to 3 feet in diameter, and sometimes free of branches for half its height but more often dividing, 15 or 20 feet above the ground, into numerous stout limbs.

This tree prefers rich moist soil near banks of streams and on low rocky hills. It ranges from New Brunswick thro Ontario to eastern Dakotas and southeastern Nebraska. Southward thro northern states to Delaware, Missouri, and northeastern Arkansas and northern Georgia and Alabama.

The wood is light, soft, not strong, rather coarse-grained, easily worked and takes a good polish. The specific gravity of dry wood is 0.4086, a cubic foot weighing 25.46 pounds. The wood is largely used for furniture and interior finish of houses.

Many Butternuts are found in the College woods and along river flats though few are growing on the Campus, as the soil is too sandy and not rich and moist enough.

Genus JUGLANS, Linn.

Juglans nigra, Linn.

Black Walnut.

Leaflets 15 to 23, ovate lanceolate. Fruit usually globose, solitary or in pairs; nut globose, deeply and longitudinally ridged, 4-celled at the base.

This tree frequently grows 100 feet high, occasionally 150 feet high, with a straight trunk often clear of branches for 50 or 60 feet, and 4 to 6 feet in diameter.

The Black Walnut is distributed from western Massachusetts through southern Michigan and Minnesota to central and northern Nebraska and eastern Kansas. Southward thro Florida, Alabama, Mississippi and Texas. It inhabits rich bottom lands and fertile hillsides.

The wood is heavy, hard, strong, rather coarse-grained, easily worked and very durable in contact with the soil. The specific gravity of dry wood is 0.6115, a cubic foot weighing 38.11 pounds. It is used in cabinet making, for interior finish and for coffins and gunstocks. Nuts are of commercial value.

This vicinity is well adapted to the growth of the Black Walnut and some very fine large trees are growing along the river-bottoms,tho a little farther back the tree does not attain a large size.

Genus HICORIA, Raf.

Hicoria minima(Marsh)Britton.

(Carya amara, Nuttall)

Bitternut. Swamp Hickory.

Leaflets 5 to 9, lanceolate to oblong-lanceolate. Fruit 4-winged from the apex nearly to the middle; nut ovate or oblong, often broader than long, thin shelled; kernel bitter. Winter buds bright yellow.

A tree, often 100 feet high, with a tall straight trunk 2 to 3 feet in diameter, and stout spreading limbs which form a broad handsome head of slender rather stiff upright branches.

The Bitternut ranges from southern Maine westward thro Ontario, central Michigan and Minnesota to southeastern Nebraska, eastern Kansas and the Indian Territory. Southward to Florida and Texas.

It inhabits low wet woods nearthe borders of streams and swamps or high rolling uplands.

The wood is heavy, hard, strong, tough and close-grained. The specific gravity of dry wood is 0.7552, a cubic foot weighing 47.06 pounds. Largely used for hoops, ox-yokes, and fuel.
It grows more rapidly in cultivation than any of the other Hickories,with the exception of the Pecan.

Only a few good Bitternuts are growing on the Campus, but just north of the College a large number of fine young trees are starting up.

Genus HICORIA, Raf.

Hicoria ovata (Mill.)Britton.

(Carya alba Nuttall.)

Shag-bark Hickory.

Leaflets 5 or 7, obovate to oblong-lanceolate, ciliate on the margins. Fruit globose, depressed at the apex; nut ovate, more or less flattened, 4-angled, pale or nearly white.

A tree, often 70 to 90 feet high, occasionally 120 feet high with a tall straight columnar shaft 3 or 4 feet in diameter, in the forest often free of branches for 50 or 60 feet from the ground.

This tree ranges from southern Maine to valley of St.Lawrence River and along northern shores of Lakes Erie and Ontario, thro central Michigan and Minnesota and southeastern Nebraska. Southward thro New York, Delaware to Florida, Alabama and Mississippi to central Kansas and Texas. Usually found growing on low hills or in the neighborhood of swamps or streams.

The wood is heavy, very hard and strong, tough, close-grained, and flexible. The specific gravity of dry wood is 0.8372, a cubic foot weighing 42.17 pounds. The nuts are hickory nuts of commerce. The wood is largely used in the manufacture of agricultural implements, ax-handles and for fuel. Few trees of northern forests grow more slowly.

Our soil is well adapted to the Shagbark and we have a large number of these fine Hickories. A few peculiar varieties have been found.

Genus HICORIA, Raf.

Hicoria laciniosa, (Michx.)Sargent.

(Carya sulcata,Nuttall).

King Nut. Big Shellbark.

Leaflets 5 to 9, obovate or oblong-lanceolate, puberulous on the lower surface. Fruit oblong, depressed at the apex; nut thick-walled, ridged or angled, dull white.

The King Nut is distributed from Iowa southward thro Missouri, Arkansas, eastern Kansas, and Indian Territory; eastward thro southern Illinois, Indiana, to central Tennesee, western and central New York and eastern Pennsylvania. It inhabits rich deep bottom-lands which are usually inundated during several weeks of every year. It grows with the swamp White Oak, Tupelo, Red Maple, Red Ash and swamp Cottonwood.

The wood is heavy and very hard, strong and tough, close-grained and very flexible. The specific gravity of dry wood is 0.8108, a cubic foot weighing 50.53 pounds. The wood is confounded commercially with the wood of Hicoria ovata.

The only specimens of this tree that we have

are found in the Arboretum, where they have not fruited as yet.

Genus HICORIA, Raf.

Hicoria glabra (Mill.)Britton.

(Carya porcina, Nuttall).

Pignut Hickory.

Leaflets 5 to 7, oblong or obovate-lanceolate, globrous or villous-pubescent. Fruit pyriform or globose; husk usually thin; nut oblong, oval or globose, thick or thin shelled; kernel sweet or slightly bitter.

The Pignut inhabits dry ridges and hillsides, and is distributed from Maine thro Ontario and southern Michigan to southeastern Nebraska and southward to Florida, Alabama and Mississippi; westward thro Missouri, Arkansas to eastern Kansas, Indian Territory and Texas. It is extremely common in all the northern states.

The wood is heavy, hard, very strong and tough, flexible and close-grained. The specific gravity of dry wood is 0.8217, a cubic foot weighing 51.21 pounds. Commercially not distinguished from wood of shellbark and is used for same purposes.

The Pignut Hickory is, also, rather rare on the grounds. Probably due to the poorness of the soil. Some good specimens are growing in the Arboretum.

Family SALICACEAE.

Genus SALIX, Linn.

Salix amygdaloides, Anderss.

Peach Willow. Almond Willow.

Leaves lanceolate or ovate-lanceolate, acuminate, pale and glaucous on the lower surface, long-stalked.

A tree, sometimes 60 or 70 feet in height with a single straight or slightly inclining trunk rarely more than 2 feet in diameter; or usually much smaller.

The Peach Willow inhabits the banks of streams and ranges from neighborhood of Montreal and New York to Valley of Upper Saskatchewan, southward to Ohio and Missouri and westward over the great plains and thro the Rocky Mountains from Texas to Oregon and Washington. It is the common arborescent Willow along the banks of the rivers which flow eastward from the Rocky Mountains, and in all the central mountain region of the continent.

The wood is light, soft, not strong, and close-grained. The specific gravity of dry wood is 0.4509, a cubic foot weighing 28.10 pounds.

The Peach Willow is nothing more than a shrubby tree here, and not very abundant. Good specimens are growing along swamp borders north of the College.

Genus SALIX, Linn.

Salix Bebbiana, Sargent.

(S. rostrata, Rich.)

Bebb's Willow.

Leaves oblong, obovate or oblong-elliptical, conspicuously reticulate-venulose, dull green on the upper surface, glaucous or silvery white and pubescent on the lower.

A bushy tree, occasionally 25 feet in height, with a short trunk 6 or 8 inches in diameter; or, usually much smaller and often shrubby in habit.

This Willow inhabits the borders of streams, lakes and swamps, dry hillsides, open woods, and forest margins, usually selecting moist rich soil. One of the commonest and most generally distributed Willows in British America, ranging from the valley of the St. Lawrence to the Arctic Circle. Common in all the northern states, it ranges southward to Pennsylvania and westward to Minnesota, and is scattered thro the Rocky Mountain regions from Idaho to western Nebraska.

Just a shrub in this locality; good specimens are growing in the Botanical garden.

Genus SALIX, Linn.

Salix discolor, Muehl.

Glaucous Willow.

Leaves oblong, oblong-obovate,

or lanceolate, glaucous or silvery-white on the lower surface.

A tree, rarely exceeding 20 feet in height with a trunk about a foot in diameter; or, more often shrubby, with numerous tall straggling stems.

Salix discolor is a common inhabitant of moist meadows, and the banks of streams and lakes, and is distributed from Nova Scotia to Manitoba and southward to Delaware, southern Indiana, Illinois and Missouri.

The wood is light, soft, and close-grained. The specific gravity is 0.4261, a cubic foot weighing 26.55 pounds.

A common Willow with us, growing along river banks and in marshy places.

Genus SALIX, Linn.

Salix nigra, Marshall.

Black Willow.

Leaves narrowly lanceolate, long-pointed, often falcate, green on bothsurfaces, glabrous at maturity.

A tree, occasionally 120 feet in height with a trunk 3 feet in diameter, or, usually 30 or 40 feet high, with trunks which are often clustered.

Salix nigra inhabits the banks of streams and lakes, over which it often extends its trunks and branches and is distributed from New Brunswick

along the northern shores of Lakes Huron and Superior, southward to Florida, westward to eastern Dakotas, Nebraska, Kansas, and the Indian Territory and thro Texas, New Mexico, and Arizona. It is the largest and most conspicuous native Willow of eastern North America and is most abundant in the basin of the Mississippi River.

The wood is light, soft, weak, and close-grained, and checks badly in drying. The specific gravity is 0.4456, a cubic foot weighing 27.77 pounds. Bark is often used as a tonic in the treatment of fevers.

This is the largest Willow which is native here. It confines itself to low bottom-lands south of the College.

Genus SALIX, Linn.

Salix lucida, Muhl.

Shining Willow.

Leaves lanceolate, long-pointed, coriaceous, dark green and lustrous, their petioles glandular.

A bushy tree, occasionally 20 or 25 feet high, with a short trunk 6 or 8 inches in diameter; or usually smaller and shrubby in habit.

Salix lucida, which inhabits the banks of streams and swamps, and is very abundant at the north, ranges from Newfoundland to shores of Hudson's Bay, thence to Valley of Mackenzie River. It extends

southward to Pennsylvania and westward to eastern Nebraska.

The Shining Willow does not become tree-like here, but grows only as a shrub.

Genus POPULUS, Linn.

Populus tremuloides, Michx.

Aspen, Quaking Asp.

Leaves ovate, or semi-orbicular, short-pointed, slightly cordate or truncate at the base, finely serrate; petioles elongated, compressed.

A tree, often 100 feet in height, with a trunk which occasionally is almost 3 feet through near the ground but in general is not more than 18 or 20 inches in diameter, and preserves its size with little diminution for 50 feet or more.

The Aspen, which is the most widely distributed tree of North America, ranges from Labrador northwesterly to the Valley of the Yukon River in Alaska, southward thro northern states to Pennsylvania, northeastern Missouri and southern Nebraska and thro allthe mountain regions of the West. In the northern states it prefers rather moist sandy soil and gravelly hillsides and grows best near borders of swamps and open forest groves.

The wood is close-grained, but soft, and neither strong nor durable. The specific gravity is 0.4032, a cubic foot weighing 25.13 pounds.

In the East it is largely used in manufacture of paper-pulp. In the West it is occasionally used for flooring and fuel.

The great value of the Aspen lies in the power of its small seeds, supported by their long hairs and wafted far and near by the wind to germinate quickly in soil which fire has rendered infertile and in the ability of the seedling plants to grow rapidly in exposed situations.

Numbers of the Aspen line the bank of the Red Cedar River, and grow back up onto the sandy soil, somewhat.

Genus POPULUS, Linn.

Populus grandidentata, Michx.

Poplar. Large Tooth Aspen.

Leaves broadly ovate, coarsely crenate, coated at first, like thebuds, with hoary tomentum. Petioles elongated, laterally compressed.

A tree, often 60 or 70 feet in height, with a trunk occasionally 2 feet in diameter; or, generally smaller and usually not more than 30 or 40 feet tall.

The Poplar, which is a common inhabitant of the forest, usually selecting rich moist sandy soil near the borders of swamps and streams, is distributed from Nova Scotia to northern Minnesota, southward thro northern states to Delaware, southern Indiana and Illinois, and along the Alleghany

mountains to North Carolina, and westward to Kentucky and Tennesee.

The wood is light, soft, and coarse-grained, but not strong. The specific gravity is 0.4632, a cubic foot weighing 28.87 pounds. Largely used in the East for paper-pulp and is occasionally used for wooden ware and turnery.

This Poplar is the most common tree of the Genus in this vicinity. Grows very plentifully in the Oak forests north of the College and along the river-banks south.

Genus POPULUS, Linn.

Populus balsamifera, Linn.

Balsam. Balm of Gilead.

Leaves ovate, lanceolate, acute or acuminate, dark green and lustrous on the upper surface, pale and often ferrugineous on the lower.

A tree, often 100 feet in height, with a tall trunk 6 or 7 feet in diameter; or, smaller toward the southern limits of its range and usually not more than 60 or 70 feet tall.

The Balsam is distributed from the Valley of the Mackenzie river and the Alaskan coast southward to northern New England, New York, Central Michigan and Minnesota, the Black Hills, northwestern Nebraska and northern Montana, Idaho, Oregon and Nevada. It inhabits the low and often inun-

dated bottom-lands of rivers and swamp borders.

The wood is light, soft, not strong, and close-grained. The specific gravity is 0.3635, a cubic foot weighing 22.65 pounds. It is largely made into paper-pulp, and in northern Michigan is manufactured into pails and small packing-cases.

The only specimen of this tree we have is found in the Arboretum, where it grows to a large size. The variety, candicans, has been introduced and grows very rapidly and well. This variety differs from the common form in its more spreading branches, forming a broader add more open head and in its broader cordate leaves which are more coarsely serrate, with gland-tipped teeth.

Genus POPULUS, Linn.

Populus deltoidea, Marshall.

(P. monilifera, Aiton.)

Cottonwood.

Leaves deltoid or broadly ovate, usually abruptly acuminate, coarsely crenate, petioles laterally compressed. A tree, sometimes 100 feet in height, with a trunk occasionally 7 or 8 feet in diameter, dividing often 20 or 30 feet above the ground into several massive limbs which spread gradually.

The Cottonwood inhabits the banks of streams, where it often forms extensive open groves. It ranges from Quebec thro New England to Pennsylvania and the Atlantic states south of the Potomac river

to Florida,and westward to the base of the Rocky mountains from Alberta to northern New Mexico. The Cottonwood is the largest and one of the most abundant trees along the streams betweenthe Appalachian and the Rocky mountains.

The wood is light, soft, and not strong, altho close-grained. The specific gravity is 0.3889, a cubic foot weighing 24.24 pounds. Warping badly in drying and extremely difficult to season, it is now used only in the manufacture of paper-pulp, for cheap packing cases and for fuel.

In the United States, no other tree has been so generally planted on the plains and prairies east of the Rocky mountains.

The Cottonwood grows very rapidly and well here. A very large specimen grows just east of Abbot Hall.

Family Betulaceae.

Genus BETULA, Linn.

Betula papyrifera, Marsh.

(B. papyracea, Aiton).

Canoe Birch. Paper Birch.

Strobiles cylindrical, elongated, pendulous, long-stalked. Staminate aments clustered or in pairs. Leaves ovate, cuneate, or rounded at the base, dull dark green.

A tree, usually 60 or 70, or, on the northwest coast, occasionally 120 feet tall, with a trunk from 2 to 3 feet in diameter.

The Canoe Birch is one of the most widely distributed trees of North America, ranging from Labrador to the shores of Hudson Bay and to the valley of the Yukon River in Alaska. Southward it ranges thro all the forest region of the Dominion of Canada, and thro the northern states to Long Island, Pennsylvania, central Michigan and Minnesota, northern Nebraska, and the Black Hills of Dakotas, and northward to Montana and Washington. It inahbits rich woody slopes and the borders of streams, lakes and swamps. Within the Arctic Circle it becomes small and crooked. Grows mostly singly or in groups.

The wood is light, strong, hard, tough, and very close-grained. The specific gravity is 0.5955, a cubic foot weighing 37.11 pounds. Largely used

in making of spools, shoe-lasts and pegs, in the manufacture of paper-pulp, and for fuel.

This tree is not native at the College but a number of trees have been planted and they are doing very well.

A fine tree can be seen just southwest of the Chemical Laboratory.

Genus BETULA, Linn.

Betula nigra, Linn.

(B. rubra, Michx.)

Red Birch. River Birch.

Strobiles cylindrical, oblong, erect. Leaves rhombic-ovate, acute at bothends, lustrous on the upper surface, pale and pubescent on the lower.

A tree, 80 or 90 feet in height, with a trunk which often divides, 15 or 20 feet above the ground, into 2 or 3 slightly diverging limbs and is sometimes 5 feet in diameter. In old age it forms an irregular and picturesque crown. Often the Red Birch sends up from the ground a clump of several small spreading stems forming a low bushy tree. It inhabits the banks of streams, ponds and swamps, growing in deep rich soil which is often inundated for several weeks at a time. Ranges from Massachusetts thro Long Island and southward to Florida and thro Gulf States to Texas, and thro Mississippi valley to Indian Territory, eastern Kansas and Nebraska, central Minnesota and southern

Wisconsin and Ohio. Attains its largest size in damp semitropical low-lands of Florida, Alabama and Texas.

The wood is light,rather hard, strong, and close-grained. The specific gravity is 0.5762, a cubic foot weighing 35.91 pounds. Much used in manufacture of furniture, wooden-ware, and in turnery.

This is the only semi-aquatic Birch.

The only trees of this species on the Campus are found in the Arboretum, where they seem to be doing fairly well.

Genus BETULA, Linn.

Betula lutea, Michx.

(B. excelsa, Pursh.)

Yellow Birch. Gray Birch.

Strobiles oblong-ovoid, sessile or short-stalked. Leaves ovate, oblong-ovate, cuneate, or slightly heart-shaped at the base. Bark yellow or silvery gray, slightly aromatic.

A tree, occasionally 100 feet in height, with a trunk 3 or 4 feet in diameter, or, near the coast and its northern and southern limits, much smaller and often not more than 20 or 30 feet tall.

The Yellow Birch which is one of the largest deciduous-leaved trees of the forests of northeastern North America is distributed from Newfoundland to valley of Rainy river, southward thro northern states

to Delaware and along Alleghany mountains to high peaks of North Carolina and Tennesee, and to northern Minnesota. Usually inhabits moist uplands, growing in rich soil.

The tree is one of the most valuable timber-trees of the north. The wood is heavy, very strong, hard, and close-grained with a satiny surface. The specific gravity is 0.6553, a cubic foot weighing 40.84 pounds. Largely used in the manufacture of furniture, of button and tassel moulds, and match boxes and for fuel.

This tree requires low temperature and abundant moisture to develop its beauty.

This Birch, also, is found only in the Arboretum, tho good trees grow south of the College.

Genus OSTRYA, Scop.

Ostrya Virginiana, (Mill.) Koch.

(Carpinus Ostrya, Linn)

Ironwood. Hop Hornbeam.

Leaves oblong-lanceolate, acuminate or acute at the apex.

A tree, occasionally 50 or 60 feet in height, with a short trunk 2 feet in diameter, but usually not more than 20 or 30 feet tall, with a trunk from 12 to 18 inches thick.

The Ironwood usually grows on dry gravelly slopes and ridges, often in the shade of Oaks,

Maples, and other large trees and is distributed from Cape Breton Island thro valley of St. Lawrence river to northern Minnesota, the Black Hills of Dakotas, eastern and northern Nebraska and Kansas, southward to Florida and Texas. The tree grows with comparative rapidity, is very hardy and is not easily defaced by insects or fungal diseases.

The wood is heavy, very strong and hard, tough, exceedingly close-grained, durable in contact with the soil and takes a rare polish. The specific gravity is 0.8284, a cubic foot weighing 51.62 pounds. Used for fence posts, levers, mallets and handles of tools.

The College woods and the Oak woods north of the College are literally filled with this tree, which occasionally grows to a large size. Many good trees are standing on the Campus.

Genus CARPINUS, Linn.

Carpinus Caroliniana, Walter.

(C. Americana, Michx.)

Blue Beech. Hornbeam.

Involucres of fruit usually 3-lobed, and coarsely toothed on one margin. Leaves ovate-oblong, sharply serrate.

A bushy tree, rarely 40 feet in height, with a short fluted trunk occasionally 2 feet in diameter, and a wide graceful airy head; usually much smaller and at the north generally shrubby with numerous

slender spreading stems.

Carpinus Caroliniana inhabits the borders of trees and swamps, growing usually in deep moist rich soil. It ranges from Quebec to shores of Georgian Bay, southward to Florida, westward to northern Minnesota, eastern Nebraska and Kansas, the Indian Territory and Texas. It grows to largest size on west slope of Alleghany mountains.

The wood is heavy, very strong, hard, and close-grained. The specific gravity is 0.7286, a cubic foot weighing 45.41 pounds. Sometimes used for levers, handles of tools, and other small articles.

As with the Ironwood so with the Blue Beech, although perhaps not quite so abundant and fewer specimens are found on the Campus. It is seldom more than a shrub in this locality.

Family FAGACEAE.

Genus FAGUS, Linn.

Fagus Americana, Sweet.

(F. ferruginea, Ait.)

(F.atropunicea (Marsh.) Sudth.)

Beech.

Lobes of the calyx of the staminate flowers short and rounded. Leaves oblong-ovate, coarsely dentate-serrate, deciduous.

A tree, usually 70 or 80 feet, but under favorable conditions occasionally 120 feet in height. With a trunk 3 or 4 feet in diameter. When crowded in the forest the Beech grows tall but when the branches have room for free lateral growth, it is short, stunted, and the short trunk divides into numerous limbs.

Altho less common than several of the Oaks, the Beech is one of the most widely distributed trees of eastern North America. It inhabits the rich soil of uplands and mountain slopes, where it often forms nearly pure forests. Its range is thro southern Canada to northern Wisconsin and southward to Florida and thro Illinois and Missouri to Texas.

The wood is hard, tough, very close-grained, and takes a fine polish; it is not durable in contact with the soil and is inclined to check badly in drying. The specific gravity of dry wood is

0.6883, a cubic foot weighing 42.89 pounds. Largely used in manufacture of chairs, shoe lasts, handles of tools and for fuel.

The Beech is the tree of all trees in this nieghborhood. Some of the finest trees on the Campus are Beeches. In the College woods it is dying out badly and in the future will probably be replaced by other trees.

Genus CASTANEA, Adams.

Castanea dentata, Bork.

(C. vesca, Willd.)

(C. Americana, Raf.)

Chestnut.

Leaves oblong-lanceolate, long-pointed, green and glabrous on both surfaces. Nuts two or three in the involucre, flattened.

A tree, occasionally 100 feet in height in the forest, with a tall, straight columnar trunk 3 or 4 feet in diameter, or often when uncrowded by other trees, developing a short trunk which in exceptional individuals attains a diameter of 10 or 12 feet and which usually divides not far above the ground into 3 or 4 stout horizontal limbs forming a broad low round-topped head.

The Chestnut ranges from Maine thro south-eastern Ontario and Michigan, southward to Delaware, Indiana and along Alleghany mountains to Alabama and Mississippi and to central Kentucky and Tennesee. Very common on glacial drift of the northern states, where it grows rapidly to a large size and lives to a great age.

The wood is light, soft, not strong, coarse-grained, liable to check and warp in drying, easily split and very durable in contact with the soil. The specific gravity is 0.4504, a cubic foot weighing 28.07 pounds. Largely used in manufacture of cheap furniture and for railroad ties, fence posts and rails. The nuts are of much commercial importance.

The only Chestnuts now growing in this locality are in the College Arboretum. A few years ago some fine large specimens were growing on the Campus, but a very severe winter killed them all. Our soil is well adapted to this tree.

Genus QUERCUS, Linn.

Quercus alba, Linn.

White Oak.

Leaves obovate-oblong, obliquely, usually 7-lobed, or pinnatifid, pale and glabrous below.

A tree, growing to average height of from

80. to 100 feet, with a trunk 3 or 4 feet in diameter. The principal limbs are stout, and, spreading irregularly from the stem at a broad angle and in a slightly zigzag manner, form an open crown of rather slender rigid branches. Leaves are wedge-shaped at thebase.

The White Oak ranges from Maine thro Quebec and Ontario, the lower peninsula of Michigan and southern Minnesota to southeastern Nebraska and Kansas, and southward to Florida and Texas. It is an inhabitant of sandy plains and gravelly ridges, of rich uplands, intervales, and moist bottom-lands. Sometimes forms pure forests but often associated with Hickories, the Red Oak and White Ash.

This Oak is one of the most valuable and important timber trees of North America. The wood is strong, very heavy, hard, tough, close-grained and durable in contact withthe soil, altho liable to check in drying. The specific gravity is 0.7470, a cubic foot weighing 46.35 pounds. Largely used for ship building, construction and cooperage. One of best woods for fuel.

The Campus was originally covered with Oak forest, but only a few of the "old settlers" are now left. These are dying out badly at the top, probably due to the fact that the forest cover is removed from under the trees each year and, also,

the soil is much dryer than in the past, due to draining.

Genus QUERCUS, Linn.

Quercus macrocarpa, Michx.

Burr Oak. Mossy Cup Oak.

Leaves obovate or oblong, lyrately, pinnatifid or deeply sinuately lobed or divided usually pale and pubescent on the lower surface.

This is one of the largest Oaks of eastern North America, rising sometimes to a height of 160 or 170 feet, forming a trunk 6 or 7 feet in diameter and clear of limbs for 70 or 80 feet above the ground. The average height of Burr Oak is not more than 80 feet and toward its northern limit is reduced to a low shrub.

The Burr Oak usually inhabits low, rich bottom-lands, or intervales, or sometimes in the north-west, low dry hills. It ranges from New Brunswick to Manitoba in Canada and from Maine westward to the foot hills of the Rockies in Montana and to western Nebraska and central Kansas and southwest to Tennesee, Indian Territory and Texas. Most frequent and generally distributed Oak of Nebraska and Kansas.

This Oak is one of the most valuable timber trees of North America, its wood being superior in strength to the White Oak, with which it is commercially confounded. It is heavy, strong, hard, tough,

close-grained and very durable in contact with the soil. The specific gravity is 0.7453, a cubic foot weighing 46.40 pounds.

For some reason this tree grows but scantily in this region and few good specimens can be found.

Genus QUERCUS, Linn.

Quercus prinus, Linn.

Chestnut Oak. Rock Chestnut Oak.

Leaves obovate or oblong to lanceolate-acuminate, coarsely crenately toothed with rounded or acute teeth.

A tree, usually 60 or 70, occasionally 100, feet in height, with a trunk 3 or 4, or, rarely, 6 or 7 feet in diameter, divided, generally, 15 or 20 feet above the surface of the ground, into large limbs which spread into a broad rather open irregular head.

This Oak is an Appalachian tree, and grows on hillsides and the high rocky banks of streams in rich and deep or in sometimes shallow and rather sterile soil. It ranges from Maine to northern Georgia and Alabama. Westward thro New York and south to Kentucky and Tenesee.

The wood is heavy, hard, strong, rather tough, close-grained, altho difficult to season, and durable in contact with the soil. The specific gravity is 0.7499, a cubic foot weighing 46.73 pounds.

Largely used for fencing, railroad ties, and for fuel.

This Oak is much more abundant about the College than the Burr Oak. In the College woods many young Chestnuts Oaks are starting up,and they, with the maples and Ashes, willgradually crowd out the Beech.

Genus QUERCUS, Linn.

Quercus rubra, Linn.

Red Oak.

Leaves oblong-obovate to oblong, pinnatifid-lobed, the lobes tapering gradually from broad bases, and acute and usually dentate at the ends.

A tree, usually 70 or 80 feet or occasionally 150 feet in height, with a trunk 3 or 4 feet in diameter. The bark of the trunk on young stems and on the upper part of the limbs of large trees is smooth and light gray.

Quercus rubra is the most boreal of the Oak-trees of eastern America. It generally inhabits rich uplands, growing to a large size on glacial drift and the well-drained borders of streams and swamps. It ranges from Nova Scotia to the divide west of Lake Superior, southward to Tenesee and Virginia and along mpuntains to Georgia and west-ward to eastern Nebraska and central Kansas. It is one of the largest and most common trees in the forest of the northern States.

The wood is heavy, hard, strong, coarse-grained, and liable to check badly in drying. The specific gravity is 0.6621, a cubic foot weighing 41.25 pounds. Used largely in construction and in manufacture of cheap furniture.

No Oak of the northern states grows more rapidly or can be more easily transplanted.

The Red Oak is very abundant on the Campus and in the woods about the College. In many places it seems to be coming in and taking the place of the White Oak.

Genus QUERCUS, Linn.

Quercus coccinea, Muench.

Scarlet Oak.

Leaves oblong or obovate, light green and lustrous, deeply lobed, with broad rounded sinuses, the slender lopes coarsely repandly dentate toward the apex.

This tree grows 70 or 80 feet in height, with a trunk from 2 to 3 feet in diameter and comparatively small branches which spread gradually and form a rather narrow open head, or usually much smaller.

The Scarlet Oak inhabits light, dry and usually sandy soil. It ranges from Maine thro Central Michigan and Minnesota to southeastern Nebraska, and southward to North Carolina. Extremely abundant in coast regions south of Massachusetts

Bay. Less abundant in the interior, growing on dry, gravelly uplands with Black Oak, Red Oak and Pignut Hickory.

The wood is heavy, hard, and strong but coarse-grained. The specific gravity of dry wood is 0,7095, a cubic foot weighing 42.20 pounds.

The Autumn colors of the foliage of no other American tree are more splendid or retain for a longer time their beauty.

Few Scarlet Oaks grow in this region, and where they do grow are confounded with the Red and Black Oaks. A fine specimen stands just northeast of Williams Hall.

Genus QUERCUS, Linn.

Quercus velutina, Lam.

(Q. tinctoria, Michx.)

(Q. nigra, DuRoi.)

Black Oak. Yellow-bark Oak.

Leaves ovate or obovate, slightly or deeply lobed, with broad or narrow nearly entire or dentate lobes, usually pubescent on the lower surface.

A tree, often 70 or 80 and occasionally 150 feet in height, with a trunk 3 or 4 feet in diameter, and slender branches which spread gradually into a narrow open head. The Black Oak inhabits dry gravelly uplands and ridges. Ranges from coast of Maine thro Ontario to central Minnesota, southward to Florida, Alabama and Kansas, Indian Territory and

Texas.

The wood is heavy, hard, and strong, altho not tough, coarse-grained, and liable to check in drying. The specific gravity is 0.7045, a cubic foot weighing 43.90 pounds. The inner bark is used largely in tanning and furnishes a yellow dye. In this Oak the cup-scales are more loosely imbricated than in the Scarlet Oak. This Oak seems to be coming into the woods north of the College. A few large specimens are standing on the Campus.

Family ULMACEAE.

Genus ULMUS, Linn.

(U. fulva, Michx.)
Ulmus pubescens, Watt.
Slippery Elm. Red Elm.

Flowers on short pedicels in crowded fascicles. Fruit naked on the margins, pubescent. Leaves ovate-oblong, scabrous on the upper, pubescent on the lower surface. Bud-scales coated with rusty brown hairs. Branchlets destitute of corky wings.

A tree, 60 to 70 feet high, with a trunk occasionally 2 feet in diameter, and spreading branches which usually form a broad open flat-topped head.

The Slippery Elm is distributed thro Ontario to North Dakota and eastern Nebraska. Southward to western Florida, central Alabama and Mississippi and Texas. Everywhere less common than the American Elm. It inhabits banks of streams and low rocky hillsides, where it grows in deep fertile soil.

The wood is heavy, hard, strong, very close-grained, durable in contact with the soil, and easy to split while green. A cubic foot weighs 43.35 pounds. Largely used for fence posts and railraad ties, hubs of wheels and agricultural implements.

The Slippery Elm grows plentifully in this region along the river-bottoms and in low places. It does not seem to hold its own as the White Elm does.

Genus ULMUS, Linn.

Ulmus Americana, Linn.

White Elm. Water Elm.

Flowers on long drooping pedicels. Fruit glabrous, ciliate on themargins. Leaves obovate-oblong to oval, usually smooth on the upper, soft-pubescent on the lower surface. Bud scales glabrous. Branchlets destitute of corky wings.

A tree, sometimes 100 to 120 feet high, with a tall trunk 6 to 11 feet in diameter, frequently enlarged at the base into great buttresses.

The White Elm ranges from Newfoundland westward to northern shores of Lake Superior and the eastern base of the Rocky Mountains southward to Florida and westward to Black Hills of Dakota, western Nebraska, Kansas, and the Indian Territory and Texas. It prefers bottom-lands, intervales and low rich hills and grows on banks of streams with Box-elder, Green Ash and the Cottonwood.

The wood is heavy, hard, strong, tough, difficult to split and rather coarse-grained. A cubic foot weighs 40.55 pounds. It is largely used for hubs of wheels, flooring and cooperage.

Our climate and soil seem particularly adapted to this tree and it is one of the commonest trees in the region. At present it is being much hurt by large numbers of scale-insects.

Genus ULMUS, Linn.

Ulmus racemosa, Thomas.

Rock Elm. Cork Elm.

Flowers on long drooping pedicels. Fruit hirsute. Leaves obovate to oblong-oval, smooth on the upper, soft pubescent on the lower surface. Bud scales puberulous. Branches often furnished with corky wings.

The Rock Elm is a tree, 80 to 100 feet high, with a trunk occasionally 3 feet in diameter, short, stout, spreading limbs which form a narrow round-topped head.

This tree ranges from Quebec and Ontario southward thro New Hampshire, Vermont and westward thro New York and southern Michigan to northeastern Nebraska, southern Missouri and middle Tennessee. It prefers dry gravelly uplands or low heavy clay soil or rocky slopes and river cliffs.

The wood is heavy, hard, very strong and tough, close-grained and takes a good polish. A cubic foot weighs 45.20 pounds. It is used for railroad ties, bridge timbers and sills of large buildings and in manufacture of agricultural implements.

A few planted specimens are growing very well on the Campus.

Genus CELTIS, Linn.

Celtis occidentalis, Linn.

Hackberry. Nettle-tree.

Leaves ovate to ovate-lanceolate, sharply and coarsely serrate. Fruit large.

A tree, sometimes 130 feet high, with a straight slender trunk 2 to 3 feet in diameter. Often free of branches for 70 or 80 feet. Usually much smaller. Stout spreading, ridged or frequently pendulous branches, which form a handsome round-topped tree.

The Hackberry is exceedingly rare and local in Canada. In the United States it ranges from Massachusetts to northwestern Nebraska, North Dakota, southern Idaho, eastern Washington and Oregon and the mountains of Nevada and New Mexico. Southward to Florida and to Missouri, eastern Kansas, Indian Territory and Texas. It is rare in the eastern states and abundant in the middle states.

The wood is heavy, rather soft, not strong, and coarse-grained. A cubic foot weighs 45.41 pounds. It is largely used for fencing and for light furniture. The tree grows rapidly under varied conditions of climate and soil.

Just a tree here and there are found in this neighborhood, and those seem to hide themselves away on the river-bottoms. Some very large trees grow on these bottoms.

Family MORACEAE.

Genus MORUS, Linn.

Morus rubra, Linn.

Red Mulberry.

Leaves ovate, smooth or scabrate on the upper, coated with pale pubescence on the lower surface. Fruit oblong, dark purple.

This is a tree, 60 to 70 feet high, with a short trunk rarely exceeding 3 or 4 feet in diameter, and stout spreading smooth branches which form a dense broad round-topped shapely head.

The Red Mulberry ranges from Massachusetts thro New York, Ontario and central Michigan to southeastern Nebraska, Kansas and southward to Florida and Texas. It inhabits the rich soils of intervale lands and low hills.

The wood is light, soft, not strong, rather tough, coarse-grained and very durable when in contact with the soil. The specific gravity of dry wood is 0.5898, a cubic foot weighing 36.75 pounds. Much used for fencing, ties and cooperage.

Along the river-bottoms and in the College woods are growing quite a number of healthy, young Red Mulberries.

Family MAGNOLIACEAE.

Genus MAGNOLIA, Linn.

Flower-bud enclosed in a stipular cadacous spathe. Flowers perfect, solitary, terminal; sepals 3; petals 6 to 12, in series of 3's; anthers introrse; pistils indefinite, imbricated on an elongated receptacle. Carpels drupaceous-baccate, persistent, opening on the back at maturity. Seeds drupaceous.

The genus Magnolia is confined to eastern North America, southern Mexico and eastern and southern Asia. Seventy species are known, with six in North America.

Magnolia acuminata, Linn.

Cucumber-tree.

Leaves deciduous, ovate or sub-cordate. Fruit glabrous. Young shoots and winter buds densely pubescent.

A tall slender tree, 60 to 90 feet in height, with a trunk three or four feet in diameter. The young branches are bright red-brown, turning gray during their third season. This tree is distributed from western New York thro southern Ontario to southern Illinois, southward to southern Alabama and west of Mississippi river in Arkansas.

The wood is light yellow brown in color, soft, satiny, not strong but close-grained and dur-

able, tho not of much commercial importance. The trunks are sometimes used for water pipes and troughs.

But one good specimen of this tree is growing on the Campus, and that stands just east of the Chemical Laboratory. This tree is hardy and strong and grows well.

Genus LIRIODENDRON, Linn.

Flower-bud enclosed in a two-valved stipular caducous spathe. Flowers perfect, solitary, terminal; sepals 3; petals 6; in two rows; anthers extrorse, pistils indifinite, imbricated. Carpels samaraeform, indehiscent, deciduous from the receptacle at maturity.

This genus has only a single species, found in eastern North America and western China.

Liriodendron tulipifera, Linn.

Tulip-tree. White-wood.

Winter buds are dark red covered with glaucous bloom. In favored localities this tree grows from 150 to 190 feet high.

The Tulip-tree ranges from Rhode Island, thro Vermont to south shore of Lake Michigan, southward to northern Florida and Mississippi, and westward in Missouri and Arkansas. No vitally destructive insects are known to prey on the tree. It is easily propagrated from seed and easily transplanted.

Under favorable circumstances it grows rapidly and is hardy.

Some of the largest trees in this vicinity are Tulip trees. A tree stands here and there, well above the other trees, and is very beautiful when in blossom. The trees on the Campus grew in the original Oak forest and now seldom reproduce themselves.

Family LAURACEAE.

Genus SASSAFRAS, Nees and Eberm.

Sassafras sassafras, Karsten.

A tree, occasionally 30 or 90 feet high with a trunk sometimes nearly 6 feet in diameter, and short, stout, more or less contorted branches which spread almost at right angles from the trunk, forming a narrow usually flat-topped head.

The Sassafras is distributed from Massachusetts thro Vermont, Ontario, central Michigan thro southeastern Iowa to eastern Kansas and the Indian Territory. Southward to Florida and Texas. It is usually found in rich sandy well-drained loam.

The wood is very durable when in contact with the soil; it is aromatic and dull orange brown in color. A cubic foot weighs 31.42 pounds. It is largely used for fence posts and rails, and for light boats.

This tree is quite common and grows, occasionally, to a large size in this vicinity.

Family HAMAMELIDACEAE.

Genus LIQUIDAMBAR, Linn.

Liquidambar styraciflua, Linn.

Leaves deeply 5 to 7-lobed, lustrous, a straight trunk 4 or 5 feet in diameter. Flowers appear from March to the end of May, when the leaves are more than half grown.

The Liquidambar ranges from Connecticut to Missouri, and southward to Florida, thence thro Arkansas, Indian Territory and eastern Texas. It prefers rich river bottom-lands where it grows with Red Maples, Tupelo, and White Ash.

The wood is heavy, hard, straight and close-grained, altho not strong. It is difficult to season and warps easily. Used principally for pavement and fruit boxes.

This is an introduced tree in this region, and only one small specimen grows on the Campus. This seems thrifty and strong.

Family PLATANACEAE.

Genus PLATANUS, Linn.

Platanus occidentalis, Linn.

Sycamore. Buttonwood.

Leaves broadly ovate, obscurely 3 to 5-lobed, the lobes usually serrulate-toothed, truncate or rarely wedge-shaped at the base. Head of fruit usually solitary.

A tree, occasionally 140 to 170 feet high, with a trunk sometimes 10 or 11 feet in diameter, above its abruptly enlarged base. Often divided near the ground into several large secondary trunks. The large trunks are usually hollow to a considerable height above the ground.

The Sycamore inhabits the borders of streams and lakes and rich bottom-lands. It ranges from New Hampshire westward to eastern Nebraska and Kansas, southward to Florida, central Alabama and Texas.

The specific gravity of the dry wood is 0.5678, a cubic foot weighing 35.39 pounds. It is used for tobacco boxes, ox-yokes and furniture, and sometimes for interior finish.

Many large Sycamore trees stand about the Campus, tho they seem to be gradually disappearing. Some very fine specimens can be seen along the river-bottoms and back a few hundred rods.

Family ROSACEAE.

Genus PRUNUS, Linn.

Prunus serotina, Ehrh.

Wild Black Cherry. Rum Cherry.

Calyx-lobes persistent. Stone oblong-obovate. Leaves oblong to lanceolate-oblong, usually gradually acuminate.

A tree, with bitter aromatic bark and leaves. Sometimes attaining a height of 100 feet, with a stout straight trunk 4 or 5 feet in diameter. The flowers appear when the leaves are about half grown.

The Rum Cherry is distributed from Nova Scotia southward thro the eastern States to Florida and westward to the valley of the Mississippi in the Dakotas and to eastern Nebraska, Kansas, the Indian Territory and Texas. Along the mountain ranges in New Mexico and Arizona to central and South America. It usually grows in rich moist soil with the White Oak, Blue Ash, Sugar Maple and the Hickories. It is one of the most valuable timber trees of the American forest.

The wood is light, strong and rather hard, with a close straight grain and a satiny surface. Light brown or red, with thin yellow sap-wood. A cubic foot of the dry wood weighs 36.28 pounds. It is the best wood in America for cabinet making and interior finish.

Only a few good BlackCherries are growing on the Campus but many can be found in the Oak woods north and east. As the other trees are cut out the great tall Cherries seem to die and disappear.

Family LEGUMINOSAE.

Genus CERCIS, Linn.

Flowers fascicled or racemose; calyx disciferous, shortly turbinate, 5-toothed, the short, broad teeth imbricated in aestivation; corolla, subpapilionaceous, the upper petal the smallest, inserted within the others; ovary many-ovuled. Legume compressed, narrow-winged on the ventral suture. Leaves simple.

Cercis canadensis, Linn.

Red Bud. Judas Tree.

Flowers in sessile clusters. Leaves ovate, acute, cordate, or truncate at the base.

A small tree, sometimes 40 or 50 feet high, with a straight trunk usually separating, 10 or 12 feet from the ground, into stout branches which form an upright or often a wide flat head.

The Judas Tree is widely distributed from New Jersey to Florida, westward to northern Alabama and Mississippi, and northwestward to Missouri, Louisiana, Indian Territory, and Texas. It grows on borders of swamps and on rich bottom-lands.

The wood is heavy, hard, altho not very strong, and rather coarse-grained. The specific gravity of absolutely dry wood is 0.6363, and a cubic foot weighs 39.65 pounds. While the wood is not of much importance commercially the tree is much used for ornamental purposes.

The Red Bud is only a tall shrub here and only a few specimens are found on the Campus. A few in the Arboretum and one in the Botanical Garden make up the number.

Genus GLEDITSIA, Linn.

Flowers regular, polygamous by abortion; calyx campanulate, disciferous, 3 to 5 lobed; petals 3 or 5, imbricated in aestivation, ovary subsessile, 2 or many ovuled. Legume indehiscent or tardily 2-valved. Leaves abruptly pinnate or bipinnate.

Gleditsia triacanthos, Linn.

Honey Locust.

Legume linear-oblong, elongated, many-seeded, pulpy, indehiscent. Leaflets lanceolate-oblong.

A tree, growing under favorable conditions from 75 to 140 feet high. Trunk is covered with spines, 3 or 4 inches long, simple or 3-forked.

The Honey Locust ranges from western slope of Alleghany mountains in Pennyslvania thro southern Ontario and central Michigan to eastern Kansas and Nebraska and southward to northern Alabama and Miss-

issippi and Texas. It inhabits the borders of streams and intervale lands, growing with Black Walnut, Shellbark Hickory, Red Elm, Blue Ash, Boxelder and Kentucky Coffee Tree.

The wood is hard, strong, close-grained, and very durable in contact with the soil. Commonly used for fence posts, rails and hubs of wheels. It can be propagated from seed and is free from diseases and attacks of insects.

Only one Honey Locust is growing near the College, and that just north of the Arboretum. A few trees of this species are growing about half way to Lansing.

Genus GYMNOCLADUS, Lam.

Legume turgid or compressed, woody, 2-valved. Leaves unequally bipinnate.

Gymnocladus dioicus (L.) Koch.

(G. canadensis, Lam.)

Kentucky Coffee Tree.

Inflorescence terminal. Leaves 14-15 pinnate, the lowest pinnae reduced to simple leaflets, the others to 7 to 13-foliolate.

A tree, growing from 75 to 110 feet high and usually separating 10 or 15 feet from the ground into 3 or 4 principal divisions.

The Coffee Tree is distributed from western New York thro Pennsylvania and southern Michigan to

eastern Nebraska and Kansas and southwestern Arkansas and southward to Tennesee. It is one of the rarest of the forest trees of eastern North America, where it grows only on richest bottom-lands.

The wood is heavy, not very hard, strong, coarse-grained, liable to check in drying and very durable in contact with the soil. Used largely in cabinet making and for fence posts and rails.

The Kentucky Coffee Tree is quite abundant along the river-bottoms south of the College and a few good trees are growing in sheltered positions on the Campus. The trees all seem to be young and healthy.

Genus CLADRASTIS, Raf.

Flowers in ample termnial panicles; calyx 5-toothed, the teeth imbricated in aestivation; corolla papilionaceous; stamens distinct, ovary stipitate, many-ovuled. Legume linear-compressed, tardily dehiscent. Leaves unequally pinnate, destitute of stipules.

Cladrastis lutea, Koch.

(C. tinctoria, Raf.)

Yellow Wood. Virgilia.

A tree, sometimes 50 or 60 feet high, with a trunk from 1 to 2 feet in diameter, usually divided 6 or 7 feet from the ground into 2 or 3 stems. The branches are clothed with pubescence when they appear

but soon become glabrous. The leaves turn a bright yellow rather late in the Autumn, sometime before falling.

The Yellow Wood is one of the rarest and most local of the trees of eastern North America. It is found only in Kentucky, Tennesee and parts of North Carolina, where it grows with the Black Walnut, White Ash, White Oak and Tulip Tree. It is hardy as far north as New England and Ontario.

The wood is heavy, very hard, strong, and close-grained, with a smooth surface. The specific gravity of absolutely dry wood is 0.6278, a cubic foot weighing 39.12 pounds. Used for fuel and occasionally for gun-stocks.

Onevery fine specimen of this tree grows on the Campus just north of the Union Literary Building. This usually blossoms only about once every three years, but in favorable years, once in two years.

Genus ROBINIA, Linn.

Flowers in drooping axillary racemes, calyx 5-lobed, the upper lobes sub-connate; standard large reflexed, barely longer than the wings or keel; ovary stipulate, many ovuled. Legume linear, 2-valved. Leaves unequally pinnate.

The genus in North American; 4 species are found in the United States and 2 in Mexico. Many insects feed

upon Robinia, which is also effected by fungal diseases.

Robinia pseudacacia, Linn.

Locust. Black Locust.

Flowers white, in slender loose racemes. Legume smooth. Branches naked.

A tree, 70 to 80 feet in height, with a trunk 3 or 4 feet in diameter.

The Locust ranges from Pennsylvania to northern Georgia, and has become widely naturalized in most of the territory of the United States east of the Rocky mountains. It occurs in groups in the forest, growing with Hickory, Walnut, Ash, and White Oak.

This tree is one of the most valuable timber trees of the American forest. The wood is heavy, exceedingly hard and strong, close-grained, and very durable in contact with the soil. It is largely used in ship-building and for all kinds of posts.

This Locust is quite plentiful in this region and many good specimens are growing about the Campus. It seldom grows to a large size here.

Family ACERACEAE.

Genus ACER, Linn.

Flowers regular, dioeciously or monoeciously polygamous, rarely perfect, or dioecious; calyx generally 5-parted, the lobes imbricated in aestivation; petals usually 5; ovary 2-celled; ovules 2 in each cell, ascending. Fruit a double samara.

The genus is made up of 60 or 70 species, nearly half of which belong to China and Japan. Nine species occur in North America, 5 of which belong to the Atlantic and 2 to the Pacific region.

Acer saccharum, Marsh.

(A. barbatum, Michx.)

Sugar Maple. Hard Maple.

Flowers in nearly sessile umbel-like corymbs, apetalous. Leaves 3 to 5-lobed.

The Sugar Maple is a tree 100 to 120 feet in height, with a trunk 3 or 4 feet in diameter. It is one of the most widely and generally distributed trees of eastern North America. The northern limit is Newfoundland; it extends southward thro Canada and the northern states to northern Georgia and western Florida. Westward to Great Lakes, Minnesota and eastern Nebraska, Kansas and Texas. It grows on rich uplands with Ashes, Hickories, White Oaks, Black Birch and Hemlock.

The wood is heavy, strong, close-grained, and

light brown tinged with red. It has a high fuel value, and is used much in ship-building, interior finish and for furniture. The trees are attacked by numerous insects.

The Sugar Maple is one of our most common trees and grows to a very good size on the sandy soil of the Campus. In the woods about the College, especially in the College woods, it is gradually taking the place of the Beeches and White Oaks.

The Black Sugar Maple is a variety of this tree which looks very much like the Sugar Maple. Prof. Wheeler distinguishes it by the way in which the leaves droop at the edges. For all purposes it is the same as the Sugar Maple.

Genus ACER, Linn.

Acer saccharinum, Linn.

(A. dasycarpum, Ehr.)

Silver Maple. Soft Maple.

Flowers sessile in axillary fascicles; ovary and young fruit tomentose. Leaves deeply 5-lobed.

A tree 90 to 100 feet high, with a trunk 3 or 4 feet in diameter. The Silver Maple ranges from New Brunswick southward thro the United States to western Florida. Westward to eastern Dakota, Nebraska and the valley of the Blue River in Kansas. It grows on sandy banks of clear streams, with Willows and Red Birch.

The wood is hard, close-grained but brittle. It is sometimes used for flooring and cheap furniture

The tree grows rapidly even on dry soil but on dry and elevated ground branches become brittle and habit is loose and unattractive.

This tree is very abundant along the river-bottoms south of the College and, also, on the Campus. Our light soil encourages its growth.

Genus ACER, Linn.
Acer rubrum, Linn.
Red Maple.

Flowers pedicellate in axillary fascicles, ovary and young fruit glabrous. Leaves 3 to 5-lobed.

The Red Maple is a slender tree, 80 to 120 feet high, withupright branches which usually form a rather narrow head.

A very commonly distributed tree ranging from New Brunswick southward thro the United States to Florida; westward to eastern Dakota, Nebraska, Indian Territory and Texas. It occurs principally along borders of streams or in low wet swamps.

The wood is very hard, close-grained, easily worked, and not very strong. Light brown in color, often tinged with red,with a smooth satiny surface. It is used in the manufacture of cheap furniture and for gun-stocks.

The Red Maple is less plentiful than the other Maples on the Campus, tho more abundant in the woods about.

Genus ACER, Linn.

Acer negundo, Linn.

(Negundo aceroides, Moench.)

Boxelder.

Flowers dioecious, destitute of petals. Leaves pinnately or ternately divided.

A tree, sometimes 50 to 70 feet high, with a trunk 2 to 4 feet in diameter, dividing near the ground into a number of stout wide-spreading branches. The branches, when they first appear, are pale green and glabrous or slightly pubescent.

The Boxelder is one of the most widely distributed and in some parts of the country one of the commonest trees of the North American forests. It ranges from Vermont to Florida; northwestward to Winnepeg and the eastern base of the Rockies, southward thro Utah to Texas, New Mexico and Arizona. It occurs on the banks of streams and lakes and the borders of swamps, mingled with Willow, Elm and Hackberry.

The wood is light, soft, close-grained, but not very strong. It is occasionally used for cheap furniture and for paper pulp. Also a nurse tree.

This tree makes a rank growth on the light sandy loam of this vicinity, but seldom grows to a large size or forms a well-shaped tree. It is much injured by fungus diseases and insects.

Family TILIACEAE.

Genus TILIA, Linn.

Flowers in axillary or termnial cymes, regular, perfect; sepals 5, distinct, valvate in aestivation, hypogynous, deciduous; petals 5, imbricated in aestivation, hypogynous; stamens numerous, polyadelphous or free. Fruit globose, indehiscent, 1 to 2 seeded.

The genus Tilia is widely distributed in the temperate regions of the northern hemisphere.It is represented in North America by 4 species.

Tilias grow rapidly and freely in cultivation, flourishing in strong rich soil; propagated by grafting or layers as well as by seed. They are subject to attack of many insects.

Tilia Americana, Linn.

Leaves green on both surfaces, pubescent only in the axils ofthe principal veins. Pedunculate bract usually tapering at the base. Fruit ovoid.

The northern limits of the Basswood are in northern New Brunswick. It extends thence westward to shores of Lake Superior and Lake Winnepeg, southward thro the Atlantic states to Virginia and along the Alleghany mountains to Alabama and Georgia and westward to eastern Dakota, Nebraska and Kansas, the Indian Territory and Texas. It is one of the most common trees in our northern forests, where it grows withthe Sugar Maple, White Elm, White Oaks and Hickories.

The wood is light brown,faintly tinged with red. A cubic foot of the dry wood weighs 28.20 pounds. Largely used for paper pulp. Also used in the manufacture of wooden ware, cheap furniture, and parts of carriages.

A number of fine Basswoods are on the Campus. Many grow along the river-bottoms, but seldom grow to a large size there. A fine specimen stand northwest of the Physical Laboratory.

Family CORNACEAE.

Genus NYSSA.

Nyssa sylvatica, Marshall.

Tupelo. Pepperidge.

Fruit small, the stone more or less distinctly ridged. Leaves linear-oblong to oval or obovate.

A slender tree with crowded spreading and pendulous tough, flexible branches. Thetrunk is often 100 feet high and 5 feet in diameter.

The Tupelo ranges from Maine thro central Michigan to Missouri, southward to Florida and Texas. It frequents the borders of swamps, growing in wet, imperfectly drained soil with the Elm, Swamp White Oak, Red Maple, and Ironwood.

The wood is heavy, soft, strong, very tough and difficult to work and not durable in contact with the soil. It is used for ox-yokes, wharf-piles and hubs of wheels.

Some very fine Pepperidges are growing about borders of small ponds in the College woods and a few on the bottom-lands south of the College.

Family OLEACEAE.

Genus FRAXINUS, Linn.

Glabrous or pubescent trees or shrubs. Leaves opposite, petiolate. The genus is widely distributed in the temperate regions of the Northern Hemisphere. About 30 species are now distinguished, ½ of which are found in North America. The largest number of species occur in the eastern part of the continent.

Numerous insects prey upon Fraxinus in North America. Also, attacked by many fungal diseases. The Ashes can be easily propagated from seeds and grafting and they are easily and safely transplanted.

Fraxinus quadrangulata, Michx.

Blue Ash.

Flowers perfect. Leaflets 5 to 9, usually 7, ovate-oblong to lanceolate, acute, coarsely serrate. Branchlets quadrangular.

The Blue Ash is a slender tree, sometimes 120 feet high, with a trunk 2 or 3 feet in diameter, altho generally smaller and not more than 60 or 70 feet tall. The branchlets are stout, four-angled, and more or less 4-winged between the nodes.

The Blue Ash is distributed from southern Michigan thro Missouri to eastern Tennesee and northern Alabama

and thro Iowa to northeastern Arkansas. It is nowhere very common.

The wood is heavy, hard, close-grained and rather brittle. A cubic foot weighs 44.77 pounds. It is not often distinguished commercially from the other Ashes. It is very free from disease and attack of insects.

A large number of small Blue Ashes are springing up in the College woods tho few are found on the Campus. These, with the young Maples, make up a large part of the second growth in the eastern part of the College woods. More would grow if it were not for the shading which the Beeches give them.

Genus FRAXINUS, Linn.

Fraxinus nigra, Marsh.

(F. sambucifolia, Linn.)

Black Ash.

Flowers polygamous, without calyx. Leaflets 7 to 12, oblong-lanceolate, gradually acuminate, the lateral sessile.

A tree, occasionally 80 to 90 feet high, with a tall trunk rarely exceeding 20 inches in diameter.

This tree inhabits deep cold swamps and the low banks of streams and lakes and ranges from Newfoundland to Lake Winnepeg and southward thro the northern states to Delaware, southern Illinois, central Missouri and New Mexico and Arizona.

The wood is heavy, , rather soft, not strong, tough, coarse-grained, durable in contact with the soil, and easily separable into thin layers. A cubic foot weighs 39.37 pounds. Lumber is largely used for cabinet making and the interior finish of houses.

The Black Ash is quite common about the College, usually on the low-lands and about the swamp north of the Campus.

Genus FRAXINUS, Linn.

Fraxinus Americana, Linn.

White Ash.

Leaflets 5 to 9, usually 7, ovate to oblong-lanceolate, mostly acute, pale on their lower surface.

The White Ash sometimes grows to height of 120 feet, with a tall massive trunk 5 or 6 feet in diameter, altho usually much smaller.

This is one of the most valuable timber trees of North America. It ranges from Nova Scotia to northern Minnesota. Southward it extends to Florida, central Alabama and Misdissippi. Westward to eastern Nebraska, Kansas, Indian Territory and Texas. Grows best in rich, rather moist soil on low hills or in neighborhood of streams.

The wood is heavy, hard, strong, close-grained and tough, altho brittle. A cubic foot weighs 40.77 pounds. Used largely in the manufacture of agricultural

implements and furniture. It will not stand drought of the plains.

The White Ash is very abundant in this vicinity and grows to a large size, Some fine trees stand just south of Williams' Hall. Many young White Ashes are springing up in the woods about the College.

Genus FRAXINUS, Linn.

Fraxinus Pennsylvanica, Marsh.

(F. pubescens,Lam.)

Red Ash.

Leaflets 7 to 9, oblong-lanceolate to ovate, mostly coarsely serrate, clothed on their lower surface like the young shoots with velvety pubescence.

A tree, 40 to 50 feethigh, with a trunk rarely exceeding 18 to 20 inches in diameter, and with stout, upright, twiggy branches which form a compact irregularly shaped head.

The Red Ash ranges from New Brunswick thro souther Ontario to eastern Nebraska and the Black Hills of Dakota. Southward it extends to Florida and Alabama. It inhabits low rich moist soil near the banks of streams and lakes.

The wood is heavy, hard, rather strong, brittle and coarse-grained. A cubic foot weighs 38.96 pounds. It is not distinguished commercially from wood of White Ash.

This is not a common tree about the Campus, and

good specimens are rare.

Genus FRAXINUS, Linn.

Fraxinus Pennsylvanica,

Var. lanceolata, Sargent.

(Fraxinus viridis, Michx.)

Green Ash.

This Ash is distributed from Vermont thro the Appalachian region to Florida and westward to Texas. Northwestward to the eastern Rocky mountains in Utah and Arizona.

It may be distinguished from the Red Ash by its glabrous leaves and branchlets and by the usually more sharply serrate leaflets, which are lustrous and bright green on both surfaces. The tree is rarely 60 feet high, and most abundant in the Mississippi basin. A cubic foot of the wood weighs 44.35 pounds. Inferior in quality, it is sometimes used as a substitute for White Ash.

This tree is usually confounded with the White Ash. Quite a number of good specimens grow on the Campus, one just west of the Botanical Laboratory. Also, fairly plentiful in the College woods.

Family BIGNONIACEAE.

Genus CATALPA, Scop.

Catalpa catalpa, Karsten.

Flowers in many-flowered crowded panicles; corolla thickly spotted on the inner surface. Fruit slender. Leaves slightly acuminate.

A tree, rarely 60 feet high, with stout elongated brittle branches which form a broad head.

In distribution supposed to be confined to small districts in Georgia, Florida, Alabama, and Mississippi, tho its hardiness indicates an origin in some colder region.

The wood is soft, not strong, coarse-grained and very durable in contact with the soil. A cubic foot weighs 27.88 pounds. Largely used for fence posts and rails.

A few years ago quite a number of these trees were growing in sheltered places about the Campus, but the cold winter of 1898 killed them, as it did the Chestnuts. Now, but one or two are found. The soil is not just right for this Catalpa.

Genus CATALPA, Scop.

Catalpa speciosa, Engl.

(C. bignonioides, Les.)

Hardy Catalpa.

Flowers in few-flowered open panicles; corolla inconspicuously spotted. Fruit stout. Leaves condate-

acuminate.

In the forest this tree is occasionally 120 feet high; rarely more than 50 feet high in the open, with a tall straight trunk 4 to 5 feet in diameter. The leaves are opposite or in threes.

This Catalpa inhabits the borders of streams, ponds, and fertile bottom-lands. It ranges from Illinois thro southern Indiana, western Kentucky and Tennesee and westward thro Missouri and northeastern Arkansas.

The wood is light, soft, not strong, coarse-grained, very durable in contact with the soil. A cubic foot weighs 25.96 pounds. It is largely used for railroad ties, fence-posts and rails.

The Hardy Catalpa stands our climate very easily, and many good trees are growing in different places about the Campus. Just south of the street car switch, half way to Lansing, two fine rows of these Catalpas are growing.

Calendar of Trees and Shrubs. autumn of 1885. Seasons '86, '87, 1900.

Species.	Leaves began falling.			Leaves all fallen.			Leaves starting		Leaves full-grown.		In blossom.		Remarks
	1885	1886	1887	1885	1886	1887	1887	1900	1886	1887	1887.	1900.	
Alder, Smooth Alnus serrulata, Willd.	Oct. 3.	Oct. 18.	Oct. 17	Nov. 10.			May 3.	Apr. 30	May 10.		Apr. 16		Fruit fell June 13, 1887.
Alder, Oregon Alnus Oregonia, Nutt.								Apr. 29				Apr. 24	
Alder, European Alnus glutinosa, Willd.	Oct. 15	Oct. 17	Oct. 7	Nov. 15			May 3.	Apr. 30	May 25	June 10	Apr. 16		Catkins out Apr. 19. 1900
Aralia Aralia cordata.								Apr. 27					
Aralia Aralia spinosa, Linn.						Oct. 4	May 3.	May 12.		June 6.	July 11 to Aug. 3.		
Ash, Black Fraxinus nigra Marsh.	Sept. 25	Oct. 6		Oct. 8	Oct. 12	Oct. 2		Apr. 30	May 28.			Apr. 26	
Ash, Amber-leaved Fraxinus Americana acuminifolia								Apr. 30.					
Ash, Green Fraxinus Viridis Michx.	Sept. 30	Oct. 8		Oct. 19	Oct. 25		May 12	May 1	May 26				
Ash, White Fraxinus Americana L.	Sept. 27	Oct. 8		Oct. 7	Oct. 25			May 1	May 28			May 9	
Ash, Red Fraxinus pubescens Lam.	Sept 30			Sept. 26			May 14		May 27	June 6			
Ash, Mountain Pyrus Americana D.C.	Oct. 2.	Oct. 10	Oct. 11	Nov. 1.			May 3	Apr. 27	May 10	June 1	June 1		Fruit bright orange Aug 3. 1887.
Aspen, American Populus tremuloides Michx.	Oct. 16.	Oct. 12	Oct. 17	Nov. 5.			May 9.	May 6.	May 10	June 6	Apr 19		Catkins Apr. 6. Shed pollen Apr. 18. 1900
Aspen, Large-toothed Populus grandidenta Mx.	Oct. 6.		Oct. 10	Oct. 20.		Oct. 30.	May 9.	May 4	May 27	June 6		3 Apr 10 7 Apr 15	
Bald Cypress Taxodium distichum Rich								May 9.					
Balm of Gilead Populus balsamifera Var Candicans Gray.	Oct. 6	Oct. 13		Oct. 28	Oct. 30		May 12	Apr. 30	June 1	June 6			Catkins Apr. 23. Fruit set May 9. 1900.
Basswood, American Tilia Americana, Linn.	Sept. 25	Oct. 8	Oct. 4.	Oct. 17	Oct. 13	Oct. 17	May 12	May 3	May 26	June 13		June 30	
Basswood, European Tilia Europea Linn.								May 2				May 28	
Beech, American Fagus ferruginea Ait	Sept. 29	Oct. 12.	Oct 3	Oct 28	Oct 30.		May 12	May 6	May 28	June 6			
Beech, Blue Carpinus Caroliniana Wat.	Sept 26	Oct. 12.	Oct. 1.	Oct. 16	Oct. 18	Oct 5.	May 9	Apr. 29	May 29	June 6	May 9		

Species	Leaves began falling			Leaves all fallen			Leaves starting	Leaves full-grown		In blossom		Remarks
	1885	1886	1887	1885	1886	1887	1886	1887	1900	1887	1900	
Birch, Canoe Betula papyrifera Marsh.			Oct. 18			Oct. 27	May 9	May 7		June 6		Catkins out Apr. 19. 1900
Birch, Red or Water Betula nigra. Linn.								Apr. 26				
Birch, Black or Cherry Betula lenta Linn								May 1				
Birch, White Betula populifolia Ait.	Sept. 21	Oct. 12	Oct. 7.	Oct. 25		Oct. 28	May 3	May 1		May 24	June 6	
Buckthorn Rhamnus catharticus L.	Sept. 30	Oct. 18		Oct. 18						May 26		
Bladdernut Staphlea trifolia L.	Sept. 27	Oct. 18	Oct. 5	Oct. 26	Oct. 30	Oct. 17	Apr. 25	May 3	May 9	May 25	June 13	May 12	May 15
Blue Beech, Carpinus caroliniana Walt.	Sept 26	Oct. 12	Oct. 1.	Oct. 16	Oct. 18	Oct. 5	Apr. 27	May 9	Apr. 29	May 29	June 6	May 9	
Buckeye, Ohio Aesculus glabra Willd						Oct. 5		May 3	Apr. 25		June 14	May 12	
Buckeye, Sweet Aesculus flava Ait.									Apr. 26				
Butternut, Juglans cinerea Linn	Sept. 28	Oct. 8		Oct. 12	Oct. 18		May 3	May 12	May 10	June 1			
Buttonwood, Platanus occidentalis L.	Oct. 1	Oct. 18	Oct. 9	Oct. 28		Oct. 28	May 3	May 12	May 12	June 6	June 13		
Catalpa, Hardy Catalpa speciosa Warder	Sept. 28	Oct. 8		Oct. 22	Oct. 30		May 3		June 7			June 17	
Catalpa, Common Catalpa Bignonioides Walt.								May 13					
Cedar, Red Juniperus Virginiana Linn.												Apr. 29	♯ Flowered 27 ♁ " May 1. 1900
Cherry, Choke Prunus Virginiana L.		Oct. 12	Oct 1	Oct. 26	Oct. 25	Oct. 28	Apr. 20	May 3	Apr. 24	May 1	June 6	May 12	May 20
Cherry, Black Prunus serotina Ehrh.	Sept. 25	Oct. 8	Oct. 6	Oct. 22	Oct. 18	Oct. 17	Apr. 24	Apr. 27	Apr. 25	May 25	May 30		
Cherry, Bird Prunus Pennsylvanica Linn.									May 1				
Chestnut, Castanea dentata Borkh	Sept. 28	Oct. 12	Oct. 4	Oct. 23	Oct. 30	Oct. 26	May 3	May 12		May 27	June 1	June 18 to July 12	
Chinquapin, Castonea pumila Mill	Oct. 10	Oct. 13		Oct. 28	Oct. 30	.	May 2	May 12	May 14	May 27	June 6	June 19	
Cottonwood, Populus deltoides March.	Sept. 26	Oct. 8	Oct. 5	Oct. 19	Oct. 25	Oct. 17	May 5	May 12	May 9	May 28	June 13		

Species	Leaves began falling.			Leaves all fallen.			Leaves starting		Leaves full-grown		In blossom		Remarks
	1885	1886	1887.	1885	1886	1887	1887	1900.	1886	1887	1887	1900	
Arcumber Tree. Magnolia acuminata L.			Oct. 7			Oct. 21	May 14	May 12		June 6	May 26		
Crab-apple, Garland Pyrus coronaria Linn	Oct. 23	Oct. 12		Oct. 27	Oct. 30		May 14	Apr. 30	May 25			May 9	
Cypress, Bald Taxodium distichum Rich.								May 9.					
Dogwood, Cornus grandiflora								May 1					
Dogwood, Cornus stolonifera Mx.								May 16					
Elder, Common Sambucus canadensis Linn			Sept. 30			Oct. 28	May 9	Apr. 30		June 6	June 19		
Elm, American Ulmus Americana Linn	Sept. 27	Oct. 8	Oct. 10	Oct. 20	Oct. 25	Oct. 28	May 9	May 2	May 26		Apr. 27	Apr. 15	Fruit set Apr. 27, 1900.
Elm, Slippery or Red Ulmus pubescens Walt.	Sept. 28	Oct. 8	Oct. 5	Oct. 5	Oct. 18	Oct. 24	May 9	May 7	May 28	June 6		Apr. 21	Fruit set Apr. 25, 1900.
Elm, European Ulmus Campestris Linn.	Oct. 1,	Oct. 12		Nov 1					May 27			Apr. 24	Fruit set May 8, 1900.
Elm, Cork or Rock Ulmus racemosa Thomas	Sept. 25			Oct. 26	Oct 18		May 9	May 3	May 28			Apr. 23	
Fir, Balsam Abies balsamea Mill								May 12					
Forsythia Forsythia viridissima Linn.								May 4				Apr. 28	
Ginko Tree Ginko biloba Linn.			Oct. 6			Oct 17	May 16	May 13					
Hawthorn, Crataegus tomentosa L.								May 16					
Hackberry Celtis occidentalis L.	Oct. 2		Oct. 10	Oct. 27	Oct. 13	Oct. 24	May 12	May 9		June 6		May 15	
Hawthorn Crataegus oxyacantha L.	Sept. 25	Oct. 30	Oct. 10			Apr. 26	May 3	May 5	June 1	June 6	May 18		
Hazel Nut. Corylus Americana Walt.						Oct. 5	May 9	Apr. 30		June 6			
Hemlock Tsuja Canadensis Carr.								Apr. 27					Leaves full-grown May 11, 1900.
Hercules Club Aralia spinosa Linn.								May 12					
Hickory, Swamp Hicoria minima Brit.	Sept. 25	Oct. 13	Oct. 5	Oct. 30	Oct. 25	Oct. 12	May 9	Apr. 30	June 1	June 6	May 14		

Species.	Leaves began falling			Leaves all fallen			Leaves starting		Leaves full grown		In blossom		Remarks
	1885	1886	1887.	1885	1886	1887	1886	1887	1900.	1886	1887	1887	1900.	
Hickory, Shagbark Hicoria ovata Britton	Sept. 26	Oct. 13		Oct. 10	Oct. 25	Oct. 3	May 3	May 12	May 11	May 27	June 6	May 16		
Horse-chestnut, Aesculus Hippocastanum L.	Sept. 30	Oct. 8	Oct. 10	Oct. 25			Apr. 24	May 9	Apr. 29	June 1	June 10	May 16		
Hop-tree, Ptelea trifoliata Linn	Sept. 26	Oct. 8.			Oct. 18			May 18	May 15		June 1	June 13		
Ironwood. Ostrya Virginiana Mld.									Apr. 28				Apr. 23	
Judas Tree Cercis Canadensis Linn.									May 16				May 12	
Kentucky Coffee Tree. Gymnocladus dioicus, Koch.				Sept. 26	Oct. 12	Oct. 4		May 18.	May 12					
Leatherwood. Dirca palustris, Linn.									Apr. 28				Apr 24	
Locust, Honey Gledistsia triacanthos L.						Oct. 5		May 12	May 9		June 6		May 9	
Locust, Common Robinia pseudacacia Linn.			Oct. 9			Oct. 24		May 9	May 3		June 6	May 26		
Larch, European Larix Europea D.C.									Apr. 22				May 2	
Larch, American Larix Americana Mx.									Apr. 24				Apr. 27	
Lombardy Poplar. Populus Imgra Italica, Duroi.	Oct. 16	Oct. 25	Oct. 11	Nov. 2			Apr. 26	May 9	Apr. 30	May 24			Apr. 23	
Maple, Red Acer rubrum, Linn.		Oct. 8	Oct. 9	Oct. 10	Oct. 31	Oct. 28	Apr. 24	May 14	Apr. 30	May 25		Apr. 19	Apr. 21	fruit formed May 2, 1900. fruit falling May 26. 1900.
Maple, Mountain Acer spicatum, Lam									Apr. 27					
Maple, Sugar or Hard Acer saccharum Marq.			Oct. 6			Oct. 17		May 9	May 8		June 1	Apr. 27	Apr. 30	
Maple, Black Acer barbatum var nigrum Britton.			Oct. 2			Oct. 12		May 9				May 3	Apr. 27	
Maple, Silver or Soft Acer saccharinum, L.	Sept. 27	Oct. 13	Oct. 10	Oct. 17	Oct. 30	Oct. 28		May 3			June 6	Apr. 19	Apr. 6	fruit out Apr. 27, 1900.
Maple, Tartarian Acer tartaricum, L.									Apr. 25					
Maple, Norway Acer platanoides L. Linn	Oct. 22	Oct. 13	Oct. 10	Nov. 1	Oct. 31	Oct. 21	Apr. 24	May 9	Apr. 28	May 24	May 30	May 3	Apr. 27	
Maple, Ash-leaved Acer negundo, Linn	Sept. 30	Oct. 8	Oct. 2	Oct. 17	Oct. 18	Oct. 7	Apr. 22	May 14		May 23	June 6	Apr. 27	Apr. 23	

Species	Leaves began falling.			Leaves all fallen.			Leaves	Starting		Leaves full-grown.		In blossom		Remarks.
	1885	1886	1887	1885	1886	1887	1886	1887	1900	1886	1887	1887	1900	
Maple, Sycamore Acer pseudo-platinus L.	Oct. 26	Oct. 25	Oct. 10	Nov 1			May 3	May 12	May 6	May 28	June 1			
Maple, Acer ginala									apr. 29					
Magnolia Magnolia Soulangeana									May 12				May 1	
Mountain Ash. Pyrus Americana D.C.									apr. 27					
Mulberry, Red Morus rubra, Linn.	Sept. 29	Oct. 25		Oct. 15			apr. 26	May 16		May 26	June 1			
Oak, White Quercus alba, Linn.	Oct. 1	Oct. 12	Oct. 10				May 4	May 16	apr. 30	June 4	June 6	May 20		Catkins May 5, 1900 On uplands. Leaves and catkins May 12, 1900.
Oak, Scarlet Quercus coccinea Mnch.									May 1					
Oak, Swamp White Quercus bicolor, Willd.									apr. 30					
Oak, Chestnut Quercus Muhlenbergii Engl.	Oct. 15	Oct. 18	Oct. 10				May 5	May 12	May 6	June 1				
Oak, Pin Quercus palustris Du Roi									May 6					
Oak, Red Quercus rubrum L.	Oct. 25	Oct. 12					May 4	May 9	May 1	June 1	June 6			
Oak, Black Scrub Quercus Banisterii									May 14				May 9	
Oak, Post or Rough Quercus stellata Wang									May 14					
Oak, Turkey Quercus Catesbaei Michx.									May 15					
Oak, Bur Quercus macrocarpa Michx	Oct. 3	Oct. 12	Oct. 9				May 3	May 14	May 7	June 1		May 18		
Oak, Black Quercus velutina Lam.	Oct. 20	Oct. 12	Oct. 10			Oct. 21	May 3	May 12	May 2	May 27	June 6	May 9		Catkins May 2, 1900.
Oak Quercus ilicifolia Wang.									May 14				May 14	
Pepperidge. Nyssa sylvatica Marsh.	Sept. 29	Oct. 12		Oct. 15	Oct. 25		May 5		May 14	June 1				
Pine, White Pinus strobus, Linn.									June 2					
Pine, Cembrian Pinus cembra, Linn.									June 3					

Species	Leaves began falling			Leaves all fallen			Leaves	starting		Leaves full-grown		In blossom		Remarks.
	1885	1886	1887	1885	1886	1887	1886	1887	1900	1886	1887	1887	1900	
Pine, Austrian Pinus Austriaca Höes.													May 25	
Pine, Norway or Red Pinus resinosa. Ait.													May 25	
Poplar, White Populus alba. Linn.	Sept. 28	Oct. 12	Oct. 11	Oct. 22	Oct. 30		Apr. 25	May 5	May 28				Apr. 25	
Poplar, Lombardy Populus nigra var Italica Du Roi.	Oct. 16	Oct. 25	Oct. 11	Nov. 2			Apr. 26	May 9	Apr. 30	May 24			Apr. 23	
Russian Oline. Eleagnus hortensis Var. Sangorica Bmk.									May 12				June 4	
Sassafras. Sassafras Sassafras Nees	Sept 29	Oct. 10		Oct. 15	Oct. 18		May 12	May 16	May 15				May 11	
Shadbush. amelanchier Canadensis. Torr.	Sept. 24	Oct. 8	Oct. 3	Oct 20	Oct. 18	Oct. 10	Apr. 25			May 24			Apr. 29	Racemes out Apr. 24. 1900.
Spruce, Norway Picea excelsa Link.									May 13					
Sweet Gum Tree. Liquidambar Styraciflua Linn.									May 14					
Sycamore. Platanus occidentalis Linn.									May 12				May 24	
Sumach Rhus glabra Linn.									May 11					
Tamarack. Larix Americana Michx.									Apr. 24				Apr 27	
Tupelo. Nyssa sylvatica Marsh.	Sept. 29	Oct. 12		Oct. 15	Oct. 25		May 5		May 14	June 1				
Tulip Tree. Liriodendron tulipifera L.		Oct. 12	Oct. 7	Oct. 12	Oct. 25	Oct. 17	Apr. 26	May 9	Apr. 27	May 28	June 13	June 1-13		
Witch Hazel Hamamelis Virginiana Linn.									May 11					
Walnut, Black Juglans nigra Linn.	Sept. 24			Oct. 12	Oct. 13		May 4	May 14	May 12	June 7				catkins out May 12. 1900.
Whitewood, Liriodendron tulipifera Linn.		Oct. 12	Oct. 7	Oct. 12	Oct. 25	Oct. 17	Apr. 26	May 9	Apr. 27	May 28	June 13	June 1-13		
Willow, weeping Salix Babylonica L.							Apr. 21	Apr. 27	Apr. 22	May 27	June 1		Apr. 26	
Willow. Salix discolor Muehl													Apr. 20	
Willow. Salix glaucophylla Bebb.									Apr. 29					

Species	Leaves began falling			Leaves all fallen			Leaves
	1885	1886	1887	1885	1885	1887	1886
Willow, Salix palmifolia							
Willow, Salix purpurea Linn.							
Willow, Salix humilis Marsh.							
Willow Salix rostrata Rich							
Willow Salix Babylonica Var. annularis.							
Willow, Salix cordata Muehl.							
Willow, Salix lucida Muehl.							
Willow, Peach Salix amygaloides Anders.							
Willow Salix sericea Marsh.							
Willow, Salix candida Willd.							
Willow, Salix alba var vitellina D. & B.	Sept 28	Oct. 13	Oct. 9				Apr. 21
Willow, Black Salix nigra Marsh.	Sept. 30	Oct. 6		Oct. 30	Oct. 25		Apr. 25
Yellow-wood. Cladrastis lutea, Koch.	Oct. 1	Oct. 12	Oct. 1	Oct. 30	Oct. 25	Oct. 7	Apr. 26

Species	Starting		Leaves full-grown.		In blossom		Remarks.
	1887	1900.	1886	1887	1887	1900.	
Willow, Salix palmifolia		May 3				Apr. 30	
Willow, Salix purpurea Linn.		Apr. 25				Apr. 25	
Willow, Salix humilis Marsh.		Apr. 29					
Willow Salix rostrata Rich		Apr. 29				Apr. 29	
Willow Salix Babylonica Var. annularis.		Apr. 30					
Willow, Salix cordata Muehl.		Apr. 29					
Willow, Salix lucida Muehl.		Apr. 30					
Willow, Peach Salix amygaloides Anders.		Apr. 29					
Willow Salix sericea Marsh.		Apr. 29					
Willow, Salix candida Willd.		Apr. 30				Apr. 30	
Willow, Salix alba var vitellina D. & B.	Apr. 27	Apr. 28	May 27	June 6			Fruit falling June 6, 1887.
Willow, Black Salix nigra Marsh.	May 3	May 2	May 28				
Yellow-wood. Cladrastis lutea, Koch.	May 9	May 1	May 23	June 13			did not flower in 1900. Flowers only about every three years.