Celtis occicfentalis L. Hackberry

Ulmaceae Elm family

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Hackberry *(Celtis occidentalis),* is a widespread small to medium-size tree, known also as common hackberry, sugarberry, nettletree, beaverwood, northern hackberry, and American hackberry. On good bottom-land soils it grows fast and may live to 200 years. The wood, heavy but soft, is of limited commercial importance. It is used in inexpensive furniture where a light-colored wood is desired. The cherrylike fruits often hang on the trees throughout the winter providing many birds with food. Hackberry is planted as a street tree in midwest cities because of its tolerance to a wide range of soil and moisture conditions.

Habitat

Native Range

Hackberry (figs. 1, 2) is widely distributed in the eastern United States from the southern New England States through central New York west in southern Ontario to North and South Dakota. Northern outliers are found in southern Quebec, western Ontario, southern Manitoba, and southeastern Wyoming. The range extends south from western Nebraska to northeastern Colorado and northwestern Texas, then east to Arkansas, Tennessee, and North Carolina, with scattered occurrences in Mississippi, Alabama, and Georgia (7).

Because sugarberry *(Celtis Zaeuigata)* and hackberry are so similar, it has been difficult to establish the exact range of either species in the South. Parts of their ranges overlap, with hackberry probably restricted to the upland and sugarberry occupying the bottom land.

Climate

The wide distribution of hackberry is evidence that this species can withstand a variety of climatic conditions (6). Annual precipitation in its growing area ranges from 360 mm (14 in) in the Great Plains to 1520 mm (60 in) in the southeastern United States, and distribution and kind of precipitation differ greatly by seasons.

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Hackberry is subjected to great extremes of temperature in the Great Plains where an annual variation of 60" C (140° F) or more is common, but variations are more moderate in the Southeast. The length of frost-free season ranges from 120 to 250 days within its growing area.

Hackberry is drought resistant and has survived extremely dry periods in the Great Plains. During the severe drought of 1934 in western Kansas, hackberry survived better than American elm *(Ulmus americana)* and honeylocust *(Gleditsia triacanthos),* to the same degree as boxelder *(Acer negundo)* and black locust *(Robinia pseudoacacia),* but not as well as bur oak *(Quercus macrocarpa)* and eastern redcedar *(Juniperus virginiana).*

Soils and Topography

Hackberry grows in many soils, and although principally a bottom-land tree, it is frequently found on limestone outcrops or limestone soils. In western Nebraska, hackberry grows on the north side of sand dunes and in river valleys.

Sites with a permanently high water table are unfavorable for hackberry, although periodic flooding apparently is not detrimental. In Kentucky, 46 days of flooding during one growing season caused no apparent damage to this tree. Hackberry begins to show ill effects from inundation after 110 days. If the duration of flooding is less than 25 percent of the growing season, *Celtis* spp. can maintain good health indefinitely. Hackberry trees often survive the first season of permanent flooding but usually die during or after the second season (8). Occasional trees have lived 3 years under flooded conditions. In Illinois, continuous flooding to a depth of 91 cm (3 ft) killed hackberry in less than 4 years. Where only mud was present, 70 percent of the trees were dead at the end of 6 years. Submergence for short periods kills many seedlings. In Pennsylvania, the presence of hackberry has been regarded as an indicator of high (7.2) pH.

Hackberry grows best on valley soils, but throughout much of its range it is also commonly found on slopes and bluffs. In the western part of its range, however, it is restricted to well-developed river valleys, north slopes, and protected ravines, and it is largely absent from windswept parts of the western river valleys. It is common in eastern Iowa on all but the wettest bottom-land sites, and seedling and sapling hackberry occur on upland sites under existing oak stands on all aspects, slopes, and ridges

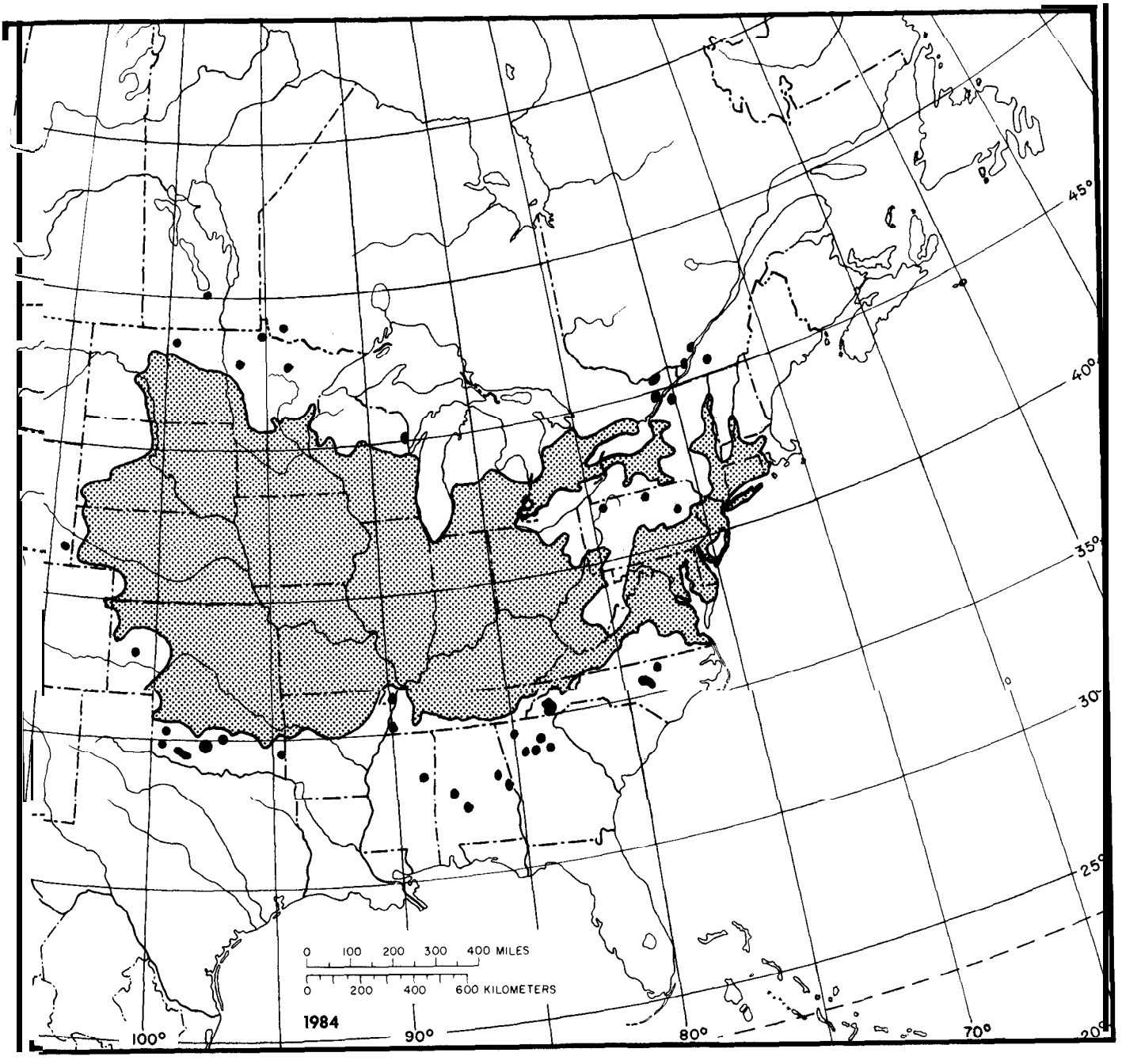

Figure l--The ***native range of*** *hackberry.*

(6). The soils upon which hackberry grows fall primarily within the soil orders Mollisols, Entisols, and, to a lesser extent, Inceptisols.

Associated Forest Cover

Hackberry is seldom found in pure stands in the forest. It is prominent, however, in the northern phase of the forest cover type Sugarberry-American Elm-Green Ash (Society of American Foresters Type 93) where it replaces sugarberry *(4)*.

Hackberry is a common associate in limited portions of three other forest cover types: Sugar Maple–Basswood (Type 26) in the Central Hardwood Region, Beech-Sugar Maple (Type 60) throughout the Midwest, and Sycamore-Sweetgum-American Elm (Type 94) in the Northern Mississippi Valley

Figure *2-Open-grown hackberry develop ragged, irregular oval crowns.*

Life History

Reproduction and Early Growth

Flowering and Seed Production-Hackberry is polygamo-monoecious. The small greenish flowers *(1)* appear with or shortly after the leaves in early April in the southern part of the range and in late May in the northern part. The seed ripens in September and October, sometimes remaining on the tree until the following spring. The fruit (a spherical drupe) is usually from 6 to 8 mm (0.25 to 0.33 in) in diameter and dark red to purple when ripe. A thin pulp encloses a single bony nutlet.

Hackberry bears good seed crops in most years and light seed crops on intervening years. The seed is disseminated principally by birds and small mammals, but some may be dispersed by water. In an Indiana study, 34 percent of the hackberry seed stored 1 year in the leaf litter germinated and 20 percent of the seed germinated after being stored 2 winters (3).

Seed Production and Dissemination-No information available.

Seedling Development-Germination of hackberry is epigeal *(1)*. In eastern Iowa, hackberry seedlings become established in existing hardwood stands but rarely in old fields. In Illinois, however, the tree has become established in prairie conditions. In Pennsylvania, hackberry seedlings were found in dense shade where seedlings of the other overstory trees did not persist. On an Indiana floodplain, however, hackberry was the only tree of the principal crown cover that had a high rate of mortality among its seedlings.

Early growth of hackberry varies greatly within its range and even on different sites in a single locality. Although height growth may not exceed 2.5 cm (1 in) per year under a dense overstory, cultivated hackberry planted in the Great Plains shelterbelts averaged 0.4 m (1.3 ft) per year during the first 6 years (6).

Vegetative Reproduction-Hackberry can be propagated by stem cuttings, grafting, budding, and by layering. Sprouts develop from stumps of small trees but rarely from those of large ones.

Sapling and Pole Stages to Maturity

Growth and Yield-On the better alluvial soils, diameter growth of hackberry may be as much as 8 mm (0.3 in) annually, although usually it is much less. In the western part of its range, an annual diameter growth of 5 mm (0.2 in) has been observed. Usually growth is most rapid between the 20th and 40th years. On poor sites, growth is very slow and the trees are often dwarfed.

Mature hackberry is usually a small- to medium-sized tree from 9 to 15 m (30 to 50 ft) tall and from 46 to 61 cm (18 to 24 in) in d.b.h. *(6)*. On the best sites, however, it may reach a height of 40 m (130 ft) and a d.b.h. of 122 cm (48 in). Trees up to 29 m (95 ft) tall and 122 cm (48 in) in d.b.h. have been found in the western part of the range. Maximum age at-

tained by hackberry is probably between 150 and 200 years.

Rooting Habit-Hackberry is a deep rooting species, ultimately reaching depths between 3 and 6 m (10 and 20 ft) on most sites *(8)*. On clay prairie soil in North Dakota, however, the roots reached only to a depth of 1.4 m (4.5 ft); lateral extension was 12.6 m (41.5 ft). Strong taproots develop only occasionally.

The root anatomy of the genus *Celtis* is unique, along with a few other genera, in that a primary structure of the root phloem is stereome (sclerenchyma and collenchyma collectively). Stereome seldom develops in roots and when present is usually a secondary structure. The mycorrhizal associates of hackberry are the ectomycorrhizae (8).

Mature hackberry is classified as moderately tolerant of flooding. New seedlings are much more sensitive to saturated soil conditions than older trees. The root systems of hackberry seedlings in saturated soil are severely injured within 60 days and are often unable to recover. Intolerance of flooding is attributed to injury to the root system, lack of strong adventitious roots, and the inability of the stems and leaves to resist desiccation due to a poorly or nonfunctioning root system.

Reaction to Competition-Hackberry is intermediate to tolerant in its ability to withstand shade (6). Trees suppressed for an extended period are often poorly formed.

Because hackberry is found in many forest types ranging from temporary to subclimax, its successional position is difficult to determine. Where it occasionally grows in small, nearly pure stands, it is probably only a temporary type.

Damaging Agents-Hackberry is the host of four gall-producing *insects-Pachypsylla celtidisgemma, P. celtidismamma, l? celtidisvesicula,* and *P. venusta.* The adults pass the winter in cracks of the bark or among the debris on the ground and in spring lay eggs on the leaves. The damage is not serious.

The hackberry engraver *(Scolytus muticus)* normally attacks only dead or dying branches but has been reported to attack the living sapwood thus killing the tree.

Several leaf-spot fungi are common on hackberry trees—*Cercospora spegazzinii, Cylindrosporium defoliatum, Cerosporella celtidis, Mycosphaerella maculiformis, Phleospora celtidis, Phyllosticta celtidis,* and *Septogloeum celtidis.* The most important disease is "witches-broom," which causes a rosette-like proliferation of the branch tips and is caused by two agents, one the gall mite *Eriophyes* spp. and the other a powdery mildew *(Sphaerotheca phytophila)* (5). Hackberry is highly susceptible to fire damage, which opens the way for wood decay organisms.

Armillaria mellea grows unaggressively on hackberry roots until they die or are injured, whereupon the fungus enters and causes extensive root rot.

Special Uses

Hackberry seed is eaten by animals, and in Kansas the fox squirrel feeds on both the nipple galls and the fruit. The fruit is eaten also by quail, ring-necked pheasant, wild turkey, cedar waxwings, sharp-tailed grouse, yellow-bellied sapsuckers, mockingbirds, robins, and other birds.

Good grades of hackberry wood are used for furniture, millwork, and some athletic equipment. Poor grades are used for crates and boxes.

Genetics

Because hackberry grows in a region with great climatic differences, genetic variation probably exists; however, provenance tests have just begun in the Great Plains area.

Although no hybrids have been reported, it has been noted that *Celtis occidentalis* and *C. laevigata* are self-compatible and therefore capable of hybridizing *(2)*.

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