

Hardwoods—Keys and Descriptions by Species

IV. KEY TO HARDWOODS—GROSS FEATURES*

Woods porous (with vessels); cross section consisting of pores (vessels) embedded in a mass of fibers and parenchyma tissue; rays distinct or indistinct to the naked eye (Figs. 12-75 to 12-140, inc., pp 514–525).

1. Early-wood pores **conspicuously larger** than the late-wood pores, distinct with the naked eye† (ex., Figs. 12-101, 12-108, 12-130); (*a*) transition from large early-wood pores to small late-wood pores abrupt (**wood ring-porous**, ex., Figs. 12-101, 12-130); (*b*) transition from large early-wood pores to small late-wood pores somewhat gradual (**wood semi-ring-porous**, ex., Fig. 12-108)..... 2
1. Early-wood pores **not conspicuously larger** than the late-wood pores and indistinct to the naked eye (ex., Fig. 12-87); early-wood zones not sharply defined (**wood diffuse-porous**)..... 13
 2. Transition in size of pores from early to late wood abrupt, wood ring-porous..... 3
 2. Transition in size of pores from early to late wood somewhat gradual, wood semi-ring-porous..... 12
3. Broad rays present, conspicuous (*x*; Figs. 12-127 to 12-130, inc.) often 1 in. or more in height along the grain (*t*; Fig. 12-126), forming a broad ray fleck on the radial surface.
 - A. Late-wood pores distinct with a hand lens, not numerous, thick-walled, the orifices plainly visible, rounded; tyloses usually absent or sparse in the early-wood pores; heartwood usually pinkish or pale brown.
Red oak—*Quercus* spp. Figs. 12-128, 12-130. Desc. pp. 566–568
 - B. Late-wood pores indistinct with a hand lens, numerous, thin-walled, the orifices scarcely visible, angular; tyloses generally present in the early-wood pores (heartwood); heartwood rich light to dark brown, usually without flesh-colored cast.

* This key is designed for the separation of the more important temperate North American hardwoods based on features visible with a 10X hand lens or without magnification.

A series of photographs (Figs. 12-75 to 12-140, inc., pp. 514 to 525) at low magnification (5X) accompanies this key to illustrate the normal appearance of the various kinds of woods under a hand lens.

† In osage-orange and black locust (Figs. 12-112, 12-133) early-wood pores are large but poorly defined because of occlusion with tyloses.

White oak—*Quercus* spp. Figs. 12-127, 12-129. Desc. pp. 569–572.

- 3. Broad rays absent (ex., Fig. 12-77)..... 4
 - 4. Late wood figured with wavy concentric (tangential) bands of pores which are mostly continuous and separated by bands of mechanical tissue (x; ex., Fig. 12-137)..... 5
 - 4. Late wood not figured with wavy, concentric (tangential) bands of pores (ex., Fig. 12-103)..... 7

- 5. Early-wood pores in a single line.
 - A. Early-wood pores plainly visible without a hand lens, approximately equal in size and quite evenly spaced in a more or less continuous row; tyloses sparse.

American elm—*Ulmus americana* L. Fig. 12-137. Desc. p. 572

- B. Early-wood pores scarcely visible without a hand lens, the larger spaced at intervals in an interrupted row and separated by smaller pores; tyloses abundant.

Hard elm—*Ulmus* spp. Fig. 12-139. Desc. p. 575

- 5. Early-wood pores in several rows (ex., Fig. 12-138)..... 6
- 6. Early-wood pores in the heartwood completely occluded with tyloses, their contours poorly defined.

- A. Heartwood golden yellow to bright orange, darkening upon exposure, often with reddish streaks along the grain; coloring matter readily soluble in water.

Osage-orange—*Maclura pomifera* (Raf.) Schneid. Fig. 12-112. Desc. p. 580

- B. Heartwood greenish yellow to dark yellowish or golden brown; coloring matter not readily soluble in water.

Black locust—*Robinia pseudoacacia* L. Fig. 12-133. Desc. p. 598

- 6. Early-wood pores in the heartwood not completely occluded with tyloses, their contours distinct.

- A. Wood light brown to dark reddish brown; rays usually indistinct without a lens.

Slippery elm—*Ulmus rubra* Mühl. Fig. 12-138. Desc. p. 574

- B. Sapwood pale yellow to grayish or greenish yellow; imperfectly developed heartwood yellowish gray or light brown streaked with yellow; rays distinctly visible to the naked eye (x).

Hackberry—*Celtis* spp. Fig. 12-95. Desc. p. 577

- C. Sapwood yellowish, narrow; heartwood orange-yellow to golden brown, turning dull dark brown on exposure; ray fleck conspicuous on the radial surface.

Red mulberry—*Morus rubra* L. Fig. 12-115. Desc. p. 578

- 7. Late-wood parenchyma appearing under the lens as fine, numerous, continuous, or broken, light-colored, tangential lines (ex., Fig. 12-91), or closely and evenly punctate (ex., Fig. 12-98).

A. Sapwood creamy white when freshly cut, darkening on exposure to light yellow-brown (sometimes with grayish-brown stain); heartwood rarely present, then only in small bands, blackish brown to black; wood with storied rays, forming ripple marks on the tangential surface; parenchyma (x) closely and evenly punctate, relatively inconspicuous.

Common persimmon—*Diospyros virginiana* L. Fig. 12-98. Desc. p. 620

B. Sapwood whitish to pale brown; heartwood pale brown to brown or reddish brown (that of pecan rich brown, sometimes with streaks of a darker hue); wood without storied rays; parenchyma conspicuous, in concentric tangential lines in the late wood.

Hickory—*Carya* spp. Figs. 12-89 to 12-91, inc. Desc. p. 541

7. Late-wood parenchyma not evident, or if evident associated with pores (paratracheal) and occasionally connecting the pores in the outer late-wood zone..... 8

8. Early-wood pores in the heartwood completely occluded with tyloses, their contours poorly defined.

A. Heartwood golden yellow to bright orange, darkening upon exposure, often with reddish streaks along the grain; coloring matter readily soluble in water.

Osage-orange—*Maclura pomifera* (Raf.) Schneid. Fig. 12-112. Desc. p. 580

B. Heartwood greenish yellow to dark yellowish or golden brown; coloring matter not readily soluble in water.

Black locust—*Robinia pseudoacacia* L. Fig. 12-133. Desc. p. 598

8. Early-wood pores in the heartwood open or partly occluded with tyloses, their contours distinct..... 9

9. Late-wood pores small, thin-walled, grouped in patches of porous tissue, which are obliquely radial (flame-shaped); rays very fine, barely visible with a hand lens.

A. Early-wood pores in one somewhat interrupted row.

Golden chinkapin—*Castanopsis chrysophylla* (Dougl.) A.DC. Fig. 12-93. Desc. p. 561

B. Early-wood pores very large, in several rows.

American chestnut—*Castanea dentata* (Marsh.) Borkh. Fig. 12-92. Desc. p. 559

9. Late-wood pores solitary or in radial rows of 2-3, in nestlike groups or in interrupted tangential bands; rays plainly visible with the naked eye or a hand lens (x)..... 10

10. Pores in the late wood solitary or in radial rows of 2-3, frequently united laterally by parenchyma toward the outer margin of the ring.

A. Wood lustrous, strong; sapwood nearly white, wide; heartwood light brown to pale yellow streaked with brown.

White ash—*Fraxinus* spp. Figs. 12-101, 12-102. Desc. p. 621

B. Wood dull, weak; sapwood whitish to light brown, narrow; heartwood grayish brown to brown.

Black ash—*Fraxinus nigra* Marsh. Fig. 12-103. Desc. p. 624

C. Sapwood light yellow; heartwood dull grayish brown to orange-brown or dark brown; freshly cut surface with aromatic odor.

Sassafras—*Sassafras albidum* (Nutt.) Nees. Fig. 12-135. Desc. p. 587

10. Pores in the late wood in nestlike groups or in interrupted tangential bands..... 11

11. Heartwood light red to reddish brown.

A. Pores in the outer late wood solitary, in short radial rows or in small groups, embedded in short tangential bands of parenchyma; rays conspicuous to the naked eye (x); reddish gum deposits in the pores are frequent in the heartwood.

Honeylocust—*Gleditsia triacanthos* L. Fig. 12-104. Desc. p. 595

B. Pores in the outer late wood in nestlike groups which occasionally coalesce laterally; short bands of parenchyma not evident; rays not conspicuous to the naked eye; gum deposits in the pores infrequent in the heartwood.

Kentucky coffeetree—*Gymnocladus dioica* (L.) K. Koch. Fig. 12-105. Desc. p. 594

11. Heartwood grayish brown or orange-yellow to golden brown.

A. Heartwood grayish brown to brown, with a faint odor resembling that of kerosene; rays relatively inconspicuous to the naked eye; the ray fleck on the radial surface not pronounced.

Catalpa—*Catalpa* spp. Fig. 12-94. Desc. p. 625

B. Heartwood orange-yellow to golden brown, turning dull dark brown on exposure, without characteristic odor; rays conspicuous to the naked eye (x), forming a pronounced fleck on the radial surface.

Red mulberry—*Morus rubra* L. Fig. 12-115. Desc. p. 578

12. Heartwood rich chocolate, purplish, or gray-brown, or brown; late-wood parenchyma frequently appearing under a hand lens as fine, broken or continuous lines, or closely and evenly punctate, or in bands toward the outer margin of the growth rings (x); rays distinct with a hand lens.

A. Heartwood rich chocolate or purplish brown, dull, with characteristic odor; wood relatively hard, heavy; late-wood parenchyma frequently appearing under a hand lens as fine, broken or continuous lines, or closely and evenly punctate (x).

Black Walnut—*Juglans nigra* L. Fig. 12-108. Desc. p. 539

B. Heartwood light chestnut-brown, lustrous, without characteristic odor; wood soft (readily dented with the thumbnail), light; late-wood parenchyma frequently appearing as fine, numerous broken or continuous lines, or closely and evenly punctate (x).

Butternut—*Juglans cinerea* L. Fig. 12-107. Desc. p. 538

C. Heartwood grayish brown, occasionally with a lavender tinge, with a faint odor resembling that of kerosene; wood soft (readily dented with the thumbnail), light; parenchyma in bands toward the outer margin of the growth ring, frequently associated with groups of small late-wood pores (x).

Catalpa—*Catalpa* spp. Fig. 12-94. Desc. p. 625

12. Heartwood grayish white to light grayish or pale reddish brown; wood soft; parenchyma not evident; rays barely distinct even with a hand lens.

Cottonwood—*Populus* spp. Fig. 12-122. Desc. p. 544

Willow—*Salix* spp. Fig. 12-134. Desc. p. 548

13. Rays wholly or in part broad (x), the broadest fully twice as wide as the largest pores (ex., Figs. 12-99, 12-120)..... 14

13. Rays narrow (x), the broadest less than twice the width of the largest pores (ex., Figs. 12-78, 12-87, 12-110)..... 17

14. Rays nearly uniform in width, close, appearing to the naked eye on the tangential surface as closely packed, broken lines (Fig. 12-121); grain generally interlocked.

American sycamore—*Platanus occidentalis* L. Fig. 12-120. Desc. p. 590

14. Rays obviously of two widths, broad and very narrow;
 (a) broad rays separated by several of the narrow type, conspicuous (x; ex., Fig. 12-99), or
 (b) broad rays relatively inconspicuous because of color, sporadic and widely spaced (ex., Fig. 12-81)..... 15

15. Broad rays sporadic, rather inconspicuous because of color (x), up to $\frac{4}{8}$ + in. in height (t) along the grain (Fig. 12-82); pores numerous, quite evenly spaced except in the outer late wood where they may be crowded; wood light and soft.

Red alder—*Alnus rubra* Bong. Fig. 12-81. Desc. p. 556

15. Broad rays common, conspicuous; wood hard and heavy..... 16

16. Pores irregularly spaced, arranged in radial fan-shaped or stream-like groups extending across the rings; broad rays frequently extending 1 in. or more along the grain.

A. Sapwood reddish brown; heartwood brown tinged with red; banded parenchyma plainly visible to the naked eye, in ragged tangential lines (x).

Tanoak—*Lithocarpus densiflorus* (Hook. & Arn.) Rehd. Fig. 12-111. Desc. p. 562

B. Sapwood whitish to grayish brown; heartwood dull brown to gray-brown; banded parenchyma barely visible with a hand lens, appearing closely and evenly punctate (x).

Live oak—*Quercus virginiana* Mill. Fig. 12-131. Desc. p. 564

16. Pores quite evenly spaced except in the outer late wood where they may be crowded, but not in radial or fan-shaped groups; rays

plainly visible to the naked eye on the tangential surface as short, staggered lines (Fig. 12-100).

American beech—*Fagus grandifolia* Ehrh. Fig. 12-99. Desc. p. 558

- 17. Wood ivory-white, creamy to grayish white, grayish brown, or shades of yellow or green..... 18
- 17. Wood pinkish, light to dark brown or reddish brown..... 23
 - 18. Rays distinct to the naked eye (x)..... 19
 - 18. Rays not distinct to the naked eye (x)..... 21
- 19. Wood shades of yellow or green or grayish green to greenish brown, or grayish brown.

A. Heartwood variable in color, ranging from clear yellow to dark yellowish green, green, or greenish brown to greenish black (in magnolia); growth rings delineated by a whitish line of marginal parenchyma; rays normally spaced, distinct with a naked eye.

Yellow-poplar—*Liriodendron tulipifera* L. Fig. 12-110. Desc. p. 584

Magnolia—*Magnolia* spp. Figs. 12-113, 12-114. Desc. p. 581

B. Heartwood greenish or brownish gray; growth rings not delineated by marginal parenchyma (indistinct); rays very close together, seemingly occupying half the area on the cross section (x, impression gained by casual observation).

Black tupelo, blackgum—*Nyssa* spp. Figs. 12-116, 12-117. Desc. p. 610

C. Heartwood grayish brown, frequently with darker streaks of pigment figure, aromatic on the freshly cut surface; pores encircled by a whitish sheath of parenchyma.

California laurel—*Umbellularia californica* (Hook. & Arn.) Nutt. Fig. 12-140. Desc. p. 585

- 19. Wood ivory-white, creamy, or creamy brown..... 20
 - 20. Wood ivory-white, frequently with bluish cast; hard; pores small, grouped in radial strings (x); rays distinct with a naked eye.
 - American holly**—*Ilex opaca* Ait. Fig. 12-106. Desc. p. 600
 - 20. Wood creamy white to pale creamy brown; often appearing lacelike under a lens (x); rays quite uniformly spaced.
 - Basswood**—*Tilia* spp. Fig. 12-136. Desc. p. 610
- 21. Rays plainly visible with a hand lens (x)..... 22
- 21. Rays barely visible or indistinct with a hand lens (x).

A. Sapwood whitish to grayish white, gradually merging into creamy white to pale yellowish-white heartwood, frequently with grayish streaks caused by oxidative sap stain; ripple marks sometimes evident on the tangential surface; pores mostly constant in size, minute, quite evenly distributed throughout the growth rings.

Buckeye—*Aesculus* spp. Fig. 12-80. Desc. p. 607

B. Heartwood uniformly grayish or pale reddish brown; pores gradually decreasing in size from early to late wood, the largest in the early wood barely visible to the naked eye.

Cottonwood—*Populus* spp. Fig. 12-122. Desc. p. 544

Willow—*Salix* spp. Fig. 12-134. Desc. p. 548

C. Heartwood pale creamy white to light grayish brown; pores small, not visible with the naked eye, decreasing gradually in size from early to late wood.

Aspen—*Populus* spp. Figs. 12-123, 12-124. Desc. p. 546

22. Wood creamy white to pale creamy brown, soft and light, often appearing lacelike under the lens (x).

Basswood—*Tilia* spp. Fig. 12-136. Desc. p. 610

22. Heartwood greenish or brownish gray or grayish brown, moderately heavy to heavy, moderately hard, not appearing lacelike under a hand lens (x).

A. Wood aromatic on the freshly cut surface; heartwood grayish brown, frequently with darker streaks of pigment figure; pores encircled by a whitish sheath of parenchyma; rays normally spaced.

California-laurel—*Umbellularia californica* (Hook. & Arn.) Nutt. Fig. 12-140. Desc. p. 585

B. Wood not aromatic; heartwood greenish or brownish gray; pores not encircled by a whitish sheath of parenchyma; rays very close together, seemingly occupying half the area on the cross section (x) (impression gained by casual observation).

Black tupelo, blackgum—*Nyssa* spp. Figs. 12-116, 12-117. Desc. p. 610

23. Rays distinct to the naked eye (x)..... 24

23. Rays not distinct to the naked eye (x)..... 28

24. Rays variable in width, the broadest separated by several narrow rays which are scarcely visible with the naked eye.

A. Sapwood whitish with a reddish tinge, narrow; heartwood uniformly light brown to reddish brown; outer margin of the growth ring usually sharply marked by a narrow darker line of denser fibrous tissue; wider rings usually quite sharply delineated against the background of pores and fibrous tissue.

Hard maple—*Acer* spp. Fig. 12-78. Desc. p. 602

B. Sapwood carmine to light pinkish brown, wide; heartwood, when present, dark brown, frequently variegated; outer margin of the growth ring and wider rays are not sharply delineated against the background of pores and fibrous tissue.

Dogwood—*Cornus* spp. Fig. 12-97. Desc. p. 615

24. Rays nearly uniform in width (ex., Fig. 12-125)..... 25

25. Rays very close, seemingly occupying half the area of the transverse surface (*x*, impression gained by casual examination); sapwood pinkish; heartwood carneous gray to varying shades of reddish brown, frequently with darker shades of reddish-brown pigment figure.
Sweetgum—*Liquidambar styraciflua* L. Fig. 12-109. Desc. p. 588
25. Rays normally spaced, not seemingly occupying half the area on the transverse surface of the wood..... 26
26. Wood aromatic on the freshly cut surface; heartwood light brown to grayish brown, frequently with darker streaks of pigment figure; pores encircled by a whitish sheath of parenchyma.
California-laurel—*Umbellularia californica* (Hook. & Arn.) Nutt. Fig. 12-140. Desc. p. 585
26. Wood not aromatic; pores not encircled with parenchyma..... 27
27. Pores in the early wood in a distinct uniseriate row; heartwood distinctly light to dark red-brown.
Black cherry—*Prunus serotina* Ehrh. Fig. 12-125. Desc. p. 592
27. Pores in the early wood not in a distinct uniseriate row.
 A. Wood soft, light brown, sometimes with a pinkish cast, often appearing lacelike under a lens (*x*); rays uniformly spaced, of the same color as the background; ray flecks (*r*) high, rather distant.
Basswood—*Tilia* spp. Fig. 12-136. Desc. p. 610
 B. Wood hard; heartwood pale brown, frequently with grayish or greenish cast; rays appearing on the tangential surface as short crowded lines, visible without magnification.
Soft maple—*Acer* spp. Figs. 12-75 to 12-77, inc. Desc. p. 605
 C. Wood hard; heartwood light to dark brown or reddish brown; largest pores obviously wider than the broadest rays; ray fleck (*t*) inconspicuous.
Birch—*Betula* spp. Figs. 12-84 to 12-87, inc. Desc. p. 552
28. Rays barely visible with a hand lens.
 A. Wood whitish, aging to flesh colored or light brown with a reddish tinge, frequently stained with gray oxidative stain; rays very close together, seemingly occupying half the area (*x*, impression gained by casual examination).
Red alder—*Alnus rubra* Bong. Fig. 12-81. Desc. p. 556
 B. Heartwood light brown to pale reddish brown; rays normally spaced.
Cottonwood—*Populus* spp. Fig. 12-122. Desc. p. 544
Willow—*Salix* spp. Fig. 12-134. Desc. p. 548
28. Rays plainly visible with a hand lens..... 29
29. Wood aromatic on the freshly cut surface; heartwood light brown to grayish brown, frequently with darker streaks of pigment figure; pores encircled by a whitish sheath of parenchyma.
California-laurel—*Umbellularia californica* (Hook. & Arn.) Nutt. Fig. 12-140. Desc. p. 585

29. Wood not aromatic; heartwood light brown, with or without grayish or greenish cast, brown or reddish brown; pores not encircled by white sheaths of parenchyma..... 30
30. Rays very close together, seemingly occupying half the area on the transverse surface (*x*), (impression gained by casual examination); sapwood pinkish; heartwood carneous gray to varying shades of brown, frequently with darker streaks of pigment figure.
Sweetgum—*Liquidambar styraciflua* L. Fig. 12-109. Desc. p. 588
30. Rays normally spaced, not seemingly occupying half the area on the transverse surface..... 31
31. Late wood figured with wavy, concentric bands of pores which are mostly continuous and separated by bands of mechanical tissue.
Hard elm—*Ulmus* spp. Fig. 12-139. Desc. p. 575
31. Late wood not figured with wavy, concentric bands of pores..... 32
32. Wood soft, light brown, sometimes with a pinkish cast; often appearing lacelike under a lens (*x*); rays uniformly spaced, of the same color as background (*x*); ray flecks (*r*) high, rather distant.
Basswood—*Tilia* spp. Fig. 12-136. Desc. p. 610
32. Wood hard, light to dark brown or reddish brown, not lacelike under a lens (*x*).
 A. Heartwood pale brown, frequently with grayish or greenish cast; rays on tangential surface appearing as short, crowded lines, visible without magnification.
Soft maple—*Acer* spp. Figs. 12-75 to 12-77, inc. Desc. p. 605
 B. Heartwood light to dark brown or reddish brown; largest pores wider than the broadest rays; ray fleck (*t*) inconspicuous.
Birch—*Betula* spp. Figs. 12-84 to 12-87, inc. Desc. p. 552

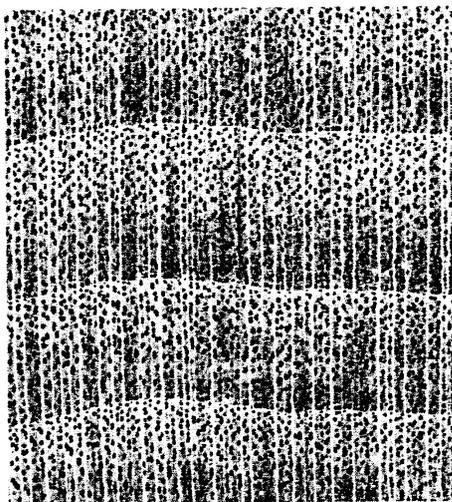


FIG. 12-75 *Acer macrophyllum* Pursh. (*x*—5×.)
 BIGLEAF MAPLE
 (PACIFIC COST HARDWOOD)

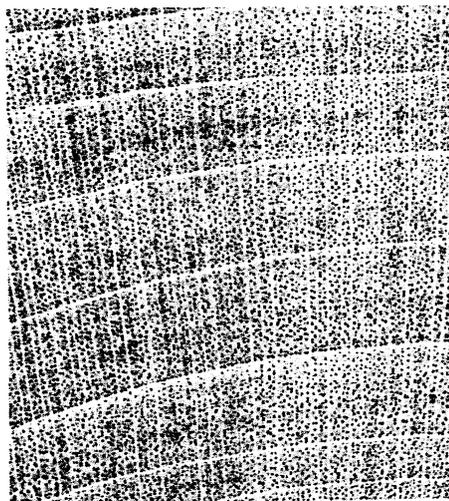


FIG. 12-76 *Acer rubrum* L. ♂
 (x—5×.)
 RED MAPLE

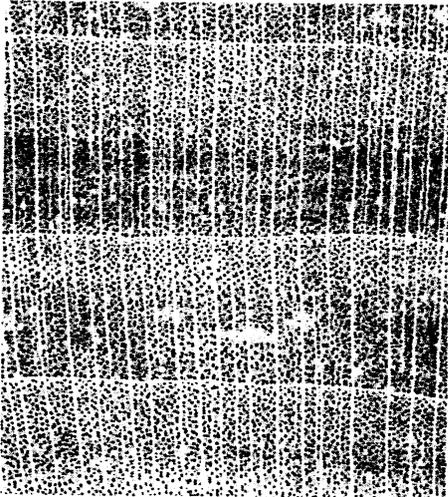


FIG. 12-77 *Acer saccharinum* L. (x-5x.) SILVER MAPLE

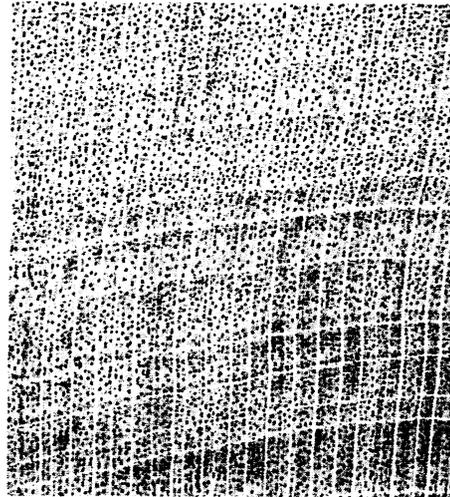


FIG. 12-78 *Acer saccharum* Marsh. (x-5x.) SUGAR MAPLE

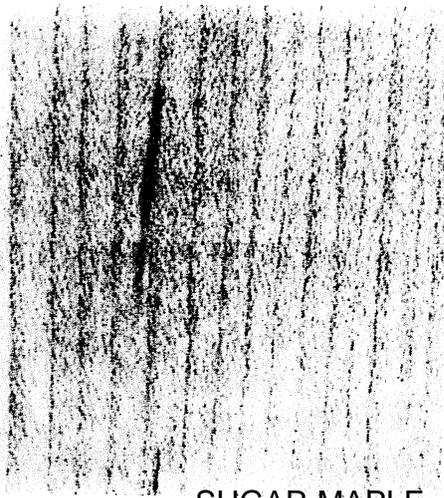


FIG. 12-79 SUGAR MAPLE *Acer saccharum* Marsh. (t—natural size.)

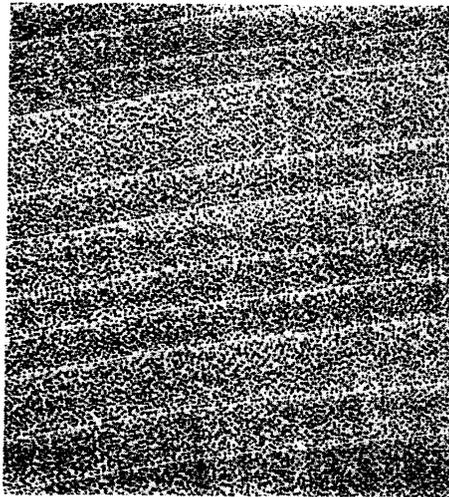


FIG. 12-80 YELLOW BUCKEYE *Aesculus octandra* Marsh. (x-5x.)

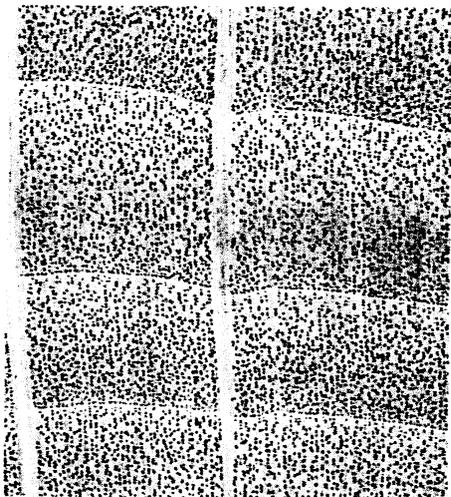
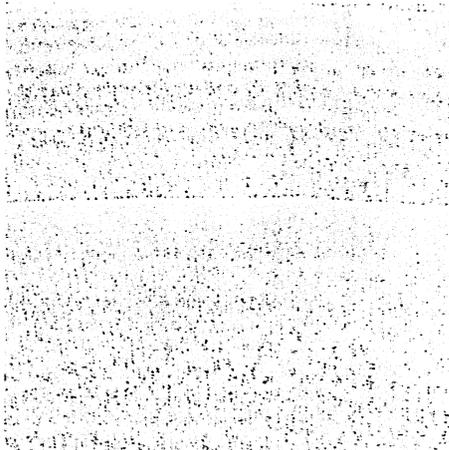


FIG. 12-81 *Alnus rubra* Bong. (x-5x.) RED ALDER



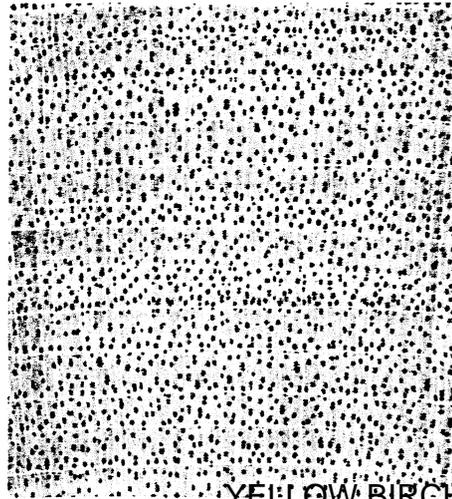
FIG. 12-82 *Alnus rubra* Bong. (t—natural size.)

(HARDWOOD IN PACIFIC NORTHWEST)



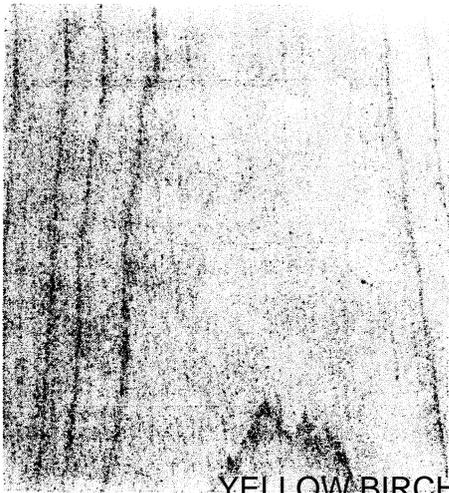
PACIFIC MADRONE

FIG. 12-83 *Arbutus menziesii* Pursh. (x—5X.)



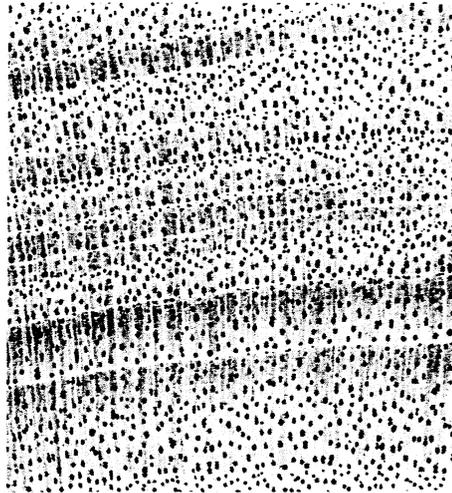
YELLOW BIRCH

FIG. 12-84 *Betula alleghaniensis* Britton. (x—5X.)



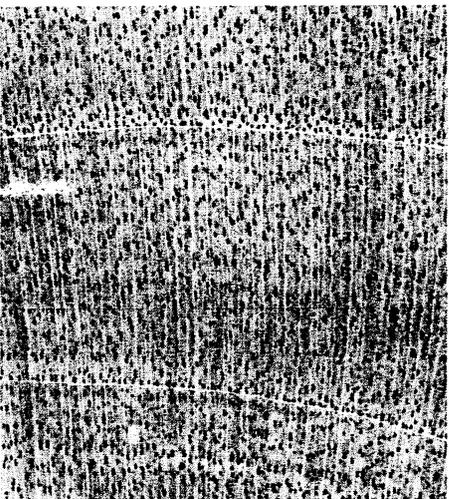
YELLOW BIRCH

FIG. 12-85 *Betula alleghaniensis* Britton. (t—natural size.)



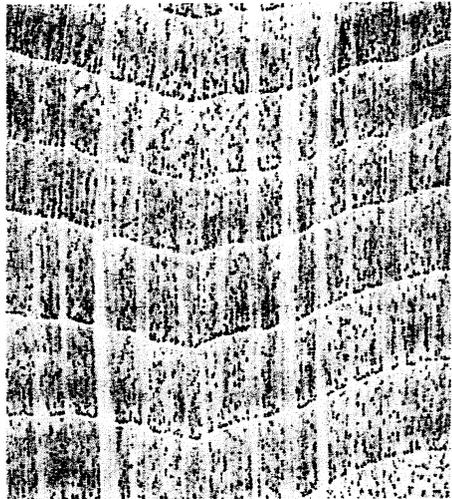
BLACK BIRCH

FIG. 12-86 *Betula lenta* L. (x—5X.)



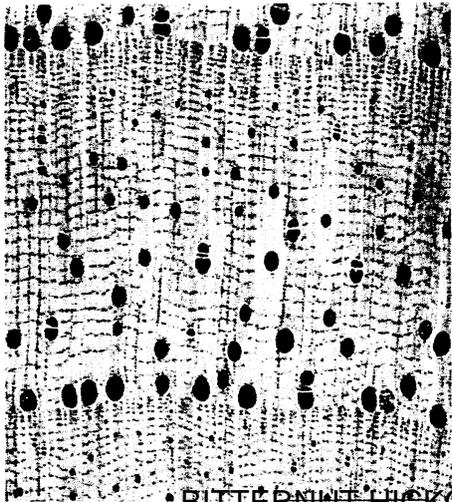
PAPER BIRCH

FIG. 12-87 *Betula papyrifera* Marsh. (x—5X.)



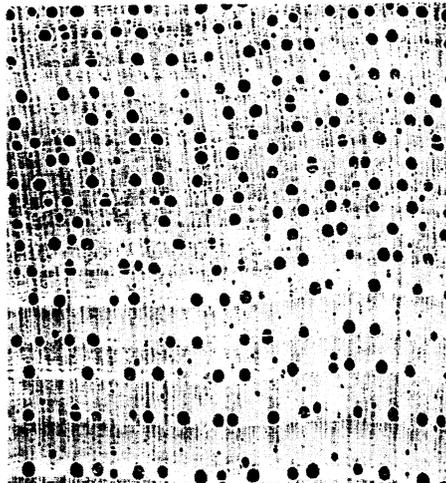
AMERICAN HORNBEAM
WATER BEECH OR MUSCLE TREE

FIG. 12-88 *Carpinus caroliniana* Walt. (x—5X.)



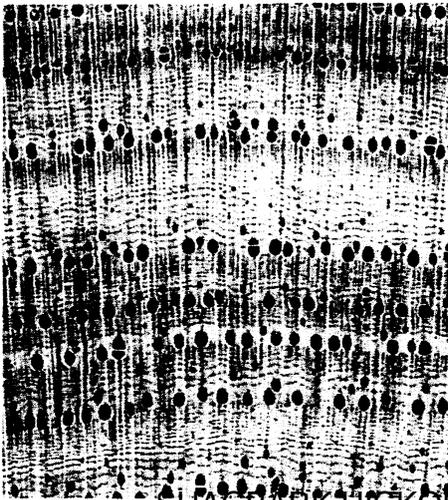
BITTERNUT HICKORY

FIG. 12-89 *Carya cordiformis*
(Wangenh.) K. Koch. (x—5X.)



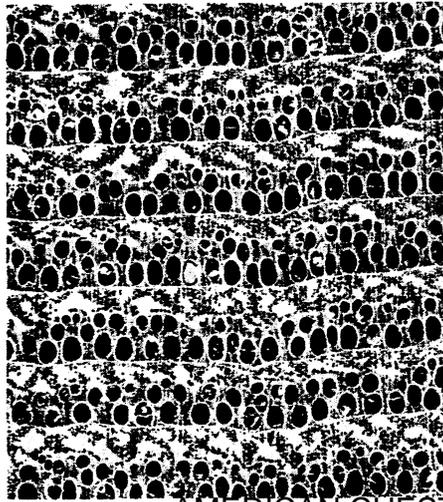
PIGNUT HICKORY

FIG. 12-90 *Carya glabra* (Mill.)
Sweet. (x—5X.)



SHAGBARK HICKORY

FIG. 12-91 *Carya ovata* (Mill.)
K. Koch. (x—5X.)



AMERICAN CHESTNUT

FIG. 12-92 *Castanea dentata*
(Marsh.) Borkh. (x—5X.)

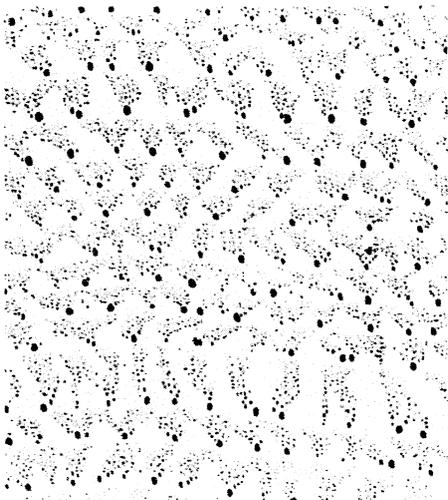


FIG. 12-93 *Castanopsis*
chrysophylla (Dougl.) A.D.C. (x—5X.)

BEECH FAMILY
(PACIFIC COAST)

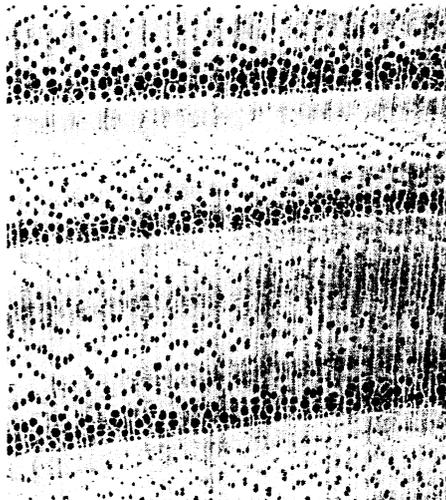


FIG. 12-94 *Catalpa speciosa*
Warder. (x—5X.)

CATALPA

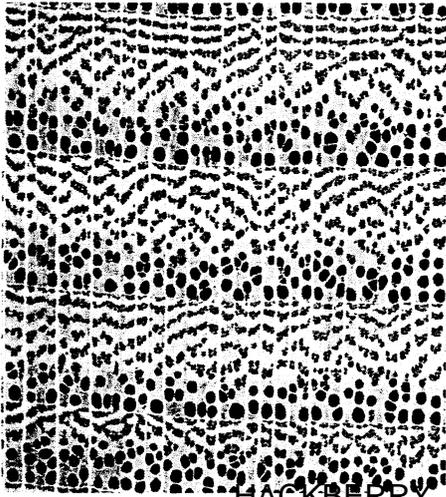


FIG. 12-95 HACKBERRY
Celtis occidentalis
L. (x—5X.)

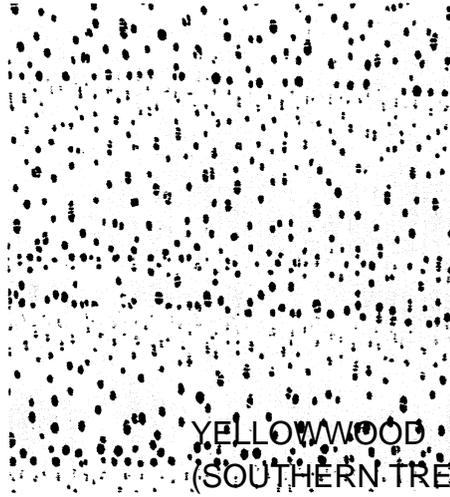


FIG. 12-96 YELLOWWOOD
(SOUTHERN TREE)
Cladrastris lutea
(Michx.f.) K. Koch. (x—5X.)

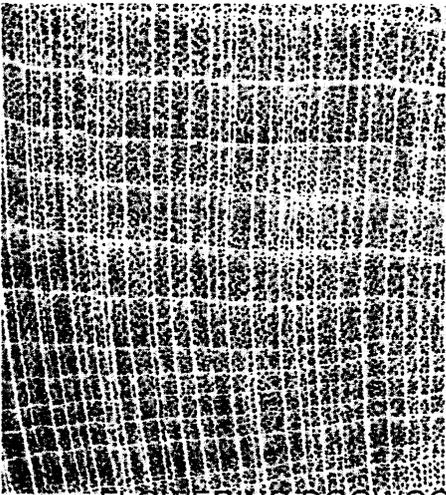


FIG. 12-97 FLOWERING DOGWOOD
Cornus florida L.
(x—5X.)

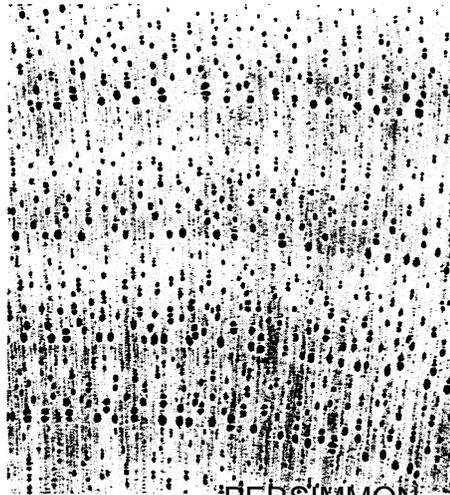


FIG. 12-98 PERSIMMON
Diospyros virginiana L. (x—5X.)

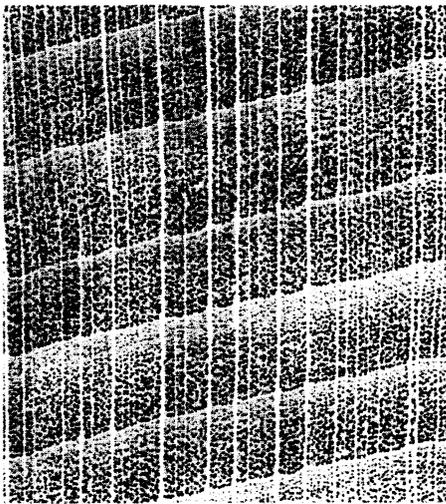


FIG. 12-99 *Fagus grandifolia*
Ehrh. (x—5X.)

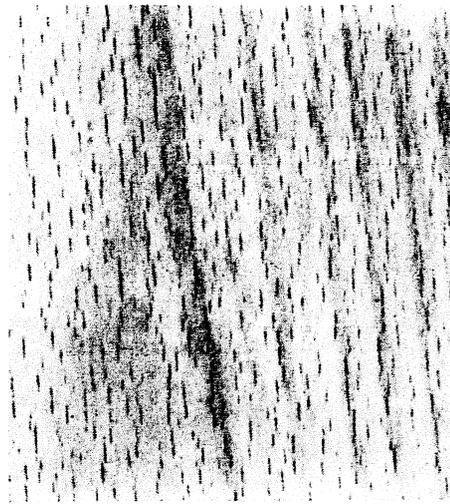
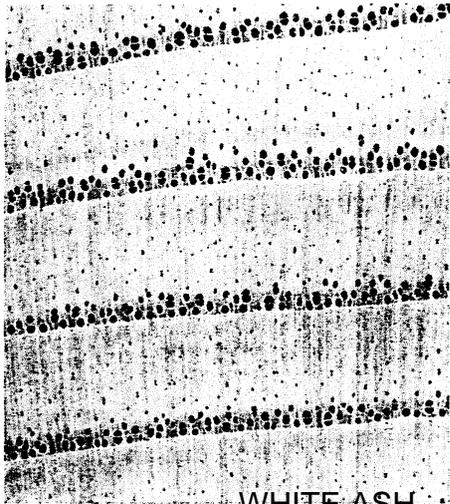


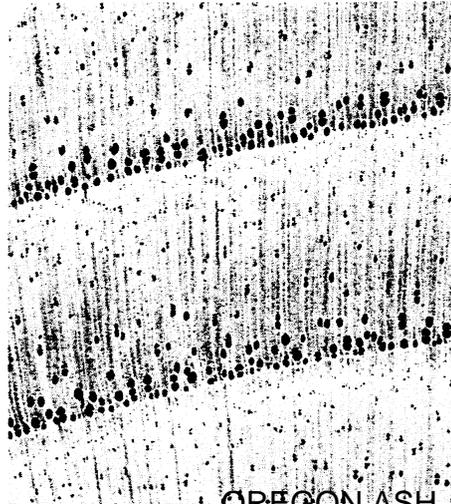
FIG. 12-100 *Fagus grandifolia*
Ehrh. (t—natural size.)

AMERICAN BEECH



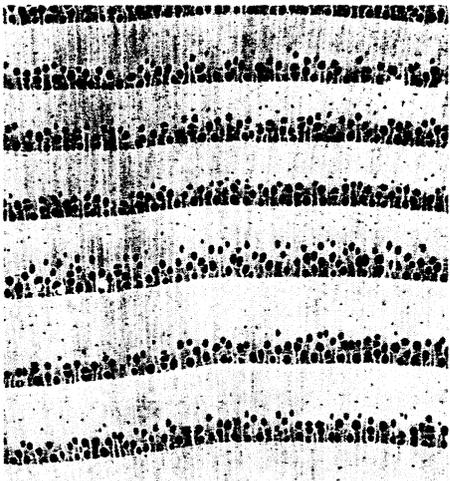
WHITE ASH

FIG. 12-101 *Fraxinus americana* L. (x—5×.)



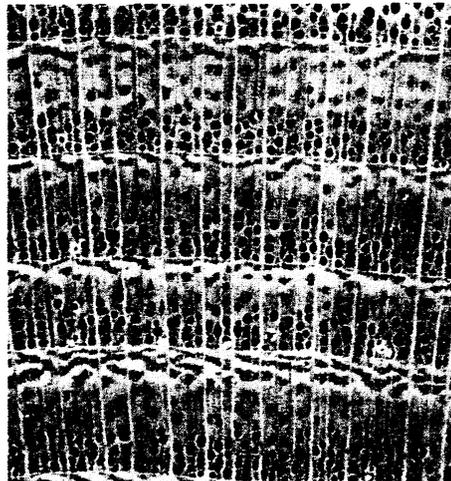
OREGON ASH

FIG. 12-102 *Fraxinus latifolia* Benth. (x—5×.)



BLACK ASH

FIG. 12-103 *Fraxinus nigra* Marsh. (x—5×.)



HONEY LOCUST

FIG. 12-104 *Gleditsia triacanthos* L. (x—5×.)

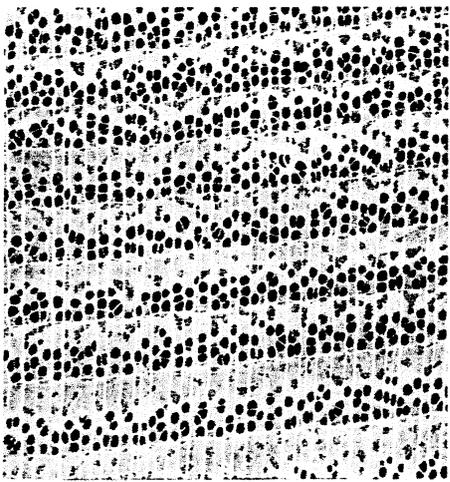


FIG. 12-105 *Gymnocladus dioica* (L.) K. Koch. (x—5×.)
KENTUCKY COFFEETREE

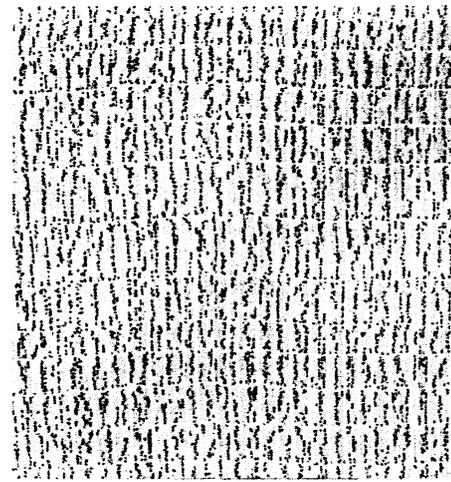


FIG. 12-106 *Ilex opaca* Ait. (x—5×.)
AMERICAN HOLLY

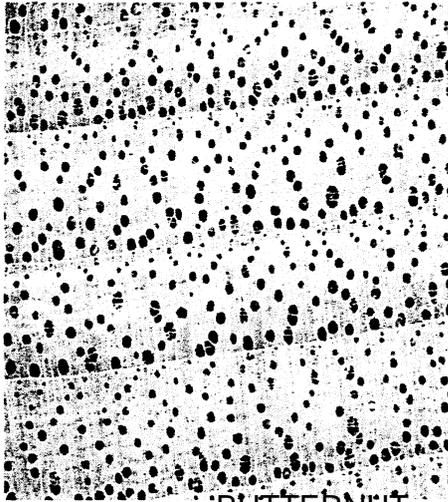


FIG. 12-107 BUTTERNUT
Juglans cinerea L. (x-5x.)

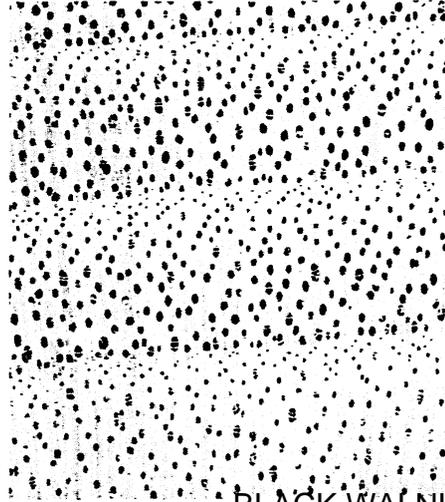


FIG. 12-108 BLACK WALNUT
Juglans nigra L. (x-5x.)

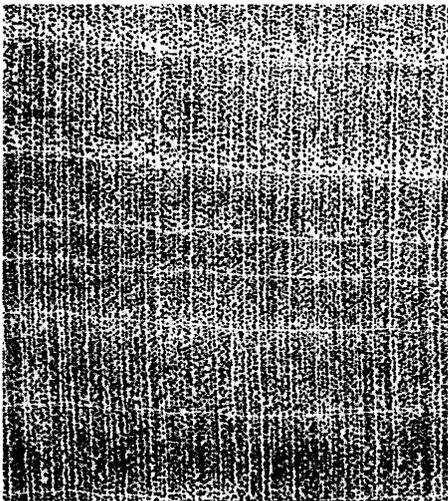


FIG. 12-109 SWEETGUM
Liquidambar styraciflua L. (x-5x.)

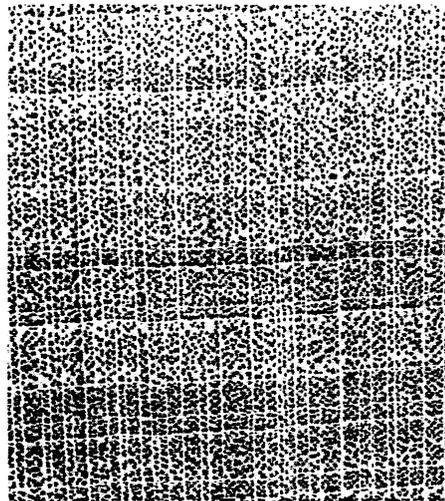


FIG. 12-110 YELLOW POPLAR
Liriodendron tulipifera L. (x-5x.)

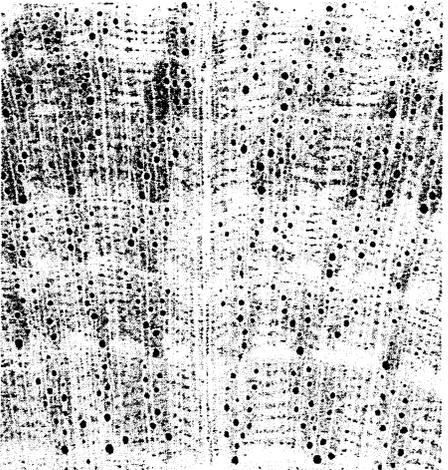


FIG. 12-111 *Lithocarpus densiflorus* (Hook. & Arn.) Rehd. (x-5x.)

BEECH FAMILY
(PACIFIC COAST)

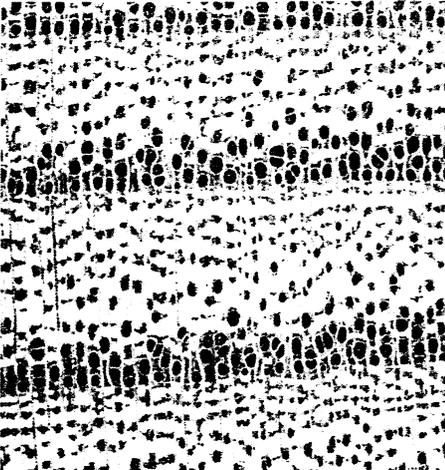


FIG. 12-112 *Maclura pomifera* (Raf.) Schneid. (x-5x.)

OSAGE-ORANGE



FIG. 12-113 CUCUMBER
Magnolia acuminata L. (x—5X.)

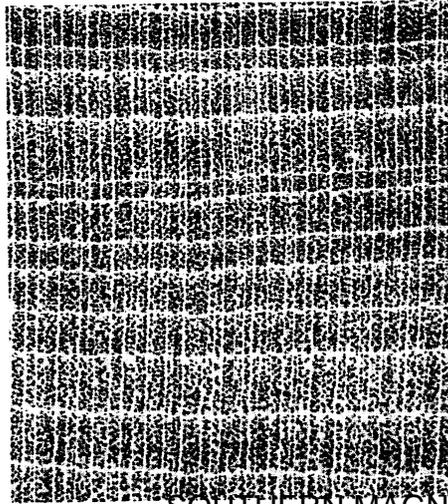


FIG. 12-114 SOUTHERN MAGNOLIA
Magnolia grandiflora L. (x—5X.)

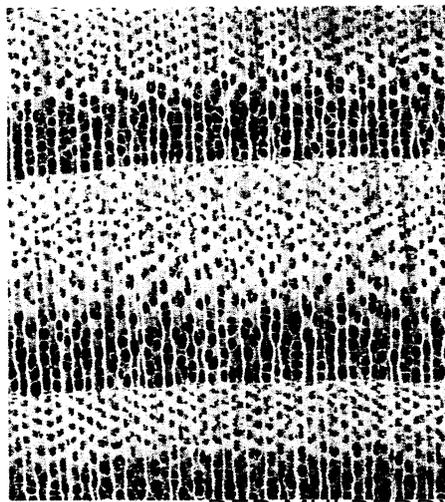


FIG. 12-115 RED MULBERRY
Morus rubra L. (x—5X.)

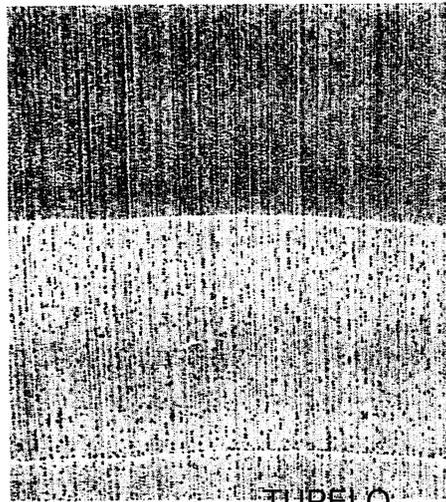


FIG. 12-116 TUPELO
Nyssa aquatica L. (x—5X.)



FIG. 12-117 BLACK GUM
Nyssa sylvatica Marsh. (x—5X.)

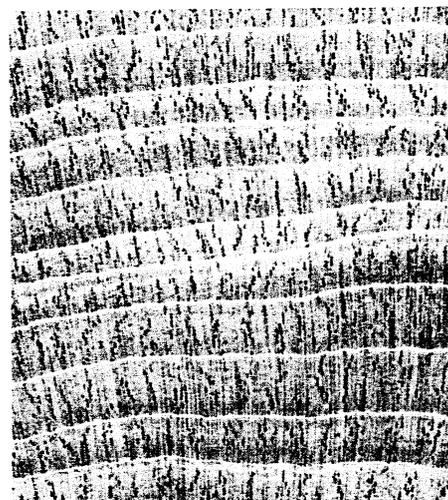


FIG. 12-118 HOP HORNBEAM
Ostrya virginiana (Mill.) K. Koch. (x—5X.)

IRONWOOD

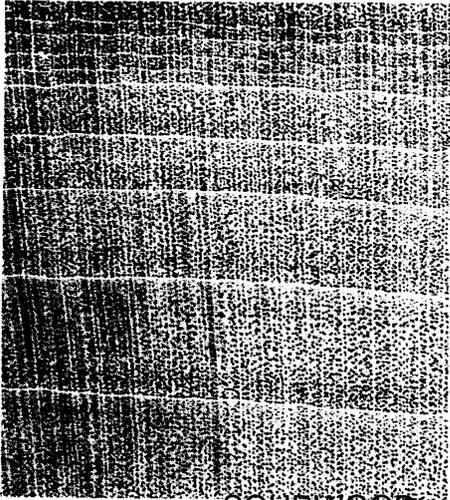


FIG. 12-119 **SOURWOOD**
Oxydendrum
arboreum (L.) DC. (x—5×.)

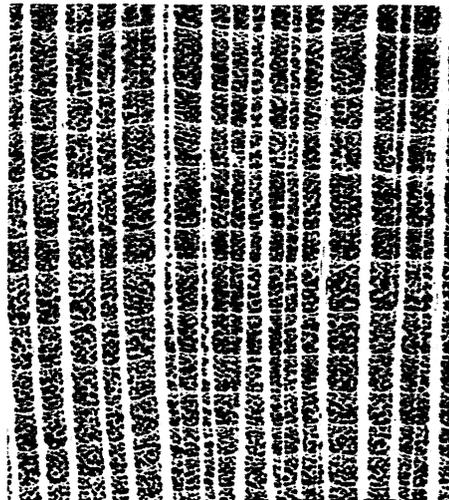


FIG. 12-120 **SYCAMORE**
Platanus occiden-
talis L. (x—5×.)

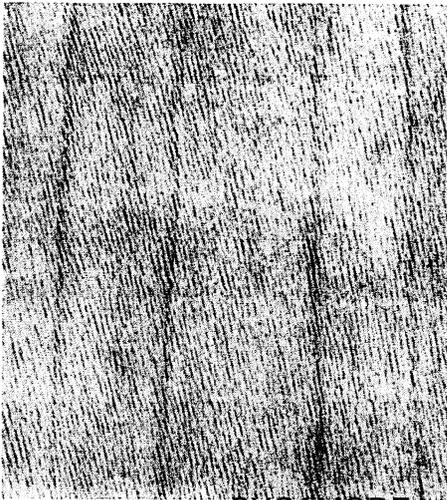


FIG. 12-121 **SYCAMORE**
Platanus occiden-
talis L. (t—natural size.)

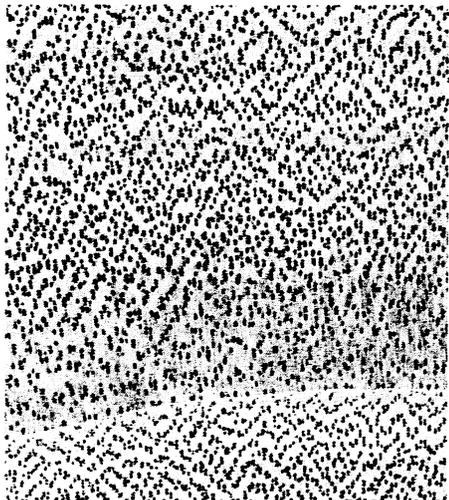


FIG. 12-122 **EASTERN COTTONWOOD**
Populus deltoides
Bartr. (x—5×.)

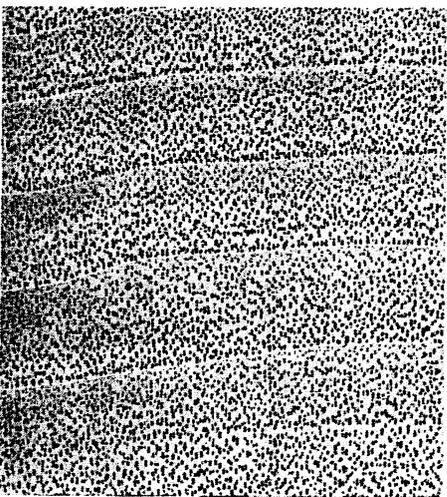


FIG. 12-123 *Populus grandi-*
dentata Michx. (x—5×.)
BIGTOOTH ASPEN

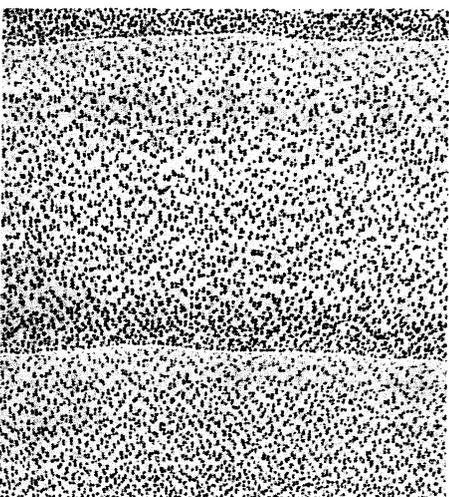


FIG. 12-124 *Populus tremu-*
loides Michx. (x—5×.)
QUAKING ASPEN

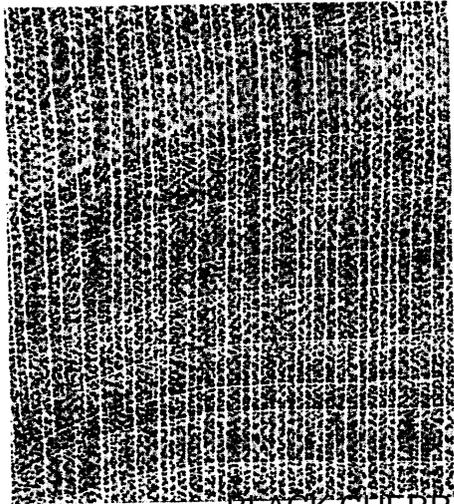


FIG. 12-125 BLACK CHERRY
Prunus serotina
Ehrh. (x—5×.)



FIG. 12-126 WHITE OAK
Quercus alba L.
(t—natural size.)

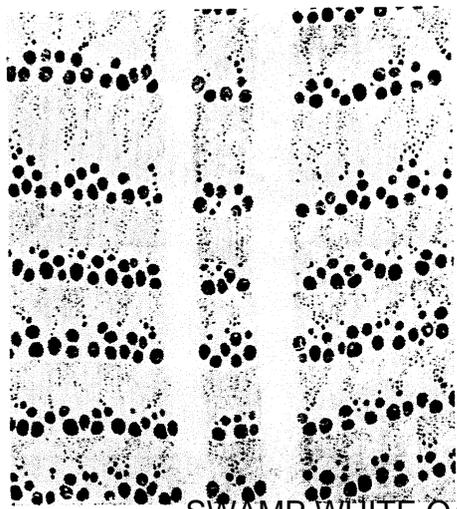


FIG. 12-127 SWAMP WHITE OAK
Quercus bicolor
Willd. (x—5×.)

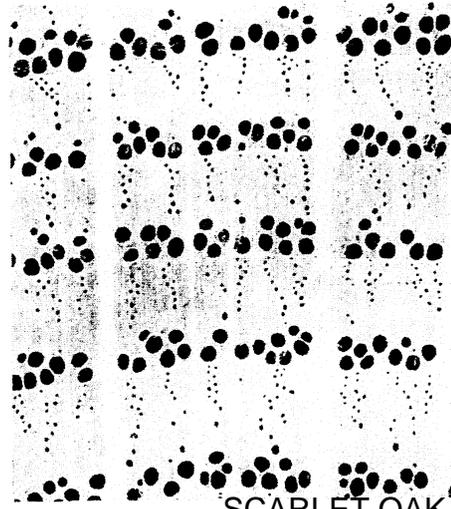


FIG. 12-128 SCARLET OAK
Quercus coccinea
Muenchh. (x—5×.)



FIG. 12-129 *Quercus stellata*
Wangenh. (x—5×.) POST OAK

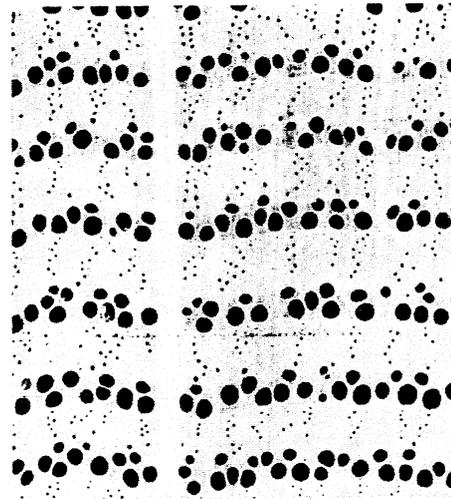


FIG. 12-130 *Quercus velutina*
Lam. (x—5×.) BLACK OAK

5

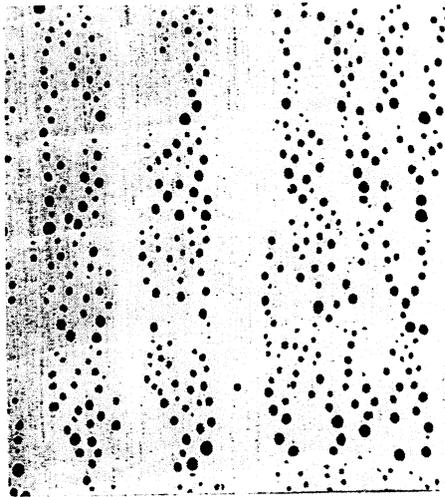


FIG. 12-131 *Quercus virginiana* Mill. (x-5X.)

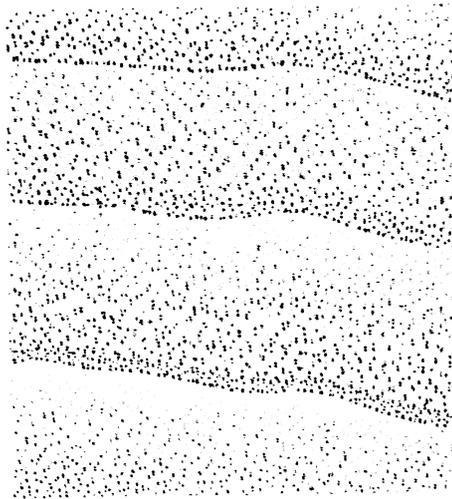


FIG. 12-132 *Rhamnus purshiana* DC. (x-5X.)

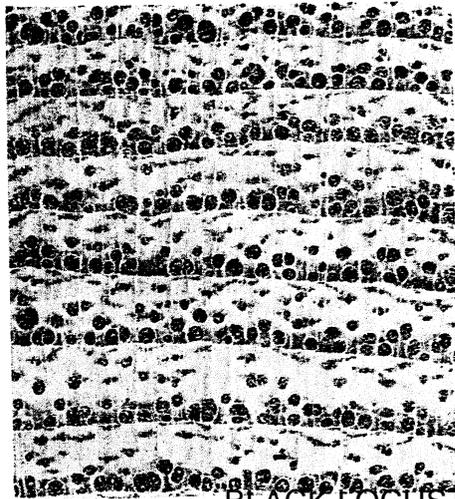


FIG. 12-133 **BLACK LOCUST**
Robinia pseudo-acacia L. (x-5X.)

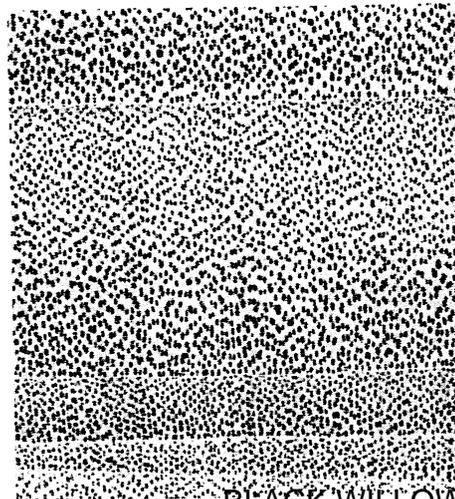


FIG. 12-134 **BLACK WILLOW**
Salix nigra Marsh. (x-5X.)

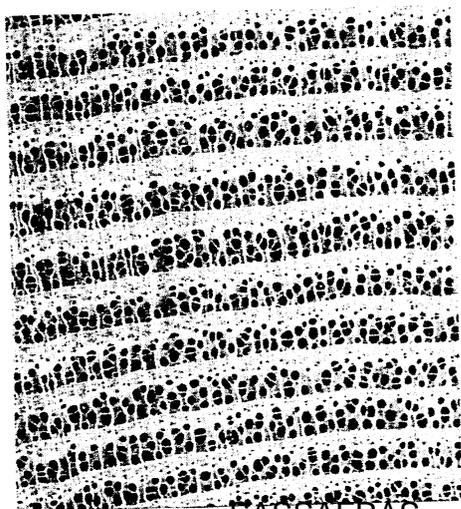


FIG. 12-135 **SASSAFRAS**
Sassafras albidum (Nutt.) Nees. (x-5X.)

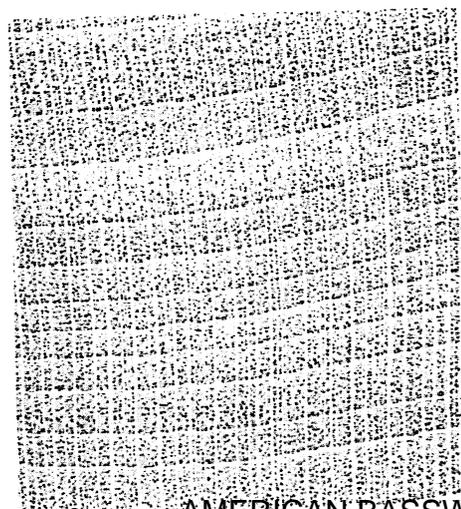
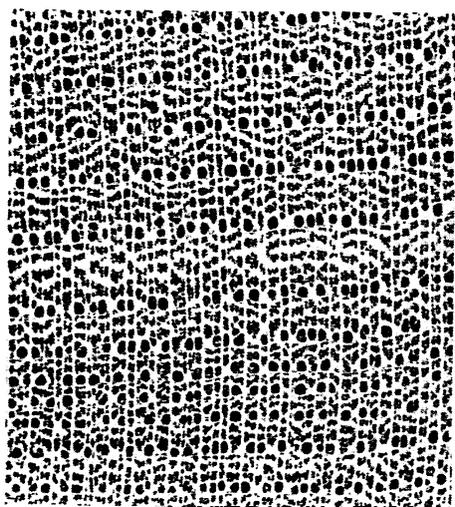


FIG. 12-136 **AMERICAN BASSWOOD**
Tilia americana L. (x-5X.)



AMERICAN ELM
FIG. 12-137 *Ulmus americana*
L. (x-5x.)

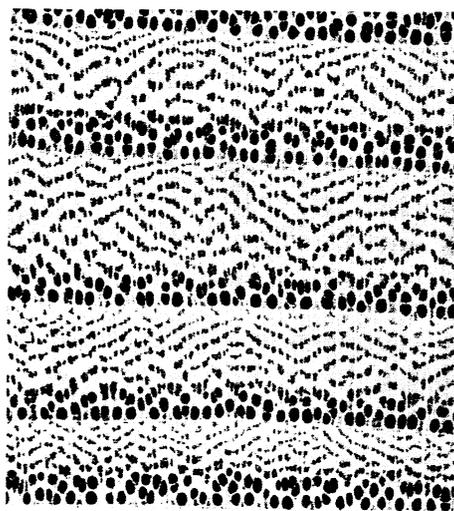


FIG. 12-138 *Ulmus rubra*
Mühl. (x-5x.)



FIG. 12-139 *Ulmus thomasii*
Sarg. (x-5x.)

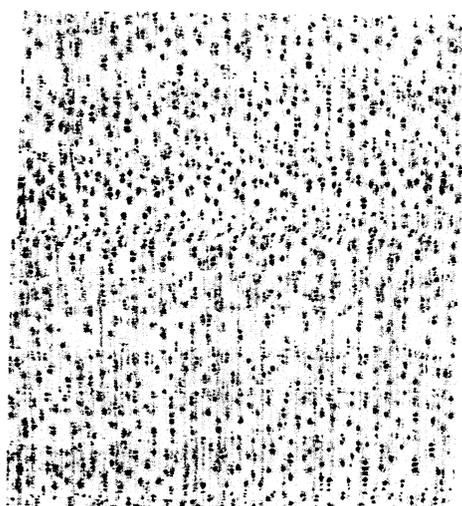


FIG. 12-140 *Umbellularia*
californica (Hook. & Arn.) Nutt.
(x-5x.)

3
27
19