

IDENTIFICATION OF TWENTY-TWO
CHINESE WOODS

Thesis for the Degree of M. S.

MICHIGAN STATE COLLEGE

Te May Tsou

1950



This is to certify that the

thesis entitled

IDENTIFICATION OF TWENTY-TWO CHINESE WOODS

presented by

Te May Tsou

has been accepted towards fulfillment
of the requirements for

Master degree in Forestry


Major professor

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IDENTIFICATION OF TWENTY-TWO CHINESE WOODS

By

Te May Tsou

A THESIS

Submitted to the School of Graduate Studies of Michigan
State College of Agriculture and Applied Science
in partial fulfillment of the requirement
for the degree of

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THESIS

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INTRODUCTION

There are about 2,550 known species of trees and shrubs in China, about one thousand of which are commercially valuable trees(2). Due to the large territory and complexity of races in China, the common names of these plants are not identical and are often misused. This situation causes considerable confusion in so far as scientific studies and trade practices are concerned. Although some progress has been recently made by the botanists in correct identification of Chinese plants, the number of timber species studied is still limited, thus chaotic conditions still prevail in the timber market at the present time.

The author obtained wood samples of twelve common timber species from the National Central University of Nanking, China, and was also fortunate in procuring additional species from the New York State College of Forestry, Syracuse, N.Y.. This entire collection served as a basis for a research problem, dealing with detailed anatomical study of a group of Chinese woods.

The specimens used in this study include one softwood species and twenty-one species of hardwoods. Of these Populus adenopoda, Pterocarya stanleyana, Betula insignis, Castanopsis fargesii, Castanopsis platyacantha, Quercus acutissima, Phoebe nanmu, Albizia kalkora, Sapium sebiferum, Schima crenata, Rhus succedanea, and Hovenia dulcis were collected by K.Y. Chow of Central University in China, from southwestern Szechuan. The rest of the specimens were provided by the New York State College of Forestry, all of these were collected in China, except Betula japonica and Juglans mandshurica which were collected in Japan, and Abies holophylla obtained from Korea.

This study consists of two parts. The first section presents two keys for identification of the twenty-two Chinese woods; one of them is based on features visible with naked eye and a hand lens(10X), the other is based on minute features determined with a microscope. The second part of the report presents descriptions of the woods, including: (1) the habit and distribution of the trees, (2) the general characteristics, uses, macroscopic and minute features of the wood, and (3) illustrations of cross and tangential sections at a magnification of 100X.

KEY FOR THE IDENTIFICATION OF TWENTY-TWO CHINESE WOODS

Based on features discernible with the naked
eye and with the hand lens(10X)

1. Wood non-porous(without vessels): tissue between the rays(X) consisting wholly or largely of tracheids arranged in distinct radial rows; rays indistinct to the naked eye; wood light-buff in color...

I. Liaotung-lengshan(遼東冷杉)--Abies holophylla Maxim.

1. Wood porous(with vessels); tissue between the rays(X) consisting of pores(vessels) embedded in fibrous(and parenchymatous tissue); rays distinct or indistinct to the naked eye.....2.
2. Wood ring porous(springwood zone generally sharply defined); springwood pores conspicuously larger than the summerwood pores, distinct to the naked eye.....3.
2. Wood diffuse porous(springwood zone not sharply defined); springwood pores not conspicuously larger than the summerwood pores, not distinct to the naked eye.....17.
3. Broad rays present, conspicuous(X), forming a broad ray fleck on the radial surface.....4.
3. Broad rays absent.....8.
4. Summerwood pores in flame-shaped patches of light tissues.....5.
4. Summerwood pores scattered.....6.
5. Heartwood light pinkish brown, summerwood pores distinct with a hand lens, tyloses sparse.....

XI. Ma-li (麻櫟)--Quercus acutissima Endl.

5. Heartwood light chestnut, summerwood pores numerous, indistinct with a hand lens, tyloses abundant.....

XII. Ho-li (栲櫟)--Quercus aliena var. grosserrata R. et W.

6. Heartwood whitish, yellowish or greyish tinge, parenchyma abundant.....7.
6. Heartwood flesh colored.....

VII. Mengtsz-chee-mu(蒙自櫟木)--Alnus nepalensis D. Don.

7. Parenchyma paratracheal-confluent.....
- XV. Pat-chun(白椿)--Ailanthus altissima Swingle.
7. Parenchyma metatracheal.....
- VIII. See-shih-li(細絲櫟)--Carpinus laxiflora var. macrostachya Oliv.
8. Transition in size of pores from spring to summerwood gradual;
wood semi-ring porous.....9.
8. Transition in size of pores from spring to summerwood abrupt;
wood typically ring porous.....14.
9. Metatracheal parenchyma present..... 10.
9. Metatracheal parenchyma absent.....12.
10. Pores arranged in flame-shaped patches throughout the growth
ring.....
- IX. Dah-shih-li(大鯉栗)--Castanopsis fargesii Franch.
10. Pores scattered.....11.
11. Heartwood creamy white to light chestnut brown; metatracheal paren-
chyma evenly distributed; rays fine and numerous, indistinct without
lens.....
- IV. Fon-yang(楓楊)--Pterocarya stanoptera DC.
11. Heartwood chestnut brown with a rosseate tinge; metatracheal paren-
chyma confined to outer margin of the growth ring; rays poorly
visible with the naked eye.....
- III. Hu-tao-chiu(胡桃楸)--Juglans mandshurica Maxim.
12. wood lustrous; terminal parenchyma present; rays fine.....13.
12. Wood dull, heartwood brown in color; terminal parenchyma absent;
rays extremely fine, poorly visible with lens.....
- XVII. Wu-chow(烏桕)--Sapium sebiferum Rox.
13. Heartwood golden yellow.....
- XVIII. Yee-chi(野漆)--Rhus succedanea L.
13. Heartwood pinkish brown.....
- XX. Sze-chu(枳椇)--Hovenia dulcis Thunb.

14. Heartwood golden brown with purplish tinge, lustrous; pores few in number; aliform parenchyma present; rays indistinct with lens.....
- XIV. Shan-wei(山槐)--Albizzia kalkora Prain.
14. Aliform parenchyma absent.....15.
15. Summerwood pores in flame-shaped patches of light tissue; springwood pores in 1-3 seriate interrupted rows;.....
- X. Shih-li(絲栗)--Castanopsis platyacantha R. et W.
15. Summerwood pores scattered.....16.
16. Heartwood reddish brown, parenchyma paratracheal.....
- XVI. Hong-chun(紅椿)--Cedrela (Toona) sinensis Juss.
16. Heartwood yellowish white to light brown, parenchyma terminal..
- XXII. Shaw-ding-mu(小丁木)--Acanthopanax evodiaefolius Fr.
17. Terminal parenchyma absent.....18.
17. Terminal parenchyma present; pores small and numerous; rays extremely fine, numerous.....
- II. Shan-ye-yang(響葉楊)--Populus adenopoda Maxim.
18. Pores appearing as white dots to the naked eye.....19.
18. Pores small, indistinct without a hand lens.....21.
19. Heartwood greyish brown to brown, with aromatic odor and bitter taste..
- XIII. Nan-mu(楠木)--Phoebe nanmu Gamble
19. Heartwood light colored.....20.
20. Heartwood aromatic, light brown with pinkish tinge.....
- V. Shang-hwa(香樺)--Betula insignis Fr.
20. Heartwood not scented, creamy white with purplish tinge.....
- VI. Hwa-mu(樺木)--Betula japonica Sieb. et W.
21. Heartwood flesh colored, rays variable in width(cross section)..
- XIX. Shui-seh-shu(水色樹)--Acer pictum var. parviflorum Schneid.
21. Heartwood pinkish brown, rays uniform in width(cross section)...
- XXI. Mu-ho(木荷)--Schima crenata Korth.

KEY FOR THE IDENTIFICATION OF TWENTY-TWO CHINESE WOODS

Based on minute features

1. Wood without vessels(non-porous).....
 - I. Liaotung-lengshan(遼東冷杉)--Abies holophylla Maxim.
1. Wood with vessels(porous).....2.
 2. Springwood vessels obviously larger than those in the summer wood (X), wood ring porous.....3.
 2. Springwood vessels not larger or but slightly larger than those in the summerwood(X), wood diffuse porous.....16.
3. Springwood vessels grading(in size) into those of the summerwood; springwood zone not sharply defined, the transition from spring to summerwood more or less gradual; wood semi-ring porous.....10.
3. Springwood vessels not grading into those of the summerwood; springwood zone sharply defined, the transition from spring to summerwood abrupt; wood typically ring porous.....4.
 4. Broad rays of oak type present.....5.
 4. Broad rays of oak type absent.....6.
5. Vessels thick walled, tyloses thin walled.....
 - XI. Ma-li(麻櫟)--Quercus acutissima Endl.
5. Vessels thin walled, tyloses thick walled.....
 - XII. Ho-li(栲櫟)--Quercus aliena var. grosserata R. et W.
6. Wood with homogeneous rays only, paratracheal parenchyma aliformed..
 - XIV. Shan-wei(山槐)--Albizzia kalkora Prain.
6. Wood with heterogeneous rays or with both homo- and hetero-geneous rays.....7.
7. Ray of two kinds: broad rays heterogeneous, narrow rays homogeneous..8.
7. Rays heterogeneous, parenchyma sparse.....9.
8. Vessels with spiral thickenings, gelatinous fibers common.....
 - XV. Pat-chun(白椿)--Ailanthus altissima Swingle.

8. Vessels without spiral thickenings, with confluent pitting and gummy deposits.....
- XVI. Hong-chun(紅椿)--Cedrela (Toona) sinensis Juss.
9. Pores arranged in flame shaped tract; perforations scalariform and simple; septate fibers common.....
- X. Shih-li(絲栗)--Castanopsis plantyacantha R. et W.
9. Pores arranged in nests; perforations simple; no septate fibers..
- XXII. Shaw-ding-mu(小丁木)--Acanthopanax evodiaefolius Fr.
10. Pores arranged in flame tracts, thick walled tyloses present...
- IX. Dah-shih-li(大絲栗)-- Castanopsis fargesii Franch.
10. Pores not arranged in flame tracts.....11.
11. Parenchyma abundant.....12.
11. Parenchyma comparatively sparse; intervessel pits often confluent..15.
12. Parenchyma zonate.....13.
12. Parenchyma not zonate^{only}; interfiber pits conspicuous.....14.
13. Rays heterogeneous.....
- XVII. Wu-chow(烏桕)--Sapium sebiferum Rox.
13. Rays homogeneous.....
- IV. Fon-yang(楓楊)--Pterocarya stanoptera DC.
14. Aggergate rays present; pores numerous(X).....
- VIII. See-shih-li(細絲榧)--Carpinus laxiflora var. macrostachya Oliv.
14. Aggregate rays absent; pores sparse(X).....
- III. Hu-tao-chiu(胡桃楸)--Juglans mandshurica Maxim.
15. Vessels thick walled; gelatinous fibers common; rays of two kinds, uniseriate rays homogeneous, 2-5 seriate rays heterogeneous.....
- XX. Sze-chu(枳椇)--Hovenia dulcis Thunb.
15. Vessels thin walled; septate fibers common; rays heterogeneous, 1-2 seriate.....
- XVIII. Yee-chi(野漆)--Rhus succedanea L.

16. Wood with two kinds of rays: simple and aggregate; perforation plates scalariform.....
- VII. Meng-tsz-chee-mu(蒙自櫟木)--Alnus nepalensis D. Don.
16. Wood without aggregate rays.....17.
17. Perforation plates scalariform.....18.
17. Perforation plates simple.....20.
18. Intervessel pits minute, often confluent.....19.
18. Intervessel pits large, often scalariform; interfiber pits conspicuous.....
- XI. Mu-ho(木柯)--Schima crenata Korth.
19. Fibers thin walled, often septate.....
- VI. Hwa-mu(樺木)--Betula japonica Sieb. et W.
19. Fibers thick walled, not septate.. ..
- V. Shang-hwa(香榉)--Betula insignis Fr.
20. Rays uniseriate, homogeneous; parenchyma terminal.....
- II. Shan-ye-yang(響葉楊)--Populus adenopoda Maxim.
20. Rays not uniseriate only.....21.
21. Vessels with spiral thickenings; rays homogeneous; interfiber pits conspicuous.....
- XIX. Shui-seh-shu(水色樹)--Acer pictum var. parviflorum Schneid.
21. Vessels without spiral thickenings; rays heterogeneous; septate fibers common; enlarged parenchymatous oil cells abundant.....
- XIII. Nan-mu(楠木)--Phoebe nanmu Gamble.

I. Liaotung-lengshan (遼東冷杉)

Abies holophylla Maxim.

Plate I

Big tree up to 30-50 meters tall, 4 meters in diameter; found in Manchuria; wood soft, used for paper making(2).

GENERAL CHARACTERISTICS OF THE WOOD--No differentiation between heartwood and sapwood(4); wood light buff, the summerwood portion of the ring with a brown tinge, without characteristic odor and taste, straight grained, medium to coarse textured, light and moderately soft; weight of air-dried wood 25 pounds per cubic foot(4).

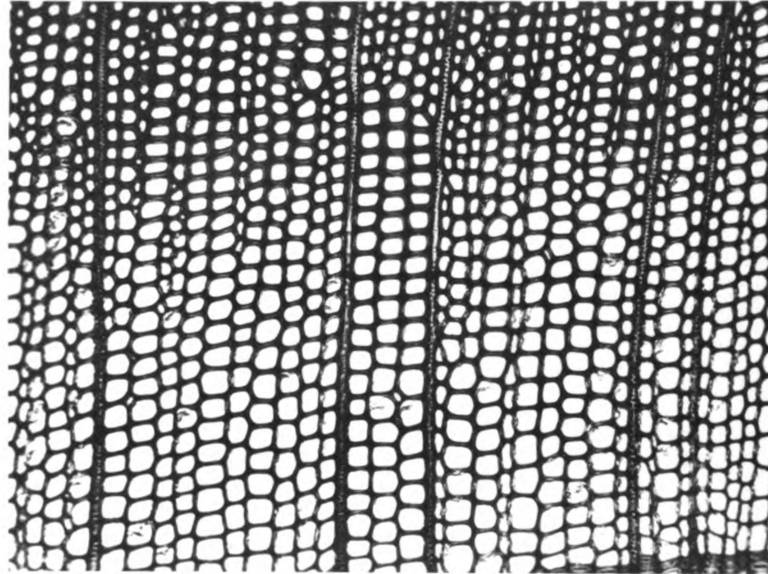
GROSS FEATURES--Growth rings distinct, delineated by a band of darker summerwood, narrow. Springwood zone occupying one-third to two-third of the ring; transition from summerwood to springwood gradual; summerwood zone distinct to the naked eye. Parenchyma not visible. Rays very fine(cross section), not distinct to the naked eye, visible with a lens, appearing as white lines. Normal resin canals wanting.

MINUTE FEATURES--Tracheids 22-36 microns in diameter, 2.231 to 2.301 millimeter in length, bordered pits in one row, occasionally in two rows, on the radial walls; pits leading to ray parenchyma small (3-5 microns in diameter), with distinct border, arranged in two rows, 2-4 per ray crossing. Longitudinal parenchyma wanting. Resin canals wanting. Rays uniseriate, up to 25 cells in height(mostly 4-10 cells), consisting of ray parenchymatous cells or occasionally with marginal ray tracheids.

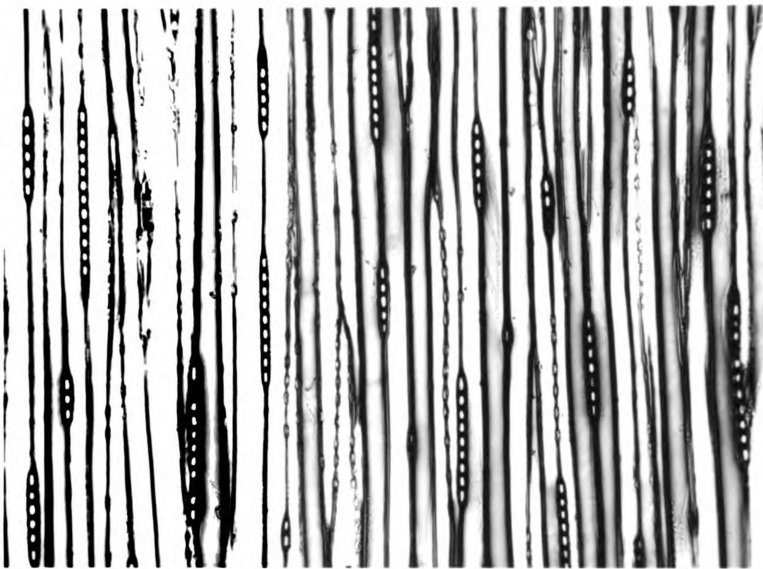
MATERIAL--Syracuse 162/2871.

Plate I

Abies holophylla Maxim.



Cross section 100X



Tangential section 100X

II. Shan-ye-yang (響葉楊)

Populus adenopoda Maxim.

Plate II

Tree of medium size up to 20-25 meters in height; distributed in Szechuan, Hupeh and lower Youngtze River region below 1,700 meters level(2). Wood is used for inlays, furniture, boxes and matches(3).

GENERAL CHARACTERISTICS OF THE WOOD--Demarcation between heart-wood and sapwood indistinct(3); wood creamy white with pinkish tinge, without odor or taste, moderately soft and moderately light, straight grained, medium and even textured.

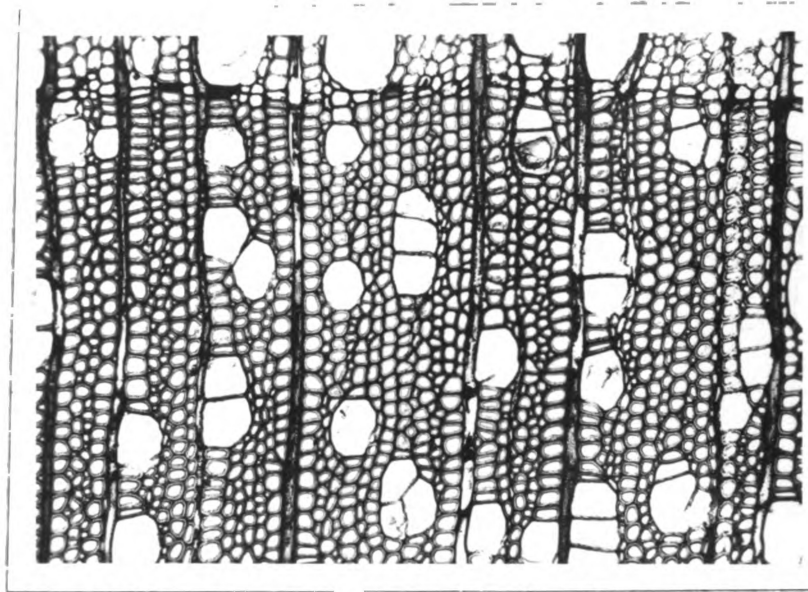
GROSS FEATURES--Growth rings distinct, defined by darker fibrous tissue and fine terminal parenchyma; wood diffuse porous, pores small, evenly distributed and numerous. Parenchyma terminal. Rays extremely fine and numerous, indistinct without a hand lens.

MINUTE FEATURES--Vessels 53-90 per square millimeter, the largest up to 97 microns in diameter; perforation plates simple; intervessel pits orbicular, oval, or angular through crowding, 7-10 microns in diameter, opposite to alternate. Parenchyma terminal, forming a more or less continuous, 1-2 seriate line; paratracheal parenchyma very sparse. Fibers thin walled(2-4 microns), 14-25 microns in diameter, .949 to .991 millimeter in length; occasional gelatinous fibers present. Rays unstoried, homogeneous, uniseriate, occasionally biseriate in the middle portion of the rays, up to 25 cells in height along the grain.

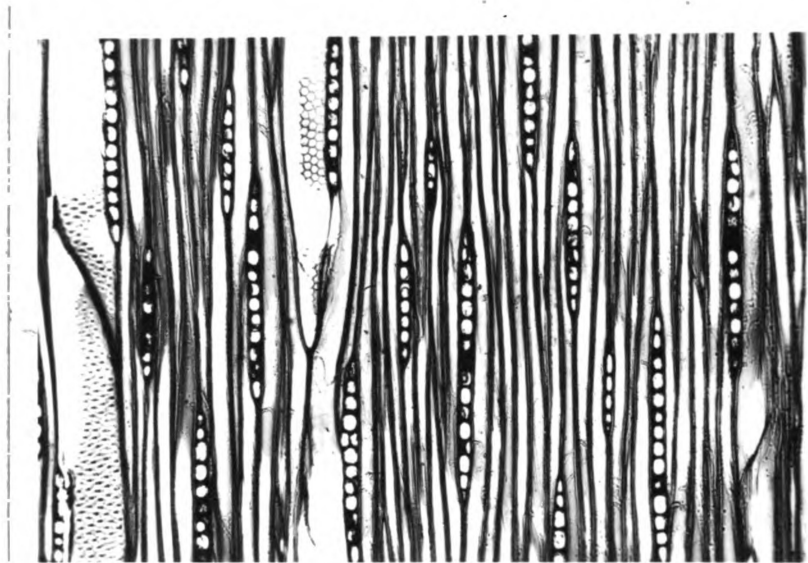
MATERIAL--C.U.No. 9, Syracuse 443/10427.

Plate II

Populus adenopoda Maxim.



Cross section 100X



Tangential section 100X

III. Hu-tao-chiu (胡桃)

Juglans mandshurica Maxim.

Plate III

Tree up to 20 meters tall and 1 meter in diameter; distributed in Manchurica, Hopeh and Honan. Wood used for gunstocks(2).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood narrow, light brown, heartwood chestnut brown with a roseate tinge; wood with a mild walnut odor, tasteless, straight grained and medium textured, lustrous, moderately heavy, hard.

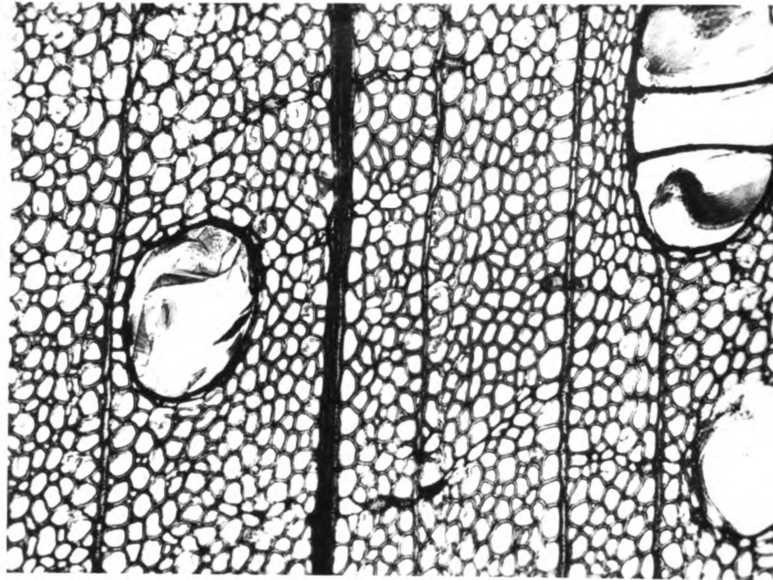
GROSS FEATURES--Growth rings distinct, defined by terminal parenchyma; wood semi-ring porous, pores scattered, solitary, tyloses fairly abundant. Parenchyma visible with a hand lens, arranged in fine, continuous or broken tangential lines in outer margin of the growth rings. Rays poorly visible to the naked eye, wavy and not numerous on cross section.

MINUTE FEATURES--Vessels in the summerwood 8-13 pores per square millimeter, the largest up to 280 microns in diameter; perforation plates simple; intervessel pits round to elliptical, or angular through crowding, alternate, 6-10 microns in diameter; tyloses present. Parenchyma abundant, (1) terminal parenchyma forming an uniseriate continuous line; (2) paratracheal parenchyma sparse, restricted to occasional cells; (3) metatracheal-diffuse parenchyma forming short tangential lines(metatracheal parenchyma). Fibers thin walled (3-5 microns), 14-25 microns in diameter; 1.075 to 1.129 millimeter in length, interfiber pits rather conspicuous. Rays unstoried, simple, heterogeneous, 1-5 seriate, up to 30 cells in height along the grain.

MATERIAL--Syracuse 9/2840.

Plate III

Juglans mandshurica Maxim.



Cross section 100X



Tangential section 100X

IV. Fon-yang (楓楊)

Pterocarya stanoptera DC.

Plate IV.

Tree of medium size up to 20 meters tall; distributed in Kiangsu , Chekiang, Kiangsi, Hupeh, Fukien, Kwangtung, Kwangsi, Kweichow, Yunnan, Kansu, Shansi, Shantung, Wood is used for chests, furniture, wooden-ware and matches(2).

GENERAL CHARACTERISTICS OF THE WOOD--No differentiation between sapwood and heartwood(5); wood creamy white to light chestnut brown, lustrous, without characteristic odor or taste, straight grained, moderately hard, fine textured, moderately light and rather brittle.

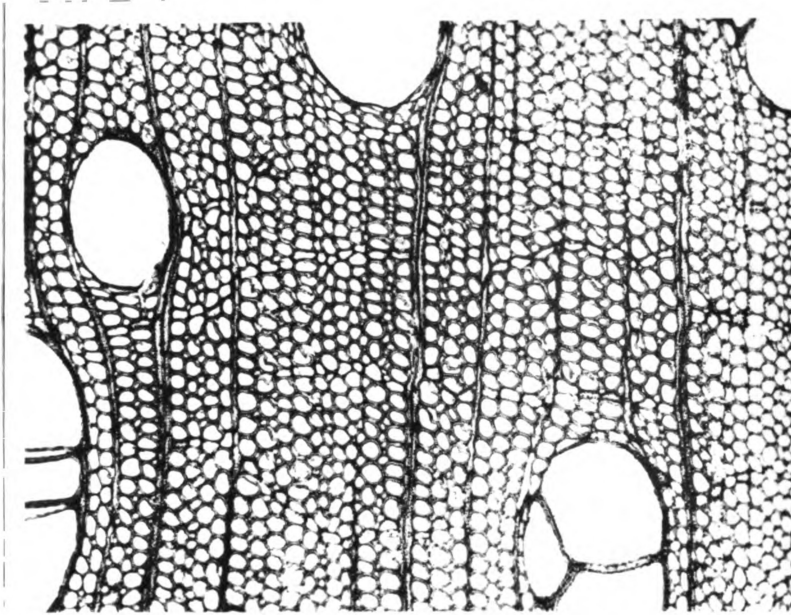
GROSS FEATURES--Growth rings distinct and undulating, delineated by an abrupt difference in size between the pores of the late summerwood and those in the springwood of the succeeding ring; wood semi-ring porous, pores scattered, those in the springwood readily visible to the naked eye, decreasing gradually in size toward the outer margin of the ring, solitary and in radial groups of 2-several, tyloses present. Parenchyma visible with a hand lens, arranged in fine, numerous, tangential lines. Rays fine and numerous, indistinct without a hand lens.

MINUTE FEATURES--Vessels in the summerwood 10-16 per square millimeter, the largest up to 17 microns in diameter; perforation plates simple; intervessel pits round to angular, 11-14 microns in diameter, alternate; tyloses present. Parenchyma abundant, forming more or less continuous uniseriate tangential lines(zonate). Fibers thin to medium thick walled (3-6 microns), 14-22 microns in diameter, .858 to .882 millimeter in length. Rays unstoried, simple, homogeneous, 1-2 seriate, up to 26 cells in height. Pith flecks present.

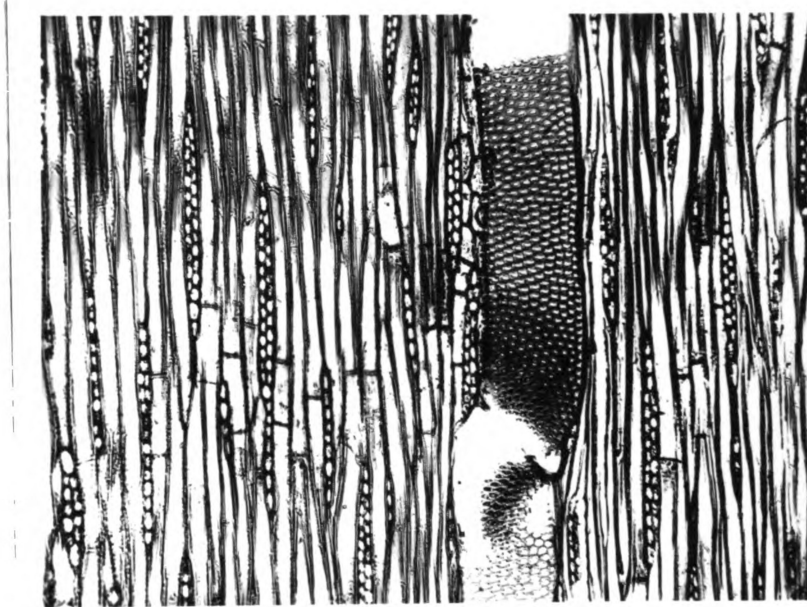
MATERIAL --C.O.No. 4.

Plate IV

Pterocarya stanoptera DC.



Cross section 100X



Tangential section 100X

v. shang-hwa (香樺)

Betula insignis Franch.

Plate V

Tree are growing commonly at 2300 to 2700 meter elevation; distributed in Hupeh, Szechuan and Seckong(2). Wood used for furniture, veneer, interior finish, flooring, sash and doors, fuelwood, and dry distillation(4).

GENERAL CHARACTERISTICS OF THE WOOD--Heartwood light brown with a pinkish tinge, no sapwood shown in the available sample; wood with a pleasant odor, tasteless, heavy and hard, straight grained, medium textured.

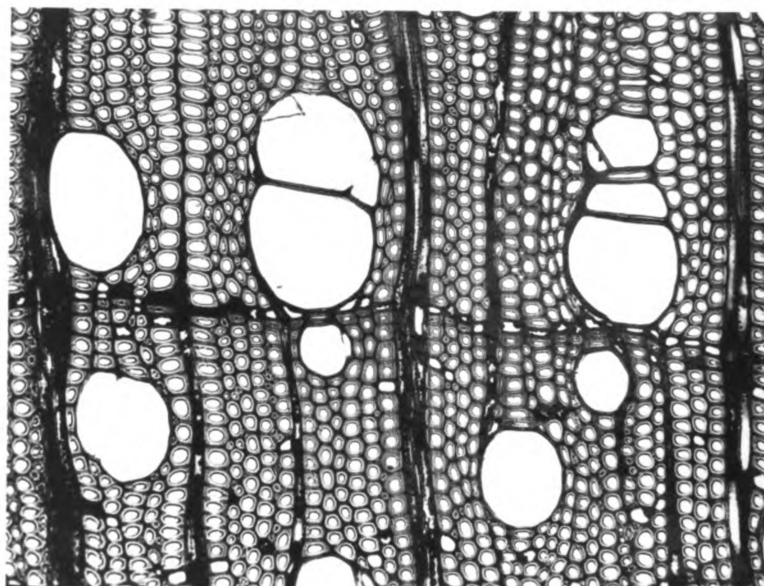
GROSS FEATURES--Growth rings distinct, delineated by the darker colored summerwood portion of the outer margin of the ring. Wood diffuse porous, pores appearing as whitish dots to the naked eye, nearly uniform in size and evenly distributed throughout the growth ring, solitary or in short radial groups of 2-3. Parenchyma not visible. Rays fine, not distinct to the naked eye, plainly visible with a hand lens, appearing as lighter colored lines, narrower than the largest pores.

MINUTE FEATURES--Vessels 19-26 per square millimeter, the largest up to 140 microns in diameter; perforation plates scalariform, with 9-15 thin bars; intervessel pits round, minute (2-4 microns in diameter), inner orifices often confluent. Parenchyma abundant, terminal and metatracheal-diffuse; (1) terminal parenchyma forming a uniseriate continuous line; (2) metatracheal-diffuse abundant, occasionally forming zone lines in the summerwood. Fibers thick walled (5-9 microns), 18-22 microns in diameter, 1.668 to 1.712 millimeter in length. Rays unstoried, simple, 1-3 seriate, homogeneous. Gummy deposits present in parenchymatous cells.

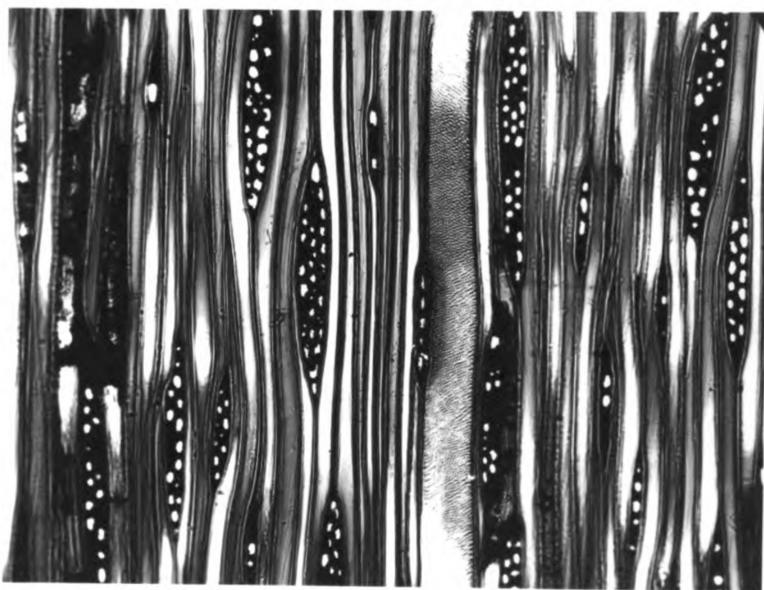
MATERIAL--C.U.No. 10.

Plate V

Betula insignis Fr.



Cross section 100X



Tangential section 100X

VI. Hwa-mu (樺木)

Betula japonica S. et W.

Plate VI

Tree are distributed in Hopeh, Shansi, Honan and Manchuria(2).
Wood used for woodenware, handles, brush backs and furniture(4).

GENERAL CHARACTERISTICS OF THE WOOD--No sapwood shown in this sample, heartwood creamy white, with purplish tinge; wood tasteless and odorless, straight grained, fine textured, moderately light, hard.

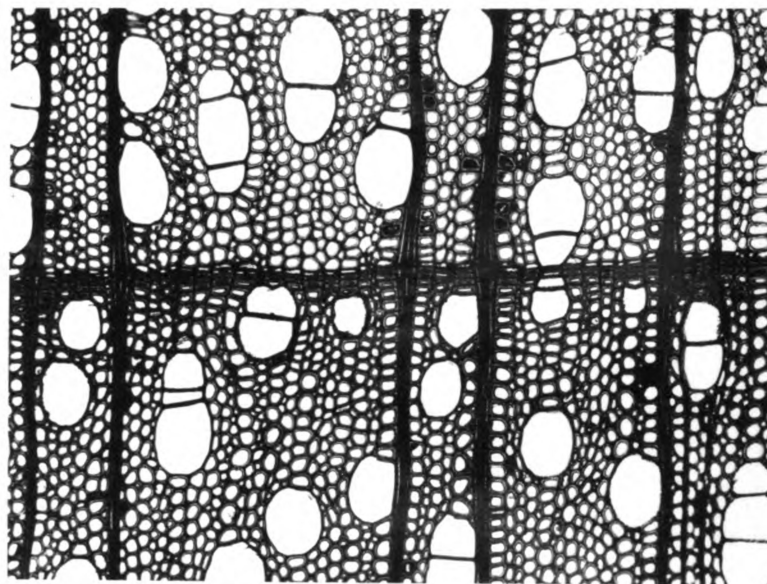
GROSS FEATURES--Growth rings distinct, delineated by denser fibrous tissue in the outer portion of the ring. Wood diffuse porous, pores appearing as white dots to the naked eye, larger pores wider than widest rays, nearly uniform in size and evenly distributed, solitary or in short radial rows of 2-several. Parenchyma not visible. Rays fine, not distinct to the naked eye but plainly visible with a hand lens, narrower than the largest pores, fine, close flecks on radial surface.

MINUTE FEATURES--Vessels 60-100 per square millimeter, the largest 40-100 microns in diameter; perforation plates scalariform with 10 plus thin bars; intervessel pits orbicular to elliptical, minute(2-4 microns in diameter), the orifices frequently confluent. Parenchyma metatracheal-diffuse, paratracheal and terminal; (1) metatracheal-diffuse and (2) paratracheal parenchyma sparse, restricted to occasional cells; (3) terminal parenchyma forming uniseriate or occasionally biseriate continuous line. Fibers thin walled(3-5 microns); 7-18 microns in diameter, 1.132 to 1.168 millimeter in length. Rays unstoried, 1-3 seriate, homogeneous, up to 30 cells in height along the grain. Pith flecks present.

MATERIAL--Syracuse 16/2851.

Plate VI

Betula japonica Sieb. et W.



Cross section 100X



Tangential section 100X

VII. Mengtsz-chee-mu (蒙自榿木)

Alnus nepalensis D. Don.

Plate VII

Tree 10-12 meters tall, distributed in Yunnan, Kweichow and Szechuan(2). Wood used for veneer, matches, lower grade furniture, boxes and handles(4)

GENERAL CHARACTERISTICS OF THE WOOD--Demarcation between sapwood and heartwood indistinct(4); wood flesh colored, no distinct odor and taste, moderately light, soft, straight grained, medium to fine, even textured, easy to work and season, susceptible to decay, weight of air-dried wood 30 pounds per cubic foot(4).

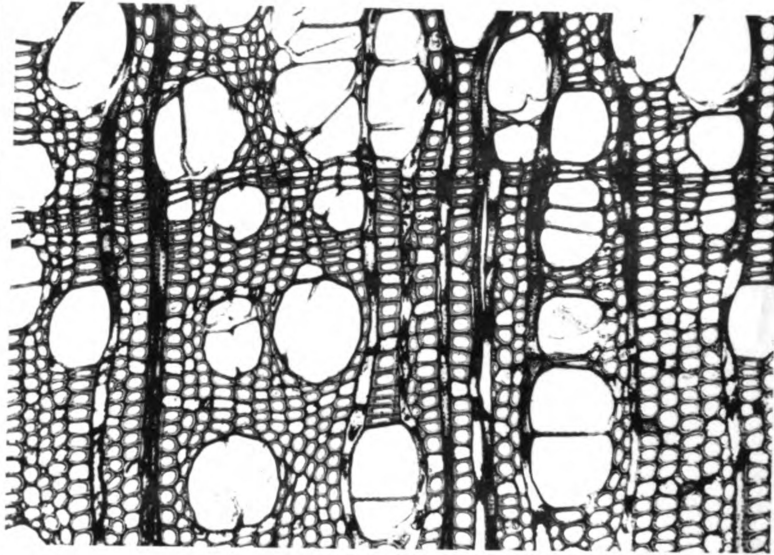
GROSS FEATURES--Growth rings distinct, defined by denser fibrous tissue in the outer margin of the ring. Wood diffuse porous; pores medium in size, numerous, solitary and 2-several in compressed radial groups. Parenchyma indistinct. Rays of two types, broad and very fine, broad rays distinct to the naked eye, separated by several-many narrow rays, appearing on the tangential surface as rather widely spaced staggered lines of varying length, forming flecks on the radial surface; narrow rays numerous and indistinct without a hand lens.

MINUTE FEATURES--Vessels in summerwood 33-67 per square millimeter, the largest 93-124 microns in diameter; perforation plates scalariform with many thin bars(20 to 30); intervessel pits round, 5-8 microns in diameter. Parenchyma terminal, metatracheal and metatracheal-diffuse; (1) terminal parenchyma rather abundant, solitary or in short uniseriate lines of 2-3; (2) metatracheal-diffuse parenchyma sparse; (3) metatracheal parenchyma in short zonate lines of 2-5. Fibers thin walled(.2-4 microns), 18-35 microns in diameter, 1.244 to 1.284 millimeter in length.

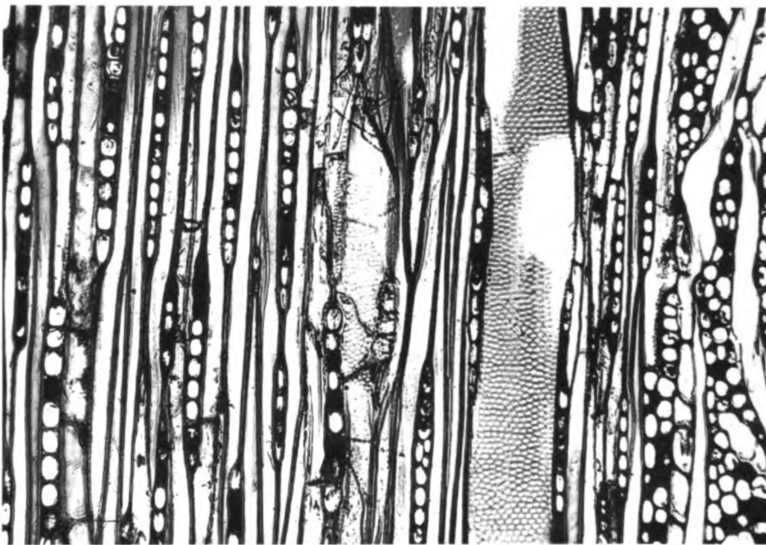
Rays unstoried, heterogeneous, upright cells marginal; (a) narrow rays uniseriate or rarely in part biseriate; (b) aggregate rays consisting of units similar to the narrow rays and of included fibers and vessels.

Plate VII

Alnus nepalensis D.Don.



Cross section 100X



Tangential section 100X

VIII. See-shih-li (细丝槐)

Carpinus laxiflora var. macrostachya Oliv.

Plate VIII

Small tree up to 17 meters tall; distributed in Szechuan, Hupeh, Kiangsu and Kwangtung(2). Wood suitable for uses where mechanical strength is required, such as athletic equipments and machine parts(4).

GENERAL CHARACTERISTICS OF THE WOOD--Demarcation between heartwood and sapwood indistinct(5); wood light brown to light greyish brown, dull, odorless and tasteless, hard and heavy; straight to cross grained, fine textured, difficult to work, easy to split along the broad rays during seasoning, air-dried wood weight 40-50 pounds per cubic foot(4).

WOOD FEATURES--Growth rings distinct under a hand lens, defined by denser fibrous tissue in the outer margin of the growth ring, narrow; wood semi-ring porous to diffuse porous; pores few in number, small, the largest distinct with a hand lens, decreasing gradually in size through the summerwood, solitary and in short radial groups of 2-3. Parenchyma abundant, arranged in fine tangential lines throughout the growth ring. Rays of variable width, broad(up to 1 mm. in width) to very fine; broad rays distinct to the naked eye, separated by several to many intergrading and narrow rays, appearing the tangential surface as rather widely spaced staggered lines of varying length, the longest extending about 1 inch along the grain, forming fleck on the radial surface; narrow rays much more numerous than the broad rays, indistinct without lens.

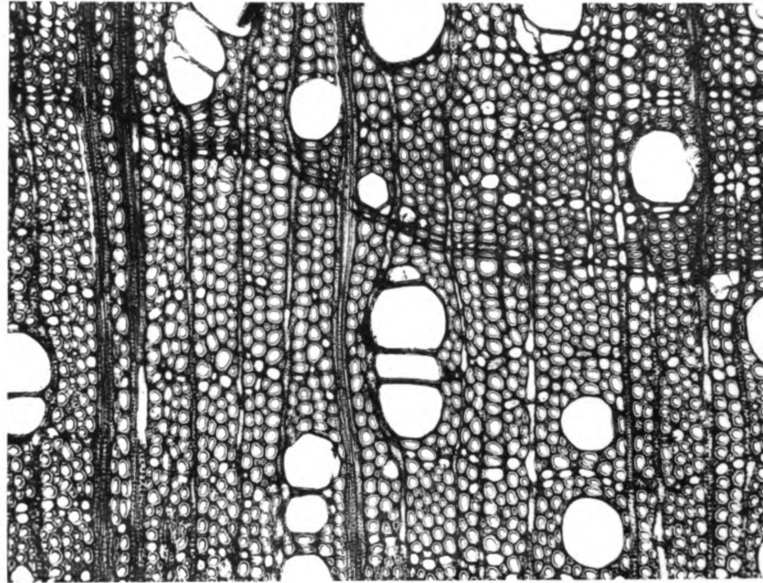
MINUTE FEATURES--Vessels in the summerwood 40-60 per square millimeter, the largest up to 100 microns; perforation plates simple; spiral thickenings present in smaller vessels, intervessel pits broad oval to round, alternate, 7-10 microns in diameter.

Parenchyma abundant, terminal, metatracheal and metatracheal-diffuse; terminal and metatracheal-diffuse parenchyma sparse, restricted to occasional cells; metatracheal parenchyma forming more or less continuous, uniseriate or occasionally biseriate tangential lines. Fibers thin to medium thick walled (3-5 microns), 15-22 microns in diameter, 1.214 to 1.256 millimeter in length; interfiber pits rather conspicuous. Ray of two kinds: (a) narrow rays 1-several seriate, homogeneous or heterogeneous; (b) aggregate rays consisting of units similar to the narrow rays and of included fibers and vessels.

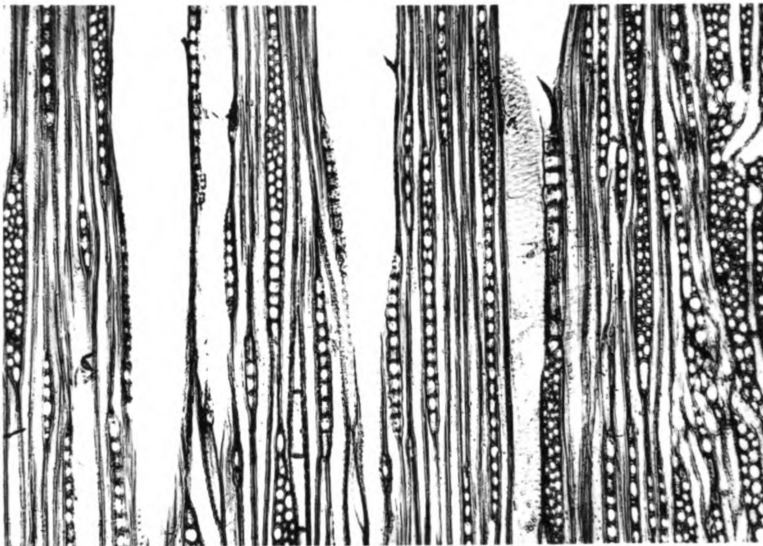
MATERIAL--Syracuse 300/10617, 374/13501, 443/10431.

Plate VIII

Carpinus laxiflora var. macrostachya Oliv.



Cross section 100X



Tangential section 100X

IX. Dah-shih-li (大絲栗)

Castanopsis fargesii Franch

Plate IX

Evergreen tree up to 15 -27 meters tall, 1-3 meters in diameter; distributed in Hupeh, Szechuan, Yunnan, and southern Anhwei(2).

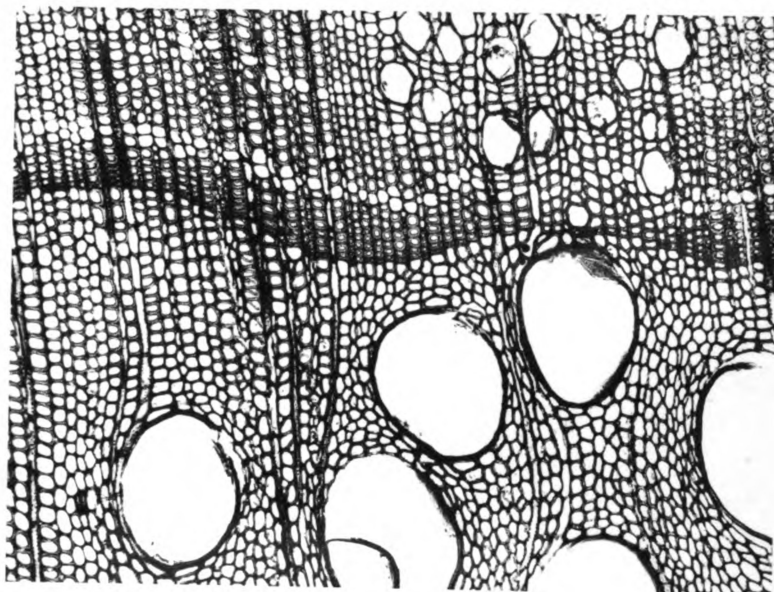
GENERAL CHARACTERISTICS OF THE WOOD--Sapwood greyish brown(4), heart-wood light brown, with brown stripes; wood lustrous, without odor and taste, medium textured and straight grained, moderately heavy, fairly hard.

GROSS FEATURES--Growth rings distinct, wavy, delineated by denser fibrous tissue in the outer margin of the ring. Wood semi-ring porous; pores in obliquely radial(flame-shaped) patches of light tissue; transition from springwood to summerwood gradually; springwood pores large, visible to the naked eye; summerwood pores small, indistinct with a hand lens. Parenchyma distinct, arranged in continuous tangential lines, evenly distributed throughout the growth ring. Rays very fine, visible with a hand lens, forming close, fine ray flecks on radial surface.

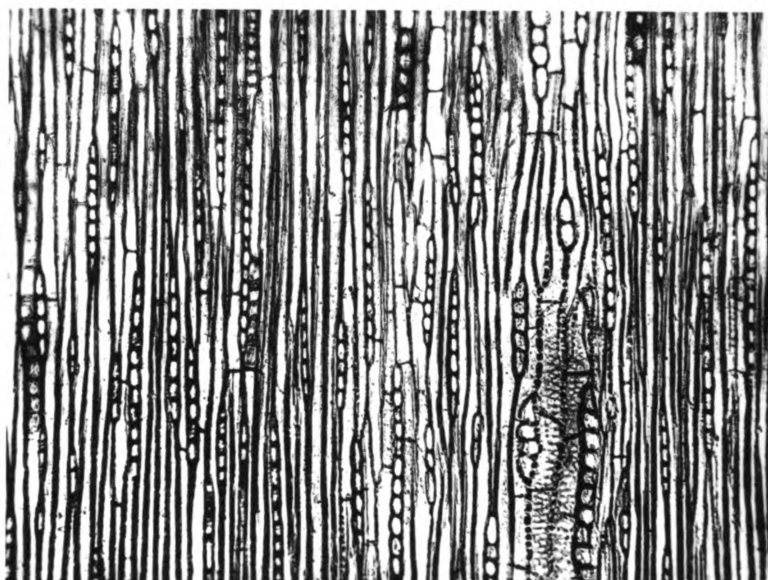
MINUTE FEATURES--vessels in summerwood 30-50 per square millimeter, the largest up to 194 microns in diameter; perforation plates simple; intervessel pits round, 6-7 microns in diameter, opposite; thick walled tyloses present. Vasicentric tracheids present, confined to the vicinity of the springwood vessels. Parenchyma paratracheal and metatracheal, (1) paratracheal parenchyma sparse, restricted to occasional cells(never forming a sheath); (2) metatracheal parenchyma abundant, forming more or less continuous 1-3 seriate conspicuous lines, especially in the summerwood. Fibers thin to medium thick walled(2-6 microns), 14-18 microns in diameter, 1.021 to 1.039 millimeter in length. Rays unstoried, uniseriate, up to 18 cells in height, heterogeneous.

Plate IX

Castanopsis fargesii Franch.



Cross section 100X



Tangential section 100X

X. Shih-li (熊秉)

Castanopsis platyacantha R. et W.

Plate X

Evergreen tree up to 22 meters tall, 1-2.5 meters in diameter; distributed in Szechuan, Yunnan, Kweichow and Hunan(2).

GENERAL CHARACTERISTICS OF THE WOOD--sapwood straw brown, narrow(1); heartwood light straw brown; wood without odor and taste, moderately light, fairly soft, medium textured and straight grained.

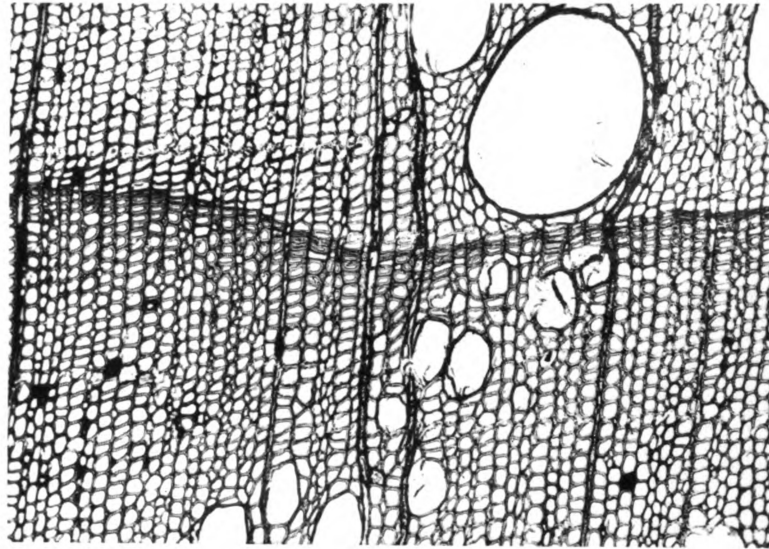
GROSS FEATURES--Growth rings distinct, delineated by denser fibrous tissue, and large springwood pores. Wood ring porous; springwood pores large, barely visible to the naked eye, arranged in 1-3 seriate interrupted rows; summerwood pores small, indistinct without a hand lens, arranged in obliquely radial(flame-shaped) groups; tyloses present. Parenchyma indistinct. Rays very fine, barely visible with a hand lens, forming close fine ray flecks on the radial surface.

MINUTE FEATURES--Vessels in the summerwood 36-62 per square millimeter, the largest in the springwood 120 to 232 microns in diameter; perforation plates simple or those in the summerwood vessels scalariform, with 3-6 thick bars(3-6 microns in diameter); thin walled tyloses present. Parenchyma abundant, metatracheal-diffuse. Fibers thin to medium thick walled(2-6 microns), 14-25 microns in diameter, .934 to .966 millimeter in length; septate fibers common. Rays unstoried, simple, heterogeneous, uniseriate, up to 20 cells in height.

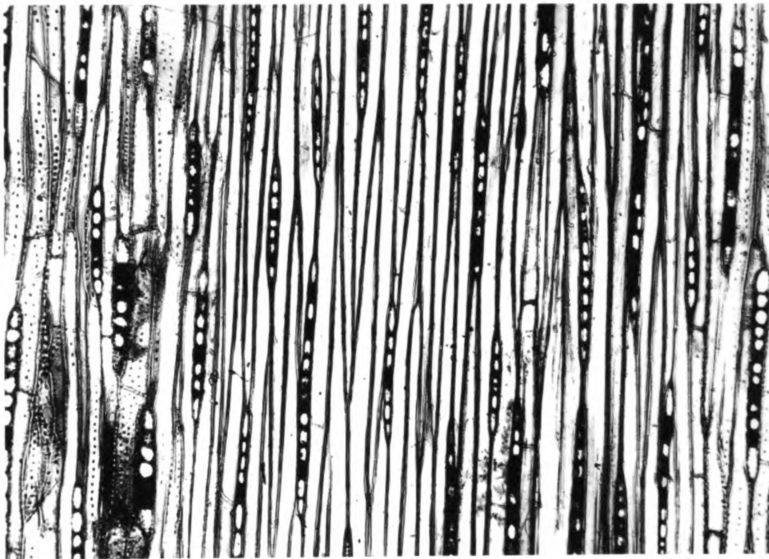
MATERIAL--C.U.No. 8, Syracuse 375/13405.

Plate X

Castanopsis platyacantha R. et W.



Cross section 100X



Tangential section 100X

XI. Ma-li (麻櫟)

Quercus acutissima Endl.

Plate XI.

Tree up to 25 meters tall and up to 70 centimeter in diameter; widely distributed in Central, Northern and Southern China below 1000 meter elevation(2). Wood used for charcoal, dry distillation, agricultural implements, vehicle construction, railway ties, boats, and building construction(2),(3).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood light brown; heartwood light brown with pinkish tinge; wood odorless and tasteless, heavy and moderately hard, straight grained and medium textured.

GROSS FEATURES--Growth rings distinct; wood ring porous; springwood pores large, visible to the naked eye, arranged in one row; summerwood pores decreasing in size from inner portion to the outer margin of the ring; summerwood pores distinct with a hand lens, concentrated in irregularly radial light patches throughout the ring(flame shaped); tyloses sparse. Parenchyma abundant, arranged in regular, fine, continuous tangential lines, evenly distributed throughout the growth ring. Rays of two types, broad(oak type)and very fine. The broad rays distinct to the naked eye, separated by many fine rays, forming a handsome high fleck on the radial section; the fine rays just visible with a hand lens, numerous.

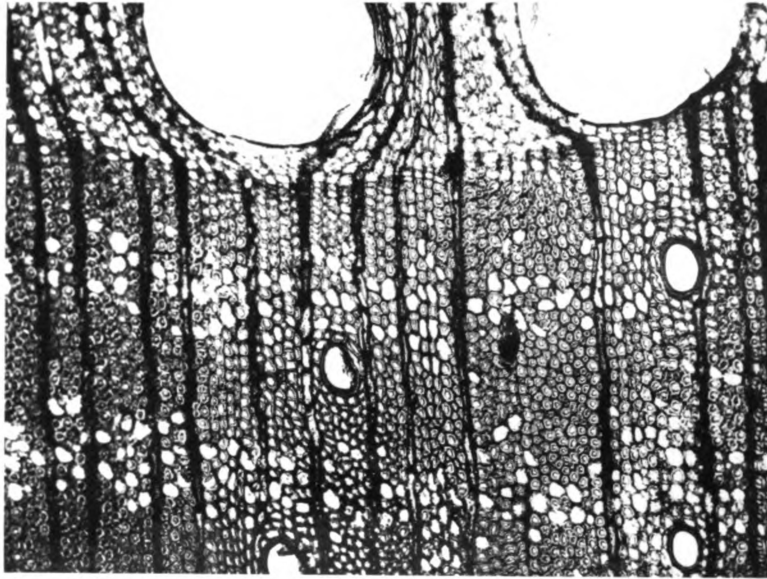
MINUTE FEATURES--Springwood vessels up to 295 microns in diameter; summerwood vessels aligned in radial flame-shaped tracts, 6-15 per square millimeter. Intervessel pits round to orbicular, 4-8 microns in diameter, alternate. Perforation plates simple. Vasicentric tracheids present, intermingled with parenchyma, (1) forming most of conjunctive tissue

between the springwood vessels and the rays; (2) composing some of the light tissue surrounding summerwood pores. Parenchyma very abundant, paratracheal, metatracheal-diffuse and usually metatracheal; (1) paratracheal parenchyma intermingled with tracheids and distributed as described above; (2) metatracheal-diffuse parenchyma restricted to the fibrous tracts and in the summerwood of the annual rings exhibiting evenly distributed concentric lines of (3) metatracheal parenchyma; crystals often present in parenchymatous cells. Fibers rather thick walled (4-8 microns), 10-18 microns in diameter, 1.175 to 1.225 millimeter in length. Rays unstoried, homogeneous, (1) broad rays(oak type) 14-40 plus seriate and 250-620 plus microns wide through the central portion, many cells (into hundreds) in height along the grain; (2) narrow rays very numerous, usually uniseriate, up to 25 cells in height along the grain.

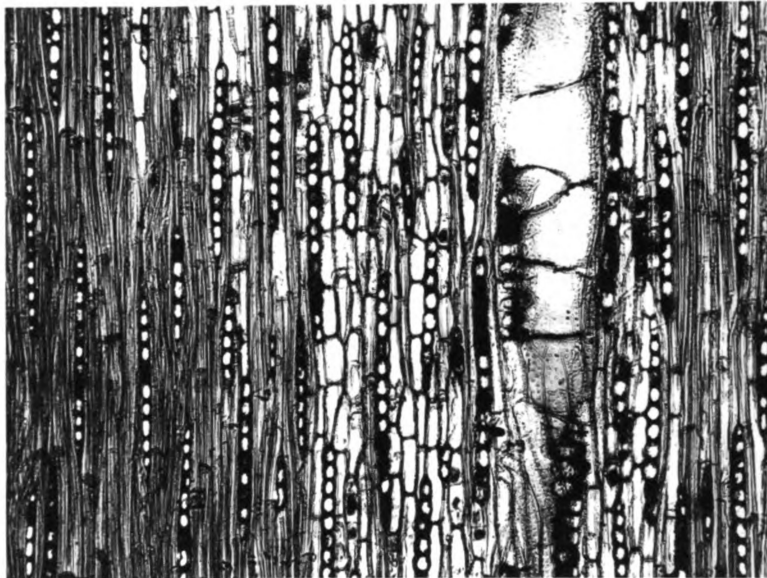
MATERIALS--CU.No. 2, Syracuse 300/10626, and Syracuse 442/10416.

Plate XI

Quercus acutissima Endl.



Cross section 100X



Tangential section 100X

XII. Ho-li (榲桲)

Quercus aliena var. grosserata R. et W.

Plate XII

Tree distributed in Central China(2). wood used for fuel, charcoal, furniture, and construction(4).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood narrow, light buff colored, heartwood light chestnut colored; odor and taste indistinct; wood moderately heavy and moderately hard, straight grained and medium textured.

GROSS FEATURES--Groth rings distinct, narrow(30 rings per inch). Wood ring poreus; springwood pores large, distinct to the naked eye, plugged with tyloses, arranged in one row; summerwood pores numerous and small, not distinct with a hand lens, arranged in obliquely radial (flame shaped) patches of light tissue. Parenchyma abundant, paratracheal and metatracheal. Rays of two types, broad(oak type) and narrow(simple); broad rays distinct to the naked eye, separated by several-many narrow rays, appearing on the tangential surface as rather widely spaced, staggered lines of varying length which frequently extend $\frac{1}{4}$ inch or more along the grain, forming flecks on the radial surface; narrow rays much more numerous than the broad rays, indistinct without a lens.

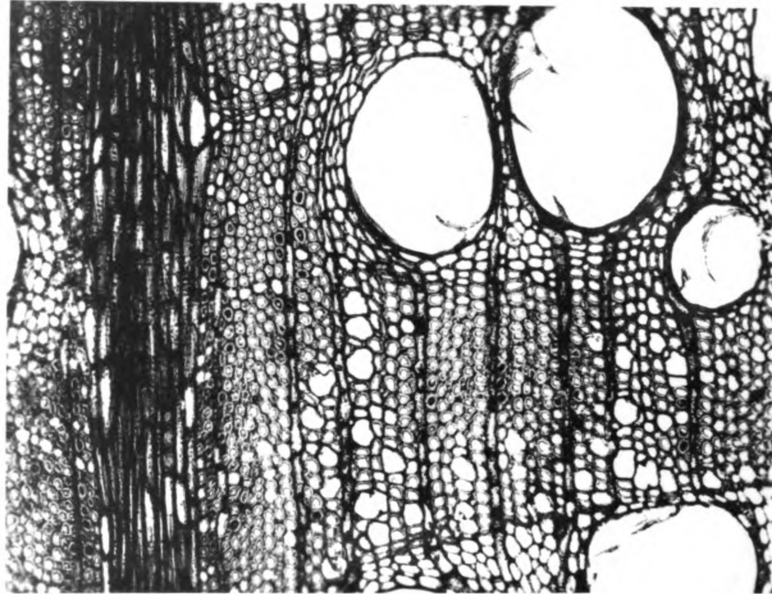
MINUTE FEATURES--Vessels in the summerwood 39-56 per square millimeter; the largest in the springwood 77-279 microns in diameter; perforation plates simple; pits leading to contiguous tracheary cells oval to long-elliptical, 4-8 microns in diameter, opposite; tyloses thick walled. Vasicentric tracheids present, confined to the vicinity of the springwood vessels. Parenchyma abundant, paratracheal, metatracheal, metatracheal-diffuse and terminal; (1) metatracheal parenchyma forming oblique uni-

seriate tangential lines in summerwood; (2) paratracheal parenchyma intermingled with vasicentric tracheids in the flame shaped tracts of the summerwood pores; (3) metatracheal-diffuse parenchyma and (4) terminal parenchyma sparse, restricted to occasional cells. Fibers medium thick walled (4-6 microns); 11-14 microns in diameter; 1.253 to 1.291 millimeter in length. Rays unstoried, homogeneous, (1) broad rays 8-20 plus seriate, 248-310 plus microns in width through the central portion; 20-30 hundreds cells in height along the grain; (2) narrow rays numerous, uniseriate, 1-22 cells in height along the grain.

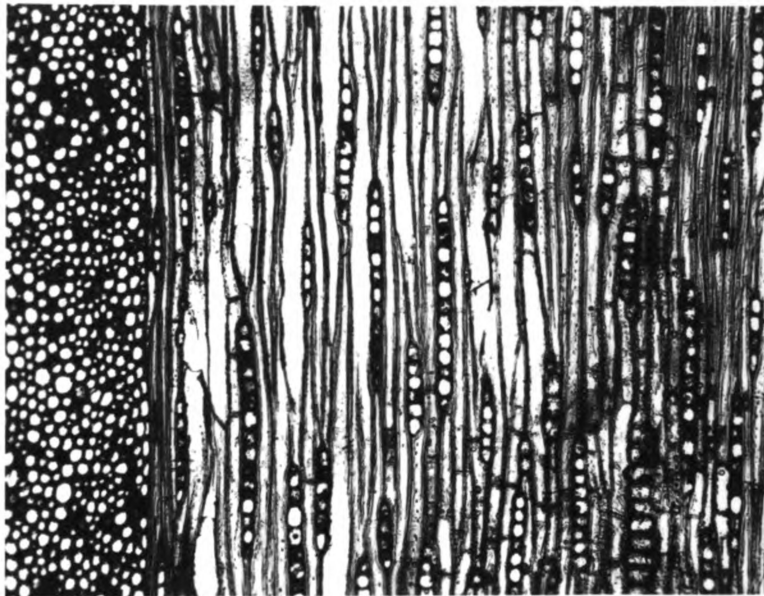
MATERIAL--Syracuse 297/10528.

Plate XII

Quercus aliena var. grosserata R. et W.



Cross section 100X



Tangential section 100X

XIII. Nan-mu (楠木)

Phoebe nanmu Gamble

Plate XIII

Evergreen large tree up to 25-30 meters tall, 3.5 meters in diameter; distributed in Yunan and Szechuan(2). Wood with good working properties, used for chests, high grade furniture and coffins(3)(4).

GENERAL CHARACTERISTICS OF THE WOOD--No sapwood shown in these samples, heartwood light brown to greyish brown; wood with mild bitter taste and mild aromatic odor, fine and even textured, straight grained, hard, moderately heavy; easy to work, difficult to season, weight of air-dried wood 35 pounds per cubic foot(4).

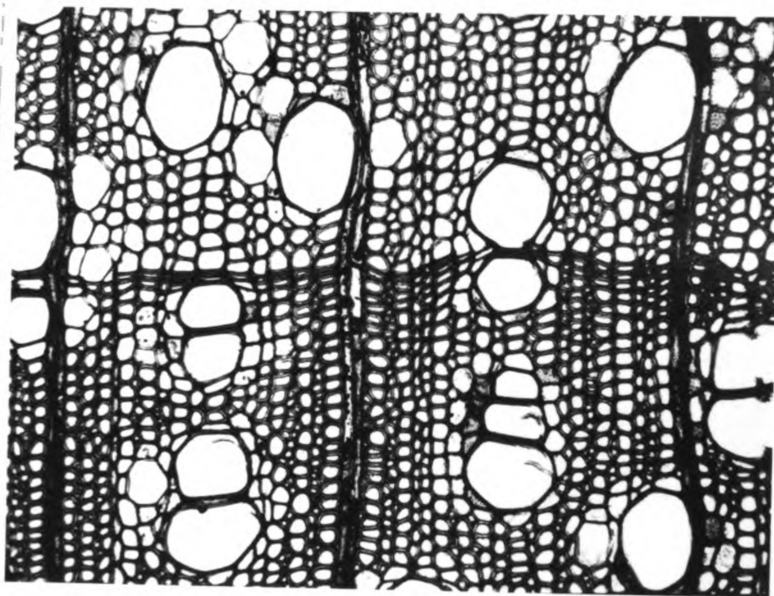
GROSS FEATURES--Growth rings fairly distinct, delineated by denser fibrous tissue in the outer portion of the ring. Wood diffuse porous, pores rather small, distinct with a hand lens, uniform in size, mostly solitary or in radial groups of 2-3. Parenchyma paratracheal. Rays fine and numerous, visible with a lens, forming beautiful flecks on radial surface; irregular ripple marks present on tangential surface.

MINUTE FEATURES--vessels 18-30 per square millimeter, up to 124 microns in diameter; perforation plates simple; intervessel pits round to elliptical, or angular through crowding, alternate, 6-7 microns in diameter, spiral thickenings present. Parenchyma paratracheal, forming 1-4 celled sheath around the vessels; parenchymatous oil cells present. Fibers thin walled(3-4 microns), 18-25 microns in diameter, .909 to .943 millimeter in length, septate. Rays unstoried, heterogeneous, upright cells marginal, 1-2 seriate(mostly biseriate), up to 24 cells in height along the grain, with occasional enlarged oil cells.

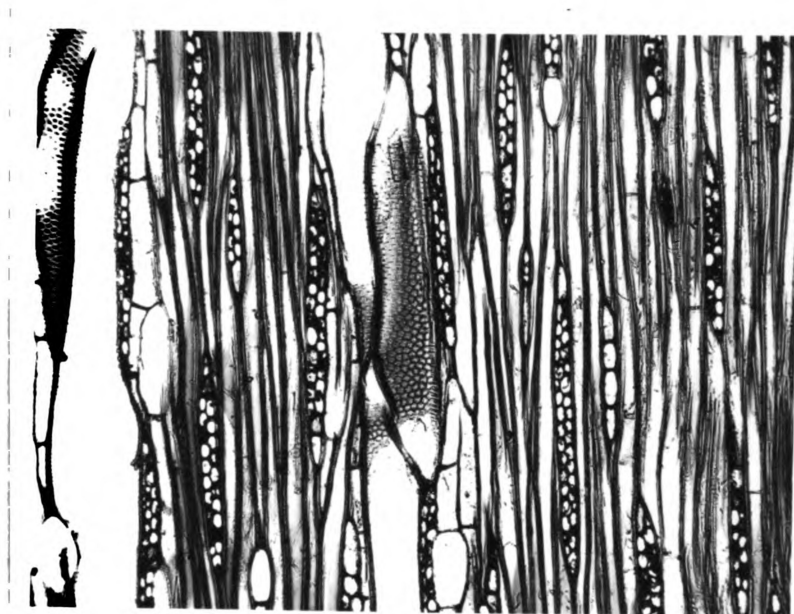
MATERIAL--C:U.No. 11, Syracuse 297/10/28.

Plate XIII

Phoebe nanmu Gamble



Cross section 100X



Tangential section 100X

XIV Shan-wei (山槐)

Albizzia kalkora Prain.

Plate XIV

Tree up to 10 meters tall and 60 cm. in diameter; grows rapidly, survives in arid area; distributed in Yellow, Youngtze, and Pearl River Regions. Wood durable and used for piles and under-water construction(2).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood light dull green(1), heartwood brown to golden brown, with purplish tinge; wood lustrous, odorless, with mild acrid taste, moderately heavy, hard, straight grained, medium textured.

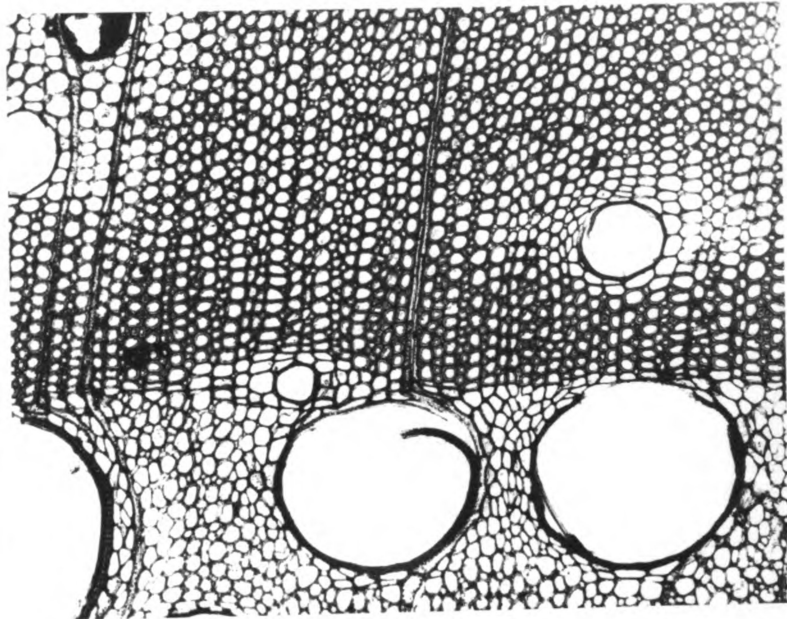
GROSS FEATURES--Growth rings distinct; wide; wood ring porous; springwood pores large, visible to the naked eye, arranged in 1-several rows, occasionally plugged with reddish black gum; summerwood pores small, indistinct without a lens, few in number; solitary or in groups of two. Parenchyma paratracheal(mostly aliform) and sometimes paratracheal-confluent. Rays fine, numerous, indistinct without a lens.

MINUTE FEATURES--Vessels in the summerwood 6-12 per square millimeter, in the springwood 110-250 microns in diameter; perforation plates simple; intervessels pits oval, or angular through crowding, alternate, 4-6 microns in diameter; pores rather thick walled(6-10 microns); red gum deposits present. Parenchyma terminal, paratracheal and paratracheal-confluent. (1) terminal parenchyma forming a 1-2 seriate continuous line; (2) paratracheal parenchyma forming 1-several celled aliformed sheath around the vessels; (3) paratracheal-confluent parenchyma forming several celled bands in the summerwood. Fusiform parenchyma present in vicinity of the springwood vessels. Fibers rather thin walled(2-4 microns), 11-18 microns in diameter, 1.059 to 1.097 millimeter in length. Rays unstoried, simple, homogeneous, 1-2 seriate, up to 30 cells in height.

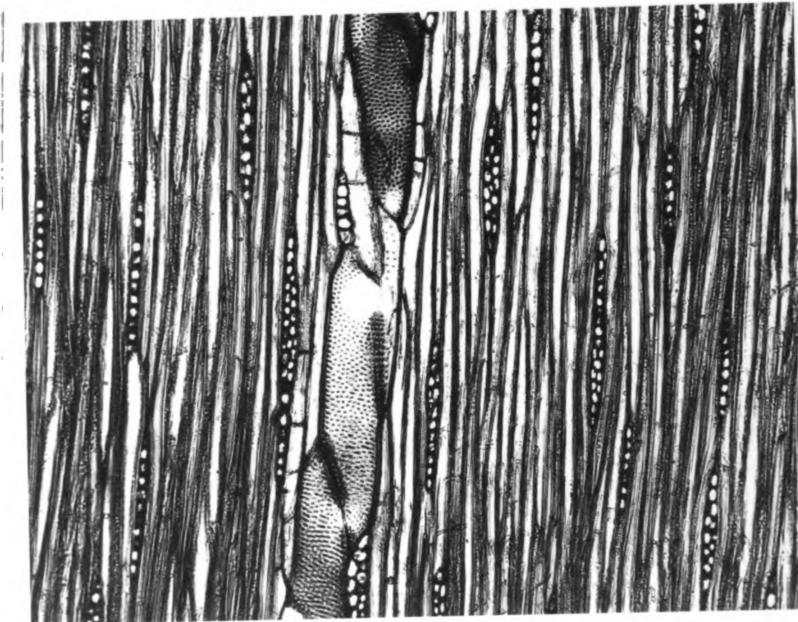
MATERIAL--C.U.No. 7, Syracuse 443/10459.

Plate XIV

Albizzia kalkora Prain.



Cross section 100X



Tangential section 100X

XV. Pat-chun (白椿)

Ailanthus altissima Swingle

Plate XV

Tree up to 30 meters tall, growing wild in the mountains of Chihli, elsewhere cultivated. It grows rapidly, is resistant to drought, and attains a large size. The wood is soft and light, suitable only for such uses as do not require strength and durability(6).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood narrow, yellowish-white; heartwood greyish yellow to light yellowish brown; wood odorless and tasteless, moderately soft and moderately light, straight grained, coarse textured; air seasons well, easy to work, susceptible to decay(4), takes a high polish(6); weight of air-dried wood 35 pounds per cubic foot(4).

GROSS FEATURES--Growth rings distinct, wide. Wood ring porous, springwood pores large, appearing as pin hole to the naked eye, arranged in several rows; summerwood pores small, appearing as white dots to the naked eye, solitary or in nest groups of 2-several; toward the outer limit of growth ring, often connected in interrupted tangential bands, which visible to the naked eye, Parenchyma paratracheal and paratracheal-confluent. Rays of two size, moderately broad and very fine, the former distinct to the naked eye, the latter indistinct without a hand lens.

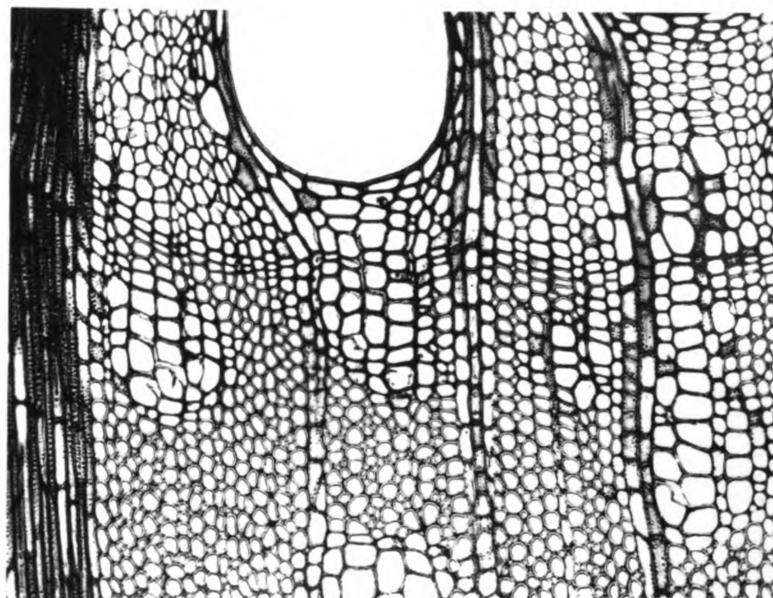
MINUTE FEATURES--Vessels in the summerwood 89-154 per square millimeter, the largest in springwood 140-340 microns in diameter; perforation plates simple; intervessel pits round or angular through crowding, 7-9 microns in diameter; spiral thickenings present. Parenchyma paratracheal, metatracheal-diffuse and terminal; (1) paratracheal parenchyma fusiform, abundant, occasionally forming a sheath; (2) metatracheal-diffuse sparse;

(3) terminal parenchyma rather common, but never forming a line. Fibers thin walled(2-4 microns), 14-22 microns in diameter, .903 to .957 millimeter in length; gelatinous fiber abundant in summerwood. Rays unstoried, heterogeneous; (a) broader rays 5-12 seriate, usually low, some up to 80 cells in height; (b) narrow rays 1-2 seriate, less than 15 cells in height; uniseriate rays consisting entirely of upright cells; biseriate rays consisting of procumbent cells through the central portion, with 1-several marginal upright cells.

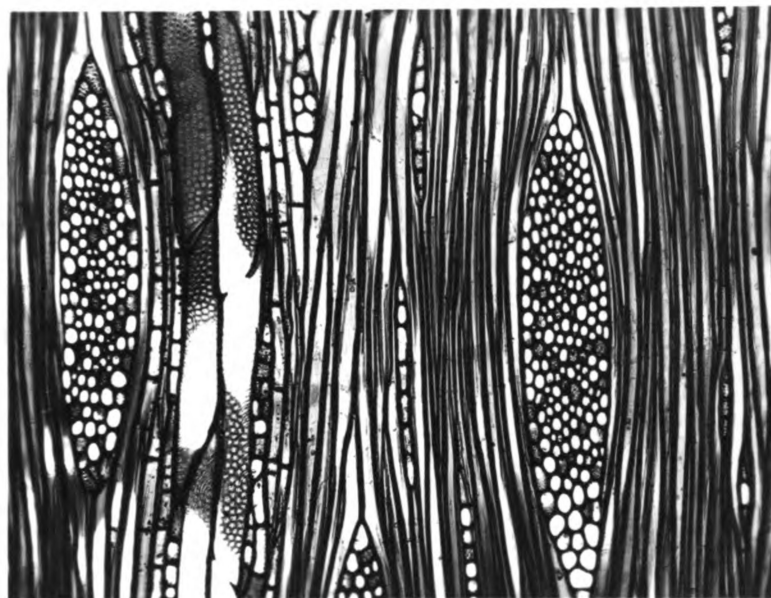
MATERIAL--Syracuse 39/807.

Plate XV

Ailanthus altissima Swingle



Cross section 100X



Tangential section 100X

XVI. Hong-chun (紅椿), Chinese Mahogany

Cedrela(Toona) sinensis Juss.

Plate XVI

Tree with straight trunk, the bigger trees more than 30 meters tall, distributed in Manchuria, Hopeh, Shantung, Kansu, Hunan, Hupeh, Szechuan, Yunnan, Kwangtung, and Kwansi(2). Wood used for high grade furniture as a substitute of mahogany, interior finishing and cigar-boxes(4).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood yellowish white to light brown with pinkish tinge, narrow; heartwood golden reddish brown to reddish brown with purplish tinge, with darker colored stripes, satiny lustre; wood without distinct odor and taste, moderately heavy, moderately hard, straight grained, medium to coarse textured, resistant to decay, easy to work, moderately weak(4).

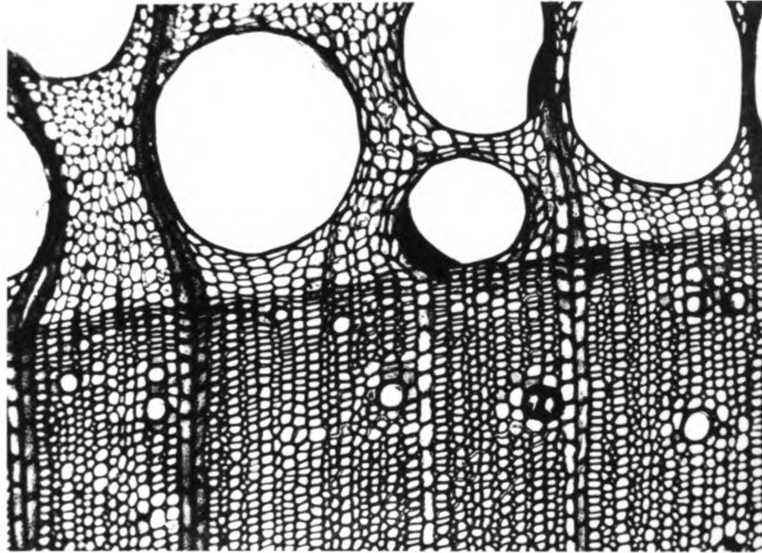
GROSS FEATURES--Growth rings distinct, wide, about 10 rings per inch. Wood ring porous; springwood pores large, barely visible to the naked eye, in several rows, red gum deposits present; summerwood pores small, indistinct without a hand lens, solitary or in groups of 2-3, few in number. Parenchyma paratracheal. Rays fine, numerous, visible to naked eye.

MINUTE FEATURES--Vessels in the summerwood 16-32 per square millimeter, the largest 108-250 microns in diameter; perforation plates simple; intervessel pits round to orbicular, alternate, 3-6 microns in diameter, inner orifices occasionally confluent; red gum deposits present. Parenchyma paratracheal forming a sheath around the vessels in the summerwood; terminal parenchyma restricted to occasional cells. Fibers thin walled (2-4 microns), 18-22 microns in diameter, .727 to .747 millimeter in length. Rays unstoried, simple, (a) uniseriate rays sparse, up to 10 cells in height, composed of upright cells; (b) 2-5 seriate rays abundant, up to 20 cells in height, heterogeneous.

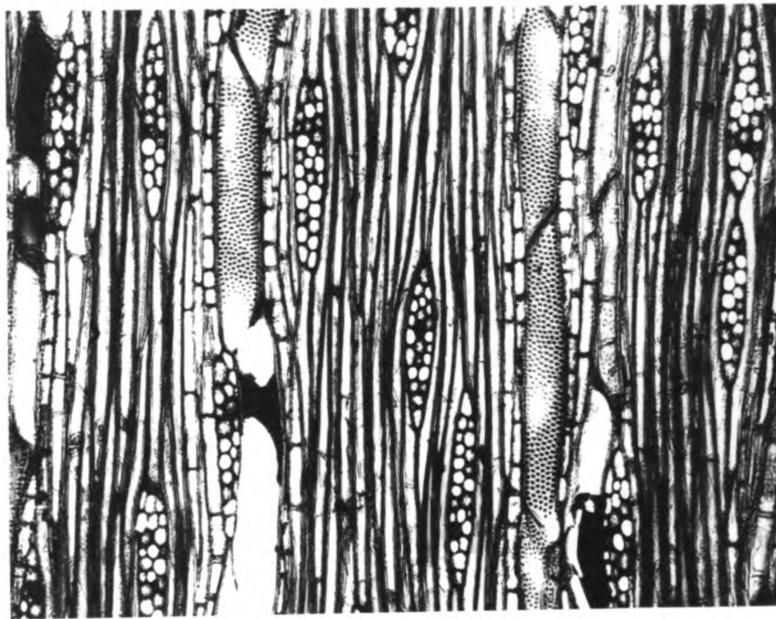
MATERIAL--Syracuse 282/804.

Plate XVI

Cedrela(Toona) sinensis Juss.



Cross section 100X



Tangential section 100X

XVII. Wu-chow (烏桕)

Sapium sebiferum Rox.

Plate XVII

Tree distributed widely from Shantung to Kwangtung and Yunnan(2).
Wood durable and used for agriculture implements(3).

GENERAL CHARACTERISTICS OF THE WOOD--Demarcation between sapwood and heartwood indistinct; wood light brown, turning greenish with age, occasionally with grey stripes, color varies in one sample; dull, odorless and tasteless; straight or cross grained, medium textured, moderately soft to soft, moderately light.

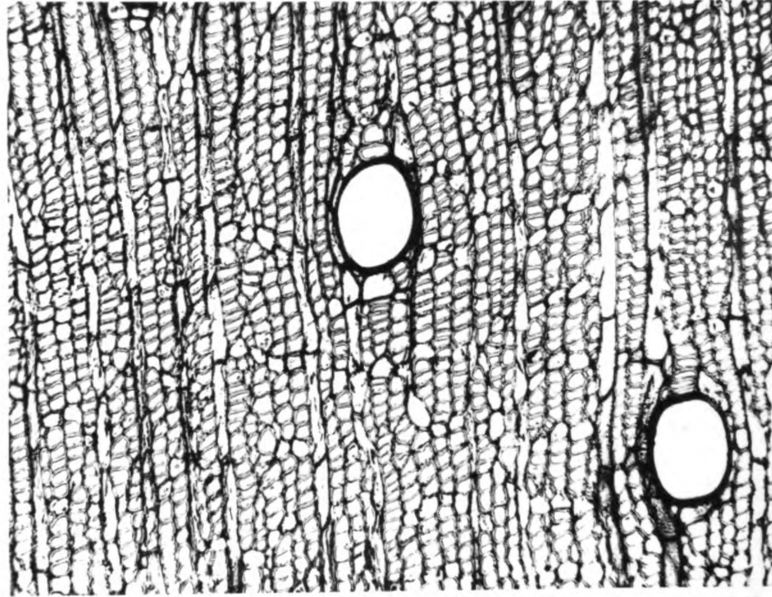
GROSS FEATURES--Growth rings defined by different pore size of late summerwood and those of springwood in succeeding ring, undulating. Wood semi-ring porous to diffuse porous; springwood pores fairly visible to the naked eye, summerwood pores indistinct without a lens; pores solitary or in radial chains(mostly 2-4), few in number. Parenchyma indistinct. Rays extremely fine, numerous, poorly visible with the lens.

MINUTE FEATURES--Vessels 4-8 per square millimeter, the largest up to 108 microns in diameter; perforation plates simple; intervessel pits orbicular, alternate, 6-8 microns in diameter. Parenchyma abundant, (1) paratracheal parenchyma present but never forming a sheath; (2) metatracheal parenchyma in short tangential lines of several cells (zonate). Fibers thin walled(3-4 microns), 13-18 microns in diameter, .831 to .869 millimeter in length. Rays numerous, uniseriate, heterogeneous, up to 30 cells in height along the grain.

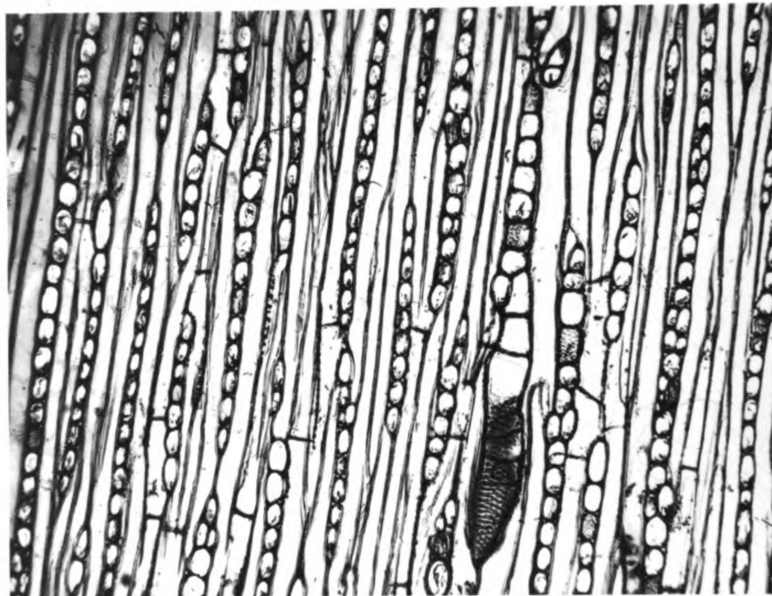
MATERIAL--C.U.No. 6, Syracuse 297/10736.

Plate XVII

Sapium sebiferum Rox.



Cross section 100X



Tangential section 100X

XVIII. Yee-chi (野漆)

Rhus succedanea Linn.

Plate XVIII

Tree up to 10 meters tall, about 1 meter in diameter; distributed in Kiangsi, Kiangsu, Hupeh, Szechuan, Yunnan and Kwangtung(2).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood light brown, heart-wood beautiful golden yellow, with satiny lustre; wood with a mild characteristic odor and bitter taste, medium textured and straight grained, moderately light, moderately hard.

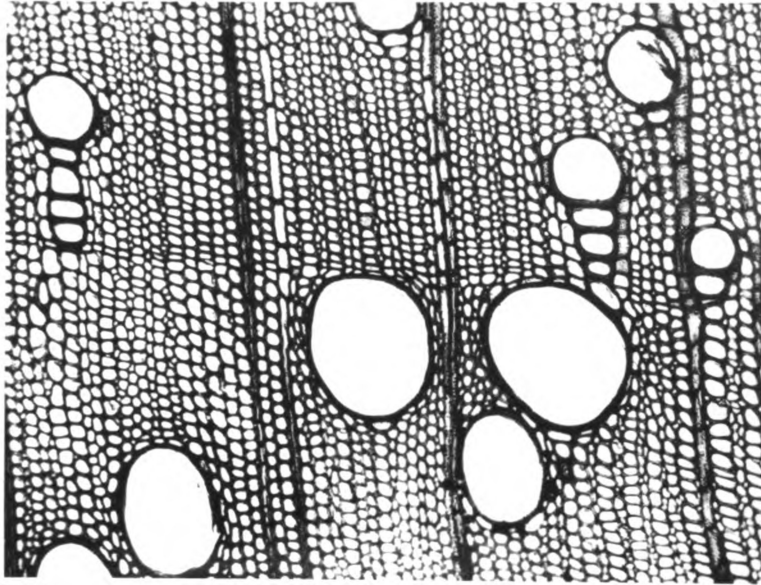
GROSS FEATURES--Growth rings distinct, defined by denser summerwood fibrous tissue and terminal parenchyma. Wood semi-ring porous; pores small, indistinct without a hand lens; few and evenly distributed, mostly solitary, occasionally in radial groups of 2-3; sporadic brown gum present. Parenchyma terminal and paratracheal. Rays fine, parallel on cross section, poorly visible to the naked eye; forming beautiful, close flecks on radial surface.

MINUTE FEATURES--Vessels 10-19 per square millimeter, the largest 77-155 microns in diameter; perforation plates simple; intervessel pits round, alternate, 5-7 microns in diameter, inner orifices often confluent; gummy deposits present. Parenchyma terminal, paratracheal and metatracheal-diffuse; (1) terminal and (2) metatracheal-diffuse sparse, restricted in occasional cells; (3) paratracheal parenchyma rather common, but never forming a sheath. Fibers thin walled(3-5 microns), 11-29 microns in diameter, .750 to .770 millimeter in length, septate fibers very common; gummy inclusion in occasional cells. Rays unstoried, simple, heterogeneous, 1-2 seriate, up to 25 cells in height; gummy inclusion present.

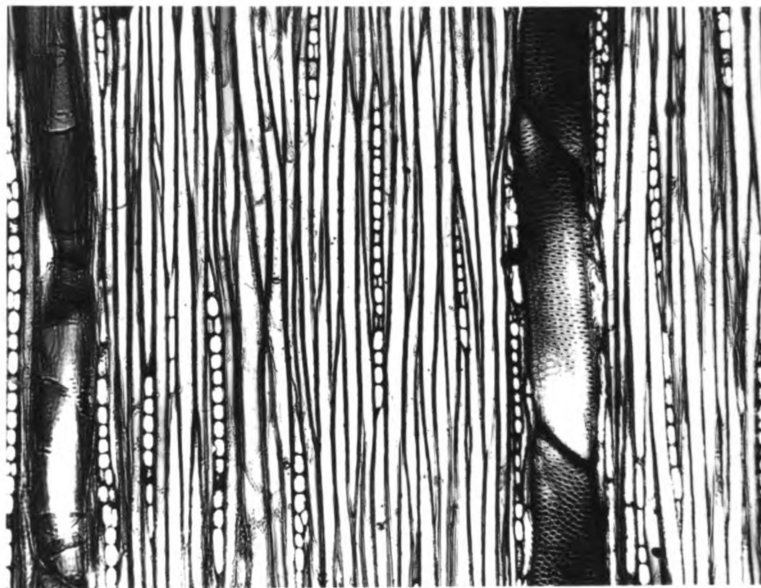
MATERIAL--C.U.No. 5, Syracuse 297/10755, 375/13377, 375/13363, and 443/10435.

Plate XVIII

Rhus succedanea L.



Cross section 100X



Tangential section 100X

XIX. Shui-seh-shu (水杉)

Acer pictum var. parviflorum Schneid.

Plate XIX

Tree distributed in Manchuria, Hupeh, Hunan, Kansu, Kiangsi, and Szechuan(2). Wood tough, used for building construction, fuel, char-coal, and furniture(3).

GENERAL CHARACTERISTICS OF THE WOOD--Heartwood light flesh colored, no sapwood evident in the available sample; wood odorless and tasteless, moderately hard to hard, moderately heavy, fine and even textured, straight grained.

GROSS FEATURES--Growth rings fine, distinct, delineated by darker colored denser fibrous tissue in the outer portion of the growth ring. Wood diffuse porous, pores small, indistinct without a hand lens, uniform in size and evenly distributed, mostly solitary. Parenchyma indistinct. Rays not very distinct to the naked eye, variable in width and closely arranged.

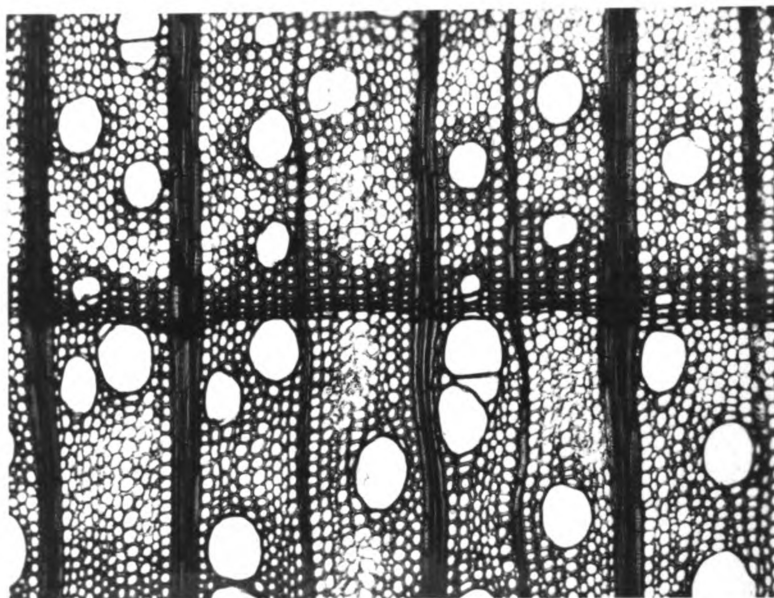
MINUTE FEATURES--Vessels 54-74 per square millimeter, the largest up to 80 microns in diameter; perforation plates simple; intervessel pits round to oval or angular through crowding, alternate, 6-8 microns in diameter; spiral thickenings present; gummy deposits not infrequent. Parenchyma very sparse, restricted to occasional cells, terminal or meta-tracheal-diffuse. Fibers thin to medium thick walled(3-6 microns), 14-18 microns in diameter, .657 to .681 millimeter in length; interfiber pits conspicuous. Rays unstoried, simple, homogeneous; (a) narrow rays uniseriate, up to 15 cells in height along the grain; (b) broad rays 2-5 seriate, up to 40 cells in height along the grain. Pith flecks present.

ATLANTIC--Syracuse 374/13496.

Plate XIX

Acer pictum var. parviflorum Schneid

Wood-destroying fungus present in the sample.



Cross section 100X



Tangential section 100X

XX. Sze-chu (杞柳)

Hovenia dulcis Thunb.

Plate XX

Tree up to 25 meters tall, widely distributed in China(2).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood light brown to flesh colored; heartwood light brown with pinkish tinge to pinkish brown; wood lustrous, odorless, with mild bitter taste, moderately hard and moderately heavy, straight to cross grained, medium and even textured.

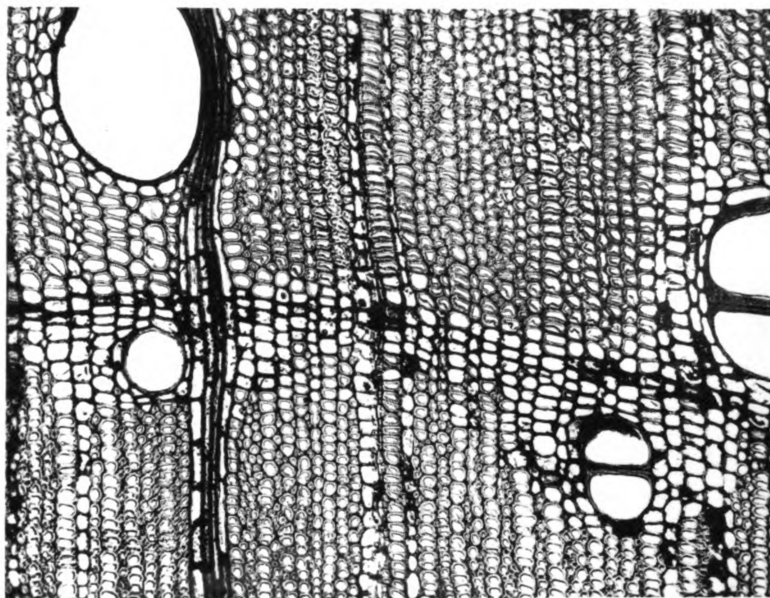
GROSS FEATURES--Growth rings distinct, wide; wood semi-ring porous, springwood pores medium in size, visible to the naked eye; summerwood pores small, appearing as white dots to the naked eye, solitary or in radial, obliquely or tangential groups of 2-several, tyloses sparse. Parenchyma paratracheal and terminal. Rays fine and numerous, distinct to the naked eye, forming beautiful ray flecks on radial surface.

MINUTE FEATURES--Vessels 5-16 per square millimeter, up to 650 microns in diameter; perforation plates simple; intervessel pits orbicular to elliptical, or angular through crowding, inner orifices occasionally confluent, 6-8 microns in diameter; gummy deposits present. Parenchyma terminal and paratracheal; (1) terminal parenchyma in irregular thick bands of 2-8 seriate (mostly 4-6 seriate); (2) paratracheal parenchyma forming a sheath (aliformed) around the vessels, the sheathes occasionally unite to short bands. Fibers medium to thick walled (4-8 microns), 11-25 microns in diameter, .960 to .988 millimeter in length; gelatinous fibers very abundant. Rays unstoried, simple, (a) uniseriate rays, up to 10 cells in height, most upright cells; (b) 2-5 seriate rays up to 30 cells in height, heterogeneous, upright cells marginal. Gummy inclusions present in parenchymatous cells.

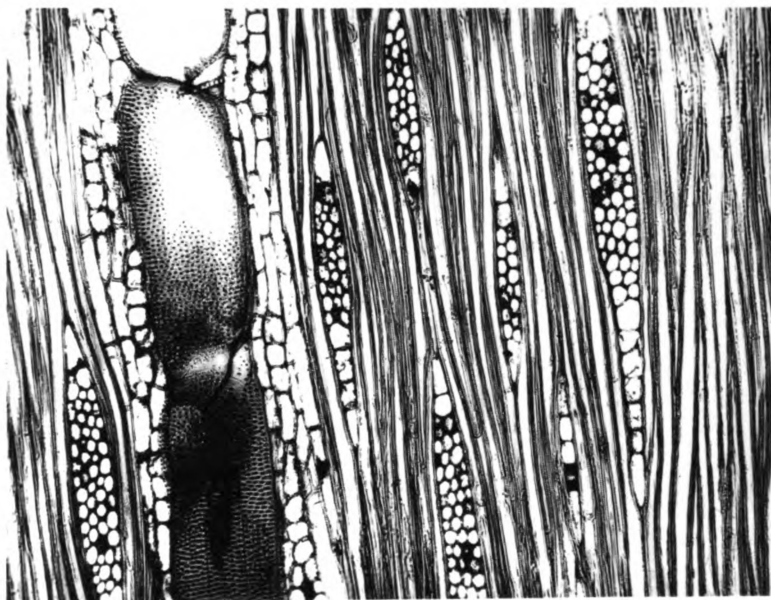
MATERIAL --C.U.No. 13.

Plate XX

Hovenia dulcis Thunb.



Cross section 100X



Tangential section 100X

XXI. Mu-ho (木柯)

Schima crenata Korth.

Plate XXI

Tree up to 20 meters tall; distributed in Chikiang, Kiangsi, Hunan, Kwangtung, Anwei and Szechuan(2). It is said that appreciable stands of this tree are found in the western portion of Szechuan(4). Wood strong and used for construction, agriculture implements, millwork and spindles(2)(4)(1).

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood whitish yellow, heartwood light pinkish brown, with a mild fragrant, tasteless, moderately heavy, moderately hard, fine and even textured, straight grained.

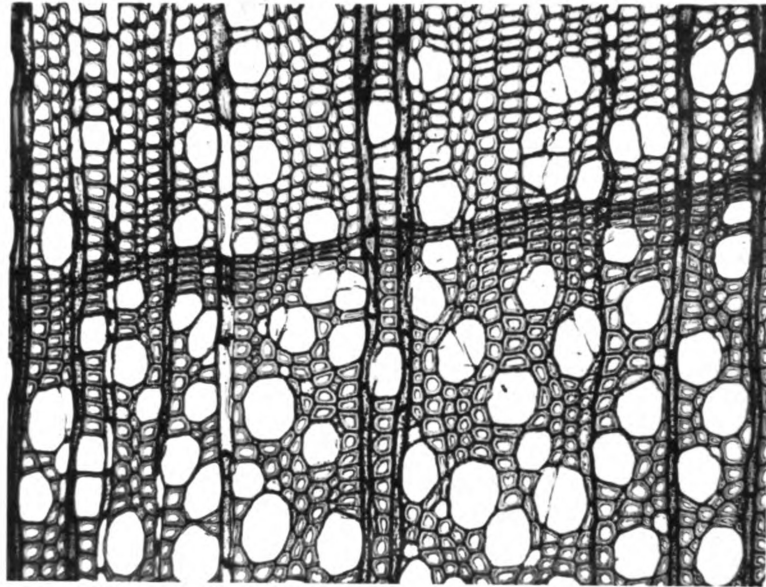
GROSS FEATURES--Growth rings rather indistinct, or poorly distinct, defined by denser fibrous tissue. Wood diffuse porous, pores small, appearing as white dots with a hand lens, mostly solitary, numerous and evenly distributed. Parenchyma indistinct. Rays fine, numerous, visible with a hand lens.

MINUTE FEATURES--Vessels 88-150 square millimeter, the largest 38-78 microns in diameter; perforation plates scalariform, with 10 plus thin bars; intervessel pits scalariform, 10-32 microns in diameter, or orbicular, 6-9 microns in diameter. Parenchyma very sparse, paratracheal and metatracheal-diffuse, restricted to occasional cells. Fibers thick walled(8-12 microns), 11-23 microns in diameter, 1.399 to 1.453 millimeter in length; interfiber pits rather conspicuous. Rays simple, unstoried, heterogeneous, uniseriate, occasionally biseriate in middle portion of the ray, up to 30 cells in height along the grain.

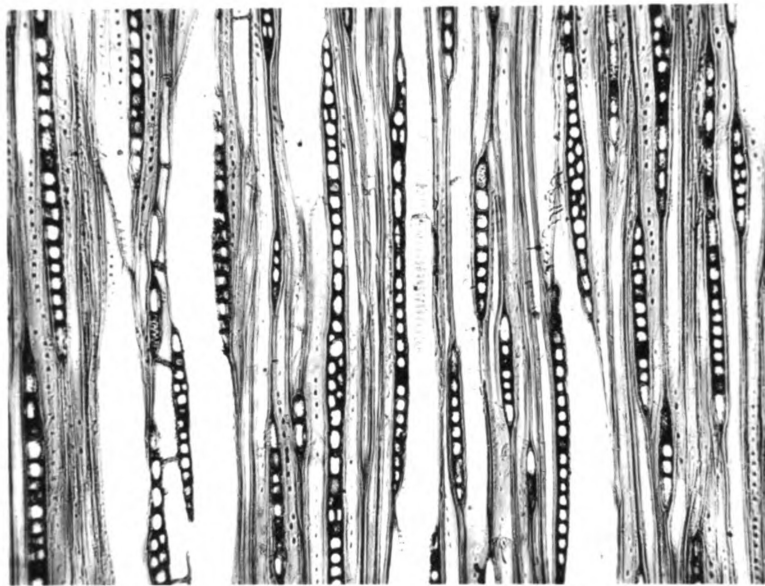
MATERIAL--C.U.No. 12, Syracuse 297/10733.

Plate XXI

Schima crenata Korth.



Cross section 100X



Tangential section 100X

XXII. Shaw-ding-mu (小丁木)

Acanthopanax evodiaefolius Fr.

Plate XXII

Small tree up to 16 meters tall; distributed in Eastern, Central and Southern China(7). Wood used in plywood manufacturing.

GENERAL CHARACTERISTICS OF THE WOOD--Sapwood creamy white, heartwood yellowish white to light brown; wood odorless and tasteless, moderately soft and light; straight grained and medium textured, sp.gr. 0.485(7).

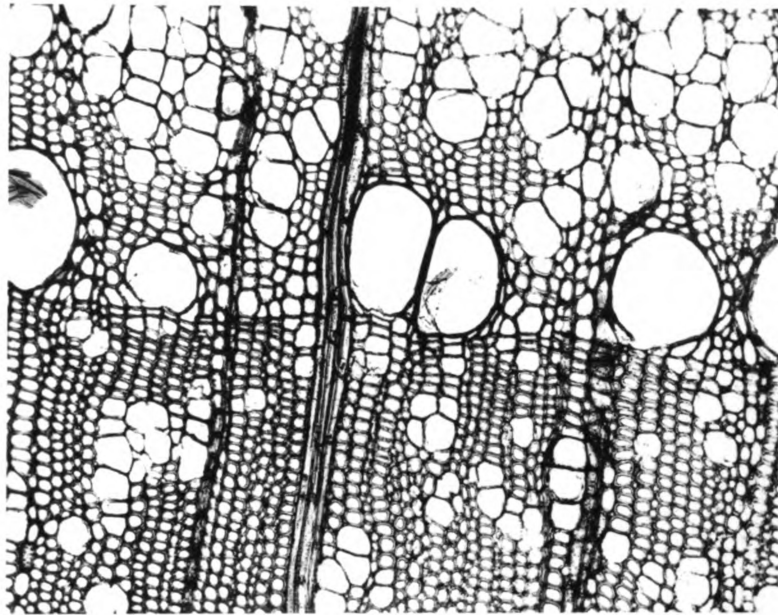
GROSS FEATURES--Growth rings distinct, narrow. Wood ring porous; springwood pores medium in size, indistinct without lens, arranged in one row; summerwood pores very small, not distinct under a lens. Parenchyma terminal. Rays fine and numerous, variable in width, distinct to the naked eye.

MINUTE FEATURES--Vessels in the summerwood 106-130 per square millimeter, the largest 62-155 microns in diameter; perforation plates simple; intervessel pits round, or angular through crowding, opposite, 8-11 microns in diameter; thin walled tyloses present. Parenchyma terminal, metatracheal-diffuse and paratracheal; (1) terminal parenchyma forming a more or less continuous line; (2) metatracheal-diffuse sparse; (3) paratracheal parenchyma restricted in springwood. Fibers thin walled (2-3 microns), 14-25 microns in diameter, .799 to .827 millimeter in length. Rays simple, unstoried, heterogeneous, 1-5 seriate, up to 25 cells in height along the grain.

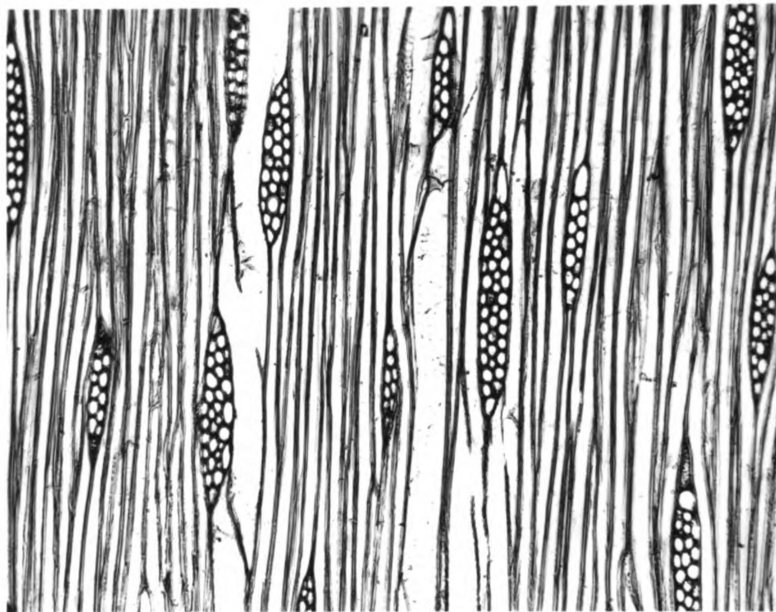
MATERIAL--Syracuse 300/10615, 375/13453.

Plate XXII

Acanthopanax evodiaefolius Fr.



Cross section 100X



Tangential section 100X

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