

# Scientific Limits of Microscopic Wood Analysis of Objects d'Art

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Microscopic wood identification and analysis from objects d'art have limitations not always apparent to conservators, curators, art historians and collectors. These limitations are based on the evolutionary conservative nature of wood with respect to species determination. Species of wood (trees and plants in general) have been determined in the past from external features, such as reproductive structures (flowers, fruits, cones), foliar structures (leaves or needles) or other parts of the plant like bark or branch morphology. These characters are rarely present in objects made of wood. Current, molecular techniques of DNA analysis are moot because of the paucity or lack of DNA in wood. It is important that those involved in the historic objects made of wood be cognizant of the limitations of analysis and identification of wood.

Commercial woody genera and the more rare taxa from Hinckley (1960) are presented, including number of species for each genus with general distributions and ability to separate species or species groups microscopically. Selected common names or trade names are for a single species in the respective genus. Because of space limitations, only the one or two most "common" common names are listed, as each species can have numerous common names. For example, there are at least 135 common names for "rosewood", 446 common names for "mahogany" and 475 common names for "cedar". The total number of recognized common names for wood is just fewer than 170,000.

**Table 1: Taxa listed by common name.**

Common Name	Genus	# of species	Distribution	Limits of Microscopic Identification
Acacia	<i>Acacia</i>	1200	Tropics	All species look alike
Alder	<i>Alnus</i>	35	North temperate regions south to southeast Asia and the Andes	All species look alike
Amaranth	<i>Peltogyne</i>	23	Tropical America	All species look alike
Amyris	<i>Amyris</i>	30	Tropical America	All species look alike
Ash	<i>Fraxinus</i>	65	North temperate regions to the tropics	All species look alike
Aspen, Poplar & Cottonwood	<i>Populus</i>	35	North temperate regions	All species look alike
Australian Beefwood & Botany Bay Oak	<i>Casuarina</i>	70	Old World tropics	All species look alike
Avodire	<i>Turraenthus</i>	2	Tropical west Africa	All species look alike
Bald Cypress	<i>Taxodium</i>	2	Eastern North America (1) and Mexican	All species look alike

			highlands (1)	
Barberry	<i>Berberis</i>	450	Eurasia, north and tropical Africa, Americas	All species look alike
Basswood	<i>Tilia</i>	45	North temperate regions	All species look alike
Beech	<i>Fagus</i>	10	North temperate regions	All species look alike
Birch	<i>Betula</i>	~60	Northern hemisphere	All species look alike
Black Gum	<i>Nyssa</i>	5	North America, China and Indomalesia	All species look alike
Boxwood	<i>Buxus</i>	30	Western Europe, Mediterranean	All species look alike
Bulletwood	Mimusops	57	Tropical Africa, Malaysia to Pacific	All species look alike
Camphorwood	<i>Cinnamomum</i>	250	East and southeast Asia to Australia	All species look alike
Canalete	<i>Cordia</i>	250	Tropics	All species look alike
Cape Beech	<i>Rapanea</i>	150	Tropics	All species look alike
Cedar	<i>Chamaecyparis</i>	7	North America and eastern Asia	All three North American species are anatomically distinct. (Ref. #6)
Cedar	<i>Thuja</i>	5	Eastern North America and eastern Asia	The two North American species can sometimes be separated. (Ref. #6)
Cherry, Plum, Almond	<i>Prunus</i>	400	Temperate regions	All species look alike, although dark red woods with light ray flecks are assumed to be Cherry.
Chestnut	<i>Castanea</i>	12	North temperate regions	All species look alike
Citrus	<i>Citrus</i>	16	Southern and southeast Asia and Malay Peninsula	All species look alike
Crocuswood	<i>Brya</i>	4	West Indies	All species look alike
Coralwood	<i>Adenanthera</i>	4	Tropical Asia and Pacific region	All species look alike
Courbaril	<i>Hymenaea</i>	15	Tropical America	All species look alike
Cypress	<i>Cypressus</i>	13	Northern hemisphere	All species look alike
Dogwood	<i>Cornus</i>	45	Northern temperate, South America and Africa	All species look alike
Eaglewood	<i>Aquillaria</i>	15	Indomalesia	All species look alike
East Indian Satinwood	<i>Chloroxylon</i>	1	Southern India, Sri Lanka	All species look alike
É bè ne Rouge	<i>Astronium</i>	15	Tropical America	All species look alike
Ebony	<i>Diospyros</i>	475	Tropics	All species look alike

Elder	<i>Sambucus</i>	20	Temperate to subtropical	All species look alike
Elm	<i>Ulmus</i>	18	North temperate regions to northern Mexico	All species look alike
Eucalyptus & Bloodwood	<i>Eucalyptus</i>	450	Australia to Malaysia	Some species can be separated. (Ref. #13)
Fir	<i>Abies</i>	39	North temperate regions and Central America	Species from Europe and western North America can sometimes be separated from the rest. (Ref. #2)
Fruitwoods	Malus & Pyrus	25 + 20	North temperate regions and Eurasia	Both genera and all species look alike.
Fustet	<i>Cotinus</i>	3	Southeast Asia, southern Europe to China	All species look alike
Hazel	<i>Corylus</i>	10	North temperate	All species look alike
Hemlock	<i>Tsuga</i>	10	Temperate North America and eastern Asia	All species look alike
Hickory	<i>Carya</i>	17	Eastern North America, Central America and eastern Asia	Can be separated into True Hickories & Pecan Hickories. (Ref. #12)
Holly	<i>Ilex</i>	400	Cosmopolitan	All species look alike
Hornbeam	<i>Carpinus</i>	35	North temperate regions	All species look alike
Horse Chestnut	<i>Aesculus</i>	13	North America, eastern Europe, India and eastern Asia	All species look alike
Jackwood	<i>Artocarpus</i>	31	Indomalaysia	All species look alike
Juniper	<i>Juniperus</i>	50	Northern hemisphere, tropical Africa and the mountains of the West Indies	All species look alike
Laburnum	<i>Laburnum</i>	2	Europe	All species look alike
Larch	<i>Larix</i>	9	Cooler regions of the northern hemisphere	All species look alike
Laurel	<i>Laurus</i>	2	Mediterranean	All species look alike
Lignum-vitae	<i>Guaicum</i>	6	Warm Americas	All species look alike
Lilac	<i>Syringa</i>	25	Southeastern Europe to eastern Asia	All species look alike
Locust	<i>Robinia</i>	5	North America	All species look alike
Magnolia	<i>Magnolia</i>	125	Eastern North America to tropical America and the Himalayas to Japan and western Malaysia	All species look alike

Manchineel	<i>Hippomane</i>	5	Mexico to West Indies	All species look alike
Manilawood	<i>Vitex</i>	250	Cosmopolitan	All species look alike
Maple & Boxelder	<i>Acer</i>	111	North temperate regions and mountains in the tropics	Can be separated into Soft Maple & Hard Maple Groups. (Ref. #10)
Mora	<i>Mora</i>	6	Tropical America	All species look alike
Mulberry	<i>Morus</i>	7	Subtropical	All species look alike
Narra & Padauk	<i>Pterocarpus</i>	20	Tropics	All species look alike
Oak	<i>Quercus</i>	600	North temperate regions south to Malaysia and Columbia	Can be separated into White, Red and Live Oak Groups. (Ref. #10)
Olive	<i>Olea</i>	20	Old World tropics and worm temperate	All species look alike
Partridgewood	<i>Andira</i>	20	Tropical America and west Africa	All species look alike
Pine	<i>Pinus</i>	93	North temperate areas	Can be separated into Red, White & Yellow Pine Groups. (Ref. #6)
Red Bay	<i>Persea</i>	150	Tropics	All species look alike
Red Gum	<i>Liquidambar</i>	4	North America and Asia	All species look alike
Rosewood	<i>Dalbergia</i>	100	Tropics	Some species can be separated. (Ref. #13)
Sabicu or Horseflesh Mahogany	<i>Lysiloma</i>	30	Tropical America	All species look alike
Sal	<i>Shorea</i>	357	Sti Lanka to southern China	All species look alike
Sandalwood	<i>Santalum</i>	9	Indomalesia to Australia and Hawaii	All species look alike
Sapanwood & Brazilwood	<i>Caesalpina</i>	100	Tropics, warm Americas and Namibia	All species look alike
Satin é Rouge	<i>Brosimum</i>	13	Tropical America	All species look alike
Savannawood	<i>Citharexylum</i>	70	Tropical America to Argentina	All species look alike
Spanish Cedar	<i>Cedrela</i>	8	Tropical America	All species look alike
Spindle Tree	<i>Euomyms</i>	177	North temperate	All species look alike
Spruce	<i>Picea</i>	34	Cooler regions of the northern hemisphere	Some separations of species groups are possible. (Ref. #11)
Stinkwood	<i>Ocotea</i>	200	Tropics	All species look alike
Sycamore	<i>Platanus</i>	6-7	Northern hemisphere	All species look alike
Teak	<i>Tectona</i>	4	Southern Asia to Malaysia	All species look alike

Thorn	<i>Crataegus</i>	280	North temperate	All species look alike
Thuja & Sandarac	<i>Tetraclinis</i>	1	Southern Spain, Malta, North Africa	All species look alike
True Cedar	<i>Cedrus</i>	4	North Africa to Asia	All species look alike
True Mahogany	<i>Swietenia</i>	3	Tropical America	Cuban Mahogany ( <i>S. mahogani</i> ) can sometimes be separated from Honduran Mahogany ( <i>S. macrophylla</i> ) based on density. Pacific Coast Mahogany ( <i>S. humilis</i> ) is not a commercial species. (Ref. #3)
Walnut & Bitternut	<i>Juglans</i>	21	North America to the Andes and the Mediterranean to eastern Asia	Butternuts can be separated from Walnuts. Tropical, American Black and European Walnuts can sometimes be separated based on their micro-anatomy, depending on sample size. (Ref. #9)
West Indian Satinwood	<i>Zanthoxylum</i>	250	America, Africa, Asia, Australia	All species look alike
Whitebeam	<i>Sorbus</i>	85	Northern hemisphere	All species look alike
Willow	<i>Salix</i>	400	Cold and temperate regions	All species look alike
Yellow Poplar	<i>Liriodendron</i>	2	Eastern North America and China	Both species look alike.
Yellowwood	<i>Podocarpus</i>	94	Southern temperate through tropics to West Indies and Japan	All species look alike
Yew	<i>Taxus</i>	7	Northern temperate to central Malaysia and Mexico	All species look alike

**Table 2: Taxa listed by genus.**

<b>Genus</b>	<b>Common Name</b>	<b># of species</b>	<b>Distribution</b>	<b>Limits of Microscopic Identification</b>
<i>Abies</i>	Fir	39	North temperate regions & Central America.	Species from Europe and western North America can sometimes be separated from the rest. (Ref. #2)
<i>Acacia</i>	Acacia	1200	Tropics.	All species look alike.
<i>Acer</i>	Maple & Boxelder	111	North temperate regions & mountains in the tropics.	Can be separated into Soft Maple & Hard Maple Groups. (Ref. #10)
<i>Adenanthera</i>	Coralwood	4	Tropical Asia & Pacific region.	All species look alike.
<i>Aesculus</i>	Horse Chestnut	13	North America, eastern Europe, India and eastern Asia.	All species look alike.
<i>Alnus</i>	Alder	35	North temperate regions south to southeast Asia and the Andes.	All species look alike.
<i>Amyris</i>	Amyris	30	Tropical America.	All species look alike.
<i>Andira</i>	Partridgewood	20	Tropical America and west Africa.	All species look alike.
<i>Aquillaria</i>	Eaglewood	15	Indomalesia.	All species look alike.
<i>Artocarpus</i>	Jackwood	31	Indomalesia.	All species look alike.
<i>Astronium</i>	I bP ne Rouge	15	Tropical America.	All species look alike.
<i>Berberis</i>	Barberry	450	Eurasia, north and tropical Africa, Americas.	All species look alike.
<i>Betula</i>	Birch	~ 60	Northern hemisphere.	All species look alike.
<i>Brosimum</i>	SatinJ Rouge	13	Tropical America.	All species look alike.
<i>Brya</i>	Cocuswood	4	West Indies.	All species look alike.
<i>Buxus</i>	Boxwood	30	Western Europe, Mediterranean.	All species look alike.
<i>Caesalpinia</i>	Sapanwood & Brazilwood	100	Tropics, warm Americas and Namibia.	All species look alike.
<i>Carpinus</i>	Hornbeam	35	North temperate regions.	All species look alike.
<i>Carya</i>	Hickory	17	Eastern North America, Central America and eastern Asia.	Can be separated into True Hickories & Pecan Hickories. (Ref. #12)

<i>Castanea</i>	Chestnut	12	North temperate regions.	All species look alike.
<i>Casuarina</i>	Australian Beefwood & Botany Bay Oak	70	Old World tropics	All species look alike.
<i>Cedrela</i>	Spanish Cedar	8	Tropical America.	All species look alike.
<i>Cedrus</i>	True Cedar	4	North Africa to Asia.	All species look alike.
<i>Chamaecyparis</i>	Cedar	7	North America and eastern Asia.	All three North American species are anatomically distinct. (Ref. #6)
<i>Chloroxylon</i>	East Indian Satinwood	1	Southern India, Sri Lanka.	All species look alike.
<i>Cinnamomum</i>	Camphorwood	250	East and southeast Asia to Australia.	All species look alike.
<i>Citharexylum</i>	Savannawood	70	Tropical America to Argentina.	All species look alike.
<i>Citrus</i>	Citrus	16	Southern and southeast Asia and Malay Peninsula.	All species look alike.
<i>Cordia</i>	Canalete	250	Tropics.	All species look alike.
<i>Cornus</i>	Dogwood	45	Northern temperate, South America and Africa.	All species look alike.
<i>Corylus</i>	Hazel	10	North temperate.	All species look alike.
<i>Cotinus</i>	Fustet	3	Southeast Asia, southern Europe to China.	All species look alike.
<i>Crataegus</i>	Thorn	280	North temperate.	All species look alike.
<i>Cupressus</i>	Cypress	13	Northern hemisphere.	All species look alike.
<i>Dalbergia</i>	Rosewood	100	Tropics.	Some species can be separated. (Ref. #13)
<i>Diospyros</i>	Ebony	475	Tropics.	All species look alike.
<i>Eucalyptus</i>	Eucalyptus & Bloodwood	450	Australia to Malaysia.	Some species can be separated. (Ref. #13)
<i>Euonymus</i>	Spindle Tree	177	North temperate.	All species look alike.
<i>Fagus</i>	Beech	10	North temperate regions.	All species look alike.
<i>Fraxinus</i>	Ash	65	North temperate regions to the tropics.	All species look alike.
<i>Guaicum</i>	Lignum-vitae	6	Warm Americas.	All species look alike.
<i>Hippomane</i>	Manchineel	5	Mexico to West Indies.	All species look alike.
<i>Hymenaea</i>	Courbaril	15	Tropical America.	All species look alike.
<i>Ilex</i>	Holly	400	Cosmopolitan.	All species look alike.

<i>Juglans</i>	Walnut & Butternut	21	North America to the Andes and the Mediterranean to eastern Asia.	Butternuts can be separated from Walnuts. Tropical, American Black and European Walnuts can sometimes be separated based on their micro-anatomy, depending on sample size. (Ref. #9)
<i>Juniperus</i>	Juniper	50	Northern hemisphere, tropical Africa and the mountains of the West Indies.	All species look alike.
<i>Laburnum</i>	Laburnum	2	Europe.	All species look alike.
<i>Larix</i>	Larch	9	Cooler regions of the northern hemisphere.	All species look alike.
<i>Laurus</i>	Laurel	2	Mediterranean.	All species look alike.
<i>Liquidambar</i>	Red Gum	4	North America and Asia.	All species look alike.
<i>Liriodendron</i>	Yellow Poplar	2	Eastern North America and China.	Both species look alike.
<i>Lysiloma</i>	Sabicu or Horseflesh Mahogany	30	Tropical America.	All species look alike.
<i>Magnolia</i>	Magnolia	125	Eastern North America to tropical America and the Himalayas to Japan and western Malaysia.	All species look alike.
Malus & Pyrus	Fruitwoods	25 + 20	North temperate regions & Eurasia.	Both genera and all species look alike.
Mimusops	Bulletwood	57	Tropical Africa, Malaysia to Pacific.	All species look alike.
Mora	Mora	6	Tropical America.	All species look alike.
Morus	Mulberry	7	Subtropical.	All species look alike.
<i>Nyssa</i>	Black Gum	5	North America, China and Indomalesia.	All species look alike.
<i>Ocotea</i>	Stinkwood	200	Tropics.	All species look alike.
<i>Olea</i>	Olive	20	Old World tropics and warm temperate.	All species look alike.
<i>Peltogyne</i>	Amaranth	23	Tropical America.	All species look alike.
<i>Persea</i>	Red Bay	150	Tropics.	All species look alike.
<i>Picea</i>	Spruce	34	Cooler regions of the northern hemisphere.	Some separations of species groups are possible. (Ref. #11)
<i>Pinus</i>	Pine	93	North temperate regions.	Can be separated into Red, White & Yellow Pine Groups. (Ref. #6)

<i>Platanus</i>	Sycamore	6 – 7	Northern hemisphere.	All species look alike.
<i>Podocarpus</i>	Yellowwood	94	Southern temperate through tropics to West Indies and Japan.	All species look alike.
<i>Populus</i>	Aspen, Poplar & Cottonwood	35	North temperate regions.	All species look alike.
<i>Prunus</i>	Cherry, Plum, Almond	400	Temperate regions.	All species look alike, although dark red woods with light ray flecks are assumed to be Cherry.
<i>Pterocarpus</i>	Narra & Padauk	20	Tropics.	All species look alike.
<i>Quercus</i>	Oak	600	North temperate regions south to Malaysia and Colombia.	Can be separated into White, Red and Live Oak Groups. (Ref. #10)
<i>Rapanea</i>	Cape Beech	150	Tropics.	All species look alike.
<i>Robinia</i>	Locust	5	North America.	All species look alike.
<i>Salix</i>	Willow	400	Cold and temperate regions.	All species look alike.
<i>Sambucus</i>	Elder	20	Temperate and subtropical.	All species look alike.
<i>Santalum</i>	Sandalwood	9	Indomalesia to Australia and Hawaii.	All species look alike.
<i>Shorea</i>	Sal	357	Sri Lanka to southern China.	All species look alike.
<i>Sorbus</i>	Whitebeam	85	Northern hemisphere.	All species look alike.
<i>Swietenia</i>	True Mahogany	3	Tropical America.	Cuban Mahogany ( <i>S. mahogani</i> ) can sometimes be separated from Honduran Mahogany ( <i>S. macrophylla</i> ) based on density. Pacific Coast Mahogany ( <i>S. humilis</i> ) is not a commercial species. (Ref. #3)
<i>Syringa</i>	Lilac	25	Southeastern Europe to eastern Asia.	All species look alike.
<i>Taxodium</i>	Bald Cypress	2	Eastern North America (1) and Mexican highlands (1).	All species look alike.
<i>Taxus</i>	Yew	7	Northern temperate to central Malaysia and Mexico.	All species look alike.

<i>Tectona</i>	Teak	4	Southeast Asia to Malaysia.	All species look alike.
<i>Tetraclinis</i>	Thuja & Sandarac	1	Southern Spain, Malta, North Africa.	All species look alike.
<i>Thuja</i>	Cedar	5	Eastern North America and eastern Asia.	The two North American species can sometimes be separated. (Ref. #6)
<i>Tilia</i>	Basswood	45	North temperate regions.	All species look alike.
<i>Tsuga</i>	Hemlock	10	Temperate North America and eastern Asia.	All species look alike.
<i>Turraenthus</i>	Avodire	2	Tropical west Africa.	All species look alike.
<i>Ulmus</i>	Elm	18	North temperate regions to northern Mexico.	All species look alike.
<i>Vitex</i>	Manilawood	250	Cosmopolitan.	All species look alike.
<i>Zanthoxylum</i>	West Indian Satinwood	250	Americas, Africa, Asia, Australia.	All species look alike.

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