

FOREIGN WOOD SERIES

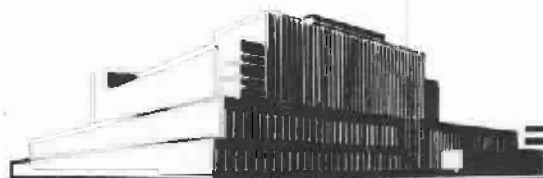


CATIVO

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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

In Cooperation with the University of Wisconsin

FOREIGN WOOD SERIES

CATIVO

Prioria copaifera Gris.
Family: Leguminosae (Caesalpinaceae)

By

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Introduction

Cativo is one of the few tropical American species that occur in abundance and often in nearly pure stands. Seemingly its abundance, size, form, and ease of logging would have suggested utilization of this wood on a large scale many years ago. Only recently, however, has large-scale exploitation been attempted. Certain inherent characteristics of this species, such as the presence of vertical gum ducts that are responsible for the "bleeding" of the lumber and the occurrence of tension wood, which is responsible for warp in this species, were previously detrimental in the general acceptance of this species. Improved methods of processing, drying, and finishing, and better selection of logs have improved the quality of cativo lumber materially, and the wood is being imported in increasing quantities.

Distribution and Habitat

Cativo occurs from Nicaragua to Colombia and also in Jamaica. Commercial stands are found in Nicaragua, Costa Rica, Panama, and Colombia. The species is limited to the low coastal plain and along rivers and may grow on two kinds of sites: in swamps that are under water during a portion of the year, where cativo forms nearly pure stands; and on fairly rich, loamy soil on slopes lying inland from the coastal plain but never more than several hundred feet above sea level. On such upland sites cativo may also occur in pure stands but is more commonly found in association with other species. When in mixture with

¹Maintained at Madison, Wis., in cooperation with the University of Wisconsin.

other species, cativo may account for three-fourths of the commercial volume of a stand. In pure stands, cativo seldom produces less than 10,000 board-feet per acre; many acres average 20,000 board-feet, and individual acres have produced 50,000 board-feet (1).²

The Tree

Cativo trees are straight, symmetrical, and without buttresses; clear boles of 50 feet or more are common. Exceptional specimens may attain diameters of 5 to 6 feet with clear boles that may extend 100 to 120 feet to the first branches. More commonly the trunks average 18 to 36 inches in diameter.

The Wood

The sapwood is usually thick, and in trees up to 30 inches in diameter the heartwood may be only 7 inches in diameter. The sapwood may be a very pale pinkish color or may be distinctly reddish. This difference is striking enough so that the loggers refer to the logs as "white cativo" or "red cativo." The center of the log usually consists of a black core surrounded by a zone of irregularly pigmented, black or brown lines, although sometimes only the pigmented lines are present.

The grain is straight, and the texture of the wood is uniform and comparable to that of mahogany (Swietenia macrophylla King). Figure on flat-sawn surfaces is rather subdued and results from the exposure of the narrow bands of parenchyma tissue. Slight differences in color may be produced by the alternating bands of normal wood and tension wood, the tension wood tending to be brownish. The pigmented zones of the heartwood also produce a rather distinctive effect. Exudation of gums from the wood may also show up as distinct lines on the surface of the wood. Odor and taste are not distinctive in the dry wood, and its luster is low.

Weight

Cativo is moderately light in weight, with a specific gravity range of 0.35 to 0.52 based on its weight when oven-dry and volume when green. The average specific gravity under these conditions is 0.40. The range of specific gravity based on its weight and volume when oven-dry is 0.36 to 0.54, with an average of 0.44. These values are for wood free of pigmented zones. Wood containing appreciable quantities of pigment, or that in the black core of the tree, has considerably higher specific gravity.

²Underlined numbers in parentheses refer to Literature Cited at the end of the text.

The weight of cativo also varies with the amount of tension wood present in a given specimen. Wood free of tension wood or containing very small amounts is in the lower density range for the species, and such specimens have a specific gravity of 0.40 and less based on its weight and volume when oven-dry. As specific gravity goes above 0.40, greater percentages of tension wood may be expected.

Mechanical Properties

Strength values for cativo are given in table 1 and compared with yellow-poplar (Liriodendron tulipifera L.), which is of similar density. Yellow-poplar is slightly higher than cativo in all properties except hardness, in which cativo is superior.

Seasoning

The light-colored wood of cativo can be kiln dried easily and rapidly with little or no degrade. One producer of cativo lumber is kiln drying green 4/4 material to 14-18 percent moisture content in 60 hours, using a starting temperature of 200° F. The wet-bulb temperature was held constant at 150° F.

Lumber containing pigmented zones requires careful seasoning to prevent collapse and honeycombing within these areas. The British Forest Products Research Laboratory suggests use of its Schedule 4 for kiln drying this wood (2). This is somewhat similar to the U. S. Forest Products Laboratory schedule for red oak, T4-D2 (7). For green material with a moisture content above 100 percent, U. S. Forest Products Laboratory schedule T4-E2 might be used. Because the pigmented wood is subject to collapse and honeycombing, high temperatures should be avoided until the interior has dried below the fiber saturation point. If the wood is already air dried or kiln dried to 15 percent or lower, a higher kiln temperature can be used immediately.

It is essential that high temperatures be used in the final stages of kiln drying because the gum content of the lumber is materially reduced and what remains is not so prone to "bleed" on to the surface of the wood. Recent experimental work at this Laboratory on the drying of 4/4 cativo lumber that was at about 15 percent moisture content shows that appreciable amounts of gum can be removed from the lumber at high initial temperatures. The schedule that gave the best results calls for a dry-bulb temperature of 200° F. and a wet-bulb temperature of 150° F. for 24 hours. The charge was then conditioned for 24 hours at 160° F. (wet-bulb 147° F.). The use of high temperatures is beneficial not only from the standpoint of gum reduction but also in relieving some of the internal stresses that are due to tension wood common in this species. In commercial practice, "shipping-dry" lumber, which has a moisture content of 20 to 22 percent, is being dried at temperatures starting with 200° F. for 42 hours, followed by 180° F. for equalizing and 160° F. for conditioning it.

Shrinkage

The light-colored wood of cativo (free of pigment streaks) has very good dimensional stability in the transverse direction. Averages of shrinkage values made at Yale University (8) and the University of Michigan (5) are 2.3 percent radially, 5.3 percent tangentially, and 8.8 percent volumetrically from the green to the oven-dry condition. Longitudinal shrinkage is variable and depends upon the amount of tension wood in a given piece. The longitudinal shrinkage of normal material is generally less than 0.3 percent, whereas material with tension wood may shrink as much as 0.7 percent in the longitudinal direction. Longitudinal shrinkage at the higher levels is partially responsible for such drying defects in cativo lumber as bow, crook, and split, and, in veneer, splitting and buckling. The tangential shrinkage of cativo when relative humidity changes from 80 to 30 percent is 1.6 percent, which practically equals that of mahogany, 1.5 percent under the same conditions. Because of its excellent stability, cativo is put to such uses as bases for piano keyboards.

The dimensional stability of both mahogany and cativo can be improved by impregnating veneers with phenolic resins. Greater improvement is attained with cativo than with mahogany.

Durability

Cativo is classed as a nondurable wood with respect to both decay and insect attack. Felled trees are rapidly attacked by ambrosia beetles and, unless they are converted immediately or protected by insecticides, may become completely riddled. An insecticide that has given good results consists of a solution of 5 pounds of benzene hexachloride containing 36 percent of the gamma isomer in 50 gallons of diesel fuel oil (1).

Working Characteristics

Although cativo lumber may contain appreciable amounts of tension wood, the dried wood is not especially difficult to machine. In exploratory machining tests made at this Laboratory (3), 85 percent of the pieces of cativo lumber tested were found to be defect free in planing, showing no raised or fuzzy grain and only traces of chipped grain. In shaping tests, 50 percent of the pieces were rated good to excellent; rough end grain was very common, but 80 percent were considered good to excellent in turning properties. In sanding tests, cativo was rated 100 percent scratch free but not fuzz free. Boring tests showed that 75 percent of the samples had smoothly cut, good to excellent holes but, in mortising, only 55 percent were fair to excellent, a rating attributed to the relatively low hardness of this wood.

Cativo is rated fair to good in steam bending (8).

Gum or Resin Content

A considerable amount of dark brown gum is present in the intercellular canals of cativo and exudes from cuts in the wood and bark of the tree. It often interferes with the cutting and sawing of green material, but this difficulty can be eliminated by using water on the headsaw and resaw. The gum imposes no machining difficulties, however, once the wood has properly dried.

Cativo gum may not be evident on dry lumber that has been surfaced, but it may exude later if the wood is heated -- for example by nearby hot air vents, radiators, or when exposed to direct sunlight. High-temperature drying, as suggested for seasoning, will materially reduce further gum exudation.

Ordinary wood sealers appear to be ineffective in sealing the gum ducts against further bleeding, but finishes that produce a continuous film over the wood have proven to be quite effective.

Gluing

Cativo is reported to have good gluing properties, giving excellent results with animal, starch, and casein glue and good results with urea and resorcinol-resin glues.

Pulping

Cativo produces a good yield of sulfate pulp that is sufficiently strong, after bleaching, for blending with stronger softwood pulp to make a variety of white papers. The strength properties of the unbleached sulfate pulp made from cativo waste differed significantly from average properties of sulfate pulps from six different native hardwood pulps, being 10 percent higher in bursting strength and 24 percent lower in folding endurance. Cativo has an average fiber length of 1.005 millimeters and the fibers range in length between 0.520 and 1.480 millimeters.

Uses

Cativo has come into extensive use in this country only in recent years. The tendency of the wood to bleed in use and the warping of narrow cuttings kept this species in disfavor for many years. Improved drying and finishing techniques have materially reduced the prominence of these inherent characteristics, and the uses for this species are rapidly increasing. Considerable quantities are used for interior trim, and resin-stabilized veneer has become an important pattern material, particularly in the automotive industry. Cativo is also widely used for furniture and cabinet parts (both exposed and concealed), lumber core for plywood, picture frames, edge banding for doors, and bases for piano keyboards.

Supply

Large and accessible stands of cativo occur in Costa Rica, Panama, and Colombia.

Imports

In 1952, more than 4 million board-feet of cativo logs were imported into the United States from Costa Rica and Colombia. In 1958, importations were estimated at an annual rate of 13,000,000 feet of logs and 7,000,000 feet of sawn lumber.

Structure

Growth rings are distinct and marked by concentric lines of marginal parenchyma, which appears lighter in color than the background wood. Pores are visible without magnification and evenly distributed in solitary arrangement or in short radial groups of 2 to 5. Parenchyma forms a thin sheath around the pores and sometimes shows short winglike extensions. The wood rays are just visible on the end grain without magnification and distinct on the quartered surfaces, where they appear darker than the background. Vertical gum ducts, the size of the pores, are common and are filled with a reddish brown gum.

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Table 1.--Strength properties of cativo (Prioria copaifera) and yellow-poplar (Liriodendron tulipifera) at 12 percent moisture content¹

Property	Species	
	Cativo (<u>Prioria</u> <u>copaifera</u>)	Yellow-poplar (<u>Liriodendron</u> <u>tulipifera</u>)
Specific gravity		
Based on green volume and oven-dry weight.....	0.40	0.40
Based on oven-dry volume and oven-dry weight...	0.44	0.43
Static bending		
Fiber stress at proportional limit.... p.s.i.:	5,970	6,200
Modulus of rupture..... p.s.i.:	8,730	10,100
Modulus of elasticity.....1,000 p.s.i.:	1,150	1,580
Work to proportional limit.....		
.....in.-lb. per cu. in.:	1.75	1.39
Work to maximum load.....in. lb. per cu. in.:	7.2	8.8
Compression parallel to grain		
Fiber stress at proportional limit....p.s.i.:	2,930	3,730
Maximum crushing strength.....p.s.i.:	4,490	5,540
Compression perpendicular to grain -- Stress at:		
proportional limit.....p.s.i.:	530	560
Shear		
Maximum shearing strength.....p.s.i.:	1,040	1,190
Hardness		
End.....lb.:	810	670
Side.....lb.:	610	540

¹Strength values for cativo are weighted averages of three logs tested at Yale University (4, 8) and one log tested at the University of Michigan (5). Values for yellow-poplar are from Wood Handbook, U. S. Department of Agriculture Handbook No. 72 (6).