FOREIGN WOOD SERIES

CRABWOOD

CARAPA SPP.

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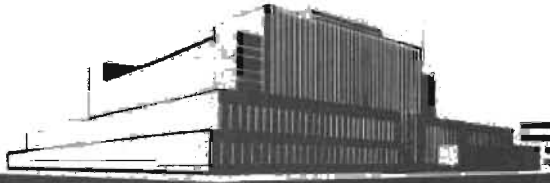

FOREST PRODUCTS LABORATORY
MADISON 5, WISCONSIN

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
In Cooperation with the University of Wisconsin

CRABWOOD
Carapa spp.
Meliaceae

By

B. FRANCIS KUKACHKA, Forest Products Technologist

Forest Products Laboratory,[1] Forest Service
U. S. Department of Agriculture

Summary

This report deals with nomenclatural changes, mechanical and physical properties, and identification of the three principal American species of *Carapa*.

Introduction

Recent studies of the genus *Carapa* (4)[2] have resolved many questions regarding the confusion in the nomenclature of this group as well as the supposed wide variation in the properties of the principal species, *Carapa guianensis*. It is now apparent that the Central American trees consist of two distinct species that vary appreciably with respect to the properties of the wood. This accounts, at least in part, for the unsuccessful attempts to establish regular markets for the Central American wood in the United States. The species of northern South America, being more nearly uniform in their properties, have received more favorable attention.

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

[2] Underlined numbers in parentheses refer to Literature Cited at the end of the report.

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Nomenclature

The principal and most widespread species is C. guianensis Aubl., which ranges from the West Indies and Central America to western Ecuador, Colombia, Venezuela, the Guianas, Amazonian Brazil, and eastern Peru. C. nicaraguensis C. DC. overlaps the range of C. guianensis from Nicaragua to western Ecuador. C. surinamensis Miq. is limited to Surinam and French Guiana, and C. macrocarpa Ducke is apparently limited to Para, Brazil.

The statements that C. guianensis occurs in West Africa and that the African C. procera DC. occurs in northern South America have been found to be erroneous. C. slateri Standl. is now regarded as synonymous with C. nicaraguensis. Material from the Guianas attributed to be C. procera is now regarded as C. surinamensis. (4)

Aside from crabwood, the names most commonly applied to the various species are krappa, tangare, cedro macho, bateo, andiroba, and guino.

The Trees

Under favorable growth conditions, C. macrocarpa and C. guianensis are reported to attain heights of 170 feet and diameters of 6 feet. More commonly, however, all species attain a height of 100 feet and diameters of 1 to 3 feet. The trees occur most commonly along rivers in lowlands that are subject to inundation and up to about 300 feet above sea level, although in western Ecuador there have been reports of C. guianensis being found at elevations of 3,000 feet.

The Wood

The heartwood of freshly cut material of C. guianensis varies from pinkish to dark red, but becomes a uniform reddish-brown to brown upon exposure to air. In C. nicaraguensis the heartwood color generally ranges from a light brown to a golden-brown, somewhat resembling baywood mahogany (Swietenia macrophylla). Luster is variable for the different woods, and neither odor nor taste is distinctive. The grain is typically straight but may be interlocked, which produces a strip figure on quartered surfaces. The texture (size of pores) is similar to that of mahogany (Swietenia).

Specific Gravity

The specific gravity values, which are based on volume when green and weight when ovendry, of three species of crabwood that were investigated at the U. S. Forest Products Laboratory and the Yale University School of Forestry are:

Species	Minimum	Mean	Maximum
Carapa nicaraguensis	0.38	0.42	0.47
Carapa surinamensis (6)[3]...	0.48	0.53	0.56
Carapa guianensis (6)	0.48	0.54	0.63

The specific gravity of *C. nicaraguensis* is appreciably lower than that of the other species, and Central American material can generally be segrated on this basis.

Machinability

A comparison of *C. nicaraguensis*[4] with the mean of 15 tropical woods tested at the U. S. Forest Products Laboratory (2) shows the following machining qualities:

Operation	Basis of evaluation	Percent of specimens	Mean of 15 tropical hardwoods (percent)
Planing	Defect-free	33	53
Shaping	Good to excellent	28	47
Turning	Good to excellent	70	73
Boring	Good to excellent	86	81
Mortising	Fair to excellent	72	72
Sanding	Fuzz-free pieces	50	76

C. nicaraguensis is thus below the average of the 15 species with respect to planing, shaping, and sanding, but on par with these woods in turning, boring, and mortising. Some of the difficulties encountered in machining this species stem from the fact that the wood is of relatively low density. Tension wood, furthermore, seems to occur commonly.

The British Forest Products Research Laboratory (1) reports that *C. guianensis* may be worked with moderate ease, and it is about 25 percent

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[3] Reported as *Carapa procera* in reference (6).

[4] Reported as *Carapa guianensis* in reference (2).

harder to machine than mahogany. It is believed that the higher density of C. guianensis would tend to give better machining results than those given above for C. nicaraguensis.

Seasoning and Shrinkage

According to the British Laboratory, (1) the wood seasons fairly well but rather slowly and has a tendency to split in the initial stages. Longitudinal distortion may be severe in material where pronounced tension wood is present. The British kiln schedule C (1) has given satisfactory results, and the equivalent Forest Products Laboratory schedule suggested for 4/4 to 6/4 stock is T3-C2. (6)

The shrinkage of three species of Carapa from the green to ovendry condition are given as follows:

Species and number of trees	Radial percent	Tangential percent	Volumetric percent
C. guianensis (3) 2 trees	3.1	7.6	10.4
C. surinamensis (3)[5] 2 trees...	4.7	8.3	13.8
C. nicaraguensis 3 trees.....	5.5	8.3	14.3

Mechanical Properties

The mechanical properties of C. guianensis and C. surinamensis are given in table 1. A limited number of tests on C. nicaraguensis from Ecuador made at the Forest Products Laboratory gave values of 5,900 pounds per square inch for maximum crushing strength in compression paralled to the grain and 610 pounds for side hardness. These values are for wood at a moisture content of 13 percent and a specific gravity of 0.47 based on volume at test and weight when ovendry.

Durability

Durability studies made at Yale University (7) show C. guianensis to be very durable to durable upon exposure to a white-rot fungus and very durable with respect to a brown rot. C. surinamensis[6] was found to be nondurable

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[5] Reported as C. procera in references (3, 7).

[6] Reported as C. procera in references (3, 7).

in resistance to a white-rot fungus and only moderately durable with respect to a brown rot. Tests made at the Forest Products Laboratory on C. nicaraguensis[7] show it to be only moderately resistant in both soil tests as well as preculture tests with two white-rot fungi.

Identification

The wood of Carapa and several related genera can generally be recognized from its gross appearance but, because these woods may overlap with respect to color, it is generally necessary to examine radial and tangential sections under the microscope to be certain of the genus involved. This is particularly true with respect to the identification of veneers, where complete growth rings may be lacking.

The use of table 2 should permit ready identification of Carapa and similar appearing species that are imported into the United States. The specific gravity is also helpful in separating the Carapa species. The maximum value obtained for C. nicaraguensis on the basis of volume when green and weight when ovendry was 0.47, while the minimum value for C. guianensis was 0.48. The marginal parenchyma of C. guianensis is more or less uniformly spaced while that of C. niacraguensis is erratic in its occurrence or may be completely lacking.

Uses

The higher density species are suited for such purposes as construction timber, flooring, furniture and cabinet work, millwork, general utility, and decorative plywood.

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[7] Reported as Carapa guianensis in reference (5).

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Table 1.--Mechanical properties of *Carapa guianensis* and *Carapa surinamensis* (7) when green and at 12 percent moisture content

Properties	*C. guianensis*		*C. surinamensis*	
	Green	12 percent	Green	12 percent
Specific gravity				
Green volume-ovendry weight	0.56	.....	0.53	.....
Static bending				
Fiber stress at proportional limit.....p.s.i.	7,190	9,650	6,090	10,830
Modulus of rupture.....p.s.i.	11,110	15,620	9,480	15,450
Modulus of elasticity.....1,000 p.s.i.	1,560	1,850	1,820	2,140
Work to proportional limit.....in.-lb. per cu.-in.	1.92	2.85	1.04	2.89
Work to maximum load.....in.-lb. per cu.-in.	11.4	13.4	8.2	14.7
Compression parallel to grain				
Maximum crushing strength.....p.s.i.	4,930	7,900	4,640	8,340
Compression perpendicular to grain				
Stress at proportional limit.....p.s.i.	960	[1]850	500	810
Shear				
Maximum shearing strength.....p.s.i.	1,320	1,680	1,120	1,340
Hardness				
Side.....lb.	1,060	1,220	710	1,040

[1] At moisture content of 13.5 percent.

Table 2.--Features useful in the identification of Carapa and related species

Species	Marginal parenchyma	Erect marginal cells of wood rays	Uniseriate rays	Storied structure	Resin plugs in fibers
		No.			
C. guianensis	Present	1-several	Common	Rare	Present
C. nicaraguensis	Sporadic	1-several	Common	Lacking	Present
Khaya ivorensis and *anthotheca*	Sporadic	1-several	Common	Rare	Lacking
Entandrophragma angolense	Present	1	Rare	Lacking	Lacking
Swietenia macrophylla	Present	1	Rare	Present	Lacking