1920

INFORMATION LEAFLET
FOREIGN WOODS

Forest Products Laboratory,¹ Forest Service
U. S. Department of Agriculture
1952

APITONG
BAGAC, ING,
GURJUN, KERUING, YANG

Dipterocarpus spp.
Family: Dipterocarpaceae

By

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In the areas where it occurs, the Dipterocarp family, with 19 genera and nearly 400 species, fills the place in timber production that is occupied by softwoods, oaks, and other familiar species in the North Temperate zone. This Indo-Malayan family extends eastward into New Guinea and the Philippines, and two genera occur to the west in the Seychelles Islands and in tropical Africa (21).² The Dipterocarps are made up mainly of species that are noted for producing very large trees, often in nearly pure stands (2).

The genus Dipterocarpus, to which apitong belongs, includes about 70 species of large trees. Eleven are found in India, 5 in Ceylon, 15 in the Philippine Islands where they rate as the most abundant structural timber, 14 or more in Borneo (12), and some 30 others in the Malay Peninsula and the Indian Archipelago (4, 5, 14, 21, 31).

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

²Underlined numbers in parentheses refer to the list of numbered references at the end of the article.

Apitong, as known commercially, may be the product of not less than 15 species of the genus Dipterocarpus (1). The most common species are D. grandiflorus Blanco (= D. tuberculatus Roxb.), D. lasiopodus Perkins, and D. vernicifluus Blanco (1, 17).

In addition to apitong, which is a common name in the Philippines, a number of other trade and vernacular names are often applied to these woods. These include eng in India and England (9, 21), gurjun in Burma, keruing in the Malay Peninsula, hora in Ceylon, and yang in Siam (4, 5, 34).

The Tree

Dipterocarpus grandiflorus Blanco (= D. tuberculatus Roxb.) may be considered as a typical species of the group of woods called apitong. It is one of the most generally known and widely distributed.

Size

The trees may attain a height of 50 to 135 feet, often with 50 to 90 feet of clear, straight, cylindrical bole before the first branches. Girths of 8 to 15 feet and diameters up to 90 inches have been reported. The trees have comparatively small buttresses (1, 4, 5, 14, 21).

Leaves

The deciduous (8) leaves are leathery and smooth (30).

Flowers

The fragrant flowers are white or pink in color (31).

Fruit

The fruit is one-celled with two large outwardly curved wings (31).

Bark

The bark may be 3 to 4 inches thick, brittle, and light gray to dark brownish gray. It sheds off in large scroll-shaped plates and bears many corky pustules; the inner bark is reddish. Resin used for varnish, torches, and boat caulking exudes when the 1/2-inch inner bark is cut. The ends of the logs tend to be resinous and "tacky" (4, 5, 14, 31).

The Wood

The woods of the different species called apitong are so similar that it is difficult to distinguish one species from another (26).

Color

The sapwood, 3/4 to 3 or more inches in thickness, may be two-zoned; the outer zone may have a creamy-yellow, gray, or reddish-white color that shades into reddish-purple or brown (4, 5). The sapwood tones into the darker reddish- or purplish-brown heartwood, which darkens on exposure (4, 5, 14, 15, 21).

Grain, Texture, and Figure

Apitong wood may notably have fairly straight grain, but it may also be shallowly interlocked or cross grained. Its even texture is fine to rather coarse (4, 5, 10, 14, 21, 26, 34).

Luster

Apitong is not a lustrous wood (15, 26).

Odor and Taste

The wood has a slightly pleasant resinous odor but no distinct taste (11, 14, 15, 26).

Weight

The weight of apitong, depending on its moisture content, ranges from 36 to 66 pounds per cubic foot with a usual range of 40 to 57 pounds (4, 5, 9, 12, 13, 21, 26).

Specific gravity values from 0.60 to 0.86 have been reported (1, 14, 15, 21, 26).

Mechanical Properties

Strength values of apitong determined on material from different localities in the Philippines varied considerably. The strongest wood was that with the highest density (1, 7). Test data from some early Philippine tests (6) have been tabulated in table 1, which lists values for some properties of green and

Table 1.--Physical and strength properties of green and air-dry apitong from the Philippines¹

Property	Moisture condition	
	Green ²	Air-dry (adjusted to 12 percent moisture content) ³
Moisture content.....percent:	39	12
Specific gravity -- volume as tested.....:	0.58	0.63
Shrinkage, in volume -- green to oven-dry..percent:	416.0	
Shrinkage, radial -- green to oven-dry.....do.:	44.9	
Shrinkage, tangential -- green to oven-dry.....do.:	411.6	
Static bending		
Fiber stress at proportional limit.....p.s.i.:	5,000	7,700
Modulus of rupture.....do.:	9,400	12,300
Modulus of elasticity.....1,000 p.s.i.:	1,940	1,940
Work to proportional limit...in.-lb. per cu. in.:	0.77	1.62
Work to maximum load.....do.:	7.67	14.8
Compression parallel to grain		
Crushing strength at proportional limit...p.s.i.:	3,300	5,300
Maximum crushing strength.....do.:	4,500	6,200
Compression perpendicular to grain		
Crushing strength at proportional limit.....do.:	680	990
Hardness ⁵		
End.....lb.:	870	910
Radial.....do.:	780	880
Tangential.....do.:		
Shearing strength		
Radial.....p.s.i.:	1,140	1,330
Tangential.....do.:		

¹Table prepared by John T. Drow, Timber Mechanics Division, U. S. Forest Products Laboratory.

²Data on green material from "Comparative Strength Properties of the Principal Philippine Commercial Woods," by Jose C. Espinosa, Phil. Jour. Sci. Vol. 33, No. 4, 1927.

³Data on air-dry material from same source as data for green material but adjusted from 17 to 12 percent moisture content on the basis of the usual exponential relationship, assuming an "intersection point" of 25 percent moisture content.

⁴Shrinkage data are approximate, representing the sum of shrinkage values from green to air-dry and air-dry to oven-dry, as reported in Phil. Bur. For. Tech. Bull. No. 7, Appendix 6.

⁵Load to imbed a 0.444-inch steel ball to 1/2 its diameter.

air-dry material. These data were obtained from specimens of the sizes used for Forest Products Laboratory tests. They have been converted from metric system units and adjusted to 12 percent moisture content to make them comparable to data available on familiar United States species. Other test data from India, Malaya, and the Philippines have been reported elsewhere but are based on specimens of different sizes with different moisture content values or are in different units (10, 13, 21, 26, 29).

Seasoning and Shrinkage

Comprehensive seasoning information is not available for apitong. The range of variation in density and resin content of the material sold in world markets as apitong is considerable. It is believed, however, that with the careful use of modern drying methods apitong can be adequately seasoned, in spite of the fact that it has had a reputation for being slow to dry and somewhat refractory with notable tendencies to warp, check, split, and collapse (4, 5, 21). Air seasoning (2) or air seasoning prior to kiln drying have both been used with this material.

The British Forest Products Research Laboratory has recommended relatively mild treatment for apitong, starting with temperatures of 110° or 120° F. and 85 percent relative humidity (Schedules Nos. 4 and 5, Leaflet No. 42, "Kiln Drying Schedules," 1949). The U. S. Forest Products Laboratory in its 1951 "Schedules for the Kiln Drying of Wood" (Forest Products Laboratory Report No. D1791) lists as a generally applicable mild schedule, T5-D1, which has been suggested for use with green apitong. Schedule T5-C2 in this report would provide a more severe schedule if conditions appeared to warrant it.

As an effective general procedure for minimizing warping, a sticker spacing of not over 18 inches, with all stickers in vertical alinement, and weighting down of the top of the pile has been used.

Shrinkage figures recorded (26) for apitong are:

	<u>Radial</u> (Percent)	<u>Tangential</u> (Percent)	<u>Longitudinal</u> (Percent)	<u>Volumetric</u> (Percent)
Green to air-dry	2.3	6.7	0.1	8.6
Air-dry to oven-dry	2.6	4.9	0.1	7.4

Workability

Working characteristics vary considerably among the different species of Dipterocarpus and even within the same species, as influenced by growth conditions. The woods are generally considered as moderately difficult to work. The presence of silica (4, 5) and gum may give some trouble from blunting of cutting edges or clogging of saws (3, 4, 5, 34). A good finish and polish, however, can be obtained, especially in thoroughly dried material (14, 21). Exceptionally resinous material is troublesome, for example, in

flooring (4, 5), and in the tropics some staining and corrosion have been reported where the wood was in contact with iron (4, 5).

Durability

Dipterocarpus species are rated as only moderately durable in exposed positions (34). For example, untreated railway ties in India lasted only 4 to 5 years and house posts only about 1 year (21). Woods from these species serve well for interior work, but need preservative treatment if used in contact with the ground. They absorb preservatives readily, however, even with open-tank treatment (4, 5, 14). The heartwood of apitong has been reported as resistant to dry-wood termites and powder post beetles (21).

Defects

Heart checks or shakes, oil shakes, end splits, and surface checks sometimes occur or develop during seasoning of apitong (4, 5). Except for the fact that the sapwood is not decay resistant and is attacked by beetles (12), these woods are comparatively free from defects in the logs. The logs, however, should be removed from the woods as soon as possible after the trees are felled. Resin sometimes exudes over the surface of sawn material and a dulling effect on the cutting edges of woodworking tools has been noted (12).

Uses

Apitong is used in construction where hard and heavy timber is required. Its uses include "posts above stumps," beams, joists, rafters, partitions, flooring, mine props, bridges and wharves, poles and railway ties (with preservative treatment), wagon beds, automobile framing, framing of barges and lighters, boats, carts, boxes, railroad cars, and medium-grade furniture (9, 21, 26).

Availability

Apitong is reported as one of the most abundant structural timbers found in good sizes in the Philippines. Volumes of 1,000 to 14,000 board feet per acre have been reported (35).

Structure

Growth rings are not distinct. Pores tend to be rather evenly distributed, rounded in shape, open, and somewhat isolated. Rays are of two sizes (9) but appear to be few in number and narrow. Resin ducts are diffusely scattered and surrounded by bands of parenchyma (14, 26).

Minor Products

Considerable quantities of oleoresin (minyak keruing) are contained in the wood. The resin may exude over the ends of logs and is sometimes collected in hollows hacked in the tree trunks. It is used for caulking boats and for medicine (12).

References

1. Aguilar, Luis
1939. The Mechanical Properties of Apitong from Tayabas Province and Negros and Basilan Islands. Phil. Jour. For. Vol. 2, No. 2, pp. 145-157.
2. Asiddao, F.
1938. Air-drying Rate of One- and Two-inch Apitong Boards Under Open Shed. Phil. Jour. For. Vol. 1, No. 3, pp. 283-291.
3. Clarke, S. H.
1937. Gurjun, Apitong, Keruing, Kapur and Allied Timbers. Forest Products Research Records No. 16 (Timber Series No. 5), pp. 11, 1 pl. London. (Rev. Tropical Woods No. 51, p. 30.) (Rev. by Arthur Koehler, Jour. For. Vol. 37, No. 4, p. 353, 1939.)
4. Desch, H. E.
1941. Dipterocarp Timbers of the Malay Peninsula. Malayan Forest Records No. 14, pp. 62-75, illus.
5.

1941. Manual of Malayan Timbers. Malayan Forest Records Vol. 1, No. 15, pp. 101-108.
6. Espinosa, Jose C.
1927. Comparative Strength Properties of the Principal Commercial Woods of the Philippines. Phil. Jour. Sci. Vol. 33, No. 4, pp. 381-395.
7.

1928. Strength Properties in Relation to Specific Gravity of Philippine Woods. Phil. Jour. Sci. Vol. 36, No. 1, pp. 55-69.
8. Foxworthy, F. W.
1927. Commercial Timber Trees of the Malay Peninsula. Malayan Forest Records No. 3, pp. 41-44. Singapore.
9. Gamble, J. S.
1922. A Manual of Indian Timbers. 2nd. ed., pp. 70, 72. Sampson Low, Marston & Co., Ltd. London.
10. Gardner, Rollan
1906. Mechanical Tests, Properties and Uses of Thirty Philippine Woods. Philippine Bur. For. Tech. Bull. No. 4 (Manila).
11. Howard, A. L.
1948. A Manual of the Timbers of the World. 3rd ed., pp. 30-31, 174-175, 196-200, 291, 648. Macmillan Co.

12. Keith, H. G.
1947. Timbers of North Borneo. Pp. 29-33. Hong Kong.
13. Kent, H. T. M.
1920. Report on the Results of Mechanical Tests Carried Out on Some Malayan Timbers. Conservator of Forests, Kuala Lumpur.
14. Kraemer, J. Hugo
1951. Trees of the Western Pacific Region. Pp. 275-277. Tri-State Offset Co., Cincinnati, Ohio.
15. Kribs, D. A.
1950. Commercial Foreign Woods on the American Market. P. 68 (illus.) School of Forestry, Pennsylvania State College.
16. Lamb, George N.
1950. Dipterocarpaceae. Wood Products Vol. 55, No. 2, p. 36.
17. Merrill, E. D.
1923. Enumeration of Philippine Flowering Plants. Vol. 3, pp. 88-91.
18.

1926. Bibliography of Philippine Botany. Enumeration of Philippine Flowering Plants. Vol. 4, pp. 155-239.
19.

1945. Plant Life in the Pacific World. Pp. 80-81. Macmillan Co.
20. Metcalfe, C. R. and Chalk, L.
1950. Anatomy of the Dicotyledons. Pp. 212-220. Clarendon Press, Oxford, England.
21. Pearson, R. S. and Brown, H. P.
1932. Commercial Timbers of India. Vols. 1 and 2, pp. 67-70, 81-85, illus. (Many refs.) Govt. of India, Calcutta.
22. Reinking, A. O. and Humphrey, C. J.
1931. Laboratory Tests on the Durability of Philippine Woods Against Fungi. Phil. Jour. Sci. Vol. 45, No. 1, pp. 77-89. (Rev. Tropical Woods No. 27, p. 41.)
23. Reyes, Luis J.
1923. Woods of the Philippine Dipterocarps. Phil. Jour. Sci. Vol. 22, No. 3, pp. 291-344 (321-322).
24.

1930. Apitong (*Dipterocarpus* spp.) of Northern Negros. Makiling Echo (Manila) Vol. 9, No. 1, pp. 37-39. (Rev. Tropical Woods No. 22, pp. 14-16.)

25. _____
1930. Characteristic Figure in Philippine Woods. Timberman (Portland, Oreg.) Vol. 31, No. 12, pp. 99-100, illus. (Rev. Tropical Woods No. 25, p. 30.)
26. _____
1938. Philippine Woods. Philippine Bur. For. Tech. Bull. No. 7 (Manila), pp. 34, 280-286, 288-296, 454, 457, 467, 470, 480.
27. _____ and Aguilar, Luis
1934. Properties and Uses of Common Philippine Woods. Makiling Echo (Manila) Vol. 13, No. 3, pp. 139-174. (Rev. Tropical Woods No. 40, p. 52.)
28. Salvoza, F. M. and Lagrimas, Martin
1940. Check List of the Trees of the Philippines With Brief Notes on Their Uses. Phil. Jour. For. Vol. 3, No. 4, pp. 477-547, 4th Quart.
29. Schneider, E. E.
1916. Commercial Woods of the Philippines. Their Preparation and Uses. Philippine Bur. For. Tech. Bull. No. 14 (Manila), pp. 163-164.
30. Scott, C. W.
1932. Tests in the Rangoon River on the Damage by Marine Borers to Various Woods, Including Burma Teak and British Guiana Greenheart, Creosoted and Untreated. Burma Forest Bull. No. 28 (Econ. Ser. No. 5) Rangoon, pp. 10, illus. (Rev. Tropical Woods No. 30, p. 52.)
31. Symington, C. F.
1941. Foresters' Manual of Dipterocarps. Malayan Forest Records, No. 16, pp. 153-166, 178-180. Kuala Lumpur.
32. Tamesis, Florencio
1927. Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ended December 31, 1926. Pp. 292. Manila. (Rev. Tropical Woods No. 14, p. 45.)
33. Thomas, A. V.
1934. Result of Mechanical and Physical Tests on Fully Air-dried Timbers. Malay Forester Vol. 3, pp. 15-17.
34. Timber Development Asso., Ltd.
Some Commercial Timbers of Malaya. Timber Information Ref. No. 38.
35. Whitford, H. W.
1911. The Forests of the Philippines. Forest Types and Products. Philippine Bur. For. Tech. Bull. No. 10 (Manila).