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Forest Products Laboratory,[1] Forest Service
U. S. Department of Agriculture
1955

KOA[2] or KOA-KA

Acacia Koa A. Gray

Family: Leguminosae, Subfamily Mimosoideae

By

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Koa is highly esteemed in Hawaii for both the beauty and usefulness of its wood (17).[3] It is an endemic species originating in the Hawaiian Islands.

The genus Acacia, to which koa belongs, is a very large one with some 500 species (5, 18). The different species of Acacia, trees and shrubs, are scattered through the tropical regions of the world. The center of distribution is Australia and the Oceanic Islands where some 300 species are recognized. Some of these resemble koa, especially the blackwood of Tasmania (A. melanoxylon R. Br.), tatakia of Samoa and viti (A. laurifolia Willd.), and A. heterophylla Willd. of Mauritius (1, 4, 5).

Koa was the royal and sacred wood of the early Hawaiians. It is said to be practically indistinguishable from "shittim" wood (Acacia Seyal Delile) of Palestine and Egypt, the wood believed employed, according to the Bible, in the making of the "Ark of the Covenant" and in building the "Tabernacle" (5, 17).

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

[2] The name Koa is also applied in West Africa to Lophira procera A. Chev. of the Ochnaceae (Tropical Woods, 20:48, 1929. Pub. by Yale School of Forestry, New Haven, Conn.).

[3] Numbers in parentheses refer to the numbered list of references at the end of the article.

The word koa in the Hawaiian language is held to mean "soldier, bold and valiant." It perhaps is associated with the use of koa logs in outrigger dug-out war canoes used in hazardous explorations. The "ka" of the name koa-ka is reputed to indicate irregularity in habit. The word Acacia is said to have been derived from the Greek "akazo" meaning "I sharpen," alluding to the spines or thorns found on some Acacias (5, 18). The name "wattle" is also applied to some Acacias (3, 4).

Distribution and Habitat

The trees may grow in mixture with ohia lehua, or more or less scattered, or may form pure stands (8). The most favored sites are the moist slopes at elevations of 3,000 to 9,000 feet (17) but the species is adaptable and may occur on the lower slopes a few hundred feet above the sea or on the dry and rugged highlands. It is intolerant of shade. Logging is much hampered by the canyons and steep hills where the trees often grow.

The species is readily propagated, grows rapidly and has been planted as a soil conservation measure (5). Three endemic species and two varieties of Acacia are reported from the Hawaiian Islands (3, 5, 18) but only koa is considered of commercial importance. Koa forests are restricted to the Hawaiian Islands in the northern Pacific and occur on all of the larger islands of the group. They are most abundant on the Isle of Hawaii and the densest tracts of timber are reported from the slopes of the volcanic Mauna Loa and Kona (5, 11, 12).

There is a tradition that the little elepaio bird (Chasiempsis sandvicensis) serves as a guide in selecting good trees. If the birds haunt a given tree it was thought to indicate insect infection that degrades the wood (17).

The Tree

Size and Shape

The trunks of koa trees tend to be short and sometimes crooked. The trees are generally spreading in form but, under favorable conditions, may reach a total height of 60 to 100 feet. Sometimes there may be only some 20 feet free from branches but other trees may have a clear length of 40 feet (5). Diameters may range from 2 up to 8 feet (5, 8, 17, 21).

Bark

The bark is more or less astringent and has been used medicinally as well as for leather tanning (13). In Australia mature acacia trees are stripped between September and December. The amount of tannin is related to the soil where the trees grow. Some have as much as 30-35 percent (3).

Leaves

The true leaves of koa in the youth of the tree have many finely divided leaflets (twice pinnate); in older trees, however, true leaves are not produced and in their place phyllodia are formed by a broadening of the leaf stem or petiole into a leaf-like structure (13). Phyllodia enable the plant to survive under dry or xerophytic conditions (3).

The leaves of Acacia koa are almost indistinguishable from those of the Australian blackwood (Acacia melanoxylon) which has been planted in southern California (8, 22).

Flowers and Fruit

The flower heads are made up of numerous small florets presenting a greenish yellow tufted appearance.

The seed pods are long and slender containing up to 12 large, flat, brownish-black beans (13).

Botanically Acacia koa is of interest with respect to its adaptability to environment. It has 52 chromosomes and is classed as a "tetraploid" or one of the "polyploids." All other tetraploid acacias, except koa and the pantropical Acacia Farnesiana Willd., are reported from Asia and Africa. The tetraploids are strictly tropical (2, 20).

The Wood

Color

The heartwood color of mature trees may vary through many rich shades of red, golden brown or brown and may have a satiny lustre. Very old trees may show nearly black streaks. The color is markedly influenced by growth conditions. The sapwood is narrow and yellowish white in color (5, 6, 13, 14, 17).

Weight

The wood weighs about 30 to 52 pounds per cubic foot (10). Specific gravities are reported of 0.46 at 11.2 percent moisture to 0.59 at 6 percent moisture (9).

Mechanical Properties

No comprehensive tests of *Acacia koa* have been made at the Forest Products Laboratory but the results of a few tests on a limited number of samples are as follows:

Acacia Koa Gray
Standard size specimens
(2 x 2 x 30 inches)

Average values

Moisture -- percent (air dry)	11.2
Specific Gravity - volume as tested	0.46
Specific Gravity - oven dry volume	0.49

Static bending, 4 tests

Fiber stress at proportional limit - lb. per sq. in.	10,065
Modulus of rupture - lb. per sq. in.	13,333
Modulus of elasticity - 1,000 lb. per sq. in.	1,573
Work to proportional limit - inch-lb. per cu. in.	3.58
Work to maximum load - inch-lb. per cu. in.	9.13

Impact bending-50 pound hammer, 2 tests

Drop causing complete failure - inches	29

Comp. parallel to grain, 6 tests

Maximum crushing strength - lb. per sq. in.	7,325

Comp. perpendicular to grain, 6 tests

Crushing strength at proportional limit - lb. per sq. in.	1,364

Hardness -- ball test, 5 tests

End - lb.	1,245
Radial - lb.	873
Tangential - lb.	828

Shearing strength, 5 tests

Radial - lb. per sq. in.	1,435	Average
Tangential - lb. per sq. in.	2,126	

Locally it is thought that growth conditions influence hardness (5). The material tested was slightly harder than black walnut.

Grain, Texture, and Figure

Large trees may be straight grained and tend to be lacking in the attractive figure produced when the grain is twisted or wavy, a characteristic for which koa veneer is noted. The wood is said to "run clear" to an unusually high degree. Curly, wavy grained wood, however, may occur, particularly near the butts of the trees. Wood for ornamental purposes is usually cut "on the quarter." "Fiddle-back" markings, varying widely, predominate (5, 17, 19).

The texture is described as unifrom; the pores, visible without magnification, being quite evenly distributed. Some contain gummy material.

Odor and Taste

Koa is not favored for food calabashes as it is thought to flavor the food disagreeably (13).

Durability

The heartwood of mature trees is reported to be durable. The living trees have insect enemies but seasoned wood is reported remarkably resistant to insect infestation and fungal decay (5).

Seasoning

Both solid wood and veneer are said to season without bad surface checking or warping (5, 17) and to hold shape well. Shrinkage is reported as follows: Longitudinal 0.49, radial 5.47, tangential 6.19, and volumetric 12.39 (9).

Working Characteristics

The wood is considered strong and dent resistant, as well as easy to work and to carve. It is possible to finish it with a high polish.

The veneer glues well and has been found satisfactory for the production of panels.

Uses

In early times koa was used for dugout war canoes, spear handles, royal coffins and general construction. Because of the natural beauty of the wood the interior of the famed Iolani Palace, built in Hawaii in 1882 was largely finished in koa (23).

In modern times its inherent resonance characteristics have led to its use for ukeleles, parts of organs, pianos, other musical instruments and radio cabinets. It is also used for interior trim, furniture, cabinet work, turnery, carving, boats, boat planking, oars, paddles, surf boards, ship's knees (from the large branches), furniture, cabinet work, picture frames, handles, gunstocks, crutches, wheels and other vechicle parts, posts, fencing, bridges, railway cars, figured veneer panels, wooden ware, and poi bowls and boards (5, 13).

Acacia melanoxylon similar to koa has been offered as an alternate for mahogany for selected uses (16) and is said to be about equal to American walnut (15).

Availability

Koa was reported in 1948 to be available for purchase for furniture or cabinet work in both western and eastern markets in the United States (23, 24).

Choice veneers are reported to come from the shorter trees with wide crowns that grow in exposed places at elevations above the area of highest rainfall. Crooked branches of such trees may extend out nearly at right angles to the trunk at heights of 5 to 20 feet above the ground. Sliced veneers with flat, smooth "tight" surfaces have been produced.

Peculiarities

Koa is considered a resinous wood. The center of a log may contain gummy streaks near the pith.

Some acacias yield perfume from their flowers.

Acacias often yield gums, including gum arabic (2, 7) and these may be used as adhesives in textile printing and medicinally in animal salves.

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