

Technical Data Report

for

ANDIROBA

Carapa guianensis



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Andiroba

Preprinted from *Herbal Secrets of the Rainforest*, 2nd edition, by Leslie Taylor
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Family: Meliaceae

Genus: *Carapa*

Species: *guianensis*, *procera*

Common Names: Andiroba, andiroba-saruba, bastard mahogany, Brazilian mahogany, iandirova, carapa, carapá, cedro macho, crabwood, figueroa, krpa, nandiroba, requia, tangare, y-andiroba

Parts Used: Seed oil, bark, and leaves

Andiroba is a tall tree that grows up to 40 m. high. It is in the same family as mahogany, and has been called Brazilian mahogany or bastard mahogany due to its similarity. It can be found growing wild throughout the Amazon rainforest, usually on rich soils, in swamps, and in the alluvial flats, marshes and uplands of the Amazon Basin. It can also be found wild or under cultivation in Brazil in the Islands region, Tocantins, Rio Solimoes and near the seaside. It is one of the large leafed trees of the rainforest and can be identified by its distinctive textured leaves.

Andiroba wood is soft and much sought after by sawmills. It has in the past been shipped to the United States for utilization in the furniture industry and other uses. Its durability and impalatability to insects have guaranteed commercial demand for the wood, and as a result the species has been devastated in all areas near major towns in Amazonia. It could, however, be cultivated easily in the Amazon or other regions of Brazil.

The andiroba tree produces a brown, woody, four-cornered nut some 3–4 inches across that resembles a chestnut. The nut contains several oil-rich kernels or seeds averaging about 63% oil which is a pale yellow color. Andiroba oil is a sustainable rainforest product which has a long history of use in South America as well as commercial value. A single tree will produce, on average, about 200 kg of nuts annually. Approximately 6 kg of nuts are required to produce 1 kg (about a liter) of andiroba oil using the traditional extraction method. This traditional method is efficient, if somewhat primitive. The seeds are collected from rivers, where they float after being shed by trees, or from the forest floor. They are then boiled in a large pot of water, left for some two weeks until they have rotted, then squeezed (in a primitive press known as a *tipiti*) to extract the oil and, sometimes, fatty solids. One consequence of this extraction method is that crude andiroba oil is associated frequently with a red coloring which is derived from the skin of the seeds. Because the oil becomes rancid very quickly, requiring rapid use, local usage is mostly limited to immediate use or the manufacture of soap or candles.

Andiroba has provided many uses for indigenous peoples in the Amazon for centuries and virtually all parts of the tree, as well as the nut oil are utilized. The Munduruku Indians traditionally used the oil for the mummification of human heads taken as war trophies. The Wayãpi, Palikur, and Creole Indian tribes have used andiroba oil to remove ticks from their scalps, other skin parasites, and even in the process of tanning animal hides. The indigenous tribes of Northwest Amazonia brew the bark, and sometimes leaves, into a tea for fevers and intestinal worms, and also apply this tea externally as a wash for ulcers, skin problems and skin parasites. Indians have also used the oil as a solvent for extracting the plant pigments and colorants with which they paint their skin. Several Indian tribes in the Amazon combine andiroba oil with the reddish-orange pigment extracted from annatto seeds (also featured in this book). This oily orange paste is rubbed all over their bodies and even rubbed into their hair to protect them from biting insects and to repel rain water (which they are constantly exposed to in the rainforest).

Andiroba oil burns well and is used as a natural lamp fuel in the rainforest. In the early 1800's the street lamps of Belém Brazil burned andiroba oil. Not only does it burn cleanly with little smoke, it also repels mosquitos, flies and other pests. Traditional forest-dwellers and river people

in Brazil called *Caboclos* make a medicinal soap using crude andiroba oil, wood ash, and cocoa skin residue. This soap is especially recommended for the treatment of skin diseases and as an insect repellent. They also apply andiroba oil directly on joints to remedy arthritis pain, and mix it with hot water and human milk—and drop it into the ear—for ear infections. To aid digestion, the bark is soaked in water for a day and one cup is taken before meals.

Many of these uses continue today in Brazilian herbal medicine systems. Andiroba oil is used by Brazilian city dwellers either in pure form or mixed with other fatty oils or natural products. They apply it externally to wounds and bruises, use it as a massage oil and natural insect repellent, and employ it topically for many skin diseases and conditions including psoriasis. A common natural remedy in Brazil is to soak 1/4 of a *cabacinha* (the fruit of *Luffa operculata*) in 250 ml of hot andiroba oil to yield an infusion that is rubbed into the skin to relieve arthritis and rheumatism and to cauterize wounds. A teaspoon of this preparation is also gargled for sore throats and taken internally for coughs. Andiroba is also still widely used as an insect repellent and for treating insect bites for both people and animals. The oil is commercially manufactured into anti-inflammatory, antibacterial, antiarthritic, and insect repellent soaps as well as turned into candles which are sold as natural insect repellents. The oil is also used in Brazil as a furniture polish which is thought to protect wooden furniture from termites and other wood-chewing insects.

Andiroba oil is a rich source of essential fatty acids including oleic, palmitic, stearic and linoleic acids. It yields up to 65% unsaturated fatty acids and can contain up to 9% linoleic acid. (Linoleic acid has shown in various studies over the years to reduce cholesterol, reduce hypertension and provide anticancer benefits.) All parts of the tree (including the oil) tastes very bitter. This bitterness is attributed to a group of terpene chemicals called *meliacins*, which are very similar in structure to the bitter anti-malarial quassinoid chemicals found in other tropical plants. One of these meliacins, called *gedunin*, has recently been documented with antiparasitic properties and an anti-malarial effect equal to that of quinine.^{1,2} Chemical analysis of andiroba oil, bark and leaves have also identified the presence of another group of chemicals called *limonoids*. The anti-inflammatory and insect repellent properties of andiroba oil are attributed to the presence of these limonoids, including a novel one which has been named *andirobin*. Another limonoid called *epoxyzadiradione* is found in andiroba oil and it has been documented with *in vitro* antitumor effects (neuroblastoma and osteosarcoma cancer cell lines were tested).³

Tests of crude andiroba oil by Brazilian scientists have produced evidence of its anti-inflammatory and analgesic properties.⁴ The bark has demonstrated *in vitro* antibacterial activity in another clinical study.⁵ At least three chemicals found in andiroba thus far have been found to have antiparasitic and/or insecticidal actions.^{6,7} A branch of the Brazilian government has been working with andiroba's insect repellent properties,⁸ and is soon to produce an insect repellent product utilizing andiroba oil which will be provided to the military and other government workers who are exposed to mosquitos and other biting bugs in the forests of Brazil. In 1999 a U.S. patent was filed detailing that andiroba oil had the ability to prevent cellulite through a chemical enzyme-blocking action when applied topically (unfortunately, it didn't have to ability to get rid of existing cellulite).⁹ Some of the more recent research has focused on andiroba's anticancerous actions. In 2002 researchers reported that the seed oil could prevent and even reverse cervical dysplasia.¹⁰ Cervical dysplasia is a precancerous condition that can oftentimes develop into cervical cancer. In addition the leaf, bark, seeds and flowers have shown some activity against sarcoma cancer cells *in vitro*,⁵ and the crude oil passed a preliminary screening test to predict antitumor activity.⁴

Andiroba oil is well known in Brazil and widely employed for its benefits to heal many skin conditions, and as a natural insect repellent. In the last several years, several andiroba oil products sold in capsules have appeared in the Brazilian market and recommended for cancer and internal healing. North American practitioners are just beginning to learn of andiroba's powerful healing properties. Andiroba oil can be applied topically several times daily to rashes, muscle/joint aches and injuries, wounds, insect bites, boils, and ulcers. It can also be used by itself or combined with other oils as a healing and anti-inflammatory massage oil as well as placed in the ears for ear infections. It's also a great natural remedy for ear mites in dogs and cats - just place a drop or two

in the affected ears daily for a week.

Documented Properties & Actions: Analgesic, antibacterial, anti-inflammatory, antimalarial, antiparasitic, antiseptic, antitumor, cicatrizant, cytotoxic, emollient, febrifuge, insecticide, vermifuge

Traditional Remedy: For skin conditions, insect bites and sore muscles and joints; liberally apply the oil topically to the affected area several times daily. For ear infections, place 2 drops of the oil inside the ears. For internal use, generally 2 ml in a small glass of warm water is taken 2-3 times daily (this can also be used as a gargle for sore throats).

Contraindications: None known.

Drug Interactions: None reported.

Phytochemicals: andirobin, arachidic acid, 6-alpha-acetoxy-epoxyzadiradione, 6-alpha-11-beta-diacetoxygedunin, 6-alpha-acetoxygedunin, 6-alpha-hydroxygedunin, 6-alpha-11-beta-dihydroxy 7-deacetoxygedunin, 6-alpha-7-alpha-11-beta-trihydroxy 7-deacetoxygedunin, 7-alpha-hydroxy 7-deacetoxygedunin, 6-beta-acetoxygedunin, 6-beta-11-beta-diacetoxygedunin, 11-beta-acetoxygedunin, 7-deacetoxy-7-oxogedunin, 7-desacetoxy-7-ketogedunin, epoxyzadiradione, gedunin, hexadecenoic acid, linoleic acid, linolenic acid, oleic acid, palmitic acid, palmitoleic acid, stearic acid

WORLDWIDE ETHNOBOTANICAL USES

Country	Uses
Amazonia	Arthritis, bitter, cold, chiggers, digestion, feet, fever, flu, insect bites, insect repellent, insecticide, itch, leprosy, lice, malaria, mites, parasites, skin problems, soap, tetanus, ulcer, worms
Brazil	Acne, analgesic, anti-inflammatory, bitter, bruises, anti-diarrheac, arthritis, cancer, cough, cuts, dermatitis, diabetes, diarrhea, digestive aid, ear infections, fevers, hepatitis, herpes, inflammation, insect bites, insect repellent, malaria, muscle pain, parasites, psoriasis, purgative, rheumatism, skin diseases, skin rashes, skin ulcers, soap, sores, splenitis, throat, tonic, worms, wound
Guatemala	Insect repellent
Guyana	Anti-inflammatory, emollient, insect repellent, insecticide, muscle pain, rheumatism, skin rash, ticks
Nicaragua	Astringent, diarrhea, skin problems
Panama	Arthritis
Peru	Dermatitis, fever, herpes, skin sores, worms
Trinidad	Colds, fever, flu, insectifuge, fever, massage oil, sore feet
Venezuela	Itch, leprosy, malaria, parasites, skin problems
Elsewhere	Arthritis, herpes, insect repellent, insecticide, skin disorders, soap, tetanus

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The information contained herein is intended for education, research, and informational purposes only. This information is not intended to be used to diagnose, prescribe or replace proper medical care. The statements contained herein have not been evaluated by the Food and Drug Administration. The plant described herein is not intended to diagnose, treat, cure, mitigate, or prevent any disease.

Ethnomedical Information on Andiroba (*Carapa guianensis*)

Part / Location	Documented Ethnomedical Uses	Type Extract / Route	Used For	Ref #
Oil Amazonia	Used for arthritis, cold, feet, fever, flu, insecticide, itch, leprosy, malaria, parasiticide, pediculicide, repellent, skin and tetanus.	Not Stated	Human Adult	ZZ1047
Bark + Leaf Amazonia	Used as a bitter, febrifugal and vermifugal. Used for ulcers and skin troubles.	Not Stated Oral Not Stated External	Human Adult	ZZ1005
Bark Brazil	Used for diarrhea, vermis and fever. Used for wounds, herpes and acne.	Decoction Oral Maceration External	Human Adult	BR1001
Bark Brazil	Used for fevers and malaria.	Decoction Oral	Human Adult	K07977
Seed Brazil	Used for hepatitis, worms and splenitis. Used for rheumatism, ulcer, poisonous insect bites and herpes.	Not Stated Oral Not Stated External	Human Adult	BR1001
Cortex Brazil	Used to treat throat inflammations and to heal insect bites, cuts, sores and bruises. Used to treat diarrhea and diabetes. Used as a digestive stimulant.	Decoction External Decoction Oral Bark Oral	Human Adult	K20709
Fruit Fixed Oil Brazil	Used as an antiphlogistic and antiarthritic.	Not Stated Oral	Human Adult	T08730
Seed Oil Brazil	Used to treat arthritis, throat inflammations, to heal insect bites, cuts, sores and bruises and to treat ear infection. Used to treat uterine cancer. Oil is applied by finger to the cervix wall.	Seed Oil External Seed Oil Vaginal	Human Adult Human Adult	K20709
Seed Oil Brazil	Used as an anti-inflammatory and antiarthritic.	Seed Oil Not Stated	Human Adult	ZZ1045
Oil Brazil	Used for cough.	Oil Oral	Human Adult	ZZ1024
Bark + Leaf Colombia	Used as a febrifuge.	Decoction Oral	Human Adult	K16262
Bark Guyana	Used for rheumatism.	Hot H2O Ext Oral	Human Adult	X00016
Oil Guyana	Used to remove ticks and <i>Schongastia guianensis</i> . Used as an emollient and anti-inflammatory for skin rash.	Oil External	Human Adult	ZZ1033
Oil Guyana	Used against muscle fatigue and for strained muscles.	Oil External	Human Adult	BR1003

Part / Location	Documented Ethnomedical Uses	Type Extract / Route	Used For	Ref #
Oil Guyana	Used as an insecticide and protectant against the rain.	Seed Oil External	Human Adult	BR1002
Bark Nicaragua	Used for diarrhea and for rituals.	Decoction Oral	Human Adult	K27070
Bark Nicaragua	Used for diarrhea. Used as an astringent.	Decoction Oral Decoction External	Human Adult Human Adult	L16047
Bark Peru	Used as a febrifuge and vermifuge. Used for skin sores, dermatitis and herpes.	Infusion Oral Infusion External	Human Adult Human Adult	L04137
Bark Peru	Used for herpes.	Infusion Not Stated	Human Adult	ZZ1041

Presence of Compounds in Andiroba (*Carapa guianensis*)

Compound	Chemical type	Plant Part	Plant Origin	Quantity	Ref #
Andirobin	Alkaloid	Seed	Not Stated	Not Stated	ZZ1022
Arachidic acid	Lipid	Seed	Not Stated	1.2%	BR1003
Azadiradione, 6-alpha-acetoxy-epoxy	Triterpene	Plant	Not Stated	Not Stated	ZZ1022
Azadiradione, epoxy	Triterpene	Plant	Not Stated	Not Stated	ZZ1022
Fat	Lipid	Seed	Not Stated	550,000-650,000 ppm	ZZ1022
Gedunin	Triterpene	Not Stated	Trinidad	Not Stated	N02487
Gedunin, 6-alpha-11-beta-diacetoxy	Triterpene	Heartwood Not Stated	West Indies Trinidad	Not Stated Not Stated	J08008 N02487
Gedunin, 6-alpha-acetoxy	Triterpene	Not Stated Heartwood	Trinidad West Indies	Not Stated Not Stated	N02487 J08008
Gedunin, 6-alpha-hydroxy	Triterpene	Plant	Not Stated	Not Stated	ZZ1022
Gedunin, 6-beta-acetoxy	Triterpene	Seed	Not Stated	Not Stated	ZZ1022
Gedunin, 6-beta, 11-beta-diacetoxy	Triterpene	Bark	Not Stated	Not Stated	ZZ1022
Gedunin, 7-deacetoxy-7-oxo	Triterpene	Plant	Not Stated	Not Stated	ZZ1022
Gedunin, 7-deacetoxy: 6-alpha-11-beta-dihydroxy	Triterpene	Not Stated	Trinidad	Not Stated	N02487
Gedunin, 7-deacetoxy: 6-alpha-7-alpha-11-beta-trihydroxy	Triterpene	Not Stated	Trinidad	Not Stated	N02487
Gedunin, 7-desacetoxy-7-keto	Triterpene	Seed	Not Stated	Not Stated	ZZ1022
Gedunin, 7-deacetoxy: 7-alpha-hydroxy	Triterpene	Not Stated	Trinidad	Not Stated	N02487
Gedunin, 11-beta-acetoxy	Triterpene	Bark	Not Stated	Not Stated	ZZ1022
Hexadecenoic acid	Lipid	Seed	Not Stated	1%	BR1004

Compound	Chemical type	Plant Part	Plant Origin	Quantity	Ref #
Linoleic acid	Lipid	Seed	Not Stated	9%	BR1003
Linolenic acid	Lipid	Seed	Not Stated	0.3%	BR1003
Oleic acid	Lipid	Seed	Not Stated	275,000-375,000 ppm	ZZ1022
Palmitic acid	Lipid	Seed	Not Stated	55,000-65,000 ppm	ZZ1022
Palmitoleic acid	Lipid	Seed	Not Stated	1%	BR1003
Stearic acid	Lipid	Seed	Not Stated	220,000-260,000 ppm	ZZ1022

PHYTOCHEMICAL SCREENING

ALKALOIDS PRESENT SEED A01890
 BARK L16047

Biological Activities for Extracts of Andiroba (*Carapa guianensis*)

Part -Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Bark Malaysia	Toxicity Assessment (quantitative)	MEOH-H2O (1:1) Ext	IP Mouse	LD50=750.0 mg/kg			A01890
Flowers Malaysia	Toxicity Assessment (quantitative)	MEOH-H2O (1:1) Ext	IP Mouse	LD50=750.0 mg/kg			A01890
Leaf Malaysia	Toxicity Assessment (quantitative)	MEOH-H2O (1:1) Ext	IP Mouse	LD50=46.0 mg/kg			A01890
Seed Malaysia	Toxicity Assessment (quantitative)	MEOH-H2O (1:1) Ext	IP Mouse	LD50=>1.0 gm/kg			A01890
Bark Malaysia	Antibacterial Activity	MEOH-H2O (1:1) Ext	Agar Plate	Not Stated	Active	<i>Proteus vulgaris</i>	A01890
Not Stated Heartwood	Antifungal Activity	Hot H2O Ext	Agar Plate	Not Stated	Active	<i>Lenzites trabea</i>	A00835
Not Stated Heartwood	Antifungal Activity	Hot H2O Ext	Agar Plate	Not Stated	Active	<i>Poria microspora</i>	A00835
Leaf Puerto Rico	Insecticide Activity	Plant	Not Stated	Not Stated	Inactive	<i>Serotoma ruficornis</i> adults (less than 40.0% toxicity)	A06820
Leaf Puerto Rico	Larvicidal Activity	Plant	Not Stated	Not Stated	Inactive	<i>Diaphania hyalinata</i> larvae <i>Laphygma frugiperda</i> larvae <i>Plutella maculipennis</i> larvae (less than 40.0% toxicity.)	A06820
Seed Oil Brazil	Cytotoxic Activity	Seed Oil	Not Stated	Not Stated	Active	Uterine cervical neoplasia.	BR1012
Leaf Malaysia	Antitumor Activity	MEOH-H2O (1:1) Ext	IP Rat	1.0 gm/kg	Equivocal	Sarcoma(Yoshida asc).	A01890
Bark Malaysia	Antitumor Activity	MEOH-H2O (1:1) Ext	IP Rat	1.0 gm/kg	Equivocal	Sarcoma(Yoshida asc).	A01890
Flowers Malaysia	Antitumor Activity	MEOH-H2O (1:1) Ext	IP Rat	1.0 gm/kg	Equivocal	Sarcoma(Yoshida asc).	A01890
Seed Malaysia	Antitumor Activity	MEOH-H2O (1:1) Ext	IP Rat	1.0 gm/kg	Equivocal	Sarcoma (Yoshida asc).	A01890

Part -Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Cortex Brazil	Anticrustacean Activity	H2O Ext	Not Stated	200.0 mg/liter	Weak Activity	<i>Artemia salina</i> larvae assay. System is intended to predict for antitumor activity.	K20709
Seed Oil Brazil	Anticrustacean Activity	Seed Oil	Not Stated	LC50=42.3 mg/liter	Active	<i>Artemia salina</i> larvae assay. System is intended to predict for antitumor activity.	K20709
Cortex Brazil	Glycosidase Inhibition	H2O Ext	Not Stated	10.0 mcg	Inactive		K20709
Seed Oil France	Adipocyte Differentiation Inhibition	Seed Oil	In vitro	0.01-100%	Active	Inhibits the differentiation of preadipocyte into adipocyte, thereby preventing cellulite.	BR1004
Seed Oil France	Glucose-6-phosphate dehydrogenase Inhibition	Seed Oil	In vitro	Not Stated	Active	Glucose-6-phosphate dehydrogenase is a key enzyme in differentiation of preadipocytes to adipocytes.	BR1004

Biological Activities for Compounds of Andiroba (*Carapa guianensis*)

Compound Tested	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Epoxyazadiradione	Cytotoxic Activity	In vitro	IC50=27 microM	Active	N1E-115 neuroblastoma (mouse) cell line. 143B.TK-osteosarcoma (human) cell line. Sf9 (insect) cell line.	BR1005
Gedunin	Insect Growth Inhibitor	Larvae	LD50=10.78 ppm	Active	<i>S. frugiperda</i> adults and neonate larvae.	BR1007
Gedunin	Insect Growth Inhibitor	Larvae	LC50=39 ppm	Active	Caused mortality, reduced pupal weights and adult emergence of <i>Spodoptera frugiperda</i> .	BR1008
Gedunin	Antimalarial Activity	In vitro In vivo (mouse)	Not Stated	Active Equivocal	<i>Plasmodium falciparum</i> <i>Plasmodium berghei</i>	BR1006
Gedunin	Antimalarial Activity	In vitro	IC50=1.25-9.63 mcg/ml	Active	<i>Plasmodium falciparum</i> . Additive effect exhibited when combined with chloroquine.	BR1009
Gedunin	Antimalarial Activity	In vitro	Not Stated	Active Weak Activity	<i>Plasmodium falciparum</i> chloroquine-sensitive. <i>Plasmodium falciparum</i> chloroquine-resistant.	BR1010
Gedunin	Antimalarial Activity	In vitro	IC50=1 microM	Active	Effect equivalent to quinine.	BR1011

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