

## Pau d'Arco (*Tabebuia impetiginosa*)

**Family:** Bignoniaceae

**Genus:** *Tabebuia*

**Species:** *impetiginosa*

**Synonyms:** *Tabebuia avellanadae*, *T. ipe*, *T. nicaraguensis*, *T. schunkeuigoii*, *T. serratifolia*, *T. altissima*, *T. palmeri*, *Gelsemium avellanadae*, *Handroanthus avellanadae*, *H. impetiginosus*, *Tecoma adenophylla*, *Tecoma avellanadae*, *Tecoma eximia*, *Tecoma impetiginosa*, *Tecoma integra*, *Tecoma ipe*

**Common Names:** Pau d'arco, ipê, ipê roxo, lapacho, tahuari, taheebo, trumpet tree, ipê-contra-sarna, tabebuia ipê, tajy

**Part Used:** Bark, wood

From [The Healing Power of Rainforest Herbs](#):

PAU D'ARCO		
HERBAL PROPERTIES AND ACTIONS		
<b>Main Actions</b> <ul style="list-style-type: none"><li>• kills bacteria</li><li>• kills fungi</li><li>• kills leukemia cells</li><li>• kills viruses</li><li>• relieves pain</li><li>• reduces inflammation</li><li>• kills parasites</li><li>• fights free radicals</li><li>• reduces tumors</li></ul>	<b>Other Actions</b> <ul style="list-style-type: none"><li>• thins blood</li><li>• enhances immunity</li><li>• mildly laxative</li><li>• relieves rheumatism</li><li>• dries secretions</li></ul>	<b>Standard Dosage</b> <p>Bark, Heartwood</p> <p><b>Decoction:</b> 1/2 cup 2-4 times daily</p> <p><b>Tincture:</b> 2-3 ml 2-3 times daily</p> <p><b>Capsules:</b> Not recommended</p>

Pau d'arco is a huge canopy tree native to the Amazon rainforest and other tropical parts of South and Latin America. It grows to 30 m high and the base of the tree can be 2–3 m in diameter. The *Tabebuia* genus includes about 100 species of large, flowering trees that are common to South American cities' landscapes for their beauty. The tree also is popular with timber loggers—its high-quality wood is some of the heaviest, most durable wood in the tropics. Pau d'arco wood is widely used in the construction of everything from houses and boats to farm tools. The common name *pau d'arco* (as well as its other main names of commerce, *ipê roxo* and *lapacho*) is used for several

different species of *Tabebuia* trees that are used interchangeably in herbal medicine systems. *T. impetiginosa* is known for its attractive purple flowers and often is called "purple lapacho." It has been the preferred species employed in herbal medicine. It is often referred to by its other botanical name, *Tabebuia avellanedae*; both refer to the same tree. Other pau d'arco species produce pink (*T. heptaphylla*), yellow (*T. serratifolia* and *T. chrysantha*) or white (*T. bahamensis*) flowers. Though many of these species may have a similar phytochemical makeup, they are different species of trees.

## **TRIBAL AND HERBAL MEDICINE USES**

Pau d'arco has a long and well-documented history of use by the indigenous peoples of the rainforest. Indications imply that its use may actually predate the Incas. Throughout South America, tribes living thousands of miles apart have employed it for the same medicinal purposes for hundreds of years. Several Indian tribes of the rainforest have used pau d'arco wood for centuries to make their hunting bows; their common names for the tree mean "bow stick" and "bow stem." The Guarani and Tupi Indians call the tree *tajy*, which means "to have strength and vigor." They use the bark to treat many different conditions and as a tonic for the same strength and vigor it puts into their bows. Pau d'arco is recorded to be used by forest inhabitants throughout the Amazon for malaria, anemia, colitis, respiratory problems, colds, cough, flu, fungal infections, fever, arthritis and rheumatism, snakebite, poor circulation, boils, syphilis, and cancer.

Pau d'arco also has a long history in herbal medicine around the world. In South American herbal medicine, it is considered to be astringent, anti-inflammatory, antibacterial, antifungal, and laxative; it is used to treat ulcers, syphilis, urinary tract infections, gastrointestinal problems, candida and yeast infections, cancer, diabetes, prostatitis, constipation, and allergies. It is used in Brazilian herbal medicine for many conditions including cancer, leukemia, ulcers, diabetes, candida, rheumatism, arthritis, prostatitis, dysentery, stomatitis, and boils. In North American herbal medicine, pau d'arco is considered to be analgesic, antioxidant, antiparasitic, antimicrobial, antifungal, antiviral, antibacterial, anti-inflammatory, and laxative, as well as to have anticancerous properties. It is used for fevers, infections, colds, flu, syphilis, urinary tract infections, cancer, respiratory problems, skin ulcerations, boils, dysentery, gastrointestinal problems of all kinds, arthritis, prostatitis, and circulation disturbances. Pau d'arco also is employed in herbal medicine systems in the United States for lupus, diabetes, ulcers, leukemia, allergies, liver disease, Hodgkin's disease, osteomyelitis, Parkinson's disease, and psoriasis, and is a popular natural remedy for candida and yeast infections. The recorded uses in European herbal medicine systems reveal that it is used in much the same way as in the United States, and for the same conditions.

## **PLANT CHEMICALS**

The chemical constituents and active ingredients of pau d'arco have been well documented. Its use with (and reported cures for) various types of cancers fueled much of the early research in the early 1960s. The plant contains a large amount of chemicals known as quinoids, and a small quantity of benzenoids and flavonoids. These quinoids

(and, chiefly, anthraquinones, furanonaphthoquinones, lapachones, and naphthoquinones) have shown the most documented biological activity and are seen to be the center of the plant's efficacy as an herbal remedy. In the 1960s, plant extracts of the heartwood and bark demonstrated marked antitumor effects in animals, which drew the interest of the National Cancer Institute (NCI). Researchers decided that the most potent single chemical for this activity was a naphthoquinone chemical named *lapachol* and they concentrated solely on this single chemical in their subsequent cancer research. In a 1968 study, lapachol demonstrated highly significant activity against cancerous tumors in rats.

By 1970, NCI-backed research already was testing lapachol in human cancer patients. The institute reported, however, that their first Phase I study failed to produce a therapeutic effect without side-effects - and they discontinued further cancer research shortly thereafter. These side-effects were nausea and vomiting (very common with chemotherapy drugs) and anti-vitamin K activity (the main concerns over which caused anemia and an anticoagulation effect). Interestingly, other chemicals in the whole plant extract (which, initially, showed positive antitumor effects and very low toxicity) demonstrated positive effects on vitamin K and, conceivably, compensated for lapachol's negative effect. Once again, instead of pursuing research on a complex combination of at least 20 active chemicals in a whole plant extract (several of which had antitumor effects and other positive biological activities), research focused on a single, patentable chemical-and it didn't work as well. Despite NCI's abandonment of the research, another group developed a lapachol analog (which was patentable) in 1975. One study reported that this lapachol analog increased the life span of mice inoculated with leukemic cells by over 80%. In a small, uncontrolled, 1980 study of nine human patients with various cancers (liver, kidney, breast, prostate, and cervix), pure lapachol was reported to shrink tumors and reduce pain caused by them - and three of the patients realized complete remissions.

The phytochemical database housed at the U.S. Department of Agriculture has documented lapachol as being antiabscess, anticarcinomic, antiedemic, anti-inflammatory, antimalarial, antiseptic, antitumor, antiviral, bactericidal, fungicidal, insectifugal, pesticidal, protisticidal, respiratory depressant, schistosomicidal, termiticidal, and viricidal. It's not surprising that pau d'arco's beneficial effects were seen to stem from its lapachol content. But another chemical in pau d'arco, beta-lapachone, has been studied closely of late-and a number of recent patents have been filed on it. It has demonstrated in laboratory studies to have activities similar to lapachol (antimicrobial, antifungal, antiviral, antitumor, antileukemic, and anti-inflammatory), with few side-effects. In one of these studies on beta-lapachone and other quinones in pau d'arco, researchers reported: "Because of their potent activity against the growth of human keratinocytes, some lapachol-derived compounds appear to be promising as effective antipsoriatic agents." In a 2002 U.S. patent, beta-lapachone was cited to have significant anticancerous activity against human cancer cell lines including: promyelocytic leukemia, prostate, malignant glioma, colon, hepatoma, breast, ovarian, pancreatic, multiple myeloma cell lines and drug-resistant cell lines. In yet another U.S.

patent, beta-lapachone was cited with the *in vivo* ability to inhibit the growth of prostate tumors.

The main plant chemicals in pau d'arco include: acetaldehydes, alpha-lapachone, ajugols, anisic acid, anthraquinones, benzoic acids, benzenes, beta-lapachone, carboxaldehydes, chromium, chrysanthemin, dehydro-alpha-lapachone, dehydroisolapachone, deoxylapachol, flavonoids, furanonaphthoquinones, hydrochlorolapachol, 2-hydroxy-3-methyl-quinone, 6-hydroxy-mellein, iso-8-hydroxy-lariciresinol, kigelinone, lapachenol, lapachenole, lapachol, lapachones, menaquinones, 4-methoxyphenol, naphthoquinones, paeonidin-3-cinnamyl-sophoroside, phthiolol, quercetin, tabebuina, tectoquinone, vanillic acid, vanillin, veratric acid, veratric aldehyde, and xyloidone.

## **BIOLOGICAL ACTIVITIES AND CLINICAL RESEARCH**

In addition to its reported antitumor and antileukemic activities, pau d'arco clearly has demonstrated broad spectrum actions against a number of disease-causing microorganisms, which supports its wide array of uses in herbal medicine. Antimicrobial properties of many of pau d'arco's active phytochemicals were demonstrated in several clinical studies, in which they exhibited strong *in vitro* activity against bacteria, fungi, and yeast (including *Candida*, *Aspergillus*, *Staphylococcus*, *Streptococcus*, *Helicobacter pylori*, *Brucella*, tuberculosis, pneumonia, and dysentery). In addition to its isolated chemicals, a hot water extract of pau d'arco demonstrated antibacterial actions against *Staphylococcus aureus*, *Helicobacter pylori* (the bacteria that commonly causes stomach ulcers), and *Brucella*. A water extract of pau d'arco was reported (in other *in vitro* clinical research) to have strong activity against 11 fungus and yeast strains. Pau d'arco and its chemicals also have demonstrated *in vitro* antiviral properties against various viruses, including Herpes I and II, influenza, polio virus, and vesicular stomatitis virus. Its antiparasitic actions against various parasites (including malaria, schistosoma, and trypanosoma) have been confirmed as well. Finally, bark extracts of pau d'arco have demonstrated anti-inflammatory activity and have shown success against a wide range of induced inflammation in mice and rats.

## **CURRENT PRACTICAL USES**

Pau d'arco is an important resource from the rainforest with many applications in herbal medicine. Unfortunately, its popularity and use have been controversial due to varying results obtained with its use. For the most part, these seem to have been caused by a lack of quality control—and confusion as to which part of the plant to use and how to prepare it. Many species of *Tabebuia*, as well as other completely unrelated tree species exported today from South America as “pau d'arco,” have few to none of the active constituents of the true medicinal species. Pau d'arco lumber is in high demand in South America. The inner bark shavings commonly sold in the U.S. are actually by-products of the timber and lumber industries. Even mahogany shavings from the same sawmill floors in Brazil are swept up and sold around the world as “pau d'arco” (due to the similarity in color and odor of the two woods). In 1987, a chemical analysis of 12

commercially-available pau d'arco products revealed only one product containing lapachol—and only in trace amounts. As lapachol concentration typically is 2–7% in true pau d'arco, the study surmised that the products were not truly pau d'arco, or that processing and transportation had damaged them. Most pau d'arco research has centered on the heartwood of the tree.

Most of the commercially-available products, though, contain the inner and outer bark of the tree—which is stripped off at sawmills when the heartwood is milled into lumber for construction materials. Additionally, at least 10 species of *Tabebuia* are logged commercially in South America for lumber purposes alone. When these logs arrive at lumber mills, the identifying leaves and flowers (which distinguish the tree species) are long gone—it's all just “pau d'arco.” This may explain varying species of pau d'arco bark being sold as herbal products—and their resulting (diminished) quality. Finally, many consumers and practitioners are unaware that, for the best results when extracting these particular active chemicals (even after obtaining the correct species), the bark and/or wood must be boiled at least 8–10 minutes—rather than brewed as a simple tea or infusion (lapachol and the other quinoids are not very water soluble).

It is therefore not surprising that consumers and practitioners are experiencing spotty results with commercially-available pau d'arco products. With its many effective applications, however, it would behoove consumers to take the time to learn about the available products and suppliers, and find a reliable source for this important medicinal plant from the rainforest. Relatively new in the marketplace are standardized extracts of pau d'arco (that guarantee the amount of lapachol and/or naphthoquinones). In such a product, it would be unclear if other active quinones have been extracted (and to what extent) in these chemically-altered products. Although the natural wood and bark are quite effective when the correct species is used and prepared properly, the new standardized extracts may be the safer (although more expensive) purchase for most laypersons and general consumers concerned about quality but which don't have the time to research each product.

There have been no reports of human toxicity when a whole-bark decoction or tincture of pau d'arco is used. The oral LD<sub>50</sub> dosage for lapachol is reported to be 1.2–2.4 g/kg (body weight) in rats and 487–621 mg/kg in mice. Good quality pau d'arco (*Tabebuia impetiginosa*) contains an average of 4% lapachol (or 40 mg of lapachol per gram of pau d'arco bark/wood).

#### PAU D'ARCO PLANT SUMMARY

**Main Preparation Method:** tincture or decoction

**Main Actions (in order):**

anticandidal, antifungal, antiviral, antibacterial, anticancerous

**Main Uses:**

1. for Candida, yeast, and other fungal infections (taken internally and used as a douche or topically).
2. for leukemia and cancer
3. for colds, flu, and other upper-respiratory bacterial and viral infections
4. for sexually transmitted diseases (syphilis, gonorrhea, etc.)
5. for psoriasis and dermatitis

**Properties/Actions Documented by Research:**

analgesic (pain-reliever), antibacterial, anticancerous, anticandidal, antifungal, anti-inflammatory, antileukemic, antimalarial, antiparasitic, antitumorous, antiviral, insecticidal

**Other Properties/Actions Documented by Traditional Use:**

anti-allergy, antiulcerous, anticoagulant (blood thinner), antidysenteric, antioxidant, anti-rheumatic, antivenin, astringent, cardiotoxic (tones, balances, strengthens the heart), hepatonic (tones, balances, strengthens the liver), immunostimulant, laxative

**Cautions:** In excessive amounts, it may cause gastrointestinal upset or nausea.

**Traditional Preparation:** One-half to one cup bark and/or heartwood decoction taken orally 2-4 times daily. (Do not prepare an infusion/tea for this plant-it will not be as effective.) This decoction also is employed traditionally as a douche for yeast infections (use once daily for three consecutive days) and is used topically on the skin for skin fungi (such as nail fungus and athlete's foot).

**Contraindications:** There have been no reports in the literature of contraindications when a whole-bark decoction or tincture is used. However, at least one isolated phytochemical in pau d'arco (lapachol) has demonstrated abortifacient properties in animal studies. As there are no studies confirming the safety of traditional bark decoctions used by pregnant women (nor is there indication in traditional medicine systems using this plant during pregnancy), the use of pau d'arco during pregnancy is not recommended.

Large single dosages of pau d'arco decoctions (more than one cup) may cause gastrointestinal upset and/or nausea. Do not use in high doses unless under the advice of a qualified health practitioner; reduce dosage if nausea occurs.

**Drug Interactions:** None reported.

WORLDWIDE ETHNOBOTANICAL USES	
<b>Amazonia</b>	for colds, cough, fever, flu, leishmaniasis, sores, urinary tract infections
<b>Argentina</b>	for diarrhea, respiratory infections, urinary tract infections

<b>Bahamas</b>	for backaches, gonorrhea, incontinence, toothache, urinary disorders
<b>Brazil</b>	for allergies, arthritis, asthma, athlete's foot, bacterial infections, bed-wetting, blood builder, boils, bursitis, cancer, cancer pain, candida, circulation (poor), colds, colitis, constipation, cystitis, diabetes, dysentery, eczema, fever, flu, fungal infections, gastritis, gingivitis, gonorrhea, hernia, hemorrhoid, hemorrhages, herpes, Hodgkin's disease, immune disorders, impetigo, inflammation, itch, leishmaniasis, leukemia, liver disorders, malaria, parasites, prostatitis, psoriasis, respiratory problems, rheumatism, ringworm, scabies, skin problems, snakebite, sore throat, stomatitis, stomach problems, syphilis, throat (sore), tendonitis, ulcers, urinary tract infections, uterine disorders, vaginal discharge, varicose veins, warts, wounds, and as a astringent, diuretic, pain-reliever and tonic
<b>Costa Rica</b>	for cancer, colds, fever, headaches, snakebites
<b>Mexico</b>	for anemia, fever
<b>South America</b>	or allergies, anemia, arthritis, bacterial infections, boils, cancer, candida, circulation problems, colitis, colds, constipation, cough, cystitis, diabetes, diarrhea, dysentery, fever, flu, fungal infections, gastritis, gastrointestinal problems, inflammation, malaria, pharyngitis, prostatitis, respiratory diseases, snakebites, syphilis, ulcers, urinary disorders
<b>United States</b>	for allergies, anti-inflammatory, arthritis, bacterial infections, boils, cancer, candida, circulation disturbances, colds, constipation, diabetes, dysentery, fevers, flu, fungal infections, gastrointestinal problems, Hodgkin's disease, inflammation, leukemia, liver disease, lupus, osteomyelitis, parasites, Parkinson's disease, prostatitis, psoriasis, respiratory problems, skin ulcerations, syphilis, ulcers, urinary tract infections, viral infections, warts, and as a pain-reliever, and antioxidant

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## REFERENCED QUOTES ON PAU D'ARCO

1. "Pau d' Arco has been revered by the Rainforest Indians for centuries. It is one of the most useful Brazilian herbs. It is called the "divine tree." It is helpful in rheumatism and arthritic inflammation, prostatitis, cystitis, and beneficial for controlling fungus and yeast overgrowth in the body. This multi-purpose herb helps prevent tumor formation and is thought to eliminate toxins and purify the blood. Pau d' Arco became very popular in 1967 after Dr. Walter Accorsi of the Municipal Hospital in Santo Andre talked to a magazine reporter who printed his story. He said:- "From my first experiments with Ipe Roxo (Pau d'Arco), I learned two important things which, greatly encouraged me in regards to cancer: First, that it eliminates the pain caused by the disease; and second, that it multiplies the number of red blood cells." This bark is used to treat stomatitis (swelling of the mucus membranes in the mouth), ulcers in the throat, gastric ulcers, syphilitic chancres, itchiness, wounds, eczema, and boils."

2. "Brazilians call pau d'arco the "divine tree." It helps to increase red blood cell production and helps respiratory disorders, ulcers, candida excess, and athlete's foot. Pau d'arco can fortify the blood, helps to dissolve phlegm and is an antifungal. Research in both the United States and South America shows that pau d'arco has ingredients found to be effective against some forms of cancer and parasites. It helps lower blood sugar levels and promotes digestion. Lapachol, from pau d'arco, was recently listed by Purdue University as among the most important antitumor agents from plants."

3. "ACTIONS: Fortifies blood, Antifungal activity, Combats Candida overgrowth. TRADITIONAL USE: Pau D'Arco tea has been revered by the Indians for centuries as one of the most useful Brazilian herbs. They call it the "Divine Tree". It has been the subject of experiments with encouraging results. Dr. Walter Accorsi, in an article March 1967, states it multiplies the amount of red corpuscles. Experiments have been conducted at the Municipal Hospital at Santo Andre, Sao Paulo using Pau D'Arco in the treatment of respiratory problems, ulcers and a variety of other ailments. Pau D'Arco is highly regarded for its effectiveness in controlling Candida excess. MERIDIAN INDICATIONS: Disperses damp, Dissolves phlegm, Aids regulation of Lung / Stomach, Relieves stagnation in all meridians. EVA POINTS: Liver, Kidney, Large and Small Intestine."

5. "Bitter herb that contains a natural antibacterial agent, has a healing effect, and cleans the blood. Good for candidiasis, smoker's cough, warts, all types of infection, diabetes, ulcers, rheumatism, allergies, tumors, AIDS, leukemia, cancer, and liver disease. NOTE: Resistant strains of Candida develop rapidly due to genetic mutation. Rotating treatment programs will be beneficial."

8. "Brazilian uses and Folklore: If you stop any Brazilian on the street and ask him "What is Ipe Roxo?"... not only will he know immediately what you are talking about, he will begin to explain enthusiastically the wonders and uses of the tea made from the inner bark. Ipe Roxo is undoubtedly one of the most valued and useful of all Brazilian herbs. Used as a health tonic and revered by the Indians for centuries, Ipe Roxo first came to the attention of botanists and doctors about 100 years ago. Since then, the uses and wonders of this tree have been studied and prescribed. In March of 1967 "O Cruzeiro" magazine published an article about the results doctors were getting with the tea at the municipal hospital in Santo Andre, Sao Paulo. The article quotes Dr. Walter Accorsi, as stating: "From my first experiments with it [IPE ROXO], I learned two important things which greatly encouraged me in regard to cancer: Firstly, Pau D'Arco eliminates the pain caused by the disease; and secondly, it multiplies the amount of red corpuscle. Our amazement grew: This bark cured everything! Ulcers, diabetes, and rheumatism - the medicine cleared them all up". After the publication of this article, the demand for Ipe Roxo grew tenfold and today Ipe Roxo bark, extract and homeopathic mother tincture are to be found in health food stores, drugstores and pharmacies all over Brazil. Ipe Roxo can be taken alone, or with other herbal teas for which it acts as a catalyst. Uses: Influential in the treatment of symptoms of: cancer, diabetes, respiratory problems, ulcers, colitis, arthritis, rheumatism, poor circulation, prostatitis, cystitis, constipation."

11. "Pau d' Arco is thought to eliminate toxins in the body and purify the blood, and it has anti-fungal properties. In an original weight loss research study performed in Chicago in 1992, I found that women's chronic yeast infections cleared up promptly when Pau d'Arco was added to the formula. Pau d'Arco also has anti-inflammatory characteristics, making it useful in the treatment of arthritis and other inflammatory



diseases. Some researchers report its ability to increase red blood cell counts and eliminate some symptoms associated with cancer."

**13.** "During the past century, LaPacho has come under scientific scrutiny. The first active constituent to be studied was lapachol; however, it is interesting to note that many of the studies show significantly better results with the whole extract and diminishing effectiveness as the extracts are refined or individual chemicals are tested."

**14.** "The native Indians of Brazil, northern Argentina, Paraguay, Bolivia and other South American countries have used lapacho [*T. impetiginosa*] for medicinal purposes for thousands of years; there are indication that its use may actually antedate the Incas. Lapacho is applied externally and internally for the treatment of fevers, infections, colds, flu, dysentery, gastrointestinal problems of all kinds, debilitating conditions such as arthritis and prostatitis, and circulatory disturbances. Other conditions reportedly cured with lapacho include lupus, diabetes, Hodgkin's disease, osteomyelitis, Parkinson's disease and psoriasis..."

Independent of Meyer, a Physician in Brazil, about 1960, after hearing a tale of its miraculous curative powers, used lapacho to treat his brother who was lying in a Santa Andre, Brazil hospital, dying of cancer. His brother recovered, and the physician, Dr. Orlando dei Santi, began to use the herb to treat cancer patients at the hospital. other physicians joined the team and after a few months, several cures were recorded. In the typical case, pain disappeared rapidly and sometimes complete remission was achieved in as little as four weeks. Because of the work at the Municipal Hospital of Santo Andre, lapacho has become a standard form of treatment for some kinds of cancer and for all kinds of infections in medical establishments throughout Brazil. It should be noted that after the first reports of "miraculous" herbal cures appeared in Brazil, the national government ordered a blackout of any more public statements by doctors involved in the research. The silence was finally broken by Alec De Montmorency, who in 1981 published a lengthy review of the ongoing clinical work in Brazil. This report succeeded in stimulating worldwide interest in the plant."

#### **21. "Tabebuia**

Tabebuia has approximately 100 species of evergreen trees or shrubs native to the warmer parts of the Americas. Several chemical compounds have been identified in the genus; lapachol is common (Paredes, 1975). The constituents of the following species have been summarized: *T. guyacan* (Manners, 1977), *T pallida* (Prakash, 1980a; Prakash, 1980), *T. rosea* (Nair, 1982) and *T. chrysantha* (Wasicky, 1967). Naphtho- and anthraquinones have been isolated from tissue cultures of *T. lepidota* (Cuellar-C., 1979), *T. argentea* (Inouye, 1982), *T. pentaphylla* (Rohatgi, 1983) and *T. cassinoides* (Rao, 1982). Iridoid glycosides have been reported from *T. heptaphylla* (Bianco, 1983). Antiinflammatory, antimicrobial and antineoplastic activities have been reported for extracts of *T. avellaneda* (Goncalves de Lima, 1971; Oga, 1969)."

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## **Third-Party Published Research**

All available third-party research on pau d'arco can be found at [PubMed/Medline](#). A partial listing of the third-party published research on pau d'arco is shown below:

### **Antimicrobial Actions (fungi, yeast, bacteria, and virus):**

***Pau d'arco contains a plant chemical named lapachol which has documented antimalarial, antiseptic, antiviral, bactericidal, fungicidal, insecticidal, pesticidal, schistosomicidal, termiticidal, and viricidal actions. Another chemical in the bark, beta-lapachone, has been demonstrated in laboratory studies to have antibacterial, antifungal, and antiviral actions. Antimicrobial properties of many of pau d'arco's other active phytochemicals were demonstrated in several laboratory studies, in which they exhibited strong in vitro activity against bacteria, fungi, and yeast (including Candida, Aspergillus, Staphylococcus, Streptococcus, Helicobacter pylori, Brucella, tuberculosis, pneumonia, and dysentery). In addition to its isolated chemicals, a hot water extract***

**of pau d'arco demonstrated antibacterial actions against *Staphylococcus aureus*, *Helicobacter pylori*, and *Brucella*. In other in vitro clinical research an extract of the bark was shown to have strong activity against 11 fungal and yeast strains. Pau d'arco and its chemicals also have demonstrated in vitro antiviral properties against various viruses, including Herpes I and II, influenza, polio virus, and vesicular stomatitis virus.**

Hofling, J., et al. "Antimicrobial potential of some plant extracts against *Candida* species." *Braz J Biol.* 2010 Nov;70(4):1065-8.

Melo e Silva, F., et al. "Evaluation of the antifungal potential of Brazilian Cerrado medicinal plants." *Mycoses.* 2009 Nov;52(6):511-7.

Pereira, E. M., et al. "*Tabebuia avellanedae* naphthoquinones: activity against methicillin-resistant staphylococcal strains, cytotoxic activity and in vivo dermal irritability analysis." *Ann. Clin. Microbiol. Antimicrob.* 2006 Mar; 5: 5.

Park, B. S., et al. "Antibacterial activity of *Tabebuia impetiginosa* Martius ex DC (Taheebo) against *Helicobacter pylori*." *J. Ethnopharmacol.* 2006 Apr; 105(1-2): 255-62.

Park, B. S., et al. "Selective growth-inhibiting effects of compounds identified in *Tabebuia impetiginosa* inner bark on human intestinal bacteria." *J. Agric. Food Chem.* 2005 Feb; 23;53(4): 1152-7.

Park, B. S., et al. "Antibacterial activity of *Tabebuia impetiginosa* Martius ex DC (Taheebo) against *Helicobacter pylori*." *J. Ethnopharmacol.* 2005 Dec;

Machado, T. B., et al. "In vitro activity of Brazilian medicinal plants, naturally occurring naphthoquinones and their analogues, against methicillin-resistant *Staphylococcus aureus*." *Int. J. Antimicrob. Agents.* 2003; 21(3): 279-84.

Portillo, A., et al. "Antifungal activity of Paraguayan plants used in traditional medicine." *J. Ethnopharmacol.* 2001; 76(1): 93-8.

Nagata, K., et al. "Antimicrobial activity of novel furanonaphthoquinone analogs." *Antimicrobial Agents Chemother.* 1998; 42(3): 700-2.

Binutu, O. A., et al. "Antimicrobial potentials of some plant species of the *Bignoniaceae* family." *Afr. J. Med. Sci.* 1994; 23(3): 269-73.

Giuraud, P., et al. "Comparison of antibacterial and antifungal activities of lapachol and b-lapachone." *Planta Med.* 1994; 60: 373-74.

Li, C. J., et al. "Three inhibitors of type 1 human immunodeficiency virus long terminal repeat-directed gene expression and virus replication." *Proc. Nat'l. Acad. Sci. USA* 1993; 90(5): 1839-42.

Anesini, C., et al. "Screening of plants used in Argentine folk medicine for antimicrobial activity." *J. Ethnopharmacol.* 1993; 39(2): 119-28.

Lagrotta, M., et al. "Antiviral activity of lapachol." *Rev. Microbiol.* 1983; 14: 21-6.

Gershon, H., et al. "Fungitoxicity of 1,4-naphthoquinones to *Candida albicans* and *Trichophyton menta* grophytes." *Can. J. Microbiol.* 1975; 21: 1317-21.

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#### **Anticancerous & Antileukemic Actions:**

**In the 1960s, extracts of pau d'arco demonstrated marked antitumor effects in animals, which drew the interest of the National Cancer Institute (NCI). Researchers decided that the most potent single chemical for this activity was a naphthoquinone chemical named lapachol and they concentrated solely on this single chemical in their subsequent cancer research. In a 1968 study, lapachol demonstrated highly significant activity against cancerous tumors in rats.**

**By 1970, NCI-backed research already was testing lapachol in human cancer patients. The institute reported, however, that their first Phase I study failed to produce a therapeutic effect without side effects—and they discontinued further cancer research shortly thereafter. These side effects were nausea and vomiting and anti-vitamin K activity. Interestingly, other chemicals in the whole plant extract (which, initially, showed positive antitumor effects at very low toxicity) demonstrated positive effects on vitamin K and, conceivably, compensated for lapachol's negative effect. Once again, instead of pursuing research on a complex combination of at least 20 active chemicals in a whole plant extract (several of which had anti-tumor effects and other positive biological activities), research focused on a single, patentable chemical—and it didn't work as well. Despite NCI's abandonment of the research, another group developed a lapachol analog (which was patentable) in 1975. One study reported that this lapachol analog increased the**

**life span of mice inoculated with leukemic cells by over 80%. In a small, uncontrolled, 1980 study of nine human patients with various cancers (liver, kidney, breast, prostate, and cervix), pure lapachol was reported to shrink tumors and reduce pain caused by them—and three of the patients realized complete remissions.**

**Another chemical in pau d'arco, beta-lapachone, has been studied closely of late and a number of recent patents have been filed on it. It has demonstrated in laboratory studies to have activities similar to lapachol (antimicrobial, antifungal, antiviral, antitumorous, antileukemic, and anti-inflammatory), with few side effects. Research published from 2003 to 2005 provides important new insights into the possible molecular mechanisms of the anti-cancer activity of beta-lapachone specifically against prostate, colon, pancreatic, and lung cancers. In a 2002 U.S. patent, beta-lapachone was cited to have significant anticancerous activity against human cancer cell lines including: promyelocytic leukemia, prostate, malignant glioma, colon, hepatoma, breast, ovarian, pancreatic, multiple myeloma cell lines and drug-resistant cell lines. In yet another U.S. patent, beta-lapachone was cited with the in vivo ability to inhibit the growth of prostate tumors.**

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