Technical Data Report

for

BOLDO

Peumus boldus

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Boldo

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

Genus: *Peumus*

Species: *boldus*

Synonyms: *Boldea fragrans, Peumus fragrans*

Common Names: Boldo, boldu, boldus, boldoa, boldina, baldina, molina

Part Used: Leaves

Boldo is a slow-growing, shrubby evergreen tree that grows 6–8 m in height and produces small, berry-like fruit. The plant's scented flowers are dioecious: they are either male or female, and only one sex is found on any one plant. As such, male and female plants must be grown together for the plants to reproduce. Boldo is found in the Andean regions of Chile and Peru, and also is indigenous to parts of Morocco. It is cultivated in Italy, Brazil, and North Africa to meet the demand for its medicinal leaves in European and Canadian markets where it is widely used.

Indigenous uses of boldo have been widely documented. Legend has it that the medicinal uses of the plant were discovered by chance: a Chilean shepherd noticed that his sheep were healthier, with fewer liver problems, when they grazed on native boldo plants growing in his fields. Since this discovery the plant has been used by the indigenous peoples of Chile for liver, bowel, and gallbladder troubles. It is also used in Chilean folk medicine as an anthelmintic against worms. In parts of Peru the leaves are used by indigenous tribes against liver diseases, to treat gallstones, and as a diuretic. Boldo is still used widely throughout Chile. For many years the fruit has been eaten as a spice, the wood has been used for charcoal, and the bark has been used in tanning hides. It commonly is used for liver, gallbladder, and bowel dysfunctions (such as hepatitis, constipation, flatulence, poor digestion, gallstones, and a lack of appetite). Boldo has also been used in Chile for insomnia, rheumatism, cystitis, colds, and earaches, and is considered a general tonic.

Boldo's uses in other traditional medicine systems is well documented. Worldwide, the plant is used in homeopathy in the treatment of digestive disorders, as a laxative, choleretic, and diuretic, and for liver problems. The leaves are used against intestinal worms, and botanist James Duke reports its traditional use for such urogenital inflammations as gonorrhea and syphilis, as well as for gout, jaundice, dyspepsia, rheumatism, head colds, and earaches. In Brazilian herbal medicine systems, boldo is used for a variety of disorders including hepatitis, liver congestion, constipation, flatulence, dizziness, stomach and intestinal cramps and pain, gallstones, insomnia, rheumatism, and a lack of appetite. Throughout the rest of South America, boldo is used for gonorrhea and liver, gallbladder, and digestive complaints. Boldo is the subject of a German therapeutic monograph which allows the use (as an herbal drug) for mild gastrointestinal spasms and dyspeptic disorders. In Germany, boldo is considered choleretic, antispasmodic, and is employed for liver and gallbladder complaints, loss of appetite, gastric disorders, and to stimulate gastric secretions. It is used for similar purposes in other countries throughout Europe. In American herbal medicine systems, boldo is used to activate the secretion of saliva, bile flow and liver activity; it's chiefly valued as a remedy for gallstones, liver problems, and gallbladder pain.

Boldo is rich in phytochemicals including alkaloids, monoterpenes, benzenoids, sesquiterpenes, and flavonols. At least 17 known alkaloids have been documented thus far, including several biologically active isoquinoline and aporphine alkaloids.[1–5] Much of the biological activity of boldo has been attributed to an aporphine alkaloid called *boldine*. The choleretic activity of the plant has been attributed to this alkaloid.[4] Boldine has also demonstrated diuretic, uric acid excretory, antipyretic, anti-inflammatory, and weak hypnotic effects in laboratory tests.[6–8] In animal studies, boldine has been shown to stimulate digestion and, specifically, to stimulate the production

of bile and its secretion from the gallbladder (and to stimulate the secretion of gastric juice).[9–11] Two clinical studies conducted in 1998 again validated boldine's use in gastrointestinal disorders in animals and humans and demonstrated an antispasmodic effect.[12,13]

In 2000, researchers documented the liver protective and antioxidant properties of boldine in a rat study with diabetic rats, surmising "boldine may attenuate the development of diabetes in rats and interfere with the role of oxidative stress, one of the pathogenesis of diabetes mellitus."[14] An earlier study had reported boldine's liver protective actions, stating: "In view of its low toxicity, lack of effect on P450 activity, and strong inhibition of peroxidation of human liver microsomes, boldine may be valuable as an antioxidant and hepatoprotective agent."[15] Another (2000) boldine study reported that it displayed strong cellular protective properties against chemically-induced hemolytic damage (it displayed an antioxidant effect in the blood).[16] Boldine also has demonstrated anti-inflammatory activities *in vivo*[12] as well as protected against colon damage and lowered inflammation against induced colitis and colon inflammation in animals.[17] Recently (in 2002), boldine was cited to have an effect on the cardiovascular system. Researchers found that it increased coronary blood flow, depressed cardiac force and heart rate, and had a vasorelaxant effect.[18] Boldine also has demonstrated (in two *in vitro* studies) to inhibit platelet aggregation.[19,20] With so many studies on this important alkaloid, it is understandable that most European boldo products are standardized to the boldine content.

A clinical study was published in 1999 about the antimicrobial properties of boldo's essential oil. While the essential oil showed bactericidal and fungicidal properties against several tested organisms, it should be noted that the essential and volatile oils of boldo contain the compound asaridole in amounts up to 40%. Asaridole has anthelminthic properties,[21] but is also a documented liver toxin—internal use of essential or volatile oil preparations of boldo is contraindicated. Boldine, too, has been reported to have a toxic effect in high dosages. In large quantities it causes cramps, convulsions and muscle paralysis, eventually leading to respiratory paralysis.[22] It also has demonstrated a uterine relaxant effect in rats.[23] In a 2000 study with rats, an extract of dry boldo leaves and the chemical boldine showed abortive and teratogenic action and lowered the blood levels of bilirubin, cholesterol, glucose, alanine aminotransferase (ALT), aspartate aminotransferase (AST), and urea. These researchers reported, however, that the long-term administration of the leaf extract and boldine did not cause histological modification over a period of 90 days.[24]

Researchers verified indigenous uses of boldo leaves in the 1950s and 1960s and showed that leaf extracts had diuretic, stomachic, and cholagogue properties in animal studies.[25,26] Although the digestive and choleretic properties largely are attributed to the phytochemical boldine, one study indicated that an alcohol extract of boldo leaves caused higher choleretic activity in rats than boldine alone.[9] An ethanol extract of the leaf administered to mice was shown to have a liver protective effect, preventing liver damage due to chemical exposure.[6] A recent human study demonstrated that boldo relaxes smooth muscle tissue and prolongs intestinal transit (which again validated its traditional uses for digestive functions).[27] The antioxidant property of boldo leaves has also been documented;[28] in rats, leaf extracts demonstrated *in vivo* anti-inflammatory activity.[6] A U.S. monograph reported that boldo caused significant diuresis (it increased urine volume by 50%), which validated the plant's traditional use as a diuretic.[29]

Centuries ago, boldo was a little-known plant growing in farmers' pastures in Chile. Today, huge fields of boldo are cultivated around the world to supply the market demand for a specific herbal remedy or herbal drug for gallstones and gallbladder inflammation, and for many types of liver, stomach, and digestive conditions.

Documented Properties and Actions: Abortive, anodyne, anthelmintic, antifungal, antihepatotoxic, anti-inflammatory, antiseptic, carminative, cholagogue, choleretic, cytotoxic, demulcent, depurative, detoxifier, diuretic, hepatic, hepatotonic, hepatoprotective, laxative, sedative, digestion stimulant, stomachic, teratogenic, tonic, vermifuge

Main Phytochemicals: alpha-3-carene, alpha-fenchol, alpha-hexylcinnamaldehyde, alpha methylionone, alpha-pinene, alpha-terpineol, ascaridole, benzaldehyde, benzyl-benzoate, beta iso-methylionene, beta-pinene, boldin, boldine, boldoglucin, bornyl-acetate, camphene, camphor, car-3-ene, choline, 1,8-cineol, coclaurine, coumarin, cuminaldehyde, 2-decanone, 6(a)-7 dehydroboldine, diethylphthalate, eugenol, eugenol methyl ether, farnesol, fenchone, gamma terpinene, 2-heptaone, isoboldine, isocorydine, isocorydine-n-oxide, kaempferols, laurolitsine, laurotetainine, limonene, linalool, 1-methyl-4-isopropenyl-benzene, n-methyl-laurotetanine, myrtenal, 2-nonanone, norboldine, norisocorydine, pachycarpine, P-cymen-7-ol, P-cymene, P cymol, pro-nuciferine, 2-para-tolyl-propene, 2-octanone, reticuline, rhamnosides, sabinene, sinoacutine, sornyl acetate, sparteine, terpin-n-en-1-ol, terpinen-4-ol, terpinoline, thymol, trans verbenol, 2-tridecanone, 2-undecanone

Traditional Remedy: One-half cup leaf infusion 1–2 times daily with meals or 2–4 ml of a 4:1 tincture twice daily; 3–4 g daily of powdered leaf in tablets or capsules can be substituted if desired. For standardized extracts, follow the labeled instructions.

Contraindications:

- Boldo been demonstrated to have abortive and teratogenic properties *in vivo* and should therefore not be used during pregnancy.
- Phytochemicals in boldo may thin the blood. Those taking blood-thinning medications (such as Warfarin) or those with disorders that have a tendency towards thin blood (such as thrombocytopenia or hemophilia) should not take boldo unless under the supervision of a qualified healthcare practitioner.
- Boldo has been documented with diuretic effects and is contraindicated for long-term, chronic use.

Drug Interactions:

- May potentiate the effects of blood thinning medications such as Warfarin.
- One *in vivo* clinical study suggests that boldo and/or boldine can decrease metabolic activation and/or metabolism of toxins, drugs, and chemicals in the liver.[30] As such, boldo may decrease the effect or reduce the half-life of certain drugs that should be metabolized in the liver.

WORLDWIDE ETHNOBOTANICAL USES

Region	Uses
Asia	Carminative, digestive, dyspepsia, hangover, liver, tonic
Brazil	Anorexia, carminative, cholagogue, choleretic, cholecystitis, constipation, debilitation, digestive, dizziness, dyspepsia, eupeptic, flatulence, gallstones, gastritis, gonorrhea, hepatitis, insomnia, liver, liver congestion, renal, rheumatism, stomach, stomach pain, tonic, weakness
Europe	Antispasmodic, choleretic, chologogue, diuretic, dyspepsia, gallbladder pain, gallstones, gastrointestinal spasms, gonorrhea, gout, hypnotic, inappetite, liver disorders, stomachic, tonic

Region	Uses
Chile	Anthelmintic, anti-inflammatory, antioxidant, antiseptic, anorexia, bowel, carminative, cholagogue, choleretic, cholesterol, colds, cough, constipation, cystitis, diarrhea, digestive, diuretic, dropsy, dyspepsia, earache, flatulence, fluid retention, gallbladder, gallstones, gastric atonia, hepatic, hepatoprotective, hypnotic, hypothyroidism, intestinal cramps, jaundice, laxative, liver, obesity, rheumatism, sedative, sores, stimulant, stomach, stomach cramps, tonic, worms
Latin America	Anodyne, antiseptic, antispasmodic, anorexia, bowel, carminative, choleretic, colds, cystitis, digestion, diuretic, dyspepsia, earache, flatulence, gallbladder, gallstones, gonorrhea, gout, hepatosis, hepatotonic, hepatitis, jaundice, kidney, laxative, liver, malaria, parasites, rheumatism, stimulant, stomachic, stomach, syphilis, tonic, urogenital, urethritis, vermifuge, worms
Mexico	Anodyne, choleretic, digestive, gallbladder, gallstones, liver, rheumatism, stomachic
Turkey	Antiseptic, diuretic, hepatotonic, rheumatism, sedative, stimulant, stomachic, tonic, vermifuge
United States	Alterative, antiseptic, bitter, cholagogue, choleretic, cystitis, digestion disorders, digestive, diuretic, elimination, gallbladder disorders, gallstones, hepatic, hepatitis, inflammation, liver disorders, pain, renal disorders, sedative, tonic, uric acid elimination, urinary demulcent, urinary infections
Elsewhere	Anthelmintic, antiseptic, cholagogue, choleretic, cold, cystitis, diuretic, digestive, dyspepsia, gallbladder, gallstones, gastrointestinal disorders, gastrointestinal spasms, gout, hepatitis, hepatic, hepatosis, hypnotic, liver, renal, rheumatism, sedative, stomach, syphilis, tonic, worms

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Ethnomedical Information on Boldo (Peumus boldus)

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Leaf Asia	Used as a tonic, digestive and carminative. Used for lack of gastric secretions, dyspepsia, liver affections and hangover due to excess alcohol intake.	Infusion Oral	Human Adult	ZZ1092
Leaf Bolivia	Used as a biliary regulant in hepatitis and for excess bile; as a genital antiseptic in urethritis, and as a carminative for flatulence.	Infusion Oral	Human Adult	T07560
Leaf Brazil	Used as a tonic, digestive and carminative.	Infusion Oral	Human Adult	ZZ1079
Leaf Brazil	Used for cholecystitis, to eliminate biliary calculi, for gastric, liver and renal affections, a lack of appetite and for hepatic insufficiency.	Hot H2O Ext Oral	Human Adult	ZZ1081
Leaf Brazil	Used for symptoms of liver dysfunctions and diseases, hepatitis, liver congestion, constipation, gases and poor digestion. Acts as a tonic and combats weakness and dizziness.	Infusion Oral	Human Adult	ZZ1070
Leaf Brazil	Used as a tonic. Used to combat hepatitis, constipation, stomach pain, biliary lithiasis, rheumatism, dyspepsia, intestinal and stomach gas, gonorrhea, digestive difficulties, dizziness, liver congestion, gastritis and a lack of appetite. Considered to have a tranquilizing effect and used for insomnia.	Not stated	Human Adult	ZZ1013
Leaf Brazil	Used for liver and stomach problems. Used as a sedative and anthelmintic. Used as a choleretic and cholagogue for chronic liver problems.	Infusion Oral ETOH Ext Oral	Human Adult	ZZ1088
Leaf Brazil	Used as a tonic, eupeptic, hepatic, cholagogue, choleretic, carminative, antirheumatic and stomachic. Used for hepatitis, liver colic and congestion, dyspepsia, flatulence, obstructions, gastric affections, lack of appetite, biliary calculi, insomnia and debilitation.	Decoction Oral	Human Adult	ZZ1072
Leaf Chile	Used for liver and bowel dysfunctions, for constipation and as a general tonic.	Infusion Oral	Human Adult	ZZ1070
Leaf Chile	Used as a carminative, cholagogue, choleretic, antidiarrheic, diuretic, eupeptic, digestive and hepatic. Used for flatulence, to stimulate the gallbladder and the secretion of bile, for inflammation and calculi of the gallbladder and a lack of appetite.	Infusion Oral	Human Adult	ZZ1076
Leaf Chile	Used as a diuretic, anthelmintic, and sedative. Used for cholesterol.	Hot H2O Ext Oral	Human Adult	A01223

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Leaf Chile	Used against liver diseases, gallstones, inflammation of the gallbladder, biliary colic, infective cystitis, hypothyroidism and fluid retention. Considered a cholagogue, liver tonic, diuretic, urinary antiseptic, laxative, choleretic, anti-obesity, liver-protective, anti-inflammatory and choleretic.	Infusion Oral	Human Adult	ZZ1011
Leaf Chile	Used as a diuretic, stomachic, sedative and anthelmintic.	Infusion Oral	Human Adult	AV1003
Leaf Chile	Used as a diuretic, antioxidant, choleretic, stomachic and cholagogue for hepatic illnesses and gallstones.	Infusion Oral	Human Adult	ZZ1060
Leaf Chile	Used as a hepatic tonic, diuretic and laxative. Used for dyspepsia, stomach and intestinal cramps.	Infusion Oral	Human Adult	ZZ1100
Leaf Chile	Used for running sores and head colds.	Roasted Leaf	Human Adult	ZZ1049
Leaf Chile	Used for dropsy and rheumatism.	Decoction External	Human Adult	ZZ1049
Leaf Chile	Used as a cholagogue, digestive, diuretic and hypnotic. Used for dyspepsia, lack of appetite, gastric disorders, gallstones and affections of the liver. Used as a digestive stimulant and to combat gastric atonia.	Not stated	Human Adult	ZZ1002
Leaf sap Chile	Used for earaches.	Not stated	Human Adult	ZZ1049
Bark Chile	Used for sores, head colds and cough.	Not stated	Human Adult	ZZ1049
Fruit Chile	Eaten as a food.	Fruit Oral	Human Adult	ZZ1049
Fruit Chile	Eaten as a food.	Fruit Oral	Human Adult	AV1006
Plant Chile	Used as a vermifuge, for chronic digestive problems, to reduce excess gastric acidity and for gallstones.	Not stated	Human Adult	ZZ1014
Plant Chile	Used as a tonic. Stimulates liver activity and bile flow; used for gallstones and liver or gallbladder pain.	Infusion Oral	Human Adult	AV1007
Leaf England	Said to stimulate the production of bile and its secretion from the gallbladder, to enhance gastric secretions, to promote the excretion of uric acid and to have a weak hypnotic effect.	Infusion Oral	Human Adult	AV1003
Leaf Europe	Used for gastrointestinal spasms. Considered a tonic and diuretic.	Not stated	Human Adult	ZZ1060
Leaf Germany	Used for gonorrhea, liver and gall bladder complaints, loss of appetite and dyspepsia. Considered to increase gastric secretions and act as an antispasmodic and choleretic.	Infusion Oral	Human Adult	AV1002

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Leaf Guatemala	Used for liver diseases.	Decoction Oral	Human Adult	K26154
Leaf Italy	Used as a cholagogue, stomachic, diuretic, and choleretic.	H2O Ext Oral	Human Adult	K04315
Leaf Mexico	Used for hepatic problems and for the stomach.	Hot H2O Ext Oral	Human Adult	T13488
Not Stated Mexico	Used as a digestive and choleretic.	Not stated	Human Adult	AV1001
Not Stated Mexico	Used for rheumatism. Considered an anodyne.	Not stated	Human Adult	AV1005
Essential Oil South America	Used for digestive upsets, liver and bile problems, kidney and urinary tract illnesses.	Not stated	Human Adult	ZZ1014
Leaf South America	Used as a diuretic in liver ailments like jaundice, stomach troubles, for urogenital inflammations, gonorrhea, dyspepsia, gout, hepatosis, rheumatism, syphilis and worms. Said to be anodyne, antiseptic, choleretic, hepatotonic, hypnotic, stimulant, tonic and vermifuge.	Hot H2O Ext Oral	Human Adult	ZZ1049
Leaf South America	Used as a tonic, antiseptic, stimulant for hepatic disorders, genito-urinary inflammation and for gonorrhea.	Not stated	Human Adult	ZZ1052
Leaf South America	Used as a diuretic, laxative and hepatic tonic; used for diseases of the liver and treatment of gallstones, for worms, urogenital inflammations, gonorrhea, syphilis, gout, rheumatism, head colds and earaches.	Infusion Oral	Human Adult	AV1006
Leaf South America	Used for its analgesic, antiseptic, bitter, cholagogue, diuretic, stimulant and tonic properties. Used for gonorrhea.	Not stated	Human Adult	ZZ1052 AV1008 AV1009
Leaf South America	Used for gallstones, urinary tract infections, intestinal parasites and rheumatism. It has been used as a substitute for quinine in the treatment of malaria.	Not stated	Human Adult	AV1010
Bark South America	Used for liver disease.	Not stated	Human Adult	AV1010
Plant South America	Used to treat liver, gallbladder and bowel dysfunctions. Promotes fat digestion, stimulates bile secretion, neutralizes acid and is good for digestion. Used for urogenital inflammations, gonorrhea, gout, hepatitis, rheumatism, syphilis and worms. Used as an antiseptic and diuretic for urinary infections and uric acid elimination.	Not stated	Human Adult	ZZ1015
Plant South America	Nourishes the blood, enhances digestion, aids liver function, balances the pH and is a good general tonic. Used to treat liver and bowel dysfunctions and to encourage proper digestion and bile secretion.	Not stated	Human Adult	ZZ1016

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Plant South America	Used as a general tonic.	Not stated	Human Adult	ZZ1014
Leaf UK	Stimulates digestion and the secretion of bile. Used as a diuretic. Facilitates digestion in those suffering from overwork. Used for liver insufficiency. Used for gallstones.	Not stated Not stated ETOH Ext	Human Adult	ZZ1066
Leaf US	Used for the liver, gallbladder and digestion, for gallstones and gallbladder inflammation. Used for visceral pain due to problems in the liver and gallbladder; used for cystitis. Considered to be a urinary demulcent and to have antiseptic properties.	Infusion Oral	Human Adult	ZZ1055
Leaf US	Considered a cholagogue, diuretic, hepatic and sedative. Used for gallstones and gallbladder inflammation and visceral pain due to problems with the liver and gallbladder. Used for cystitis.	Infusion Oral	Human Adult	ZZ1056
Leaf US	Used to enhance renal and digestive elimination functions. Considered a choleretic and cholagogue.	Not stated	Human Adult	ZZ1048
Leaf US	Used for poor digestion, hepatitis, urinary infection, uric acid buildup, as a diuretic, antiseptic, alterative, bitter, tonic, cholagogue and to stimulate gastric and bile secretions.	Not stated	Human Adult	AV1004

Biological Activities for Extracts of Boldo (Peumus boldus)

Part – Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Brazil	Toxicity (general)	Hydro-alcohol Ext	Rat	800 mg/kg	Active	Changes in blood levels of bilirubin, cholesterol, glucose, ALT, AST and urea.	L09403
Leaf Brazil	Toxicity (general)	Hydro-alcohol Ext	Rat	800 mg/kg	Inactive	No histological modification.	L09403
Not Stated	Toxicity (general)	Not stated	Not stated	Not stated	Active	Exaggerated reflexes, disturbed coordination and convulsions. In large doses caused paralysis of the motor and sensory nerves and muscle fibers with eventual death due to respiratory arrest.	AV1013
Leaf Brazil	Abortifacient Effect Teratogenic Activity	Hydro-Alcoholic Ext	IG Rat (Pregnant)	800.0 mg/kg	Active		L09403
Leaf Italy	Drug Interaction	ETOH (95%) Ext	Oral Adult Female	Not Stated	Active	A patient was treated with warfarin for atrial fibrillation. During treatment, an increase in International Normalized Ratio (INR) and her admission that she was taking a variety of natural products, to include boldo and fenugreek, led us to suspect that some of these natural products could alter the effect of warfarin. When she stopped the culpable products, the INR returned to normal after 1 week.	E00541
Leaf Italy	Choleretic Activity	ETOH (95%) Ext	IG Rat	Not Stated	Active		L00940
Leaf Germany	Choleretic Activity	ETOH (95%) Ext H2O Ext	Oral Rat Oral Rat	Not Stated Not Stated	Active Inactive		A02959
Leaf Not Stated	Choleretic Activity	Not Stated	IG Dog	Not Stated	Weak Activity		W04226
Leaf Chile	Choleretic Activity	ETOH (70%) Ext	IP Mouse	10.0 mg/kg	Active		M27101
Leaf Chile	Antihepatotoxic Activity	ETOH (70%) Ext	Cell Culture	0.5 mg/ml	Active	Rat liver cells vs. tert-butylhydro-peroxide-induced hepatotoxicity. Lactate dehydrogenase and malonaldehyde levels were decreased. Leakage of aspartate aminotransferase was also decreased.	M27101

Part – Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Chile	Antihepatotoxic Activity	ETOH (70%) Ext	IP Mouse	500.0 mg/kg	Active	Glutamate pyruvate transaminase and alanine aminotransferase levels were increased vs. CCl4-induced hepatotoxicity.	M27101
Leaf Chile	Alanine Aminotransferase Stimulation	ETOH (70%) Ext	IP Mouse	500.0 mg/kg	Active	vs. CCl4-induced hepatotoxicity.	M27101
Leaf Chile	Aspartate Aminotransferase Inhibition	ETOH (70%) Ext	Cell Culture	Not Stated	Active	Rat liver cells.	M27101
Leaf Chile	Glutamate-Pyruvate-Transaminase Stimulation	ETOH (70%) Ext	Mouse IP Mouse	500.0 mg/kg 500.0 mg/kg	Active Active	vs. CCl4-induced hepatotoxicity.	M27101
Leaf Chile	Xanthine Oxidase Inhibition	ETOH (70%) Ext	Cell Culture	500.0 mg/kg	Active	Rat liver cells vs.tert-butyl hydro-peroxide-induced hepatotoxicity. Lactate dehydrogenase levels were decreased by 57%.	M27101
Leaf Chile	Effect on Intestinal Transit Time	Not stated	Human Adult	2.5 g	Active	Prolongs the orocecal transit time.	AV1021
Leaf Chile	Anti-inflammatory Activity	ETOH (70%) Ext	IP Rat	100.0 mg/kg	Active	vs. carrageenan-induced pedal edema.	M27101
Leaf Not Stated	Antiyeast Activity	ETOH-H2O (1:1) Ext	Agar Plate	500.0 mg/ml	Inactive	*Saccharomyces pastorianus.* Dose expressed as dry weight of plant.	T16238
Leaf Not Stated	Antifungal Activity	ETOH-H2O (1:1) Ext	Agar Plate	500.0 mg/ml	Inactive	*Penicillium digitatum* *Trichophyton mentagrophytes*	T16238
Leaf Not Stated	Antifungal Activity	ETOH-H2O (1:1) Ext	Agar Plate	500.0 mg/ml	Active	*Aspergillus fumigatus* *Aspergillus niger* *Botrytis cinerea* *Rhizopus nigricans*	T16238
Leaf Not Stated	Antiviral Activity	H2O Ext	Cell Culture	10.0%	Inactive	*Herpes* Type 2, *Influenza* A2 (Manheim 57), *Poliovirus* II *Vaccinia*	T09507
Leaf Not Stated	Antiviral Activity	ETOH-H2O (1:1) Ext	Agar Plate	500.0 mg/ml	Inactive	*Candida albicans*	T16238
Leaf Chile	Antiviral Activity	Decoction Hydro-Alcoholic Ext	Cell Culture	100.0 mcg/ml	Inactive	Viruses— *Herpes simplex 1* and *Herpes simplex 2* assayed in vero cells; *HIV* assayed in JM cells.	K27888

Part – Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Leaf Not Stated	Cytotoxic Activity	H2O Ext	Cell Culture	10.0%	Weak Activity	HeLA cells.	T09507
Leaf + Stem Chile	Antitumor Activity, Cytotoxic Activity	ETOH-H2O (1:1) Ext	IP Mouse Cell Culture	Not Stated ED50 >20.0 mcg/ml	Inactive	Leuk-P388. CA-9KB.	A00678

Biological Activities for Compounds of Boldo (Peumus boldus)

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Boldine	Toxicity (general)	Intradermal	Not stated	Active	Paralyzes motor and sensory nerves and muscle fibers.	ZZ1049
Boldine	Toxicity (general)	Not stated	Not stated	Active	Causes excitement, exaggerates the reflexes and respiratory movement, causes cramps and convulsions. Leads to death from respiratory paralysis.	ZZ1049 ZZ1052
Boldine	Uterine Relaxant Effect	Rat (uterus)	Not stated	Active	Uterine relaxant effect through its ability to block calcium entry.	AV1037
Boldine	Genotoxic Activity	Cell Culture	10 mcg/ml 20 mcg/ml 40 mcg/ml	Inactive	No significant increase in the frequency of chromosome aberrations or sister-chromatid exchanges.	AV1023
Boldine	Genotoxic Activity	Mouse	225 mg/kg 450 mg/kg 900 mg/kg	Inactive	No significant increase in the frequency of chromosome aberrations or sister-chromatid exchanges.	AV1023
Boldine	Genotoxic Activity Mutagenic Activity	Cell Culture Cell Culture	Not stated Not stated	Inactive Weak Activity	No effect. Some crossing over and gene conversion with cytoplasmic ‘petite’ mutation.	AV1024
Boldine	Choleretic Activity	Not stated	Not stated	Active		AO1223
Boldine	Hepatic microsome CYP3A Inhibition	Cell culture	Not stated	Active	Inhibited CYP1A-dependent 7-ethoxyresorufin O-deethylase and CYP3A-dependent testosterone 6 beta-hydroxylase activities.	AV1014
Boldine	Diuretic Activity	Dog	Not stated	Active	Increased urinary excretion by 50%.	AV1011
Boldine	Antioxidant Activity	Oral Rat	100 mg/kg	Active	Decreased the level of malondialdehyde and carbonyls in liver, kidney and pancreas mitochondria and decreased the elevation of MnSOD in the kidney and pancreas mitochondria in streptozotocin-induced diabetic rats.	AV1015
Boldine	Antioxidant Activity	Oral Rat	100 mg/kg	Active	Restored altered glutathione peroxidase enzyme activity in the liver and pancreas of streptozotocin-induced diabetic rats.	AV1015

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Boldine	Antioxidant Activity	Oral Rat	100 mg/kg	Active	Attenuated both streptozotocin- and iron plus ascorbate-induced malondialdehyde and carbonyl formation and thiol oxidation in the pancreas.	AV1015
Boldine	Antioxidant Activity	Oral Rat	100 mg/kg	Active	Decomposed superoxide anions, hydrogen peroxides and hydroxyl radicals. Attenuated the production of superoxide anions, hydrogen peroxide and nitric oxide caused by liver mitochondria.	AV1015
Boldine	Antioxidant Activity	Cell Culture	Not stated	Active	Protected intact red blood cells against the hemolytic damage induced by a free radical initiator AAPH.	AV1016
Boldine	Antioxidant Activity	Cell Culture	Not stated	Active	Reduced the production of ROS induced by stannous chloride, and the lethal effect of ROS on *E. coli* AB1157.	AV1017
Boldine	Antioxidant Activity	Cell Culture (PC12 cells)	10-100 microM	Active	Reduced the effect of catecholamine oxidation in brain mitochondria. Scavenged hydrogen peroxide and hydroxyl radicals, decreased the formation of melanin from dopamine. All of the above resulted in the decrease of dopamine-induced death of PC12 cells.	AV1026
Boldine	Antioxidant Activity	Cell culture (rat hepatocytes)	200 micromol/L 0.91 mol/L	Active Weak Activity	Inhibited peroxidation induced by tert-butyl hydroperoxide (TBOOH). No effect on reduced glutathione levels. Inhibited lipid peroxidation induced by TBOOH.	AV1031
Boldine	Antioxidant Activity	Cell Culture	Not stated	Active	Prevented brain homogenate autooxidation, AAP-induced lipid peroxidation of RBC membranes and AAP-induced inactivation of lysozyme.	AV1036
Boldine	Gluthathione S-transferase Stimulation	Cell Culture	Not stated	Active		AV1014
Boldine	Cytoprotective Effect	Cell Culture	Not stated	Active	Protected red blood cells against chemically induced hemolytic damage.	AV1016
Boldine	Cytoprotective Activity	Cell culture (rat hepatocytes)	200 micromol/L 0.91 mol/L	Active Inactive	Prevented lytic damage induced by tert-butyl hydroperoxide (TBOOH).	AV1031

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Boldine	Neuromuscular Blocking Activity	In vitro (mouse diaphragm)	<200 microM	Active Inactive	After an initial period of twitch augmentation, inhibited the nerve-evoked twitches of the mouse diaphragm. Muscle-evoked twitches unaffected.	AV1019
Boldine	Neuromuscular Blocking Activity	In vitro (mouse diaphragm)	IC50=13.5 mcM 50 microM	Active Active	Inhibited the acetylcholine-induced contraction of denervated diaphragm. Inhibited the amplitude of the miniature end plate potential.	AV1019
Boldine	Neuromuscular Effect	In vitro (mouse diaphragm)	200 microM	Active	Increase in resting tension seen.	AV1019
Boldine	Neuromuscular Effect	In vitro (mouse diaphragm)	10-200 mcM 300 mcM	Inactive Active	Muscle-evoked twitches. Induced muscle contracture.	AV1020
Boldine	Neuromuscular Effect	Skeletal muscle of Rat or Rabbit	Not stated	Active	Induced calcium release from storage in skeletal muscle.	AV1020
Boldine	Vascular Smooth Muscle Effect	Guinea pig (trachea)	0.1-100 microM	Inactive	Contractions induced by acetylcholine or histamine.	AV1030
Reticuline	Antispasmodic Activity	Uterine muscle	Not stated	Active	Antagonize uterine muscular contractions induced by acetylcholine and calcium.	AV1038
Coclaurine	Antispasmodic Activity	Uterine muscle	Not stated	Active	Antagonize uterine muscular contractions induced by acetylcholine and calcium.	AV1038
Boldine	Immunosuppressive Activity	Oral Human	Not stated	Active	Decreased blastogenesis in normal subjects and patients with chronic lymphocytic leukemia.	AV1034
Boldine	Immunostimulant Activity	Oral Human	Not stated	Active Inactive	In patient with chronic lymphocytic leukemia natural killer cell activity was enhanced. No effect on natural killer cell activity in tumor-bearing patients.	AV1034
Boldine	Anti-inflammatory Activity	Guinea Pig	ED50=34 mg/kg 75 microM	Active Active	Carrageenan-induced paw edema. 53% inhibition of prostaglandin synthesis.	AV1022
Boldine	Anti-inflammatory Activity	Oral Mice Rats	Not stated	Active Active Inactive Active	Protected against colonic damage (expressed by reductions in cell death, tissue disorganization and edema) in acetic acid induced colitis. Reduced colonic neutrophil infiltration. Tissue lipoperoxides. Preserved colonic fluid transport.	AV1028

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Terpinen-4-ol	Anti-inflammatory Activity	Cell Culture	Not stated	Active	Suppressed the production of TNFalpha, IL-1beta, IL-8, IL-10 and PGE2 by LPS-activated monocytes.	AV1045
Terpinen-4-ol	Antiulcer Activity	Not stated	Not stated	Active Active	HCl/ethanol, HCl/aspirin, water-immersion stress and pylorus-ligation induced ulceration. Secretion of gastric juice and output of acid and pepsin activity lowered.	AV1046
Boldine	Antiallergic Activity	Cell Culture	Not stated	Active	Relieved allergic symptoms by inhibiting histamine-release from mast cells.	AV1047
Boldine	Antipyretic Activity	Oral Rabbits	60 mg/kg	Active	Reduced bacterial pyrogen-induced hyperthermia between 50%-98%.	AV1022
Boldine	Antidiabetic Activity	Oral Rat	100 mg/kg	Active	Attenuated the development of hyperglycemia and weight loss induced by streptozotocin.	AV1015
Boldine	Cardiovascular Effect	Guinea pig (heart)	10(-5) - 2 x 10 (-4) M	Active	Increased coronary flow, depressed cardiac force and heart rate.	AV1025
Boldine	Cardiovascular Effect	Guinea pig (aorta)	IC50=1.4 microM 300 microM 1-300 microM 30 microM	Active Weak Activity Inactive Active	Inhibited contractile response evoked by noradrenaline Calcium-induced contractions. Contraction induced by caffeine. Inhibited inositol phosphate formation induced by noradrenaline.	AV1030
Boldine	Vasorelaxant Activity	Rat (kidney)	Not stated	Active	Inhibited potassium-evoked vasoconstriction at doses 70-fold higher than diltiazem.	AV1025
Boldine	Vasorelaxant Activity	Rat (thoracic aorta)	Not stated	Active		AV1032
Boldine	Alpha 1-adrenoceptor Blocking Agent	Guinea pig (aorta)	Not stated	Active	Competitive antagonism to noradrenaline-induced vasoconstriction.	AV1030
Boldine	Platelet Aggregation Inhibition	Cell culture (rabbit platelets)	Not stated	Active Active	Inhibited platelet aggregation. Inhibited the release of ATP induced by arachidonic acid and collagen in rabbit platelets.	AV1029
Boldine	Platelet Aggregation Inhibition	Cell Culture	Not stated	Active	Inhibited arachidonic acid induced platelet aggregation.	AV1032
Boldine	Calcium Channel Antagonist Activity	Not stated	Not stated	Active		AV1025

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Boldine	Dopamine Antagonist Activity	Mice	IP 40 mg/kg	Inactive	In spite of its affinity for D1- and D2-like receptors it does not display central dopaminergic antagonist activities.	AV1027
1,8-cineole	Anticancer Activity	Cell Culture	Not stated	Active Inactive	Apoptosis of human leukemia Molt 4B and HL-60 cells. Human stomach cancer KATO III cells.	AV1042
Farnesol	Anticancer Activity	Cell Culture Hamster	Not stated 1% (w/w) diet	Active Active	After 48 hrs of treatment human BxPC3 pancreatic cancer cells had a 3-10 fold increase in apoptosis and higher BAK expression than controls. Decreased incidence of pancreatic carcinoma.	AV1043
Boldine	Antitumor promoting Activity	Cell Culture (rat liver epithelial cells)	50 microM	Active	100% inhibition of the effect of TPA, in part due to its ability to reduce the increased accumulation of intracellular oxidants.	AV1033
Linalool 1,8-cineole	Antimicrobial Activity	Agar Plate	Not stated	Active	*Candida albicans* *E. coli* *Listeria monocytogenes* *Proteus mirabilis* *Salmonella spp.* *Staphylococcus aureus*	AV1039
Terpinen-4-ol 1,8-cineole	Antimicrobial Activity	Agar Plate	Not stated	Active		AV1041
Ascaridole	Anthelmintic Activity	Not stated	Not stated	Active		AV1012
Boldine	Antitrypanosomal Activity	Broth Culture	IC50=110 microM	Active	*Trypanosoma cruzi*, LQ strains and DM 28c clone.	AV1035
1,8-cineole	Antifungal Activity	Agar Plate	Not stated	Weak Activity	13 fungi species.	AV1040
Essential Oil	Antibacterial Activity	Agar Plate	15.0 mcl 25.0 mcl 25.0 mcl	Active Active Active	*Escherichia coli* *Pseudomonas aeruginosa* *Staphylococcus aureus*	T14973
Essential Oil	Antiyeast Activity	Agar Plate	5.0 mcl	Active	*Candida albicans*	T14973
Farnesol	Antibacterial Activity	Agar Plate	MIC=100 microg/ml	Active	*S. aureus*	AV1044

Presence of Compounds in Boldo (Peumus boldus)

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Ascaridol	Monoterpene	Leaf Essential Oil Leaf Leaf	Chile Not stated Not stated	18.08–34.1% Not stated 4,000-10,000 ppm	N16089 J10046 ZZ1095
Ascaridole	Monoterpene	Leaf Essential Oil	Brazil	Not stated	L12701
Benzaldehyde	Benzenoid	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 1 ppm 0.0001%	J10046 ZZ1095 ZZ1049
Benzene, 1-methyl-4-isopropenyl-	Benzenoid	Leaf	Not stated	60-75 ppm	ZZ1095
Benzoic acid benzyl ester	Benzenoid	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 80-100 ppm	J10046 ZZ1095
Boldin	Alkaloid	Plant	Not stated	Not stated	ZZ1095
	Isoquinoline Alkaloid	Leaf Bark Leaf Leaf Leaf Leaf Leaf Bark Bark Leaf Leaf	Italy Chile Not stated Australia Chile Belgium Not stated Chile Chile Poland Chile	Not stated Not stated Not stated Not stated Not stated 00.053% 00.2% 05.71429% 06.27692% Not stated Not stated	K03760 K12333 M19360 M28638 M27101 N18645 L00940 N18154 N19784 N14697 A01223
Boldine, 6(a)-7-dehydro-	Isoquinoline Alkaloid	Leaf Bark	Not stated Chile	Not stated 00.00131%	A2230A N19784
Boldine, iso-	Isoquinoline Alkaloid	Leaf	Chile	Not stated	A01223
Boldine, nor-	Isoquinoline Alkaloid	Suspension Culture	Not stated	00.00625%	M20021
Boldoglucin	Glycoside	Leaf	Not stated	Not stated	ZZ1095
Bornyl-acetate		Leaf Leaf	Not stated Not stated	40-50 ppm 0.004-0.005%	ZZ1095 ZZ1049

Camphene	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 120-150 ppm 0.012-0.015%	J10046 ZZ1095 ZZ1049
Camphor	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 120-150 ppm 0.012-0.015%	J10046 ZZ1095 ZZ1049
Car-3-ene	Monoterpene	Leaf Essential Oil	Not stated	Not stated	J10046
Carene, alpha-3-	Monoterpene	Leaf	Not stated	100-125 ppm	ZZ1095
Cineol, 1–8-	Monoterpene	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 6,000-40,000 ppm	J10046 ZZ1095
Cinnamaldehyde, alpha-hexyl-	Phenylpropanoid	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 80-100 ppm	J10046 ZZ1095
Coclaurine, (r)-	Isoquinoline Alkaloid	Stembark	Chile	Not stated	K16615
Coclaurine, (s)-	Isoquinoline Alkaloid	Stembark	Chile	Not stated	K16615
Corydine, iso-	Isoquinoline Alkaloid	Leaf	Poland Not stated	Not stated Not stated	N14697 M19360
Corydine, n-oxide-iso-	Isoquinoline Alkaloid	Leaf Leaf	Australia Chile	Not stated Not stated	M28638 A01223
Corydine, nor-iso-	Isoquinoline Alkaloid	Leaf	Chile	Not stated	A01223
Coumarin	Coumarin	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 100-125 ppm 0.01-0.0125%	J10046 ZZ1095 ZZ1049
Cuminaldehyde	Monoterpene	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 60-75 ppm	J10046 ZZ1095
Cymen-7-ol, para-	Monoterpene	Leaf Essential Oil	Brazil	Not stated	L12701
Cymene, para-	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 7,150 ppm 0.715%	J10046 ZZ1095 ZZ1049
Cymol, para-		Leaf Leaf	Not stated Not stated	6,000-7,500 ppm 0.6-0.75%	ZZ1095 ZZ1049

Decan-2-one	Alkanone C5 or More	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 1 ppm	J10046 ZZ1095
Eugenol		Leaf Leaf	Not stated Not stated	Not stated 0.01-0.0125%	ZZ1095 ZZ1049
Eugenol methyl ether	Phenylpropanoid	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 100-125 ppm	J10046 ZZ1095
Farnesol	Sesquiterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 80-100 ppm 0.008-0.01%	J10046 ZZ1095 ZZ1049
Fenchol, alpha-	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 34-43 ppm 0.0034-0.0043%	J10046 ZZ1095 ZZ1049
Fenchone	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 160-200 ppm 0.016-0.02%	J10046 ZZ1095 ZZ1049
Heptan-2-one	Alkanone C5 or More	Leaf Essential Oil	Not stated	Not stated	J10046
Ionene, alpha-methyl-	Sesquiterpene	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 80-100 ppm	J10046 ZZ1095
Ionone, beta-iso-methyl-	Sesquiterpene	Leaf Essential Oil	Not stated	Not stated	J10046
Kaempferol-3-glucoside-7-rhamnoside		Leaf	Not stated	Not stated	ZZ1095
Laurolitsine		Leaf	Not stated	Not stated	ZZ1095
Laurotetanine, n-methyl-	Isoquinoline Alkaloid	Leaf Leaf Leaf Leaf	Australia Poland Not stated Chile	Not stated Not stated Not stated Not stated	M28638 N14697 M19360 A01223
Limonene	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 320-400 ppm 0.032-0.04%	J10046 ZZ1095 ZZ1049
Linalool	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 3,400-4.300 ppm 0.34-0.43%	J10046 ZZ1095 ZZ1049

Myrtenal	Monoterpene	Leaf Essential Oil Flower	Not stated Not stated	Not stated Not stated	J10046 ZZ1095
Nonan-2-one	Alkanone C5 or More	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 80-100 ppm	J10046 ZZ1095
Nuciferine, (-)pro-	Isoquinoline Alkaloid	Bark	Chile	00.00300%	N18154
Octan-2-one	Alkanone C5 or More	Leaf Essential Oil	Not stated	Not stated	J10046
Pachycarpine		Plant	Not stated	Not stated	ZZ1095
Phthalate, diethyl-	Benzenoid	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 60-75 ppm	J10046 ZZ1095
Pinene, alpha-	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 800-1,000 ppm 0.016-0.02%	J10046 ZZ1095 ZZ1049
Pinene, beta-	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 160-200 ppm 0.08-0.1%	J10046 ZZ1095 ZZ1049
Propene, 2-para-tolyl-	Monoterpene	Leaf Essential Oil	Not stated	Not stated	J10046
Reticuline, (+)	Isoquinoline Alkaloid	Leaf	Chile	00.001%	A01223
Rhamnetin, 3-o-alpha-l-arabinosisoyl-7-o-alpha-l-rhamnoside	Flavonol	Leaf	Italy	Not stated	K04315
Rhamnetin, 3-glucoside-7-rhamnoside iso-		Leaf	Not stated	Not stated	ZZ1095
Rhamnetin-3-arabinoside-3'-rhamnoside		Leaf	Not stated	Not stated	ZZ1095
Sabinene	Monoterpene	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 160-200 ppm	J10046 ZZ1095
Sinoacutine	Isoquinoline Alkaloid	Bark	Chile	00.00607%	N18154
Sornyl acetate	Monoterpene	Leaf Essential Oil	Not stated	Not stated	J10046
Sparteine	Quinolizidine Alkaloid	Leaf	Not stated	Not stated	A2230A
Terpin-n-en-1-ol	Monoterpene	Leaf Essential Oil	Not stated	Not stated	J10046
Terpinen-4-ol		Leaf Leaf	Not stated Not stated	520-650 ppm 0.052-0.065%	ZZ1095 ZZ1049

Terpinene, gamma-	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 200-250 ppm 0.02-0.025%	J10046 ZZ1095 ZZ1049
Terpineol, alpha-	Monoterpene	Leaf Essential Oil Leaf Leaf	Not stated Not stated Not stated	Not stated 180-225 ppm 0.018-0.0225%	J10046 ZZ1095 ZZ1049
Terpinolene	Monoterpene	Leaf Essential Oil Leaf	Not stated Not stated	Not stated 80-100 ppm	J10046 ZZ1095
Tetainine, lauro		Leaf	Not stated	Not stated	ZZ1095
Thymol	Monoterpene	Leaf Essential Oil	Brazil	Not stated	L12701
Tridecan-2-one	Alkanone C5 or More	Leaf Essential Oil	Not stated	Not stated	J10046
Undecan-2-one	Alkanone C5 or More	Leaf Essential Oil	Not stated	Not stated	J10046
Verbenol, trans-	Monoterpene	Leaf Essential Oil	Brazil	Not stated	L12701

Phytochemical Screening:
Alkaloids Present Leaf T06418

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