

Technical Data Report

for

SANGRE DE GRADO

“Dragon's Blood”

(Croton lechleri)



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Sangre de Grado

"Dragon's Blood"

Reprinted from the book *The Healing Power of Rainforest Herbs*
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Family: Euphorbiaceae

Genus: *Croton*

Species: *lechleri, salutaris*

Synonyms: *Croton draco*

Common Names: Sangre de grado, sangre de drago, dragon's blood, drago, sangue de drago, sangue de agua

Parts Used: Bark, resin/sap

Herbal Properties & Actions		
Main Actions:	Other Actions:	Standard Dosage: Resin
heals wounds	kills cancer cells	Internal: 10-15 drops twice daily
stops bleeding	prevents tumor growth	External: Apply to affected area
kills bacteria	stops cellular mutations	twice daily
kills germs		
kills fungi		
kills viruses		
relieves diarrhea		
reduces inflammation		
relieves itching		

Sangre de grado is a medium to large-sized tree that grows from 10–20 m high in the upper Amazon region of Peru, Ecuador, and Colombia. Although tall, the trunk is usually less than 30 cm in diameter and is covered by smooth, mottled bark. It has large, heart-shaped, bright green leaves and unique, greenish-white flowers on long stalks. Its Peruvian name, *sangre de grado*, means “blood of the dragon” (in Spanish). In Ecuador, it’s named *sangre de drago* (which means “dragon’s blood” as well). When the trunk of the tree is cut or wounded, a dark red, sappy resin oozes out as if the tree is bleeding—earning this local name. The genus *Croton* is a large one, with 750 species of trees and shrubs distributed across the tropical and subtropical regions of both hemispheres. *Crotons* are rich in active alkaloids, and several species are well-known medicinal plants used as laxatives and tonics.

TRIBAL AND HERBAL MEDICINE USES

Sangre de grado’s red sap or latex (and also its bark) has a long history of indigenous use in the rainforest and in South America. The earliest written reference dates its use to the 1600s, when Spanish naturalist and explorer P. Bernabé Cobo found that the curative power of the sap was widely known throughout the indigenous tribes of Mexico, Peru, and Ecuador. For centuries, the sap has been painted on wounds to staunch bleeding, to accelerate healing, and to seal and protect injuries from infection. The sap dries quickly and forms a barrier, much like a “second skin.”

It is used externally by indigenous tribes and local people in Peru for wounds, fractures, and hemorrhoids, internally for intestinal and stomach ulcers, and as a douche for vaginal discharge. Other indigenous uses include treating intestinal fevers and inflamed or infected gums, in vaginal baths before and after childbirth, for hemorrhaging after childbirth, and for skin disorders.

Sangre de grado resin and bark are used in traditional medicine in South America today in much the same manner as indigenous ones. In Peruvian herbal medicine, it is recommended for hemorrhaging, as an antiseptic vaginal douche and, topically, for healing wounds. It is also used internally for ulcers in the mouth, throat, intestines, and stomach; as an antiviral for upper respiratory viruses, stomach viruses, and HIV; internally and externally for cancer and, topically, for skin disorders, insect bites, and stings. In Brazilian traditional medicine, the sap currently is used for wounds, hemorrhaging, diarrhea, mouth ulcers, and as a general tonic.

PLANT CHEMICALS

Sangre de grado resin or sap is a storehouse of phytochemicals, including proanthocyanidins (antioxidants), simple phenols, diterpenes, phytosterols, and biologically active alkaloids and lignans. Scientists have attributed many of the biologically active properties of the sap (especially its wound-healing capacity) to two main “active” constituents: an alkaloid named *taspine*, and a lignan named *dimethylcedrusine*.

Of course, botanists, herbalists, and naturopaths would disagree with such reductionist conclusions (and often do); in this particular case, the matter is actually proven by science. Noted author and ex-USDA economic botanist Dr. James Duke summed this up eloquently, saying,

I like the comments on dragon's blood, and would add one further note: in addition to the proanthocyanadins (including Pycnogenol) and taspines, there's another active ingredient—dimethylcedrusine. While each of these alone—dimethylcedrusine, Pycnogenol and taspine—was shown to effectively heal wounded rats (with squares of skin exfoliated, i.e., peeled off) by European scientists, the whole dragon's blood was shown to speed healing four times faster. The whole was better than the sum of its parts. Synergy makes the whole herb stronger; diversity makes the rainforest stronger.¹

The *taspine* alkaloid from *sangre de grado* was first documented with antiinflammatory actions in 1979.² In 1985, *taspine* was documented with antiinflammatory, antitumorous (against sarcomas), and antiviral actions.³

The main plant chemicals in *sangre de grado* include alpha-calacorene, alpha-copaene, alpha-pinene, alpha-thujene, beta-caryophyllene, beta-elemene, beta-pinene, betaine, bincatriol, borneol, calamenene, camphene, catechins, cedrucine, colechic acid, cuparophenol, D-limonene, daucosterol, dihydrobenzofuran, dimethylcedrusine, dipentene, eugenol, euparophenol, gallo-catechin, gamma-terpinene, gamma-terpineol, hardwickic acid, isoboldine, korberin A and B, lignin, linalool, magnoflorine, methylthymol, myrcene, norisoboldine, p-cymene, proanthocyanidins, pro-cyanidins, resin, tannin, *taspine*, terpinen-4-ol, and vanillin.

BIOLOGICAL ACTIVITIES AND CLINICAL RESEARCH

The wound-healing action of *sangre de grado* resin was first related to the *taspine* alkaloid in 1989.⁴ Several later studies also concentrated on the wound-healing⁵ and antitumorous properties of *taspine*.⁶ The lignan *dimethylcedrusine* was isolated by scientists in 1993 and was shown to play a central role in *sangre de grado*'s effective wound-healing action.⁷ This Belgian study revealed that the crude resin stimulated contraction of wounds, helped in the formation of a crust/scab at the wound site, regenerated skin more rapidly, and assisted in the formation of new collagen. This was the study to which Dr. Duke referred in documenting that the crude resin was found to be four times more effective at wound healing and collagen formation than its isolated chemicals (and healed wounds ten to twenty times faster than using nothing at all).⁷

The Belgian scientists also determined that *taspine* was active against herpes virus in this

study. In 1994 other phytochemicals were found, including phenolic compounds, proanthocyanadins, and diterpenes, which showed potent antibacterial activity (against *E. coli* and *Bacillus subtilis*) as well as wound-healing properties.⁸ Another study documented sangre de grado's antioxidant effects⁹ and researchers in Canada documented its antifungal properties.¹⁰

Another important traditional use of the sap was verified by clinical research in a 2000 study designed to evaluate its gastrointestinal effects. Researchers concluded that "Sangre de grado is a potent, cost-effective treatment for gastrointestinal ulcers and distress via antimicrobial, anti-inflammatory, and sensory afferent-dependent actions."¹¹ In 2002, these same researchers reported that sangre de grado evidenced an *in vitro* effect against stomach cancer and colon cancer cells as well.¹² In 2003, Italian researchers reported that the resin inhibited the growth of a human myelogenous leukemia cell line and also prevented cells from mutating in test tube studies.¹³

Extracts of sangre de grado have demonstrated antiviral activity against influenza, parainfluenza, herpes simplex viruses I and II, and hepatitis A and B.^{7, 8, 14, 15} The antiviral and anti-diarrhea properties of sangre de grado have come to the attention of the pharmaceutical industry over the last ten years. A U.S.-based pharmaceutical company has filed patents on three pharmaceutical preparations that contain antiviral constituents and novel chemicals (a group of plant flavonoids they've named SP-303), extracted from the bark and resin of sangre de grado. Their patented drugs include an oral product for the treatment of respiratory viral infections, a topical antiviral product for the treatment of herpes, and an oral product for the treatment of persistent diarrhea. These products have been the subject of various human clinical trials. Although the immunomodulating effects of sangre de grado have not been the subject of targeted research yet, some researchers believe that the anti-inflammatory, antimicrobial, and antioxidant activities may provide nonspecific immune enhancement effects as well.¹⁶

More recently, several scientific tests have been conducted on a proprietary sangre de grado product (made into a skin balm), which was also based on traditional uses. They reported that in pest control workers, a sangre de grado balm was preferred over placebo, for the relief of itching, pain, discomfort, swelling, and redness in response to wasps, fire ants, mosquitoes, bees, cuts, abrasions, and allergic plant reactions (poison ivy and others).¹⁷ Subjects reported relief within minutes, and that it provided pain relief and alleviated symptoms (itching and swelling) for up to six hours. These reported effects in humans, as well as several other tests they conducted in animals and *in vitro* models of inflammation, led them to conclude that sangre de grado prevents pain sensation by blocking the activation of nerve fibers that relay pain signals to the brain (therefore functioning as a broad-acting pain killer), as well as blocking the tissue response to a chemical released by nerves that promotes inflammation.

CURRENT PRACTICAL USES

Research has confirmed many of the indigenous uses of this powerful rainforest plant. It is a wonderful, sustainable rainforest resource that warrants consumer attention as it becomes more widely available in the marketplace. Applied directly to the affected area, it is helpful for all types of cuts, scrapes, external wounds, bites, stings, rashes, and skin problems, including skin and nail fungi. James E. Williams, OMD, sums up sangre de grado's many uses by natural health practitioners, stating:

There is a wide range of potential applications for sangre de grado, including as a broad-spectrum anti-diarrheal agent from causes such as side effects of drugs, chemotherapy or radiation treatment, microbial infections of the intestine, traveler's diarrhea, and viral-induced diarrhea as in AIDS. It may also have other uses in gastrointestinal disorders such as irritable bowel syndrome and ulcerative diseases. Its cytotoxic effects make it a possible antitumor agent and its cicatrizant properties provide wound-healing potential. In addition, the antimicrobial and anti-inflammatory effects of sangre de grado make it a

*useful compound in the clinical treatment of chronic viral diseases and as a natural antibacterial agent.*¹⁵

In addition, several health practitioners in the U.S. indicate benefits in using sangre de grado resin internally for diabetic neuropathy because of its previously documented effects on nerve endings, nerve pain, and nerve inflammation. Benefits have also been reported with diabetes-related skin ulcers and sores (applied topically), which have refused to heal using other methods.

TRADITIONAL PREPARATION

For external use, the resin/sap is rubbed directly on the affected area several times daily and allowed to dry. Please note: the resin is red! It will temporarily stain the skin a reddish-brown (which will wash off), but it will permanently stain clothing. Rubbing the resin in the palm of the hand first or directly where applied will thicken the resin into a thin, lighter colored paste, which helps form a second skin on top of a wound or rash and reduces staining. For internal use, the traditional remedy is 10–15 drops in a small amount of liquid, taken one to three times daily (be prepared, however; it tastes quite dreadful).

Contraindications: None reported.

Drug Interactions: None reported.

Worldwide Ethnomedical Uses

Region	Uses
Brazil	for bacterial infections, blood cleansing, cancer, digestive disorders, fever, fungal infections, hemorrhages, stomach ulcers, tumors, ulcer (mouth), wounds, and for its astringent (drying) effects
Dominican Republic	for wounds, and to stop bleeding
Ecuador	for cancer, inflammation, wounds
Mexico	for fever, infected gums, wounds
Peru	for cancer, diabetes, diarrhea, eczema, fractures, fungal infections, gastrointestinal problems, hemorrhages, hemorrhoids, infected gums, infections, insect bites, laryngitis, rheumatism, skin cancer, skin rashes, throat problems, toothache, tumors, ulcers (intestinal, mouth, stomach), vaginal discharge, vaginal infections, vaginitis, wounds, and as an antiseptic
United States	for cancer, diabetic neuropathy, eczema, fungal infections (skin, nail, foot), hemorrhages, inflammation, insect bites, itching, pain, rashes, ulcers (intestinal, mouth, skin, stomach), wounds, and as an antiseptic

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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 Sangre de Grado (Croton lechleri)

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Latex Amazonia	Used externally for wounds, taken internally for intestinal fevers and pyorrhea.	Latex / Various	Human Adult	AS1003
Latex Amazonia	Taken orally in hot water to hasten internal healing following an abortion. Used to stop bleeding and heal wounds. Used as a vaginal douche after childbirth. Used for tuberculosis and bone cancer.	Latex / Oral Latex / External Latex / Douche Latex / Oral	Human Adult	ZZ1011
Latex Amazonia	Used for wound healing. Used for internal inflammation, ulcers and cancer.	Latex / External Latex / Oral	Human Adult	ZZ2007
Latex Brazil	Used to treat wounds and as a protection against bacterial and fungal infections to wounds.	Latex / External	Human Adult	ZZ1099
Latex Brazil	Used for wounds, hemorrhaging, mouth ulcers and a general tonic.	Latex / Oral & External	Human Adult	ZZ1013
Latex Ecuador	Used for inflammation and the treatment of wounds.	Latex / External	Human Adult	H11766
Latex Ecuador	Used for cancer.	Latex / External & Oral	Human Adult	H11766
Latex Peru	Used as a cicatrizant and hemostat for wounds. Used for stomach, liver and uterine cancers, and stomach ulcers. Three drops of resin in a coca leaf tea with salt used for tonsilitis and sore throat. Resin mixed in a bath with Llanten herb used for vaginal infections and gonorrhea.	Latex / External Latex / Internal Latex / Gargle Latex / Bath	Human Adult	ZZ2009
Latex Peru	Used for wound healing, in baths before childbirth.	Latex / External	Human Adult	L04137
Latex Peru	Used for stomach ulcers.	Latex / Oral	Human Adult	L04137
Latex Peru	Used as an anti-inflammatory and vulnerary to heal wounds. Considered astringent, antioxidant, antiviral, anti-tumoral, anti-inflammatory, antiangiogenic, and anti-cancerous.	Latex / External Latex / External & Oral	Human Adult	ZZ2013
Latex Peru	Used topically on skin cancer.	Latex / External	Human Adult	H22027

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Latex Peru	Used for rheumatism.	Latex / Oral	Human Adult	N00002
Latex Peru	Used for cancer.	Latex / Oral	Human Adult	K10718
Latex Peru	Used to improve gastrointestinal function, to protect the mucous membrane lining of the lower gastrointestinal tract, and to treat diarrhea.	Latex / Oral	Human Adult	AS1002
Latex Peru	Used as an oral gargle for sore throat, as a vaginal antiseptic after childbirth, topically as a hemostatic, and taken internally for wound healing.	Latex / Various	Human Adult	AS1002
Latex Peru	Used for for hemorrhaging, as an antiseptic vaginal douche, for wounds, and ulcers in the mouth, throat and stomach.	Latex / Oral	Human Adult	ZZ1008
Latex Peru	Used for sore throat and laryngitis, toothaches, menstrual hemorrhages.	Latex / Oral	Human Adult	ZZ1093
Latex Peru	Used for stomach and intestinal ulcers.	Latex / Oral	Human Adult	ZZ1045
Latex Peru	Used for wounds, leucorrhea, fractures and piles.	Latex / External	Human Adult	ZZ1041
Latex Peru	Used for wound healing.	Latex / External	Human Adult	K10718
Latex Peru	Used for wounds and skin cancer. Used for cancer, high blood pressure, sore throat, infections, and diabetes.	Latex / External Latex / Oral	Human Adult	ZZ1084
Latex Peru	Used as a cicatrizant for wounds. Used for fractures and rheumatism (to reduce pain and inflammation). Used as a vaginal wash after childbirth. Used for stomach ulcers.	Latex / External Latex / External Infusion / Douche Latex / Oral	Human Adult	ZZ1101
Latex Peru Bark Peru	Considered cicatrizant, antiulcerous, anti-inflammatory, anti-tumorous, and anticancerous. Used for internal and external wounds and ulcers, for tuberculosis, cancer, urogenital disorders, internal and external inflammation, uterine disorders and inflammation, and mouth and throat inflammation, soreness and infections.	Latex / Oral & External and Bark Decoction / Oral	Human Adult	ZZ2012
Latex Peru	Used as a cicatrizant (forms scabs) and vulnerary (heals wounds). Used for hemorrhoids, leucorrhea, fractures, a vaginal wash after childbirth, stomach ulcers, and rheumatic swellings.	Latex / External Latex / Oral or External	Human Adult	ZZ1105

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Latex Peru	Peruvian ethnobiologist, Nicola Bautista Monardes (1493-1588) recorded Peruvian Indians using the latex medicinally in a 1580 publication.	Latex / Not stated	Human Adult	AS1011
Latex South America	Used as a cicatrizant, anti-inflammatory, hemostat, and antitumoral. Used for cuts, wounds, and skin ulcers.	Latex / Not stated Latex / External	Human Adult	AC1010
Latex South America	Used for diarrhea, wounds, tumors, stomach ulcers, herpes infection, and insect bites.	Latex External & Oral	Human Adult	L26272
Leaf+Bark Peru	A cold maceration of leaves and bark are used by various indigenous tribes in the Peruvian Amazon for bloody urine and clots in the bladder.	Maceration / Oral	Human Adult	AS1010
Leaves Peru	Fresh leaves are chewed to fortify the teeth and for toothaches.	Leaves / Oral	Human Adult	ZZ1093
Leaves Brazil	Considered depurative, febrifuge and stomachic.	H2O extract / Oral	Human Adult	ZZ1099

Presence of Compounds in Sangre de Grado (Croton lechleri)

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Benzene, 1-3-5-trimethoxy:	Benzenoid	Bark Sap Sap	Ecuador Ecuador Ecuador	0.0024%	H11766 K18768 H11766
Benzofuran-5-yl,2-3-dihydro: 2-(3 -dimethoxy-phenyl): 7-methoxy-3-methoxy-carbonyl-propan-1-oic acid methyl ester	Lignan	Sap	Brazil		K10718
Benzofuran-5-yl,2-3-dihydro:2-(4-hydroxy-3-methoxy-phenyl)-7-methoxy-3-methoxy-carbonyl-propen-1-oic acid methyl ester	Lignan	Sap	Brazil		K10718
Benzyl alcohol, 3-4-dimethoxy:	Benzenoid	Bark Sap	Ecuador Ecuador	0.0008%	H11766 H11766
Bincatriol	Diterpene	Bark Sap	Ecuador Ecuador	0.00792%	H11766 K18768
Boldine, iso	Alkaloid	Sap Sap Leaf Leaf	Peru Ecuador Peru Ecuador		AS1001 AS1001 AS1001 AS1001
Boldine, nor, iso	Alkaloid	Sap Sap Leaf Leaf	Peru Ecuador Peru Ecuador		AS1001 AS1001 AS1001 AS1001
Catechin (4-alpha-8)-gallocatechin (4-alpha-6)- gallocatechin	Flavonoid	Latex	Ecuador	00.09%	H07769
Catechin (4-alpha-8)-gallocatechin (4-alpha-8)-gallocatechin	Flavonoid	Latex	Ecuador		H07769
Catechin, (+):	Flavonoid	Latex Sap Latex	Ecuador Ecuador Ecuador	00.04%	H07769 K18768 L26126
Catechin, epi: (-):	Flavonoid	Latex Sap Latex	Ecuador Ecuador Ecuador	00.038%	H07769 K18768 L26126

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Cedrusin, 3'-4-o-dimethyl:	Lignan	Sap Sap	Peru Peru	00.00136%	J16430 K22608
Cedrusin, 3'-4-o-dimethyl: (dl):	Lignan	Sap	Brazil		K10718
Cedrusin, 4-o-methyl:	Lignan	Sap	Peru	00.00025%	J16430
Crolechinic acid	Diterpene	Bark Sap Sap	Ecuador Ecuador Ecuador	00.02943%	H11766 H11766 K18768
Crolechinol	Diterpene	Sap Bark	Ecuador Ecuador	00.00717%	K18768 H11766
Daucosterol	Steroid	Bark Sap Sap	Ecuador Ecuador Ecuador	00.0028%	H11766 H11766 K18768
Gallocatechin (4-alpha-6)-epi-gallocatechin	Flavonoid	Latex	Ecuador	00.36%	H07769
Gallocatechin (4-alpha-8)-epi-catechin	Flavonoid	Latex	Ecuador	00.0083%	H07769
Gallocatechin (4-alpha-8)-gallocatechin (4-alpha-8)-epi-gallocatechin	Flavonoid	Latex	Ecuador	00.13%	H07769
Gallocatechin, (+):	Flavonoid	Latex Sap	Ecuador Ecuador	00.072%	H07769 K18768
Gallocatechin, epi: (-):	Flavonoid	Latex Sap Latex	Ecuador Ecuador Ecuador	00.085%	H07769 K18768 L26126
Glaucine	Alkaloid	Leaf	Peru		AS1001
Hardwickiic acid	Diterpene	Bark Sap	Ecuador Ecuador	00.00660%	H11766 K18768
Korberin A	Diterpene	Bark Sap	Ecuador Ecuador	00.03584%	H14225 K18768
Korberin B	Diterpene	Bark Sap	Ecuador Ecuador	00.03018%	H14225 K18768

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Magnoflorine	Alkaloid	Sap Sap Leaf Leaf	Peru Ecuador Peru Ecuador		AS1001 AS1001 AS1001 AS1001
Phenethyl alcohol, 4-hydroxy:	Benzenoid	Sap Bark Sap	Ecuador Ecuador Ecuador	00.032%	K18768 H11766 H11766
Phenethyl alcohol, 4-hydroxy: acetate	Benzenoid	Bark Sap	Ecuador Ecuador	00.0044%	H11766 H11766
Phenol, 2-4-6-trimethoxy:	Benzenoid	Sap Bark Sap	Ecuador Ecuador Ecuador	00.0012%	K18768 H11766 H11766
Phenol, 3-4-dimethoxy:	Benzenoid	Bark Sap	Ecuador Ecuador	00.0014%	H11766 H11766
Procyanidin B-1	Flavonoid	Latex Latex	Ecuador Ecuador	00.046%	H07769 L26126
Procyanidin B-2	Flavonoid	Latex	Ecuador		L26126
Procyanidin B-4	Flavonoid	Latex Sap	Ecuador Ecuador	00.073%	H07769 K18768
Sinoacutine	Alkaloid	Leaf	Peru	00.0001%	K28263
Sitostenone, beta:	Steroid	Bark Sap	Ecuador Ecuador	00.0018%	H11766 H11766
Sitosterol, beta:	Steroid	Sap Bark Sap	Ecuador Ecuador Ecuador	00.0054%	K18768 H11766 H11766
SB-300	Flavonoid	Latex	Peru		L26431
SP-303	Flavonoid	Latex Latex Latex	Peru Peru Peru	01.0%	H14332 L26272 L26431

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #	
Taspine	Alkaloid	Sap	Peru	00.08504%	A14041	
		Latex	Peru		W02272	
		Sap	Peru		K22608	
		Latex	Peru		M26029	
		Sap	Peru		N00002	
		Sap	Peru		J16430	
		Bark	Ecuador		00.00014%	H11766
		Sap	Ecuador		H11766	
		Leaf	Peru		AS1001	
		Latex	Peru		AS1001	
		Latex	Ecuador		L26126	
		9.4%				
Thaliporphine	Alkaloid	Leaf	Peru		AS1001	

Biological Activities for Extracts of Sangre de Grado (*Croton lechleri*)

Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Latex Peru	Toxic Effects General	Fresh Latex	PO Mouse & Topical Mouse	Various	Inactive	In a two-stage mouse skin carcinogenesis system neither Latex nor taspine had carcinogenic or tumor promoter activity after 17 months of treatment.	M26029
Latex Peru	Cell Proliferation Activity	Fresh Latex	Cell Culture	Not stated	Inactive		AS1014
Latex Peru	Cell Proliferation Activity	Fresh Latex	Cell Culture	150 ng/ml	Inactive	vs. human foreskin fibroblasts (Had no effect on cell proliferation.)	M26029
Freeze-dried Latex Ecuador	Antiproliferation Activity	Fresh Latex	Cell Culture	100 mcg/ml	Weak Activity	vs. mitogen stimulated splenocytes and lymphoid leukemia cells	L26126
Latex Peru	Tumor Promoting Activity	Fresh Latex	Cell Culture	Not stated	Inactive		AS1014
Freeze-dried Latex Ecuador	Mutagenic Activity	H2O EXT	Agar Plate	IC50: 50 mcg/plate IC50: 100 mcg/plate IC50: 340 mcg/plate IC50: 430 mcg/plate	Inactive Inactive Active Active	<i>Salmonella typhimurium</i>	L24801
Latex Peru	Mutagenic Activity	H2O EXT	Agar Plate	Various	Weak Activity	<i>Salmonella typhimurium</i>	L27225
Latex Ecuador	Antimutagenic Activity	H2O EXT	Agar Plate	Various	Active	vs. sodium azid- and 2-nitrofluorene- induced mutagenicity	L24801
Dried Trunkbark Ecuador	Cytotoxic Activity	MEOH EXT	Cell Culture	IC50: 50.0 mcg/ml	Weak Activity	vs. CA-9KB	K18768
Heartwood Ecuador	Cytotoxic Activity	MEOH EXT	Cell Culture	IC50: 25.0 mcg/ml	Weak Activity	vs. CA-9KB	K18768
Dried Leaf Ecuador	Cytotoxic Activity	MEOH EXT	Cell Culture	IC50: 90.0 mcg/ml	Weak Activity	vs. CA-9KB	K18768

GI = Gastric Intubation IG = Intragastric IP = Intraperitoneally IV = Intravenously PO = Orally SC = Subcutaneously IM = Intramuscular

Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Dried Latex Ecuador	Cytotoxic Activity	CHCL3 EXT	Cell Culture	IC50: >900 mcg/ml	Inactive	vs. CA-9KB	K18768
Dried Latex Ecuador	Cytotoxic Activity	MEOH EXT Acetone EXT CHCL3 EXT ETOAC EXT	Cell Culture Cell Culture Cell Culture Cell Culture	IC50: 186.0 mcg/ml IC50: 125.0 mcg/ml IC50: 186.0 mcg/ml IC50: 70.0 mcg/ml	Equiv. Equiv. Equiv. Weak Activity	vs. CA-9KB	K18768
Freeze-dried Latex Ecuador	Cytotoxic Activity	H2O EXT	Cell Culture	IC50: 2.5 mcg/ml	Active	vs. Leuk-K562	L24801
Latex Peru	Cytotoxic Activity	Latex	Cell Culture	Not stated	Active	various tumor cell lines	AS1015
Latex Peru	Cytotoxic Activity	Dimethlycedrusine Ext	Cell Culture	GI50: 0.3 mcg	Active	various tumor cell lines	AS1009
Dried Bark Peru	Crown Gall Tumor Inhibition	ETOAC EXT	Cell Culture	LC50: 1.8 mcg/ml	Active	Assay system is intended to predict for antitumor activity.	T16253
Dried Bark Peru	Crown Gall Tumor Inhibition	H2O EXT	Cell Culture	LC50: 3.0 mcg/ml	Active	Assay system is intended to predict for antitumor activity.	T16253
Dried Bark Peru	Anticrustacean Activity	ETOAC EXT	<i>Artemia salina</i>	LC50: 15.2 mcg/ml	Active	Assay system is intended to predict for antitumor activity.	T16253
Dried Bark Peru	Anticrustacean Activity	H2O EXT	<i>Artemia salina</i>	LC50: 1000 mcg/ml	Active	Assay system is intended to predict for antitumor activity.	T16253
Fresh Latex Brazil	Anticytotoxic Activity	Latex	Cell Culture	Not stated	Active	endothelium-human-umbilical vein (Cells were protected against degradation in a starvation medium.)	K10718
Dried Stembark Ecuador	Cell Differentiation Induction	MEOH EXT	Cell Culture	IC50: 2.3 mcg/ml	Active	LEUK - HL60	L10644

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Freeze-dried Latex Ecuador	DNA Synthesis Inhibition	MEOH EXT Acetone EXT CHCL3 EXT ETOAC EXT	Cell Culture Cell Culture Cell Culture Cell Culture	20.0 mcg/ml 20.0 mcg/ml 20.0 mcg/ml 20.0 mcg/ml	Active Inactive Active Active	cells - endothelial	K18768
Fresh Latex Brazil	DNA Synthesis Inhibition	Not stated	Cell Culture	Not stated	Active	endothelium-human-umbilical vein (Cells were protected against degradation in a starvation medium.)	K10718
Fresh Latex Peru	Wound Healing Acceleration	Latex	External Mouse	Not stated	Active		M26029
Latex Peru	Wound Healing Acceleration	Latex Polyphenolic fraction	External Rat External Rat	0.01% 7.0%	Active Active		M26029
Fresh Latex Brazil	Wound Healing Acceleration	Not stated	Not stated	Not stated	Active		K10718
Freeze-dried Latex Ecuador	Immunostimulant Activity	Latex	Not stated	5 mcg/ml	Active	Increased phagocytosis in neutrophils.	L26126
Freeze-dried Latex Ecuador	Immunostimulant Activity	Latex	Not stated	10 mcg/ml	Active	Increased phagocytosis in monocytes.	L26126
Fresh Latex Peru	Analgesic Activity	Latex	IP Rat	50.0 mcg/animal	Active		L16482
Latex Peru	Anti-inflammatory Activity	Taspine fraction	Rat	Various	Active	vs. carrageenan-induced pedal edema, vs cotton pellet-induced granuloma and vs. adjuvant polyarthritis model.	N00002
Freeze-dried Latex Ecuador	Anti-inflammatory Activity	Latex	IP Rat	5 mg/kg	Active	vs. carrageenan-induced pedal edema	L26126
Fresh Latex Peru	Anti-inflammatory Activity	Latex	IP Rat	500 mcg/animal	Active		L16482
Freeze-dried Latex Ecuador	Antiulcerous Activity	Latex	Not stated	IC50: 5 mcg/ml	Active	vs. prednisolone-induced ulcers	L26126
Freeze-dried Latex Ecuador	Antioxidant Activity	Latex	Cell Culture	IC50: 7.73 mcg/ml	Active		L26126

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Latex Peru	Antioxidant Activity	Latex	In vitro	Not stated	Active	Scavenged free radicals, reduced lipid peroxidation and mediated free radical mediated DNA damage.	AS1012
Latex Peru	Antioxidant Activity	Latex	Cell Culture	Various	Active	vs. apomorphine-induced oxidative damage in <i>Saccharomyces cerevisiae</i>	L27225
Fresh Latex Peru	Hemostatic Activity	Latex	Rat	1%	Active	vs. mucosa (gastric)	L16482
Fresh Latex Peru	Vasorelaxation Activity	Latex	Rat	Not stated	Active	Artery	L16482
Fresh Latex Peru	Antioxidant Activity	Lyophilized EXT	Not stated	IC50: 1.0 mcg/ml	Active		J19239
Freeze-dried Latex Peru	CNS Depressant Activity	Latex	IG Mouse	ED50: 88.35 mg/kg	Active	vs. exploratory assay	L04841
Freeze-dried Latex Ecuador	Antidiarrheal Activity	Isolated favonoids SB-300 & SP-303	Cell Culture	Not stated	Active	Inhibited CFTR-mediated chloride secretion in human colonic epithelial cells.	L26431
Freeze-dried Latex Ecuador	Antibacterial Activity	Acetone EXT	Agar Plate	MIC: 30.0 mcg/disc	Weak Activity	<i>Bacillus subtilis</i> <i>Escherichia coli</i>	K18768
Freeze-dried Latex Ecuador	Antibacterial Activity	CHCL3 EXT	Agar Plate	MIC: 0.08 mcg/disc MIC: 10.0 mcg/disc	Active Active	<i>Bacillus subtilis</i> <i>Escherichia coli</i>	K18768
Freeze-dried Latex Ecuador	Antibacterial Activity	ETOAC EXT	Agar Plate	MIC: 50.0 mcg/disc	Weak Activity	<i>Bacillus subtilis</i> <i>Escherichia coli</i>	K18768
Freeze-dried Latex Ecuador	Antibacterial Activity	MEOH EXT	Agar Plate	MIC: 10.0 mcg/disc	Active	<i>Bacillus subtilis</i> <i>Escherichia coli</i>	K18768
Dried Bark Peru	Antibacterial Activity	ETOAC EXT	Agar Plate	1.0 mg/disc	Active Inactive	<i>Staphylococcus aureus</i> <i>Escherichia coli</i>	T16253
Dried Bark Peru	Antibacterial Activity	H2O EXT	Agar Plate	1.0 mg/disc	Inactive Inactive	<i>Staphylococcus aureus</i> <i>Escherichia coli</i>	T16253
Latex Colombia	Antibacterial Activity	H2O EXT	Agar Plate	1.0 mg/disc	Active	<i>Staphylococcus aureus</i>	AS1013

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Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Dried Bark Peru	Antifungal Activity	ETOAC EXT	Agar Plate	0.25 mg/ml 0.13 mg/ml 0.13 mg/ml Not stated	Active Active Active Inactive	<i>Trichophyllum gallinae</i> <i>Microsporium canis</i> <i>Microsporium gypseum</i> <i>Microsporium fulvum</i>	T16253
Dried Bark Peru	Antifungal Activity	H2O EXT	Agar Plate	Not stated	Inactive Inactive Inactive Inactive	<i>Trichophyllum gallinae</i> <i>Microsporium canis</i> <i>Microsporium gypseum</i> <i>Microsporium fulvum</i>	T16253
Dried Bark Peru	Antiyeast Activity	ETOAC EXT	Agar Plate	1.0 mg/disc	Inactive Inactive	<i>Candida albicans</i> <i>Saccharomyces cerevisiae</i>	T16253
Dried Bark Peru	Antiyeast Activity	H2O EXT	Agar Plate	1.0 mg/disc	Inactive Inactive	<i>Candida albicans</i> <i>Saccharomyces cerevisiae</i>	T16253
Latex Colombia	Antiviral Activity	H2O EXT	Cell Culture	Not stated	Active Active	Virus - <i>Cytomegalovirus</i> Virus - <i>Sindbis</i>	AS1013
Fresh Latex South America	Antiviral Activity	Latex	Cell Culture	Not stated	Active Active	Virus - Respiratory <i>Syncytial</i> Virus - <i>Influenza A</i>	H14332
Dried Bark Peru	Antiviral Activity	ETOAC EXT	Cell Culture	LC50: 0.28 mcg/ml LC50: <1.0 mcg/ml	Active Active	Virus - <i>Cytomegalovirus</i> Virus - <i>Sindbis</i> (Virus exposed to extract before infecting host cells.)	T16253
Dried Bark Peru	Antiviral Activity	H2O EXT	Cell Culture	IC50: 487.0 mcg/ml LC50: >100 mcg/ml	Active Inactive	Virus - <i>Cytomegalovirus</i> Virus - <i>Sindbis</i> (Infected host cells exposed to extract.)	T16253
Dried Bark Peru	Antiviral Activity	ETOAC EXT	Cell Culture	LC50: >100 mcg/ml	Inactive Inactive	Virus - <i>Cytomegalovirus</i> Virus - <i>Sindbis</i> (Virus exposed to extract before infecting host cells.)	T16253
Dried Bark Peru	Antiviral Activity	ETOAC EXT	Cell Culture	LC50: >100 mcg/ml	Inactive Inactive	Virus - <i>Cytomegalovirus</i> Virus - <i>Sindbis</i> (Infected host cells exposed to extract.)	T16253

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Biological Activities for Compounds in Sangre de Grado (Croton lechleri)

Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Taspine	Toxicity Assessment	PO Rat	LD50: 518 mg/kg	Active		N00002
Taspine	Carcinogenic Activity	External Mouse	0.2 mg/animal	Inactive	Dosing twice weekly for 17 months.	M26029
Taspine	Teratogenic Activity	Cell Culture	Not stated	Inactive	vs. rat embryo cultures	AS1006
Taspine	Embryotoxic Activity	Cell Culture	80 mcg/ml	Inactive	vs rat embryo cultures	AS1006
Taspine	Wound Healing Activity	Rat External	250 mcg/animal	Active	Had significantly greater mononuclear cellular infiltration over controls.	AS1007
Taspine	Wound Healing Activity	Rat External	250 mcg/animal	Active	Wound tensile strength increased at 5 & 7 days post surgery	AS1007
Taspine	Wound Healing Activity	Mouse External	ED50: 0.375 mg/kg	Active		M26029
Taspine	Wound Healing Activity	Human External	Not stated	Active		K15048
Taspine	Wound Healing Activity	In vivo In vitro	150-300 mcg/animal 0.50-0.4 mcg/ml	Active Active	Enhanced wound healing by increasing the autocrine of TGF-beta1 and EGF by fibroblasts.	AS1016
Taspine	Wound Healing Activity	Rat External	2 mg/ml	Active	Promoted skin wound healing, accelerated the growth of newly born capillaries and raised the production of protein and collagen in wound tissue.	AS1017
Taspine	Cytotoxic Activity	Cell Culture	IC50=0.39 mcg/ml IC50=0.17 mcg/ml	Active Active	KB cancer cells V-79 cancer cells	AS1008
Taspine	Cytotoxic Activity	Cell Culture	IC50=0.39 mcg/ml IC50=0.17 mcg/ml	Active Active	CA-9KB cancer cells. Hamster-Chinese V79	L04063 M30433
Taspine	Immune Enhancement Activity	Cell Culture	Not stated	Active	Enhanced phagocytosis in monocytes.	L26126
Taspine	Cell Growth Enhancement	Cell Culture	100 mcg/ml	Inactive	fibroblasts - foetal lung	AS1007
Taspine	Cell Migration Effect	Cell Culture	0.2 ng/ml	Active	fibroblasts - human	M26029

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Taspine	Anticomplement Activity	Cell Culture	IC50: 38 mcg/ml	Active	vs. CP complement system	L26126
Taspine	Anti-inflammatory Activity	GI Rat GI Rat	100 mg/kg 20 mg/kg 20 mg/kg	Active Active Active	vs. carrageenan-induced pedal edema vs. adjuvant-induced arthritis vs. cotton pellet granuloma	A14041
Taspine	Anti-inflammatory Activity	IG Rat	58 mg/kg 20 mg/kg 20 mg/kg	Active Active Active	vs. carrageenin-induced pedal edema vs. cotton pellet-induced granuloma vs. adjuvant polyarthritis	N00002
Taspine	Antiviral Activity	Cell Culture	Not stated	Active Active Active	Avian myeloblastosis Rauscher murine leukemia Simian sarcoma	K10864
Taspine	Antiviral Activity	Cell Culture	Not stated	Active	Inhibited glucose-6-phosphate dehydrogenase in animal tumor viruses.	L00933
SP-303	Toxic Effect	IG Mouse	90 mg/kg	Inactive		H14332
SP-303	Toxic Effect	IG Monkey	> 200 mg/kg	Active	CNS side effects, thrombocytopenia & histopathological side effects.	H14332
SP-303	Toxic Effect	IG Dog	100 mg/kg	Inactive		H14332
SP-303	Toxic Effect	IP Rat	30 mg/kg	Active	All animals died.	K19993
SP-303	Toxicity Assessment	IP Mouse IV Mouse IV Rat IP Rat IG Rat IV Dog	LD50: >50 mg/kg LD50: >100 mg/kg LD50: >50 mg/kg LD50: >100 mg/kg LD50: >300 mg/kg LD50: >18.9 mg/kg	Inactive		H14332
SP-303	Toxic Effect	IP Mouse	30 mg/kg	Inactive		H14332
SP-303	Antidiarrheal Activity	Human Oral	50 mg daily Not stated 2 gm daily 2 gm daily	Active Active Active Active		J16486 J17024 L05604 L06176
SP-303	Antidiarrheal Activity	IG Mouse	100 mg/kg	Active		L06695

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
SP-303	Antiviral Activity	Cell Culture	ED50: 13.6 mcg/ml ED50: 6.7 mcg/ml ED50: 7.0 mcg/ml ED50: 13.7 mcg/ml ED50: 3.0 mcg/ml ED50: 50.0 mcg/ml	Active Active Active Active Active Active	Respiratory syncytial A Respiratory syncytial B Influenza A Influenza B Parainfluenza Type 1 Parainfluenza Type 3	H14332
SP-303	Antiviral Activity	Cell Culture	ED50: 79.0 mcg/ml ED50: 3.0 mcg/ml ED50:14.0 mcg/ml ED50: 7.0 mcg/ml ED50: 14.0 mcg/ml	Active Active Active Active Active	Parainfluenza Type 3 Parainfluenza Type 1 Respiratory syncytial Influenza A Influenza B	K10599
SP-303	Antiviral Activity	IP Rat IP Rat IG Rat IG Rat	ED50: 3.0 mcg/ml ED50: 3.0 mcg/ml ED50: 10.0 mcg/ml ED50: 10.0 mcg/ml	Active Active Active Active	Respiratory syncytial Parainfluenza Type 3 Respiratory syncytial Parainfluenza Type 3	K10599
SP-303	Antiviral Activity	Cell Culture	Not stated	Inactive Inactive	Adenovirus 5 Measles virus	H14332 K11125
SP-303	Antiviral Activity	IV Monkey IG Monkey	5.0 mg/kg 30.0 mg/kg	Active Active	Respiratory syncytial	H14332
SP-303	Antiviral Activity	IP Rat IG Rat	1 mg/kg 1 mg/kg	Active Active	Respiratory syncytial	H14332
SP-303	Antiviral Activity	IP Mouse IG Mouse	9 mg/kg 9 mg/kg	Active Active	Influenza A	H14332
SP-303	Antiviral Activity	IP Ferret	10 mg/kg	Inactive	Influenza A	H14332
SP-303	Antiviral Activity	Aerosol Rat	1 mg/kg	Active	Respiratory syncytial	H14332
SP-303	Antiviral Activity	IP Rat	10 mg/kg	Active	Parainfluenza Type 3	H14332
SP-303	Antiviral Activity	Vaginal Guinea Pig	30%	Inactive	Herpes Simplex 1	H14332
SP-303	Antiviral Activity	IP Mouse IG Mouse Vaginal Mouse Vaginal Guinea Pig	30 mg/kg 90 mg/kg 10% 10%	Active Active Active Active	Herpes Simplex 2	H14332

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Compound	Activity Tested For	Test Model	Dosage	Result	Notes/Organism tested	Ref #
SP-303	Antiviral Activity	IP Rat IP Rat	1.0 mg/kg 3.4 mg/kg	Active Active	Respiratory syncytial Parainfluenza Type 3	K10657
SP-303	Antiviral Activity	Cell Culture	ED50: 9 mcg/ml ED50: 7 mcg/ml ED50: 11 mcg/ml ED50: 3 mcg/ml ED50: 98 mcg/ml ED50: 5 mcg/ml	Active Active Active Active Active Active	Influenza A - Taiwan Influenza A - Shanghai Influenza B - Yamagata Parainfluenza Type 1 Parainfluenza Type 3 Respiratory syncytial	K11125
SP-303	Antiviral Activity	Vaginal Mouse IG Mouse IP Mouse	10% 540 mg/kg 30 mg/kg	Active Active Active	Herpes Simplex 2	K13678
SP-303	Antiviral Activity	Cell Culture	IC50: 1 to 5 mmol IC50: 1 to 7 mmol	Active Active	Herpes Simplex 1 (various strains) Herpes Simplex 2 (various strains)	K13678
SP-303	Cytotoxic Activity	Cell Culture	Various	Inactive Inactive Inactive Inactive Inactive	Cells-Vero CA-A549 CA-HEP-2 Canine-Kidney Glioma-Human-ONS-12	K14332 K11125
SP-303	Cytotoxic Activity	Cell Culture	IC50: 4.0 mmol IC50: 3.0 mmol	Active Active	Hep2 Cells Cells-Vero	K13678

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