Technical Data Report

for

MULLACA

Physalis angulata

Sage Press

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Mullaca

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Family: Solanaceae

Genus: *Physalis*

Species: *angulata*

Synonyms: *Physalis capsicifolia, P. lanceifolia, P. ramosissima*

Common Names: Mullaca, camapu, bolsa mullaca, cape gooseberry, wild tomato, winter cherry, juá-de-capote, capulí cimarrón, battre-autour, k'u chih, 'urmoa batoto bita, cecendet, dumadu harachan, hog weed, nvovo, polopa, saca-buche, thongtheng, tino-tino, topatop, wapotok

Parts Used: Whole plant, leaves, roots

Mullaca is an annual herb indigenous to many parts of the tropics, including the Amazon. It can be found on most continents in the tropics, including Africa, Asia, and the Americas. It grows up to 1 m high, bears small, cream-colored flowers, and produces small, light yellowish-orange, edible fruit sometimes referred to as cape gooseberry.

Mullaca has long held a place in natural medicine in the tropical countries where it grows. Its use by rainforest Indians in the Amazon is well documented, and its edible sweet-tart fruits are enjoyed by many rainforest inhabitants, animal and human alike. Indigenous tribes in the Amazon use a leaf infusion as a diuretic. Some Colombian tribes believe the fruits and leaves have narcotic properties and decoct them as an anti-inflammatory and disinfectant for skin diseases; others use a leaf tea for asthma. Indigenous peoples in the Peruvian Amazon use the leaf juice internally and externally for worms and the leaves and/or roots for earache, liver problems, malaria, hepatitis, and rheumatism. Indigenous tribes in the Brazilian Amazon use the sap of the plant for earaches and the roots for jaundice. Mullaca has also been used by indigenous peoples for female disorders. In the Solomon Islands, the fruit of mullaca is decocted and taken internally to promote fertility. A tea is made of the entire plant and/or the leaves in the West Indies and Jamaica to prevent abortion or miscarriages. In Peru the leaf is infused and used to treat postpartum infection while in Tonga the entire plant is used for the same condition.

Mullaca is employed in herbal medicine in both Peru and Brazil. In Peruvian herbal medicine the plant is called *mullaca* or *bolsa mullaca*. To treat diabetes, the roots of three mullaca plants are sliced and macerated in 1/4 liter of rum for seven days. Honey is added, and 1/2 glass of this medicine is taken twice daily for 60 days. In addition, an infusion of the leaves is recommended as a good diuretic, and an infusion of the roots is used to treat hepatitis. For asthma and malaria, the dosage is 1 cup of tea made from the aerial parts of the plant. In Brazilian herbal medicine the plant is named *camapu.* There it is employed for chronic rheumatism, for skin diseases and dermatitis, as a sedative and diuretic, for fever and vomiting, and for many types of kidney, liver, and gallbladder problems.

Phytochemical studies on mullaca reveal that it contains many types of biologically active, naturally occurring chemicals including flavonoids, alkaloids, and many different types of plant steroids, some of which have never before been seen in science.[1–6] Mullaca has been the subject of recent clinical research (which is still ongoing), based on the preliminary studies showing that it is an effective immune stimulant, is cytotoxic to numerous types of cancer and leukemia cells, and that it has antimicrobial properties. The new steroids found in mullaca have received the most attention, and many of the documented anti-cancerous, anti-tumorous and anti-leukemic actions are attributed to these steroids. Various extracts of mullaca, as well as these extracted plant steroids called *physalins,* have shown strong *in vitro* and *in vivo* (mice) cytotoxic activity against numerous types of human and animal cancer cells including lung, colon, nasopharynx, liver, cervix,

melanoma and glioma (brain) cancer cells.[7–12] This cancer research began in the early 1980s with researchers in Thailand and the U.S.[7,8] and was verified with research performed at the University of Taiwan in 1992 (where they demonstrated a significant cytotoxic effect against five human cancer cell lines and three animal cancer cell lines).[9] Then in 2001, researchers at the University of Houston isolated yet another new chemical in mullaca which demonstrated remarkable toxicity against nasopharynx cancer cells, lung adenocarcinoma cancer cells as well as leukemia in mice.[10] The same Taiwanese researchers had already published a separate study on mullaca's other anti-leukemic phytochemicals in 1992, reporting that two physalin chemicals inhibited the growth of five types of acute leukemia, including lymphoid (T & B), promyelocytic, myeloid and monocytic.[11] Other researchers in China and Russia independently demonstrated significant immunomodulatory effects against blastogenesis while boosting other immune functions which might account for the anti-leukemic effects in mice seen by other researchers.[13,14] With tumor cells, research suggests that several of the steroidal chemicals in mullaca act on topoisomerase II to arrest the cell cycle in cancer cells[15,16] as well as enhance phosphorylation.[17,18]

In another area of study, mullaca's antimicrobial actions have been confirmed by several research groups. Most recently in 2002 and 2000, mullaca was shown to be active *in vitro* against several strains of mycobacteriums and mycoplasmas.[19,20] In addition to these actions, mullaca has demonstrated effective antibacterial properties *in vitro* against numerous types of gram positive and gram negative bacteria, including *Pseudomonas, Staphylococcus* and *Streptococcus.*[21,22] Other research groups in Japan have been focusing on mullaca's antiviral actions and preliminary studies show that it is active *in vitro* against Polio virus I, Herpes simplex virus I, the measles virus, and HIV-I—demonstrating reverse transcriptase inhibitory effects.[23–26] Mullaca has also demonstrated antispasmodic activities in guinea pigs,[27] hypotensive properties in cats and isotonic muscle contracting properties in toads,[28] and an *in vitro* anticoagulant effect[29] by other research groups. Western scientists did somewhat validate the indigenous use for diabetes when they reported a mild hypoglycemic effect in mice fed a water extract of the root.[30] One must wonder what the results would have been if they had followed native customs and employed an alcohol extract instead.

Interestingly enough, much of the clinical research has ignored the local and indigenous uses of the plant; thus, many of its effective uses in herbal medicine remain unexplained. Its tested antibacterial properties could validate its use as a antiseptic and disinfectant for skin diseases and its use to treat gonorrhea. Its antiviral properties could well explain its long history of use for hepatitis, although scientists have not tested it specifically against hepatitis. Possibly the antispasmodic and muscle contractive properties documented for mullaca might explain its widespread use for asthma and female disorders as well. Yet its widespread use throughout the rainforests for malaria and fevers remains unexplained by science.

Documented Properties and Actions: Analgesic, antiasthmatic, antibacterial, anticoagulant, antigonorrhoeal, antihyperglycemic, anti-inflammatory, anti-leukemic, antimicrobial, antimutagenic, antimycobacterial, antiseptic, antispasmodic, antitumorous, antiviral, cytotoxic, diuretic, expectorant, febrifuge, hypotensive, immunostimulant, trypanocidal

Main Phytochemicals: Ayanin, chlorogenic acid, choline, ixocarpanolide, myricetin, phygrine, physagulin A thru G, physalin A thru K, physangulide, sitosterol, vamonolide, withaminimin, withangulatin A, withanolide D, withanolide T, withaphysanolide

Traditional Remedy: One-half to one cup of a whole herb infusion 1–3 times daily or 1–2 ml of a 4:1 tincture twice daily. Two to 4 grams of powdered whole herb (depending on body weight) in tablets or capsules or stirred into water or juice twice daily can be substituted if desired.

Contraindications: One *in vitro* study and one animal study indicates this plant or isolated chemicals in this plant may lower blood pressure[27] and has demonstrated a blood anticoagulant activity.[28] People with blood disorders such as hemophilia, those taking heart medications, or those with other heart problems such as low blood pressure should not use this plant without supervision

and advice of a qualified health care practitioner.

Drug Interactions: None reported; however, see above contraindications above.

WORLDWIDE ETHNOBOTANICAL USES

Country	Uses
Africa	Sterility, throat
Brazil	Depurative, dermatitis, diuretic, dysuria, earache, emesis, fever, gallbladder, kidney, jaundice, liver, malaria, rheumatism, sedative, skin disease
Burkina Faso	Analgesic, diarrhea, nausea, sleeping sickness
Central America	Abortion preventative, fever, gonorrhea, malaria, skin disease
China	Diuretic, expectorant, fever, labor
Colombia	Anti-inflammatory, asthma, disinfectant, narcotic, skin disease
Ghana	Fever, stomach, syncope
Haiti	Diuretic, fever, hydropsy
Japan	Antidote, cold, diuretic, fever, swelling, throat
Peru	Anti-inflammatory, asthma, diabetes, disinfectant, diuretic, earache, hepatitis, infection (postpartum), jaundice, liver, malaria, pruritis, rheumatism, skin disease, worms
Taiwan	Antipyretic, diuretic, hepatitis, liver disease, tumors
Thailand	Boil, rectum
Trinidad	Antiseptic, fever, indigestion, nephritis, rectitis
Suriname	Diuretic, gonorrhea, jaundice, malaria, nephritis
Upper Volta	Analgesic, diarrhea, nausea, sleeping sickness
Elsewhere	Abortion preventative, antibacterial, anti-inflammatory, antiseptic, asthma, childbirth, dermatosis, diabetes, diarrhea, hemostatic, hemorrhage (postpartum), infertility, narcotic, ophthalmia, tumor (testicle), skin disease, sleeping sickness

References

1. Vasina, O. E., et al. “Withasteroids of Physalis. VII. 14-alpha-hydroxyixocarpanolide and 24,25-epoxy-withanolide D.” *Chem. Nat. Comp.* 1987; 22(5): 560–65.
2. Chen, C. M., et al. “Withangulatin A, a new withanolide from *Physalis angulata*.” *Heterocycles* 1990; 31(7): 1371–75.
3. Shingu, K., et al. “Physagulin C, a new withanolide from *Physalis angulata* L.” *Pharm. Bull.* 1991; 39(6): 1591–93.
4. Shingu, K., et al. “Three new withanolides, physagulins A, B and D from *Physalis angulata* L.” *Chem. Pharm. Bull.* 1992; 40(8): 2088–91.
5. Shingu, K., et al. “Three new withanolides, physagulins E, F and G from *Physalis angulata* L.” *Chem. Pharm. Bull.* 1992; 40(9): 2448–51.
6. Basey, K., et al. “Phygrine, an alkaloid from *Physalis* species.” *Phytochemistry* 1992; 31(12): 4173–76.
7. Anon. “Biological assay of antitumor agents from natural products.” Abstr.: Seminar on the Development of Drugs from Medicinal Plants Organized by the Department of Medical Science Department at Thai Farmer Bank, Bangkok, Thailand 1982; 129.

8. Antoun, M. D., et al. “Potential antitumor agents. XVII. physalin B and 25,26-epidihydrophysalin C from *Witheringia coccoloboides*.” *J. Nat. Prod.* 1981; 44(5): 579–85.
9. Chiang, H., et al. “Antitumor agent, physalin F from *Physalis angulata* L.” *Anticancer Res.* 1992; 12(3): 837–43.
10. Ismail, N., et al. “A novel cytotoxic flavonoid glycoside from *Physalis angulata*.” *Fitoterapia* 2001 Aug. 72(6): 676–79.
11. Chiang, H. et al. “Inhibitory effects of physalin B and physalin F on various human leukemia cells *in vitro*.” *Anticancer Res.* 1992; 12(4): 1155–62.
12. Kawai, M., et al. “Cytotoxic activity of physalins and related compounds against HeLa cells.” *Pharmazie* 2002; 57(5): 348–50.
13. Lin, Y. S. et al. “Immunomodulatory activity of various fractions derived from Physalis angulata L. extract.” *Amer. J. Chinese Med.* 1992; 20(3/4): 233–43.
14. Sakhibov, A. D. et al. “Immunosuppressive properties of vitasteroids.” *Dokl. Akad. Nauk. Uzb. SSR.* 1990; 1: 43–45.
15. Lee, W. C., et al. “Induction of heat-shock response and alterations of protein phosphorylation by a novel topoisomerase II inhibitor, withangulatin A, in 9L rat brain tumor cells.” *Cell Physiol.* 1991; 149(1): 66-67.
16. Juang, J. K., et al. “A new compound, withangulatin A, promotes type II DNA topoisomerasemediated DNA damage.” *Biochem. Biophys. Res. Commun.* 1989; 159(3): 1128–34.
17. Lee, Y. C., et al. “Integrity of intermediate filaments is associated with the development of acquired thermotolerance in 9L rat brain tumor cells.” *J. Cell. Biochem.* 1995; 57(1): 150–62.
18. Perng, M. D., et al. “Induction of aggregation and augmentation of protein kinase-mediated phosphorylation of purified vimentin intermediate filaments by withangulatin A.” *Mol. Pharmacol.* 1994; 46(4): 612–17.
19. Januario, A. H., et al. “Antimycobacterial physalins from *Physalis angulata* L. (Solanaceae).” *Phytother. Res.* 2002; 16(5): 445–48.
20. Pietro, R. C., et al. “*In vitro* antimycobacterial activities of *Physalis angulata* L.” *Phytomedicine* 2000; 7(4): 335–38.
21. Hussain, H., et al. “Plants in Kano ethnomedicine; screening for antimicrobial activity and alkaloids.” *Int. J. Pharmacol.* 1991; 29(1): 51–56.
22. Ogunlana, E. O., et al. “Investigations into the antibacterial activities of local plants.” *Planta Med.* 1975; 27: 354.
23. Otake, T., et al. “Screening of Indonesian plant extracts for anti-Human Immunodeficiency Virus- Type 1 (HIV-1) Activity.” *Phytother. Res.* 1995; 9(1): 6–10.
24. Kusumoto, I. T., et al. “Screening of some Indonesian medicinal plants for inhibitory effects on HIV-1 protease.” *Shoyakugaku Zasshi* 1992; 46(2): 190-93.
25. Kusumoto, I., et al. “Inhibitory effect of Indonesian plant extracts on reverse transcriptase of an RNA tumour virus (I).” *Phytother. Res.* 1992; 6(5): 241–44.
26. Kurokawa, M. et al. “Antiviral traditional medicines against *Herpes simplex* virus (HSV-1), polio virus, and measles virus *in vitro* and their therapeutic efficacies for HSV-1 infection in mice.” *Antiviral Res.* 1993; 22(2/3): 175–88.
27. Cox, P. A. “Pharmacological activity of the Samoan ethnopharacopoeia.” *Econ. Bot.* 1989; 43(4): 487–97.
28. Cesario De Mello, A., et al. “Presence of acetylcholine in the fruit of *Physalis angulata* (Solanaceae).” *Cienc. Cult.* (Saõ Paulo) 1985; 37(5): 799–805.
29. Kone-Bamba, D., et al. “Hemostatic activity of 216 plants used in traditional medicine in the Ivory Coast.” *Plant Med. Phytother.* 1987; 21(2): 122–30.
30. Richter, R. K., et al. “Reporting biological assay results on tropical medicinal plants to host country collaborators.” *J. Ethnopharmacol.* 1998; 62(1): 85–88.

Ethnomedical Information on Mullaca (Physalis angulata)

Plant Part / Location	Documented Ethnic Use	Type Extract / Route	Used For	Ref #
Entire Plant Ivory Coast	Used for treatment of sleeping sickness.	H2O Ext / Oral	Human Adult	W00799
Entire Plant Jamaica	Used to prevent an abortion after a fall during pregnancy.	H2O Ext / Oral	Human (pregnant)	W01270
Entire Plant Nigeria	Taken during childbirth	H2O Ext / Oral	Human (pregnant)	A00040
Entire Plant Nicaragua	Used for fever. Used for skin sores and rashes.	Decoction / Oral Decoction / External	Human Adult Human Adult	L16047
Entire Plant Surinam	Used for nephritis, jaundice, gonorrhea, malaria, and as a diuretic.	Infusion / Oral	Human Adult	J12451
Entire Plant Taiwan	Used as an antipyretic, a diuretic, antitumor medicine.	Hot H20 Ext / Oral	Human Adult	H06423
Entire Plant Taiwan	Used for liver disease.	Hot H20 Ext / Oral	Human Adult	T14999
Entire Plant Tonga	Used to treat postpartum hemorrhage.	Infusion / Oral	Human (female)	T08685
Fruit Solomon Islands	Used to promote fertility.	H2O Ext / Oral	Human (female)	A04392
Fruit Peru	Used for postpartum infection. Used for itching.	Infusion / Vaginal Infusion / External	Human (female) Human Adult	L17008
Fruit Colombia	Narcotic properties. Used as an anti-inflammatory. Used as a disinfectant for skin diseases.	Decoction / Oral Decoction / Oral Decoction / Oral	Human Adult Human Adult Human Adult	AC1004
Leaf Colombia	Used for asthma.	Hot H2O Ext / Oral	Human Adult	AC1005
Leaf Guatemala	Used for gonorrhea.	Infusion / Oral	Human Adult	K27236
Leaf Guinea	Used as an anti-dermatosis.	H2O Ext / Oral	Human Adult	K27039
Leaf Nicaragua	Used for fever and for malaria.	Infusion / Oral	Human Adult	K27070
Leaf West Indies	Used to prevent abortion after a fall during pregnancy.	Hot H2O Ext / Oral	Human (pregnant)	T00701
Dried Leaf Peru	Used for malaria.	Infusion / Oral	Human Adult	H28598

Plant Part / Location	Documented Ethnic Use	Type Extract * Route	Used For	Ref #
Dried Leaf Peru	Used for postpartum infection. Used for itching.	Infusion / Vaginal Infusion / External	Human (female) Human Adult	L17008
Leaf Peru	Used as a diuretic and antiinflammatory and for asthma. Used as a disinfectant for skin diseases. Used for worms. Used for earache. Used for liver problems. Used for hepatitis. Used for rheumatism.	Infusion / Oral Decoction / External Leaf Juice / Oral Leaf Juice / Aural Leaf Juice / Oral & Ext Leaf Juice / Oral & Ext Leaf Juice / Oral & Ext	Human Adult Human Adult Human Adult Human Adult Human Adult Human Adult Human Adult	L04137 L04137 L04137 L04137 AC1001 AC1002 AC1003
Fresh Leaf Ivory Coast	Used as a hemostatic.	Leaves / External	Human Adult	T15327
Fresh Leaf Philippines	Used to treat diarrhea - heat leaves over a low flame then paste it on the stomach.	Leaves / External	Human Adult	M29360
Fresh Leaf Rotuma	Used for bacterial infection.	Leaves / External	Human Adult	J12394
Entire Plant Brazil	Used to treat malaria.	Not stated / Oral	Human Adult	J14512
Root Brazil	Used for jaundice. Used to treat malaria, for liver disorders, and as a febrifuge for intermittent or ordinary fevers.	Infusion / Oral	Human Adult	AC1007 L15570
Root Mozambique	Used for diabetes.	H20 Ext / Oral	Human Adult	L01568
Root Peru	Used for hepatitis and for jaundice.	Infusion / Oral	Human Adult	L04137
Root Peru	Used for earache, liver problems, malaria and rheumatism.	Not stated / Oral and External	Human Adult	AC1001 AC1002 AC1003
Root Peru	Used for diabetes.	Alcohol Tincture / Oral	Human Adult	AC1006
Sap Brazil	Used for earaches.	Not stated / Aural	Human Adult	AC1007
Dried Sap Peru	Used for postpartum infection. Used for itching.	Sap / Vaginal Sap / External	Human (female) Human Adult	L17008
Seed Bougainville	Used for barrenness.	Hot H20 Ext / Oral	Human (female)	T05034
Dried Stem Taiwan	Used to treat hepatitis.	Decoction / Oral	Human Adult	M29355

Plant Part / Location	Documented Ethnic Use	Type Extract * Route	Used For	Ref #
Part Not Specified Brazil	Used as a sedative and diuretic, used to treat chronic rheumatism, skin diseases and dermatitis, fever, vomiting and kidney, liver and gallbladder problems.	Not stated	Human Adult	AC1008

Presence of Compounds in Mullaca (Physalis angulata)

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Ayanin	Flavonol	Entire Plant	Not stated	Not stated	K01546
Chlorogenic Acid	Phenylpropanoid	Leaf	France	Not stated	W03775
Choline,acetyl;	Alkaloid-misc	Fruit	Brazil	Not stated	M10843
Ixocarpanolide,14-alpha-hydroxy	Steroid	Aerial Parts	USSR	00.01257%	H03000
Myricetin-3-O-Neohesperidoside	Flavonol	Leaf	USA-TX	00.034%	H28598
Phygrine	Alkaloid	Entire Plant	China	Not stated	H11266
Physagulin A	Steroid	Leaf + Stem	Japan(cult)	00.00143%	H09792
Physagulin B	Steroid	Leaf + Stem	Japan(cult)	00.01%	H09792
Physagulin C	Steroid	Leaf + Stem	Japan(cult)	00.0135%	H07746
Physagulin D	Steroid	Leaf + Stem	Japan(cult)	00.0075%	H09792
Physagulin E	Steroid	Fruit	Japan(cult)	00.00027%	H09950
Physagulin F	Steroid	Fruit	Japan(cult)	00.00054%	H09950
Physagulin G	Steroid	Fruit	Japan(cult)	00.000409%	H09950
Physalin B	Steroid	Stem Leaf Stem Root Culture Stem Leaf Entire Plant	India(cult) India(cult) India Brazil India(cult) India Taiwan	00.0125% 00.021% 00.0053% Not stated Not stated Not stated Not stated	N00729 N00729 N00729 L11291 N00665 N06627 K08937

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Physalin D	Steroid	Entire Plant Stem Leaf Leaf Leaf Stem	Taiwan India(cult) India India India(cult) India	00.00666% Not stated Not stated Not stated 00.01% 00.0062%	K07329 N00665 N06627 N06627 N00729 N00729
Physalin E	Steroid	Stem Leaf Leaf Stem	India(cult) India India(cult) India	Not stated Not stated 00.01% 00.0062%	N00665 N06627 N00729 N00729
Physalin F	Steroid	Entire Plant Entire Plant Stem Leaf Stem Leaf Stem	Taiwan Taiwan India(cult) India India(cult) India(cult) India	Not stated 00.00311% Not stated Not stated 00.01% 00.035% 00.00083%	K08937 K07329 N00665 N06627 N00729 N00729 N00729
Physalin G	Steroid	Stem Leaf Stem	India(cult) India India	Not stated Not stated 00.0043%	N00665 N06627 N00729
Physalin H	Steroid	Leaf Stem	India India(cult)	Not stated 00.0096%	N06627 N00729
Physalin I	Steroid	Stem Stem	India(cult) India(cult)	00.0018% Not stated	N00729 N06627
Physalin J	Steroid	Stem	India(cult)	Not stated	N00665
Physalin K	Steroid	Leaf	India	Not stated	N06627
Physangulide	Steroid	Leaf	USSR	Not stated	M26779
Sitosterol,beta;	Steroid	Stem	India(cult)	00.0125%	N00729
Vamonolide	Steroid	Aerial Parts	USSR	00.0015%	T14820
Withagulatin A	Steroid	Leaf + Stem	India(cult)	00.0045%	H09792

Compound	Chemical Type	Plant Part	Plant Origin	Quantity	Ref #
Withaminimin	Steroid	Leaf + Stem	Japan(cult)	00.0035%	H09792
Withangulatin A	Steroid	Entire Plant	Taiwan	00.0058%	H06423
Withanolide D,24-25-epoxy:	Steroid	Aerial Parts	USSR	00.02586%	H03000
Withanolide T	Steroid	Aerial Parts	USSR	00.00264%	M28655
Withaphysanolide	Steroid	Leaf	Sudan	Not stated	M11773

Other Phytochemical Screening:

Alkaloids Present	**Entire Plant**	**M27767**
	Entire Plant	**L16047**
Steroidal Saponins Present	**Leaf**	**M11773**

Biological Activities for Extracts of Mullaca (Physalis angulata)

IN VIVO RESEARCH

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Entire Plant Taiwan	Antitumor Activity	ETOH(95%)Ext	IP Mouse	75 mg/kg	Active	LEUK-P388	K07329
Leaf Not Stated	Antitumor Activity	Fraction: Physalin F	IP Mice	Not stated	Active	P388 lymphocytic leukemia.	AC1009
Part Not Stated China	Cytotoxic Activity	Fraction: Withangulatin A	IP Rat	Not stated	Active	In 9L rat brain tumor cells inhibited Topoisomerase II	AC1011
Leaf USA	Cytotoxic Activity	MEOH Ext	Cat	IC50=3.93 mcg/ml	Active	Cancer cells: CA-A549	H28598
Root Not Stated	Antileukemic Activity	Fraction: Physalin B	Mouse	Not stated	Weak Activity	3PS murine leukemia	AC1016
Entire Plant Taiwan	Protein Synthesis inhibition Activity	ETOH(95%)Ext	IP Mouse	20 mg/kg	Active	LEUK-P388	K07329
Entire Plant USSR	Immunomodulatory Activity	Not stated	IP Mouse	50 mg/kg	Active	Blastogenic transformation of human lymphocytes was assayed.	M30421
Entire Plant USSR	Lymphocyte Blastogenesis Inhibition	Not stated	IP Mouse	50 mg/kg	Active		M30421
Entire Plant Samoa	CNS Effects(general)	Not stated	Gastric Mouse IP Mouse	1 gm/kg 1 gm/kg	Inactive Inactive	Hippocratic Screen Hippocratic Screen	J11102
Entire Plant Samoa	Spasmolytic Activity	Not stated	Guinea Pig Illeum	2 mg/ml	Active	vs. electrical stimulation.	J11102
Fruit Brazil	Contracting Effect (non-specific)	H2O Ext	Rat	Not stated	Active	Blocked by gallamine or atropine.	M10843
Fruit Brazil	Contracting Effect (non-specific)	H2O Ext	Toad	Not stated	Active	Isotonic contraction of isolated rectus abdominis.	M10843
Fruit Brazil	Contracting Effect (non-specific)	H2O Ext	Toad (Heart)	Not stated	Active	Blocked by gallamine or atropine	M10843

GI = Gastric Intubation IG = Intragastric NG = Nasogastric IP = Intraperitoneally IV = Intravenously SC = Subcutaneously IM = Intramuscular

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Fruit Brazil	Hypotensive Activity	H2O Ext	Cat	Not stated	Active	Blocked by gallamine or atropine	M10843
Not Stated Brazil	Colony-stimulating factor production stimulation	Infusion	IP Mouse	0.5 ml/animal	Equivocal	vs. IPS-induced proliferation	L07194
Entire Plant Surinam	Binding Effect	ETOH(80%)Ext	Human Adult	10.0 mcg/ml	Inactive	Inhibited radioligand binding to adrengeric-receptor in human frontal cortex.	J12451
Entire Plant Surinam	Binding Effect	ETOH(80%)Ext	Human Adult	10.0 mcg/ml	Inactive	Inhibited radioligand binding to serotonin receptor in human frontal cortex.	J12451
Entire Plant Surinam	Binding Effect	ETOH(80%)Ext	Human Adult	10.0 mcg/ml	Inactive	Inhibited radioligand binding to dopamine receptor in human frontal cortex.	J12451
Entire Plant Surinam	Binding Effect	ETOH(80%)Ext	Human Adult	10.0 mcg/ml	Inactive	Inhibited radioligand binding to muscarinic receptor in human hippocampus tissues.	J12451
Entire plant Surinam	Binding Effect	ETOH(80%)Ext	Human Adult	10.0 mcg/ml	Inactive	Inhibited radioligand binding to adenosine nmdr receptor channel complex.	J12451
Entire plant Surinam	Binding Effect	ETOH(80%)Ext	Human Adult	10.0 mcg/ml	Inactive	Inhibited radioligand binding to beta-2-adrenergic receptor.	J12451
Entire plant Surinam	Serotonin (5-ht) receptor binding activity	CHCL3 Ext	Calf	100mcg/ml	Weak Activity	Hippocampus	J0986
Root Not Stated	Antihyperglycemic Activity	H2O Ext	Intragastric Mouse	Not stated	Weak Activity		J17961

IN VITRO RESEARCH

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Not Stated Brazil	Mitogenic Activity	Infusion	Cell Culture	Not stated	Inactive	Mouse splenocytes	L07194
Entire Plant Taiwan	Cytotoxic Activity	ETOH(95%)Ext	Cell Culture	10.0 mcg/ml 10.0 mcg/ml 10.0 mcg/ml 10.0 mcg/ml 10.0 mcg/ml 10.0 mg/ml 100 mcg/ml 100 mcg/ml	Active Active Active Active Active Active Equivocal Equivocal	CA-9KB CA-HUMAN-COLON CA-HUMAN-LUNG LU-1 HELA CELLS HEPATOMA-2 HEPATOMA-HA22T GLIOMA-8401 MELANOMA-H1477	K07329
Leaf USA	Cytotoxic Activity	MEOH Ext	Cell Culture	IC50=2.5 mcg/ml	Active	Leukemia cells: LEUK-P388	H28598
Leaf USA	Cytotoxic Activity	MEOH Ext	Cell Culture	IC50=3.15 mcg/ml	Active	Cancer cells: CA-KB-16	H28598
Aerial Parts Indonesia	Cytotoxic Activity	H2O Ext MEOH Ext	Cell Culture Cell Culture	4 mcg/ml 4 mcg/ml	Active Active	Cells-MT-4 Cells-MT-4	K21579
Not Stated Thailand	Cytotoxic Activity	Not stated	Cell Culture	Not stated	Active	CA-9KB (Data incomplete from abstract)	P00044
Root Not Stated	Cytotoxic Activity	Fraction: Physalin B	Cell Culture	Not stated	Active	9KB and 9PS tumor cells	AC1016
Leaf China	Antitumor Activity	Fraction: Withangulatin A	Cell Culture	0.5 ul 20 ul	Active Active	Acts on Topoisomerase II-mediated DNA damage.	AC1012
Entire Plant Taiwan	Antibody Formation Enhancement	ETOH(95%)Ext	Cell Culture	10 mcg/well	Active	Lymphocytes-B	K09956
Entire Plant Taiwan	Lymphocyte Blastogenesis Stimulant	ETOH(95%)Ext	Cell Culture	0.39 mcg/well	Active	CA-HTB43	K09956
Entire Plant Taiwan	Lymphocyte Blastogenesis Stimulant	ETOH(95%)Ext	Cell Culture T Lymphocytes	0.39 mcg/well	Active	T lymphocytes lipopolysaccharide induced blastogenesis was enhanced by treatment with extract	K09956
Entire Plant Taiwan	Lymphocyte Blastogenesis Stimulant	ETOH(95%)Ext	Cell Culture T Lymphocytes	0.39 mcg/well	Active	Phytohemagglutinin induced blastogenesis was enhanced by treatment with extract.	K09956

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Entire Plant Taiwan	Lymphocyte blastogenesis stimulant	ETOH(95%)Ext	Cell Culture	20 mcg/well	Active	Lymphocytes-B	K09956
Entire Plant Taiwan	RNA Polymerase I stimulation	ETOH-H2O (1:1) Ext	Cell Culture Cells-rat-liver	1.0 Mg/ml	Inactive	vs. PGE-1-induced pedal edema	T14999
Not Stated China	Phosphorylation Enhancement Activity	Fraction: Withangulatin A	Cell Culture	Not Stated	Active	9L rat brain tumor cells	AC1021
Not Stated	Phosphorylation Enhancement Activity	Fraction: Withangulatin A	Cell Culture	50-100 ul	Active	Concentration dependent alteration of vimentin molecules.	AC1022
Leaf Not Stated	Antimycobacterial Activity	ETOH Ext + fractions	Agar Plate	32 mcg/ml	Active	*Mycobacterium tuberculosis* H(37)Rv strain	AC1010
Aerial Parts Brazil	Antimycobacterial Activity	CHCL3 Ext CHCL3 Ext CHCL3 Ext CHCL3 Ext CHCL3 Ext Hydroalcoholic Ext Hydroalcoholic Ext Hydroalcoholic Ext Hydroalcoholic Ext Hydroalcoholic Ext	Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate	128.0 mcg/ml 156.3 mcg/ml 32.0 mcg/ml 625.0 mcg/ml 78.1 mcg/ml 400 mg/ml 500.0 mcg/ml 250.0 mcg/ml 2500 mcg/ml 2500 mcg/ml	Active Active Active Active Active Equivocal Active Active Inactive Inactive	*Mycobacterium intracellulare* *Mycobacterium malmoense* *Tubercule bacillus* H-37-RV *Mycobacterium avium* *Mycobacterium kansasi* *Mycobacterium intracellulare* *Tubercule bacillus* H-37-RV *Mycobacterium malmoense* *Mycobacterium avium* *Mycobacterium kansasi*	L09660
Aerial Parts Indonesia	Antiviral Activity	H2O Ext MEOH Ext	Cell Culture Cell Culture	4 mcg/ml 4 mcg/ml	Inactive	Virus- HTLV-I	K21579
Aerial Parts Japan	Antiviral Activity	Hot H20 Ext Hot H20 Ext Hot H20 Ext	Cell Culture Cell Culture Cell Culture	0.1 mg/ml 0.5 mg/ml 0.5 mg/ml	Active Inactive Inactive	Virus- *Poliovirus I* Virus- *Herpes simplex 1* Virus-Measles	K16835
Aerial Parts Indonesia	Protease(HIV) Inhibition	H2O Ext MEOH Ext	Not stated Not stated	500 mcg/ml 340 mcg/ml	Inactive Active		K08273
Aerial Parts Indonesia	Reverse Transcriptase Inhibition Activity	H2O Ext MEOH Ext	Cell Culture Cell Culture	1000 mcg/ml 1000 mcg/ml	Inactive Inactive	Virus-avian myeloblastosis	K08721

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Entire Plant Nigeria	Antibacterial Activity	MEOH Ext MEOH Ext MEOH Ext MEOH Ext MEOH Ext MEOH Ext MEOH Ext MEOH Ext	Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate Agar Plate	2.0 mg/ml 2.0 mg/ml 2.0 mg/ml 2.0 mg/ml 2.0 mg/ml 2.0 mg/ml 2.0 mg/ml 2.0 mg/ml	Active Active Active Active Active Active Inactive Inactive	*Corynebacterium diphtheriae* *Klebsiella* species *Neisseria* species *Pseudomonas aeruginosa* *Staphylococcus aureus* *Streptococcus species* *Salmonella species* *Streptobacillus species*	M27767
Leaf Guatemala	Antibacterial Activity	ETOH-H2O (1:1) Ext	Agar Plate	50 ul / disc	Inactive	*Neisseria gonorrhea*	K27236
Leaf Nigeria	Antibacterial Activity	MEOH(50%)Ext	Broth Culture	Not stated	Active Inactive Inactive Inactive Inactive Inactive	*Bacillus subtilis* *Escherichia coli* *Proteus species* *Pseudomonas aeruginosa* *Staphylococcus albus* *Staphylococcus aureus*	J00209
Entire plant Taiwan	Glutamate-Pyruvate-Transaminase Inhibition	ETOH-H2O (1:1) Ext	Cell Culture Cells-rat-liver	1.0 Mg/ml	Inactive	vs. CCL4-induced hepatotoxicity	T14999
Entire Plant Samoa	Prostaglandin Synthesis Inhibition Activity	ETOH(100%)Ext	Not stated	100.0 mcg/ml	Inactive	vs. COX-1 catalysed prostaglandin biosynthesis	L14626
Entire Plant Puerto Rico	Molluscicidal Activity	Aqueous Slurry	Not stated	LD100 >1M ppm	Inactive	Fruits, roots and leaves were tested vs *Lymnaea columella* and *Lymnaea cubensis*	T04621
Aerial Parts Tanzania	Antitrypanosomal Activity	CH2CL2 Ext H2O Ext MEOH Ext Pet Ether Ext	In vitro	19 mcg/ml 56 mcg/ml 19 mcg/ml 19 mcg/ml	Active Active Active Active	*Trypanosoma brucei rhodesiense*	L13940
Leaf Tanzania	Antitrypanosomal Activity	CH2CL2 Ext H2O Ext Pet Ether Ext	In vitro	19 mcg/ml 56 mcg/ml 19 mcg/ml	Active Active Active	*Trypanosoma brucei rhodesiense*	L13940
Root Tanzania	Antitrypanosomal Activity	CH2CL2 Ext H2O Ext MEOH Ext Pet Ether Ext	In vitro	19 mcg/ml 19 mcg/ml 56 mcg/ml 19 mcg/ml	Active Active Active Active	*Trypanosoma brucei rhodesiense*	L13940

Plant Part - Origin	Activity Tested For	Type Extract	Test Model	Dosage	Result	Notes/Organism tested	Ref #
Fruit Tanzania	Antitrypanosomal Activity	CH2CL2 Ext H2O Ext MEOH Ext Pet Ether Ext	In vitro	19 mcg/ml 167 mcg/ml 19 mcg/ml 19 mcg/ml	Active Inactive Active Active	*Trypanosoma brucei rhodesiense*	L13940
Leaf Ivory Coast	Anticoagulant Activity	not stated	Blood-human-whole	50%	Active		T15327

Literature Cited - Mullaca (Physalis angulata)

AC1001	FLORA INVASORA DE LOS CULTIVOS DE PACALLPI Y TINGO MARIA. FERREYRA,R. 1970
AC1002	CATALOGO DE PLANTAS UTILES DE LA AMAZONIA PERUANA. RUTTER,RA. INSTITUTO LINGUISTICO DE VERANO. YARINACOCHA, PERU (1990)
AC1003	NOTES ON SOME MEDICINAL AND POSIONOUS PLANTS OF AMAZONIAN PERU. AYALA FLORE,F: ADVANCES IN ECONOMIC BOTANY 1 PP1-8 (1984)
AC1004	FLORA MEDICINAL DE COLUMBIA, BOTANICA-MEDICA. GARCIA-BARRIGA,H: CEIN. NAT. 3 VOLS. (1974-5) BOGOTA
AC1005	ETHNOBOTANY OF THE CUNA AND WAUNANA INDIGENOUS COMMUNITIES. FORERO,P.L.E: CESPEDESIA. 9 33: 115-302 (1980) (COLOMBIA)
AC1006	PLANTAS MEDICINALES DE USO POPULAR EN LA AMAZONIA PERUANA. KEMBER MEJIA: ELSA RENG: AECI AND IIAP (1995) LIMA, PERU
AC1007	FOLK MEDICINE OF ALTER DO CHAO, PARA, BRAZIL. BRANCH, L: DA SILVA,I: ACTA AMAZONICA 13 5/6: 737-797 (1983) (MANAUS, BRAZIL)
AC1008	PLANTAS MEDICINAIS BRASILEIRAS, CONHECIMENTOS POPULARES E CIENTIFICOS, DE ALMEIDA,ER: HEMUS EDITORA LTDA, SAU PAULO, BRAZIL (1993)
AC1010	ANTIMYCOBACTERIAL PHYSALINS FROM PHYSALIS ANGULATA L. (SOLANACEAE) JANUARIO,AH, ET AL: PHYTOTHER RES 16 5:445-448 (2002)
AC1011	INDUCTION OF HEAT-SHOCK RESPONSE AND ALTERATIONS OF PROTEIN PHOSPHORYLATION BY A NOVEL TOPOISOMERASE II INHIBITOR, WITHANGULATIN A, IN 9L RAT BRAIN TUMOR CELLS. LEE,WC, ET AL. CELL PHYSIOL 149 1: 66-7 (1991)
AC1012	A NEW COMPOUND, WITHANGULATIN A, PROMOTES TYPE II DNA TOPOISOMERASE-MEDIATED DNA DAMAGE. JUANG JK, ET AL. BIOCHEM BIOPHYS RES COMMUN 159 3: 1128-34 (1989)
AC1015	ANTIVIRAL ACTIVITY OF PLANTAGO MAJOR EXTRACTS AND RELATED COMPOUNDS IN VITRO. CHIANG,LC: CHIANG,W: CHANG,MY: NG,LT: LIN,CC: ANTIVIRAL RES 55 1: 53-62 (2002) (DEPT MICRO, KAOHSIUNG MED UNI, TAIWAN)
AC1016	POTENTIAL ANTITUMOR AGENTS. XVII. PHYSALIN B AND 25, 26-EPIDIHYDROPHYSALIN C FROM WITHERINGIA COCCOLOBOIDES. ANTOUN,MD. ABRAMSON,D: TYSON,RL: CHANG,CL: MCLAUGHLIN,JL: PECK,G: CASSADY,JM: J NAT PROD 44 5: 579-85 (1981)
AC1021	INTEGRITY OF INTERMEDIATE FILAMENTS IS ASSOCIATED WITH THE DEVELOPMENT OF ACQUIRED THERMOTOLERANCE IN 9L RAT BRAIN TUMOR CELLS. LEE,YC: LAI,YK: J CELL BIOCHEM 57 1: 150-62 (1995) (INST LIFE SCI, NAT TSING HUA UNI, TAIWAN)

AC1024	CYTOTOXIC ACTIVITY OF PHYSALINS AND RELATED COMPOUNDS AGAINST HELA CELLS. KAWAI,M, ET AL. PHARMAZIE. 57 5: 348-50 (2002) (DEPT APP CHEM, NAGOYA INST TECH, NAGOYA, JAPAN)
A00040	AFRICAN PLANTS POTENTIALLY USEFUL IN MENTAL HEALTH. WATT,JM: LLOYDIA 30 1: 1- (1967) (DEPT PHYSIOL UNIV QUEENSLAND ST.LUCIA QUEENSLAND AUSTRALIA)
A04392	BOTH SIDES OF BUKA PASSAGE. OXFORD AT THE CLARENDON PRESS. BLACKWOOD,B: BOOK : - (1935) (NO ADDRESS GIVEN)
H03000	WITHASTEROIDS OF PHYSALIS. VII. 14-ALPHA-HYDROXYIXOCARPANOLIDE AND 24,25-EPOXYWITHANOLIDE D. VASINA,OE ET AL., CHEM NAT COMP 22 5: 560-565 (1987) (INST CHEM PLANT SUBST ACAD SCI UZBEK SSR TASHKENT USSR)
H06423	WITHANGULATIN A, A NEW WITHANOLIDE FROM PHYSALIS ANGULATA. CHEN,CM. ET AL., HETEROCYCLES 31 7: 1371-1375 (1990) (DEPT CHEM NAT TSING HUA UNIV HSINCHU 30043 TAIWAN)
H07746	PHYSAGULIN C, A NEW WITHANOLIDE FROM PHYSALIS ANGULATA L. SHINGU,K. ET AL., CHEM PHARM BULL 39 6: 1591-1593 (1991) (FAC PHARM SCI KUMAMOTO UNIV KUMAMOTO 862 JAPAN)
H09792	THREE NEW WITHANOLIDES, PHYSAGULINS A, B AND D FROM PHYSALIS ANGULATA L. SHINGU,K. ET AL., CHEM PHARM BULL 40 8: 2088-2091 (1992) (FAC PHARM SCI KUMAMOTO UNIV KUMAMOTO 862 JAPAN)
H09950	THREE NEW WITHANOLIDES, PHYSAGULINS E, F AND G FROM PHYSALIS ANGULATA L. SHINGU,K: ET AL., CHEM PHARM BULL 40 9: 2448-2451 (1992) (FAC PHARM SCI KUMAMOTO UNIV KUMAMOTO 862 JAPAN)
H11266	PHYGRINE, AN ALKALOID FROM PHYSALIS SPECIES. BASEY,K. ET AL., PHYTOCHEMISTRY 31 12: 4173-4176 (1992) (NAT PROD RES SCH APPL SCI DE MONTFORT UNIV LEICESTER LE1 9BH ENGLAND)
H28598	A NOVEL CYTOTOXIC FLAVONOID GLYCOSIDE FROM PHYSALIS ANGULATA. ISMAIL,N. ET AL., FITOTERAPIA 72 6: 676-679 (2001) (COLL PHARM UNIV HOUSTON HOUSTON TX 77204 USA)
J00209	INVESTIGATIONS INTO THE ANTIBACTERIAL ACTIVITIES OF LOCAL PLANTS. OGUNLANA,EO. ET AL., PLANTA MED 27 : 354- (1975) (FAC PHARM UNIV IFE ILE-IFE NIGERIA)
J10986	SCREENING OF MEDICINAL PLANTS FROM SURINAME FOR 5-HT 1A LIGANDS: BIOACTIVE ISOQUINOLINE ALKALOIDS FROM THE FRUIT OF ANNONA MURICATA. HASRAT,JA. ET AL., PHYTOMEDICINE 4 2: 133-140 (1997) (DEPT PHARM SCI UNIV ANTWERP ANTWERP B-2610 BELGIUM)
J11102	PHARMACOLOGICAL ACTIVITY OF THE SAMOAN ETHNOPHARMACOPOEIA. COX,PA, ET AL., ECON BOT 43 4: 487-497 (1989) (DEPT BOT RANGE SCI BRIGHAM YOUNG UNIV PROVO UT 84602 USA)
J12394	THE ETHNOPHARMACOPOEIA OF ROTUMA. MC CLATCHEY,W: J ETHNOPHARMACOL 50 3: 147-156 (1996) (FLORIDA MUSEUM NATURAL HISTORY HERBARIUM UNIV FLORIDA GAINESVILLE FL 32611 USA)

J12451	MEDICINAL PLANTS IN SURINAME: SCREENING OF PLANT EXTRACTS FOR RECEPTORBINDING ACTIVITY. HASRAT,JA. ET AL., PHYTOMEDICINE 4 1: 59-65 (1997) (DEPT PHARM SCI UNIV ANTWERP ANTWERP B-2610 BELGIUM)
J14512	MALARIA AND ANTIMALARIAL PLANTS IN RORAIMA, BRAZIL. MILLIKEN,W: TROP DOCTOR SUPPL 1997 : 20-25 (1997) (ROYAL BOT GARDENS CENT ECONOMIC BOT SURREY TW9 3AE ENGLAND)
J17961	REPORTING BIOLOGICAL ASSAY RESULTS ON TROPICAL MEDICINAL PLANTS TO HOST COUNTRY COLLABORATORS. RICHTER,RK. ET AL., J ETHNOPHARMACOL 62 1: 85-88 (1998) (DEPT ETHNOBOTANY CONSERVATION SHAMAN PHARMACEUTICALS INC SAN FRANCISO CA 94080 USA)
K01546	ISOLATION OF AYANIN FROM PHYSALIS ANGULATA. LOPEZ,JA. ET AL., PHYTOCHEMISTRY 15 : 2028C-. (1976) (DEPT PHARMACOG SCH PHARM UNIV PITTSBURGH PITTSBURGH PA 15213 USA)
K07329	ANTITUMOR AGENT, PHYSALIN F FROM PHYSALIS ANGULATA L. CHIANG,HC. ET AL., ANTICANCER RES 12 3: 837-843 (1992) (SCH PHARM COLL MED NATION TAIWAN UNIV TAIPEW TAIWAN)
K08273	SCREENING OF SOME INDONESIAN MEDICINAL PLANTS FOR INHIBITORY EFFECTS ON HIV-1 PROTEASE. KUSUMOTO,IT. ET AL., SHOYAKUGAKU ZASSHI 46 2: 190-193 (1992) (RES INST ORIENTAL MED TOYAMA MED & PHARM UNIV TOYAMA 930-01 JAPAN)
K08721	INHIBITORY EFFECT OF INDONESIAN PLANT EXTRACTS ON REVERSE TRANSCRIPTASE OF AN RNA TUMOUR VIRUS (I). KUSUMOTO,IT. ET AL., PHYTOTHER RES 6 5: 241-244 (1992) (RES INST ORIENTAL MED TOYAMA MED & PHARM UNIV TOYAMA 930-01 JAPAN)
K08937	INHIBITORY EFFECTS OF PHYSALIN B AND PHYSALIN F ON VARIOUS HUMAN LEUKEMIA CELLS IN VITRO. CHIANG,HC ET AL., ANTICANCER RES 12 4: 1155-1162 (1992) (SCH PHARM COLL MED NATL TAIWAN UNIV TAIPEI TAIWAN)
K09956	IMMUNOMODULATORY ACTIVITY OF VARIOUS FRACTIONS DERIVED FROM PHYSALIS ANGULATA L EXTRACT. LIN,YS: ET AL. AMER J CHINESE MED 20 3/4: 233-243 (1992) (DEPT MICRBIOL IMMUN NATL CHENG KUNG UNIV MED COLL TAINAN TAIWAN)
K16835	ANTIVIRAL TRADITIONAL MEDICINES AGAINST HERPES SIMPLEX VIRUS (HSV-1), POLIOVIRUS, AND MEASLES VIRUS IN VITRO AND THEIR THERAPEUTIC EFFICACIES FOR HSV-1 INFECTION IN MICE. KUROKAWA,M: ET AL., ANTIVIRAL RES 22 2/3: 175-188 (1993) (DEPT VIROL TOYAMA MED PHARM UNIV TOYAMA JAPAN)
K21579	SCREENING OF INDONESIAN PLANT EXTRACTS FOR ANTI-HUMAN IMMUNODEFICIENCY VIRUS- TYPE 1 (HIV-1) ACTIVITY. OTAKE,T: ET AL. PHYTOTHER RES 9 1: 6-10 (1995) (OSAKA PREFECT INST PUBL HEALTH OSAKA 537 JAPAN)
K27039	MEDICINAL PLANTS USED BY THE FANG TRADITIONAL HEALERS IN EQUATORIAL GUINEA. AKENDENGUE,B: J ETHNOPHARMACOL 37 2: 165-173 (1992) (DEPT TRAD MED PHARM FAC MED HEALTH SCI LIBREVILLE GABON)
K27070	ETHNOBOTANY OF THE GARIFUNA OF EASTERN NICARAGUA. COEE,Fg. ET AL ECON BOT 50 1: 71-107 (1996) (SCH PHARM UNIV CONNECTICUT STORRS CT 06268 USA)

K27236	ANTIOGONORRHOEAL ACTIVITY OF PLANTS USED IN GUATEMALA FOR THE TREATMENT OF SEXUALLY TRANSMITTED DISEASES. CACERES,A. ET AL., J ETHNOPHARMACOL 48 2: 85-88 (1995) (FAC CHEM SCI PHARM UNIV SAN CARLOS GUATEMALA CITY GUATEMALA)
L01568	MEDICINAL PLANTS OF SOUTHERN ZAMBESIA. AMICO,A: FITOTERAPIA 48 : 101-139 (1977) (INST BOTANY UNIV BARI BARI ITALY)
L04137	AMAZONIAN ETHNOBOTANICAL DICTIONARY. DUKE,JA: BOOK : 181- (1994) (USA)
L07194	COLONY STIMULATING FACTOR-INDUCING ACTIVITY OF ISOFLAVONE C-GLUCOSIDES FROM THE BARK OF DALBERGIA MONETARIA. KAWAQUCHI,K: ET AL., PLANTA MED 64 7: 653-655 (1998) (SCH PHARM SCI KITASATO UNIV KANAGAWA 228 JAPAN)
L09660	IN VITRO ANTIMYCOBACTERIAL ACTIVITIES OF PHYSALIS ANGULATA L. PIETRO,RCLR: ET AL., PHYTOMEDICINE 7 4: 335-338 (2000) (DEP SCI PHARMACEUT UNIV RIBEIRAO PRETO SAO PAULO BRAZIL)
L11291	ROOT CULTURE OF PHYSALIS ANGULATA INDUCED BY AGROBACTERIUM RHIZOGENES FOR PRODUCTION OF SECONDARY METABOLITES. FRANCA,SC. ET AL. ACTA HORT 502 : 389-394 (1999) (DEPT BIOTECHNOL VEGETAL UNIV RIBEIRAO PRETO PRETO BRAZIL)
L13940	EVALUATION OF AFRICAN MEDICINAL PLANTS FOR THEIR IN VITRO TRYPANOCIDAL ACTIVITY. FREIBURGHAUS,F. Et al., J ETHNOPHARMACOL 55 1: 1-11 (1996) (SWISS TROP INST BASEL SWITZERLAND)
L14626	EVALUATION OF SOME SAMOAN AND PERUVIAN MEDICINAL PLANTS BY PROSTAGLANDIN BIOSYNTHESIS AND RAT EAR OEDEMA ASSAYS. DUNSTAN,CA. ET AL., J ETHNOPHARMACOL 57 : 35-56 (1997) (DEPT PHARMACOG FAC PHARM UNIV UPPSALA UPPSALA S-751 23 SWEDEN)
L15570	TRADITIONAL ANTI-MALARIAL MEDICINE IN RORAIMA, BRAZIL. MILLIKEN,W: ECON BOT 51 3: 212-237 (1997) (CENTRE ECONOMIC BOTANY ROYAL BOTANIC GARDENS SURREY ENGLAND)
L16047	SCREENING OF MEDICINAL PLANTS USED BY THE GARIFUNA OF EASTERN NICARAGUA FOR BIOACTIVE COMPOUNDS. COE,FG. ET AL., J ETHNOPHARMACOL 53 : 29-50 (1996) (DEPT ECOL EVOLUNT BIOL UNIV CONNECTICUT STORRS CT 06269 USA)
L17008	AN ETHNOBOTANICAL STUDY OF THE TRADITONAL MEDICINE OF THE MESTIZO PEOPLE OF SUNI MIRANO, LORETO, PERU. JOVEL,EMET AL.: J ETHNOPHARMACOL 1996 53: 149-156 (1996) (DEPT BOTANY UNIV BRITISH COLUMBIA VANCOUVER V6T 1Z4 CANADA)
M10843	PRESENCE OF ACETYLCHOLINE IN THE FRUIT OF PHYSALIS ANGULATA (SOLANACEAE). CESARIO DE MELLO,A ET AL., CIENC CULT(SAO PAULO) 37 5: 799-805 (1985) (DEP FISIOL FARMACOL UNIV FED PERNAMBUCO RECIFE BRAZIL)
M11773	STEROIDAL COMPONENTS IN PLANTS OF THE SUDAN FLORA AND SEED GERMINATION EFFECTS OF WITHAOBTUSIFONALIDE AND WITHAPHYSANOLIDE ON ERUCA SATIVUM. MODAWI,BM. ET AL., FITOTERAPIA 56 1: 53-55 (1985) (DEPT CHEM FAC SCI UNIV KHARTOUM SUDAN)

M26779	WITHASTEROIDS OF PHYSALIS. IX. PHYSANGULIDE - THE FIRST NATURAL 22S-WITHASTEROID. VASINA,OE. ET AL., CHEM NAT COMP 26 3: 304-307 (1990) (INST CHEM PLANT SUBST ACAD SCI UZBEK SSR TASHKENT UZBEK USSR)
M27767	PLANTS IN KANO ETHOMEDICINE; SCREENING FOR ANTIMICROBIAL ACTIVITY AND ALKALOIDS. HUSSAIN,HSN: ET AL. INT J PHARMACOG 29 1: 51-56 (1991) (DEPT BIOL SCI BAYERO UNIV KANO NIGERIA)
M28655	WITHASTEROIDS OF PHYSALIS. X. CIRCULAR DICHROISM OF WITHASTEROIDS FROM PLANTS OF THE GENUS PHYSALIS. MOISEEVA,GP. ET AL., CHEM NAT COMP 26 3: 308-312 (1990) (INST CHEM PLANT SUBST ACAD SCI UZBEK SSR TASHKENT UZBEK USSR)
M29355	MEDICINAL PLANTS USED FOR THE TREATMENT OF HEPATITIS IN TAIWAN. LIN,CC. ET AL. AMER J CHINESE MED 18 1/2: 35-43 (1990) (SCH MED KAOHSIUNG MED COLL KAOHSUING TAIWAN)
M29360	ETHNOPHARMACOLOGICAL STUDY OF THE ATI TRIBE IN NAGPANA, BAROTAC VIEJO, ILOILO*. MADULID,DA. ET AL., ACTA MANILANA 38 1: 25-40 (1989) (BOTANY DIV NATL MUSEUM MANILA PHILIPPINES)
M30421	IMMUNOSUPPRESSIVE PROPERTIES OF VITASTEROIDS. SAKHIBOV,AD. ET AL., DOKL AKAD NAUK UZB SSR 1990 1: 43-45 (1990) (INST IMMUNOL TASHKENT USSR)
N00665	THE STRUCTURE OF PHYSALINS F AND J FROM PHYSALIS ANGULATA AND P.LANCIFOLIA. ROW,LR. ET AL., PHYTOCHEMISTRY 17 : 1647-1650 (1978) (DEPT CHEM ANDHRA UNIV VISHAKHAPATNAM AP 530 003 INDIA)
N00729	PHYSALINS E AND H, NEW PHYSALINS FROM PHYSALIS ANGULATA AND P. LANCIFOLIA. ROW,LR. ET AL., PHYTOCHEMISTRY 17 : 1641-1645 (1978) (DEPT CHEM ANDHRA UNIV VISHAKHAPATNAM AP 530 003 INDIA)
N06627	NEW PHYSALINS FROM PHYSALIS ANGULATA AND PHYSALIS LANCIFOLIA. STRUCTURE AND REACTIONS OF PHYSALINS D,I,G AND K. RAMACHANDRA ROW,L. ET AL. PHYTOCHEMISTRY 19 : 1175-1181 (1980) (DEPT CHEM ANDHRA UNIV VISHAKHAPATNAM AP 530 003 INDIA)
P00044	BIOLOGICAL ASSAY OF ANTITUMOR AGENTS FROM NATURAL PRODUCTS. ANON: SABSTR SEMINAR ON THE DEVELOPMENT OF DRUGS FROM MEDICINAL PLANTS ORGANIZED BY THE DEPARTMENT OF MEDICAL SCIENCE DEPARTMENT AT THAI FARMER BANK BANGKOK THAILAND 1982 1982 : 129-. (1982) (BANGKOK THAILAND)
T00701	MEDICINAL PLANTS OF THE WEST INDIES. AYENSU,ES: UNPUBLISHED MANUSCRIPT : 110 P- (1978) (OFFICE OF BIOLOGICAL CONSERVAT SMITHSONIAN INSTITUTION WASHINGTON DC 20560 USA)
T04621	TERRESTRIAL PLANTS MOLLUSCICIDAL TO LYMNAEID HOSTS OF FASCILIASIS HEPATICA IN PUERTO RICO. MEDINA,FR. Et al., J AGR UNIV PUERTO RICO 63 : 366-376 (1979) (PUERTO RICO JUNIOR COLLEGE RIO PIEDRAS PUERTO RICO)
T05034	TRADITIONAL MEDICINAL PLANTS OF THE NORTH SOLOMONS PROVINCE PAPUA NEW GUINEA. HOLDSWORTH,DK: Q J CRUDE DRUG RES 18 : 33-44 (1980) (UNIV PAPUA-NEW GUINEA PAPUA-NEW GUINEA)

T08685	FOLK MEDICINE IN TONGA. A STUDY ON THE USE OF HERBAL MEDICINES FOR OBSTETRIC AND GYNAECOLOGICAL CONDITIONS AND DISORDERS. SINGH,YN., ET AL J ETHNOPHARMACOL 12 3: 305-329 (1984) (SCHOOL OF NATURAL RESOURCES UNIV OF SOUTH PACIFIC SUVA FIJI)
T14820	WITHASTEROIDS OF PHYSALIS. VIII. VAMONOLIDE VASINA,OE. ET AL., CHEM NAT COMP 23 6: 712-714 (1988) (INST CHEM PLANT SUBST ACAD SCI UZBEK SSR TASHKENT USSR)
T14999	ANTIHEPATOTOXIC ACTIONS OF FORMOSAN PLANT DRUGS. YANFG,LL. ET AL., J ETHNOPHARMACOL 19 1: 103-110 (1987) (TAIPEI MED COLL TAIPEI TAIWAN)
T15327	HEMOSTATIC ACTIVITY OF 216 PLANTS USED IN TRADITIONAL MEDICINE IN THE IVORY COAST. KONE-BAMBA,D. ET AL., PLANT MED PHYTOTHER 21 2: 122-130 (1987) (LAB PHARMACOG FAC PHARM ABIDJAN ABIDJAN IVORY COAST)
W00799	HISTORIC AND ETHNOPHARMACOGNOSIC REVIEW ON THE BELIEF AND TRADITIONAL PRACTICES IN THE TREATMENT OF SLEEPING SICKNESS IN WEST AFRICA. KERHARO,J: BULL SOC MED AFR NOIRE LANG FR 19 : 400-. (1974) (FAC MED & PHARM DAKAR SENEGAL)
W01270	MEDICINAL PLANTS OF JAMAICA. IV. ASPREY,GF ET AL., WEST INDIAN MED J 4 : 145-165 (1955) (NO ADDRESS GIVEN)
W03775	DISTRIBUTION OF CHLOROGENIC ACID IN SOLANACEAE AND IN THE ORGANS OF THESE PLANTS. POLITIS,J: COMPT REND 226 : 692-693 (1948) (NO ADDRESS GIVEN)

Clinical Abstracts

Anticancer Res 1992 Jul-Aug;12(4):1155-62
Inhibitory effects of physalin B and physalin F on various human leukemia cells in vitro.
Chiang, H.C., et al.
Physalins B and F were isolated and characterized from the ethanolic extract of the whole plant of Physalis angulata L. (Solanaceae). Both physalin B and physalin F inhibited the growth of several human leukemia cells: K562 (erythroleukemia), APM1840 (acute T lymphoid leukemia), HL-60 (acute promyelocytic leukemia), KG-1 (acute myeloid leukemia), CTV1 (acute monocytic leukemia) and B cell (acute B lymphoid leukemia). Physalin F showed a stronger activity against these leukemia cells than physalin B, especially against acute myeloid leukemia (KG-1) and acute B lymphoid leukemia (B cell). From the structural features, the active site seems to be the functional epoxy group for physalin F and the double bond for physalin B located at carbon 5 and 6; the former is much more active than the latter as regards anti-leukemic effects.

Anticancer Res 1992 May-Jun;12(3):837-43
Antitumor agent, physalin F from Physalis angulata L
Chiang, H.C., et al.
Physalin F and physalin D were isolated and characterized from the ethanolic extract of the whole plant of Physalis angulata L. (Solanaceae). Systematic fractionation of the ethanolic extract of the plant led to characterization of physalin F from the fraction PAIV-2 as an active ingredient which showed cytotoxicity in vitro by DEA and MTT assays on 8 cancer cell lines, five human cancer cell lines: HA22T(hepatoma), HeLa(cervix uteri), KB(nasopharynx), Colo-205(colon) and Calu-1(lung); and three animal cancer cell lines: H1477(melanoma), Hep-2(laryngeal) and 8401(glioma). It was found that the anti-hepatoma action is the strongest, and the anti-HeLa is the next. Physalin F also had an antitumor effect in vivo against P388 lymphocytic leukemia in mice whereas physalin D was inactive both in vitro and in vivo.

Am J Chin Med 1992;20(3-4):233-43
Immunomodulatory activity of various fractions derived from Physalis angulata L extract.
Lin, Y. S., et al.
The immunomodulatory effects of Physalis angulata L. extract fraction VII PA-VII), PA-VII-A, PA-VII-B and PA-VII-C were investigated in this study. The results showed that PA-VII and PA-VII-C strongly enhanced blastogenesis response, PA-VII-B had moderate activity, and PA-VII-A exerted only slight effect on cell proliferation. A synergistic effect was observed when the suboptimal dosage of phytohemagglutinin (PHA) or lipopolysaccharide (LPS) was added to the culture. Furthermore, PA-VII and PA-VII-C possessed stimulatory activity on B cells and less effect on T cells. The antibody responses were also augmented by PA-VII, PA-VII-B and PA-VII-C, but not by PA-VII-A. The enhancement of antibody response could be observed both in BALB/c and C3H/HeJ mice.

Fitoterapia 2001 Aug;72(6):676-9
A novel cytotoxic flavonoid glycoside from Physalis angulata.
Ismail, N., et al.,
A new flavonol glycoside, myricetin 3-O-neohesperidoside (1) was isolated from a cytotoxic MeOH extract of the leaves of Physalis angulata. Compound 1 showed remarkable cytotoxicity in vitro against murine leukemia cell line P-388, epidermoid carcinoma of the nasopharynx KB-16 cells, and lung adenocarcinoma A-549 with ED(50) values of 0.048, 0.50 and 0.55 microg ml(-1), respectively.

Phytother Res 2002 Aug;16(5):445-448
Antimycobacterial physalins from Physalis angulata L. (Solanaceae).
Januario, A.H., et al.
Crude extracts and fractions from aerial parts of Physalis angulata have been bioassayed for antimycobacterial activity. Fraction A1-29-12 containing physalins B, F and D exhibited a minimum inhibitory concentration value (MIC) against Mycobacterium tuberculosis H(37)Rv strain of 32 &mgr;g/mL. Purified physalin B and physalin D were also tested showing MIC values against Mycobacterium tuberculosis H(37)Rv strain of >128 &mgr;g/mL and 32 &mgr;g/mL respectively, suggesting that physalin D plays a relevant role in the antimycobacterial activity displayed. Structural elucidation of both physalins D and B was

based on detailed (13)C and (1)H NMR spectral analysis with the aid of 2D-correlation spectroscopy ((1)H-(1)H, COSY, HSQC and HMBC). The assignment of the (13)C chemical shift for physalin D is reported here for the first time.

Phytomedicine 2000 Jul;7(4):335-8
In vitro antimycobacterial activities of Physalis angulata L.
Pietro, R. C., et al.
The HIV-tuberculosis co-infection has caused an impact on tuberculosis epidemiology all over the world and the efficacies of the therapeutic schemes traditionally prescribed in the treatment of tuberculosis, such as isoniazid, rifampicin and pyrazinamide, have decreased due to the appearance of multidrug-resistant M. tuberculosis strains (MDR). This work is part of research on natural antimicrobial agents from plant extracts through bioassay-guided fractionation, by in vitro determination of the minimum inhibitory concentration (MIC) using the microdilution method with Alamar blue oxidation-reduction dye. Crude CHCl3 Physalis angulata extracts and physalin- containing fractions displayed antimycobacterial activity against Mycobacterium tuberculosis, Mycobacterium avium, Mycobacterium kansasii, Mycobacterium malmoense and Mycobacterium intracellulare.

Cell Physiol 1991 Oct;149(1):66-7
Induction of heat-shock response and alterations of protein phosphorylation by a novel topoisomerase II inhibitor, withangulatin A, in 9L rat brain tumor cells.
Lee, W. C., et al.
Withangulatin A is a newly identified in vitro topoisomerase II inhibitor isolated from the Chinese antitumor herb Physalis angulata. In vivo, it was found to be cytotoxic, capable of suppressing general protein synthesis and of inducing the synthesis of a small set of proteins including those generated by heat-shock treatment. The 70 kDa protein generated by withangulatin A was unequivocally identified as the heat-shock protein 70 (HSP70) since both proteins migrated to the same position on two- dimensional polyacrylamide gels, could be recognized by a monoclonal antibody to human HSP70, and exhibited identical peptide maps. The induction of protein synthesis by withangulatin A was regulated at the transcriptional level since it was aborted in cells pre-treated with actinomycin D. However, the initiation of this process did not require de novo protein synthesis since it was not affected by cycloheximide. Other cellular effect of withangulatin A was alterations of protein phosphorylation including an enhancement of phosphorylation of a 65 kDa protein which was also detected in the heat-shocked cells. Moreover, this process was observed within 7.5 min after the initial heat treatment which is much faster than the onset of HSP synthesis. Therefore, increased phosphorylation of the 65 kDa protein may represent one of the earliest signals generated by both heat-shock and withangluatin A and may be involved in the upstream regulation of heat-shock response in cells.

J Ethnopharmacol 1996 Dec;55(1):1-11
Evaluation of African medicinal plants for their in vitro trypanocidal activity. Freiburghaus, F., et al.
Petroleum ether, dichloromethane, methanol and water extracts from 24 plants, belonging to 19 families, which are reported in the literature as traditional remedies for sleeping sickness (human African trypanosomiasis) were screened for in vitro activity against Trypanosoma brucei rhodesiense, as well as for cytotoxicity for a human fibroblast cell-line (WI-38). The trypanocidal activity of the natural compounds berberine and harmane, both documented as being trypanocidal, was also evaluated. Promising trypanocidal activity with IC50 values below 10 micrograms/ml was found in 32 extracts of 13 plant species. The most active extracts with IC50 below 1 microgram/ml were derived from Annona senegalensis, Bussea occidentalis and Physalis angulata. The plant extracts showed a modest selectivity index, in contrast to commercially available trypanocides which have a more distinct selective toxicity against trypanosomes.

J Ethnopharmacol 1995 Oct;48(2):85-8
Antigonorrhoeal activity of plants used in Guatemala for the treatment ofsexually transmitted diseases.
Caceres, A., et al.
Plants popularly used in Guatemala for the treatment of gonorrhoea were macerated in 50% alcohol and the tincture tested for in vitro activity against Neisseria gonorrhoeae using strains isolated from symptomatic patients and confirmed by standard bacteriological procedures. From 46 plants investigated, 13 (28.3%) showed evident inhibition zones (> 9 mm), seven (15.2%) showed small activity (6.1-8.9 mm) and 26 (56.5%) showed no activity; nine of these plants inhibited five strains of N. gonorrhoea freshly isolated. The most

active plants of American origin were: bark of Bixa orellana fruits of Parmentiera edulis, leaf of Diphysa robinioides, Eupatorium odoratum, Gliricidia sepium, Physalis angulata, Piper aduncum and Prosopis juliflora, root of Casimiroa edulis, and whole Clematis dioica.

Mem Inst Oswaldo Cruz 1990 Oct-Dec;85(4):413-7

Trypanosomatid protozoa in fruit of Solanaceae in southeastern Brazil.

Kastelein. P., et al.

Fruits of cultivated and indigenous Solanaceae from Southeastern Brazil have been examined for the presence of trypanosomatid flagellates. The 14 species found infected were: Capsicum annuum, C. praetermissum, Lycopersicon esculentum, Nicandra physaloides, Physalis angulata, Solanum sp., S. americanum, S. concinnum, S. diflorum, S. erianthum, S. gilo, S. robustum, S. variable and S. viarum. The pentatomid hemipteran Arvelius albopunctatus experimentally transmitted flagellates to fruits of some species. Cultures of flagellates were obtained from fruits of eight species of Solanaceae and from A. albopunctatus.

Biochem Biophys Res Commun 1989 Mar 31;159(3):1128-34

A new compound, withangulatin A, promotes type II DNA topoisomerase-mediated DNA damage.

Juang, J. K., et al.

Withangulatin A, a new compound with a known chemical structure and from the antitumor Chinese herb Physalis angulata L, was found to act on topoisomerase II to induce topoisomerase II-mediated DNA damage in vitro. It has two effective dosage ranges of approximate 0.5 and 20 microM, with about one-third the activity of 20 microM VM-26.