

Mullaca

Physalis angulata

Monograph 3/1/04

Family: Solanaceae

Synonyms: *Physalis capsicifolia*, *P. lanceifolia*, *P. ramosissima*, *P. esquirolii*, *P. linkiana*, *P. pendula*

Standard Common Name: Not listed in the Herbs of Commerce, 2nd edition.

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

Overview

Botanical Description

Mullaca is an annual herb indigenous to many parts of the tropics, including the Amazon. 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.

Ethnobotanical Uses

All parts of the mullaca plant have been used medicinally in traditional herbal medicine systems. The following properties have been attributed to mullaca by traditional herbal medicine practitioners: antiasthmatic, antibacterial, antigonorrhoeal, antihyperglycemic, anti-inflammatory, antimicrobial, antiseptic, antiviral, diuretic, expectorant and febrifuge.

The traditional use of mullaca has been recorded in herbal medicine systems in the following countries:

Bougainville,¹ Brazil,²⁻⁵ Colombia,⁶ Guatemala,⁷ Guinea,⁸ Ivory Coast,^{9,10} Jamaica,¹¹ Mozambique,¹² Nicaragua,^{13,14} Nigeria,¹⁵ Peru,¹⁶⁻²² Philippines,²³ Rotuma,²⁴ Solomon Islands,²⁵ Surinam,²⁶ Taiwan,²⁷⁻²⁹ Tonga,³⁰ West Indies.³¹

Summary of Traditional Uses of Mullaca:³²

Entire Plant: Childbirth, diuretic, fever, gonorrhea, jaundice, liver diseases, malaria, nephritis, postpartum hemorrhage, rashes, skin sores, sleeping sickness, to prevent abortion, tumors.
Fruit: Infection, infertility, inflammation, postpartum infection, pruritis, skin diseases.
Leaf: Asthma, dermatosis, diarrhea, diuretic, earache, fever, gonorrhea, hemorrhage, hepatitis, infections, inflammation, liver disorders, malaria, postpartum infection, pruritis, rheumatism, skin diseases, to prevent abortion, worms.
Root: Diabetes, earache, fever, hepatitis, jaundice, liver disorders, malaria, rheumatism.
Sap: Earache, postpartum infection, pruritis.
Seed: Infertility.
Stem: Hepatitis.

Primary Uses in Traditional Herbal Medicine Systems

Internal

Herbal practitioners in both South and North America today rely on mullaca for various bacterial and viral infections as well as a complementary therapy for cancer and leukemia.³³

External

Externally the entire plant has primarily been used in traditional herbal medicine systems for skin sores, rashes, pruritis and earaches.^{3,13,34}

Chemistry

Mullaca contains flavonoids, alkaloids and plant steroids known as *physalins*, many of which have never been seen in science before.^{27,35-39} Chemicals include: 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.³²

Various chemicals in mullaca have been documented with the following biological activities:

In vivo* and *In vitro

Cytotoxic and Antitumor Activity

The steroid withangulatin A given intraperitoneally to rats was active against 9L rat brain tumor cells.⁴⁰ Physalin B and withangulatin A demonstrated cytotoxic and antitumor activity *in vitro*.^{41,42} The steroid, physalin B, isolated from the root, demonstrated activity against 3PS murine leukemia in mice.⁴¹ Physalin F given intraperitoneally to mice was active against P388 lymphocytic leukemia.⁴³ The P388 cell line is a general predictor of antitumor activity.

Immunomodulatory Activity

Physalins B, F and G caused a reduction in nitric oxide production by macrophages stimulated with lipopolysaccharide and interferon-gamma. Physalin-B lowered serum TNF-alpha significantly after lipopolysaccharide challenge. Mice injected with physalins survived after a lethal lipopolysaccharide challenge.⁴⁴

Molluscicidal

Physalins extracted from the leaf and stem had molluscicide activity against *Biomphalaria tenagophila*.⁴⁵

***In vivo* and *In vitro* Research and Pharmacological Actions**

Anticancerous Activity

Cytotoxic Activity and Antitumor Activity

A methanol leaf extract in cats was active against human lung carcinoma (CA-A549), with an IC₅₀=3.93 mcg/ml.¹⁷ In *in vitro* studies, ethanol extracts of the entire plant at 10 mcg/ml were active against the following cell lines: human oral epidermoid carcinoma (Ca-9KB); human colon cancer; human lung cancer (lu-1); human cervical adenocarcinoma (HeLa), hepatoma-2 and hepatoma-HA22T.⁴³

In an *in vitro* study a methanol extract of the leaf was active against the human cell line KB-16, with an IC₅₀=3.15 mcg/ml.¹⁷ A water and methanol extract of aerial parts at 4 mcg/ml demonstrated *in vitro* activity towards MT-4 (metallothionein-4) cells.⁴⁶

An ethanol extract of the entire plant given intraperitoneally to mice at 75 mg/kg was active against leuk-P388.⁴³ In an *in vitro* study a methanol extract from the leaf showed activity towards leuk-P388 cells at IC₅₀=2.5 mcg/ml.¹⁷ The P388 cell line is a general predictor of antitumor activity.

Immunomodulatory Activity

In vitro ethanol extracts of the entire plant at 0.39-20 mcg stimulated T-lymphocyte blastogenesis.⁴⁷ At 10 mcg antibody formation was enhanced in mice.⁴⁷

Anti-inflammatory Activity

Flower extracts at 200 mg/kg orally in mice inhibited acute and subacute carrageenan-induced paw edema, arachidonic acid-induced ear edema and formaldehyde-induced arthritis.⁴⁸

Anti-allergic Activity

Flower extracts at 200 mg/kg orally, administered for 1 week, inhibited 2,4-dinitrofluorobenzene-induced contact hypersensitivity type IV allergic reaction in mice.⁴⁸

Antimicrobial and Antiprotozoal Activity

Antibacterial

Methanol extracts of the entire plant at 2 mg/ml showed *in vitro* activity against *Corynebacterium diphtheriae*, *Klebsiella sp.*, *Neisseria sp.*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, and *Streptococcus sp.*^{49,50} No activity was seen against *Salmonella sp.* and *Streptobacillus sp.*⁴⁹ A leaf methanol extract in a broth culture inhibited *Bacillus subtilis*.⁵⁰ No activity was seen against *Escherichia coli*, *Proteus sp.*, *Pseudomonas aeruginosa*, *Staphylococcus albus* and *Staphylococcus aureus*.⁵⁰ An ethanol-water leaf extract at 50 ul/agar plate was inactive against *Neisseria gonorrhoea*.⁷

Antimycobacterial

Ethanol, chloroform, hydroalcoholic and chemical fractions of the leaf and aerial parts of mullaca demonstrated antimycobacterial activity *in vitro* at 32-625 mcg/ml. Activity was against the following mycobacterium: *M. tuberculosis*, *M. intracellulare*, *M. malmoense*, *M. avium* and *M. kansasii*.⁵¹ A leaf ethanol extract showed the greatest activity at 32 mcg/ml towards *M. tuberculosis*.⁵² Chloroform extracts were active towards a greater number of organisms at a lower dose than the hydroalcoholic extracts.⁵¹

Antiviral

A hot water extract of the aerial parts of the plant at 0.1 mg/ml showed *in vitro* activity against poliovirus I.⁵³ At 340 mcg/ml a methanol extract showed protease inhibition *in vitro*; a water extract was inactive.⁵⁴

Antimalarial

A plant decoction using mullaca (*Physalis angulata*) along with *Jatropha curcas*, *Gossypium hirsutum* and *Delonix regia*, was administered to human patients with malaria. The complex eliminated malaria parasites (*Plasmodium falciparum* and *Plasmodium malarie*) from the peripheral blood of patients with malaria. No undesired effects were seen.⁵⁵ In rats the herbal complex affected select cytochrome p450 isozymes in relation to the sex of the rat, indicating it may precipitate interactions with other drugs via liver transformation and elimination.⁵⁵

Antitrypanosomal

Various extracts of the aerial parts, leaf, root and fruit showed *in vitro* antitrypanosomal activity against *Trypanosoma brucei rhodesiense* between the concentrations of 19-56 mcg/ml.⁵⁶

Molluscicidal

Ethyl acetate and acetone extracts from the whole plant and ethanol extracts of the roots between 0.1-500 mg/l had *in vitro* molluscicide activity against *Biomphalaria tenagophila*.⁴⁵ An aqueous slurry of the fruit, roots and leaves was inactive against *Lymnaea columella* and *Lymnaea cubensis in vitro*.⁵⁷

Cardiovascular Activity

Hypotensive Activity

A water extract of the fruit had a hypotensive effect in cats.⁵⁸ Activity was blocked by gallamine or atropine.

Anticoagulant Activity

In an *in vitro* study a leaf extract at 50% concentration had an anticoagulant effect on whole human blood.⁵⁹

Central Nervous System Effect

A chloroform extract of the entire plant at 100 mcg/ml had weak serotonin receptor binding activity in calves.⁶⁰

Antihyperglycemic Activity

A water extract of the root given intragastrically to mice had weak hypoglycemic activity.⁶¹

Antispasmodic Activity

In the guinea pig ileum 2 mg/ml of an entire plant extract inhibited muscle spasms induced with electrical stimulation.⁶²

Patents Filed / Pending

A US Patent is filed on a method for treating polio virus infection comprising an oral administration of at least one crude drug selected from a group of plants including the aerial parts of *Physalis angulata*. Aqueous and methanol plant extracts were used and tested against the poliovirus (vaccine strain and Sabin strain) using the plaque formation *in vitro* test method. At 100 mu.m/ml mullaca showed plaque formation efficiency at 17.6%.⁶³

Mechanism of Action

Anticancerous Activity

- The steroid withangulatin A inhibited topoisomerase II.⁴⁰
- Withangulatin A enhanced phosphorylation.^{64,65}
- Extracts of mullaca inhibited protein synthesis in leukemia cells.⁴³

Immunomodulatory Activity

- *In vivo*, extracts enhanced antibody response.⁴⁷
- *In vitro*, extracts stimulated T-lymphocyte blastogenesis.⁴⁷
- Immunomodulatory activity is considered to be due to the physalin chemicals.⁴⁴

Antimicrobial Activity

- Mullaca extracts are able to inhibit protease.⁵⁴

Central Nervous System Effect

- Plant extracts have serotonin receptor binding activity.⁶⁰

Dosage

Internal

Crude Preparations, Entire Plant.

2-4 grams daily.

Infusion: 1 cup (150 ml) boiling water poured over approximately 2 grams of dried whole herb. Steep, covered, for 5-10 minutes. Drink 1-3 times daily.

Tincture: 1-3 ml twice daily of a 4:1 tincture.

External

Infusion applied topically.

Duration of Administration

Internal

Duration of administration varies per complaint and individual. No adverse effects have been reported with long-term ingestion.

Contraindications

None reported.

Drug Interactions

May potentiate hypotensive medications.⁵⁸

May potentiate anticoagulant medications.⁵⁹

Side Effects

None reported.

Safety Rating

Not rated.

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