

Review Article

**Review Of
Ethnobotanical,
Phytochemical And
Pharmacological Profile
Of *Cardiospermum
halicacabum* Linn.**

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Abstract

Cardiospermum halicacabum Linn. belonging to family Sapindaceae is an herbaceous plant, extensively dispersed in tropical and subtropical areas of world. *Cardiospermum halicacabum* Linn. is commonly known as “Balloon vine”. It is used for cough, hyperthermia, rheumatism, lumbago, nervous illnesses and amenorrhea. This plant is used in Ayurveda and folk medicine for the treatment of rheumatism, lumbago, earache and fever. The presence of flavones, aglycones, triterpenoids, glycosides, variety of fatty acids and volatile esters are confirmed by phytochemical screening. The plant possesses activities like antioxidant, antifungal, antiparasitic, antidiarrheal, anxiolytic, rubifacient, antipyretic and management of painful, arthritic inflammatory conditions. Therefore, the present reviews paper an attempt to compile an up-to-date and comprehensive review of *Cardiospermum halicacabum* Linn. that covers its Ethnobotanical, phytochemical, pharmacological data.

Keywords: Ethnobotanical, *Cardiospermum halicacabum* Linn., phytochemical and pharmacological profile.

Introduction

Plants have been used in medicines since time immemorial. India has a rich heritage of using medicinal plants in traditional medicines, as in the Ayurveda, Siddha and Unani systems besides folklore practices. Currently, 80% of the world population depends on plant-derived medicine for the first line of primary health care for human alleviation. Keeping in mind that herbal medicines are gaining growing interest because of their cost effective and eco-friendly attributes, this is an urgent need to meet the ever growing demand of medicinal plants in the researcher, farmers, conservationist, and policy makers to manage the use our natural resources wisely. The review on *Cardiospermum halicacabum* Linn. is in light of it.

Cardiospermum halicacabum Linn. is commonly known as “Balloon vine or Kanphuti” from family Sapindaceae is an annual or perennial climber, widely distributed in tropical and subtropical Asia and Africa, and often found throughout India. *Cardiospermum halicacabum* Linn. has been used in Ayurveda and folk medicine for a long time in the treatment of rheumatism, lumbago, nervous diseases, as a demulcent in orchitis and in dropsy. The herb is diuretic, stomachic and rubefacient (Nadkarni, 1976). *Cardiospermum halicacabum* Linn is commonly used in human homeopathy. In traditional medicine in Asia and Africa, *Cardiospermum halicacabum* Linn. is used orally or dermally.

Taxonomic position:

Table 1: Taxonomic position of *Cardiospermum halicacabum* Linn.

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Sapindales
Family	Sapindaceae
Sub-family	Sapindoideae
Genus	<i>Cardiospermum</i>
Species	<i>halicacabum</i> Linn.

Vernacular Names:

Hindi: Kanphata, Kanphuti, Kapalphodi

Bengali: Lalaphatkari

Marathi: Kanphuti, Shibjal, Kakumardanika

Sanskrit: Bunuchchhe, Indravalli, Jyotishmati

Malyalam: Jyotishmati, Katabhi

Kannada: Agniballi, Erumballi

Tamil: Mudakkan

Telugu: Buddakakara, Ekkudutige, Jyotishmatitige

English name: Heart pea, Puff-ball, Balloonvine, Heart seed vine, Love-in-a-puff

Synonyms of *Cardiospermum halicacabum* Linn. (Sapindaceae)

Cardiospermum corumdum L.

Cardiospermum glabrum

Cardiospermum inflatum

Distribution and botanical description:

This herb contains 16 species present in Brazil and among them, 12 species are found in South America. This plant exhibits mainly various chromosome number of the family, having metacentric and submetacentric chromosomes, some have subtelo-centric chromosomes, but lacking in telocentric chromosomes (Warrier, 1996). The roots, leaves and seeds of the herb are employed as herbal medication (Urdampilleta *et al.*, 2013). Plant is reported to possess anti-inflammatory activity by reducing PLA2 activity that is concerned with inflammatory process.

Leaves are alternate and have axillary tendrils. Fruits are the inflated, membranous fruits give this species its common name Balloonvine. The sepals remain attached in the fruit. The seeds inside the capsule have a white heart shape spot which is described in the generic name *Cardiospermum* (Cardio - heart, sperma - seed). Balloon-vine is a perennial creeper at its base, the plant's stem is only approximately 3 mm thick, but it can reach a height of up to 2 metres. The stem forms internodes of between 5-10 cm in length.

The grooved stem carries alternate double triad leaves, 3 to 5 cm long, which are hairless or cov-

ered in a soft down of hairs. The oval or lanceate leaves have a deeply serrated or lobated edge. The leaflets at the side are smaller. The tiny radiate flowers are white, standing in rolls on long flower stems of 5 to 10 cm in length. The perianth consists of 4 to 5 egg-shaped sepals and four petals with banner or wing-like fine combs. There are 8 anthers. Just beneath the flower stalks are 2 cm long tendrils, usually in pairs. The long green fruit is roughly 3 cm long and blown up, almost entirely spherical capsule containing the characteristic seeds with their heart-shaped white markings. The plant is blooms in different periods, depending on where it grows. The Sapindaceae family is almost only to be found in tropical regions. The fruits of the species *Sapindus* contain saponins and foam in water, which is why they are used for washing in their native land. The flesh of the fruit is usually edible.

Nutritional value:

Seed oil contains a number of fatty acids (Shareef *et al.*, 2012). The oil is yellow in colour, clear having distinguishing smell with extractive value 28.8460%. Gas chromatography-mass spectrometry (GC-MS) analysis categorizes 27 elements link to various groups. The seed oil have erucic acid 43%, oleic acid (30%), eicosonic acid 12%, octanoic acid 4.57% and n-hexadecanoic acid 4.15% (Jayanthi *et al.*, 2012), rich in triterpenoids (Ferrar *et al.*, 1996). The presence of octanoic acid, dodecanoic acid, tetradecanoic acid, pentadecanoic acid and arachidic acids together with other components supports its use in anti-inflammatory activity. It further includes antioxidants like eicosonic (arachidic acid) and palmitic acid (hexadecanoic acid), stearic acid (octadecanoic acid) and lauric acid (dodecanoic acid). Its refractive index at 25°C is 1.4870. Its weight/ml at 25°C is 0.9011 g. Its acid value is 27.4014 and saponification value is 158.6257. Its iodine value is 78.1886 (Jayanthi *et al.*, 2012).

Ethnobotany:

For millennia, many cultures have used balloon vine as a source of nutrition and as a medicine for many ailments. In Africa, balloon vine is used to treat snakebites; however most people consume it as green vegetable as well as traditional medicine for rheumatism, lumbago, and nervous disease and as demulcent in orchitis and in dropsy (Venka-

tesh Babu and Krishna Kumari 2006, Sidigia *et al.*, 1990, Neuwinger 2000, Bussmann 2006). Also this herb is traditionally used to treat symptoms of malaria in parts of East and Central Africa (Waako *et al.*, 2005). Traditional use of balloon vine in India includes consumption as a vegetable, fodder and various medicinal remedies to treat chronic bronchitis, snakebites or use as a diuretic, stomachic, and rubefacient (Kumaranand Karunakaran 2006, Venkatesh Babu and Krishna Kumari 2006). The juice of the herb is claimed to cure earaches and to reduce hardened tumors. It exhibits significant analgesic, anti-inflammatory activity and vasodepressant activity (Kumaranand Karunakaran 2006). The leaves have been mixed with castor oil and administered internally to treat rheumatism and to check lumbago (Kirtikar and Basu 1969). Two glasses of a 12-hour maceration of the aerial parts of the plant are consumed or used for bathing in the treatment of hyperthermia, and in some areas water extracts of the seed are used (Neuwinger 2000). Chopra *et al.*, (1956) have suggested that this plant is used for rheumatism, stiffness of limbs and snakebite. The plant is also known to contain saponin, quebrachitol, apigenin, proanthocyanidin and stigmasterol (Dass 1966, Satyavathi *et al.*, 1976). Many of the medicinal claims reported concerning balloon vine from throughout the globe are largely unsubstantiated by scientific proof. We report these claims with the caveat that they should not be used for any medicinal purposes until further research is conducted.

The most common medicinal use for balloon vine is for the treatment of rheumatoid arthritis. Ethanol extract of *Cardiospermum halicacabum* Linn. may be useful as an anti-inflammatory preparation, but it has been revealed that the crude powder of this plant is not toxic up to 40g/kg in rats (Santhakumari *et al.*, 1981). In an earlier study (Sadique *et al.*, 1987), anti-inflammatory properties of *Cardiospermum halicacabum* Linn. extracts were evaluated in vivo using an albino rat model system. The extract was fed to the rats at a dose of 500 mg/kg body weight which was found to be optimal. The development of edema induced by the application of carrageenan on rat paws was significantly reduced in the sets fed with *Cardiospermum halicacabum* Linn. extracts. The anti-inflammatory properties of the extract were also evident in a cotton pellet granuloma assay, where cotton pellets were implanted

subcutaneously and the inflammation evaluated. In general, there was a reduction in the lipid peroxide content and phospholipase A2 activity in the exudate of the cotton pellet granuloma. It was concluded that a reduction in phospholipase A2 activity may down regulate the prostaglandin biosynthesis, thus reducing the inflammation in treated rats. However, conclusive information on the active ingredients was not provided. It appears that the anti-inflammatory properties of the *Cardiospermum halicacabum* Linn. extracts may be the major effect that causes a reduction in symptoms associated with rheumatism, wounds and swellings as observed in its use in traditional medicine.

Phytochemistry:

The whole plant contains Alkaloid, flavanoids, proanthocyanidin, apigenins and phytosterol (eg. Stigmasterol) etc. Tannins (Yu *et al.*, 2000) flavonoids (Galvez *et al.*, 1993) alkaloids (Al-Rehaily *et al.*, 2001) saponins, reducing sugars, sterols and triterpenes (Otshudi *et al.*, 2000) are reported for their antidiarrhoeal activity. The seeds contain approximately 33% of fatty acids and of these fatty acids about 55% are cyano lipids. The major cyano lipids (49%) is diester having 2 fatty acids moieties esterified with 2-cyano,2-hydroxyl methyl prop-2-ene-3-ol followed by diester derived from 2-cyano,2-hydroxyl methyl prop-2-ene-3-ol (6%). Of the fatty acids, 11-eicosinic acid is with 42% of major one (42%), other chief constituents of oil are oleic acid (22%), arachidonic acid (10%), linoleic acid (3%), stearic acid (2%). In the leaves, larger amount of alkaloids and saponins were found. Also (+) - pinitol, apigenin, luteolin and chrysoarinol. The occurrence of esterified fatty acids, pentacyclitriterpenoids and hydrocyanic acid releasing cyano lipids in the mother tincture. Alkaloids have not been detected in the homeopathic mother tincture. The mother tincture contains a relatively higher amount of flavanoids than the plants (Ahmed *et al.*, 1993, Ferrara *et al.*, 1996, srinivas *et al.*, 1998 and Hopkins *et al.*, 1968).

Pharmacological properties:

Anti-diarrheal activity:

Anti-diarrhoeal activity of whole plant extracts of *Cardiospermum halicacabum* Linn. One-fifth of the maximum dose of LD50 of each extract was selected to study the anti-diarrhoeal activity in dif-

ferent experimental models such as castor oil-induced diarrhoea, prostaglandin E2 (PGE2)-induced enteropooling and charcoal meal test in rats. The whole plant extracts (i.e. petroleum ether, alcohol and aqueous) of *Cardiospermum halicacabum* Linn. contain tannins, flavonoids, saponins, sterols and triterpenes, which could have contributed to the antidiarrhoeal activity. Antidiarrhoeal activity of the extracts of *Cardiospermum halicacabum* Linn., which may be due to the presence of phytochemical constituents such as sterols, tannins, flavonoids and triterpenes (Di Carlo *et al.*, 1993, Rao *et al.*, 1997 and Rao *et al.*, 2006).

Anti-fungal activity:

All the herbal extracts have inhibition against the fungi *C. albicans* while alcohol extract exhibited highest activity than chloroform; ether and aqueous extract. The herbal extracts have high effective antifungal activity against *C. albicans* than the antibacterial activity against the bacteria mentioned (Warrier, 1996). Against *Saccharomyces cerevisiae* and *Aspergillus niger*, ethanolic extract of the plant was effective but ethanol, aqueous and oil extracts produce temperate activity against *C. albicans*. Seed oil is also valuable to animal pathogens. Finally it is concluded that presence of several chemical components which can be the part of novel bioactive compounds, the herbal extract possess large possible source of active antimicrobial agents (Shareef *et al.*, 2012).

Anti-inflammatory activity:

Effects of *Cardiospermum halicacabum* Linn. on acute and chronic inflammatory process induced by xylol and croton oil. In acute inflammation in mouse, the test drug in 10 g / kg dose level, afforded significant ($p < 0.001$) protection from edema. It showed 70% inhibition of edema as compared to 46% of phenylbutazone. Similarly in chronic inflammatory process drug decoction 10 and 20 g / kg showed very significantly ($p < 0.001$) reduced the inflammatory exudates with reduction in weight of pouch wall. This activity was almost similar to that of phenylbutazone (100 mg/kg).

Anxiolytic activity:

The plant root is an effective anxiolytic mediator. Its phyto constituents that are accountable for its anxiolytic actions were separated and recognized

as cardiospermin, a cyanogenic glucoside which is a famous compound (Kumar *et al.*, 2011).

Antipyretic activity:

This herb also possesses antipyretic activity against yeast-induced pyrexia in rats. Potent antipyretic ability has been exhibited by ethanol and n-hexane extracts of the herbal powder while its aqueous extract did not show this activity (Asha and Ushpangadan, 1999).

Antioxidant activity:

A study was conducted to evaluate the antioxidant activity and HPTLC fingerprint of *Cardiospermum halicacabum* Linn. The stem extract of ethanol and analyzed for their free radical scavenging activity in different e.g. DPPH radical scavenging and Nitric oxide radical scavenging activity, Superoxide radical scavenging activity, ferric ion scavenging activity, were compared with standard antioxidant like ascorbic acid. All the extracts showed good antioxidant activity (Krishna murthi *et al.*, 2014)

Antidiabetic activity:

Diabetes was induced by intraperitoneal injection (single dose) of alloxan monohydrate (120 mg/kg, body weight) in 0.9% w/v NaCl solution (normal saline) to overnight fasted normal rats. Blood glucose level was checked by using one-touch glucometer and diabetes was confirmed after 72 hours of alloxanisation. Rats shown FBG >300 mg/dl were considered to diabetic and were selected for studies.

Antimalarial activity:

The ethyl acetate extracts showed limited in vitro antimalarial activity, not sufficient to warrant further investigation. The extracts showed similar activity against chloroquine-sensitive D10 and the chloroquine- and sulphonamideresistant K1 parasites (Neill and Hunt, 1992).

Cure for different ailments:

Gastrointestinal problems:

The herbal leaves are helpful in biliousness curing, and leaves decoction alleviate diarrhoea and dysentery. Its juice can be applied to treat haemorrhoids (Manandhar and Manandhar, 2002; Jayabalan, 2006).

Respiratory disorder:

For cold and asthma the plant decoction is applied. In Nepal, its juice is helpful for asthma while in Hong Kong it is employed to treat pertussis (Panda, 2000; Mat-Salleh and Latiff, 2002).

Urinogenital infection:

The roots possess diuretic abilities and employed in the treatment of renal problems. A decoction of the herb together with *Vernonia cinera* and *Desmodium barbatum* is best suggested for kidney problems in Guyana. In Hong Kong and Korea the whole herb is employed for the treatment of urinary tract infection, oedema, nephritis and oliguria (Panda, 2000).

Conclusion:

Cardiospermum halicacabum Linn possess certain significant properties that support its role in medicinal field. It possesses anti-inflammatory, anti-diarrheal, antiparasitic, antipyretic, anxiolytic, Anti-diabetic activities, urinary tract infections suppression and anti-fungal properties. It also plays important role in epilepsy and certain nervous disorders. Its chemical constituents are well documented and further investigations are needed to assess its isolates mode of action on various activities. A considerable amount of work has been done to study the potential of herbal medicines and modern science has accepted the plant kingdom as a source of new biodynamic constituents.

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