

# Pharmacognostic And Physio-Chemical Studies On The Leaves Of *Cardiospermum halicacabum* L.

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## ABSTRACT

*Cardiospermum halicacabum* L. (Sapindaceae) commonly known as "Balloon vine" is a dioecious, hairy, climbing vine with balloon like clusters of white flowers framed by finely dissected, delicate foliage. The leaf has a bitter taste; the entire plant is used as anti-inflammatory, antibiotic against many bacteria, antiparasitic, antipyretic and as an analgesic. The ethanolic extract of leaves exhibits significant anti-arthritis effect. The present study was therefore carried out to provide requisite pharmacognostic details about the leaf. Pharmacognostic investigation of the leaf and leaf powder of *Cardiospermum halicacabum* L. was carried out to determine its morphological, anatomical and phytochemical diagnostic features. The preliminary phytochemical analysis and Thin Layer Chromatography has been performed. The leaf was also characterized for its physico-chemical properties. The presence of covering trichomes and anomocytic type of stomata are the characteristic features observed in the microscopy of leaf. Preliminary phytochemical analysis indicated presence of tannins, saponins, flavonoids, glycosides and cardiac glycosides. The results of the study could be useful in setting some diagnostic indices for the identification and preparation of a monograph of the plant.

**Keywords:** *Cardiospermum halicacabum* L., Pharmacognosy, Physicochemical analysis.

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## INTRODUCTION:

Traditional knowledge of plants is responsible for most of the medicine and food used in modern society. The exploration of traditional knowledge for cures to common diseases is attractive, but also overwhelming. *Cardiospermum halicacabum* L., commonly known as Balloon vine, is an important medicinal herb belonging to family Sapindaceae. The plant is a dioecious, hairy, climbing vine with clusters of white flowers, finely dissected, delicate foliage and balloon like fruits. The root of the plant is considered as diaphoretic, diuretic and aperient. It is also administered in fever. The whole plant is applied to reduce swellings and hardened tumors (1). There is a claim that it is used by some locals to treat rheumatoid arthritis in Asian and African communities. This claim is substantiated by the researchers (2, 3).

The whole plant has been used as anti-inflammatory (4, 5), as an antibiotic against many bacteria such as *Escherichia coli*, *Salmonella typhi* etc. (4, 6), as an antipyretic (4, 7), antiparasitic (8), as an effective non toxic antifertility herb (9) and as analgesic (4). Eswar Kumar *et al.*(10) reported that the ethanolic extract of leaves exhibits significant anti-arthritis effect.

In the global market, balloon vine has been utilized in several products, 'Love in a puff', 'Balloon Vine' and 'Heartseed'. It is also one of the ingredients in "Allergy Relief Liquid™" and "Bioforce Pollinoson® Tabs" marketed by Bioforce USA as a natural relief for hay fever, allergies, sneezing, watery eyes, and allergic reactions. Another US based company, Boericke and Tafel produces "Florasone *Cardiospermum* Cream" for skin ailments such as swelling, scaling, blisters/vesicles, burning and pain. These products are supported by the various claims concerning the many medicinal properties of balloon vine (11).

Therefore the present investigation of *Cardiospermum halicacabum* L. leaves is taken up to establish pharmacognostic profile of the leaves which will help in crude drug identification as well as in standardization of the quality and purity.

## MATERIALS AND METHODS

Herbarium of *Cardiospermum halicacabum* was prepared and authenticated from Blatter Herbarium, St. Xavier's College, Mumbai. Fresh leaves of *Cardiospermum halicacabum* were collected from Haji Malang (Kalyan, M.S., India), washed under running tap water and blotted dry for further studies. The leaves were dried in preset

oven at  $40 \pm 2^\circ\text{C}$  for about two weeks, ground into powder and used for further analysis. Physicochemical constants such as the percentage of total ash, acid insoluble ash, water soluble ash; water soluble and alcohol soluble extractive values were calculated according to the methods described by Mukherjee (12). Preliminary phytochemical analysis of powdered leaf was performed as described by Khandelwal (13) and Kokate (14). Phytochemical analysis was carried out using Thin Layer Chromatography as described by Wagner and Bladt (15). Fluorescence analysis was conducted using methods of Kokoski (16) and Chase and Pratt (17).

## RESULTS

### Macroscopic Characters (Plate 1 A, 1 B)

Color: Green.

Size and Shape: Petiole: 1.7-3.4 cm long, ultimate segments of the leaves 2.7 – 4.0 cm in length, lanceolate.

Texture: Sparsely pubescent.

Extra features: Leaves alternate and compound, deltoid, 2-ternate, serrate, very acute at the apex and narrowed at the base.

### Microscopy

Surface preparation of leaves revealed presence of covering unicellular trichomes and anomocytic type of stomata (Plate 1 G, 1 H).

### Transverse section of leaf:

It is dorsiventral leaf. Following tissues are present in midrib and lamina.

### Midrib:

The midrib is broadly hemispherical on the abaxial side with short lump on the adaxial side. Covering unicellular trichomes are present on either sides of midrib. Inverted vascular bundles (i.e., xylem towards the dorsal surface and phloem towards the ventral surface) is the characteristic of the leaf (Plate 1 C).

### Lamina:

The lamina of the leaf shows upper epidermis, mesophyll and lower epidermis. Upper epidermis is composed of single layer of rectangular cells covered with cuticle. It also shows presence of covering unicellular trichomes. Mesophyll is differentiated into 1-2 layers of palisade followed by 3-4 layered spongy parenchyma. Lower epidermis consists of single layer of rectangular cells (Plate 1 D).

### Transverse section of petiole

Transverse section of petiole shows two prominent grooves towards upper side whereas the lower side is round. The epidermis is composed of single layer of cells. Few trichomes are observed on epidermal cells, which are identical with that of leaf. Chlorenchymatous hypodermis is present below grooves. 4-6 vascular bundles are present in the ground tissue. Each vascular bundle is collateral. The xylem is found towards upper side and the phloem lies towards lower side. The remaining portion of the ground tissue is composed of parenchyma (Plate 1 E).

### Transverse section of rachis

Transverse section of rachis is polygonal in outline with two winged projections at the upper side. Epidermis is single layered and is composed of horizontally flattened cells. The cells are compactly arranged and showed presence of cuticle. Covering unicellular trichomes are present on epidermal cells. The peripheral layers in the ground tissue are composed of collenchymatous and chlorenchymatous cells. These cells occur as bands and they alternate with each other thus forming a continuous layer next to epidermis. This forms the hypodermis. A continuous ring of pericyclic fibers is present in the ground tissue. Vascular bundles are arranged in a ring in the ground tissue and are collateral. The rest of ground tissue is parenchymatous (Plate 1 F).

### Powder characteristics:

#### Preliminary examination of powder

Leaf powder is green in color with characteristic odor and smooth texture.

#### Microscopic examination of powder

The various diagnostic characteristics of powdered leaf are shown in Table -1.

#### Quantitative determination

The number of stomata, vein islet number, measurement of stomatal index and size of stomata were done with the

**Table - 1: Microscopical features of the powdered leaves of *Cardiospermum halicacabum* L.**

Observations	Plate 1
Covering unicellular trichomes.	I
Spiral thickening	J
Leaf surface showing stomata	K
Fibers	L

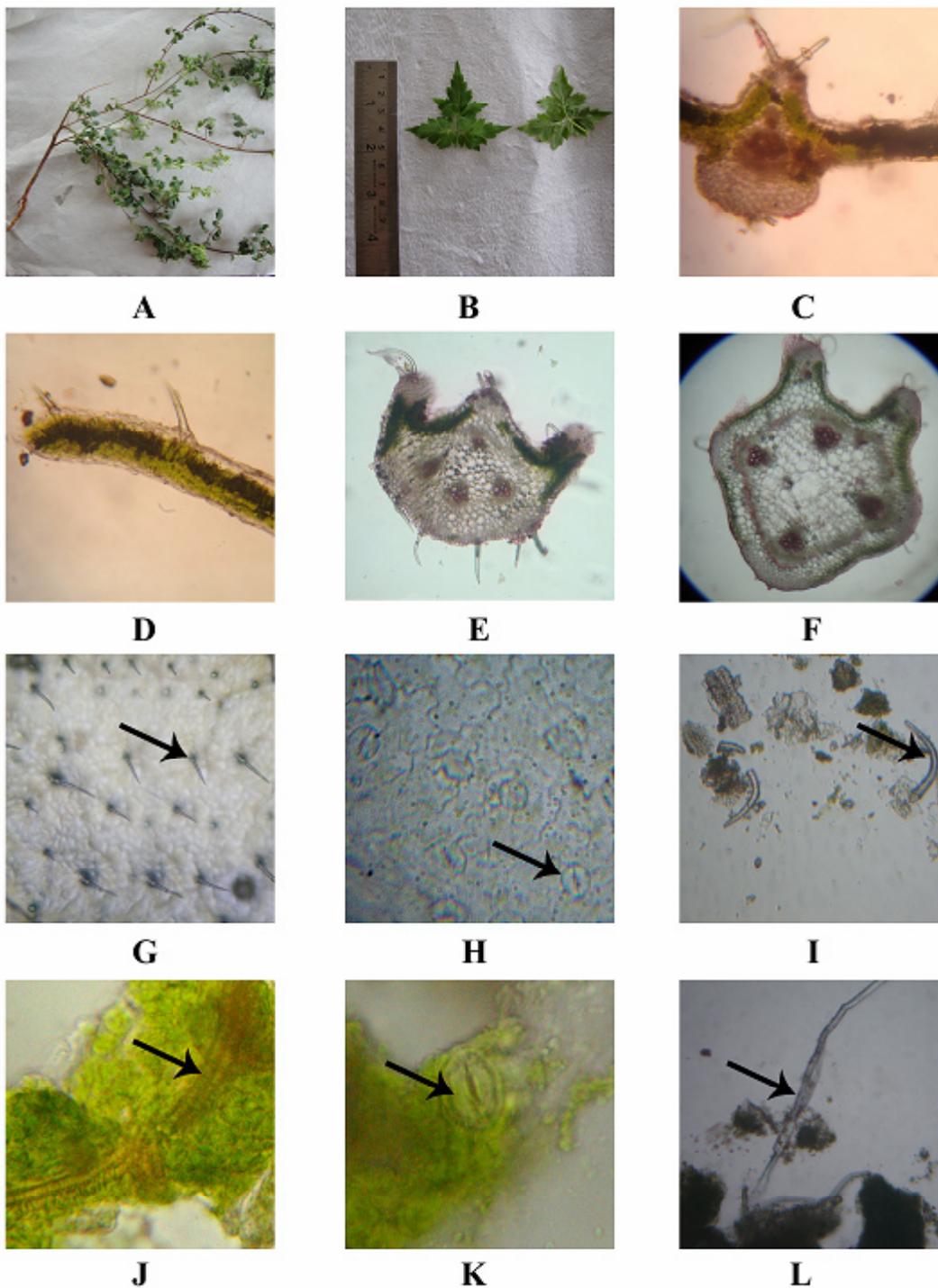


Plate No.1: Macroscopic, microscopic and powder characteristics of *Cardiospermum halicacabum* Linn.

**Table 2: Quantitative leaf microscopy of *Cardiospermum halicacabum* L.**

Parameter	Value
Stomatal index	33.6
Number of Stomata	20
Vein islet number	17
Stomatal size	
Length (µm)	15.6 – 20.8
Breadth (µm)	7.8 – 13

**Table 3: Physico-chemical studies of *Cardiospermum halicacabum* L. leaves**

Parameter	Observation
Ash values	
a. Total ash content (%)	12.9
b. Acid insoluble ash (%)	1.5
c. Water soluble ash (%)	4.3
Extractive values	
a. Water soluble extractive values (%)	18.08
b. Alcohol soluble extractive values (%)	19.84
Loss on drying (%)	56.18

help of calibrated ocular micrometer. Values are tabulated in Table - 2.

### Physico-chemical Parameters

The data on ash values are indicative of the purity of drug, extractive values are representative of the presence

**Table - 4: Preliminary phytochemical screening of *Cardiospermum halicacabum* L. leaves**

Tests for Phytoconstituents	WE	AE	CE
Carbohydrate	+	+	+
Proteins	+	-;	-;
Amino acid	+	-;	-;
Saponins	+	-;	-;
Tannins	+	+	+
Hydrolysable Tannins	-;	-;	+
Flavanoid	+	-;	-;
Steroid	-;	+	+
Glycosides	+	-;	-;
Cardiac glycosides	+	+	+
Antraquinone	-;	-;	-;
Volatile oil	-;	-;	-;

WE: Water Extract

AE: Alcohol Extract

CE: Chloroform Extract

+ : Present

-; : Absent

of polar or non-polar compounds and loss on drying value also indicates that where the drug is safe regarding any growth of bacteria, fungi and yeast (18). Loss on drying, percentage of total ash, acid insoluble ash, water soluble ash and different extractive values are tabulated in Table - 3.

### Phytochemical Evaluation

Preliminary phytochemical screening is tabulated in Table - 4.

**Table 5: Chromatographic result of *Cardiospermum halicacabum* L. leaf extract:**

Compound	Extract	Number of Spots	Rf value
Arbutin	Methanolic	4	0.05, 0.13, 0.44, 0.50
	Aqueous	2	0.05, 0.11
Cardiac glycoside	Methanolic	5	0.11, 0.26, 0.62, 0.75, 0.91
	Aqueous	1	0.15
Essential oil	Methanolic	9	0.15, 0.26, 0.29, 0.39, 0.42, 0.53, 0.57, 0.89, 0.94
	Aqueous	-	-
Bitter principle	Methanolic	5	0.16, 0.30, 0.42, 0.68, 0.77
	Aqueous	2	0.21, 0.47
Pungent principle	Methanolic	5	0.52, 0.63, 0.76, 0.84, 0.90
	Aqueous	-	-
Anthracene	Methanolic	4	0.25, 0.53, 0.58, 0.93
	Aqueous	1	0.28
Saponin	Methanolic	3	0.29, 0.48, 0.85
	Aqueous	1	0.57

**Table 6: Fluorescence analysis of *Cardiospermum halicacabum* L. leaves**

Treatment	Observation under		
	Ordinary light	UV light	
		254 nm	366 nm
Powder as such	Green	Green	Green
Powder+ Nitrocellulose	Green	Green	Green
Powder+ 1N NaOH in methanol	Green	Green	Green
Powder+ 1N NaOH in methanol + Nitrocellulose in amyl acetate	Green	Dark brown	Brown
Powder+ 1N HCl	Brownish green	Black	Dark brown
Powder+ 1N HCl+ Nitrocellulose in amyl acetate	Green	Black	Reddish brown
Powder+ 1N NaOH in water	Green	Black	Brownish green
Powder+ 1N NaOH in water, dried and mounted in Nitrocellulose in amyl acetate	Dark green	Black	Brownish green
Powder+ HNO <sub>3</sub> (1:1)	Brownish green	Brown	Brown
Powder+ H <sub>2</sub> SO <sub>4</sub> (1:1)	Dark green	Dark brown	Brownish green

Results for TLC are tabulated in Table - 5.

Color reaction of powdered drug with different reagents and their fluorescence analysis were studied and recorded in Table - 6.

## DISCUSSION

The diagnostic microscopic features of leaf are presence of covering unicellular trichomes and anomocytic stomata. The powder microscopy of leaf also showed presence of unicellular trichomes, stomata, spiral thickening and fibers. Presence of covering unicellular trichomes, collenchyma, chlorenchyma, collateral vascular bundle are few of the important characteristics of the petiole and rachis.

The quantitative determination of some pharmacognostic parameters is useful for setting standards for crude drugs. The physical constant evaluation of the drugs is an important parameter in detecting adulteration or improper handling of drugs. The total ash is particularly important in the evaluation of purity of drugs i.e. presence or absence of foreign inorganic matter such as metallic salts and / or silica (19).

In present study, the stomatal index and number of stomata was found to be 33.6 and 20 respectively. Vein islet number was found to be 17. The total moisture content was found to be 56.18%, along with total ash 12.9 %, of which, 1.5 % is acid insoluble ash, and 4.3 % is water soluble ash. The extractive values were found to be 18.08% and 19.84% for water and alcohol respectively.

Thin Layer Chromatography revealed that methanol gives better extraction of the phytochemicals than water since the methanolic extract resolved into maximum number of bands as compare to aqueous extract.

The pharmacognostical study is one of the major criteria for identification of plant. The present study on the pharamcognostical characteristics of *Cardiospermum halicacabum* L. leaves will provide useful information for its correct identity and may enable those who handle this plant to maintain its quality control. In addition the results of the present study could be useful for preparation of a monograph of the plant.

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