

# Centella Asisatica (Brahmi): A Herbal Medicince Plant

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**Abstract:** It has been in use, as a medicinal herb, for thousands of years in India, China and Indonesia. Its ability to heal wounds, improve mental clarity, and treat skin conditions such as leprosy and psoriasis were important reasons for its extensive use in these countries. It has also been called one of the "miracle elixirs of life". Historically, *Centella asiatica* has also been used to treat syphilis, hepatitis, stomach ulcers, mental fatigue, epilepsy, diarrhea, fever, and asthma. Today herbalists use *Centella asiatica* for disorders that cause connective tissue swelling, such as scleroderma, psoriatic arthritis (arthritis occurring in conjunction with psoriasis), ankylosing spondylitis (arthritis of the spine), and rheumatoid arthritis. Recent studies confirm some of the traditional uses and also suggest possible new applications for *Centella asiatica*, such as lowering high blood pressure, treating venous insufficiency (pooling of blood in the veins, usually in the legs, boosting memory and intelligence, easing anxiety, and speeding wound healing. These leaves are useful in abdominal disorders 1-4 due to dysentery in children. Charaka includes this drug in his Vayasthapana Varga, the group of drugs that are capable of maintaining the youthful vigour and strength, 'Mandooka Parni' is also a 'Medhya' drug, which improves the receptive and retentive capacity of the mind. Legend goes that the tigers used to rub themselves with the Tiger's herb (*Centella* plant), in order to heal their scars. *Centella* has also been used traditionally as an anti-inflammatory, particularly for eczema, and also for minor itching and insect bites.

**Keywords:** Tiger's herb, medicinal plants, miracle elixirs of life, Mandooka Parni

## 1. Introduction

It has been in use, as a medicinal herb, for thousands of years in India, China and Indonesia. Its ability to heal wounds, improve mental clarity, and treat skin conditions such as leprosy and psoriasis were important reasons for its extensive use in these countries. It has also been called one of the "miracle elixirs of life". Historically, *Centella asiatica* has also been used to treat syphilis, hepatitis, stomach ulcers, mental fatigue, epilepsy, diarrhea, fever, and asthma. Today herbalists use *Centella asiatica* for disorders that cause connective tissue swelling, such as scleroderma, psoriatic arthritis (arthritis occurring in conjunction with psoriasis), ankylosing spondylitis (arthritis of the spine), and rheumatoid arthritis. Recent studies confirm some of the traditional uses and also suggest possible new applications for *Centella asiatica*, such as lowering high blood pressure, treating venous insufficiency (pooling of blood in the veins, usually in the legs, boosting memory and intelligence, easing anxiety, and speeding wound healing.

The plant is bitter, acrid, sweet, cooling, soporific, cardiogenic, nervine tonic, stomachic, carminative, antileprotic, diuretic and febrifuge, it is useful in vitiated conditions of pitta, insomnia, cardiac debility, epilepsy, hoarseness, asthma, bronchitis, hiccough, amentia, abdominal disorders, leprosy, strangury and fever. These leaves are useful in abdominal disorders 1-4 due to dysentery in children. Charaka includes this drug in his Vayasthapana Varga, the group of drugs that are capable of maintaining the youthful vigour and strength, 'Mandooka Parni' is also a 'Medhya' drug, which improves the receptive and retentive capacity of the mind. The whole plant is reported to be nervine and cardiogenic capable of improving memory power, physical strength, voice, complexion and 5-8 digestive power.

*Centella* has been used as a wound-healing agent and a constituent of a brain tonic for the mentally challenged. It has also been used traditionally and in Ayurvedic medicine for central nervous system ailments including failing memory, insomnia, depression, stress and epilepsy. In South Africa it was used to treat leprosy, wounds, cancer, fever and syphilis, while in Europe, the extract has been used for many years to treat wounds. The plant is also used to treat acne and allergies. And as a psychophysical regenerator and blood purifier. In China, *Centella asiatica* has been used for a long time to treat dermal wounds and leprosy patients. Other folk medicine uses are for abscesses, headache, asthma, bronchitis, catarrh, convulsions, dysentery, eczema, gonorrhoea, hypertension, jaundice, pleuritis, rheumatism, spasms, tuberculosis, ulcers, urethritis and as a diuretic. In Kenya, the leaves were applied after of the skull amongst the Kisii tribe to improve healing.

Legend goes that the tigers used to rub themselves with the Tiger's herb (*Centella* plant), in order to heal their scars. Perhaps the legend is not without truth, nowadays the selected triterpenes of *Centella asiatica* is the principle active in a range of specialties for the management of dermatological conditions including post operative scarring.

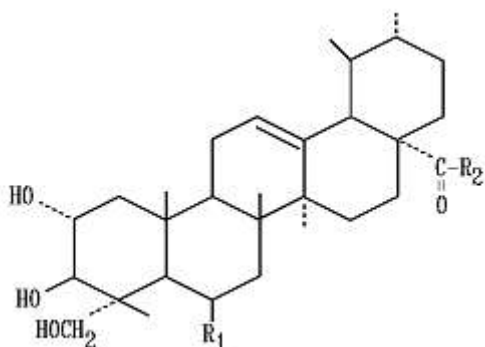
The use of *Centella asiatica* in the management of dermatological conditions has a long tradition in its native areas, such as India and Sri Lanka, where it is used to support faster healing of small wounds, chaps and scratches, surgical wounds, superficial burns and varicose ulcers and as an oral preparation for atonic wounds and hypertrophic healing. *Centella* has also been used traditionally as an anti-inflammatory, particularly for eczema, and also for minor itching and insect bites.

The IUCN report for the year 2000 revealed that India ranked fifth in the case of threatened plant species and birds. Recently some rapid assessment of the threat status of

Medicinal plants using IUCN designed CAMP methodology revealed that about 112 species in Southern India,

74 species in Northern and Central India and 42 species in High altitude of Himalayas are threatened in the wild.

## 2. Structural Formula:



R = H; R = OH: Asiatic acid  
 R = OH; R = OH: Madecassic acid

### Classification:

Kingdom: Plantae  
 Division: Angiospermae  
 Class: Dicotyledonae  
 Order: Apiales  
 Family: Apiaceae  
 Genus: Centella  
 Species: asiatica Linn.

### Vernacular Names:

English: Gotu kola  
 Sanskrit: Mandukaparni  
 Hindi: Brahma-manduki, Khulakhudi, Gotu Kola  
 Kannada: Brahmisoppu  
 Marathi: Karinga  
 Tamil: Vallarei, Yoshnavalli, Chandaki, Pinderi  
 Bengali: Tholkari  
 Gujarati - Karbrahmi  
 Telegu- Brahmi, Saraswataku

### Botanical Synonyms

Centella coriacea  
 Hydrocotyle asiatica  
 Hydrocotyle lunata

Synonym	Centella coriacea, Hydrocotyle asiatica, Hydrocotyle lunata
Common name	Gotu kola, Brahma-manduki, Khulakhudi,
Habitat	The stems are slender, creeping <u>stolons</u> , green to reddish-green in color, connecting plants to each other. It has long-stalked, green, rounded apices which have smooth texture with palmately netted veins.
Distribution	<i>Centella asiatica</i> is indigenous to the Indian subcontinent, Southeast Asia, and wetland regions of the Southeastern US. Its Asian distribution includes India (including the Andaman Islands), Sri Lanka, Indonesia, Pakistan, Bhutan, Korea, Viet Nam, Lao PDR, Thailand
Description	The plant is aquatic, it is especially sensitive to biological and chemical pollutants in the water, which may be absorbed into the plant. Petiole 0.5–10(–30) cm; leaf blade orbicular or reniform, 1–4.5 × 1.5–5 cm,

	palmate veins 5–7, prominent, both surfaces glabrous or abaxially sparsely pubescent on the veins, base broadly cordate, coarsely toothed. Peduncles 2–4, clustered axillary, 0.2–1.5 cm; bracts 2 (rarely 3), ovate, 3–4 × 2.1–3 mm, persistent in fruit; umbels 3–4-flowered, capitate. Flowers sessile or subsessile. Petals white or rose-tinged. Fruit 2.1–3 × 2.2–3.6 mm.
Biology	Creeping herb, rooting at the nodes. Stems shallowly grooved, sometimes purplish. Leaves solitary or in groups of 2-5, kidney-shaped to almost circular, distinctly and broadly cordate at the base, up to 7 cm wide, hairless or with hairs on the petiole; margin crenate. Flowers in 2-8-flowered umbels, greenish-white to dark crimson. Fruit c. 3.5 × 3 mm, laterally flattened, round or ellipsoid, ribbed, brown when ripe.

### Characteristic of Centella Asiatica:

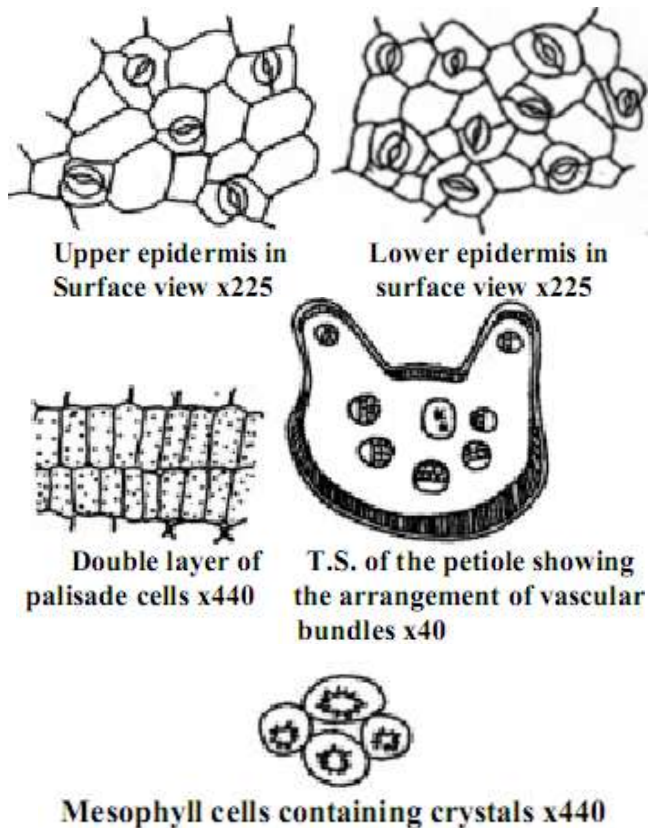
Macroscopic Character of Centella Asiatica	
Colour & Appearance	Almost Green, slender, prostrate or creeping perennial herb, with long internodes and rooting at nodes.
Root	The plant consist of vertical root stalk
Leaves	Leaves are cordate or hastate or orbicular or reniform or sub entire or palmately lobed consisting of long petiole and small stipules.
Stem	The stems are slender, creeping <u>stolons</u> , green to reddish green in color, interconnecting one plant to another.
Flower	Flowers are small, sessile and dark pink in colour.
Fruits	Clusted at joints. Carpels oblong, sub – cylindric curved and less in length much laterally compressed, readily separating into 2 indehiscent halves (mericarps) united by a very narrow plane of junction. Vittae are seen in the furrows of each mericarp
Odour	Characteristic
Taste	Bitter sweet taste
Seeds	Solitary in each mericarp, pendulous embryo, laterally compressed

Microscopic Characteristics of Centella Asiatica	
Stomata	both surfaces of the leaf, 30 by 28µm, rubiaceous type
Palisade cells	2 layers of cells, 45 by 25µm
parenchymatous cells	with crystals of calcium oxalate; midrib region shows 2 or 3 layers.
collenchymas	2 or 3 layers of cells; a broad zone of parenchyma; 7 vascular bundles within parenchymatous zone 2 in projecting arms and 5 forming the central strand.
trichomes	similar to the leaves, sheets of elongated parquetry layer cells, bundles of narrow annular vessels.

### Leaf:

#### Anatomy of the Leaf

Paracytic and diacytic type of stomata is present on both surfaces of the leaf. Palisade cells two layered thick. Spongy parenchyma three layers of cells with many intercellular spaces, some with rosette crystals of calcium oxalate. Hairs are absent. Midrib region shows 2-3 layers of collenchymas cells below the epidermis. Petiole shows 7 vascular bundles within parenchymatous zone.



**Constituents Amounts (MG/L)**

**Macronutrients**

NH<sub>4</sub>NO<sub>3</sub> 1650  
 KNO<sub>3</sub> 1900  
 CaCl<sub>2</sub> .2H<sub>2</sub>O 440  
 MgSO<sub>4</sub> .7H<sub>2</sub>O 370  
 KH<sub>2</sub> PO<sub>4</sub> 170

**Micronutrients**

MnSO<sub>4</sub> .4H<sub>2</sub>O 16.9  
 FeSO<sub>4</sub> .7H<sub>2</sub>O 27.8  
 ZnSO<sub>4</sub> .7H<sub>2</sub>O 8.60  
 H<sub>3</sub>BO<sub>3</sub> 6.20  
 KI 0.83  
 Na<sub>2</sub>MoO<sub>4</sub> .2H<sub>2</sub>O 0.25  
 CoCl<sub>2</sub> .6H<sub>2</sub>O 0.025  
 CuSO<sub>4</sub> .7H<sub>2</sub>O 0.025  
 Na<sub>2</sub> EDTA. 2H<sub>2</sub>O 30.00

**Vitamins:**

Myoinositol 100  
 Glycine 2.0  
 Nicotinic Acid 0.5  
 Pyridoxine HCl 0.5  
 Thiamine HCL 0

**Climate:**

Growth is faster at high temperature range of 33-40 C with relative humidity of 60-80% and should be cultivated in summer as the rainy season begins for its optimum vegetative growth. Brahmi should be taken as summer and monsoon crop.

**Light:**

This plant likes sunshine.

**Land Preparation**

The field should be ploughed thoroughly and all the weeds should be taken out. The land should be irrigated a day before planting for establishment of cuttings. If irrigation is not available this should be done with start of monsoon.

**Manures and Fertilizers**

**FYM** - 10 t well decomposed FYM per ha should be applied to the field at the time of field preparation.

**Fertilizer:**

N, P O, K 0-100: 60:60 kg/ha of which phosphorus 2 5 2 and potash are applied as basal and N in 3 splits. First dose of N is applied with establishment of the crop (30 days after planting) and second dose at 60-70 days and the final dose at 90 days after planting.

**Planting:**

Brahmi is propagated by stem cutting with nodal roots. The whole plant is cut into small divisions to about 4-5 cm long, each with few leaves and nodes are planted directly in the beds. The cuttings are transplanted in wet soil at a spacing of 20 x 20 cm to get maximum herbage yield. Flood irrigation is provided quickly just after planting.

**Cultivation**

**Location**

Asiatic coinwort appears to have originated in the wetlands of Asia. China, India, and Malaya were probably within its original range. It apparently spread through the South Pacific and to Mauritius, Madagascar, East and South Africa, Turkey, and the southeastern United States many centuries (or perhaps millennia) ago. *Centella asiatica* probably invaded these regions naturally (maybe by seeds carried on the feet of wading birds), and has long been integrated into their ecosystems, it should be regarded as a pantropical species and managed as a native wherever evidence for recent human introduction is lacking. Recent genetic studies have shown that the *Centella* in the southeastern United States is in fact a distinct species, to be called *C. erecta* (American coinwort), but it is very closely related to *C. asiatica* and practically indistinguishable to all but the geneticists.

**Culture**

Coinwort volunteers in sunny damp places like wetland edges, roadside ditches, and soggy lawns. It seems to prefer somewhat disturbed areas where the sandy soils have been heavily enriched with organic matter. Since this species is common in pine flatwoods, which are fire-maintained habitats, it can be assumed that it would recover or reestablish itself readily after a fire.

**Soil**

It grows well on alluvial marshy soil zone. This creeping herb is found growing along the canals and water bodies and in marshy areas. The plant grows well in poorly drained soils. The plant prefers the soil of acidic nature for its congenial growth.



#### Planting Time:

Planting is done in March – June to get maximum herbage. Ideally, the plants should be transplanted in March-June and are allowed to grow and proliferate through hot and humid months of monsoon till September after which harvesting should be done. The plants can also be maintained in a perennial state with two harvests in a year, the first one in June and the other one after monsoon, in October.

#### Moisture

Coinwort is a wetland plant. It will grow on flooded sites, floating its leaves on the surface like a waterlily, but it is happiest where the soil is wet, but its leaves are dry. It may disappear during a drought, but it will come back when the rains come.

#### Propagation:

Coinwort spreads by producing new plants on above-ground runners. The new plants can be separated from the parent plant once they have taken root. It should also be easy to start this plant from seed set in damp soil.

#### Irrigation:

It is essential to water the field after transplanting for survival and establishment. Subsequently irrigation should be applied at 10-12 days interval when there is no rain.

#### Interculture:

Hand weeding needed at every 15-20 days interval but later on as plants proliferate and form a dense mat of vegetation, weeding may be done occasionally.

#### Major Insect:

Grasshopper. Spray with Neem based insecticide or 0.2 % Nuvocon.

#### Harvesting and Yield:

The best time for harvesting is between October-November, (after 4-5 months of planting) during which the maximum biomass is produced. Later than this senescence sets in and there is a loss of plant biomass and alkaloid yield. The ratoon crop can be taken favourably. In that case the upper portions including leaves and stems are harvested leaving 4-5 cm from the base for quick regeneration, which is again harvested during June. The October /November harvest yield maximum herb with higher bacoside content. On an average, anyield of 150 q/ha fresh and 30 q dry herbage can be obtained from a single harvest whenharvested after September. After the first harvest about 20 q/ha additional dry herbageyield can be obtained from the ratoon crop in June, totaling 50 q/ha dry herb yield in a year. If planted in March the first cutting can be done in June and second cutting in September-October.

#### Post Harvest Management:

Generally, the traditional method of drying is by spreading the fresh herb on the ground under shade at room temperature. The material should be turned over, alternatively, during drying. The maximum bacoside-A content of dried herb can be maintained by drying the raw materials at 80 C in oven for 30 minutes just after harvest. The dried material should be stored in a cool dry room

packed in waterproof bags. Care should be taken towards insects and other fungi during storage.

#### Chemical Constituent

##### Triterpenoids:

Asiatic acid, 6-hydroxy asiatic acid, madecassic acid, betulinic acid, thankunic acid and isothankunic acid are present together with their glycosides (up to 8%), depending on the country of origin of the plant. The major saponins are asiaticoside, asiaticoside A, asiaticoside B, madecassoside, braminoside, brahmoside, brahminoside, thankuniside and isothankuniside

##### Essential Oil:

This constitutes about 0.1 % of the aerial parts and contains sesquiterpenoids (up to about 80%), with  $\beta$ -caryophyllene, (X-humulene and germacrene-D, elemene and bicycloelemene, trans-farnesene being the most abundant:

The essential oil from *Centella asiatica* grown in South Africa contains 11 monoterpenoid hydrocarbons (20.2%), 9 oxygenated monoterpenoids (5.46%), 14 sesquiterpenoid hydrocarbons (68.8%), 5 oxygenated sesquiterpenoid (3.9%) and 1 sulphide sesquiterpenoid (0.76%). The predominant constituents were  $\beta$ -caryophyllene (19.08%), bicyclogermacrene (11.22%), germacrene B (6.29%) and myrcene (6.55%). Other reports included trans-b-farnesene and germacrene D as prominent constituents of the essential oil.

##### Flavone Derivatives:

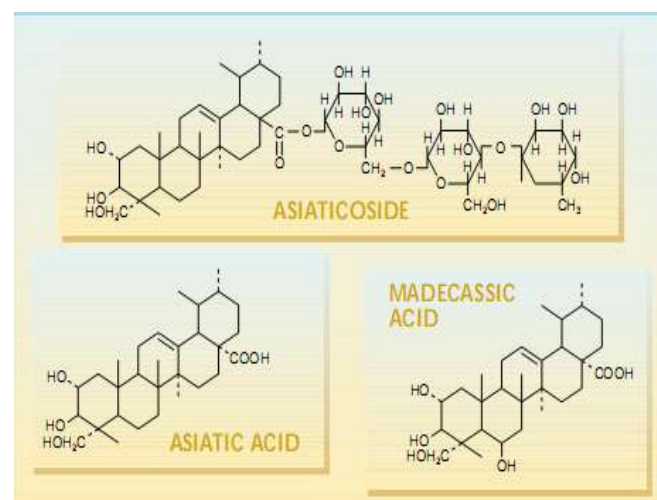
Quercetin and kaempferol glycosides and astragalgin have been found.

##### Phytosterols:

Stigmasterol, sitosterol.

##### Amino Acids

The leaf contains alanine, arginine, aspartic acid, glutamic acid, glycine, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, threonine and tryptophan.



##### Nitrogen Containing Constituents:

An alkaloid hydrocotylin, C<sub>22</sub>H<sub>33</sub>O<sub>8</sub>N, melting point 110-12°C, has been isolated from this plant with 0.0016%

yield. The plant also yields glycine, aspartic acid, glutamic acid, alanine and phenylalanine.

#### **Sterols and Lipid Constituents:**

The plant is reported to possess stigmasterol and stigma sterol- $\beta$ -D-glucopyranoside.

#### **Flavanoids:**

The plant is reported to contain hyperin. The leaves were found to contain 3 glucosylquercetin, 3-glucosylkaempferol and 7-glucosylkaempferol.

#### **Saponins:**

Various saponins have been isolated from *Centella asiatica*. This includes Asiaticoside, Madecassoside, Centelloside, Brahmoside Brahminoside, Thakuniside Isothankuniside, and Asiaticoside-A, Asiaticoside- B.

#### **Sugars:**

Rhamnose, arabinose, fructose, sucrose, raffinose.

#### **Pharmacological Activities:**

##### **Central Nervous System:**

Asiaticoside derivatives were found to inhibit or reduce H<sub>2</sub>O<sub>2</sub> induced cell death and lower intracellular free radical concentration, protecting against the effects of beta-amyloid neurotoxicity (Mook-Jung et al., 1999). An extract of *Centella asiatica* was found to increase brain GABA levels

##### **Antiulcerogenic Activity:**

The antiulcerogenic activity of the fresh juice of *C. asiatica* was studied against ethanol-, aspirin-, cold restraint stress- and pyloric ligation-induced gastric ulcers in rats. When given orally at doses of 200 and 600 mg/kg twice daily for 5 days, the drug showed significant protection against all the above experimental ulcer models. This effect was thought to be due to the strengthening of mucosal defensive factors. Oral administration of *Centella* extracts (0.05, 0.25 and 0.50 g/kg) before ethanol administration significantly inhibited gastric lesion formation (by 58-82%) and decreased mucosal myeloperoxidase (MPO) activity in a dose-dependent manner. It prevented gastric mucosal lesions by strengthening the mucosal barrier and reducing the damaging effects of free radicals

##### **Spasmolytic Activity:**

The Spasmolytic effect of an alcoholic extract of *Centella asiatica* on isolated ileum tissue obtained from pigs. After contact with isolated ileum tissue, the *Centella asiatica* developed a Spasmolytic effect.

##### **Wound-Healing Activity:**

A titrated extract of *Centella asiatica* (TECA), containing asiatic acid, madecassic acid and asiaticoside, and its separate components were evaluated for their effects in the wound chamber model. TECA-injected wound chambers were characterised by increased dry weight, DNA, total protein, collagen and uronic acid contents. Peptidic hydroxyproline was also increased, showing an increased remodelling of the collagen matrix in the wound. The three purified components of TECA were all able to reproduce the effects of the complete drug. The activity of asiaticoside was

studied in normal and delayed-type wound healing. In guinea pig punch wounds topical applications of a 0.2% solution of asiaticoside produced a 56% increase in hydroxyproline, 57% increase in tensile strength, increased collagen content and improved epithelialisation. In streptozotocin-diabetic rats, where healing is delayed, topical application of a 0.4% solution of asiaticoside over punch wounds increased hydroxyproline content, tensile strength, collagen content and epithelialisation, thereby facilitating healing. Asiaticoside was also active by the oral route at 1 mg/kg and is thought to be the main active constituent of *Centella asiatica*. Asiaticoside enhanced antioxidant levels at an initial stage of wound healing which may be an important contributory factor in the healing properties of this constituent. The extract also protected skin against radiation injury.

##### **Immunomodulatory Activity:**

An alcoholic extract showed stimulatory effect on the reticuloendothelial system (RES) in mice and an in vitro study of the aqueous extract demonstrated a positive effect on both the classic and alternative pathways of complement activation.

##### **Antitubercular Activity:**

An injection of 0.5 ml of a 4% solution of hydroxyasiaticoside was given in guinea pigs, inoculated 15 days previously with tubercle bacillus. It reduced the number of tubercular lesions in the liver, lungs, nerve ganglions and spleen and decreased the volume of the spleen over that of untreated control animals, thereby displaying antitubercular activity.

##### **Antianxiety:**

Triterpenoids (active compounds in *Centella asiatica*) have been shown to soothe anxiety and boost mental function in mice. A recent study found that people who took *Centella asiatica* were less likely to be startled by a novel noise (a potential indicator of anxiety) than those who took placebo. Although the results of this study are somewhat promising, the dose used in this study was extremely high, making it difficult to draw any conclusions about how *Centella asiatica* might be used by people with anxiety.

##### **Psychoneurological Activity:**

The alcoholic extract, when given orally to rats and mice treated with phenobarbitone, significantly prolonged sleeping time. In the maximum electroshock-induced convulsion test in rats, it significantly reduced the duration of individual convulsions. In a behavioural test it reduced the duration of the immobility phase, indicating sedative, antidepressive and analgesic actions.

##### **Antimicrobial Activity:**

Asiaticoside at a concentration of 10 mg/ml showed antibacterial activity against *Pseudomonas pyocyanus* and *Trichoderma mentagrophytes*.

##### **Cardiovascular:**

A three week treatment of a triterpene fraction of *Centella asiatica* in clients with postphlebotic syndrome significantly reduced the number of circulating endothelial cells, as compared to normal subjects (Montecchio et al., 1991). A

clinical trial of an extract of *Centella asiatica* found that it was efficacious in the treatment of venous insufficiency, reducing ankle, edema and foot swelling, and improving capillary filtration rate and microcirculatory parameters

#### **Autoimmune:**

The usage of madecassol (asiaticoside) in tablet, ointment and powdered form was found to be efficacious in the treatment of chronic or subchronic systemic scleroderma with limited skin involvement, and in progressive and/or advanced focal scleroderma

#### **Antiviral Activity:**

The alcoholic extract showed antiviral activity against Herpes simplex type II virus.

#### **Antilarval Activity:**

A new triterpenoid glycoside 3-O-[ $\alpha$ -L-arabinopyranosyl] 2a, 3 p, 6p, 23a - tetrahydroxyurs-12-ene-28-oic acid exhibited dose-dependent growth inhibitory activity against larvae of *Spilarctia obliqua*.

#### **Antioxidant:**

The administration asiaticoside, an isolated constituent of *Centella asiatica*, significantly increased the levels of superoxide dismutase, catalase, glutathione peroxidase, vitamin E and ascorbic acid in excision-type cutaneous wounds in rats. The level of antioxidant activity was highest during the initial stages of treatment

Oral treatment with 50 mg/kg/day of crude methanol extract of *Centella asiatica* for 14 days significantly increased the anti-oxidant enzymes, like superoxide dismutase (SOD), catalase and glutathione peroxidase (GSHPx), and antioxidants like glutathione (GSH) and ascorbic acid decreased in lymphoma-bearing mice.

An aqueous extract of *Centella asiatica* at 200 & 300 mg/kg for 21 days was effective in preventing the cognitive deficits, as well as the oxidative stress.

#### **Anticancer Activity**

As anticancer drugs of plant origin are gaining popularity, many scientists cast light on *C. asiatica*, in search of potential bioactive molecules against tumor. Crude extract of *C. asiatica* as well as its partially purified fractions exhibited selective cytotoxicity in vitro and anti-tumour properties in vivo. Synergistic inhibitory effect of Asiaticoside combined with vincristine on proliferation of several cancer cell lines was also reported, showing asiaticoside as a biochemical modulator can induce apoptosis. Besides, the water extract of *C. asiatica* was displayed to exert a chemopreventive effect on colon tumorigenesis. Furthermore, asiatic acid was suggested to be a good candidate for the therapeutic intervention of human skin cancer.

#### **Effect On Various Veins**

There was significant reduction in the serum levels of uric acid and the lysosomal enzymes. This reduction is interpreted as evidence of a positive effect of *Centella* extract veins.

#### **Collagen Synthesis Stimulating Activity**

The active ingredients of the selected triterpenes of *Centella asiatica* have shown to have modulating properties on the development and metabolism of connective tissue.

*Centella asiatica* has been documented to aid wound healing in several scientific studies. One of the primary mechanisms of action of this plant appears to be the stimulation of type-I collagen production. Animal studies have consistently shown topical application of *Centella asiatica* to a sutured wound significantly increased the breaking strength of the wound. Asiaticoside, a saponin extracted from *Centella asiatica*, is thought to be one of its active constituents. It was shown that a 0.2% Asiaticoside solution applied topically twice daily for seven days to punch wounds in guinea pigs resulted in 56% increase in hydroxyproline, 57% increase in tensile strength, increased collagen content, and better epithelialization compared to control

#### **High Blood Pressure**

In a study of people with heart disease and high blood pressure, those who took abana (an Ayurvedic herbal mixture containing *Centella asiatica*) experienced a significant reduction in diastolic blood pressure (pressure on blood vessels when the heart is at rest) compared to those who took placebo. Further studies are needed to determine whether *Centella asiatica* alone, some other herb in the Ayurvedic mixture or the particular combination of all the herbs in the remedy is responsible for the beneficial effect.

#### **Venous Insufficiency and Varicose Veins**

When blood vessels lose their elasticity, blood pools in the legs and fluid leaks out of the blood vessels, causing the legs to swell (venous insufficiency). In a study of 94 people with venous insufficiency, those who took *Centella asiatica* reported a significant improvement in symptoms compared to those who took placebo. In another study of people with varicose veins, ultrasound examination revealed improvements in the vascular tone of those who took *Centella asiatica*.

#### **Memory Enhancer:**

*Centella asiatica* has been found to improve the power of concentration and general ability and behavior of mentally retarded children. The clinical trials demonstrated that the extract increases the intelligence quotient in mentally retarded children. Ayurvedic drug having *Centella asiatica* as one of the main ingredients reported marked improvement is seen in children with behavioral problems. It is found to improve short-term memory and learning performance due to its possible nootropic action involving cholinergic and GABAergic modulation.

#### **Other Effects**

Asiatic acid and its derivatives protected cultured neurons from glutamate-induced excitotoxicity





Oral administration of *Centella asiatica* water extract and asiaticoside reduced the size of acetic acid-induced gastric ulcers in rats at 3 and 7 days in a dose-dependent manner with concomitant attenuation of myeloperoxidase activity in the ulcer tissues. Cell proliferation and angiogenesis were promoted, the expression of basic fibroblast growth factor in

ulcer tissues in rats treated with extract or compound were upregulated. The aqueous extract of *Centella asiatica* (0.05g, 0.25 and 0.50 g/kg) significantly inhibited ethanol-induced gastric lesions and decreased mucosal myeloperoxidase in a dose dependent manner when the extract was given before ethanol administration. These results suggest that *Centella asiatica* protected the gastric mucosa by improving the integrity of the mucosal lining

while reduction of myeloperoxidase and gastric lesions could be due to a decrease in the recruitment of neutrophils by *Centella asiatica* or to its free radical scavenging activity.

**Commercial products**

List of some Products launched in the market, containing *Centella asiatica*;

Name of the Product	Company	Application
<p style="text-align: center;">Mandukaparni</p> 	<p>The Himalaya Drug Company, Bangalore [India]</p>	<p>Improves mental abilities, vascular support, blood Circulation and psoriasis.</p> <p><b>Dose:</b> Take 1 or 2 capsules twice daily with meals.</p>
<p><b>Gotu Kola 425mg 100 Capsules Nature's Sunshine.</b></p> 	<p>The Nature Sunshine company</p>	<p>A herb used traditionally in Ayurvedic and Chinese herbal medicine to support mental activity. May also be used as a tonic to assist during periods of mental fatigue.</p> <p><b>Dosage:</b>  <b>For adults:</b> take two capsules with a meal twice daily.  <b>For children:</b> aged 6-12 years: take one capsule with a meal twice daily.</p>
<p style="text-align: center;"><u><b>Cradle Clear Lotion</b></u></p>  <p><b>INGREDIENTS:</b> Almond Oil, Calendula, <i>Centella asiatica</i>, Viola.</p>	<p>Native remedies company. Scalp conditioning for babies.</p>	<p><b>Use:</b>                      a) Soothes your baby's scalp                      b) Moisturises &amp; nourishes , flaky skin                      c) Prevents spread &amp; infection                      d) Natural, safe and effective</p>
<p style="text-align: center;"><b>SNP Control Cream</b></p> 	<p>SD Biotechnologies co.,Ltd. [Korea]</p>	<p><i>Centella asiatica</i> extract and Allantoin, improves drying and delays skin aging.</p>



 <p style="text-align: center;"><b>Nourishing Skin Cream</b></p>	The Himalaya Drug Company, Bangalore[India]	Provides all day moisturizing, nourishment and protection to skin from pollution and dry weather
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### 3. Conclusion

It is observed from various studies that the *Centella asiatica* have a number of pharmaceutical and medicinal properties and according to this it is effective in the treatment of a number of chronic diseases, But a Huge research work is required. This is the tree that is effective in treatment of various diseases without producing any side effect.

An estimate of the EXIM Bank projects international market of medicinal plants related trade over US \$ 60 billion per year that is growing at a rate of 7% per year. India's surface land has been grouped into ten distinct zones and these are further divided into 25 biotic provinces and 426 biomes.

About 90% of medicinal plants used by the industries are collected from the wild. While over 800 species are used in production by industry, less than 20 species of plants are under commercial cultivation. Over 70% of the plant collections involve destructive harvesting because of the use of parts like roots, bark, wood, stem and the whole plant in case of herbs. This poses a definite threat to the genetic stocks and to the diversity of medicinal plants, if biodiversity is not sustainably used. The IUCN report for the year 2000 revealed that India ranked fifth in the case of threatened plant species and birds. Recently some rapid assessment of the threat status of Medicinal plants using IUCN designed CAMP methodology revealed that about 112 species in Southern India, 74 species in Northern and Central India and 42 species in High altitude of Himalayas are threatened in the wild.

*Centella asiatica* has also been used to treat syphilis, hepatitis, stomach ulcers, mental fatigue, epilepsy, diarrhea, fever, and asthma. Today herbalists use *Centella asiatica* for disorders that cause connective tissue swelling, such as scleroderma, psoriatic arthritis (arthritis occurring in conjunction with psoriasis), ankylosing spondylitis (arthritis of the spine), and rheumatoid arthritis. Recent studies confirm some of the traditional uses and also suggest possible new applications for *Centella asiatica*, such as lowering high blood pressure, treating venous insufficiency (pooling of blood in the veins, usually in the legs, boosting memory and intelligence, easing anxiety, and speeding wound healing.

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