

CENTELLA ASIATICA (L.): A PLANT WITH IMMENSE MEDICINAL POTENTIAL BUT THREATENED

Sakshi Singh*, Asmita Gautam, Abhimanyu Sharma and Amla Batra
Lab no. 5, Department of Botany, University of Rajasthan, Jaipur, India.

*Email: ten14@rediffmail.com

ABSTRACT

Centella asiatica (L.) is a perennial, creeper, faintly aromatic and a valuable medicinal herb of both Old World and the New World. It is distributed throughout tropical and subtropical regions of World such as India, China, Nepal, Madagascar, Srilanka and Indonesia etc. The requirement of *Centella asiatica* is now met from natural population, leading to their gradual depletion and thus followed by its placement in the list of threatened species as mentioned by IUCN. Much of the ancient and contemporary lore surrounding this plant with its chemistry and pharmacology related to efficacy of both herbal preparations and chemical isolates are justified on the basis of experimental evidences. This paper provides its immense importance as economic plant with medicinal value as well as brief information of its products in the market launched, showing its dependability.

Keywords : *Centella asiatica*, threatened, pharmacology, perennial and ancient.

INTRODUCTION

Centella asiatica L. has been used as a medicinal herb for thousands of years in India, China, Srilanka, Nepal and Madagascar. *Centella asiatica* is one of the chief herbs for treating skin problems, to heal wounds, for revitalizing the nerves and brain cells, hence primarily known as a "Brain food" in India.

Centella asiatica (Linn.) Urban. synonym *Hydrocotyle asiatica* Linn. commonly known as Indian Pennywort, belongs to the family Apiaceae (previously known as Umbelliferae). In India the plant was earlier confused with *Bacopa monnieri* Wettst., as both plants have been sold in the market by the name "Brahmi". However, the controversy has been resolved and it is concluded that Brahmi is *B. monnieri* and mandookaparni is *C. asiatica*¹.

According to the reports of Export and Import Bank of India *Centella asiatica* is one of the important medicinal plants in the International market of medicinal Plant Trade. However, the wild stock of this plant species has been markedly depleted, because of its large scale and unrestricted exploitation coupled with limited cultivation and insufficient attempts for its replacement has been made. Moreover, now it has been listed as Threatened plant species by the International Union for Conservation of Nature and Natural Resources (IUCN)², and also as an endangered species^{3,4}.

Vernacular names

This plant has been known by an array of Vernacular names in different regions of India and Abroad; Table 1

Morphological features

Centella asiatica (L.) is a prostrate, faintly aromatic, stoloniferous, perennial, creeper herb, attains height up to 15cm (6inches) Fig. B. **Stem** is glabrous, striated, rooting at the nodes. *Centella asiatica* flourishes extensively in shady, marshy, damp and wet places such as paddy fields, river banks forming a dense green carpet⁵

and rather than clayey soil, the sandy loam (60% sand) is found to be the most fertile soil for its regeneration⁶.



Figure A: Leaves; **Figure B:** Stem; **Figure C:** Flower



The **leaves**, 1-3 from each node of stems, long petioled, 2-6cm long and 1.5-5cm wide, orbicular-renaliform, sheathing leaf base, crenate margins, glabrous on both sides Fig. A. **Flowers** are in fascicled umbels, each umbel consisting of 3-4 white to purple or pink flowers, flowering occurs in the month of April-June Fig. C. **Fruits** are borne throughout the growing season in approx 2 inches long, oblong, globular in shape and strongly thickened pericarp. Seeds have pedulous embryo which are laterally compressed.

Centella asiatica found throughout tropical and sub tropical regions of India up to an altitude of 600m. The plant has been reported to occur also at high altitudes of 1550m in Sikkim and 1200m in Mount Abu (Rajasthan). The plant is indigenous to South-East Asia, India, Sri-Lanka, parts of China, the Western South Sea Islands, Madagascar, South Africa, South East USA, Mexico, Venezuela, Columbia and Eastern South America⁷.

Table 1: Vernacular names in different regions of India and Abroad.

In India:

Region/Language	Vernacular Name	Region/Language	Vernacular Name
Hindi	Bemgsag, Brahma-Manduki, Gotukola, Khulakhudi, Mandookaparni	Sanskrit	Bhekaparni, Bheki, Brahmamanduki, Darduchhada, Divya, Mahaushadhi, Mandukaprnika, Manduki, Mutthil, Supriya, Tvasthi
Malayalam	Kodagam, Kodangal, Kutakm, Kutannal, Muthal, Muttil, Muyalchevi	Kanarese	Brahmisoppu, Urage, Vandelaga-illikiwigidda, Vondelaga [
Telugu	Bekaparnamu, Bokkudu, Saraswataku, Mandukbrahmami, Saraswati plant	Gujrati	Barmi, Moti Brahmi
Marathi	Karinga, Karivana	Tamil	Babassa, Vallarai
Tripura	Thankuni, Thunimankuni	Bengal	Thankuni, Tholkuri
Assam	Manimuni	Deccan	Vallarai
Bihar	Chokiora	Meghalaya	Bat-maina
Oriya	Thalkudi	Sinhalese	Hingotukola
Urdu	Brahmi		

Out of Nation:

Region/Language	Vernacular Name	Region/Language	Vernacular Name
USA	Indian Pennywort, Marsh Pennywort	China	Fo-ti-tieng, Chi-hsueuh-ts'ao
Hawaii	Pohe Kula	Nepal	Ghod tapre
Cook Islands	Kapukapu	Tahiti	Tohetupou
Fiji	Totodro	Samoa, Tonga	Tono

The ethnopharmacological and economical values

The plant material and its products are being used for health care since ages. Indigenous knowledge is valued and recognized as a rich natural resource in the custody of our society. But this knowledge is being lost due to non-transfer to the future generations, which is mainly due to more of stress being laid on instant medication, although it is so effective even today as it was thousands of years ago. The study of folk-lore remedies more precisely 'Ethnomedicine' or 'Ethnopharmacology' procrastinately picked up momentum since the last few decades in the context of exploring scarce plant sps. for development of phytomedicine. Some of the important traditional Socio-Economic uses of this marvellous herb *Centella asiatica* in different countries and in different

ways are illustrated as;

In India - *Centella asiatica* is valued as an ethnomedicine as well as in Ayurveda and Unani, the traditional Indian medicinal systems for thousands of years for different ailments like asthma, skin disorders, ulcers and body aches⁸⁻¹², for improving memory, as a nervine tonic and in treatment of dropsy, elephantiasis, gastric catarrh, kidney troubles, leprosy, leucorrhoea and urethritis¹³, in maternal health care¹⁴, in treatment of stomach disorders and also as a vegetable¹⁵,

► Paniya women (A tribal of Wayanad district in Western Ghats) prefer to cook Muthil i.e. *Centella asiatica* L. mixed with *Trianthema portulacastrum* L. and *Passiflora calcarata* Mast. with crabs or fish¹⁶.



► Leaf extract is taken orally to cure dysentery and improve memory power¹⁷.

In China - The traditional Chinese function include the use of this herb for dysentery and summer diarrhoea, vomiting, jaundice and scabies, Hansen's disease (leprosy), nosebleeds, tonsillitis, fractures, measles, tuberculosis, urinary difficulties, as an endocrine tonic and as an 'adaptogen', have diuretic properties¹⁸.

► It was historically known as "Snow plant" for the reason of its cooling properties¹⁹.

► Accounts of longevity and virility are derived from Leyei's treatment of the herb. She asserts that Chinese herbalist Chang-li-yun lived to the age of 256yrs and married 24 times, attributing this to his drunk an infusion of *Centella* everyday, so also known as 'miracle of elixiris'.

In Nepal also this herb is used traditionally in rheumatism, indigestion, leprosy, poor memory²⁰,

► About 4 teaspoonfuls of leaf juice by squeezing about 50 leaves between palms is taken orally in the morning for 2-3 weeks for its alleged cooling property to body and stomach²¹.

► Crushed leaf and root extract is applied to the affected parts to kill germs from wounds²².

► Decoction of leaves is also applied to cure leprotic wound²².

In Malaysia, the plant is used by Kadazandusun communities around Crocker Range, Sabah as; ► Tea of the plants are taken for hypertension, diarrhoea and urinary tract infections.

► The dried herb is used as a detoxicant, diuretic and to lower blood pressure and decrease heart rate²³.

In Bangladesh, whole plant is utilized by Kavirajes (a community of Chalna area, Bangladesh) to treat multiple ailments like dog bite, asthma, carminative, itching, leucorrhoea, malaria, tumour and wounds²⁴.

In Fiji for treating Childhood tidal fevers, eye problems, fractures, swollen joints, rib pain and unwanted pregnancy²⁰.

In Madagascar this herb traditionally utilized in leprosy, tuberculosis etc.^{25,26}.

In Brazil for elephantiasis and leprosy etc.²⁰.

Economically the whole plant especially the leaves are used for the preparation of hair oil. Leaves are also used to prepare chutney, hasuvale, tambali and toddy²⁷.

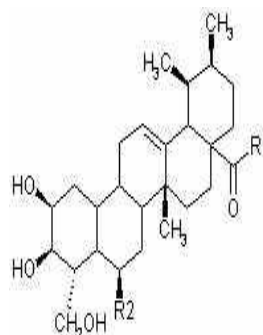
Chemical Constituents

The scientific studies have proved the claim of Indian system of medicines and a variety of Biochemical components i.e. Secondary metabolites have been found in *Centella asiatica* and so it is vividly medicinally important in modern medicine system also. *Centella asiatica* is reported to have following types of chemical

compounds:-

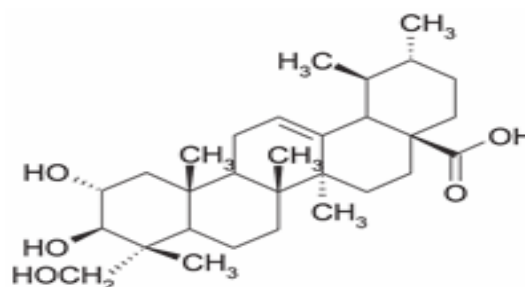
- ◆ Triterpenoids
- ◆ Volatile and Fatty acids
- ◆ Alkaloids
- ◆ Glycosides
- ◆ Flavanoids
- ◆ Others- Vitamin B, C, G and some amino acids etc.

Triterpenoids: Include asiaticoside, centelloside, madecassoside, thankuniside, isothankunic acid, centellose, asiatic, centellic and madecassic acids^{28,29} and brahmoside, brahminoside, brahmicaicid, the structure of their genin, brahmica acid (m.p. 293°) has been established as 2,6-hydroxy, 23-hydroxy-methyl ursolic acid. Asiaticoside and madecassoside predominated in the leaves with less in roots³⁰.

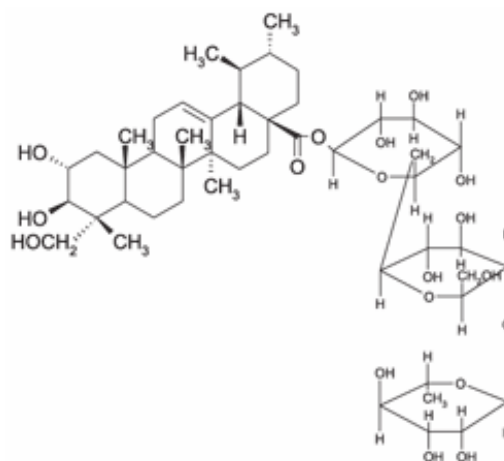


R1= OH, R2= H: Asiatic acid
 R1=OH, R2= O: Madecassic acid
 R1= O-glu-glu-glu-glu, R2= H: Asiaticoside
 R1= O-glu-glu-glu-glu, R2=OH: Madecassoside

Asiatic acid derivatives



Madecassic acid



Asiaticoside

Volatile and Fatty acids: The fatty oil consists of glycerides of palmitic, stearic, lignoceric, oleic, linoleic and linolenic acids³¹.

Alkaloids: An alkaloid, hydrocotylin (C₂₂ H₃₃ NO₈) has been isolated from the dried plants³¹.

Glycosides: Asiaticoside, madecassoside and centelloside have been isolated from the plant parts. On hydrolysis, these glycosides yield the triterpene acids, asiatic acid, madegascaric acid³²⁻³⁴ and centellic acid, except this Centella acid, all the above are present in free form in the plant.

Flavanoids: Flavanoids, 3-glucosylquercetin, 3-glucosylkaemferol and 7-glucosylkaemferol have been isolated from the leaves³³.

The plant is reported to contain tannins, sugars, inorganic acids³⁵ and resin³¹, amino-acids, viz. aspartic acid, glycine, glutamic acid, α -alanine and phenylalanine³⁶.

The total ash contains chloride, sulphate, phosphate, iron, calcium, magnesium, sodium and potassium. The leaves are rich in vitamins such as vit.B, vit.C³⁷ and vit.G¹⁸.

PHARMACOLOGICAL USES

Several research workers have reported different biological activities of *C. asiatica*. These have been given under following headings;

Wound Healing

Madecassol, an extract of this plant containing madecassic acid, asiatic acid and Asiaticoside accelerates cicatrisation and grafting of wounds¹. Asiaticoside promotes fibroblasts proliferation and extracellular matrix synthesis in wound healing³⁸.

Cytotoxic and Antitumour

Oral administration of the crude extract of *C. asiatica* and its partially purified fractions induced apoptosis in solid and Ehrlich Ascites tumour and increased the life span of these tumours bearing mice^{9, 39}. Asiatic acid was found to have anticancer effect on skin cancer⁴⁰.

Memory Enhancing

Aqueous extract of the herb showed significant effects on learning and memory and decreased the levels of norepinephrine, dopamine and 5-HT and their metabolites in the brain⁴¹. *Centella asiatica* contains brahmigic acid, isobrahmic acid, brahminoside and brahmoside. It has psychotropic, sedative and anti-convulsant properties. It is also useful in dementia, mental disorders and anxiety. Thus, Mentat a polyherbal formulation where all the herbs act in synergistic manner produces improvement of memory, attention and concentration in children with learning disability⁴².

Cardioprotective

The alcoholic extract of the whole plant showed strong cardioprotective activity in limiting ischemia-reperfusion induced myocardial infraction in rats⁴³.

Radioprotective

Centella asiatica could be useful in preventing radiation induced behavioral changes during clinical radiotherapy⁴⁴.

Antidepressant

The total triterpenes had antidepressant activity and caused significant reduction of the corticosterone level in serum^{45, 46}.

Sliming

C. asiatica extracts showed a dramatic increase in the cyclic adenosine monophosphate content with a subsequent rise in the nonesterified fatty acids content in human adipocytes⁴⁷.

Striae gravidarum

A cream containing Centella extract, α -tocopherol and collagen-elastin hydrolysates was associated with less women developing stretch marks⁴⁸.

Immunomodulating

Pectin isolated from *C. asiatica* showed immunostimulating activities⁴⁹ and triterpenoid saponins⁵⁰ and methanol extracts showed preliminary immunomodulatory effect⁵¹.

Antiprotozoal

Alcoholic extract of the entire plant showed antiprotozoal activity against *Entamoeba histolytica*⁵².

Mental-retardation

Centella asiatica tablets administered orally to mentally retarded children showed significant increase in general ability and behaviour patterns^{32, 53, 54}.

Antitubercular and Antileprotic

Asiaticoside has been shown to be useful in the treatment of leprosy⁵⁵ and certain types of tuberculosis¹.




Clinical trials conducted on normal adults showed that the drug increased the level of RBC, blood sugar, serum cholesterol and total protein. The increase in the mean blood urea level^{56, 57}. It has a calming effect on the body and supports the central nervous system.







Commercial products



List of some Products launched in the market, containing *Centella asiatica*; Table 2



Table 2: Some Products launched in the market, containing *Centella asiatica*.

Name of the Product	Company	Applications
Mandukaparni 	The Himalaya Drug Company, Bangalore [India]	Improves mental abilities, vascular support, blood circulation and psoriasis.
Mentat 	The Himalaya Drug Company, Bangalore [India]	Improves mental functions by a modulation of the cholinergic and GABAergic neurotransmission. It improves mental quotient, memory span, concentration ability and stress threshold, beneficial in insomnia and corrects speech defects. It exhibits significant anti-parkinsonian activity.
Gertiforte (Geri Care/ Stress Care) 	The Himalaya Drug Company, Bangalore [India]	The antistress, adaptogenic properties of Gertiforte retard degenerative changes and accelerate cellular regeneration. It enhances body immunity, delays aging, it assists cardiovascular functioning by improving circulation and reducing raised lipid levels also improves appetite.
Abana (Heart Care) 	The Himalaya Drug Company, Bangalore [India]	Abana regulates serum lipids by lowering the cholesterol, triglycerides, low-density lipoprotein (LDL) and very low density lipoprotein (VLDL) levels and restores the cardioprotective high density lipoprotein (HDL) level. It also reduces platelet aggregation.
Menosan 	The Himalaya Drug Company, Bangalore [India]	Menosan possesses phytoestrogens, which act through estrogen receptor dependent mechanism. Menosan helps in alleviating symptoms of menopausal syndrome.

<p>Nourishing Skin Cream</p> 	<p>The Himalaya Drug Company, Bangalore [India]</p>	<p>Provides all day moisturizing, nourishment and protection to skin from pollution and dry weather.</p>
<p>SNP Control Cream</p> 	<p>SD Biotechnologies co.,Ltd. [Korea]</p>	<p><i>Centella asiatica</i> extract and Allantoin, improves drying and delays skin aging.</p>
<p>Eye Treatment Serum</p> 	<p>Eye Love Beauty, Inc [Korea]</p>	<p><i>Centella asiatica</i> extract, fucoidan sea algae ingredient pacify the skin moistly provides high purity.</p>
<p>Diamond Shiny Pearl BB</p> 	<p>Elishacoy, [Korea]</p>	<p><i>Centella asiatica</i> and <i>Portulaca oleracea</i> extract, makes the skin viable by calming irritation.</p>
<p>Organic Baby Skin Care</p> 	<p>Nutricare Co., Ltd.[Korea]</p>	<p><i>Centella asiatica</i> and <i>Portulaca</i> extracts, it soothes and calms the irritated skin and restores the purified and clean skin.</p>
<p>Mandarin O2 Foaming Cleanser</p> 	<p>H & H Co., Ltd. [Korea]</p>	<p><i>Centella asiatica</i> extract and Rosemary extract help your skin clean and healthy.</p>

<p>Weight Loss Tea</p> 	<p>Pairs of Horses Biotechnology Co., Ltd. [China]</p>	<p><i>C. asiatica</i>, Wolfberry fruit, Chrysanthemum, Pinellia, Salvia, for sliming.</p>
<p>Gotu Kola and Germanium Moisturizer</p> 	<p>SUNDARI</p>	<p>Gotu kola (<i>Centella asiatica</i>) firms and lifts skin while Germanium extract balances sebum productions to produce faster results leaving a soft, dewy finish.</p>
<p>Gertiforte Vet (Animal Health Care)</p>	<p>The Himalaya Drug Company, Bangalore [India]</p>	<p>Antioxidant, antistress and immunomodulatory.</p>
<p>Anxocare (Animal Health Care)</p>	<p>The Himalaya Drug Company, Bangalore [India]</p>	<p>Anxiolytic, Behaviour modifier, Memory enhancer.</p>

CONCLUSION

Centella asiatica has been in use since times immemorial to treat wide range of indications. It has been subjected to quite extensive phytochemical, experimental and clinical investigations. The dynamic nature of indigenous knowledge has led to its survival through centuries. The use of this knowledge is necessary as it is not only socially desirable but is economically affordable, sustainable and involves minimum risks and procedures. In 1990, the estimated annual requirement of *C. asiatica* was around 12,700 tonnes of dry biomass valued at Rs. 1.5billion⁵⁸.

The tissue culture techniques developed in this study can be useful for propagation and also for the conservation of the germplasm of this medicinally important plant which can enhance the rate of multiplication and can reduce the time period and cost of production⁵⁹. Scientific and social validation of indigenous knowledge can help to provide both scientific and social sanction and improve the chances of use of alternate sources of medicine among the generations to come.

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