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***Centella asiatica* (L.) urban: A review on panoramic exploration of medicinal marvels for health and healing**

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Abstract

Centella asiatica, commonly known as Gotu Kola, has been a staple in traditional medicine systems across various cultures for centuries. This review provides a comprehensive overview of the medicinal uses of *Centella asiatica*, highlighting its phytochemical composition, pharmacological properties, and potential therapeutic applications. The bioactive compounds present in this plant, including triterpenoids, asiaticoside, Asiatic acid, and madecassic acid, contribute to its diverse medicinal properties. The plant has demonstrated anti-inflammatory, antioxidant, antimicrobial, and wound healing activities. These properties have been explored in the management of various health conditions, ranging from dermatological issues to neurological disorders. In dermatology, *Centella asiatica* has shown promise in promoting wound healing, reducing scar formation, and improving skin conditions such as psoriasis and eczema. Its anti-inflammatory effects extend to other systems, making it a potential candidate for the management of inflammatory diseases, including arthritis. Moreover, *Centella asiatica* has been studied for its neuroprotective effects, suggesting its potential in addressing cognitive disorders and neurodegenerative diseases. Additionally, its adaptogenic properties have been implicated in stress management and cognitive enhancement. The review also discusses the safety profile of *Centella asiatica* and its traditional uses in different cultures. However, it emphasizes the need for further research, including clinical trials, to validate its efficacy and safety for specific medical conditions. This plant emerges as a versatile medicinal plant with a wide range of potential therapeutic applications. Continued research and clinical studies are essential to harness its full potential and integrate it into modern healthcare practices.

Keywords: *Centella asiatica*, anti-inflammatory, antimicrobial, neuroprotective

Introduction

Centella asiatica, commonly referred to as Gotu Kola, is a botanical marvel that has been an integral part of traditional medicine systems in various parts of the world for centuries. With its lush green leaves and creeping habit, this herbaceous plant is not only aesthetically pleasing but also harbours a rich reservoir of bioactive compounds that contribute to its diverse medicinal properties. The surge in global interest in natural remedies and herbal medicine has spurred a renewed investigation into the potential therapeutic applications of *Centella asiatica*. This comprehensive review aims to explore and elucidate the medicinal uses of this plant shedding light on its phytochemical composition, pharmacological activities, and potential benefits for human health. As we delve into the intricate world of this botanical treasure, it becomes evident that *Centella asiatica* is not merely a cultural anecdote but a source of bioactive compounds with the potential to impact various physiological systems. The plant's traditional uses in ayurveda, traditional Chinese medicine, and other indigenous healing practices have paved the way for scientific scrutiny. Recent research has begun to unveil the molecular mechanisms behind the acclaimed therapeutic effects of *Centella asiatica*, ranging from anti-inflammatory and antioxidant properties to its role in wound healing and neurological well-being. In this era of evidence-based medicine, understanding the scientific basis of traditional knowledge is paramount. Through this review, we aim to bridge the gap between ancient wisdom and modern science, providing a synthesized and up to date account of the medicinal properties of *Centella asiatica*. As we embark on this exploration, we anticipate not only to document the existing knowledge but also to identify avenues for future research and potential integration into mainstream

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healthcare practices.

Taxonomic Classification

Kingdom	:	Plantae
Division	:	Mangoliophyta
Class	:	Magnoliopsida (Dicotyledons)
Order	:	Umbellales
Family	:	Umbelliferae/ Apiaceae
Genus	:	<i>Centella</i>
Species	:	<i>Asiatica</i>

Synonyms: *Hydrocotyle asiatica* Linn

Vernacular names

Bengali	:	Thulakusi, Jholkhuri
English	:	Indian Penny Wort
Guajarati	:	Moti Brahmi, Khoda Brahmi
Hindi	:	Khulakudi, Brahma manduki,
Kannada	:	Ondelaga, Brahmi soppu
Malayalam	:	Kudangal
Marathi	:	Karinga, Karivana
Tamil	:	Vallarai, Vellarai
Telegu	:	Babassa
Sanskrit	:	Mandooka Parni, Kudakkom,
Manduki	:	
Urdu	:	Brahmi

Plant Description

Centella asiatica, commonly known as Gotu Kola, is a low-growing, herbaceous plant that belongs to the Apiaceae/ Umbelliferae family. This perennial herb is native to the wetlands of Asia, particularly found in India, Southeast Asia, and parts of China. It thrives in tropical and subtropical regions and is often cultivated for its medicinal properties. The most distinctive feature of this plant is its kidney-shaped or reniform leaves, which are generally small, about 2 to 4 centimeters in diameter. The leaves have a smooth texture, and their margins are often slightly serrated. The plant typically spreads horizontally, sending out slender, creeping stems that root at nodes. This creeping habit gives rise to its colloquial name Gotu Kola or pennywort as the leaves resemble the shape of a coin. The inconspicuous flowers of *Centella asiatica* are small and white, pink to blue in colour, which are arranged in umbels or umbel-like clusters and bloom above the leaves. The plant is not primarily grown for its ornamental value, as the flowers are modest and not showy. They are well-adapted to moist and marshy environments, often found near water bodies, such as ponds, streams, and rice fields. It can thrive in both sunny and partially shaded areas. While it can grow in a variety of soils, it prefers well-drained, loamy soil. The plant is often cultivated for medicinal purposes, and its cultivation involves providing consistent moisture.

Chemical Constituents

Through various modern techniques the following chemical compounds were isolated and identified from this plant and they include

- 1. Triterpenoids:** Madecossoside, thankuniside, centellose, isothankunic acid, asiaticoside, brahmoside, brahminoside, brahmic acid, centelloside, Asiatic, centellic and madecassic acids, (Dutta and Basu, 1968; Singh and Rastogi, 1969) ^[10, 30].
- 2. Volatile and Fatty Acids:** The fatty oil consists of

glycerides of lignoceric, stearic, palmitic, oleic, linoleic and linolenic acids (Chopra *et al.*, 1956) ^[8].

- 3. Flavonoids:** 3-glucosylkaemferol, 3-glucosylquercetin, and 7-glucosylkaeferol (Rastogi and Mehrotra, 1960-69) ^[28].
- 4. Glycosides:** Asiaticoside, madecossoside and centelloside (Schaneberg *et al.*, 2003; Chopra *et al.*, 1992) ^[29, 7].
- 5. Alkaloids:** Hydrocotylin has been isolated (Chopra *et al.*, 1956) ^[8].
- 6. Vitamins and Aminoacids:** The plant contain vitamins such as B, C, G and certain Amino acids like aspartic acid, glycine, glutamic acid, phenyl alanine and α -alanine (Malhotra *et al.*, 1961; Tiwari *et al.*, 2000; Leye and Elixir, 1970) ^[15, 33, 13].

Plant Part used: Whole plant.

Pharmacological importance

Centella asiatica has a long and rich history of traditional use in various cultures, including Ayurveda and traditional Chinese drugs for its medicinal properties. Scientific research has increasingly explored and validated many of these traditional claims. Some of the medicinal uses are

Wound Healing and Scar reduction Activity

Centella asiatica is renowned for its wound-healing properties. It stimulates the production of collagen, which is essential for the regeneration of skin tissues. Its adaption is considered beneficial in treating cuts, burns, and other skin injuries. Due to its ability to enhance collagen production, this plant is used to minimize scars and promote the healing wounds without excessive scarring. It is a common ingredient in topical creams as oilments for scar management. (Q. Hou *et al.*, 2016; Srivastava *et al.*, 1997) ^[24, 31].

Anti-inflammatory Activity

The triterpenoids present in *Centella asiatica*, such as asiaticoside and Asiatic acid, exhibit anti-inflammatory properties. It has been traditionally used to alleviate inflammation in conditions like arthritis and other inflammatory disorders. (L. Jing, *et al.*, 2018) ^[14].

Skin disorders healing activity

Gotu kala is often used to address various skin conditions, including psoriasis, and eczema. It is believed to promote overall skin health and reduce the severity of skin disorder. (Q. Hou *et al.*, 2016; W. Bylka *et al.*, 2014) ^[24, 36].

Cognitive- Enhancing Activity

Some studies suggest that *Centella asiatica* may have cognitive function. It is traditionally used to support brain function and memory, and ongoing research is exploring its potential in neurodegenerative disorders. (N.E Gray *et al.* 2018; Upadhyay *et al.* 2002; Nalini *et al.* 1992; Rao *et al.* 1973) ^[19, 34, 18, 25].

Anticancer Activity

Reports are available on the cytotoxic and antitumour activity of crude extracts as well as partially purified extracts of *Centella asiatica* on induced apoptosis in solid and Ehrlich Ascites tumour and also the anticancer effect of Asiatic acid isolated from this plant on skin cancer (D. Song

et al., 2018; Park *et al.*, 2005; Babu *et al.*, 1995; Babu and Padikkala, 1994) [9, 20, 2-3].

Antioxidant Activity

The plant contains flavonoids and other compounds that act as antioxidants, helping to neutralize free radicals and reduce oxidative stress. This antioxidant activity may contribute to its overall health-promoting effects. (T. Intararuchikul *et al.* 2019; B. Masola *et al.* 2018) [32, 4].

Anti-depressant Activity

It was reported that the total triterpenes present in the *Centella asiatica* plant had antidepressant activity and it caused significant reduction in the level of serum corticosterone in experimental organisms. (Chen *et al.*, 2003; 2005) [5-6].

Anxiolytic and Adaptogenic Activity

Centella asiatica has been traditionally used as an adaptogen, helping the body adapt to stress. Some studies suggest anxiolytic effects, indicating its potential role in managing anxiety and stress.

Cardioprotective Activity

Clinical studies were conducted to study the cardioprotective activity of the alcoholic extract of *Centella asiatica* in laboratory rats and it was found that the extract showed strong cardioprotective activity in limiting ischemia-reperfusion induced myocardial infarction. (Pragada, 2004) [23].

Immunomodulating Activity

The bioactive compounds like pectin, triterpenoid saponin and the methanolic extract of *Centella asiatica* showed immunomodulatory activities in experimental organisms. (Wang *et al.*, 2003; Plohmman *et al.*, 1994; Jayathirtha and Mishra., 2004) [35, 21, 12].

Antidiabetic Activity

Reports are available on the antidiabetic activity of the different solvent extracts of *Centella asiatica* in laboratory experiments and was found that there is significant change in the level of glucose in experimental animals. (Maulidianif *et al.* 2016; A. B. Oyenihni *et al.* 2019) [16, 1].

Antitubercular and Antileprotic Activity

The glycoside, Asiaticoside isolated from *Centella asiatica* has been shown to be useful in the treatment of certain types of tuberculosis and leprosy. Experiments conducted in adults using this drug showed an increase in the level of blood sugar, RBC, Cholesterol and total protein. The mean blood urea level was also increased in them (Rao *et al.*, 1969; 1967) [26-27].

Hepatoprotective Activity

There are reports indicating the hepatoprotective effects of extracts of *Centella asiatica* in clinical experiments in laboratory conditions. (T. Intararuchikul *et al.* 2019; P. Maneesai *et al.* 2017; M.J. Choi *et al.* 2016; H.M. Zheng *et al.* 2016) [32, 22, 17, 11].

Anti-Ulcer Activity

Some research suggests that *Centella asiatica* may have protective effects against gastric ulcers, possibly due to its

anti-inflammatory and antioxidant activities. (T. Intararuchikul *et al.*, 2019; H.M. Zheng *et al.*, 2016) [32, 11].

Conclusion

This review of the medicinal uses of *Centella asiatica* underscores its remarkable potential as a therapeutic agent with a wide range of applications. The plant's rich phytochemical composition, including triterpenoids, asiaticoside, Asiatic acid, and madecassic acid, contributes to its diverse pharmacological activities. The documented anti-inflammatory, antioxidant, antimicrobial, and wound healing properties of *Centella asiatica* align with its traditional uses across cultures, substantiating its reputation as a botanical powerhouse in natural medicine. The evidence presented in this review supports the use of *Centella asiatica* in dermatological applications, where it has shown efficacy in wound healing, scar reduction, and management of skin conditions. Its anti-inflammatory effects extend beyond dermatology, presenting potential benefits in addressing inflammatory diseases, such as arthritis. Moreover, the plant's neuroprotective properties open avenues for research in cognitive disorders and neurodegenerative conditions. While traditional knowledge has paved the way for scientific exploration, it is evident that further research is imperative. Well-designed clinical trials are needed to validate the efficacy and safety of *Centella asiatica* for specific medical conditions. Additionally, understanding optimal dosage, administration routes, and potential drug interactions is crucial for its integration in to modern healthcare. The adaptogenic and stress-reducing properties of *Centella asiatica* also warrant attention in the context of mental health and well-being. As mental health challenges become increasingly prevalent, exploring natural remedies with adaptogenic effects becomes particularly relevant. *Centella asiatica* emerges as a versatile botanical with promising therapeutic potential. The synthesis of traditional wisdom and contemporary research in this review contributes to the ongoing dialogue between traditional medicine and evidence-based healthcare. As the scientific community continues to unravel the intricacies of this botanical gem, *Centella asiatica* holds promise as a valuable addition to the pharmacopeia, offering novel avenues for the development of natural remedies and healthcare interventions.

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