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CENTELLA ASIATICA - A MEDICINAL PLANT - A REVIEW

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Centella asiatica or Indian pennywort has considerable reputation in Indian system of medicine. Its extract is recommended for wound healing and treatment of skin lesions and diseases such as leprosy, lupus, eczema and psoriasis. It is a rasayan, brain tonic, improves learning, memory and strengthens C.N.S. It has tranquillizing, sedative and spasmolytic properties. It is a multipurpose drug that has enormous potential for use in a large number of other diseases also.

Keywords : *Centella asiatica*; Chemical composition; Medicinal properties.

Centella asiatica (Linn) urban; syn. *Hydrocotyle asiatica* (L) is a medicinal plant which belong to the family Apiaceae (umbellifereae). It is commonly known as Brahmi; Manduka-parni; Cheka-parni in Sanskrit, Indian pennywort in English, Asiatischer Wassernabel in German, Khulakudi; Brahma-manduki in Hindi, Tholkuri; Brahma-manduki in Bengali, Karbrahmi in Gujrati, Artaniyal-hindi in Arab, Saraswathi; Aku; Manduka; Brahma-kuraku; Bokuduechettu in Telegu, Vaellarai; Babassa in Tamil, Kutakam in Malyalam and Vondelaga in Cannad[1,2].

It is a prostrate, perennial, aromatic herb that is widely distributed in India and Sri Lanka in marshy places up to an altitude of 1828 m. The plant possesses constantly growing roots and string shaped stolon. The leaves are orbiculo - reniform, 0.5-1.5 inches in diameter with short stalk. Each leaf blade is round to reniform and is deeply cordate. The leaf margins can be smooth, crenate or slightly lobed. Usually 3 to 6 red flowers arise in a sessile manner or with a very short pedicel in axillary umbel at the end of 2-8 mm long peduncle. Each flower is surrounded by small bracts. The fruits are formed throughout the growing season. A Fruit is approximately 5 mm long with 7-9 ribs and a curved strongly thickened pericarp. The seeds are laterally compressed[3].

Chemical composition

The plant contains various types of chemical compounds such as Asiaticoside, Hydrocotyline, Vallerine (0.8-1.1%), Pectic acid, Sterol, Fatty acids, Sugar (24.5%), Volatile acid, Ascorbic acid (13.8 mg/100 gm), Thankunoside, Thankunic acid, Asiatic acid, Brahmoside (0.37%), Brahminoside (0-16%), Brahmic acid (0.097%), Isobrahmic acid (0.9%), Betullic acid (0.110%), Stigamasterol (0.004%), Gum ans salt (11.5%), Vitamin C, Sitosterol, Tannin, Resinous substances, glucose, Oleic acid, Linolic, Lignoceric and Palmitic acid, Stearic acid, Ascorbic acid, Centelloside, Mesoinositol, Centellose, Albuminoid matter (12.5%), Ash (2.4%), Phytosterol or ß-sitosterol, Indocentoic acid and Madasiatic acid[4,5].

Medicinal properties

It is used in a number of herbal preparations and is prescribed for the treatment of various diseases in the Indian system of medicine. Ayurvedic literature refers it as a rasayan (tonic). The plant is acrid, bitter, sweetish, digestable, laxative, cooling, alexiteric, antipyretic, antifertility, improves appetite, voice, memory, cures leucoderma, anaemia, urinary discharges, diseases of blood, bronchitis, inflammation, fever and biliousness. It is also useful in vitiated conditions of *Pitta*, cardiac debility, epilepsy, hoarseness, asthma, bronchitis, amentia, abdominal disorders, leprosy and strangury. Its leaves are used in abdominal disorders due to dysentary in children[1].

The first clinical investigations of this plant and its extract were completed during the 1940's, on the experimently induced wounds. A comparison of treated and control wounds during the different phases, indicated that asiaticoside substantially

hastened the progress of healing. Asiaticoside stimulates the rapid and healthy growth of the reticuloendothelium system[6].

Aqueous extract of mandukparni (25 mg/kg b. wt.) decreased spontaneous motor activity and delayed pentylene-tetrazole induced convulsion in mice. This influence of aqueous extract of *Centella asiatica* claimed to be a brain tonic and it has antianxiety effect[7].

Aqueous extract of fresh leaves improves learning and memory in albino rats[8]. In combination with other plant extracts it is effective in enhancing the psycomotor performance. It was also effective in controlling the somatic and psychic anxiety[9]. It has antitumor property. It is found to increase body weight, total leucocyte and polymorphonuclear counts and also enhanced the circulating antibody against sheep RBCs and prolonged the life span of mice[10]. It has anti-hypertensive effect based on inhibition of angiotensin converting enzyme[11]. It has antifeedant activity against lepidopteran insect *Spilosomea oliqua*[12]. It has antiulcer activity. 500 mg / kg b.wt. of its extracts produced complete mucosal cytoprotection[13]. Chemical constituents isolated from *Centella asiatica* have shown cytotoxic, antistress, antileprotic, antibacterial, antifilarial, anti-tuberculosis and wound healing capacity.

The hydro-alcoholic extract of *Centella asiatica* shows anxiolytic and anticonvulsant activity against pentyteneletrazol induced convulsion. The oral LD_{50} of the extract in rats was found to be higher than 675 mg/kg indicating a high therapeutic index in addition a chronic oral administration also exhibited a low toxicity of *Centella asiatica*[14].

Haxane and EtOAC extract of *Centella asiatica* displayed significant inhibitory activity against *Bacillus subtilis, E. coli, P. aeruginosa* and *P. cichorri*. While n-BuOH extract was found to be inactive. Similarly, stigmasterol and dotriacont -8-en-1-oic acid inhibited *B. subtilis, E. coli* and *P. aeruginosa*[15].

The activity of traditional medicinal leaves *Cynodon dactylon, Solanum nigrum* and *Centella asiatica* on the xenobiotic metabolizing enzymes. The Xenobiotic metabolizing enzyme phase I (cytochrome B5 and cytochrome P450) and phase II (Glutathione-S-Transferase and glutathione) were examined on the basis of results obtained. It is concluded that the active principles present in medicinal plants are responsible for the high induction by Xenobiotic metabolizing enzymes. Preferably the Phase I enzymes might have involved in the conversion/degradation of the carcinogen to procarcinogen thereby generating reactive intermediates. These reactive intermediates then detoxified by the conjugating reaction with the sulphydryl groups of the Phase II cytosolic enzymes[16].

It decreases the level of total ATPase, Mg^{+2} ATPase, Na^{+}, K^{+} ATPase and increases level of Ca^{+2} ATPase to protect the tissue against peroxidation reaction, thereby against the cell damage[17].

It inhibits the lipid peroxidation in liver, kidney, lungs, heart, brain, spleen and serum[18].

It has antielastase activity and acts as a free radical scavanger[19].

In a clinical study conducted on the impact of *Centella asiatica* in a series of 30 mentally retarted children shows encouraging results with significant improvement in performance, I.Q., immediate memory score and social quotient in these children after 6 months of treatment. It seems to be a potential plant drug for care of mentally retarted children[20].

The leaves of *Centella asiatica* when consumed orally it protects the cell against oxidative damage[21].

In a clinical trial 43 patients of stool positive giardiasis were treated with *Centella asiatica* powder 400 gm t.d.s. p.o. for a period of 14 days (powder filled in gelatin capsule). The plant was found effective against

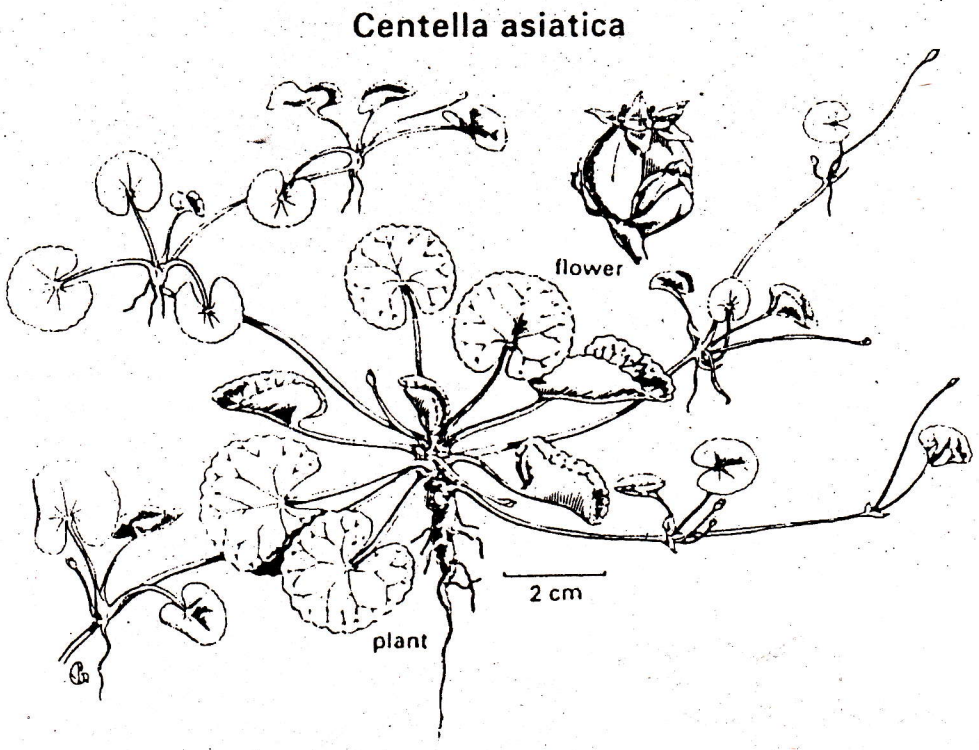
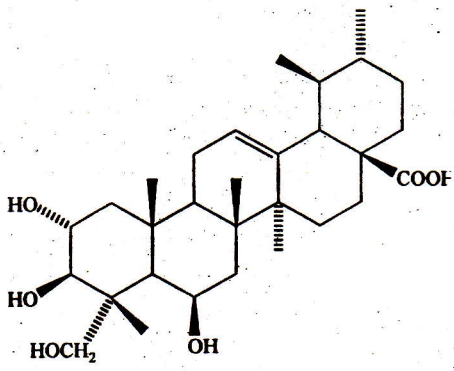


Fig. 1.

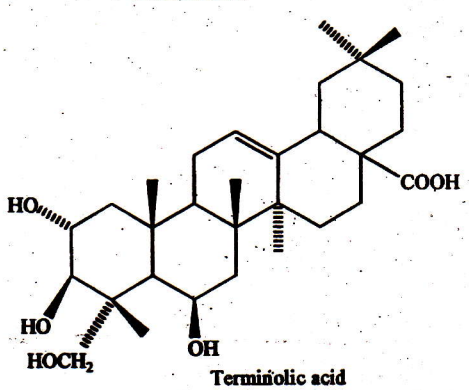
giardiasis and improved malabsorption syndrome in children. A decrease in eosinophil and increase in Haemoglobin percentage was also observed. Reinfection was not observed after the completion of treatment[22].

Asiaticoside derived from the plant *Centella asiatica* is known to possess good wound healing activity. Enhanced healing activity has been attributed to increased collagen formation and angiogenesis. The effect of asiaticoside on the levels of certain antioxidants in the wound has been discussed. Asiaticoside application (0.2% topical) twice daily for 7 days to excision type cutaneous wounds in rats led to increased enzymatic and nonenzymatic antioxidants such as superoxide dismutase (35%), catalase (67%), glatathione peroxidase (49%), vitamin E (77%) and ascorbic acid (36%) in newly formed tissues. It also resulted in a several fold decrease in lipid peroxide levels (69%) as measured in terms as thiobarbituric acid reactive substance. Continued application for 14 days shows no significant difference in these antioxidant compounds with their value in vehicle treated wound tissue. Asiaticoside enhanced induction of antioxidant levels at an initial stage of healing has been suggested to be an important contributory factor in the healing properties of this substance[23].

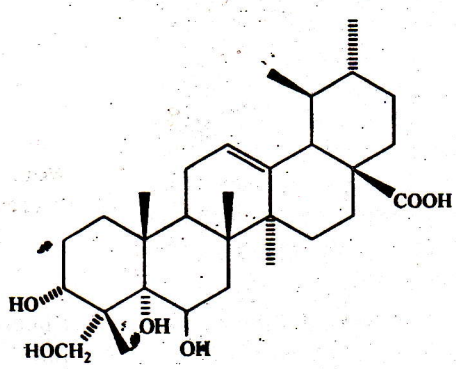
In radiotherapy, which has been routinely resorted to treat brain tumors, often leads to behavioural perturbations at a dose range of 0.1-10 CGy. Unfortunately, present day radioprotectors have inherent behavioural toxicity, necessitating the quest for less toxic agents. *Centella asiatica* has been investigated in this context especially because it improves mental ability. The role of it as a behavioral radioprotector has been



Brahmic acid

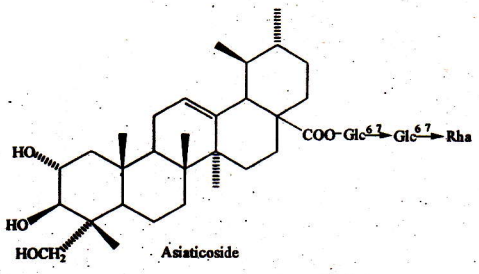


Terminolic acid

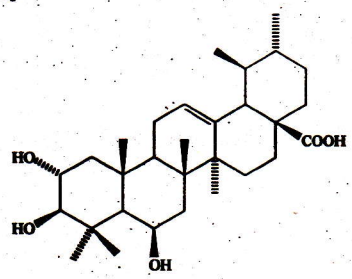


Isothankunic acid

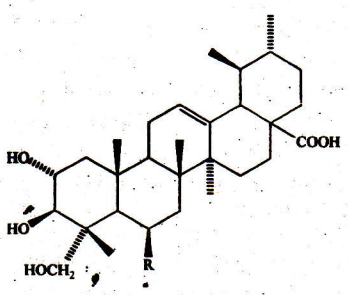
Fig. 2.



Asiaticoside



Madasiatic acid



Asiatic acid R=H
6β-Hydroxyasiatic acid R=OH

Fig. 3.

investigated against low dose radiation exposures, employing conditioned taste aversion (CTA) as a parameter, in albino rats. Pre-irradiation administration (1 h) of aqueous extracts of *Centella asiatica* at a dose of 100 mg/kg b.w., i.p. rendered significant protection against CTA [45.26(16%)] on second post-irradiation day. The recovery was equivalent to the unirradiated control group on fifth post-irradiation day [76.27 (26.97%)]. *Centella asiatica* is more effective than *Ondansetron* (an anti-emetic drug widely used in clinical practice). This study suggest that *Centella asiatica* could be useful in preventing radiation induced behavioral changes in clinical radiotherapy[24].

Oral administration as Brahma Rasayan (BR 10 and 50 mg/dose/animal) for 15 days increased total leukocyte count and percentage of polymorphonuclear cells significantly in irradiated mice. Bone marrow cellularity and *a*-esterase positive cells also increased significantly in radiation treated animals after BR administration. Number of nodular colonies on the surface of spleen on day seven increased significantly in lethally irradiated recipients receiving bone marrow cells. From animals treated with BR and administration of BR also enhanced in serum level of interferon-*y* (IFN-*y*), interleukin-2 (IL-2) and granulocyte macrophage colony stimulating factor (GM-CSF) in normal and irradiated mice. These results indicate that proliferation of stem cells induced by BR in irradiated mice be related to its stimulation of cytokine production[25].

Radioprotective property of plant ectract was tested against 8 Gy of Co^{60} gamma radiation. For this animals were divided into two groups,the first one is the control group which received 8 Gy of Co^{60} gamma rays externally and experimental group which received plant extract orally at different doses and for different time intervals. It was observed that the protective dose of the extract is 100 mg/kg b.w. when given orally in the form of a single dose just one hour before irradiation. The dose increased survival time of the mice significantly. The animals showed considerable improvement in their haemoglobin percentage and haematocrit value[26].

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