



**AMARANTHUS SPINOSUS & CAMELLIA SINENSIS - ANTI ULCER PLANTS BEING
USED IN TRADITIONAL MEDICINE OF SIKKIM (INDIA)**

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ABSTRACT

Antiulcer plants are known in literature. Few of them are, *Ageratum conyzoides*, *Amaranthus spinosus*, *Asparagus racemosus*, *Astilbe rivularis*, *Bacopa monnieri*, *Camellia sinensis*, *Cassampelos mucronata*, *Convolvulus pluricaulis* Choisy, *Costus speciosus*, *Embliba officinalis*, *Ginkgo biloba*, *Mentha spicata*, *Murra koenigii*, *Musa sapientum*, *Piper longum*, *Strychnos potatorum*, *Syzygium cumini*, *Vernonia lasiopus* etc. The plants are being used as antiulcer agents in different states of India. In Sikkim *Amaranthus spinosus* and *Camellia sinensis* are used in traditional medicine for treatment of peptic ulcer. Village people of Sikkim are of the opinion that this traditional medicine is very much helpful to cure gastric and duodenal ulcers and they take it as the medicine is natural, easily available, less costly and has no side effect. In the present article antiulcer activity of *Amaranthus spinosus* and *Camellia sinensis* is discussed in addition to their botanical description, vernacular names, classification, traditional use, content of bioactive compounds as well as other pharmacological properties.

KEYWORDS: Traditional medicine of Sikkim, use of antiulcer plants, *Amaranthus spinosus*, *Camellia sinensis*.

INTRODUCTION

An ulcer is as an open sore of the skin or mucous membrane characterized by sloughing of inflamed dead tissue.^[1] Peptic ulcer is the ulcer in lower oesophagus, stomach or duodenum, in the jejunum after surgical anastomosis to the stomach or, rarely in the ileum adjacent to a Meckel's diverticulum. When ulcer develops in stomach it is known as gastric ulcer. Likewise duodenal and esophageal ulcers occur in the duodenum and esophagus respectively. Meckel's Diverticulum ulcer is the ulcer that develops in the Meckel's Diverticulum.^[2-4] In 1963 Quincke^[5] was probably the first to use the term 'Peptic ulcer'. Because of its frequency and worldwide distribution, peptic ulcer occupies a place secondary to carcinoma in the field of gastroenterology. It also continues to be a subject of numerous investigations, both experimental and clinico pathological.

Abnormalities in secretion of acid and pepsin as well as in mucosal defense, delayed gastric emptying, reflux of bile and pancreatic juice, emotional stress, role of microbes, genetic predisposition etc.^[6,7] are the factors playing significant role in pathogenesis of peptic ulcer disease. However, the disease is generally characterized by the imbalance between gastric offensive factors like acid, pepsin secretion, *Helicobacter pylori*, nitric oxide, lipid peroxidation etc. and defensive mucosal factors like

bicarbonate and mucin secretion, mucus proliferation, prostaglandins, glycoproteins, mucosal cell shedding and anti oxidating enzymes like super oxide dismutase, catalase as well as levels of glutathione.^[8,9] Normally peptic ulcer develops when aggressive factors overcome the defensive factors.

Synthetic drugs are used for treatment of peptic ulcer.^[10] In case, the ulcer is due to infection of *Helicobacter pylori* (*H. pylori*), the different medications are usually prescribed. This is known as "Triple therapy". This includes a proton pump inhibitor viz. omeprazole to reduce acid production and two antibiotics to get rid of the organism. Sometimes, instead of one of the antibiotics, bismuth salicylate may be the third medication recommended. This drug, available over the counter, coats and soothes the stomach, protecting it from the damaging effects of acid. Two, rather than three, drug regimens are currently being developed. For non *H. pylori* ulcers number of drugs are now available for treatment.

These drugs are broadly classified into two categories.^[11]

- 1) Those that decrease or counter acid-pepsin secretion viz. ranitidine, famotidine etc. (H₂ - blockers), pirenzepine, telenzepine etc. (M₁-blockers), omeprazole, lansaprazole etc. (proton pump inhibitors)

- 2) Those that affect cytoprotection by virtue of their effects in mucosal defense factors like sucralfate, carbenoxolone etc.

No doubt the above said drugs have brought about remarkable changes in peptic ulcer therapy, the efficacy of these drugs is still debatable. Reports on clinical evaluation of these drugs show that there are incidences of relapses and adverse effects and danger of drug interactions during ulcer therapy. For example, proton pump inhibitors (omeprazole, lansoprazole) may cause nausea, abdominal pain, constipation, diarrhoea etc. and H₂ receptor antagonists (cimetidine) may cause gynaecomastia as well as loss of libido.^[12-15]

Hence, search for an ideal anti-ulcer drug continues and has also been extended to medicinal plants / herbs in search for new and novel molecules, which afford better protection and decrease the incidence of relapse. Many of the investigated plants / herbs are found efficacious in treatment of peptic ulcer.^[16-21] Interestingly, most of

these plants / herbs are being utilized in preparation of traditional medicine as drug for peptic ulcer in many states of India since long.

In this article, efforts are made to discuss antiulcer activity of *Amaranthus spinosus* and *Camellia sinensis* - the two medicinal plants being used in traditional medicine of Sikkim for treatment of peptic ulcer.

Amaranthus spinosus

Botanical description

Amaranthus spinosus (*A. spinosus*), commonly known as Pig weed, is found generally in tropical, subtropical and Himalayan regions. It is also frequently seen in the lower and middle hills (3000-5000 feet) in the northeast Himalayas and has also been found in Sikkim Himalaya. *A. spinosus* L. is an erect, spiny, annual or perennial herb monocious herb. It is branched and grows up to around 100-130 cm. The stem is obtusely angular, hard, glabrous or slightly covered.



Amaranthus spinosus

by a layer of fine hair and may be green, reddish brown or purple in colour. The spines which are present on the stem are sharp and divaricate in nature. The leaves have an alternate pattern and are simple, devoid of stipules. Flowers are numerous, appear throughout the year. Fruit is ovoid shaped. Seed is shiny, black or brownish-black in colour.^[22]

Vernacular names

A. spinosus L. is known by different vernacular names such as Bengali : *Kantanotya*, English: *Spiny amaranth*, *Pig weed*, *Thorny amaranth*, *Prickly amaranth*, *Needle burr*, *Edlebur* etc., Gujrati : *Kantalo dhimdo*, *Kantanu dant*, *Tandaljo*, Hindi: *Kanta wali chaulai*, *Kantamiris*, *Kantabhajji*, *Kataili-chaulai*, *Kantanatia* etc., Kannada : *Mulla-dantu*, *Mulla harave soppu*, Malayalam: *Kattumullenkeera*, *Mullan-cheera*, Manipuri : *Ch Meghanada*, *Alpamarisha*, *Tandula*, *engkruk*, Marathi : *Kante bhaji*, *Kante mat*, Nepali : *Kaande Lunde*, *Bandanee*, *Ban lure*, *Dhutighans*, Oriya : *Kantaneutia*,

Sanskrit : *Meghanada*, *Alpamarisha*, *Tandula*, *Tanduliuyah* etc., Tamil : *Mud-kerrai*, *Mullukeerai*, Telugu : *Mundla kura*, *Nalladoggali*, *Mullatatakura*.^[23]

Classification

A. spinosus L., under taxonomic classification, falls as under.

Kingdom-*Plantae*, Subkingdom - *Viridaplantae*, Phylum - *Magnoliophyta*, Subphylum-*Euphyllophytina*, Division -*Magnoliophyta*, Class - *Magnoliopsida*, Subclass - *Caryophyllidae*, Order - *Caryophyllales*, Suborder-*Chenopodiineae*, Family - *Amaranthaceae*, Genus-*Amaranthus*, Species - *spinosus*.^[24]

Traditional use

In traditional medicine *A. spinosus* L. is used for the treatment of diabetes, gastric ulcer, burns, wounds, eczema, ulcerated mouths, boils, indigestion, ear ache, diarrhea, jaundice etc.^[25]

Bioactive compounds

A. spinosus L. contains various phytochemicals. Few are, Saponin-II- β -D-glucopyranosyl-(1-4)- β -D-glucopyranosyl-(1-3)- α -spinasterol, aliphatic ester- α -spinasterol octacosanoate, Saponin I- β -D-glucopyranosyl-(1-2)- β -D-glucopyranosyl-(1-2)- β -D-glucopyranosyl-(1-3)- α -spinasterol, saponin- β -D-glucopyranosyl-(1-4)- β -D, glucopyranosyl-(1-4)- β -D-glucuronopyranosyl-(1-3)-oleonic acid etc.^[57,58] Amaricin- a coumaroyl adenosine, stigmaterol glycoside Amaranthoside- a lignan glycoside, α -xylofuranosyl uracil, β -D-ribofuranosyl adenine, β -sitosterol glucoside, 7-p-coumaroyl apigenin 4-O- β -D glucopyranoside, Rutin and quercetin.^[26]

Pharmacological activity

A. spinosus has many pharmacological properties. These include, antioxidant, hepato-protective, spasmolytic, bronchodilator, antidiabetic, antiulcer, antitumor, analgesic, antimicrobial, spermatogenic, antifertility, anti-inflammatory, antimalarial etc.^[27]

Antiulcer activity of *Amaranthus spinosus*

Antiulcer activity of *A. spinosus* was studied in experimental animals. Hussain *et al.* showed^[28] that ethanol extract of whole plant of *A. spinosus* has anti diarrheal and antiulcer activity in rats. In screening program Mitra and coworkers noted anti gastric ulcer activity of *A. spinosus* leaves in ethanol induced gastric ulcers in albino rats.^[19] Since one experimental model is not sufficient to confirm anti gastric ulcer activity of the medicinal plant, the authors evaluated anti gastric ulcer activity of *A. spinosus* leaves in indomethacin as well as pyloric ligation induced gastric ulcer in rats. Results showed that *A. spinosus* leaves could protect formation of gastric ulcer in rats as induced by indomethacin and pyloric ligation.^[21]

Village-people of Sikkim use leaf infusion of *A. spinosus* in stomach disorder specially in case of indigestion and peptic ulcer.^[29] Based on this Ghosh *et al.*^[23] studied role of *A. spinosus* leaves in peptic ulcer models in experimental animals. Ethanol and cysteamine were used to induce gastric and duodenal ulcers respectively in rats. The results obtained were compared with omeprazole, the known standard drug of peptic ulcer. The study revealed that the leaves of *A. spinosus* exhibited anti-peptic ulcer potential against ethanol and cysteamine induced peptic ulcerations, but the activity was less in comparison to that of Omeprazole.

Anti gastric ulcer activity of *A. spinosus* leaves was also studied in aspirin induced gastric ulcers in rats. Gastric ulcer was induced in rats by standard dose of aspirin. Powder of *A. spinosus* leaves in the dose of 1 g / kg was given to rats orally for fifteen days. Results showed that *A. spinosus* leaves significantly reduced ulcer index induced by aspirin. The plant leaves produced gastric anti secretory effect by decreasing gastric volume and acidity. Elevated level of gastric pepsin during aspirin

induced ulcers was found lowered by the leaves indicating its involvement in offensive mechanism in production of gastric ulcer. Leaves further increased gastric mucin which showed its gastric cytoprotective effect. The plant leaves prevented loss of gastric protein, DNA and the increased lipid peroxidation in rats during ulceration by aspirin. Activities of the antioxidant enzymes were enhanced during ulceration by this plant leaves. Results were comparable to that of ranitidine, a standard anti ulcer drug. Authors commented, *A. spinosus* leaves could exert anti gastric ulcer activity in aspirin induced gastric ulcers in rats through gastric cytoprotective effect.^[30]

Comparative study on anti-gastric ulcer activity of roots, stem and leaves of *A. spinosus* was carried out in rats. Rats were divided in five groups and administered respectively with ethanol, hydrochloric acid, indomethacin, stress and pyloric ligation to induce gastric ulcer. Ulcerated animals were given separately powder of roots, stem and leaves of *A. spinosus* through oral route. In another group omeprazole was given as reference drug. Results showed that roots, stem and leaves of *A. spinosus* could exert significant anti-gastric ulcer activity. However, the highest activity comparable to that of omeprazole was shown by the roots of the plant.^[31]

Seasonal variation in anti ulcerogenic activity of *A. spinosus* leaves was studied. Results showed that *A. spinosus* leaves of May and June had maximum anti gastric ulcer activity. Ulcer index in ethanol treated rat was 31.3 ± 3.18 and the same came down to 15.2 ± 1.27 (ulcer inhibition, 51.43%) by *A. spinosus* leaves of May and June. Result was statistically significant up to the level of $p < 0.001$.^[32]

A compound was isolated from *A. spinosus* leaves. The compound was characterized as 1,3,5- trihydroxy-7-methylanthracene-9,10-dione (Emodin). Compound showed anti gastric ulcer activity in different gastric ulcer models in rats. The compound had antisecretory activity as well as gastric cytoprotective effect and could decrease lipid peroxidation but increase activities of the anti oxidant enzymes during ulceration. Anti gastric ulcer activity of the compound was, therefore, mediated through anti secretory, cytoprotective and anti oxidant defense mechanism. Authors claimed, the compound provides a scientific rationale for the use as anti gastric ulcer drug.^[33]

Camellia sinensis

Botanical description

Camellia sinensis (*C. sinensis*), commonly known as 'green tea', is the most consumed drink in the world after water. Though tea is native to mainland China, South and Southeast Asia presently it is cultivated in at least 30 countries around the world. Tea is now mainly produced in India, Kenya, China, and Sri Lanka. China is the largest producer. In India and Kenya, black tea is the

main tea product and exported to American and European countries. Botanical description of green tea is: shrubs 1-5(-9) m tall, leaves are 4–15 cm long and 2–5

cm broad, petiole 4-7 mm, petals 6-8, sepals 5, flowers - axillary and yellow-white, ovary- globose, stamens- numerous, seeds - brown subglobose.^[34]



Tea leaves

Vernacular names^[35]

Arabic: *Shay 'akhdar* Bengali: *Cha* Chinese: *Lùchá* Dutch: *Groene thee* French: *Thé vert* German: *Grüner Tee* Greek: *Prásino tsái* Gujrati: *Lili ca* Hindi: *Green tee* Italian: *Tè verde* Japanese: *Ryokucha* Kannada: *Hasiru cahā* Malayalam: *Grin ti* Marathi: *Hiravā cahā* Nepali: *Hariyō ciyā* Portuguese: *Chá verde* Punjabi : *Hari caha* Spanish: *Té verde* Swedish: *Grönt te* Tamil: *Paccai tēylai tēnīr* Telugu: *Grīn fī*.

Classification^[36]

Kingdom: *Plantae-plants* Subkingdom: *Tracheobionta-vascular plants* Super division: *Spermatophyte- seedplants* Division: *Magnoliophyta-flowering plants* Class: *Magnoliopsida-dicotyledons* Subclass: *Dilleniidae* Order: *Theales* Family: *Theaceae-tea family* Genus: *Camellia L.-camellia* Species: *Camellia sinensis* (L.) Kuntze-tea.

Traditional use

C. sinensis has many traditional uses. It is used to alleviate the symptoms of hypertension, improve oral health, reduce the risk of cardiovascular disease, protect against solar ultraviolet radiation, control body weight, improve glucose tolerance and insulin sensitivity, increase bone mineral density, maintain neuroprotective activity etc. Green tea extract is also used as a safe dietary supplement due to its many properties that are beneficial for human health.^[37]

Bioactive compounds

Tea contains phenolic compounds like catechins, gallic acid, epigallocatechin, epicatechin gallate and epigallocatechin gallate, flavones, O-glycosylated flavonols, C-glycosylated proanthocyanidins, phenolic acids and their derivatives; purine alkaloids such as xanthines; other alkaloids like

caffeine, theobromine, theophylline etc. Tea also contains fatty acids, volatile oils, polysaccharides, lipids, essential oils, terpenoids and amino acids; vitamins like vitamin C; inorganic elements e.g., aluminium, fluorine, manganese etc. Kaempferol-3-O-glucosyl-(1-3)-rhamnosyl-(1-6)-galactoside, quercetin-3-O glucosyl-(1-3)-rhamnosyl-(1-6)-glucoside, quercetin-3-O-glucosyl-(1-3)-rhamnosyl-(1-6)-galactoside are the main flavonol glycosides found in fresh leaves of *C. sinensis*.^[38]

Pharmacological activity

C. sinensis has several pharmacological activities like anti-diabetic, anti-inflammatory, anti-pyretic, anti-mutagenic, anti-viral, anti-oxidant, anti-microbial, anti-cancer, anti-cataract, anti-caries, anti-Alzheimer, anti-stroke, anti-Parkinson, anti-obesity, anti-spasmodic, anti-genotoxic, anti-ageing, anti-allergic, anti-fibrotic, anti-hair fall etc. Further, the plant is hepato protective, chemo preventive and analgesic. Tea has lipid lowering and immunomodulatory effect and is used in renal failure, skin, eye and cardiovascular diseases.^[39]

Antiulcer activity of *Camellia sinensis*

Beneficial effect of tea in peptic ulcer diseases is not clearly understood. Only few studies were undertaken to note anti peptic ulcer activity of tea. Maity *et al.*^[40] studied effect of the hot water extract of black tea (*Camellia sinensis* (L.) O. Kuntze, Theaceae) on ulceration induced by various ulcerogens and by cold restraint stress in albino rats. They observed that the hot water extract of black tea possessed anti-ulcer activity and this activity was mediated through prostaglandins. In 2000, Yuk-kei yee & Marcel Wing-leung Koo showed^[41] that tea has anti-*Helicobacter pylori* activity in a daily consumed concentration and epigallocatechin gallate present in tea was the active ingredient responsible for the action. Authors pointed out that *H. pylori* is the

bacteria responsible for peptic ulcer diseases. In another study cytoprotective effect of tea root (*Camellia sinensis* var *assamica*) extract was studied in ethanol-induced rat gastric ulcer as an experimental model. The study provided evidence for possible involvement of both glutathione and nitric oxide in the tea root-mediated cytoprotection against ethanol-induced ulceration.^[42]

Hamaishi *et al.* in 2006 studied^[43] anti-ulcer effect of tea catechin in rats was studied. Results showed that oral administration of tea catechin dose-dependently prevented absolute ethanol-induced or restraint plus water immersion stress-induced acute gastric mucosal injury in rats.

In 2009 Ratnasooriya *et al.*^[44] examined gastric ulcer healing potential of black tea (*Camellia sinensis*) using Sri Lankan high grown Dust grade No: 1 black tea in rat acetic acid-induced gastric ulcer model. Authors concluded that black tea possessed strong, oral gastric ulcer healing activity which was mediated via multiple mechanisms.

Mitra *et al.* studied anti peptic ulcer activity of tea leaves in cysteamine induced duodenal ulcer and ethanol, hydrochloric acid, aspirin, indomethacin, swimming stress, pyloric ligation and restraint induced gastric ulcer in albino rats. Results showed that in all the ulcer models studied tea leaves showed antiulcer activity. The result was comparable to that of ranitidine, the standard drug for ulcer treatment. Tea leaves could lower gastric secretion, gastric acidity and increase gastric mucus content during indomethacin induced gastric ulcer. This suggests cytoprotective activity of the tea leaves. Further, tea leaves could decrease lipid peroxidation and elevate activities of antioxidant enzymes during indomethacin induced gastric ulcer. This also suggests that anti peptic ulcer activity of tea leaves was mediated through antioxidant mechanism. Authors concluded that tea leaves powder may provide a scientific rationale for use as anti peptic ulcer drug. These workers also studied seasonal variation in anti gastric ulcer activity of tea leaves and found that the activity was maximum during the period March–April.^[45]

CONCLUSION

Peptic ulcer diseases like gastric and duodenal ulcers are most prevalent gastrointestinal disorder and affecting 10% of the world population.^[46] Every year about fifteen thousand deaths occur due to peptic ulcer diseases.^[47] In India, peptic ulcer disease is also common. There are drugs to treat peptic ulcer but the drugs have side effects. In experimental research it has been demonstrated that *Amaranthus spinosus* and *Camellia sinensis* have antiulcer activity. Future researchers may take a note of it and try to isolate the active compounds from these medicinal plants which may be used in future as drug(s) of peptic ulcer. They may also characterize the isolated compounds. and conduct clinical trial for greater interest of mankind.

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