

A COMPREHENSIVE REVIEW ON ULCER HEALING POTENTIAL OF MEDICINAL PLANTS

DIVYA SHARMA^{1*}, SHAILENDRA BHATT¹

¹Maharishi Arvind Institute of Pharmacy, Mansarovar, Jaipur.
Email: divyasharma1089@gmail.com

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ABSTRACT

Peptic ulcers are a broad term that includes ulcers of gastrointestinal tract. The formation of peptic ulcers is due to the presence of acid, peptic activity in gastric juice and a breakdown in mucosal defenses. There are two main factors that can disrupt the mucosal resistance to injury, non-steroidal anti-inflammatory drugs and H. pylori infection. A number of anti-ulcer drugs such as proton pump inhibitors and H₂ receptor antagonists are used for the treatment of peptic ulcer, but these drugs have shown incidence of relapses, side effects, and drug interactions. Plant origin drugs are gaining popularity to treat number of disorders, including peptic ulcer. There is a need for less toxic and potent anti-ulcerogenic drugs. Since long time plant extracts are used to produce promising anti-ulcerogenic effects. The present work was carried out to investigate the possible preventive anti-ulcerogenic effect. In the present study we have reviewed most commonly employed herbal medicines and various animal models which were used in the screening of anti ulcer activity.

Keywords: Anti-ulcer, Medicinal plant, Animal model.

INTRODUCTION

Peptic ulcer is one of the major gastrointestinal disorders and it affects about 10% of the world population. As a consequence of peptic ulcer about 15000 deaths occur each year [1]. In the Indian pharmaceutical industry, antacids and antiulcer drugs occupy 4.2% of the market share.

An ulcer is basically an inflamed break in the skin or the mucus membrane lining the alimentary tract. Ulceration mainly occurs due to the disturbance of the normal equilibrium caused by either enhanced aggression or diminished mucosal resistance. Today, there are two main techniques for treating peptic ulcer. The first is reducing the production of gastric acid and the second is re-enforcing gastric mucosal protection. There are two major factors that can disrupt the mucosal resistance to injury: non-steroidal anti-inflammatory drugs (NSAIDs) and Helicobacter pylori infection. Several natural products have been evaluated as therapeutic agents for the treatment of peptic ulcer.

The gastric mucosa is continuously exposed to various injurious agents such as acid, bile acids, pepsin, food ingredients, bacterial products and drugs. These agents have been played a role in the pathogenesis of gastric ulcer, including enhanced pepsin and gastric acid secretion, cell proliferation growth, inhibition of prostaglandin synthesis and diminished gastric blood flow and gastric motility [2]. Peptic ulcers are once believed to be caused by spicy food, emotional stress, alcohol and smoking are the principal etiological factors associated with peptic ulcer [3]. The Gram-negative bacterium Helicobacter pylori remain present between the mucous layer and the gastric epithelium and are strategically designed to live within the aggressive environment of the stomach. There are many types of ulcer such as mouth ulcer, esophagus ulcer, peptic ulcer, stress ulcer and genital ulcer. The peptic ulcers are found in the lining of our stomach or duodenum [4]. The two most common types of peptic ulcer are called "gastric ulcer" and "duodenal ulcer." Gastric ulcers are located in the stomach, characterized by pain; ulcers are frequent in older age group. Eating may add to pain rather than relieve pain. Other symptoms may include nausea, vomiting, loss of appetite, bloody stool, frequent burping and weight loss. While patients with gastric ulcers have normal or diminished acid production, yet ulcers may occur even in absence of acid [5]. Duodenal ulcers are found at the beginning of small intestine and are characterized by severe pain with burning sensation in upper abdomen that awakens patients from sleep. Eating something or taking an antacid medication sometimes makes the pain go away for awhile.

A duodenal ulcer is more frequent in younger individuals and mostly affects males. In the duodenum, ulcers may become visible on both the anterior and posterior walls [6]. In some cases, peptic ulcer can be life threatening with symptoms like bloody stool, sharp stomach pain, and cramps along with vomiting blood [7].

Antiulcer drugs like H₂ -receptor blockers, proton pump inhibitors, anti-muscarinic drugs produce adverse reactions such as hypersensitivity, arrhythmia and haemopoietic changes with a possibility of increased rate of ulcer recurrence within one year after cessation of the treatment. Because of the above mentioned demerits reported with the current antiulcer therapy there is a need for the search of newer therapeutic antiulcer agents from plant sources from the alternative therapy of Ayurveda medicine. Some plant extracts produce promising and favorable reasons in the treatment of gastric ulcers. Several plants and herbs are used for the treatment of gastrointestinal disorders including gastric ulcers [8].

In this modern era also 75–80% of the world populations still use herbal medicine for primary health care because of better compatibility with the human body, and lesser side effects [9]. Histological studies revealed that acute toxicity did not shown by these medicinal plants. Preliminary phytochemical screening of these medicinal plants identified the presence of important secondary metabolites like flavonoids and tannins which are the active principles of antiulcer activity [10].

Current treatment of ulcers in developing countries has been largely focused on suppression of pain, with no strategy aimed at a cure. Herbal medicines are promising as an alternative treatment to available synthetic drugs for treatment of ulcer possibly due to lower costs, availability, and fewer adverse effects and perceived effectiveness [11]. Many tropical herbs have been scientifically reported to possess potent antiulcer activity with examples as *Carica papaya*, *Aloevera*, *Bryophyllum pinnatum* and *Artocarpus altalis*. A large number of spices and herbs have been evaluated for their antiulcer effects to achieve a constructive outcome. Large numbers of medicinal plants and dietary nutrients have been shown to possess gastro-protective activities such as *Aloe*, *Terminalia Chebula*, *Ginseng*, *Capsicum* etc.

Present study was conducted to evaluate medicinal plants considered as gastro protective and healing agents on ulcers in ayurvedic resources and beside that to gather evidence for their effectiveness and biological mechanisms in modern investigation. Following compiled data recommended that medicinal plant those are evidently reported for its antiulcer activity.

Screening models for anti ulcer activity

For the screening of the anti ulcer activity, various screening models are used that helps in the understanding of the etiology of ulcer and screening of anti ulcer agents. Animal models which were used in the screening of anti ulcer activity are as follows:

- Ethanol induced ulcers
- Aspirin induced ulcers
- Water immersion stress induced ulcers
- Pylorus ligation induced ulcers
- Reserpine induced ulcers
- Serotonin induced ulcers
- Indomethacin induced ulcers
- Histamine induced ulcers
- Hydrochloric acid induced ulcers
- Acetic acid induced ulcers

Ethanol induced ulcers

Principle

Alcohol decrease mucosal resistance and causes secretion of gastric juice and due to which protein content of gastric juice is significantly increased. This could be leakage because of plasma protein in the gastric juice this leading to peptic ulcer with weakening of mucosal resistance barrier of gastric mucosa [12].

Aspirin induced ulcers

Principle

Aspirin inhibit the synthesis of prostaglandins which protects the gastric mucosa. Aspirin increases mucosal hydrogen peroxide and hydroxyl ions level to cause oxidative mucosal damage due to the inhibition of gastric peroxidase [13].

Water immersion stress induced model

Principle

Stress can arise from tension, prolonged anxiety, emotion, burns and trauma, severe physical discomfort, surgical shock, haemorrhage thereby resulting in severe gastric ulceration.

Pylorus ligation induced ulcers

Principle

In Pylorus ligation pylorus part of the stomach was ligated, it creates the acidic medium in stomach for longer time and produces the ulcer [14].

Reserpine induced ulcers

Principle

Reserpine induced ulceration has been attributed to the degranulation of gastric mast cells and subsequent liberation of histamine [15].

Serotonin induced ulcers

Principle

Serotonin induced ulceration is arises from a disturbance of gastric mucosal microcirculation.

Indomethacin induced ulcers

Principle

Indomethacin is inhibits the synthesis of prostaglandins which are protective agents for gastric mucosa high doses of the NSAIDs causes ulceration [13].

Histamine induced ulcers

Principle

Histamine causes ulceration by increasing the gastric acid secretion by directly acting on histamine receptors of parietal cells [16].

Hydrochloric acid induced ulcers

Principle

Hydrochloric acid causes ulceration by enhancing the acidity of the stomach contents.

Acetic acid induced ulcers

Principle

Acetic acid induces the ulceration in stomach by increasing the acidity of stomach contents and it also causes gastric obstruction, which leads to the ulceration.

THE ULCER HEALING POTENTIAL OF MEDICINAL PLANTS

In spite of being one of the well known medicinal plants used in Indian traditional medicine to treat several ailments, studies related to the pharmacological properties of some medicinal plants are rare. The antiulcer activity and acute toxicity of a few medicinal plants were studied, and our investigation showed that these medicinal plants could prevent ulcer in rats in a dose-dependent manner. Histological studies illustrated that these medicinal plants did not show any acute toxicity.

Preliminary photochemical screening of these plants identified the presence of secondary metabolites like flavonoids and tannins. A variety of botanical products have been reported to possess antiulcer activity but the documented literature has focused primarily on pharmacological action in experimental animals.

Except a few phytochemical compounds (i. e. aloe, liquorice etc.), limited clinical data are available to support the use of herbs as gastro-protective agents and thus, the data on efficacy and safety of these herbs are limited.

There are several botanical products with potential therapeutic applications because of their high efficacy and low toxicity. It was also found that substances such as flavonoids, aescin, aloe gel and various others that possess antiulcer activity are of particular therapeutic importance as most of the anti-inflammatory drugs used in modern medicine are ulcerogenic[17-19]. Active principles of antiulcer activity are flavonoids, tannins and terpenoids.

SOME POTENTIAL MEDICINAL PLANTS USED IN THE TREATMENT OF ULCER

Some potential plants with antiulcer activity are given in Table 1.

Ficusarnottiana

Description

Ficusarnottiana is an important medicinal plant distributed throughout India, mostly in rocky hills. It has several names including Paraspipal and kodiarasu. The fruits of the plant contain β -sitosterol, gluanoacetate and glucose. In the bark extractsterols, alkaloids, carbohydrates, tannins, phenols and many others are present. Bark of the plant is used as astringent, aphrodisiac, demulcent and emollient [20].

Uses

It is useful in inflammation, diabetes, burning sensation, leprosy, scabies and ulcer.

AlstoniaScholaris R. Br.

Description

Alstoniaspecies are found in the Malaysian region. These trees can grow large, such as *Alstonia pneumatophore*. *Alstonia* trees are used in traditional medicine. The *Alstoniascholaris* is used against malaria, toothache, rheumatism and snake bites and latex is used in treating coughs, sorethroat and fever [21].

Active constituent

The chief active constituents are alkaloids, coumarins, flavonoids, reducing sugars, simple phenolic, steroids, lipid, saponins and tannins. These chemical compounds detected in *A. scholaris*, could

make the plant functional in treating different ailments. Flavonoids are a group of polyphenolic compounds which includes free-radical scavenging, hydrolytic enzymes inhibitory and anti-inflammatory property. The flavonoids and saponins are used in ulcer treatments.

Use

Used in ulcers, dysentery and wood paste is applied in rheumatism and toothache.

Asparagus racemosus Wild

Description

They are mainly used as cooling, demulcent, diuretic, tonic and aphrodisiac, and are used both internally and in the preparation of several medicated oils. The fresh juice of the root is used as a demulcent in dyspepsia or diarrhoea [22].

Active constituents

The principal chemical constituents exhibiting medicinal properties are Shatavarin (steroidal saponin). Four types of Shatavarin, Shatavarin I-IV are present in roots. Apart from this, quercetin-3-glucuronide, rutin in shoots; sitosterol, stigma sterol and some other unidentified saponins are found in fruits and seeds.

Use

It is used in leucorrhoea, headache, and also useful in acidity. It is said to relieve pains, so it is given to pregnant ladies before they deliver babies. Root powder is used to increase energy and strength; roots are used as an anti-inflammatory, anti-ulcerogenic, anti-tumor activity.

Azadirachta indica

Description

Neem is a native tree of India. It is mainly grown in many Asian countries and in the tropical regions of the western hemisphere. The most active, currently identified ingredient of Neem is 'azadirachtin'. It is used to formulate pesticides that are safe, natural and bio-degradable [23].

Active constituents

The most common active constituents found in Neem are Azadirachtin, Nimbin, Nimbodin, Nimbido, Sodium nimbinate.

Use

Seeds are used in skin diseases, and in rheumatism. Bark is useful in malarial fever. Dry fruits are used as tonic and stomachic. Tender twigs are used as tooth brush.

Table 1: Medicinal plants with anti-ulcer activity

Botanical name Family	Common name	Parts used	Active constituents	Extract	Animal Model	Reference
<i>Ficus arnottiana</i> Moraceae	Paras papal	Leafs, fruits	β - sitosterol, Gluanol acetate and Glucose, Sterols, alkaloids, Carbohydrates, Tannins, Phenols.	Methanolic extract	Ethanol induced ulcer	21
<i>Alstonia scholaris</i> Apocyanaceae	Blackboard tree	Bark	Alkaloids, coumarins, flavonoids, phlobatannin, reducing sugars, simple phenolic, steroids, saponins and tannins	Ethanol extract	Pylorus ligation model	22
<i>Asparagus Racemosus</i> Asparagaceae	Asparagus fern	Roots Fresh Juice	Shatavarin	Methanolic extract	Indomethacin treated	23
<i>Azadirachta indica</i> Meliaceae	Neem	Leaves	Flavonoids, tannins, carbohydrates and proteins.	Aqueous extract, Methanolic extract	Indomethacin treated, ethanol and histamine	24
<i>Bauhinia Variegata</i> Fabaceae	Orchid tree	Leaves	Flavonoids	Aqueous extract, ethanol extract	Aspirin induced	25
<i>Butea foandosa</i> Fabaceae	Palas	Leaves	Butrin, flavonoids and steroids	Petroleum ether, chloroform, ethanol and water extracts	HCl induced ulcer	26
<i>Carica Papaya</i> Caricaceae	Papita	Fruit and seeds	Papain, chymopapain, pectin, carposide, carpaine, pseudocarpaine, dehydrocarpines, carotenoids, crypto glavine, cis-violaxanthin and antheraxanthin.	Aqueous extract	Aspirin induced ulcer	27
<i>Annona squamoza</i> Annonaceae	Guma, Seetha	Leaves, fruit, seeds, bark.	Alkaloids, flavonoids, saponins, and tannins	Aqueous extract	Indomethacin induced ulcer	28
<i>Adansonia digitata</i> Malvaceae	Dead rat tree	Leaves	Wax, glucose, salts, gum, and albuminoids	Aqueous extract	Ethanol induced ulcer	29
<i>Aegle marmelos</i> Rutaceae	Bael tree	Fruits	Flavonoids, tannins, and saponins	Aqueous extract, Methanolic extract	Indomethacin induced ulcer	30
<i>Allium sativum</i> Amaryllidaceae	Garlic	Seeds	Alliin, allicin, starch, mucilage, albumen, and sugar	Methanolic extract	Stress-induced gastric ulcers	31
<i>Aloe Vera</i> Liliaceae	Gritkumari	Leaves	Barbaloin, Iso- Barbaloin, saponins	Hydroalcoholic extract	Indomethacin induced ulcer	32
<i>Careya arborea</i> Myrtaceae	Slow match tree	Bark	Tannin, Saponins	Ethanol extract	Ethanol induced ulcer, Pylorus ligation	33
<i>Euphorbia nerifolia</i> Euphorbiaceae	Common milk hedge	leaf	Resin, gum, caoutchouc, malate of calcium,	Hydro-alcoholic extract	Pylorus ligation	34
<i>Ficus religiosa</i> Urticaceae	Sacred fig	Bark	Tannin, caoutchouc (cochtone), and wax, flavonoids, saponins, and tannins	Ethanol extract	Pyloric ligation	35
<i>Hibiscus Rosa</i>	Changing rose	Leaves	Flavonoids, anthocyanins, quercetin,	Methanolic	Pyloric ligation	36

<i>Sinensis</i> Malvaceae			cyanidin, kaempferol, and hydrocitric acid	extract		
<i>Indigofera Tinctoria</i> Papilionaceae	True indigo	Leaves	Indican (a glucoside)	Petroleum ether, chloroform, ethanolic and aqueous extracts	Aspirin plus pylorus ligated model	37
<i>Lawsonia inermis</i> Lythraceae	Henna	Leaves	Hanno, tannic acid	Ethanolic extract	Ethanol induced ulcer	38
<i>Magnifera Indica</i> Anacardiaceae	Mango tree	Leaves, flower	Alkaloids, sterols, saponins, tannins, and flavonoids	Petroleum ether and ethanol extracts	Aspirin-induced ulcer	39
<i>Mimosa Pudica</i> Fabaceae	Touch me not	Leaves	Flavonoids, quercetin, naringin, saponins, tannins, gums, and mucilage	Alcoholic extract	Aspirin, Alcohol and pyloric ligation	40
<i>Momordica Charantia</i> Cucurbitaceae	Bitter gourd	Fruits	Glucoside, yellow acid, resin	Methanolic extract	Acetic acid induced gastric ulcer, pyloric ligation induced ulcer	41
<i>Moringa Oleifera</i> Moringaceae	Drum-stick, horse radish tree	Leaves	Alkaloids, flavonoids, saponin, tannins, zeatin, quercetin, kaempferom, and terpenoids	Alcoholic extract	Aspirin and ethanol induced	42
<i>Myrtus Communis</i> Myrtaceae	Myrtle	Berries	Resin, tannin, citric acid, malic acid, and sugar	Aqueous extracts	Ethanol, indomethacin and pyloric ligation induced models	43
<i>Ocimum Sanctum</i> Lamiaceae	Holy basil	Leaves	Alkaloids, tannins, saponins, flavonoids, and sterols	Ethanolic extract	Methanol induced ulcer	44
<i>Phyllanthus Niruri</i> Euphorbiaceae	Stonebreaker or seed-under-leaf	Roots	Alkaloids, saponins, tannins, flavonoids, carbohydrates, and glycosides	Aqueous extract	Ethanol induced ulcer	45
<i>Psidium Gugava</i> Myrtaceae	Guava	Bark, leaves	Resin, crystals of calcium oxalate, fat, cellulose, tannin	alcoholic extract, ethyl acetate fraction	Ethanol and pylorus ligature model	46
<i>Rhus Coriaria</i> Anacardiaceae	Sumach	Fruits	Flavonoids and tannins	Hydroalcoholic extract	Ethanol induced	47
<i>Sesbaniagrاندiflora</i> Fabaceae	Basna	Leaves	Saponins, tannins, and triterpenes	Ethanolic extract	Aspirin, ethanol and indomethacin induced ulcer	48
<i>Shorea Robusta</i> Dipterocarpaceae	Sal tree	Resin	Ursolic acid, tri and tetrahydroxyursenoic acid, Asiatic acid alpha and beta amyrrin, and mangiferonic acid uvaol	Resin	Ethanol and pyloric ligation	49
<i>Solanum Nigrum</i> Solanaceae	Black nightshade berries	Fruits	Alkaloids, saponins, flavonoids, and phytosterols	Fruit extract	Cold restraint stress, indomethacin, pyloric ligation and ethanol and acetic acid induced ulcer	50
<i>Terminalia Chebula</i> Combretaceae	Handa	Seed	Tannins, gallic acid, chebulinic acid, sorbitol	Methanolic extract	Pylorus ligation and ethanol induced ulcer	51

***Bauhinia variegata* Linn.**

Description

Bauhinia variegata is a medium-sized tree. The bark of the plant is grey and the leaves are sub-coriaceous and deeply cordate. The flowers are variously colored and the pods are long, hard, flat, and glabrous [24].

Active constituents

The seeds and bark yields fatty oil and fiber respectively. Flavonoids isolated from the different organs of *B. variegata* were identified as Quercetin, rutin, Quercetin, apigenin and apigenin 7-O-glucoside. Saponins, steroids, flavonoids, alkaloids, tannins, sugars are also present.

Uses

The bark is astringent, tonic and anthelmintic and useful in skin diseases, ulcers and leprosy. It is used to remove intestinal worms and to prevent the decomposition of the blood in tumors. The root is carminative, and is used in dyspepsia and flatulence.

***Butea frondosa* Roxb**

Description

It is a species of *Butea*, native to tropical southern Asia, from India, Pakistan, Bangladesh, Nepal, Myanmar, Sri Lanka, Thailand and western Indonesia. It is used for resin, timber, fodder, dye and medicine. The wood is dirty white and soft and, being durable under water, is used for well-curbs and water scoops [25].

Active constituents

The main constituent of the flower is butrin besides butein and butin. It also contains flavonoids and steroids. Other than these in flowers, coreopsis, isocoreopsis, sulfuring (glycoside) and other two with monospermoside and isomonospermoside structures are also identified. Roots contain glucose, glucoside glycine, and aromatic compounds. Tetramers of leucocyanidin are isolated from gum and stem bark.

Uses

The fresh juice is used in ulcers. The gum is a powerful astringent given internally for diarrhea and dysentery, and hemorrhage from stomach and the bladder. The bark is reported to possess astringent, bitter, pungent, alliterative, aphrodisiac and anthelmintic properties. It is useful in tumors, bleeding piles and ulcers. Roots are useful in elephantiasis and in curing night blindness and other eyesight defects. It is applied in sprue, piles, ulcers, tumors.

Carica papaya L.**Description**

Papaya is a fast-growing, semi-woody tropical herb. The stem is single, straight and hollow and contains prominent leaf scars. The skin is waxy and thin but fairly tough. It is then juicy, sweetish and somewhat like a cantaloupe in flavor but some types are quite musky. Mature fruits contain numerous grey-black ovoid seeds attached lightly to the tannin [26].

Medicinal properties

Papaya latex is very much useful for curing dyspepsia and is externally applied to burns and scalds. It contains many biologically active compounds. Two important compounds are papain and chymopapain, which are widely known as being useful for digestive disorders and disturbances of the gastrointestinal tract.

Active constituents

Main chemical components are pectin, papain, chymopapain, carposide, carotenoids, carpaine, pseudocarpaine, dehydrocarpines, cis-violaxanthin, cryptoglavine, and antheraxanthin.

Uses

Papaya is basically an agent that helps in the digestive process. The leaves of the tree as well as the fruit, both ripe and raw, are used medicinally to aid digestion. The papaya seeds are also useful as when ingested they help in throwing out worms from the body. The latex or the white sap produced by the papaya tree trunk is also effectual in this manner, but comparatively more aggressive. On the other hand, an infusion prepared with the flowers of the plant may be used to stimulate menstruation. While the raw papaya contains a white milky substance called papain, the ripe fruit is moderately laxative and helps in the movement of bowels.

Annonasquamoza**Description**

A tree growing to a height of 5 to 10 m. Leaves are alternate, ovate to oblong-ovate or elliptic-ovate, with entire or undulate margins, pointed tip and with pointed, rounded or heart-shaped base. Flowers are stalkless, white or yellowish-white. The calyx is ovoid. Throat of the corolla and stamens are hairy. Fruit is a drupe, yellowish white or pinkish, ovoid, long with a rather scanty pulp and a hard stone [27].

Active constituents

Chemical constituents in this plant are alkaloids, saponins, flavonoids, and tannins. Seeds yield oil and resin, leaves, seeds and immature fruit contain an acrid principle. Bark contains a large amount of tannic acid. Fruit pulp contains sugar, extractive matters, gum, and ash. Fruit is considered demulcent, the bark, astringent and tonic. Tannic acid is considered as active constituent.

Uses

The bark is moistened and applied to boils and tumors to hasten ripening. Also used for headaches and stomach aches. Bark is used as anti-dyspeptic. Powdered bark is used for mouth ulcers. Infusion of bark is used as gargle. The barks are used to strengthen teeth. Leaves are used for ulcers and headaches. The highly mucilaginous fruit is used for coughs and ailments of the chest, uterus and urethra. In large quantities, used as a laxative. Stem-bark extract is used as an antiarrhoeal activity. In one of the studies it was found that the aqueous leaf extract protected against ethanol-induced and pylorus ligation-induced gastric ulcer in rats [28].

Adansoniadigitata**Description**

Adansoniadigitata is locally known as "paparapuli." It is one of the largest and long-lived trees in the world and mainly found in Bombay, Gujarat and Ceylon [29].

Active constituents

In this plant, pulps contain phlobaphenes, mucilage and glucose, gum, tartrate and acetate of potash, and other salts. A leaf contains glucose, wax, gum, salts, and albuminoids. Bark contains acid gum, wax, soluble and insoluble tannin, albuminous carbonate and chloride of sodium and potassium, and a glucoside adansonin. Leaves are used as fomentations and poultices for irritable inflammatory ulcers [30].

Aeglemarmelos**Description**

It is locally called as "vilvam." This plant chiefly grows throughout India [31].

Active constituents

Active constituents in this plant are tannins, flavonoids, and saponins. Luvangetin, isolated from the seeds, is considered. In one of the investigations it was found that ulcers are induced by aspirin plus pylorus ligated gastric ulceration in rats [32].

Allium sativum**Description**

Allium sativum locally called as "vellapundu." It is cultivated all over India [33].

Active constituents

In this plant area acrid volatile oil which is the active principle, alliin, allicin, mucilage, starch, sugar, albumen. Seeds yield aromatic oil. The juice, more particularly its oil constituents, is rich in organically bound sulphur, salicylic acid combinations, and iodine. It was found that the extract significantly increases healing of gastric ulcer and prevents the development of experimentally induced gastric and duodenal ulcers in rats [34].

Aloe vera**Description**

It is locally called "kattalai" and it is found all over India.

Active constituents

In this plant are Aloin, Barbaloin, isobarbaloin, saponins and emodin [35].

Antiulcer Activity

The extract of this plant showed significant anti-ulcer activity in indomethacin-induced gastric ulcer [36].

Careyaarborea**Description**

Careyaarborea is locally called "pailacputatammi."

Active constituents

In this plant are thick red barks containing tannin. Liber contains calcium oxalate in large simple crystals. Saponins are also present [37].

Antiulcer Activity

The extract showed significantly increases healing of gastric ulcer [38].

Euphorbia neriifolia**Description**

Euphorbia neriifolia is locally called "ilaikkalli."

Active constituents

Euphorbia neriifolia plants are Euphorbon, gum, resin, caoutchouc, malate of calcium, and so forth [39].

Ficus religiosa**Description**

Ficus religiosa is locally called "arasha-maram". This sacred peepul is a large tree round wild and cultivated all over India by the Hindus [40].

Active constituents

Active constituents in this plant are bark containing caoutchouc (cochtone), tannin, and wax. Bioactive compounds like flavonoids, saponins, and tannins are considered.

Antiulcer Activity

In one of the investigation it was found that the hydro alcoholic extract leaves of *F. religiosa* significantly decreases the ulcer index value when compared to control [41].

Hibiscus rosasinensis**Description**

It is locally called "chembaruthi." It is native to China and grown widely as an ornamental plant through India [42]

Active constituents

Active constituents in this plant are flavonoids, anthocyanins, quercetin, cyanidin, kaempferol, and hydrocitric acid.

Antiulcer Activity

It was found that the aqueous and alcohol extracts of *H. rosasinensis* roots possess significant antiulcer activity [43].

Indigoferatinctoria**Description**

It is locally called "neelum; avari." This is cultivated extensively in Northern India, especially in Bengal, Orissa, Oudh, Southern India, Madras, and Bombay [44].

Active constituents

Active constituents in this plant are Indican (a glucoside).

Lawsonialba**Description**

It is locally called "maruthoni." It is common all over India.

Active constituent

Active constituents in this plant are leaves that yield a colouring matter (henna dye) 12 to 15% Henna, tannic acid, a kind of tannin, and an olive green resin soluble in ether and alcohol. Seeds yield oil. There is also glucoside in the plant [45].

Antiulcer Activity

Leaves of this plant are used to cure wounds and ulcers.

Mangifera indica**Description**

It is locally called "mangai." It is cultivated throughout India

Active constituents

Chemical constituents in this plant are alkaloids, saponins, tannins, sterols, and flavonoids.

Antiulcer Activity [46].

The extract of this leaves significantly reduced the gastric juice volume and gastric acidity [47].

Mimosa pudica**Description**

It is locally called "thottalsinunjee." It grows in all tropical countries and many subtropical regions of the world [48].

Active constituents

Active constituents in this plant are flavonoids, naringin, tannins, quercetin, saponins, gums, and mucilage.

Antiulcer Activity

Ethanol extract of the leaves of *Mimosa pudica* have been investigated to possess antiulcer activity [49].

Momordicacharantia**Description**

It is locally called as "pavakka-chedi." This climbing plant is cultivated in gardens everywhere in India.

Active Constituents

Active constituents in this plant are bitter glucoside soluble in water and insoluble in ether, a yellow acid, resin, and ash. Flavonoids, sterols and saponins, are considered as active constituents.

Antiulcer Activity

Alcoholic and aqueous extract of *M. charantia* fruit are used against pylorus ligation, aspirin, and stress induced ulcer in rats. [51]

Moringaoleifera**Description**

It is locally called "murungai."

Active Constituents

Active Constituents in this plant are alkaloids, tannins, zeatin, flavonoids, saponin, quercetin, terpenoids, kaempferol, beta sitosterol, and beta carotene are considered [52].

Antiulcer Activity

The alcoholic leaves extract of *M. oleifera* has been reported against pylorus ligation, ethanol, cold restraint stress, and aspirin induced gastric ulcer [53].

Myrtus communis**Description**

It is cultivated in many parts of India.

Active constituents

Active constituents in this plant are ripe berries that contain an essential volatile oil (oil of Myrtle), malic acid, tannin, citric acid, resin, and sugar.

Antiulcer Activity

M. communis fruits protected against, indomethacin, pylorus ligation gastric ulcer.

Description

It is locally called "tulsi." It grows throughout India. It is one of the sacred herbs for Hindus in the Indian subcontinent [54].

Active constituents

Active constituents in this plant are alkaloids, sterols, tannins, flavonoids, saponins, and fixed oil. Eugenol is considered.

Antiulcer Activity

Plant extract showed aspirin, indomethacin, alcohol, and stress.

Phyllanthusniruri**Description**

It is locally called "kizhkaaynelli." It is common in Central and Southern India, extending to Ceylon. Chemical constituents in this plant are alkaloids, saponins, tannins, flavonoids, carbohydrates, and glycosides.

Active Constituents

Alkaloids-4-methoxy-securinine, ellagic acid, beta sitosterol, gallic acid, and hypophyllanthin are considered.

Antiulcer Activity

The methanolic aerial part extract of *P. niruri* has been shown significant antiulcer activity [55].

Psidiumguyava**Description**

Psidiumguyava is locally called "koyya".

Active constituents

Active constituents in leaves contain resin, cellulose, flavonoids, fat, tannin, cellulose, tannin, volatile oil, chlorophyll, and mineral salts.

Antiulcer Activity

The methanol leaf extract of *P. guyava* has been shown significant anti-ulcer against ethanol induced gastric ulcer [56].

Rhuscoriaria**Description**

It is native to southern Europe.

Active constituents

Chemical constituents in this plant are ellagic acid, gallic acid, isoquercitrin, myricitrin, and tannic acid. Flavonoids and tannins are considered as active constituents.

Antiulcer Activity

The hydro alcoholic extract of *R. coriaria* showed significantly increased gastric ulcers healing activity [57].

Sesbaniagrandiflora**Description**

It is locally called "akathi." Active constituents

Active constituents

Active constituents in this plant are saponins, tannins, and triterpenes [58].

Antiulcer Activity

The ethanol leaf extract of *S. grandiflora* extract significantly inhibited gastric mucosal damage and reduced the basal gastric acid secretion [59].

Shorearobusta**Description**

It is locally called "taloora; kungiliyam"

Active constituents

Active constituents in this plant are ursolic acid, tri and tetrahydroxyursenoic acid, Asiatic acid alpha and beta amyryn, and mangiferonic acid uvaol [60].

Antiulcer Activity

The extract of *S. Robusta* was significantly increases the gastroprotective activity as compared to control [61].

Solanumnigrum**Description**

It is locally called "manathakkalikeerai." It is cultivated throughout India.

Active constituents

Active constituents in this plant are alkaloids, flavonoids, saponins, and phytosterols [62].

Antiulcer Activity

Aqueous leaf extract of *Solanumnigrum* protected against pylorus ligation induced gastric ulcers in rats [63].

Terminaliachebula**Description**

It is locally called "kaduk-kai." This tree is wild in the forests of Northern India, Central Provinces, and Bengal and common in Madras, Mysore, and in the Southern parts of the Bombay Presidency.

Active Constituents

Active Constituents in this plant are tannins (tannic acid) and a large amount of gallic acid, sorbitol, a brownish yellow colouring matter, and chebulinic acid which when heated in water splits up into tannic and gallic acids [64].

Antiulcer Activity

The extract showed significant reduction in gastric volume, free acidity, and ulcer index as compared to control. [65]

CONCLUSION

From the present study, it is clear that various medicinal plants and plant extract have significant anti-ulcer activity in vivo experiments on animal models. It was also observed that limited clinical data are available to support these plants as gastroprotective agent thus; the data on efficacy and safety are limited. But in spite of this, there are several medicinal plants which possess high efficacy and safety. The anti-ulcer activity is mainly due to the presence of flavonoids. It has gastric anti-secretory, free radical scavenging property and mucoprotective activity when compared with the reference drugs. From this study, the above mentioned plants could prevent ulcer in a dose dependent manner in rats. The results of this study revealed that the plant extract of several medicinal plants have good potential for use in peptic ulcer disease. It is evident that experimental evaluation of herbal drugs for the treatment of gastric ulcer is rather promising but very few have reached clinical trials and still few have been marketed. This shows that the benefits of research are not reaching the people. Hence, pharmacologists need to take more interest in evaluation of herbal drugs for potential antiulcer activity and standardization of such herbal drugs to be clinically effective and globally competitive.

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