International Research Journal of Pharmacy and Medical Sciences
ISSN (Online): 2581-3277

# Natural Remedies in the Treatment of Peptic Ulcer: A Review

Palash Mondal[1], Durba Banerjee[2], Partha Ghorai[3], Shubhranil Debnath[4], Nirvik Pal[5]
[1]Department of Pharmaceutical Chemistry, GNIPST, Kolkata, West Bengal, India-700114; Email: mondal.palash2020@gmail.com
[2]Department of Pharmaceutical Chemistry, GNIPST, Kolkata, West Bengal, India-700114, Email: banerjeedurba34@gmail.com
[3]Department of Pharmacognosy, GNIPST, Kolkata, West Bengal, India-700114; Email: parthaghorai20@gmail.com
[4]Department of Pharmacy, GNIPST, Kolkata, West Bengal, India-700114; Email: b.shubhranil0319@gnipst.ac.in
[5]Department of Pharmacy, GNIPST, Kolkata, West Bengal, India-700114; Email: b.nirvik0315@gnipst.ac.in

***Abstract—*** *Herbs are highly regarded for their potential activity to yield novel molecules, making them an attractive avenue for discovering alternative drug sources. Herbal drugs are now generally used in most of the country including India and increased demand for these drugs over the world. An ulcer is the most common gastrointestinal disorder and generally affects 4 million people worldwide in a year an estimated 15,000 deaths occur every year due to peptic ulcer. The aim of this study is to the treatment of peptic ulcers using natural remedies to heal the ulcer, relieve pain, and delay ulcer recurrence. Generally, peptic ulcer affects the gastrointestinal tract which comes in contact with gastric acid and pepsin and may lead to stomach and the duodenum. This review explores commonly used medicinal plants in Ayurvedic or modern medicine for treating or preventing peptic ulcers. Additionally, it delves into natural and simple methods of utilizing readily available herbs in ulcer treatment. This study highlights, various medicinal plants known for their anti-ulcer properties. The article provides an overview of the anti-peptic and gastroprotective effects of commonly used herbal remedies, along with their respective active components. In conclusion, exploring natural remedies for peptic ulcers through comprehensive reviews offers valuable insights into potential alternative treatments that may complement or even replace conventional therapies. It could involve further exploration of novel plant-based compounds, enhanced understanding of their mechanisms of action, and the development of innovative formulations for improved efficacy and patient compliance.*

***Keywords****—Antiulcer activity; Medicinal plants; Peptic ulcer; Herbal drugs; Traditional medicine.*

## I. INTRODUCTION

Herbal medicine is practiced worldwide, with notable traditions in Chinese, Indian, and European cultures. Each region has its own rich history of utilizing herbal remedies. The philosophies of traditional medicine share some similarities but are quite distinct from modern Western medicine. With the advancements in Western medicine, both synthetic and herbal drugs must meet international standards for quality, safety, and efficacy. Herbal drugs have the benefit of being accessible to patients in regions where specific traditional medicines are practiced. However, the development process for herbal drugs intended for global use must differ from that of synthetic drugs [1]. Ulcers are lesions found on the skin or mucous membranes, marked by a superficial loss of tissue. They are most frequently observed on the lower extremities' skin and within the gastrointestinal tract but can occur in various locations. Different types of ulcers include mouth ulcers, oesophagus ulcers, peptic ulcers, and genital ulcers, with peptic ulcers being particularly prevalent. Peptic ulcers involve the erosion of the stomach lining or the duodenum [2]. The two primary types of peptic ulcers are known as "gastric ulcers" and "duodenal ulcers," named after the specific locations where they occur. The primary cause of stomach ulcers is a bacterium known as *Helicobacter pylori (H. pylori). H. pylori* persist within the space between the gastric epithelium and mucous layer, adeptly adapting to the harsh conditions of the stomach environment. Initially colonizing the antrum, they gradually migrate towards the more proximal segments of the stomach. Peptic ulcer disease ranks among the most prevalent gastrointestinal ailments globally, impacting approximately 10% of the population. Duodenal ulcers constitute the majority, accounting for 19 out of 20 cases. In the Indian pharmaceutical sector, antacids and antiulcer medications command a significant market presence, collectively valued at 6.2 billion rupees and holding a market share of 4.5%. Additionally, ulcers can result from the excessive use of pain relievers, including aspirin and non-steroidal anti-inflammatory drugs like ibuprofen and naproxen as well as alcohol and tobacco consumption, and Zollinger–Ellison syndrome. It is generally more common in those who keep themselves in a hurry, become worry and consume curry [3]. Peptic ulcer disease is identified by the presence of inflamed lesions or erosions in the mucosal lining, compromising the protective barrier of the gastrointestinal tract. This damage to the mucous membrane of the oesophagus, stomach, and duodenum by gastric acid and pepsin leads to the development of peptic ulcers [4].

Ayurvedic medicines primarily sourced their raw materials from plants, typically in the form of crude drugs like dried herbal powders, extracts, or various mixtures of plant-based products [5]. Ayurveda, Siddha, and Unani-Tibb. are ancient healthcare practices that have thrived for centuries. In addition to these systems, diverse tribal communities in the country have a long-standing tradition of utilizing herbs for medicinal purposes [6].

In the modern era, a significant portion, around 75-80%, of the global population still relies on herbal medicine, particularly in developing nations, for basic healthcare needs. This preference is attributed to herbal remedies being more compatible with the human body and having fewer adverse side effects compared to synthetic pharmaceuticals. Preliminary



Palash Mondal, Durba Banerjee, Partha Ghorai, Shubhranil Debnath, and Nirvik Pal, "Natural Remedies in the Treatment of Peptic Ulcer: A Review," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 7, Issue 4, pp. 24-38, 2024.

screening of medicinal plants has revealed the presence of important secondary metabolites such as flavonoids and tannins, which are known for their active role in treating ulcers. Ethnomedicinal herbs documented in materia medica contain valuable information regarding their antiulcer properties. Several researchers have conducted experiments validating the efficacy of these medicinal plants in treating ulcers [7,8]. The symptoms of an ulcer are described below:

The sensation of pain is often depicted as sharp and gradually intensifying, accompanied by a burning sensation. The symptoms of ulcers can vary depending on their location. Below are some indications of peptic ulcers and duodenal ulcers.

- Discomfort may arise between the belly button and the breast bone, occasionally extending to the back.
- The duration of pain can vary from brief moments to several hours.
- Generally, a duodenal ulcer causes more intense discomfort on an empty stomach, alleviated temporarily by eating.
- In instances of a bleeding ulcer, symptoms may include vomiting or the passing of dark to black stool.
- Typically, symptoms of a peptic ulcer worsen at night or when lying down.

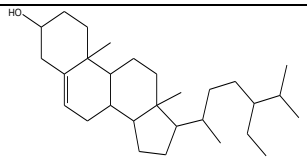
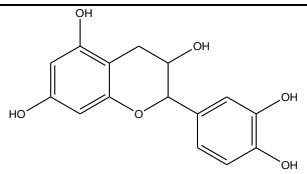
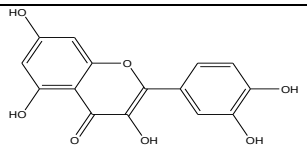
The aim of this review is to provide an extensive overview of peptic ulcers and it will cover their epidemiology, main symptoms, and clinical characteristics. The report will delve into the pathogenesis of peptic ulcers, emphasizing the role of *H. pylori* infection. It will also discuss the pharmacological treatments available for effective management, and outline the latest challenges and opportunities in this area of research. To captivate readers' attention on the topic and ensure efficient management of health-related systems, measures were taken to address the safety and security of plant-based products.

## II. Ulcer Treatment

Ayurvedic medicine has been found effective in treating ulcers, especially when used topically. It can act as a rinse for haemorrhagic ulcers and wounds if employed as a gargle. Additionally, when the tender leaves are crushed and applied as a poultice, they can help stimulate healing and act as an astringent for ulcers [9]. Recent studies have demonstrated that the utilization of *Acacia senegal* gum effectively prevented stomach ulcers in rats exposed to cold restraint stress [10]. Additionally, protective benefits against intestinal damage induced by meloxicam, along with a decrease in the activity of intestinal enzymes, were observed in research employing an aqueous extract of *A. arabica* gum [11].

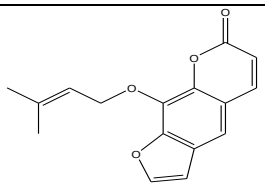
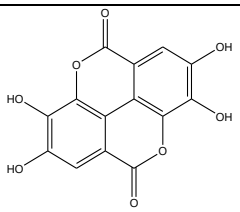
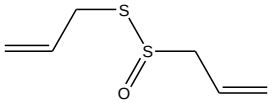
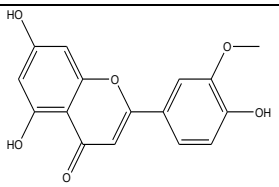
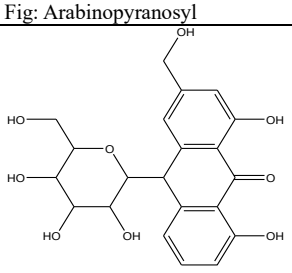
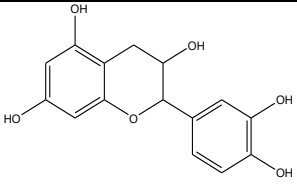
Different Plants contain different phytoconstituents which are beneficial for the treatment of ulcers as they are naturally occurring and therefore have lesser side effects. Various plants containing different phytochemical constituents that are helpful in the treatment of ulcers are displayed in Table 1.

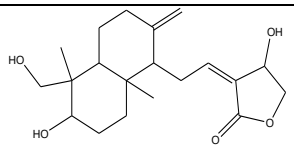
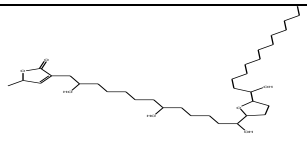
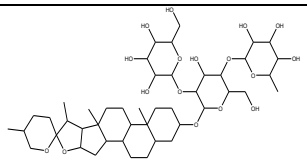
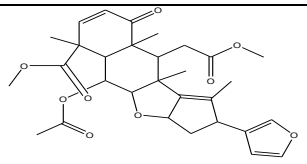
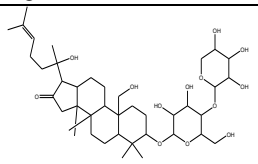
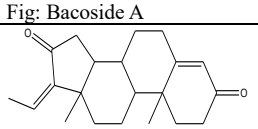
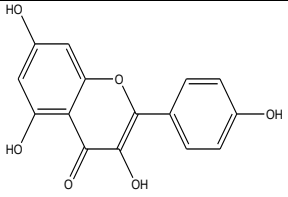
TABLE 1: Contribution of Phytochemical constituents in ulcer treatment

| S. No. | Scientific name (Common name) and family | Phytochemical constituents | Chemical Structure | Treatment | Reference |
|---|---|---|---|---|---|
| 1 | *Abutilon indicum L.* (Indian mallow)<br><br>Malvaceae | Mucilage, flavonoids, alkaloids, and polysaccharides, beta-sitosterol |  <br>Fig: Beta-Sitosterol | ❖ Anti-Ulcer Properties: Extracts have significant anti-ulcerogenic effects in preclinical studies. These effects are attributed to its ability to reduce gastric acid secretion, enhance mucosal defence mechanisms, and exhibit antioxidant properties.<br>❖ Gastroprotective Effects: bioactive compounds help to strengthen the gastric mucosal barrier, inhibit inflammatory pathways, and promote tissue repair. | [12] |
| 2 | *Acacia arabica* (Babul tree)<br><br>Leguminosae | Gum arabic acid, malic acid, catechin, kaempferol, calcium, magnesium, potassium |  <br>Fig: Catechin | Ayurvedic Medicine<br>❖ Can be utilized as a wash for haemorrhagic ulcers and wounds when used as a gargle.<br>❖ The delicate leaves, when bruised and made into a poultice, can stimulate and act as an astringent for ulcers.<br>Latest Research Findings<br>❖ *Acacia senegal* gum effectively prevented stomach ulcers in rats subjected to cold restraint stress.<br>❖ A study using an aqueous extract of *A. arabica* gum demonstrated protective effects against meloxicam-induced intestinal damage and reduced activity of intestinal enzymes. | [13,14,15] |
| 3 | *Adansonia digitata* (Baobab tree)<br><br>Malvaceae | Quercetin, phobaphenes, mucilage, tartrate, Gum, glucose, albuminous, glucoside, adansonin |  <br>Fig: Quercetin | ❖ Ayurvedic evidence supports antiulcer activity.<br>❖ The indolent syphilitic ulcer shows positive response to application of fresh juice from leaves combined with powdered ginger and fresh juice expressed from the root of Salvadora indica.<br>❖ Leaves are suitable for poultices and fomentations for irritable, inflammatory ulcers. | [16] |



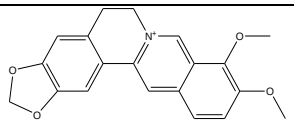
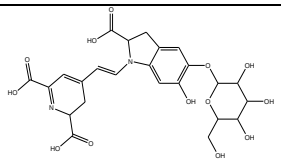
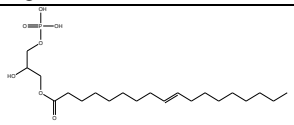
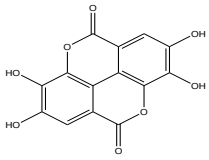
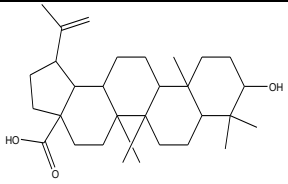
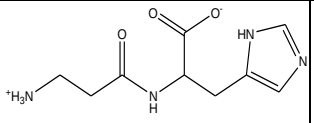
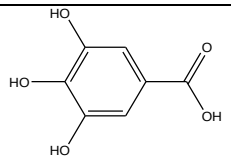
Palash Mondal, Durba Banerjee, Partha Ghorai, Shubhranil Debnath, and Nirvik Pal, "Natural Remedies in the Treatment of Peptic Ulcer: A Review," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 7, Issue 4, pp. 24-38, 2024.

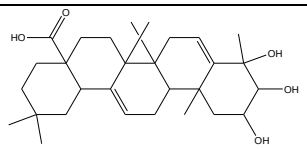
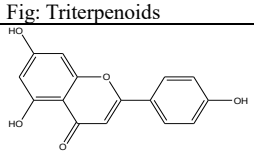
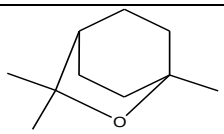
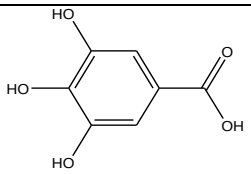
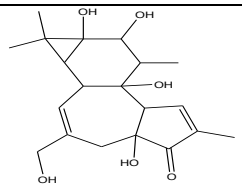
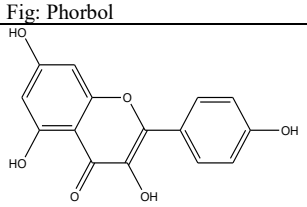
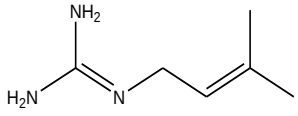
| | | | | | |
|---|---|---|---|---|---|
| 4 | *Aegel marmelos* (Bael tree)<br><br>Rutaceae | Marmelosin, flavonoids, lupeol, tannins, saponins, terpenoids, carotenoids, coumarins |  <br>Fig: Marmelosin | ❖ Traditional remedies with proven efficacy against ulcers include the use of *A. marmelos* fruit, a practice that has been employed for centuries by the Kani people residing in the Kanyakumari district of Tamil Nadu, India, for ulcer treatment.<br>❖ Recent research findings have revealed that rats with stomach ulcers induced by aspirin with pylorus ligation exhibited a significant reduction in the number of ulcer lesions after receiving a daily dose of 1 gm/kg of an aqueous extract of *A. marmelos* leaves for 21 days. | [17,18,19] |
| 5 | *Aerva persica Merrill* (Buari)<br><br>Amaranthaceae | Quercetin, aervanone, ellagic acid, kaempferol-3-galactoside, isorhamnetin-3-o-β-d-glucoside, β-cyanins |  <br>Fig: Ellagic Acid | ❖ Traditionally, it is prepared as a decoction or infusion and administered orally to treat peptic and gastric ulcers by increasing mucus secretion in the stomach and reducing gastric acid secretion, which helps protect the gastric mucosa and promote healing.<br>❖ Recent research demonstrating significant anti-ulcer activity and protective effects on the gastric lining. Studies have shown that the plant's extracts can reduce ulcer size and enhance healing, with effects comparable to standard anti-ulcer medications. | [20] |
| 6 | *Allium sativum* (Garlic)<br><br>Liliaceae | Alliin, allicin, acrid volatile oil, starch, mucilage, albumen, diallyl disulfide, diallyl trisulfide, ajoene, and sugar |  <br>Fig: Allicin | Ayurvedic Treatment for Ulcers<br>❖ Maggots in ulcers, ulcerated surfaces, and wounds can be effectively treated by applying a paste made from fried garlic and mustard or coconut oil.<br>❖ Wounds and smelly ulcers can be washed with a mixture of three or four parts garlic juice to one part regular or distilled water.<br>Latest Research Findings<br>❖ Oral extract of *A. sativum* bulb juice demonstrated protective effects in rats with stomach ulcers caused by cysteamine at doses of 250 and 500 mg/kg.<br>❖ The extract prevented experimentally induced stomach and duodenal ulcers in rats and significantly accelerated gastric ulcer healing. | [21,22] |
| 7 | *Albizia lebbeck* (Shirish)<br><br>Mimoceae | Quercetin, oleic acid, phenolic acids, cinnamic acid, flavonoids, saponins, Arabinopyranosyl chrysoeriol, hesperidin |  <br>Fig: Arabinopyranosyl | Ayurvedic Treatment for Ulcers<br>❖ Common formulations include Sirisha Churna (powder) and decoction made from the bark.<br>❖ It is often combined with honey or ghee for enhanced healing effects.<br>Latest Research Findings<br>❖ Bark and leaf extract reduce gastric acid secretion and enhance mucosal protection.<br>❖ Experimental models show its effectiveness in healing gastric ulcers and reducing inflammation. | [23] |
| 8 | *Aloe vera* (Ghritkumari)<br><br>Liliaceae | Aloin A, barbaloin, isobarbaloin, aloe emodin, emodin, vitamins, enzymes, minerals, lignin, saponins, salicylic acids, amino acids |  <br>Fig: Aloin A | Ayurvedic Treatment for Ulcers<br>❖ Traditional remedy in the United States involves locally applying leaves to persistent ulcers.<br>❖ Promising results have been observed, with ulcers healing within a few weeks, accompanied by a reduction in discomfort.<br>Latest Research Findings<br>❖ In rats with stomach ulcers induced by indomethacin:<br>❖ *Aloe vera* powder combined with gum acacia at a dosage of 200 mg/kg demonstrated effectiveness.<br>❖ Compared to the control group, the extract exhibited significant antiulcer activity. | [24,25] |
| 9 | *Ananas comosus* (Pineapple)<br><br>Bromeliaceae | Gallic acid, syringic acid, vanillin, ferulic acid, sinapic acid, epicatechin, ellagic acid, ferulic acid, chlorogenic acid |  <br>Fig: Epicatechin | ❖ The dichloromethane extract of pineapple demonstrates gastroprotective properties in mice and rats, shielding the gastric mucosa from injuries induced by various factors including 0.3 M HCl, absolute ethanol, non-steroidal anti-inflammatory drugs, and pylorus ligation.<br>❖ This protective action is attributed to the presence of sulfhydryl groups in the dichloromethane extract. Furthermore, bromelain a compound found | [26,27] |

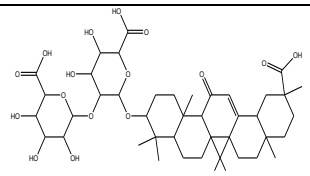
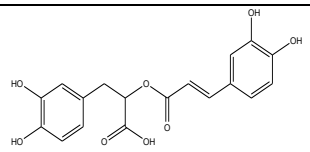
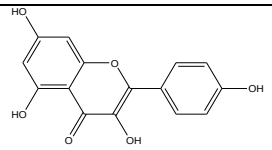
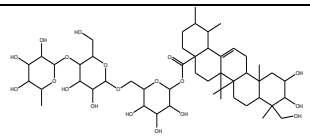
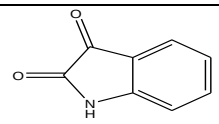
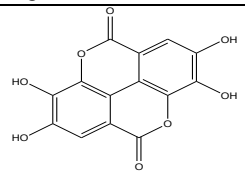
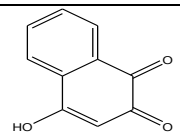
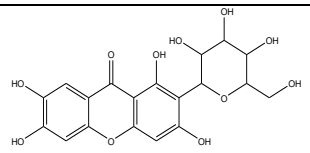
| | | | | | |
|---|---|---|---|---|---|
| | | | | in pineapple, exhibits wound healing abilities in a guinea pig ischemic ulcer model. | |
| 10 | *Andrographis paniculata* (Kalmegh)<br><br>Acanthaceae | Andrographolide, neoandrographolide, dehydroandrographolide, Flavonoids, polyphenols |  <br>Fig: Andrographolide | Ayurvedic Treatment for Ulcers<br>❖ It possesses anti-inflammatory, anti-ulcer, and antioxidant properties.<br>Recent research confirms its effectiveness in reducing ulcer size and promoting tissue repair.<br>❖ Mechanisms include inhibition of gastric acid secretion and enhancement of mucosal defense.<br>❖ Its anti-inflammatory properties help alleviate gastrointestinal inflammation. | [28] |
| 11 | *Annona squamosa* (Custard apple)<br><br>Annonaceae | Alkaloids, annonacin, flavonoids, saponins, tannic acid |  <br>Fig: Annonacin | ❖ Ayurvedic medicine effectively treats unhealthy ulcers using a paste derived from ground leaves.<br>❖ Recent studies indicate that a water extract of leaves can prevent stomach ulcers induced by pylorus ligation and ethanol in rats.<br>❖ Tannic acid is a key component within these Ayurvedic remedies known for its dynamic properties in ulcer treatment. | [29,30] |
| 12 | *Asparagus racemosus* (Shatavari)<br><br>Liliaceae | Shatavarin IV, asparagamine, racemosol, mucilage, essential oils, arginine, tyrosine, flavonoids, resin, tannin |  <br>Fig: Shatavarin IV | Ayurvedic Treatment for Ulcers<br>❖ Renowned in Ayurveda for gastroprotective properties.<br>❖ Balances stomach acid and reduces inflammation.<br>❖ Promotes healing of the mucosal lining and enhances gastric mucus production.<br>Latest Research Findings<br>❖ Studies confirm a significant reduction in ulcer severity.<br>❖ Extracts shown to lower gastric acid secretion.<br>Increases mucus production, protecting the stomach lining. | [31] |
| 13 | *Azadirachta indica* (Neem)<br><br>Meliaceae | Nimbin, nimbidin, Azadirachtin, margolone, margolonone, phenolic chemicals, saponin, flavonoids |  <br>Fig: Nimbin | Ayurvedic Treatment for Ulcers<br>❖ Ulcers and unhealthy ulcerations show significant improvement with a poultice made from a combination of leaves and sesame seeds.<br>Latest Research Findings<br>❖ Gastric ulcers induced by pylorus ligation and cold restraint stress were prevented in rats through the administration of an extract derived from *A. indica* leaves. | [32,33,34] |
| 14 | *Bacopa moniera* (Brahmi shak)<br><br>Scrophulariaceae | Bacoside a, saponins (bacosides), betulinic acid, d-mannitol, β-stigmasterol, stigmastanol |  <br>Fig: Bacoside A | ❖ Bacopa monnieri is employed in traditional medicine for treating ulcers.<br>❖ The use of Bacopa monnieri has shown promise in alleviating ulcer symptoms and promoting healing.<br>❖ Research suggests that *Bacopa monnieri* may exert its anti-ulcer effects through various mechanisms, such as reducing gastric acidity and enhancing mucosal protection. | [35,36] |
| 15 | *Balsamodendron mukul* (Gum-gugul)<br><br>Burseraceae | Guggulsterone, volatile oil, gum-resin, di- and triterpenoids |  <br>Fig: Guggulsterone | ❖ Mild ulcers can be managed using a combination of guggul gum mixed with lime juice or coconut oil, applied topically as a lotion or plaster.<br>❖ Severe ulcers require treatment with an ointment comprising *B. pubescens* gum, sulphur, catechu, and borax sourced from Sind, Karachi, and Baluchistan. | [37] |
| 16 | *Bauhinia variegate* (Orchid tree)<br><br>Caesalpiniaceae | Quercetin, kaempferol rutin, tannic acid, apigenin, apigenin 7-0-glucoside |  <br>Fig: Kaempferol | Ayurvedic Treatment for Ulcers<br>❖ Prepare a wash by mixing *Bauhinia variegate* bark with various spices and apply to ulcers.<br>❖ Create pills by mixing the powdered mixture with guggula.<br>❖ Take half a tola of the pill with a decoction of Sphaeranthus mollis, Triphala, or catechu in the morning.<br>Latest Research Findings<br>❖ Oral administration of extracts from *Bauhinia variegate* root protected rats from stomach ulcers induced by various factors.<br>❖ The extract reduced gastric acid output and protected the gastric mucosa. | [38,39] |



Palash Mondal, Durba Banerjee, Partha Ghorai, Shubhranil Debnath, and Nirvik Pal, "Natural Remedies in the Treatment of Peptic Ulcer: A Review," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 7, Issue 4, pp. 24-38, 2024.

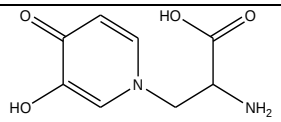
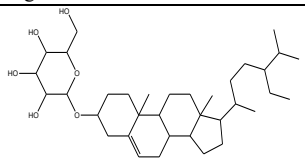
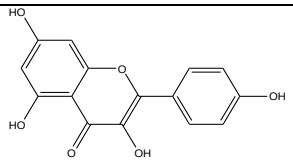
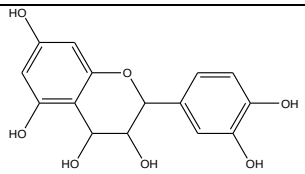
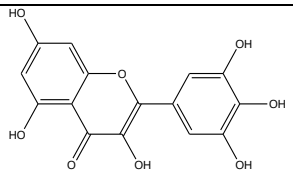
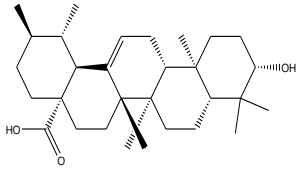
| | | | | | |
|---|---|---|---|---|---|
| 17 | *Berberis aristata* (Barberry)<br><br>Berberidaceae | Berberine, oxyberberine, berbamine, aromoline, karachine, |  <br>Fig: Berberine | Ayurvedic Treatment for Ulcers<br>❖ Rasaut, derived from the root, possesses crude extract known for its efficacy.<br>❖ Combination of bark with honey serves as an effective topical application for treating skin ulcerations.<br>❖ It helps treat ulcers by inhibiting *Helicobacter pylori* and promoting mucosal healing. | [40] |
| 18 | *Beta vulgaris* (Beetroot)<br><br>Chenopodiaceae | Beetin, betanin, betacyanins, betaxanthins, ellagic acid, pyrogallol, salicylic acid, protocatchuic acid, chlorogenic acid, |  <br>Fig: Betanin | ❖ A root infusion combined with a small amount of vinegar is highly effective for treating various types of ulcers and persistent sores.<br>❖ Ayurvedic tradition recognizes the antiulcer activity of this treatment method.<br>❖ Its extract significantly mitigates ethanol-induced gastric ulcers in rats, demonstrating both biochemical and histopathological protection of gastric tissue | [41] |
| 19 | Brassica oleraceae (Cabbage)<br><br>Brassicaceae | Tannins, saponins, glycosides, terpenoids, flavonoids, lysophosphatidic acid |  <br>Fig: Lysophosphatidic acid | ❖ The aqueous extract of Brassica oleracea has been utilized for treating gastric disorders such as ulcers in Wistar rats at doses of 0.250, 0.50, and 1.0 mg/kg.<br>❖ It contains a chemical called Lysophosphatidic acid (LPA), a lipid mediator involved in various physiological processes, including wound healing. This phospholipid demonstrates anti-ulcerogenic activity. | [42,43] |
| 20 | *Buchanania lanzan* (Chironji)<br><br>Anacardiaceae | Ellagic acid, celidoniol, vomicine, saponins, coumarins, glycosides, flavonoids, and tannins |  <br>Fig: Ellagic acid | Ayurvedic Treatment for Ulcers<br>❖ Used to treat ulcers due to its anti-inflammatory and gastroprotective properties.<br>❖ Seeds and leaves help soothe stomach mucous membranes and promote healing.<br>Latest Research Findings<br>❖ Exhibits strong antioxidant activity, reducing oxidative stress linked to ulcers.<br>❖ It reduced ulcer index and improved mucosal defence. | [44] |
| 21 | *Careya arborea* (Kamber)<br><br>Myrtaceae | Betulinic acid, terpenoids, flavonoids (quercetin), alkaloids, saponins, tannins |  <br>Fig: Betulinic acid | Ayurvedic Treatment for Ulcers<br>❖ Pulverized leaves applied topically as a poultice three to four times daily have been found to expedite the healing process of chronic sores.<br>Latest Research Findings<br>❖ Rats were administered 300 and 600 mg/kg doses of a *C. arborea* stem bark extract in ethanol for five consecutive days to mitigate the adverse effects induced by ethanol, cold restraint stress, and pylorus ligation-induced ulcer models.<br>❖ The extract significantly healed gastric ulcers compared to the control group over a five-day treatment period. | [45,46] |
| 22 | *Carica papaya* (Papaya)<br><br>Caricaceae | Papain, chymopapain, pectin, carposide, carpaine, carotenoids, antheraxanthin |  <br>Fig: Papain | Ayurvedic Treatment for Ulcers<br>❖ Cooked unripe fruit treats indolent ulcers.<br>❖ Provides protective effects against stomach ulcers.<br>Latest Research Findings:<br>❖ Oral administration of 50 and 100 mg/kg water-diluted *Carica papaya* seed extract protects rats from ethanol-induced stomach ulcers.<br>❖ Prevents damage to the stomach lining.<br>❖ Reduces gastric juice production and acidity. | [47,48,49] |
| 23 | *Ceratonia siliqua* (Carob)<br><br>Fabaceae | Carbohydrates, gallic acid, polyphenolic compounds, especially tannin, dietary fibers, minerals |  <br>Fig: Gallic acid | ❖ Carob has demonstrated effectiveness in reducing gastroesophageal reflux and vomiting in infants. This benefit is largely attributed to its high flavonoid content. The flavonoids in carob provide gastroprotective and antioxidant properties, which are crucial in mitigating reflux symptoms.<br>❖ Additionally, carob's demulcent properties help soothe and protect the mucous membranes of the gastrointestinal tract. | [50] |

| | | | | | |
|---|---|---|---|---|---|
| 24 | *Cordial sebestena* L. (Raktarag)<br><br>Boraginaceae | Alkaloids, flavonoids phenols, saponin, tannins, triterpenoids, coumarins, |  <br>Fig: Triterpenoids | ❖ It is used in Ayurvedic medicine, is believed to have anti-ulcer properties.<br>❖ Recent studies indicate its potential to soothe gastric irritation and promote ulcer healing.<br>❖ However, further research is needed to confirm its efficacy and safety for ulcer treatment.<br>❖ It helps in ulcer management by promoting mucosal healing and reducing gastric acidity. | [51] |
| 25 | *Cynodon dactylon* (Durva grass)<br><br>Poaceae | Apigenin, β-sitosterol, β-carotene, palmitic acid, triterpenoids, ergonovine, |  <br>Fig: Apigenin | ❖ It has been substantiated for its antiulcer activity in albino rats when administered at varying doses of 200, 400, and 600 mg per kg.<br>❖ Analysis of the herb revealed the presence of flavonoids, particularly in its alcoholic extract. Flavonoids are believed to be the key constituents responsible for the observed antiulcer properties of the herb. | [50] |
| 26 | *Elettaria cardamomum* (Elach)<br><br>Zingiberaceae | 1, 8 cineole, α-terpineol, myrcene, limonene, menthone, β-phellandrene, α-terpinyl acetate |  <br>Fig: 1, 8 Cineole | Ayurvedic Treatment for Ulcers<br>❖ Rich in antioxidants and anti-inflammatory compounds.<br>❖ Supports digestion and soothes the gastrointestinal tract.<br>❖ Balances stomach acidity and aids in ulcer healing.<br>Latest Research Findings<br>❖ Active compounds inhibit acid secretion and enhance mucosal defense.<br>❖ Cardamom strengthens the stomach lining and reduces oxidative stress, offering a natural remedy for ulcers. | [52] |
| 27 | *Emblica officinalis* (Amlaki)<br><br>Euphorbiaceae | Gallic acid, chebulic acid, ellagic acid, kaempferol, gallo tannin, rutin, phosphoric acid, linoleic acid, oleic acid, stearic acid, palmitic acid, |  <br>Fig: Gallic acid | Ayurvedic Treatment for Ulcers<br>❖ *Emblica officinalis*, is valued in Ayurvedic medicine for its digestive benefits and anti-inflammatory properties, deemed effective in ulcer treatment.<br>Latest Research Findings<br>❖ Various studies confirm its anti-ulcerogenic effects, including mucosal defense enhancement, reduced gastric acid secretion, and inhibition of ulcer-causing bacteria growth, endorsing its use in Ayurvedic formulations for ulcer management. | [53] |
| 28 | *Euphorbia neriifolia* (Common milk hedge)<br><br>Euphorbiaceae | Euphorbon, phorbol, resin, gum, caoutchouc, calcium malate |  <br>Fig: Phorbol | Ayurvedic Treatment for Ulcers<br>❖ Individuals with severe ulcers and scabies frequently use a combination of plant juice and clarified or fresh butter.<br>❖ This traditional remedy offers relief from these conditions.<br>❖ Bioactive compound exhibits significant anti-inflammatory properties, which can contribute to ulcer healing by reducing inflammation and promoting tissue repair | [54] |
| 29 | *Ficus religiosa* (Asbattha)<br><br>Moraceae | Kaempferol, tannins, steroids, flavonoids, β-sitosteryl-d-glucoside, n-octacosanol, lanosterol, stigmasterol, lupen-3-one |  <br>Fig: Kaempferol | ❖ Ayurvedic remedy for ulcers involves using infusions or decoctions of bark sweetened with honey.<br>❖ Recent research indicates that *Ficus religiosa* hydroalcoholic extract leaves, administered orally at doses of 250 and 500 mg/kg, significantly reduce stomach ulcers induced by 100% ethanol, aspirin, and pylorus ligation in rats.<br>❖ The extract contains flavonoids, saponins, and tannins, which are bioactive compounds known for their beneficial biological effects. | [55,56,57] |
| 30 | *Galega purpurea* (Jangli neel)<br><br>Papilionaceae | Galegine, flavones, flavanones, chalcones, rotenoids |  <br>Fig: Galegine | ❖ Ayurvedic Ulcer Treatment<br>❖ Brew a decoction of *Galega purpurea* leaves and consume regularly.<br>❖ Incorporate *Galega purpurea* extract into your diet as a supplement.<br>❖ Create a poultice using crushed *Galega purpurea* leaves and apply it externally to affected areas. | [58] |

| | | | | | |
|---|---|---|---|---|---|
| 31 | *Glycyrrhiza glabra* (Liquorice)<br><br>Leguminosae | Glycyrrhizin, glycyrrhetic acid, liquiritin, isoliquiritin, liqcoumarin, glabrocoumarone a and b, herniarin, umbelliferone |  <br>Fig: Glycyrrhizin | ❖ Study suggests this substance aids in healing ulcers caused by alcohol. It appears to work in two ways: by reducing stomach acid production and by stimulating the stomach to produce a thicker protective mucus layer.<br>❖ This mucus coating shields the stomach lining from ulcers. Additionally, the substance may increase the local levels of prostaglandins, which are themselves known to promote mucus secretion and cell growth in the stomach, further aiding in healing. | [59,60] |
| 32 | *Heliotropium indicum* (Hatisura)<br><br>Boraginaceae | Pyrrolizidine alkaloids, rosmarinic acid, tannins, saponins, steroids, oils, terpenoids, flavonoids, glycosides, |  <br>Fig: Rosmarinic acid | ❖ *Heliotropium indicum*, used in Ayurvedic medicine, treats ulcers due to anti-inflammatory properties.<br>❖ Ayurvedic formulations utilize various plant parts for gastrointestinal health.<br>❖ Recent studies confirm its antiulcerogenic and antioxidant effects.<br>❖ Phytochemical analysis identifies key compounds enhancing its therapeutic potential.<br>❖ Integration of traditional and modern approaches shows promise for ulcer treatment. | [61] |
| 33 | *Hibiscus rosa-sinensis* (Joba tree)<br><br>Malvaceae | Flavonoids, Anthocyanins, quercetin, cyanidin, kaempferol, Hydrocitric acid |  <br>Fig: Kaempferol | ❖ Traditional Medicines with Anti-ulcer Properties: Historically, among the Kani people in the Kanyakumari district of Tamil Nadu, India, *H. rosa sinensis* root has been used to treat ulcers.<br>❖ Recent research has shown that both aqueous and alcohol extracts of *H. rosa sinensis* roots demonstrated significant antiulcer efficacy in rats with pylorus ligation, particularly at dosages of 250 and 500 mg/kg. | [62,63] |
| 34 | *Hydrocotyle asiatica* (Thankuni Pata)<br><br>Umbelliferae | Vellarin, asiaticoside, aromatic material, gum,<br>Sugar, tannin, albuminous debris |  <br>Fig: Asiaticoside | Ayurvedic Treatment for Ulcers<br>❖ Dosage: Consume 3–5 grains of the powder three times daily.<br>❖ Topical Application: Apply a light dusting of the powder directly onto the ulcers.<br>❖ Poultice: Create a poultice using fresh leaves for application on the affected areas.<br>❖ Recent research indicates that it exhibits anti-ulcer activity, potentially promoting ulcer healing. | [64] |
| 35 | *Indigofera tinctoria* (Real indigo)<br><br>Papilionaceae | Indican (a glucoside), the oxidised form of luc-indigo, indigo-white, isatin |  <br>Fig: Isatin | Ayurvedic Treatment for Ulcers<br>❖ Crushed leaves are utilized topically for addressing various skin conditions like eczema, psoriasis, and speeding up the healing process of cuts, scrapes, and ulcers.<br>❖ Indigo powder is also applied externally specifically for treating ulcers. | [65] |
| 36 | *Lafoensia pacari* (Pacari)<br><br>Lytraceae | Ellagic acid, punicalagin, punicalin, kaempferol, quercetin-3-o-rhamnopyranoside |  <br>Fig: Ellagic Acid | Ayurvedic Treatment for Ulcers<br>❖ It is used in Ayurvedic medicine for ulcer treatment due to its anti-ulcerogenic properties.<br>❖ Pacari is believed to possess anti-inflammatory, antioxidant, and mucosal healing properties.<br>❖ Recent research confirms its traditional uses and explores its potential as a gastroprotective agent.<br>❖ Preliminary studies suggest pacari extracts modulate biochemical pathways involved in ulcer formation and healing. | [66] |
| 37 | *Lawsonia alba* (Henna)<br><br>Lythraceae | Hanno, a tannin called tannic acid, and an olive-green resin, lawsone |  <br>Fig: Lawsone | ❖ Ayurvedic medicine has demonstrated efficacy in combating stomach ulcers.<br>❖ Wounds and ulcers are effectively treated with an ointment crafted from the leaves.<br>❖ It exhibits significant anti-ulcer activity by reducing gastric acid secretion and protecting the gastric mucosa, as demonstrated in aspirin-induced ulcer models in rats | [67] |
| 38 | *Mangifera indica* (Mango tree)<br><br>Anacardiaceae | Mangiferin, alkaloids, sterols, saponins, tannins, and flavonoids |  | Ayurvedic Treatment for Ulcers<br>❖ Leaf extracts were dissolved in rice bran oil and ingested orally, as per traditional usage for ulcer treatment.<br>Latest Research Findings | [68,69] |

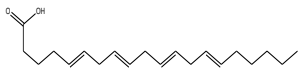
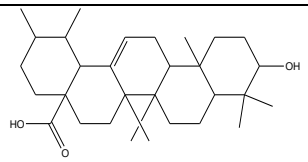
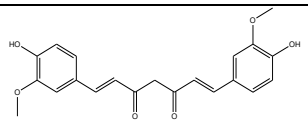
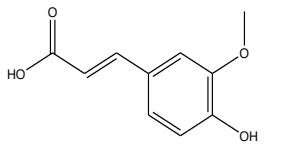
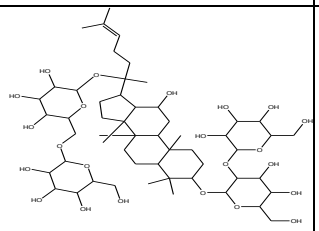
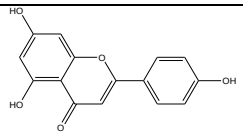
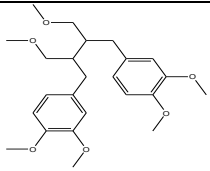


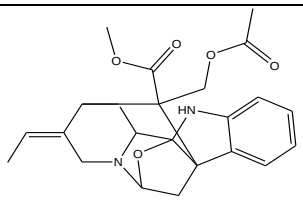
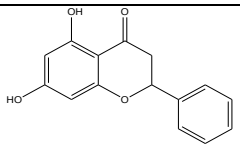
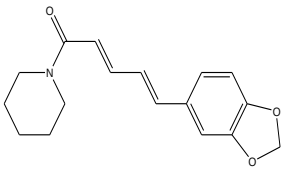
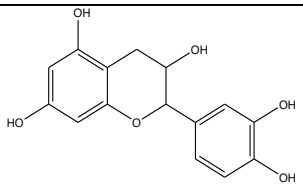
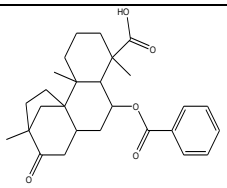
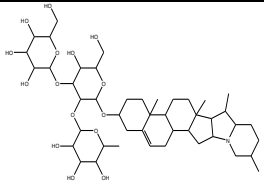
Palash Mondal, Durba Banerjee, Partha Ghorai, Shubhranil Debnath, and Nirvik Pal, "Natural Remedies in the Treatment of Peptic Ulcer: A Review," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 7, Issue 4, pp. 24-38, 2024.

| | | | | | |
|---|---|---|---|---|---|
| | | | Fig: Mangiferin | ❖ Rats with stomach lesions were administered flower decoction orally in doses of 250, 500, and 1000 mg/kg in a dose-dependent manner.<br>❖ The extract significantly reduced both the quantity and acidity of gastric juice. | |
| 39 | *Mimosa pudica* (Lajjabati)<br><br>Fabaceae | Flavonoids, alkaloid, mimosine Naringin, saponins, tannins, mucilage, cellulose |  <br>Fig: Mimosine | ❖ Fresh leaves and seeds decoction is recommended in Ayurvedic medicine for treating intestinal ulcers.<br>❖ Recent research indicates that the ethanolic extract of *Mimosa pudica* leaves serves as a natural antioxidant, potentially aiding in ulcer treatment.<br>❖ The antiulcer effects of *Mimosa pudica* extract were found to vary depending on the dosage. | [70,71] |
| 40 | *Momordica Charantia* (Karala)<br><br>Cucurbitaceae | Charantin, triterpenoids, saponins, polypeptides, flavonoids, alkaloids, sterols |  <br>Fig: Charantin | Ayurvedic Treatment for Ulcers<br>❖ Whole plant powder combined with cinnamon, long pepper, rice, and chaulmoogra oil effectively treats malignant ulcers.<br>❖ This combination also accelerates healing of stubborn ulcers and wounds when applied topically.<br>Latest Research Findings<br>❖ Alcoholic extract of *M. charantia* fruit at 200 mg/kg and aqueous extract at 400 mg/kg doses effectively treat ulcers caused by pylorus ligation, aspirin, and stress in rats. | [72] |
| 41 | *Moringa oleifera* (Drum-stick)<br><br>Moringaceae | Alkaloids, flavonoids, saponin, tannins, zeatin, quercetin, kaempferol, terpenoids |  <br>Fig: Kaempferol | Ayurvedic Treatment for Ulcers<br>❖ Traditional medicine recognizes plant parts for healing properties.<br>❖ Kani tribe in Tamil Nadu uses leaf tea for stomach ulcers.<br>Latest research findings<br>❖ Oral intake of ethanol extract from *M. oleifera* leaves at doses of 125, 250, and 500 mg/kg demonstrated protective effects in rat's stomach, effectively preventing the development of gastric ulcers.<br>❖ The extract also notably reduced ulcer formation and acid pepsin secretion in the treated subjects. | [73,74] |
| 42 | *Musa sapientum* (Kela)<br><br>Musaceae | Alkaloids, flavonoids, leucocyanidin, steroids, glycosides, saponins, phenols, tannin, heamaglutinin, phytate, |  <br>Fig: Leucocyanidin | ❖ Musa, administered at a dosage of 100 mg/kg, was investigated for its antiulcer properties and mucosal defensive factors in rats with Non-Insulin Dependent Diabetes Mellitus (NIDDM).<br>❖ The anti-ulcerogenic effects of Musa are likely attributed to its dual action of reducing secretion and providing cytoprotective activity. It acts as a mucoadhesive agent, forming a protective lining in the stomach and duodenum, shielding them from the corrosive effects of acid and pepsin. | [75,76] |
| 43 | *Myrica nagi* (bay-berry)<br><br>Myricaceae | Tannin, myricotin, myricetin, saccharine matter, and salts |  <br>Fig: Myricetin | ❖ Scrofula ulcers can be managed using a poultice prepared by crushing the bark, boiling it in water, and mixing Indian meal until achieving the desired thickness (known as Tukina).<br>❖ Myrtle wax, obtained from boiled fruit, is topically applied for ulcer healing.<br>❖ Methanolic extracts of its fruit were found to substantially reduce gastric lesions and acidity in animal models, showing promising potential for both ulcer prevention and healing. | [77] |
| 44 | *Myrtus communis* (myrtle)<br><br>Myrtaceae | Essential volatile oil (oil of myrtle), ursolic acid, resin, tannin, citric acid, malic acid, and sugar |  <br>Fig: Ursolic acid | Ayurvedic Treatment for Ulcers<br>❖ Application of leaf powder on wounds and ulcers is a traditional method for pain relief and infection control.<br>❖ Myrtle berry infusions are employed for treating stomach and intestinal ulcers due to their carminative properties.<br>Latest research findings<br>❖ In a rat model with excision wounds, a topical application of *M. communis* at low concentrations demonstrated efficacy in wound healing.<br>❖ *M. communis* fruits were found to protect against gastric ulcers induced by ethanol, indomethacin, and pylorus ligation in rats by reducing stomach | [78,79,80] |



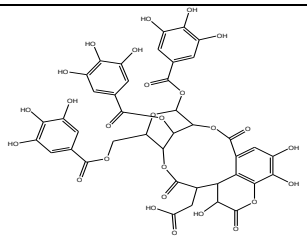
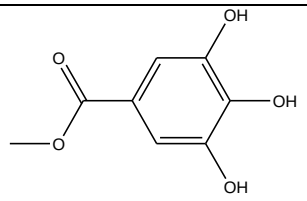
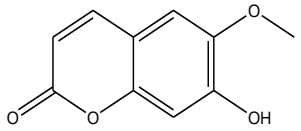
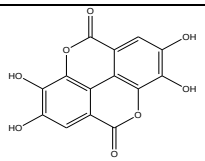
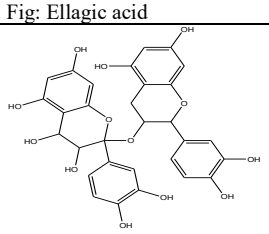
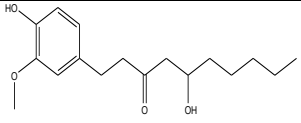
Palash Mondal, Durba Banerjee, Partha Ghorai, Shubhranil Debnath, and Nirvik Pal, "Natural Remedies in the Treatment of Peptic Ulcer: A Review," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 7, Issue 4, pp. 24-38, 2024.

| | | | | | |
|---|---|---|---|---|---|
| | | | | secretion and acidity while enhancing the mucosal barrier. | |
| 45 | *Nigella sativa* L. (Kalojira)<br><br>Ranunculaceae | Arachidonic acid, beta-sitosterol, cycloeucalenol, linoleic, linolenic, oleic, palmitic, stearic and myristic acid |  <br>Fig: Arachidonic acid, | ❖ It is used in Ayurvedic medicine, treats ulcers for its anti-inflammatory and antimicrobial qualities.<br>❖ It's recommended by Ayurvedic practitioners for gastric ulcer relief and digestive health.<br>❖ Recent studies show it reduces gastric acid, enhances mucosal protection, and inhibits Helicobacter pylori.<br>❖ Antioxidants heal ulcers by reducing inflammation. | [81] |
| 46 | *Ocimum sanctum* (Holy basil)<br><br>Lamiaceae | Fixed oil, eugenol, ursolic acid, alkaloids, tannins, saponins, flavonoids, sterols |  <br>Fig: Ursolic acid | ❖ Ayurvedic herbs like Tulsi possess antiulcer properties, widely utilized in Indian traditional medicine.<br>❖ Tulsi, or Holy Basil, is extensively used in India for various ailments and is documented in Indian materia medica.<br>❖ Recent research reveals that intraperitoneal administration of 1, 2, and 3 mL/kg of *Ocimum sanctum* fixed oil to rats with ulcers induced by aspirin, indomethacin, alcohol, and stress resulted in a dose-dependent decrease in the ulcer index. | [82,83] |
| 47 | *Odina wodier* (Jiyal)<br><br>Anacardiaceae | Tannin and ash containing potassium carbonate, curcumin, alkaloids, flavonoids, steroids |  <br>Fig: Curcumin | ❖ Certain Ayurvedic herbs exhibit antiulcer properties.<br>❖ Fresh juice extracted from the bark has shown effectiveness in treating persistent ulcers.<br>❖ Chronic ulcers can be managed by applying a paste comprising bark powder and neem oil.<br>❖ Leprous ulcers are addressed through the application of a paste made from powdered bark. | [84] |
| 48 | *Oryza sativa* (Rice)<br><br>Gramineae | Carbohydrate, starch, ferulic acid, amylose, and amylopectin. The rice grain constitutes 12% water, 75%–80% starch and only 7% protein |  <br>Fig: Ferulic acid | Ayurvedic Treatment for Ulcers<br>❖ Rice gruel, prepared with rice powder boiled in water, salt, and lemon, soothes stomach irritation and inflammation.<br>❖ Schnabel's study in the American Journal of Medical Science highlights successful ulcer treatment using a rice-water mixture, particularly for gastric ulcers.<br>Latest Research Findings:<br>❖ Oral dose of 1ml/day for four days of *Oryza sativa* bran extract (rice bran oil) prevents ulcers induced by swimming stress and pylorus ligation.<br>❖ The extract reduces stomach acid secretion at rest, showing promise in ulcer management. | [85,86] |
| 49 | *Panax ginseng* (ginseng)<br><br>Araliaceae | Saponins, ginsenoside rb1, polysaccharides, ginsenosides, amino acids, polyacetylenes, sterols, |  <br>Fig: ginsenoside Rb1 | ❖ Korean red ginseng exhibits a healing effect on gastric ulcers in mice when administered orally at doses of 30, 100, and 300 mg/kg, one hour before ulcer induction.<br>❖ The mechanism behind this effect involves a notable increase in mucin secretion and the inhibition of malondialdehyde (MDA) and $H^+/K^+$ ATPase activity in the stomach.<br>❖ Recent studies reveal that *Panax ginseng*, particularly its polysaccharides and ginsenosides, effectively protects against gastric ulcers by reducing inflammation, oxidative stress, and promoting mucosal healing. | [87] |
| 50 | *Peucedanum Grandis* (Wild carrot)<br><br>Umbelliferae | Coumarins, apigenin, flavonoids, terpenoids, phenolic compounds |  <br>Fig: Apigenin | ❖ Ayurvedic remedy for ulcers involves the use of fennel seeds.<br>❖ Fennel seeds are consumed in the form of a 1 in 10 fruit infusion.<br>❖ The recommended dosage ranges from 1/2 to 1 ounce.<br>❖ It is used for treating carminative, stomach, and intestinal diseases, among other ailments. | [88] |
| 51 | *Phyllanthus Niruri* (Stonebreaker)<br><br>Euphorbiaceae | Alkaloids, phyllanthin, Saponins, tannins, flavonoids, sugars, glycoside |  | Ayurvedic Medications with Antiulcer Effects:<br>❖ Poultices from the whole plant, prepared by pounding the root and mixing it with rice water, are applied to ulcers.<br>❖ Recent research has demonstrated that oral administration of a methanolic extract of *P. niruri's* aerial parts at a dosage of 400 mg/kg significantly | [89,90] |

| | | | | | |
|---|---|---|---|---|---|
| | | | Fig: Phyllanthin | reduced ulcer formation induced by indomethacin in rats. | |
| 52 | *Picralima nitida* (Akuamma) Apocyanaceae | Picraline, glycosides, alkaloids, triterpenes flavonoids, polyphenols, saponins, tannins |  Fig: Picraline | Ayurvedic Treatment for Ulcers<br>❖ Powdered seeds mixed with honey or ghee.<br>❖ Taken orally to reduce pain, inflammation, and promote healing.<br>❖ Stimulates digestive enzymes and improves gastrointestinal health.<br>Latest Research Findings<br>❖ Studies confirm anti-ulcerogenic properties.<br>❖ Reduces gastric acid, increases mucosal defense, accelerates healing.<br>❖ Potential natural therapeutic agent for ulcers. | [91] |
| 53 | *Pinus longifolia* (long-leaved pine)<br><br>Coniferae | Turpentine, pinene, volatile oil of turpentine, pinocembrin, Limonene, colophony or resin |  Fig: Pinocembrin | ❖ Ayurvedic treatment methods have demonstrated effectiveness in combatting acid reflux and ulcers.<br>❖ Both external and internal burns, including ulcers, can benefit from the application of wood to alleviate pain and regulate the temperature of the affected region.<br>❖ Wood is a source of adhesive substances that can be applied to ulcers to expedite the healing process. | [92] |
| 54 | *Piper aleyreanum* (Paninixpu)<br><br>Piperaceae | Piperine, β-caryophyllene, isocaryophyllene B-pinene, Caryophyllene oxide, spathulenol, camphene, β-elemene, pinocarvone |  Fig: Piperine | Ayurvedic Treatment for Ulcers<br>❖ Traditionally, leaves or roots are ground into a paste or powder and combined with liquorice and Indian gooseberry, administered orally or topically for anti-inflammatory and mucosal protective effects.<br>Latest Research Findings<br>❖ The bioactive compounds demonstrate significant anti-ulcerogenic activity, aiding gastric mucosal defense and potentially managing Helicobacter pylori infections, supporting its integration into modern ulcer treatment approaches | [93] |
| 55 | *Pithecellobium dulce* (Dekhani babul)<br><br>Fabaceae | Catechin, steroid, saponin, lipids, phospholipids, glycosides, glycolipids, polysaccharides |  Fig: Catechin | Ayurvedic Treatment for Ulcers<br>❖ Grinding dried seeds of *Pithecellobium dulce* into a powder.<br>❖ Powder mixed with honey or ghee to create a paste.<br>❖ Decoctions made from bark or leaves used internally to support digestive health and alleviate ulcer symptoms.<br>Latest Research Findings<br>❖ bioactive compounds exhibit anti-inflammatory, antimicrobial, and antioxidant properties.<br>❖ Experimental studies show potential for promoting wound healing and reducing gastric ulcer formation in rats. | [94] |
| 56 | *Scoparia dulcis* (Sweet-broom)<br><br>Scrophulariaceae | Scopadulcic acid b, flavonoids, alkaloids, triterpenoids |  Fig: Scopadulcic acid B | Ayurvedic Treatment for Ulcers<br>❖ Decoctions made from the whole plant or its parts.<br>❖ Anti-inflammatory and wound-healing properties for ulcer relief.<br>Latest Research Findings<br>❖ Actions include reducing gastric acidity and inflammation.<br>❖ Clinical trials support symptom relief, healing, and prevention.<br>❖ Antioxidant properties protect gastric mucosa. | [95] |
| 57 | *Solanum nigrum* (Potato)<br><br>Solanaceae | Solanine, flavonoids, coumarin, lignin, glycoproteins, m coumarins, phytosterols, gentisic acid, luteolin, apigenin, kaempferol, anthocyanidin |  Fig: solanine | ❖ Employed in Ayurvedic formulations as a decoction or paste for ulcer relief.<br>❖ Traditional belief in its anti-inflammatory and gastroprotective properties.<br>❖ *Solanum nigrum* demonstrates both antiulcerogenic and ulcer-healing properties. Its antiulcer activity involves inhibiting acid secretion by blocking the H+/K+ ATPase and reducing gastrin hormone secretion.<br>❖ Latest Research indicates its potential to reduce gastric acidity and inflammation. | [96] |



Palash Mondal, Durba Banerjee, Partha Ghorai, Shubhranil Debnath, and Nirvik Pal, "Natural Remedies in the Treatment of Peptic Ulcer: A Review," *International Research Journal of Pharmacy and Medical Sciences (IRJPMS)*, Volume 7, Issue 4, pp. 24-38, 2024.

| | | | | | |
|---|---|---|---|---|---|
| 58 | *Terminalia chebula* (Haritaki)<br><br>Combretaceae | Tannins, gallic acid, sorbitol, chebulinic acid, ellagic acid, anthraquinones corilagin, galloyl glucose, punicalagin, terflavin A, maslinic acid |  <br>Fig: Chebulinic acid | ❖ Haritaki, is a key component of Ayurvedic remedy "Triphala," revered for its ulcer-healing prowess.<br>❖ Its anti-ulcer actions involve reducing inflammation, boosting mucus secretion, and inhibiting *Helicobacter pylori* growth.<br>❖ Recent studies validate its antioxidant, anti-inflammatory, and ulcer-preventing effects.<br>❖ Modern formulations with Haritaki show promise in easing ulcer symptoms and improving gut health.<br>❖ It works by inhibiting *H. pylori* adhesion to gastric cells, thereby reducing infection and promoting ulcer healing. | [57,97] |
| 59 | *Toona ciliate* (Mahanim)<br><br>Meliaceae | Methyl gallate, coumarin glycoside, flavonoids, phytosterol, phenols, triterpenoids, cedrelone, polyynes, limonoids |  <br>Fig: Methyl gallate | ❖ Its inclusion in traditional ulcer treatments is due to its anti-inflammatory and wound-healing properties.<br>❖ Recent research confirms its effectiveness in protecting against gastric and duodenal ulcers by modulating inflammation and promoting tissue regeneration.<br>❖ It validates its traditional use as a natural ulcer remedy.<br>❖ It exhibits potential ulcer-healing properties, possibly due to its anti-inflammatory and antioxidative effects. | [98] |
| 60 | *Urtica dioica* (Common nettle)<br><br>Urticaceae | Scopoletin, phenolic compounds, sterols, fatty acids, alkaloids, terpenoids, flavonoids, lignans |  <br>Fig: Scopoletin | ❖ It is traditionally used for ulcer management due to its anti-inflammatory and wound-healing properties.<br>❖ Recent research indicates its potential in ulcer treatment, attributed to its ability to modulate inflammation, enhance mucosal defense, and promote tissue repair.<br>❖ Bioactive compounds have antioxidant and anti-inflammatory effects, supporting their ulcer-healing properties. | [99] |
| 61 | *Utleria salicifolia* (Willow)<br><br>Asclepiadaceae | Ellagic acid, eugenol, tannins, saponins, flavonoids, phenolic acids |  <br>Fig: Ellagic acid | ❖ It is used for ulcer management due to its anti-inflammatory and healing properties.<br>❖ Recent research indicates promising anti-ulcerogenic effects, suggesting its potential to mitigate ulcer formation and aid in healing.<br>❖ Further clinical studies are needed to validate its efficacy and integrate it into modern ulcer treatment approaches. | [100] |
| 62 | *Vaccinium oxycoccos* (Cranberry)<br><br>Ericaceae | Proanthocyanidins, gallic acid, vanillic acid, hydroxycinnamic (coumaric) acids, flavonols, anthocyanins |  <br>Fig: Proanthocyanidins | ❖ Cranberry juice exhibits efficacy in treating peptic ulcers, especially in cases involving antibiotic-resistant *H. pylori* strains.<br>❖ Regular consumption of cranberry juice has shown potential in suppressing *H. pylori* infections, particularly in populations where the bacterium is prevalent. The antiulcer activity is attributed to cranberry juice's ability to immobilize *H. pylori* strains in human mucus, erythrocytes, and cultured gastric epithelial cells, providing a possible mechanism for its therapeutic effect. | [101,102,103] |
| 63 | *Zingiber montanum* (mountain ginger)<br><br>Zingiberaceae | Gingerol, shogaol, curcuminoids, terpenoids, curcumin |  <br>Fig: Gingerol | ❖ It is traditionally used in ulcer treatment for its anti-inflammatory and gastrointestinal protective properties.<br>❖ Recent research suggests its potential to prevent ulcer formation and aid in healing.<br>❖ It exhibits potential ulcer-healing effects through its anti-inflammatory properties, aiding in gastric ulcer mitigation. | [104] |

## III. DISCUSSION

Traditional medicinal systems, some of the oldest in the world, offer valuable leads in discovering beneficial compounds from plants for therapeutic purposes. Integrating traditional knowledge with modern scientific methods is crucial for identifying and standardizing active ingredients from herbal sources, potentially leading to improved antiulcer medications with fewer side effects. Folklore reviews focusing on specific

herbs traditionally cited as antiulcer agents highlight the importance of investigating their efficacy. Research guided by traditional wisdom has significantly contributed to drug innovation, unveiling new chemical structures and mechanisms of action. Numerous herbal extracts, rooted in folk medicine, are used to treat various disorders, providing ample opportunity for compiling literature data on antiulcer drugs and conducting detailed studies on specific herbs for therapeutic use.

The antiulcer properties of various medicinal plants have gained attention as effective and safer alternatives to conventional treatments. Liquorice is known for promoting mucus secretion and reducing inflammation, which helps in preventing and healing ulcers. Shatavari and Aloe Vera are recognized for their soothing effects on the gastrointestinal tract and enhancing mucosal defenses. Neem enhances mucosal defense and has anti-inflammatory properties, while Bitter Melon reduces oxidative stress and inflammation in the gastric mucosa. Holy Basil exhibits antiulcer effects through its antioxidant properties and modulation of gastric acid secretion. These plants, with their diverse active compounds, offer a holistic approach to ulcer management, highlighting the potential of herbal remedies in modern medicine.

The study emphasizes the significant role of medicinal plants in treating various diseases, particularly ulcers. Various herbal plants and extracts show significant antiulcer activity in animal models, potentially preventing ulcers through various underlying mechanisms. Botanical substances such as flavonoids, tannins, alkaloids, glycosides, terpenoids, steroids, and saponins possess antiulcer properties, each with unique therapeutic benefits.

The antiulcer activity of these herbal drugs can be attributed to various mechanisms, including free-radical scavenging, inhibition of acid secretion, reinforcement of the gastric mucosal barrier, reduction in vascular permeability, enhancement of cytoprotective mechanisms, and elevation of glutathione levels. Extracts from leaves and various plant parts demonstrate promising mucoprotective and gastric antisecretory properties compared to reference herbal drugs, with demonstrated non-toxicity even at high concentrations.

## IV. Conclusion

This study asserts the therapeutic efficacy of certain plants in treating peptic ulcers induced by various factors, such as *H. pylori* infection, aspirin, and alcohol consumption. Through screening in both in vivo and in vitro settings, these plants have demonstrated significant antiulcer activity, offering promising alternatives for ulcer treatment. Emphasizing the importance of reinforcing the body's defensive mechanisms and reducing acid secretion, medicinal plants containing active constituents like tannins and flavonoids emerge as preferable options over allopathic medicines due to their proven efficacy, safety profile, and cost-effectiveness. This study underscores the significance of herbal medicines in addressing various ailments, including ulcers, and advocates for continued research in identifying and harnessing the therapeutic potential of natural compounds for better gastrointestinal health. The findings of this review hold crucial implications for both the scientific community and clinical practice, highlighting the importance of integrating traditional knowledge with modern research methodologies to develop novel and effective treatments for peptic ulcers. Further exploration into the mechanisms of action of these natural remedies and their potential applications in combination therapies or preventive strategies could pave the way for enhanced management of peptic ulcers and related gastrointestinal disorders. Additionally, efforts to standardize herbal preparations, optimize dosage regimens, and evaluate long-term safety and efficacy profiles are essential for their widespread acceptance and incorporation into mainstream healthcare practices. Overall, this study contributes to the growing body of evidence supporting the therapeutic value of herbal medicines and underscores the need for continued investigation and utilization of natural compounds in the treatment of peptic ulcers and other gastrointestinal conditions.

### *Conflicts of interests*

The authors declare that there is no conflict of interest.

## Acknowledgment

The authors would like to express their sincere gratitude to the Department of Pharmaceutical Chemistry at Guru Nanak Institute of Pharmaceutical Science and Technology for their invaluable support and resources throughout the course of this review. Special thanks to Dr. Prerona Saha for her guidance on herbal medicine and to Mr. Biplab Banerjee, Assistant Librarian for assistance in sourcing relevant literature.

## References

[1] H. G. Vogel, "Similarities between various systems of traditional medicine: Considerations for the future of ethnopharmacology," J. Ethnopharmacol., vol. 35, pp. 179-190, 1991.
[2] B. Debjit, C. Chiranjib, K. K. Tripathi, Pankaj, and K. P. Sampath Kumar, "Recent trends of treatment and medication peptic ulcerative disorder," International Journal of PharmTech Research, vol. 2, no. 1, pp. 970–980, 2010.
[3] A. Jamal, A. Siddiqui, A. S. Tajuddin, and M. A. Jafri, "A review on gastric ulcer remedies used in Unani system of medicine," 2006.
[4] M. G. Brenner and C. W. Stevens, "Pharmacology," 2nd ed. New Delhi: Elsevier, 2006, pp. 310-314.
[5] A. V. Ramarao and M. K. Gurjar, "Drugs from plant resources: an overview," Pharma. Times, vol. 22, no. 5, pp. 19-21, 1990.
[6] S. S. Handa, "Plants as drugs," The Eastern Pharmacist, vol. 34, no. 397, pp. 79-85, 1991.
[7] J. Y. Lau, J. Sung, C. Hill, C. Henderson, C. W. Howden, and D. C. Metz, "Systematic review of the epidemiology of complicated peptic ulcer disease: incidence, recurrence," Digestion, vol. 84, no. 2, pp. 102-113, 2011.
[8] R. Kumar, "A review on medicinal plants for peptic ulcer," Scholar Research Library, Der Pharmacia Letter, vol. 3, pp. 414-240, 2011.
[9] K. Roshan, P. Damwani, S. Kumar, A. Suman, and U. Suthar, "An overview on health benefits and risk factor associated with coffee," International Journal Research and Analytical Review, vol. 7, no. 2, pp. 237-249, 2020.
[10] F. P. Brooks, "The pathophysiology of peptic ulcer disease," Digestive Diseases and Sciences, vol. 30, suppl. 11, pp. 15S–29S, 1985.
[11] N. S. Vyawahare, V. V. Deshmukh, M. R. Godkari, and V. G. Kagathara, "Plants with anti-ulcer activity," Pharmacognosy Review, vol. 3, pp. 108–115, 2009.
[12] N. L. Dashputre and N. S. Naikwade, "Evaluation of Anti-Ulcer Activity of Methanolic Extract of *Abutilon indicum* Linn Leaves in Experimental Rats," Int. J. Pharm. Sci. Drug Res., vol. 3, no. 2, pp. 97–100, 2011.
[13] K. Roshan, P. Damwani, S. Kumar, A. Suman, and U. Suthar, "An overview on health benefits and risk factor associated with coffee,"

International Journal Research and Analytical Review, vol. 7, no. 2, pp. 237-249, 2020.
[14] F. P. Brooks, "The pathophysiology of peptic ulcer disease," Digestive Diseases and Sciences, vol. 30, suppl. 11, pp. 15S–29S, 1985.
[15] N. S. Vyawahare, V. V. Deshmukh, M. R. Godkari, and V. G. Kagathara, "Plants with anti-ulcer activity," Pharmacognosy Review, vol. 3, pp. 108–115, 2009.
[16] Y. Umama, G. Venkatajah, R. Shourabh, R. Kumar, A. Verma, A. Kumar, and M. K. Gayoor, "The scenario of pharmaceuticals and development of microwave assisted extraction technique," World Journal of Pharmacy and Pharmaceutical Sciences, vol. 8, no. 7, pp. 1260–1271, 2019.
[17] B. J. Marshall and J. R. Warren, "Unidentified curved bacilli in the stomach of patients with gastritis and peptic ulceration," The Lancet, vol. 1, no. 8390, pp. 1311–1315, 1984.
[18] K. M. Nadkarni, Indian Materia Medica, vol. 1, pp. 9–10, Popular Prakashan, Mumbai, India, 1976.
[19] A. M. A. Abd El-Mawla and H. E. H. Osman, "Effects of Gum acacia aqueous extract on the histology of the intestine and enzymes of both the intestine and the pancreas of albino rats treated with Meloxicam," Pharmacognosy Research, vol. 3, no. 2, pp. 114–121, 2011.
[20] N. Vasudeva, P. Sethi, S. K. Sharma, S. Kumar, and S. Sharma, "Antiulcer Potential of the Ethanolic Extract of *Aerva Persica Merrill* Root in Rats," J. Acupunct. Meridian Stud., vol. 5, no. 2, pp. 80–86, 2012.
[21] T. Kumari Subitha, M. Ayyanar, M. Udayakumar, and T. Sekar, "Ethnomedicinal plants used by Kani tribals in Pechiparai forests of Southern Western Ghats, Tamilnadu, India," International Research Journal of Plant Science, vol. 2, no. 12, pp. 349–354, 2011.
[22] K. M. Nadkarni, Indian Materia Medica, vol. 1, pp. 776, 783, Popular Prakashan, Mumbai, India, 1976.
[23] Y. S. Lawande, R. S. Hase, D. P. Jadhav, and T. A. Hyalij, "Recent Advances In Research Of Antiulcer Drug Of Natural Origin: A Review," Int. J. Pharm. Res. Dev., vol. 3, no. 11, pp. 160–170, 2012.
[24] M. C. Divakar, S. B. Rao, G. R. N. Nair, and A. Hisham, "The role of fatty acids on the ulcer healing property of the nimbidin fraction of the neem oil," Journal of Medicinal and Aromatic Plants Science, vol. 23, no. 3, pp. 404–408, 2001.
[25] K. M. Nadkarni, Indian Materia Medica, vol. 1, pp. 187-188, Popular Prakashan, Mumbai, India, 1976.
[26] J. S. Silva, M. A. Andreo, F. R. Tubaldini, E. A. Varanda, L. R. Rocha, A. R. Brito, W. Vilegas, and C. A. Hiruma-Lima, "Differences in gastroprotective and mutagenic actions between polar and apolar extracts of Ananas ananassoides," Journal of Medicinal Food, vol. 11, no. 1, pp. 160-168, 2008.
[27] E. M. Skrabut, P. A. Hebda, J. A. Samuels, S. M. Richards, T. Edmunds, M. F. Cunneen, C. A. Vaccaro, and J. M. McPherson, "Removal of necrotic tissue with an ananain-based enzyme-debriding preparation," Wound Repair and Regeneration, vol. 4, no. 4, pp. 433-443, 1996.
[28] S. K. Gupta and I. J. Singhvi, "Herbal and hepatoprotective drugs acting on peptic ulcer and liver disease: a review," International Journal of Pharmacy and Technology, vol. 3, no. 1, pp. 824-853, 2011.
[29] K. M. Nadkarni, Indian Materia Medica, vol. 1, p. 197, Popular Prakashan, Mumbai, India, 1976.
[30] R. Y. Ibrahim, A. I. Hassan, and E. K. Al-Adham, "The anti-ulcerative colitis effects of *Annona squamosa* Linn. leaf aqueous extract in experimental animal model," International Journal of Clinical and Experimental Medicine, vol. 8, no. 11, p. 21861, 2015.
[31] R. K. Goel, K. Sairam, S. Priyambada, and N. C. Aryya, "Gastroduodenal ulcer protective activity of Asparagus racemosus: an experimental, biochemical and histological study," Journal of Ethnopharmacology, vol. 86, pp. 1–10, 2003.
[32] K. Kumar, K. Mruthunjaya, S. Kumar, and R. Mythreyi, "Anti ulcer activity of ethanol extract of the stem bark of *Careya arborea Roxb*," International Current Pharmaceutical Journal, vol. 2, no. 3, pp. 78-82, 2013.
[33] T. Kumari Subitha, M. Ayyanar, M. Udayakumar, and T. Sekar, "Ethnomedicinal plants used by Kani tribals in Pechiparai forests of Southern Western Ghats, Tamilnadu, India," International Research Journal Plant Science, vol. 2, no. 12, pp. 349-354, 2011.
[34] N. Neelima, M. Sudhakar, M. B. Patil, and B. V. S. Lakshmi, "Anti-ulcer activity and HPTLC analysis of *Mangifera indica* leaves," International Journal of Pharmaceutical and Phytopharmacological Research, vol. 1, no. 4, pp. 146-155, 2012.
[35] S. Murthy, M. K. Gautam, S. Goel, V. Purohit, H. Sharma, and R. K. Goel, "Evaluation of in vivo wound healing activity of Bacopa monniera on different wound model in rats," BioMed Research International, 2013.
[36] R. Sharath, B. G. Harish, V. Krishna, B. N. Sathyanarayana, and H. K. Swamy, "Wound healing and protease inhibition activity of Bacoside-A, isolated from Bacopa monnieri wettest," Phytotherapy Research, vol. 24, no. 8, pp. 1217-1222, 2010.
[37] Z. P. Lima, J. A. Severi, C. H. Pellizzon, et al., "Can the aqueous decoction of mango flowers be used as an antiulcer agent?" Journal of Ethnopharmacology, vol. 106, no. 1, pp. 29-37, 2006.
[38] N. V. Rao, K. Venu, U. Sowmya, G. J. Reddy, and K. Anirudan, "Evaluation of antiulcer activity of Momordica charantia in rats," International Journal of Pharmacy and Biological Sciences, vol. 1, no. 1, pp. 1-16, 2011.
[39] R. Kumar, P. Saha, P. Lokare, K. Datta, P. Selvakumar, and A. Chourasia, "A Systemic Review of *Ocimum sanctum* (Tulsi): Morphological Characteristics, Phytoconstituents and Therapeutic Applications," International Journal for Research in Applied Sciences and Biotechnology, vol. 9, no. 2, pp. 221-226, 2022.
[40] A. N. Yadav, P. Verma, R. Kumar, V. Kumar, and K. Kumar, "Current applications and future prospects of eco-friendly microbes," EU Voice, vol. 3, no. 1, pp. 21-22, 2017.
[41] C. G. Awuchi, I. O. Amagwula, P. Priya, R. Kumar, U. Yezdani, and M. G. Khan, "Aflatoxins in foods and feeds: A review on health implications, detection, and control," Bulletin of Environmental Pharmacology and Life Sciences, vol. 9, pp. 149-155, 2020.
[42] C. A. Carvalho, K. M. Fernandes, S. L. Matta, M. B. Silva, L. L. Oliveira, and C. C. Fonseca, "Evaluation of antiulcerogenic activity of aqueous extract of Brassica oleracea var. capitata (cabbage) on Wistar rat gastric ulceration," Arquivos de Gastroenterologia, vol. 48, no. 4, pp. 276-282, 2011.
[43] M. Urikura, J. Morishige, T. Tanaka, and K. Satouchi, "Phosphatidic acid production in the processing of cabbage leaves," Journal of Agricultural and Food Chemistry, vol. 60, no. 45, pp. 11359-11365, 2012.
[44] S. Pareta, D. Kodati, and K. C. Patra, "Antiulcer activity of ethanolic extract of *Buchanania lanzan* Spreg. Roots," Annals of Biological Research, vol. 1, no. 4, pp. 234-239, 2010.
[45] A. Bind, S. Das, V. D. Singh, R. Kumar, A. Chourasia, and P. Saha, "Natural Bioactives For The Potential Management Of Gastric Ulceration," Turkish Journal of Physiotherapy and Rehabilitation, vol. 32, no. 3, pp. 221-226, 2020.
[46] R. Kumar, P. Saha, R. O. Nyarko, I. Kahwn, E. A. Boateng, P. O. Boateng, and A. Bertram, "Role of Cytokines and Vaccines in Breakthrough COVID-19 Infections," Journal of Pharmaceutical Research International, vol. 33, no. 60B, pp. 2544-2549, 2021.
[47] P. Saha, R. Kumar, R. O. Nyarko, I. Kahwa, and P. Owusu, "Herbal Secondary Metabolite For Gastro-Protective Ulcer Activity With Api Structures," 2021.
[48] A. Daharia, V. K. Jaiswal, K. P. Royal, H. Sharma, A. K. Joginath, R. Kumar, and P. Saha, "A Comparative review on ginger and garlic with their pharmacological Action," Asian Journal of Pharmaceutical Research and Development, vol. 10, no. 3, pp. 65-69, 2022.
[49] R. Kumar, P. Saha, Y. Kumar, S. Sahana, A. Dubey, and O. Prakash, "A Review on Diabetes Mellitus: Type1 & Type2," World Journal of Pharmacy and Pharmaceutical Sciences, vol. 9, no. 10, pp. 838-850, 2020.
[50] S. Tripathy and R. Afrin, "Herbal treatment alternatives for peptic ulcer disease," Journal of Drug Delivery and Therapeutics, vol. 6, no. 3, 2016, doi: 10.22270/jddt. v6i3.1210.
[51] M. H. Trivedi, K. V. Ramana, and C. V. Rao, "Evaluation of antiulcer activity of *Cordia sebestena* root," International Journal of Pharmacy and Pharmaceutical Research, vol. 4, no. 1, pp. 167-170, 2015.
[52] M. A. Jafri, A. Jamal, K. Javed, and M. Aslam, "Gastroprotective effect of cardamom, *Elettaria cardamomum* Maton. fruits in rats," Journal of Ethnopharmacology, vol. 103, pp. 149–153, 2006.
[53] R. K. Goel, K. Sairam, C. V. Rao, M. D. Babu, K. V. Kumar, and V. K. Agrawal, "Antiulcerogenic effect of methanolic extract of Emblica officinalis: an experimental Ethnopharmacology," Journal of Ethnopharmacology, vol. 82, pp. 1-9, 2002.
[54] P. Saha, R. O. Nyarko, P. Lokare, I. Kahwa, P. O. Boateng, and C. Asum, "Effect of Covid-19 in Management of Lung Cancer Disease: A Review," Asian Journal of Pharmaceutical Research and Development, vol. 10, no. 3, pp. 58-64, 2022.

[55] R. O. Nyarko, E. Boateng, I. Kahwa, and P. O. Boateng, "A comparison analysis on remdesivir, favipiravir, hydroxychloroquine, chloroquine and azithromycin in the treatment of corona virus disease 2019 (COVID-19)-A Review," World Journal of Pharmacy and Pharmaceutical Sciences, vol. 9, pp. 121-133, 2020.
[56] A. Kumar, "The Scenario of Pharmaceuticals and Development of Microwave Assisted Extraction Techniques," 2019.
[57] D. Raju, K. Ilango, V. Chitra, and K. Ashish, "Evaluation of anti-ulcer activity of methanolic extract of *Terminalia chebula* fruits in experimental rats," Journal of Pharmaceutical Sciences and Research, vol. 1, no. 3, pp. 101-107, 2009.
[58] F. Nalimu, J. Oloro, I. Kahwa, and P. E. Ogwang, "Review on the phytochemistry and toxicological profiles of Aloe vera and Aloe ferox," Future Journal of Pharmaceutical Sciences, vol. 7, pp. 1-21, 2021.
[59] P. A. Bafna and R. Balaraman, "Anti-ulcer and anti-oxidant activity of pepticare, a herbomineral formulation," Journal of Phytomedicine, vol. 12, no. 4, pp. 264-270, 2005.
[60] C. P. Khare, Encyclopedia of Indian Medicinal Plants, New York: Springer-Verlag, 2004, pp. 233-235.
[61] A. M. Shenoy and S. C. Shastry, "Anti Ulcer Activity Of *Heliotropium indicum* Leaves Extract," International Journal of Parmaceutical Sciences and Research, vol. 2, no. 10, pp. 2651-2654, 2011.
[62] Y. Singh, S. K. Paswan, R. Kumar, M. K. Otia, S. Acharya, D. Kumar, and E. Keshamma, "Plant & Its Derivative Shows Therapeutic Activity on Neuroprotective Effect," Journal for Research in Applied Sciences and Biotechnology, vol. 1, no. 2, pp. 10-24, 2022.
[63] R. Kumar, A. Singh, and N. Painuly, "Investigation of in-vitro anti-oxidant & anti-ulcer activity of polyherbal medicinal plants," Journal of Pharmaceutical Negative Results, pp. 2077-2088, 2022.
[64] A. N. Yadav, P. Verma, R. Kumar, S. Kumar, V. Kumar, K. Kumar, and H. S. Dhaliwal, "Probiotic microbes: Biodiversity, mechanisms of action and potential role in human health," in Proceedings of the National Conference on Advances in Food Science and Technology, Paris, France, Oct. 2017, pp. 23-25.
[65] M. Cheniany, H. Ebrahimzadeh, K. Vahdati, J. E. Preece, A. Masoudinejad, and M. Mirmasoumi, "Content of different groups of phenolic compounds in microshoots of Juglans regia cultivars and studies on antioxidant activity," Acta Physiologiae Plantarum, vol. 35, pp. 443-450, 2013.
[66] D. T. O. Martins, P. T. Filho, B. S. Olaitan, D. A. T. Almeida, J. C. S. Lima, P. G. Marson-Asccencio, S. D. Asccencio, F. Rios-Santos, "Evaluation of antiulcer activity and mechanism of action of methanol stem bark extract of *Lafoensia pacari* A. St.- Hil.(Lytraceae) in experimental animals," Journal of Ethnopharmacology, vol. 144, pp. 497–505, 2012.
[67] K. Pycia, I. Kapusta, G. Jaworska, and A. Jankowska, "Antioxidant properties, profile of polyphenolic compounds and tocopherol content in various walnut (Juglans regia L.) varieties," European Food Research and Technology, vol. 245, pp. 607-616, 2019.
[68] I. B. Abdallah, N. Tlili, E. Martinez-Force, A. G. P. Rubio, M. C. Perez-Camino, A. Albouchi, and S. Boukhchina, "Content of carotenoids, tocopherols, sterols, triterpenic and aliphatic alcohols, and volatile compounds in six walnuts (Juglans regia L.) varieties," Food Chemistry, vol. 173, pp. 972-979, 2015.
[69] C. G. Fraga, K. D. Croft, D. O. Kennedy, and F. A. Tomás Barberán, "The effects of polyphenols and other bioactives on human health," Food Function, vol. 10, pp. 514-528, 2019.
[70] C. Mert, "Anther and Pollen Morphology and Anatomy in Walnut (Juglans regia L.)," HortScience, vol. 45, pp. 757–760, 2010.
[71] N. Acarsoy Bilgin, "Morphological Characterization of Pollen in Some Varieties of Walnut (Juglans regia)," Int. J. Fruit Sci., vol. 22, pp. 471–480, 2022.
[72] D. Milatović, D. Nikolić, S. Janković, D. Janković, and J. Stanković, "Morphological characteristics of male reproductive organs in some walnut (Juglans regia L.) genotypes," Sci. Hortic., vol. 272, p. 109587, 2020.
[73] Y. Singh, S. K. Paswan, R. Kumar, M. K. Otia, S. Acharya, D. Kumar, and E. Keshamma, "Plant & Its Derivative Shows Therapeutic Activity on Neuroprotective Effect," Journal for Research in Applied Sciences and Biotechnology, vol. 1, no. 2, pp. 10-24, 2022.
[74] S. Cosmulescu, I. Trandafir, and V. Nour, "Chemical Composition and Antioxidant Activity of Walnut Pollen Samples," Not. Bot. Horti Agrobot. Cluj Napoca, vol. 43, pp. 361–365, 2015.
[75] K. M. Mohan, M. C. Joshi, T. Prabha, M. Dorababu, and R. K. Goel, "Effect of plantain banana on gastric ulceration in NIDDM rats: role of gastric mucosal glycoproteins, cell proliferation, antioxidants and free radicals," Indian Journal of Experimental Biology, vol. 44, no. 4, pp. 292-299, 2006.
[76] S. A. Onasanwo, B. O. Emikpe, A. A. Ajah, and T. O. Elufioye, "Anti ulcer and ulcer healing potentials of *Musa sapientum* peel extract in the laboratory rodents," Pharmacognosy Research, vol. 5, no. 3, pp. 173-178, 2013.
[77] R. Rahmani, M. Dehganiasl, R. Heidari, R. Rezaee, and R. Darvishzadeh, "Genotype impact on antioxidant potential of hull and kernel in Persian walnut (Juglans regia L.)," Int. Food Res. J., vol. 25, pp. 35–42, 2018.
[78] M. Jabli, N. Sebeia, M. Boulares, and K. Faidi, "Chemical analysis of the characteristics of Tunisian Juglans regia L. fractions: Antibacterial potential, gas chromatography–mass spectroscopy and a full investigation of their dyeing properties," Ind. Crops Prod., vol. 108, pp. 690–699, 2017.
[79] T. Ogunmoyole, "In vitro antioxidant properties of aqueous and ethanolic extracts of walnut (Juglans regia)," J. Med. Plants Res., vol. 5, pp. 6839–6848, 2011.
[80] K. Ghasemi, Y. Ghasemi, A. Ehteshamnia, S. M. Nabavi, S. F. Nabavi, M. Ebrahimzadeh, and F. Pourmorad, "Influence of environmental factors on antioxidant activity, phenol and flavonoids contents of walnut (Juglans regia L.) green husks," J. Med. Plants Res., vol. 5, pp. 1128–1133, 2011.
[81] B. Rajkapoor, R. Anandan, and B. Jayakar, "Antiulcer effect of *Nigella sativa* Linn, against gastric ulcers in rats," Current Science, vol. 82, no. 2, pp. 177-179, 2002.
[82] M. Jahanban-Esfahlan, A. Ostadrahimi, M. Tabibiazar, and R. Amarowicz, "A Comparative Review on the Extraction, Antioxidant Content and Antioxidant Potential of Different Parts of Walnut (Juglans regia L.) Fruit and Tree," Molecules, vol. 24, p. 2133, 2019.
[83] J. Regueiro, C. Sánchez-González, A. Vallverdú Queralt, J. Simal-Gándara, R. Lamuela-Raventós, and M. Izquierdo-Pulido, "Comprehensive identification of walnut polyphenols by liquid chromatography coupled to linear ion trap–Orbitrap mass spectrometry," Food Chem., vol. 152, pp. 340–346, 2014.
[84] A. Fernández-Agulló, A. Castro-Iglesias, M. S. Freire, and J. González-Álvarez, "Optimization of the Extraction of Bioactive Compounds from Walnut (Juglans major 209 x Juglans regia) Leaves: Antioxidant Capacity and Phenolic Profile," Antioxidants, vol. 9, p. 18, 2019.
[85] J. Yang, C. Chen, S. Zhao, F. Ge, and D. Liu, "Effect of Solvents on the Antioxidant Activity of Walnut (Juglans regia L.) Shell Extracts," J. Food Nutr. Res., vol. 2, pp. 621–626, 2014.
[86] N. Żurek, A. Pawłowska, K. Pycia, D. Grabek Lejko, and I. T. Kapusta, "Phenolic Profile and Antioxidant, Antibacterial, and Antiproliferative Activity of Juglans regia L. Male Flowers," Molecules, vol. 27, p. 2762, 2022.
[87] C. S. Jeong, "Effect of butanol fraction of *Panax ginseng* head on gastric lesion and ulcer," Archives of Pharmacal Research, vol. 25, no. 1, pp. 61-66, 2002.
[88] M. Salimi, A. Majd, Z. Sepahdar, K. Azadmanesh, S. Irian, M. H. Ardestaniyan, and N. Rastkari, "Cytotoxicity effects of various Juglans regia (walnut) leaf extracts in human cancer cell lines," Pharm. Biol., vol. 50, pp. 1416–1422, 2012.
[89] A. S. Negi, S. Luqman, S. Srivastava, V. Krishna, N. Gupta, and M. P. Darokar, "Antiproliferative and antioxidant activities of Juglans regia fruit extracts," Pharm. Biol., vol. 49, pp. 669–673, 2011.
[90] M. Carvalho, P. J. Ferreira, V. S. Mendes, R. Silva, J. A. Pereira, C. Jerónimo, and B. M. Silva, "Human cancer cell antiproliferative and antioxidant activities of Juglans regia L.," Food Chem. Toxicol., vol. 48, pp. 441–447, 2010.
[91] A. M. Ogochukwu, O. J. Mathew, and M. U. Michael, "Antiulcer activity of methanolic extract and fractions of Picralima nitida seeds (Apocynacaea) in rats," Asian Pacific Journal of Tropical Medicine, pp. 13-15, 2011.
[92] E. Catanzaro, G. Greco, L. Potenza, C. Calcabrini, and C. Fimognari, "Natural Products to Fight Cancer: A Focus on Juglans regia," Toxins, vol. 10, p. 469, 2018.
[93] A. R. S. Santos, D. K. S. Lima, L. J. Ballico, F. R. Lapa, H. P. Goncalves, L. M. D. Souza, M. Iacomini, M. F. D. P. Werner, C. H. Baggio, I. T. Pereira, L. M. D. Silva, and V. A. Facundo, "Evaluation of the antinociceptive, anti-inflammatory and gastric antiulcer activities of the

essential oil from *Piper aleyreanum* C.DC in rodents," Journal of Ethnopharmacology, vol. 142, pp. 274–282, 2012.
[94] A. Geetha and J. Megala, "Antiulcerogenic activity of hydroalcoholic fruit extract of *Pithecellobium dulce* in different experimental ulcer models in rats," Journal of Ethnopharmacology, vol. 142, pp. 415–421, 2012.
[95] M. Babincova, K. Schronerova, and P. Sourivong, "Antiulcer activity of water extract of Scoparia dulcis," Fitoterapia, vol. 79, pp. 587-588, 2008.
[96] M. Jainu and C. S. Devi, "Antiulcerogenic and ulcer healing effects of *Solanum nigrum* (L.) on experimental ulcer models: possible mechanism for the inhibition of acid formation," Journal of Ethnopharmacology, vol. 104, no. 1-2, pp. 156-163, 2006.
[97] V. Mishra, M. Agrawal, S. A. Onasanwo, G. Madhur, P. Rastogi, H. P. Pandey, G. Palit, and T. Narender, "Anti-secretory and cyto-protective effects of chebulinic acid isolated from the fruits of Terminalia chebula on gastric ulcers," Phytomedicine, vol. 20, no. 6, pp. 506-511, Apr. 2013.
[98] Malairajan, G. Gopalakrishnan, S. Narasimhan, K. V. K. Jessi, and S. Kavimani, "Anti-ulcer activity of crude alcoholic extract of Toona ciliata Roemer (heart wood)," Journal of Ethnopharmacology, vol. 110, pp. 348–351, 2007.
[99] O. I. Kufrevioglu, I. Gulçin, M. Oktay, and M. E. Buyukokuroglu, "Antioxidant, antimicrobial, antiulcer, and analgesic activities of nettle (Urtica dioica L.)," Journal of Ethnopharmacology, vol. 90, pp. 205–215, 2004.
[100] C. V. Rao, S. K. Ojha, K. Radhakrishnan, R. Govindarajan, S. Rastogi, S. Mehrotra, and P. Pushpangadan, "Anti-ulcer activity of *Utleria salicifolia* rhizome extract," Journal of Ethnopharmacology, vol. 91, pp. 243–249, 2004.
[101] Y. T. Lin, Y. I. Kwon, R. G. Labbe, and K. Shetty, "Inhibition of Helicobacter pylori and associated urease by oregano and cranberry phytochemical synergies," Applied and Environmental Microbiology, vol. 71, no. 12, pp. 8558-8564, 2005.
[102] L. Zhang, J. Ma, K. Pan, V. L. Go, J. Chen, and W. C. You, "Efficacy of cranberry juice on Helicobacter pylori infection: a double-blind, randomized placebo-controlled trial," Helicobacter, vol. 10, no. 2, pp. 139-145, 2005.
[103] O. Burger, E. Weiss, N. Sharon, M. Tabak, I. Neeman, and I. Ofek, "Inhibition of Helicobacter pylori adhesion to human gastric mucus by a high-molecular-weight constituent of cranberry juice," Critical Reviews in Food Science and Nutrition, vol. 42, no. 3 Suppl, pp. 279-284, 2002.
[104] C. F. Hossain, M. Al-Amin, and G. N. N. Sultana, "Antiulcer principle from Zingiber montanum," Journal of Ethnopharmacology, vol. 14, pp. 57–60, 2012.