IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

IN VITRO SCREENING OF ANTIULCER POTENTIAL OF SPATHODEA CAMPANULATA P.BEAUV.

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ABSTRACT

Spathodea campanulata P.Beauv. commonly known as the Flame tree and African Tulip Tree, has demonstrated a variety of therapeutic properties in traditional medicine, including potential antiulcer effects. This study explores the use of Spathodea campanulata in the formulation of an antiulcer gel, evaluating its efficacy and safety in treating gastric ulcers. The plant's bioactive compounds, particularly flavonoids, alkaloids, and phenolic compounds, are believed to contribute to its anti-inflammatory, antioxidant, and healing properties, which may help in reducing ulcer formation and promoting mucosal repair. In vitro experiments were conducted to assess Spathodea Campanulata's ability to prevent ulcer development .Peptic disorders, such as gastro intestinal reflux, gastritis, and peptic ulcers, are common due to stress and improper diet. Non-steroidal anti-inflammatory drugs (NSAIDs) are commonly used to manage such conditions but are often associated with serious side effects. A study investigated the anti-ulcer potential of an ethanolic extract derived from Spathodea campanulata leaves through in vitro testing. The extract demonstrated protective effects against aspirin-induced gastric ulcers. Preliminary phytochemical analysis identified the presence of carbohydrates, glycosides, alkaloids, flavonoids, phenols, tannins, and saponins. These findings support the traditional use of the plant in Indian folk medicine for treating ulcers. However, further research is necessary to isolate the active compounds and explore their specific mechanisms of action.

Keywords: Spathodea Campanulata, Antiulcer, Flavanoids, antioxidant, pepticulcer

INTRODUCTION

Gastrointestinal disorders are the most common issue in the modern world. Acid reflux disease, another name for peptic ulcer, is an ulceration of the stomach and duodenum's mucous membranes.

Peptic Ulcer

An ulcer is a painful sore or erosion that develops when the lining of the digestive tract is damaged by acidic digestive fluids. Hydrochloric acid and the enzyme pepsin are primarily responsible for sustaining the lesion once it forms. Peptic ulcers only develop in areas exposed to gastric acid, such as the stomach and the upper part of the small intestine (duodenum). Therefore, the term "peptic ulcer" generally refers to ulcers occurring in these acid-exposed regions.

Gastric Ulcer

Gastric ulcers, which occur in the stomach lining, affect a significant number of individuals globally. In the United States alone, around 50,000 people are diagnosed with gastric ulcers annually.

Duodenal Ulcer

Duodenal ulcers, which develop in the first section of the small intestine, are most commonly found in people aged 30 to 55. Modern lifestyles, which often involve high stress and poor dietary habits such as frequent consumption of fast food, contribute to the rise in gastrointestinal issues. It is estimated that approximately 10% of the population will experience a peptic ulcer at some point in their lives.

Peptic Ulcer Disease

Peptic ulcer disease includes both gastric and duodenal ulcers. Several factors can lead to the development of these ulcers, including stress, smoking, poor nutrition, and the use of non-steroidal anti-inflammatory drugs (NSAIDs). Additionally, free radicals play a significant role in causing damage to the gastrointestinal lining by attacking biological molecules. As a result, treatments involving antioxidants may help reduce damage caused by substances like ethanol in the stomach lining.

Causes of Peptic Ulcers:

H pylori infection: This bacterial infection damges mucus which protects the stomach lining.

NSAID’S: Some painkillers and fever medicines can damage mucus lining.

Alcohol: Excesseive consumption can weaken and damage the stomach lining.

Drugs use in peptic ulcer:

H2 receptor antagonist-Cimetidine,Famotidine,Ranitidine

Proton pump inhibitors-Omeprazole,Pantoprazole,Rabeprazole

Anticholinergics: Pirenzepine and Telenzepine

Prostaglandin analogues: Misoprostol

Antacids: Sodium bicarbonate, Aluminum hydroxide, and Magnesium hydroxide

Ulcer protectives: Sucralfate and Colloidal bismuth subcitrate

Anti-Helicobacter pylori agents: Amoxicillin, Clarithromycin, and Metronidazole

Herbal formulations over synthetic formulations:

Synthetic drugs can cause side effects such as constipation, diarrhea, and nausea, as well as aluminum toxicity, blackening of the tongue, teeth, and stools due to bismuth chelates. Alternative therapies, particularly those made from medicinal plants, have gained interest due to their potential to treat various diseases. Plant extracts have shown promising results in treating peptic ulcers, particularly those with antioxidant capabilities. Medicinal plants have therapeutic properties due to their ability to provide renewable and secondary metabolites called phytochemical constituents, which act as protection mechanisms against pathogens. Pharmaceutical companies are developing new antimicrobial medicines derived from medicinal plants, but synthetic antibiotics remain dominant. Higher education and legislation on herbal therapy are crucial for randomized trials to evaluate the effectiveness and safety of these products. Randomised studies to assess the efficacy and safety of Ayurvedic knowledge and modern medicine depend on preferred antiulcer medications with minimal side effects from herbal treatment.

Role of herbal plant intreatment of pepticulcer:

Flavonoids and phenolic compound:

Flavonoids and phenolic chemicals compounds protect the gastrointestinal mucosa, acting as antihistaminic, antihistaminic, and protective against various necrotic agents. They inhibit H. pylori growth and enhance mucosal non protein SH compounds, which are beneficial in peptic ulcers. Drug release is a major area of pharmaceutical research, with sustained release bi-layer floating tablets offering stability, gastric retention, bioavailability, and patient compliance. This method is particularly useful for herbal medicine, providing larger stability to formulations.

MATERIALS AND METHODS

Leaves of Spathodea campanulata P. Beauv were collected from the original garden. The plant material was authenticated by Mrs. Bhagat, Department of Botany, Radhabai Kale Mahila Mahavidyalaya, Ahilyanagar. A voucher specimen was deposited in the college garden for reference. The collected leaves were shade-dried at room temperature. Once dried, they were coarsely powdered and subjected to successive extraction using 70% ethanol at approximately 70°C for 2 to 3 days at room temperature. The mixture was kept in a conical flask, and after extraction, it was filtered. The filtrate was concentrated at a bath temperature of 50°C and stored in an airtight container. The ethanolic extract was selected for use in the present study..

Fig: Powder & Extract of S.Campanulata.P.Beauv.

EXPERIMENTAL STUDY (IN VITRO STUDY)

PHYTOCHEMICAL TEST

Alkoloids test

1.Mayer's Test:

Procedure: Place 2 ml of the plant extract or filtrate into a test tube.

Reaction: Add 1-2 drops of Mayer's reagent (potassium mercury iodide result) to the extract.

Observation: The presence of alkaloids is indicated by a creamy white or yellow precipitate.

2.Wagner's Test:

Procedure: Take 1 ml of the extract or filtrate in a test tube.

Reaction: Add an equal amount of Wagner's reagent (a dilute iodine solution).

Result: The formation of a reddish-brown precipitate confirms the presence of alkaloids.

Dragendorff's Test:

Procedure: Measure 2 ml of the extract or filtrate into a test tube.

Reaction: Add 1 ml of Dragendorff's reagent (a solution containing potassium iodide and bismuth subnitrate).

Result: The appearance of an orange or orange-red precipitate indicates the presence of alkaloids.

Flavonoids Test

1.Alkaline Reagent Test (NaOH-HCl): Take a small sample of the plant extract (e.g., 2

mL) in a test tube. Add a few drops of diluted sodium hydroxide solution. The appearance of a bright yellow color indicates a positive result. Add a few drops of dilute HCl. If flavonoids are present, the yellow color will become colorless.

2. Shinoda's Test (Magnesium Foil and HCl)

Shinoda Test (for Flavonoids):

Procedure: Dissolve the plant extract in 95% ethanol. Add a small piece of magnesium ribbon to the solution, followed by 3–5 drops of concentrated hydrochloric acid.

Observation: The development of an intense cherry-red color suggests the presence of flavonoids.

Phenolic Test – Ferric Chloride Test:

Procedure: Dissolve the sample in water and add a few drops of neutral ferric chloride solution.

Observation: A color change to blue, violet, purple, green, or reddish-brown indicates the presence of phenolic compounds.

Tannins Test:

1.Ferric Chloride Test:

Extract the sample: Boil a sample (e.g., 1g of plant leaves) with distilled water for 5

minutes, then cool and filter.

Ferric Chloride Test for Tannins:

Add a few drops of 10% ferric chloride solution to the filtrate.

A color change ranging from greenish to black signifies the presence of tannins.

Sapponins:

1.Foam Test:

Take a 1 to 2 ml solution of the extract and add with distilled water. Shake vigorously in a cylinder or test tube.

Observe for the formation of a stable foam that persists for a specific duration (e.g., 15

minutes) A significant amount of foam, even if it doesn't fully disappear, indicates the presence of sapiens.

Fig : Phytochemical test

IN VITRO TEST

1.Acid Neutralizing Capacity model

Acid Neutralizing Capacity (ANC) refers to a solution's ability to counteract strong acids while maintaining a relatively stable pH level.. It is crucial in understanding the buffering capacity of natural waters and soils against acidification. ANC is determined by the balance between acid-producing and base-producing ions and reflects how much acid a system can absorb before the pH drops significantly, which can harm aquatic life and alter ecosystem functions. ANC is primarily expressed in units such as µeq/L, meq/L, and mg $CaCO_3$/L. It is sourced from carbonate rocks, soil weathering, atmospheric deposition, and biological uptake. High ANC (>300 µeq/L) indicates strong buffering capacity, while moderate ANC (100–300 µeq/L) is buffering present but vulnerable to high acid inputs. Low ANC results in pH decline, increased aluminum solubility, stress on sensitive species, and loss of biodiversity in aquatic ecosystems. ANC is central to understanding and managing acid rain impacts, soil and water acidification, lake and stream ecosystem health, and forest decline in acid-sensitive regions.

Broth Dilution Method:

The Broth Dilution Method is a widely used laboratory procedure for determining the Minimum Inhibitory Concentration (MIC) of antimicrobial substances against specific microorganisms. The method involves creating a series of dilutions of the antimicrobial agent in a liquid culture medium, followed by the introduction of a standardized microbial inoculum. The lowest concentration at which no visible microbial growth occurs is identified as the MIC. The procedure includes preparing a stock solution of the antimicrobial agent, establishing a dilution range, and inoculating it with the test organism. The organism's response is evaluated based on established interpretive standards to determine its susceptibility. Quality control includes control strains with known MIC values to ensure accuracy and reliability. The Broth Micro dilution Method is a high-throughput version of the broth dilution method, commonly performed in 96-well microliter plates,

allowing simultaneous testing of multiple antimicrobial agents and concentrations against various microorganisms. Its applications include antimicrobial susceptibility testing, resistance monitoring, drug development, and clinical decision-making.

RESULT AND DISCUSSION

The crude extract obtained through the maceration process using ethanol resulted in an extract yield of 4.3% w/w for Spathodea campanulata. Carbohydrates, glycosides, alkaloids, flavonoids, phenols & tannins, saponin were all detected in the extract. We find all necessary chemical constituent in spathodea campanulata P.Beauv. so it can be used as antiulcer eventuality.

SR.NO	CONSTITUENT	ETHANOLIC EXTRACT
1	Alkaloids	+
2	Flavonoids	+
3	Glycoside	+
4	Saponin	+
5	Phenol	+
6	Tannins	+

In vitro test:

Acid Neutralizing model: The acid neutralizing (ANC) of a solution tells you to well it can neutralize strong acid without changing the PH too much.

Broth dilution Method: A common way to find out the minimum inhibitory concentration (MIC) of antimicrobial drug against microorganisms is to use the broth dilution method.

ACKNOWLEDGEMENT

We thank precedent, secretary, and the principle of Samarth Institute of Pharmacy, Belhe, Junnar, Maharashtra, for offering the essential research facilities required to conduct this study.

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