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COMPARITIVE REVIEW ON ANTI-ULCER ACTIVITY OF SOME MEDICINAL PLANT EXTRACTS

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ABSTRACT: Peptic ulcer is an excavation of mucosa and may extend to the submucosal layer. The bacterium *Helicobacter pylori* is regarded as the most common cause of infection. Long-term use of NSAIDs (non-steroidal anti-inflammatory disease drugs) like Aspirin, Diclofenac, and Naproxen and stress were also regarded as causes of ulceration. Ancient technology of synthesizing and utilizing plant-based medicine is known from time immemorial. Chronic and complicated diseases have been cured with plant-based products. Considering their importance in manufacturing new medicines, their efficacy and safety have become a major concern. This literature review reviews some investigated plants that have shown promising results in mitigating peptic ulcers at different doses. Preliminary phytochemical screening of these herbs has shown the presence of important secondary metabolites like flavonoids, alkaloids, terpenoids, tannins which are responsible for the anti-ulcer activity. Acute toxicity studies have proved the safety of the selected plant extracts. This article reviews the overall active constituents, anti-ulcer, gastro protective activity of some medicinal plants investigated between 2015-2022.

INTRODUCTION: Peptic ulcers are generally caused due to an imbalance between destructive and defensive factors in the stomach. The destructive factors include HCl, pepsin, ethanol, NSAIDs, stress, smoking, and H-pylori infection. The defensive factors include mucus-bicarbonate barrier, mucin secretion, prostaglandins, and anti-oxidant enzymes [1].

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Treatment for ulcers includes either antagonizing the destructive factors or stimulating the defensive factors [2]. The present pharmacological treatment includes histamine type 2 receptor antagonists such as ranitidine, cimetidine, or proton pump inhibitors like omeprazole [3].

Side effects and relapse of ulcers are major concerns for these medicines. A wide range of plants contains phytochemicals like flavonoids, terpenoids, tannins, alkaloids that help in the treatment of ulcers as they have antioxidant activity and antibiotic activity with less or no side effects. This article gives information about some medicinal plants which were proved to have antiulcer activity.

TABLES 1: EXTRACTION WITH NON-AQUEOUS SOLVENTS

Botanical Name	Family	Parts used	Solvent used	Chemical constituents	Animals used	Screening method	Reference
Aconitum heterophyllum	Ranunculaceae	Roots	Ethanol	Alkaloid, Phenol, Flavonoids, Saponin, Tannins, Protiens, Aminoacids, Terpenoids	Albino Wistar rats	Ethanol-induced ulcer	Rasve VR *et al.*, 2018 [4]
Annona reticulata	Annonaceae	Leaves	Methanol	Steroids, triterpenoids, alkaloids, saponins, phenols, tannins, flavonoids	Wistar albino rats	Ethanol, indomethacin, pyrrolic ligation, water immersion stress induced	Yadav K *et al.*, 2019 [5]
Baccharis trimera	Asteraceae	Aerial parts	Hydroethanolic	Flavanoids, caffeoylquinic acids	Adult Female wistar rats, Male or female swiss mice	Ethanol, acetic acid, pyloric ligation induced	dos Reis Lívero FA *et al.*, 2016 [6]
Citrullus lanatus	Cucurbitaceae	Seeds	Methanol	Flavonoids, tannins, alkaloids, terpenoids, saponins, steroids	Albino rats	Ethanol-induced	Ukwuani-Kwaja AN *et al.*, 2018 [7]
Coccinia grandis	Cucurbitaceae	Leaves	Ethanol	Flavonoids, tannins, alkaloids, glycosides, terpenoids, phytosterols, saponins	Adult male wistar rats	Indomethacin induced	Datchanamurty B *et al.*, 2019 [8]
Cordia Africana	Boraginaceae	Seeds	Methanol	Tannins, flavonoids, saponins, phenols	Wistar albino rats	Pyloric ligation induced	Yismaw YE *et al.*, 2020 9
Costus speciosus	Zingiberaceae	Rhizome	Hydroalchol	Flavonoids, saponins, phenolics, amino acids	Adult swisswistar albino rats	Pyrolic ligation induced	Kujur N *et al.*, 2019 [10]
Croton macrostachyus	Euphorbiaceae	Roots	Methanol	Tannins, terpenoids, alkaloids, saponins, phenols, flavonoids	Adult Sprague dawleyrats, swiss albino mice	Pyloric ligation, ethanol/HCl induced	Mekonnen AN *et al.*, 2020 [11]
Ficus thonningii	Moraceae	Stem, bark	Hydromethanolic	Terpenoids, saponins, alkaloids, tannins, glycosides, phenols, flavonoids	Female swiss albino mice, wistar rats	Pyrolic ligation, Ehanol, indomethacin induced	Adane H *et al.*, 2021 [12]
Hannoa klaineana	Simaroubaceae	Leaves	Methanol	Alkaloids, flavonoids, tannins, glycosides, saponin, terpenoids, steroids	Wistar rats	Ethanol, indomethacin induced	Abubakar I *et al.*, 2020 [13]
Indigofera tinctoria	Fabaceae	Leaves	Ethanol	Flavonoids, terpenoids, saponin,	Albino rats	Pyrolic ligation	Venkatachalam D *et*

				tannins, glycosides		induced	*al.*, 2018 [14]
Lactuca sativa	Asteraceae	Leaves	Ethanol	Tannins, glycosides, phytosterols, phenols, saponins	Wistar albino rats	Ethanol, pyloric ligation induced	Maheswari B *et al.*,2020 [15]
Lagenaria siceraria	Cucurbitaceae	Fruit	Methanol	flavonoids, terpenoids, tannins, saponins, glycosides, phenols, alkaloids	Sprague Dwaley rats	Pyloric ligation, aspirin, cold restraint stress, ethanol induced	Srivastava V *et al.*, 2021 [16]
Lilium candidum	Liliaceae	Flowers	Hydroalcoholic	Alkaloids, flavonoids, saponins, phenolics	Wistar rats	Aspirin induced	Balmik M *et al.*, 2019 [17]
Nymphaea alba	Nymphaeaceae	Flowers	Ethanol	Alkaloids, glycosides, steroids, flavonoids, tannins, phenols	Wistar albino rats	Pyloric ligation, ethanol induced	Paharia AK *et al.*, 2020 [18]
Osyrisquadripartita	Santalaceae	Leaves	Methanol	Alkaloids, phenols, terpenoids, tannins, saponins, flavonoids	Adult wistar albino rats	Ethanol induced, pyloric ligation	Abebaw M *et al.*, 2017 [19]
Peltophorumpterocarpum	Fabaceae	Leaves	Methanol	Flavonoids, phenols, tannins	Wistar Albino rats	Indomethacin, Pyrolicligation induced	Pradeepkumar B *et al.*, 2017 [20]
Phyllanthus niruri	Euphorbiaceae	Leaves	Methanol	Saponins, steroids, alkaloids, terpenoids, flavanoids, tannins, phenols, glycosides	Swiss albino rats	Ethanol - acid induced	Mostofa R *et al.*, 2017 [21]
Salvadora indica	Salvadoraceae	Leaves	Ethanol	Flavonoids, alkaloids, phenolics, terpenoids, tannins, saponins, aminoacids	Male albino rats	Pyrolic ligation, ethanol, cysteamine induced	Sahoo SK *et al.*, 2016 [22]
Spathodeacampanulata	Bignoniaceae	Leaves	Ethanol	Alkaloids, Glycosides, flavonoids, saponins, phenols, tannins	Wistar rats	Aspirin induced	Khatri S *et al.*, 2019 [23]
Spondia smombin	Anacardiaceae	Leaves	Ethanol	Alkaloids, glycosides, saponins, tannins, flavonoids, terpenoids	Swiss mice and wistar rats	Ethanol, Indomethacin, Acetic acid induced	Brito SA *et al.*, 2018 [1]
Terminalia bellirica	Combretaceae	Leaves	Methanol	Saponins, alkaloids, terpenoids, steroids, flavonoids, coumarins	Female Albino wistar rats	Ethanol-acid induced	Akter S *et al.*, 2019 [24]

TABLES 2: EXTRACTION WITH AQUEOUS SOLVENT

Botanical Name	Family	Parts used	Chemical constituents	Animals used	Screening method	Reference
Azadirachta indica	Meliaceae	Leaves	Flavonoids, saponin, alkaloids, tannins	Male Wistar rats	Pyloric ligation, aspirin, cold restraint stress-induced	Bhajoni PS *et al.*, 2016 [25]
Balanites	Zygophyllaceae	Stem,	Flavonoids, polyphenols	Wistar rats	Ethanol, indomethacin,	Ugwah MO

aegyptiaca		bark			pyrolic ligation, acetic acid-induced	*et al.*, 2019 [26]
Bryophyllum pinnatum	Crassulaceae	Leaves	Flavonoids	FemaleWistar rats, swiss albino mice	Ethanol, Acetic acid, indomethacin-induced	De Araújo ER *et al.*, 2021 [27]
Carica papaya	Caricaceae	Seeds	Flavonoids, tannins, saponins	Male albino rats	Indomethacin induced	Oloyede HO *et al.*, 2015 [28]
Citrus sinensis	Rutaceae	Fruit peel	Flavonoids, polyphenols, tannins	Male wistar rats	Ethanol-induced	Selmi S *et al.*, 201 73
Eremomastax speciosa	Acanthaceae	Leaves	Alkaloids, flavonoids, triterpinoids, phenols, tannins, saponins	Male albino wistar rats	HCl/ethanol, indomethacin, cold restraint stress induced, absolute ethanol	Amang AP *et al.*, 2017 [29]
Macaranga barteri	Euphorbiaceae	Leaves	Polyphenols, Tannins, flavonoids, saponins, alkaloids, sterols	Albino wistar rats	Ibuprofen, pyloric ligation, cold restraint stress, Hcl/ethanol induced	Hervé EE *et al.*, 2018 [30]
Mentha piperita	Lamiaceae	leaves	Terpenoids, flavonoids, tannins	Wistar rats	Ethanol-induced	Zangeneh MM *et al.*, 2019 [31]
Myrtle berries	Myrtaceae	seeds	Polyphenols, flavonoids, linoleic acid, oleic acid	Adult male wistar rats	Ethanol-induced	Jabri MA et al., 2017 32
Plantago ovata	Plantaginaceae	Seeds	Polyphenols, flavonoids, fibers	Male albino rats	Indomethacin induced	Bagheri SM *et al.*, 2018 [33]
Terminalia catappa	Combretaceae	leaves	Flavonoids, tannins, alkaloids	Male wistar rats	Absolute ethanol, ischemia-reperfusion induced	Silva LP *et al.*, 2015 [34]
Ximenia americana	Olacaceae	Stem, bark	Flavonoids, alkaloids, saponins, tannins, triterpenoids, steroids	Rats	Absolute ethanol, Ethanol-acid, Indomethacin induced	Aragão TP *et al.*, 2018 [35]
Ziziphus jujuba	Rhamnaceae	Stem, bark	Phenols, tannins, Flavanoids	Albino wistar rats	HCl/absolute ethanol induced	Hamedi S *et al.*, 2015 [36]

TABLES 3: EXTRACTION WITH VARIOUS SOLVENTS

Botanical Name	Family	Parts used	Solvent used	Chemical constituents	Animals used	Screening method	Reference
Averrhoa carambola	Oxalidaceae	Leaves	Petroleum ether, Chloroform, Ethanol, Distilled water	Tannins, flavonoids, phenols, terpenoids, sterols, fats, fixed oils	Wistar albino rats	Ethanol, pylorus ligation induced	Pal A *et al.*, 2019 [37]
Citrus maxima	Rutaceae	Leaves	Ethanol, distilled water	Alkaloids, phenols, flavonoids, terpenoids.Tannins	Wistar albino rats	Ethanol, water immersion stress-induced	Sapkota B *et al.*, 2021 [38]
Ficus religiosa	Moraceae	Stem, bark	Ethanol, acetone	Alkaloids, glycosides, steroids, flavonoids, tannins, phenols	Adult wistar albino rats	Ethanol-induced	Panchawat S *et al.*, 2020 [39]
Melia azedarach	Meliaceae	Leaves	Alcohol, aqueous	Alkaloids, glycosides, flavonoids, saponins, steroids, triterpenoids	Wistar albino rats	Aspirin, Pyrolic ligation	Kayande N *et al.*, 2018 [40]
Moringa oleifera	Moringaceae	Flowers, seeds	Petroleum ether, acetone, methanol	Alkaloids, glycosides, flavonoids, tannins, saponins, steroids	Male albino wistar rats	Acetic acid-induced	Patel VK, Lariya NK *et al.*, 2019 [41]

DISCUSSION: This literature review consists of 40 medicinal plants belonging to different families having antiulcer activity. The most common plant parts used for the extract preparation were the leaves (52.5%), followed by the stem, bark (12.5%), seed (10%), flower (7.5%), roots (5.6%). The least used plant parts were fruits, rhizomes, aerial plants, and peels (2.5%). The most often preferred solvent for extract preparation was aqueous followed by methanol, ethanol, hydroalcoholic and petroleum ether.

The phytochemical screening of these extracts has shown the presence of alkaloids, flavonoids, tannins, terpenoids majorly, which are responsible for the anti-ulcer activity. *In-vivo* studies were also performed for all these plant extracts and satisfactory results were shown. Various screening methods were used for inducing ulcers in animals, of all, ethanol and pyloric ligation methods were mostly preferred. The authors declare no conflict of interest.

CONCLUSION: This review article concludes that the above-mentioned medicinal plants have shown significant antiulcer activity in animal models. Based on the above observations, the enlisted medicinal plants can also be considered for treatment or as adjunctive drugs to manage peptic ulcer disease.

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