



REVIEW ARTICLE

The pharmacological aspects of *Merremia tridentata*: A Comprehensive review

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Abstract

Ayurveda, the traditional Indian medical system, emphasises a natural, all-encompassing approach to mental and physical wellness. The ayurvedic treatment method heavily relies on plant based preparations, making it one of the oldest healthcare systems in the world. Most of the traditional ayurvedic remedies are polyherbal, combining three to thirty different plants and considered to have a little or no side effects. However, consuming ayurveda remedies without guidance may cause major health problems. Therefore, for their safe selection and consumption, a full understanding of the medicinal plant and its action is required. The present work focuses on the review of an ayurvedic plant, *Merremia tridentata*, which is the source of an ayurvedic medicine 'Prasarani' in India. It is attributed with astringent, aphrodisiac, laxative and bitter properties. In Ayurveda, the plant has been in medical use since Samhita period and is used for various ailments such as piles, swellings, body pain, tooth ache, ulcers rheumatic affections, stiffness of joints hemiplegia, urinary infections and general debility. Ethnomedicinal uses, phytochemistry and biological activities revealed that *M. tridentata* is a promising medicinal plant with various pharmaceutical potentials. This study would be an evidence for further investigations related to its pharmacological aspects.

Keywords: *Merremia tridentata*, GC-MS, Bioactivity

Introduction

About 80% of the world depends on the traditional medicines to treat the diseases (Ekor 2014). They show a long history of importance to cure the disease and are globally safer than other drugs. Around 20,000 medicinal plants are globally listed out by the World Health Organization (WHO) in which 15-20% is contributed by India (Vaou *et al.* 2021). Natural, plant derived medicines are valuable sources of new drugs due to the presence of diverse biologically active compounds and its pharmaceutical properties.

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How to cite this article: Sabu, J.A., Brijithlal, N.D. 2024. The pharmacological aspects of *Merremia tridentata*: A Comprehensive review. J. Indian bot. Soc., Doi: [10.61289/jibs2024.11.15.1180](https://doi.org/10.61289/jibs2024.11.15.1180)

Source of support: This work is supported by Basic Science Division, Kerala State Council for Science Technology and Environment (KSCSTE), Kerala, India

Conflict of interest: None.

Over the years, medicinal plants have been used by human populations all over the world in the treatment of different ailments and diseases. This is largely due to their health benefits, effectiveness, affordability and least side effects when compared to synthetic drugs (Welz *et al.* 2018).

Merremia tridentata (L.) Hallier f. belongs to the family Convolvulaceae is a perennial, spreading herb with thick root stock. It is commonly known as 'Prasarani', 'Thiruppan pallu', 'Savulikodi', 'Mudiyarkunthal' and are distributed throughout India (Sabu *et al.* 2020]. In Indian Ayurvedic system of medicine it is used for curing body pain, piles, urinary infections, toothache, swellings, rheumatic affections, stiffness of the joints, etc. (Khare 2007).

Systematic Position

Domain : Eukaryota
Kingdom : Plantae
Phylum : Spermatophyta
Subphylum : Angiospermae
Class : Dicotyledonae
Order : Solanales
Family : Convolvulaceae
Genus : *Merremia*
Species : *Merremia tridentata* (L.) Hallier. f.
Synonym: *Xenostegia tridentata* (L.) D.F. Austin and Staples

Morphological characters

Merremia tridentata is a perennial herb, usually twining but also prostrate and rooting at the nodes. Leaves simple, linear to narrowly lanceolate with small toothed lobes at the base (tridentate). Flowers- solitary, bisexual, regular, pedicel present, sepals- 5, usually subequal, funnel shaped corolla, 5 lobes, cream to yellow in colour, stamens-5, inserted near the base of the corolla tube, filaments often unequal in length, ovary with 4 ovules, style-1, simple, filiform, stigma-2, capitate. Fruit is a four seeded capsule (Olatunji *et al.* 2021) Figure 1.

Ethnomedicinal uses

M. tridentata have been reported in different parts of the world for the treatment of different diseases. The whole plant and aerial parts prepared by maceration have been recorded to be useful in the treatment of leprosy, piles, swellings, rheumatism, stiffness of the joints, hemiplegia, urinary infections and toothache (Sowndhararajan *et al.* 2010). The root extracts are beneficial in the treatment of diabetes (Arunachalam and Parimelazhagan 2012), rheumatism, hemiplegia, piles, swellings, and urinary infections (Bidkar *et al.* 2009). Oil derived from the whole plant or the leaves alone mixed with coconut oil is used to cure various skin disorders and dandruff (Ambika and Nair 2019).

Physico-chemical constants

The physical and chemical properties of *M. tridentata* including total ash content, water-soluble ash, sulphated ash, acid-insoluble ash and moisture content were measured (Aron *et al.* 2013) Table 1.

Phytochemical screening

The phytochemical studies revealed the presence of 7-O-methylapigenin, luteolin, glycoflavones and proanthocyanidins, p-hydroxy benzoic acid, 2-hydroxy 4-methoxy benzoic acid, gentisic acid, vanillic acid, syringic acid, hygrine, nicotine, diosmetin, glucosides, lutein, β -sitosterol, etc. (Sharma and Gupta 2022, Rajashekhara *et al.* 2012, Sereena *et al.* 2012). A preliminary phytochemical analysis of aqueous extracts reported reducing sugars, phytosterols, fixed oils, saponins, phenolics, flavonoids while alkaloids and proteins were absent. Alkaloids, sugars, amino acids, phytosterols, phenols, flavonoids, tannins, saponins and quinones were all detected in the ethanol extract. The ethyl acetate extract had tested positively for phytosterols, flavonoids, saponins and quinines. Alkaloids, phenols, phytosterols, flavonoids and tannins were found in acetone extract (Aron *et al.* 2013). Phytosterol and flavonoid components are reported in all the extracts. It has been established that these metabolites are in charge of the therapeutic effects of medicinal plants. The potential flavonoids like luteolin, cynaroside, apigenin, cosmoiin and quercitrin having strong anti-diabetic properties were isolated from the stem extracts of *M. tridentata* (Vo Van *et al.* 2022).

GC-MS analysis

The crude methanol root extract analysis shows the presence of ten major phytoconstituents such as Dodecanoic acid, Tridecanoic acid 12-methyl-methyl ester, Undecanoic acid 10-methyl methyl ester, Tetra decanoic acid, Hexa decanoic acid 14- methyl methyl ester, 10-octa undecanoic acid methyl ester, Nonadecanoic acid methyl ester, Heneicosanoic acid 20-oxo methyl ester, Hexadecanoic acid methyl ester and Heptadecanoic acid 16-methyl methyl ester. Dodecanoic acid shows bioactivities like anti-bacterial, anti-viral, anti-oxidant, hypocholesterolemic, and Nonanoic acid methyl ester reported to have anti-cancer properties (Thirunavukkarasu *et al.* 2016).

Bioactivity studies

Anti-microbial

The methanolic leaf extract reported to have anti-fungal activity against yeast and antibacterial activity against *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Vibrio parahaemolyticus* (Kaladhar *et al.* 2009). The methanolic stem extract only showed strong antibacterial activity on Gram-positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*) (Pavithra *et al.* 2010).

Anti-diabetic

The aqueous root extract showed anti-diabetic properties in Streptozotocin-induced diabetic rats when compared to Glibenclamide. The significant reducing effect in the elevated blood glucose level and lipid profile in Streptozotocin induced diabetic rats may be due to the phytochemicals present in the extract (Arunachalam and Parimelazhagan 2012)

The flavonoid components such apigenin, cosmoiin, cynaroside, luteolin, and quercetin identified from *M. tridentata* extract have better hypoglycemic effects in alloxan-induced diabetic rats than the medications such as Glibenclamide and Metformin. Based on a molecular docking study, cosmoiin and cynaroside molecules are the most attractive ligands on a variety of anti-diabetic targets, including α -amylase and α -glucosidase for their hypoglycemic activity (Van *et al.* 2022).

Anti-oxidant

Acetone root extract exhibited potential anti-oxidant activity in the DPPH assay, ABTS assay, FRAP assay and in Phosphomolybdenum reduction assay. The reducing power activity of the extracts was linked to high levels of phenolics (Sowndhararajan *et al.* 2010). The root and aerial part extracts possess significant free radical scavenging and antioxidant activities (Olatunji *et al.* 2021). Study on the ethanol leaf extract revealed high increase in glutathione level, catalase activity and superoxide dismutase activity. This adds to the presence of Diosmetin and Luteolin having free radical scavenging potential, proving its antioxidant activity (Olubodun *et al.* 2022).

Anti-urolithiatic

M. tridentata are used in traditional medicines to treat urinary infections and kidney disorders. It was reported to have significant *in vitro* anti-urolithiatic activity in the dissolution of calcium oxalate crystals (Sabu *et al.* 2020) and calcium phosphate crystals when performed in presence of standard drug, Cystone[®]. Thus, it is beneficial in the treatment of kidney stones (Sabu *et al.* 2021).

Anti-arthritis

The ethanolic extract of the whole plant reported to have anti-arthritis activity. The *in vivo* study on male albino rats using the complete Freuds adjuvant induced arthritis model with indomethacin as standard drug showed higher anti-arthritis activity (Olatunji *et al.* 2021) (Kamalutheen *et al.* 2009).

Anti-inflammatory

The acetone root extract demonstrated a significant anti-inflammatory activity against carrageenan induced and histamine induced inflammation or oedema (Arunachalam *et al.* 2011). Methanolic root extract predominantly inhibit the release of prostaglandin like substance and showed significant anti-inflammatory activity at 3 hours against carrageenan injection (Kamble and Kamble 2017). The ethanol extract also shows best activity against carrageenan induced oedema (Kamalutheen *et al.* 2009)]. The presence of flavonoids may be responsible for anti-inflammatory activity (Ferrandiz and Alcaraz 1991).



Figure 1: Habitat of *Merremia tridentata*

Table 1: Physico-chemical constants of *Merremia tridentata*.

Particulars	Value % ww
Total ash value	15.3
Water soluble ash value	5.8
Sulphated ash value	4.5
Acid insoluble ash value	3.1
Moisture content	11.2

Wound healing

The roots extract was tested in albino mice for investigating the wound-healing activity using the tensile strength of both re-sutured incision and granuloma wound models with Tween 80 solution as the control. The results showed considerably higher tensile strength when compared to the control in the re-sutured incision model and the granuloma model. The wound-healing effect was attributed to the astringent property of flavonoid in the extracts (Bidkar *et al.* 2009).

Conclusion

Merremia tridentata exhibits a wide range of pharmacognostic and phytochemical properties. It is vital to define its major therapeutic activities such as anti-diabetic, anti-inflammatory, anti-urolithiatic and anti-microbial to standardize it as a medicine. In order to stop the adulteration of the plant, the current study gives a brief overview on the botanical identification and authenticity of the plant. The biological activity and phytochemical characteristics described in this paper may be crucial in establishing some diagnostic indices for identification, thereby expanding its medicinal and economic significance.

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