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## "Phytochemical Characterization and Antimicrobial Properties of *Merremia tridentata* (L.) Hallier.f.: A Traditional Medicinal Plant"

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### Abstract

*Merremia tridentata* (L.) Hallier.f., a member of the *Convolvulaceae* family, has been traditionally used in various cultures for its medicinal properties. This study investigates the phytochemical composition and antimicrobial activities of *M. tridentata* leaf extracts obtained using Hexane, Benzene, Acetone, and Water. Phytochemical screening revealed the presence of alkaloids, flavonoids, tannins, saponins, and terpenoids. The antimicrobial potential was evaluated using the agar disc diffusion method, where the plant extracts showed significant antibacterial activity against *Escherichia coli*, *Bacillus cereus*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*, as well as antifungal effects against *Aspergillus niger* and *Penicillium notatum*. These findings support the traditional use of *M. tridentata* in treating infections and provide a foundation for its further pharmacological development.

**Keywords:** *Merremia tridentata*, Phytochemical analysis, Antimicrobial activity, Bioactive compounds, Traditional medicine

### Introduction



Medicinal plants have long been a source of bioactive compounds for the treatment of various diseases. *Merremia tridentata* (L.) Hallier.f., a species in the *Convolvulaceae* family, is known for its medicinal properties and is widely used in traditional remedies. This plant is particularly noted for its potential in treating ailments like inflammation, infections, and digestive issues. Despite its traditional use, limited research has focused on its phytochemical composition and pharmacological potential.

Preliminary studies suggest that *M. tridentata* contains bioactive compounds such as alkaloids, flavonoids, and terpenoids, which may contribute to its therapeutic effects. Furthermore, the plant's antimicrobial properties, particularly against common pathogens like *Escherichia coli* and *Staphylococcus aureus*, have been suggested but remain underexplored. This study aims to provide a detailed analysis of the phytochemicals in *M. tridentata* and evaluate its antimicrobial activities, thereby supporting its potential use as a natural therapeutic agent.

## Methodology

## Materials

The plant material used for this study was *Merremia tridentata* (L.) Hallier.f., collected from the premises of G. Venkataswamy Naidu College, Kovilpatti Taluk, Tamil Nadu, India. The species identification was confirmed through references from "Flora of the Presidency of Madras" (Gamble, 1928) and "Flora of Tamilnadu Carnatic" (Mathew, 1981).

**Figure. 1. Natural Habit of *Merremia tridentata* (L.) Hallier.f.**





### Phytochemical Analysis

Phytochemical screening was performed on extracts obtained using four solvents: Hexane, Benzene, Acetone, and Water. The plant extracts were analyzed for the presence of various bioactive compounds, including tannins, alkaloids, flavonoids, glycosides, terpenoids, and others, based on standard protocols described by Azhagu Raj et al. (2017) and Harborne (1998).

### Extraction Procedure:

1. Fresh leaves of *M. tridentata* were washed, dried, and ground into a fine powder.
2. A 30g sample of the powdered plant was subjected to Soxhlet extraction using Hexane, Benzene, and Acetone.
3. The aqueous extract was prepared by boiling the plant powder with distilled water.
4. Extracts were concentrated and stored for further phytochemical analysis.

### Phytochemical Screening:

- **Alkaloids:** Mayer's reagent was used to detect alkaloids by the formation of a white precipitate.
- **Steroids:** A reddish-brown ring formed when acetic acid and sulfuric acid were added to the extract indicated steroids.
- **Reducing Sugars:** Brick-red precipitation upon heating with Fehling's solution indicated reducing sugars.
- **Tannins:** Brownish-green coloration after ferric chloride treatment indicated the presence of tannins.
- **Saponins:** Persistent frothing and emulsion formation with olive oil indicated saponins.
- **Terpenoids:** A reddish-brown interface color formed after adding sulfuric acid confirmed the presence of terpenoids.
- Other compounds like flavonoids, glycosides, and amino acids were detected using standard methods outlined in the literature.

### Antimicrobial Activity



The antimicrobial activity of the leaf extracts was tested using the agar disc diffusion method (Bauer et al., 1996) against the following bacterial strains: *Escherichia coli*, *Bacillus cereus*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*. The fungi tested were *Aspergillus niger* and *Penicillium notatum*. The test was conducted as follows:

#### **Plant Extract Preparation:**

- Thirty grams of powdered *M. tridentata* leaves were extracted sequentially using 250 mL of Hexane, Benzene, Acetone, and distilled water.
- The extracts were concentrated and dissolved in their respective solvents to prepare 1/10 solutions for testing.

#### **Microbial Strains:**

- The bacterial strains were obtained from Scudder Institute of Medical Diagnostic Centre, Nagercoil, and cultured on Muller Hinton Agar plates.
- Fungi were grown on Sabouraud Dextrose Agar (SDA) and Potato Dextrose Agar (PDA).

#### **Agar Disc Diffusion Method:**

- Bacterial strains were cultured on Muller Hinton Agar plates.
- Filter paper discs (5 mm) were soaked with 200-500  $\mu$ L of plant extract and placed on the agar surface.
- The plates were incubated at 37°C for 24 hours, and the zone of inhibition around the discs was measured.

#### **Fungal Assay:**

- The fungal strains *Aspergillus niger* and *Penicillium notatum* were cultured on SDA.
- The plant extract was applied to sterile filter paper discs, which were then placed on the fungal inoculated agar plates.
- The plates were incubated at 37°C, and the zone of inhibition was measured at 24 and 48 hours.

**Controls:**

- The negative control was the respective solvents (Hexane, Benzene, Acetone, or Water).
- The positive control for the fungal assay was Clotrimazole.

**Results and Discussion****Analysis of Qualitative Phytochemical screening**

The phytochemicals analyses of the four solvents like Hexane, Benzene, Acetone, and Aqueous extracts were tested for 13 phytochemicals (Table 1 & 2). The procedure for the phytochemicals analysis is carried out using standardized protocols. The Leaves of Hexane extract of *Merremia tridentata* which contains only 5 phytochemicals such as Alkaloids, Tannins, Coumarins, Glycosides and Essential oils. The remaining 7 Phytochemicals are absent such as Steroids, Reducing sugars, Saponins, Terpenoids, Aminoacids, Aromatic acids, Carbohydrates and Quinones. Whereas Benzene Extract of *Merremia tridentata* which contains only 4 Phytochemicals such as Alkaloids, Tannins, Glycosides and Essential oils. The remaining 9 phytochemicals were absent such as Reducing sugar, Steriods, Saponins, Coumarins, Terpenoids, Quinones, Amino acids, Aromatic acids and Carbohydrates. Whereas the Acetone Extract of *Merremia tridentata* Which contains only 6 Phytochemicals such as Tannins, Steroids, Coumarins, Terpenoids, Glycosides and Aromatic acids. The remaining 7 phytochemicals were absent such as Saponins, Quinones, Carbohydrates, Amino acids, Saponins, Reducing sugar, Alkaloids, Essential oil and Aromatic acids. Whereas the Aqueous extract of *Merremia tridentata* Which contains only 8 Phytochemicals such as Steroids, Tannins, Coumarins, Terpenoids, Glycosides, Aromatic acids, Carbohydrates and Quinones. The remaining 5 phytochemicals were absent such as Alkaloids, Saponins, Reducing sugar, Aminoacids and Essential oils.

**Table No. 1: The details of selected solvents and Soxhlet unit running parameters of Leaves of *Merremia tridentata* (L.) Hallier.f.**



S.No.	Solvent Name	Boiling Point	Polarity	Total No. of Cycles	Soxhlet Total Running Hours
1.	Hexane	69 <sup>0</sup> C	0.1	17	3
2.	Benzene	80 <sup>0</sup> C	2.7	13	3
3.	Acetone	56 <sup>0</sup> C	5.1	09	3
4.	Aqueous	100 <sup>0</sup> C	10.2	03	3

**Table No. 2: Qualitative analysis of phytochemicals constituents of Leaves of *Merremia tridentata* (L.) Hallier.f.**

S.NO	TEST NAME	HEXANE	BENZENE	ACETONE	AQUEOUS
1.	Alkaloids	+	+	-	-
2.	Steroids	-	-	+	+
3.	Reducing sugars	-	-	-	-
4.	Tannins	+	+	+	+
5.	Saponins	-	-	-	-
6.	Coumarins	+	-	+	+
7.	Terpenoids	-	-	+	+
8.	Glycosides	+	+	+	+
9.	Amino acids	-	-	-	-
10.	Essential oils	+	+	-	-
11.	Aromatic acids	-	-	+	+
12.	Carbohydrates	-	-	-	+
13.	Quinones	-	-	-	+
<b>Total No. of Phytochemicals</b>		<b>5</b>	<b>4</b>	<b>6</b>	<b>8</b>



Note: (+) Present; (-) Absent

### **Antibacterial activity Screening**

A number of synthetic drugs have been used to cure various diseases caused by pathogenic microbes in man. These drugs produced side effect due to overdose. Several medicinal plants have been identified and used to cure bacterial infection to human beings. In the present investigation antibacterial activity of the leaves of *Merremia tridentata* (L.) Hallier.f. was reported with six pathogens and their zone of the inhibition was tabulated. The results indicated that the plant extracts have good antimicrobial activity against different microorganisms. Recently, the use of plant extracts against bacteria has increased because of the gradual increase in drug resistance among microorganism. A number of synthetic drugs have been used to cure various diseases caused by pathogenic microbes in human beings. Several medicinal plants have been identified and used to cure bacterial infection to human beings.

In the present study the antibacterial activities of different solvent extracts of leaves of *Merremia tridentata* (L.) Hallier.f. were investigated and showed good activity for the zone of inhibition against four human pathogens (Table 3 & Figure 2). The Acetone solvent extract exhibited different zones of inhibition against various microorganisms. Among the different extracts of leaves of *Merremia tridentata* (L.) Hallier.f. showed maximum level of zone of inhibition.

*E.coli* showed maximum level of inhibition against Acetone extract (17 mm) followed by *Pseudomonas aeruginosa* (15 mm), *Staphylococcus aureus* (14.2 mm) and *Bacillus subtilis* showed (13 mm) showed minimum zone of inhibition. Whereas aqueous extract shows minimum zone of inhibition noted in *E.coli* and *Staphylococcus aureus* (12 mm) (Figure 3).

**Table No. 3. Antimicrobial activity of leaves of Leaves of *Merremia tridentata* (L.) Hallier.f.**

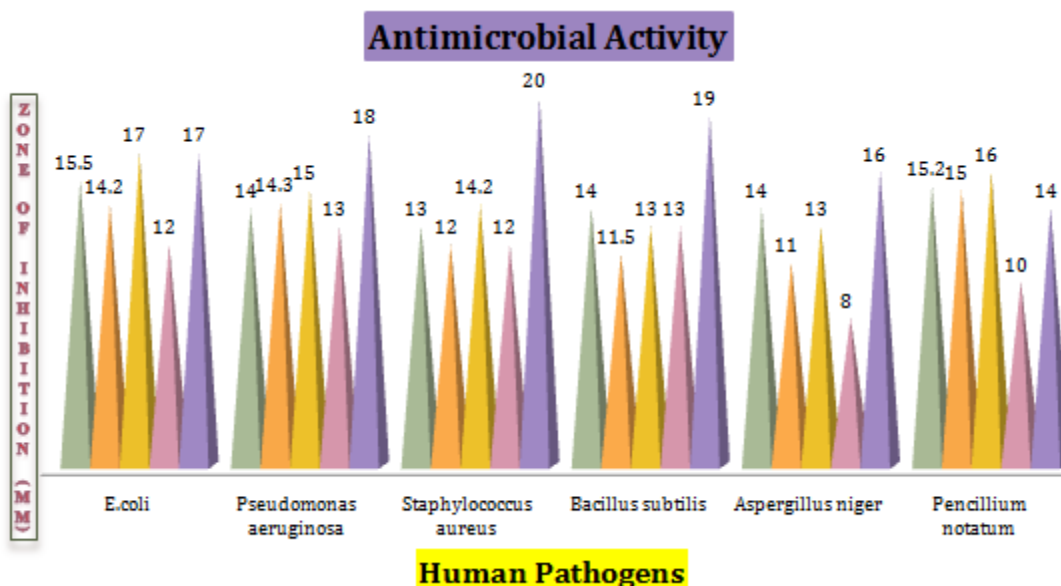
**using disc diffusion assay**



S. No	Pathogens	Antibacterial activity - Zone of Inhibition (mm)				
		Hexane	Benzene	Acetone	Aqueous	Control (Amikacin)
1.	<i>Escherichia coli</i>	15.5 ± 0.5	14.2 ± 0.5	17 ± 0.3	12 ± 0.6	17 ± 0.4
2.	<i>Pseudomonas aeruginosa</i>	14 ± 0.2	14.3 ± 0.2	15 ± 0.4	13 ± 0.3	18 ± 0.5
3.	<i>Staphylococcus aureus</i>	13 ± 0.3	12 ± 0.3	14.2 ± 0.2	12 ± 0.2	20 ± 0.4
4.	<i>Bacillus subtilis</i>	14 ± 0.4	11.5 ± 0.4	13 ± 0.5	13 ± 0.5	19 ± 0.3
S. No	Pathogens	Antifungal activity - Zone of Inhibition (mm)				
		Hexane	Benzene	Acetone	Aqueous	Control (Nystatin)
1.	<i>Aspergillus niger</i>	14 ± 0.5	11 ± 0.5	13 ± 0.3	8 ± 0.6	16 ± 0.4
2.	<i>Pencillium notatum</i>	15.2 ± 0.2	15 ± 0.2	16 ± 0.4	10 ± 0.3	14 ± 0.5

± Standard Error, + Present, – Absent

**Figure No. 2. Antimicrobial activity of leaves of Leaves of *Merremia tridentata* (L.) Hallier.f. using disc diffusion assay**



### Antifungal activity

The antifungal activity of various solvent extracts of fruit skin of *Memordica cymbalaria* Hook.f. were carried out against two strains viz. *Aspergillus niger* and *Penicillium notatum*. The results of the antifungal activity of different extracts of leaves of *Merremia tridentata* (L.) Hallier.f. were presented in Table 3. *Penicillium notatum* growth is controlled by a maximum zone of inhibition (16 mm) in the Acetone extract and the minimum zone of inhibition (16 mm) in the aqueous extract. In *Aspergillus niger*, maximum zone of inhibition (14 mm) in the Hexane extract and the minimum zone of inhibition (8 mm) in the aqueous extract of leaves of *Merremia tridentata* (L.) Hallier.f.

### Summary and Conclusion

*Merremia tridentata* is an important medicinal plant traditionally used in various regions for treating ailments like infections, stomach issues, and cancer. This study evaluated its phytochemical composition and antimicrobial properties. The phytochemical analysis revealed that extracts from different solvents (Hexane, Benzene, Acetone, and Aqueous) contained varying



levels of bioactive compounds, including alkaloids, flavonoids, and terpenoids. Among the extracts, the aqueous extract exhibited the highest diversity of phytochemicals.

Antimicrobial testing demonstrated significant antibacterial and antifungal activities. The ethanol extract showed the largest inhibition zones against *Escherichia coli*, while the acetone extract was most effective against *Penicillium notatum*. All extracts exhibited moderate to good antimicrobial activity, supporting the plant's therapeutic potential.

These findings underscore the importance of *M. tridentata* as a source of bioactive compounds with antimicrobial properties. Further studies are recommended to isolate specific bioactive compounds and explore their therapeutic applications in modern medicine, especially in pharmaceutical formulations.

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