

# Comparative Antimicrobial Evaluation of Available *Mikania* Species in Bangladesh

Rafeza Khatun<sup>1</sup>, Laila Nasrin<sup>2</sup>, Sudipta Roy<sup>1</sup>, Mudasir A. Tantry<sup>3</sup>, Md Aziz Abdur Rahman<sup>1,\*</sup>

<sup>1</sup>Department of Pharmacy, University of Rajshahi, Rajshahi, Bangladesh

<sup>2</sup>IBSC, Plant Pathology Mycology and Microbiology Lab, University of Rajshahi, Rajshahi, Bangladesh

<sup>3</sup>Department of Chemistry, S. P. College, Cluster University Srinagar, Kashmir, India

**Abstract** There is considerable interest of using oriental medicinal plants to treat various infections due to multiple and repeated issues with antibiotic efficacy. The vast history of traditional Asian medicine may facilitate the discovery of new antibiotics from herbal products used to treat infections. In present investigation, we selected three available *Mikania* species (family-Asteraceae) *Mikania cordata* (MC), *Mikania micrantha* (MM) and *Mikania scandens* (MS) for comparative antimicrobial evaluation. The ethanolic extract of these plants were tested by using disc diffusion method. The significant antibacterial activity was shown by *M. cordata* against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Shigella sonnei* with zone of inhibition in between 30 to 35 mm whereas other two species showed mild to moderate activity with average zone of inhibition 11-30 mm. All the three species showed significant activity against *Aspergillus niger* with mild to moderate activity against *Aspergillus viridis*, *Fusarium solani* and *Trichoderma* spp. Based on the evaluation, it is concluded that *Mikania cordata* possesses highest antimicrobial potentials among all the species tested.

**Keywords** Asteraceae, *Mikania cordata*, *Mikania micrantha*, *Mikania scandens*, Pathogen, Antimicrobial activity

## 1. Introduction

Nowadays, antibiotics are essential arms for fighting bacterial infections [1]. Antibiotics have become less effective against certain illnesses because many of them produce toxicity as well drug resistance [2]. So, it is emergency to investigate newer drugs of therapeutically and industrially important with lesser resistance to ensure the health-related quality of human life [1].

From the ancient time, plants play an important role to prevent different types of human diseases [3]. *Mikania* is one of the important plant genus found in the tropics of America and Asia and are widely and combined known as guaco. It comprises about 300 identified species, [4] but only 15-20 of them have been studied. In folkloric medicine, the plants from the genus are used to treat fever, rheumatism, inflammation, oxidative stress, spasmolytic, cancer, respiratory diseases as well as snake bites and scorpion stings [4].

Keeping these words, we have selected species from *Mikania* genus that are native to Bangladesh. We identified four species *Mikania cordata*, *Mikania dioscoreifolia*,

*Mikania micrantha* and *Mikania scandens*. Among these, *Mikania cordata* has been used in traditional herbal medicine of Bangladesh for a long to treat various ailments including pain, inflammations and some other infectious diseases by folklore people [5-7].

A wide variety of biological activities are reported for *Mikania* species such as antimicrobial, antiviral, anti-inflammatory, antispasmodic, antitumoral, anticoagulant, bronchodilator and antioxidant due to the presence of coumarin, diterpenes, dilactones, and flavonoids [8, 9]. Likewise, terpenes, diterpenes and sesquiterpene lactones are often found, mainly the dilactones type mikanolide and miscandenin derivatives, which have analgesic and antibacterial [10, 11] activities. There were some considerable studies, carried out the evaluation of antibacterial activity of *Mikania micrantha*, *Mikania cordata*, *Mikania laevigata* and *Mikania glomerata* [12-14].

Though a lot of research have been done on *Mikania* species but most of them are limited to *Mikania micrantha* and *Mikania cordata*, and comparative antibacterial evaluation was not reported elsewhere that might be interesting among biological scientists making the use of active medicinal plants safe.

In this study we report comparative antimicrobial study of three available *Mikania* species: *Mikania cordata*, *Mikania micrantha* and *Mikania scandens*.

\* Corresponding author:

aziz2002@asia.com (Md Aziz Abdur Rahman)

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## 2. Materials and Methods

### 2.1. Collection and Identification of Plant Material

The whole part of *M. cordata* was collected from Rajshahi (University of Rajshahi campus) which is northern part of Bangladesh. *M. micrantha* and *M. scandens* were collected from Barisal (Southern region) and Kushtia (western region, Kumarkhali area), respectively, during the month of August 2015 and were identified by taxonomist Dr. AHM Mahbubur Rahman, Associate Professor, Department of Botany, University of Rajshahi, Bangladesh. The plants were labeled, air dried for several days and then oven dried at 45°C for 24 hours to assist grinding. The dried plants were crushed separately into course powder.

### 2.2. Preparation of Extract

About 170gm dried powdered plant materials of *M. cordata* (MC), *M. micrantha* (MM) and *M. scandens* (MS) taken separately in an amber colored extraction bottle (2.5liter capacity) and the materials were soaked with 70% ethanol (90ml × 3 times). The sealed bottle was kept for 7 days with occasional shaking and stirring. The extracts were filtered through cotton and then Whatman No.1 filter papers and were concentrated with a rotary evaporator under reduced pressure at 45°C and was preserved in refrigerator for further assay. The obtained MC, MM and MS percentage were 11.00%, 9.5% and 7.3%, respectively.

### 2.3. Antimicrobial Screening

Antibacterial and antifungal activity of plant crude extract were evaluated by Disc diffusion susceptibility method [15-17]. Bacterial and fungal strains were collected from Department of Botany, University of Rajshahi. Bacterial strains *S. aureus*, *B. cereus*, *E. coli* and *S. sonnii* were used for antibacterial activity. For antifungal assay *A. niger*, *A. viridis*, *F. solani* and *Trichoderma* spp. were used. The bacterial and fungal stock cultures were incubated for 24 hours at 37°C on nutrient agar and potato dextrose agar (PDA) medium, respectively, following refrigeration storage at 4°C.

The stock solution was prepared by the addition of 20 mg of crude in 1ml MeOH (20µg/ml). Then, sterile discs (made from Whatman filter paper) each about 5mm diameter was impregnated with the specific volume of plant extract to get 300 and 200µg/disc for antibacterial and antifungal assay, respectively. With the help of sterilized forcep, dried discs were then placed on agar plate containing microorganisms. All the plates were incubated at specific temperature (bacteria: 37°C and fungi: 28°C) for 24-48 hours. The zones of growth inhibition around the disc were measured after 48 hours. The sensitivity of the microorganism to the plant extracts was determined by measuring the sizes of inhibition zones (diameter of the zone) on the agar surface around the disc. Standard clindamycin (10 µg/disc) and fluconazole (5 µg/disc) (both purchased from Sigma-Aldrich) were used as positive

control for bacteria and fungus, respectively.

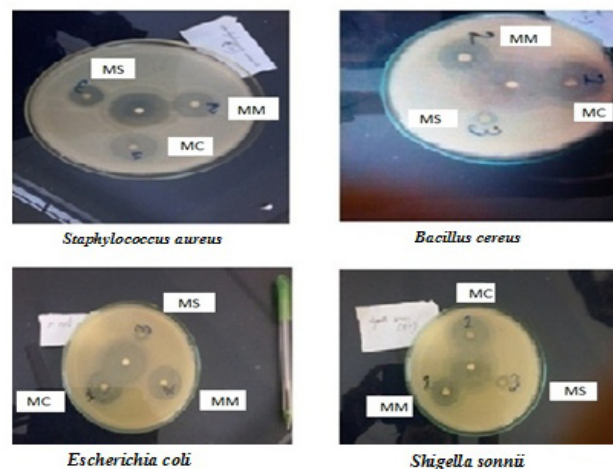
## 3. Results and Discussion

### 3.1. Antibacterial Activity

The inhibitory activity of extracts of MC, MM and MS was determined at a concentration 300 µg/disc against two Gram positive and two Gram negative bacteria. The results are shown in Table 1 and Figure 1. Results revealed that all three extracts are sensitive to the organisms tested. Among the extracts, MC was found to be most active other than MM and MS. Extract MC showed strong activity with zone of inhibition 35, 32 and 32 mm against *B. cereus*, *S. aureus* and *E. coli*, respectively (Table 1). Activity of MM and MS was in between 14-30 and 11-21 mm, respectively.

**Table 1.** *In vitro* antibacterial activity (zone of inhibition in mm) of three extracts MC, MM, MS and standard Clindamycin

Organism	MC	MM	MS	Standard
	(300 µg/disc)			(10 µg/disc)
<i>S. aureus</i>	32	25	21	40
<i>B. cereus</i>	35	14	11	39
<i>E. coli</i>	32	30	15	35
<i>S. sonnii</i>	30	28	19	40



**Figure 1.** Zone of inhibition (mm) of MC, MM, MS and standard Clindamycin (Centered disc) against *S. aureus*, *B. cereus*, *S. sonnii*, and *E. coli*

### 3.2. Antifungal Activity

The plants extract of MC, MM and MS were tested against the four pathogenic fungi at a concentration of 200 µg/disc for each and the result was compared with standard antifungal Fluconazole 5 µg/disc. It was observed that among three plant extract MC showed comparably strong antifungal activity than other two extracts MM and MS (Table 2). All the three extracts showed strong activity against *A. niger* with zone of inhibition in the range of 25-40 mm. Fungi *A. viridis*, *F. solani* and *Trichoderma* spp. were mild to moderate sensitive to MC, MM and MS.

**Table 2.** *In vitro* antifungal activity (zone of inhibition in mm) of three extracts MC, MM, MS and standard Fluconazole

Organism	MC	MM	MS	Fluconazole
	(200 µg/disc)			(10 µg/disc)
<i>A. niger</i>	40	30	25	40
<i>A. viridis</i>	10	5	6	16
<i>F. solani</i>	11	5	3	20
<i>Trichoderma spp.</i>	11	4	5	40

## 4. Conclusions

It is concluded that among three plants extract *Mikania cordata* possesses significant and comparable antibacterial and antifungal activity than *Mikania micrantha* and *Mikania scandens*. Considering the broadest range of antimicrobial properties this would suggest that *Mikania cordata* might possess phytochemicals that can be useful as a broad-spectrum antimicrobial agent. This study revealed the importance of these plant parts as a novel source of antimicrobial agents due to the increasing drug resistance among microorganisms. The mechanism of action will be done in further study on the basis of *in vitro* experimentation for development of new products.

The bioactivity results will provide scientific foundation for rational development and utilization of this plant. This study can easily identify a more potent species which showed a significant pharmacological effect. To utilize the plant extract as a therapeutic agent, further toxicity and pharmacological studies are needed.

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