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Research Article

Studies on Comparative Antimicrobial Activities of *Aerva lanata* and *Momordica charantia* Leaf Extracts

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ABSTRACT

Screening and comparison of antimicrobial action of leaf extract of *Aerva lanata* and *Momordica charantia.* Ethyl acetate and methanolic extracts of leaves of plants were screened for antimicrobial activity using the cup plate method and the spread plate method against gram-positive and gram-negative reference organisms (*Bacillus subtilis* and *Escherichia coli).* The standard antibacterial agent used for reference is chloramphenicol and the results were calculated as the zone of inhibition. The methanolic extract showed a comparatively broader and better antimicrobial spectrum than ethyl acetate extract in selected plants. Plant extracts showed dose-dependent action, results were similar to the action of the standard chloramphenicol. Extracts of *A. lanata* and *M. charantia* demonstrated antimicrobial activity on tested microorganisms. Methanolic extracts showed higher antimicrobial potential than ethyl acetate extract. *A. lanata* extracts showed a better response than *M. charantia* extracts in the cup plate method antibacterial activity with *B. subtilis* and *E. coli*.

Introduction

In the past decade, many infections, like respiratory, bacterial meningitis, sexually transmitted, and other acquired infections, have acquired resistance to many antimicrobial drugs, especially penicillin, ampicillin, and fluoroquinolones.[1-5] The traditional medicinal plants containing various antimicrobial molecules are used in the alleviation of various infections for their antimicrobial activity and some of the bioactive molecules are used in the market as raw products. Major reasons for antimicrobial resistance are poor patient acceptance and irrational use, resulting in impulsive mutations in the microorganisms.[4-7] Plants have been an essential element of human culture for their fundamental wellbeing.[8] *M. charantia* (family Cucurbitaceae) and *A. lanata* (Amaranthaceae) are used in many parts of Asia, amid its use for skin infections. Tea of these plants is in use for diabetes, to force out intestinal gases, in menstruation, and like antiviral for the treatment of measles and hepatitis.[9-11] In the present study, an effort has been shown to screen the antimicrobial action of extracts of the selected medicinal plants on some human pathogenic bacteria.

Materials and Methods

Collection of Plant Materials

Leaves of both plants were collected from the Siddipet district of Telangana state. *A. lanata* (Amaranthaceae) was authenticated by Dr. K. Madhav Shetty at Osmania University (Botany Department); (voucher no. 288)

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M. charantia (family Cucurbitaceae) was authenticated by Dr. Baba Shankar, Department of Pharmacognosy, School of Pharmacy, Anurag Group of Institutions. Specimen access no.: AG/LCP/MC-155.

Extraction Procedures

Shade dried plant materials (100 grams of powder of each plant) were extracted by cold maceration method, with 500 mL of either ethyl acetate or methanol at room temperature for 7 days. The extracts were concentrated by a Rotavapor. Two concentrations of the plant extracts (100 and 200 µg/mL) were prepared with ethyl acetate and methanol as solvents.

Preliminary Phytochemical Screening

Phytochemical screening of *M. charantia* and *A. lanata* leaf extracts with both the above-mentioned solvents were done to identify the occurrence of constituents, like alkaloids, flavonoids, tannin, saponins, carbohydrates, proteins, glycosides, and steroids.

Test Microorganisms and Control Antibiotics

E. coli (ATCC 25922) and *B. subtilis* (ATCC 90028) were tested. Chloramphenicol at a dose of 10 µg/mL was used as a standard antibacterial drug.

Antimicrobial Assay

Cup Plate Method

Nutrient agar medium is used for the antimicrobial assay. The nutrient agar is prepared by dissolving 20 grams of nutrient agar in 200 mL of distilled water. Then, it is autoclaved at 121°C for 45 minutes. Sterilized media is allowed to cool and poured into Petri plates. The plates were inoculated with bacteria by streaking. A 6 mm cork borer was used for making bores. The extracts are dissolved in solvents to form dilutions of 100 and 200 µg/mL. Chloramphenicol at a dose of 10 µg/mL is used as standard. The zone of inhibition (ZI) was measured from the diameter of the ZI in mm.[12,13]

Pour Plate Method

Culture plates were and sterilized. A 6 mm cork borer was used for making bores. Such plates were incubated at 37°C for 24 hours. ZI was calculated as mentioned above. The test extracts and the standard were poured into the well using sterile pipettes.[12-15]

Results

Qualitative Analysis of Phytochemicals

Phytochemical screening results were presented in Table 1. They reveal the presence of alkaloids, phenolics, flavonoids, tannin, carbohydrates, proteins, saponin, glycosides, and steroids (Table 1).

Antimicrobial Activity of Methanolic Extracts

The methanolic extracts exhibited better activity compared to ethyl acetate extracts. The maximum ZI was shown by methanolic extract against *E. coli.* An increasing dose-response was observed with the methanolic extract of both *M. charantia* and *A. lanata*. Both extracts showed similar activity with the methanolic extract. The higher dose showed greater ZI against both *E. coli* and *B. subtilis.* The effective antimicrobial doses for methanolic extracts of *M. charantia* and *A. lanata* are 100 and 200 µg/mL (Table 2; Fig. 1).

Antimicrobial Activity of Ethyl Acetate Extracts

A. lanata ethyl acetate extract showed greater activity than *M. charantia* extract. The effective antimicrobial

Table 1: Qualitative phytochemical analysis of leaf extracts of *M. charantia* and *A. lanata*

		A. Lanata		*M. charantia*	
S. No.	*Chemical constituents*	*Ethyl acetate*	*Methanol*	*Ethyl acetate*	*Methanol*
1	Alkaloids	+	+	+	+
2	Flavonoids	+	+	+	+
3	Tannins	+	+	+	+
4	Carbohydrates	-	-	+	+
5	Proteins	+	+	+	+
6	Saponins	-	+	-	+
7	Glycosides	+	-	+	+
8	Steroids	+	+	+	+

+: Positive; -: Negative

Table 2: ZI of test methanolic extracts and standard drug

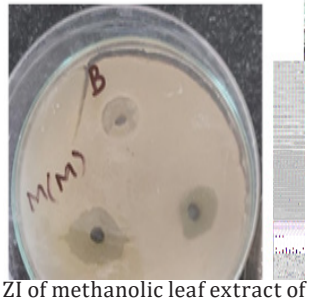
			ZI of methanol extract of A. lanata (in mm)		*ZI of methanol extract of M. charantia (in mm)*	
S. No.	*Microorganism*	*ZI of chloramphenicol (10 µg/mL) (in mm)*	*100 µg/mL*	*200 µg/mL*	*100 µg/mL*	*200 µg/mL*
1	*E. coli*	9	8.5	9.5	8.5	9.5
2	*B. subtilis*	8	8	8.5	8	8.5

Table 3: ZI of test ethyl acetate extracts and standard drug

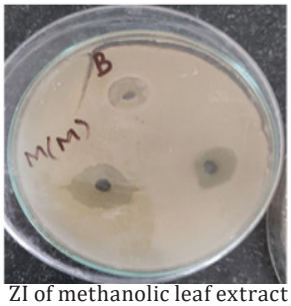
S. No.	Microorganism	ZI of chloramphenicol (10 µg/mL) (in mm)	ZI of ethyl acetate extract of A. lanata (in mm)		ZI of ethyl acetate extract of M. charantia (in mm)	
			100 µg/mL	200 µg/mL	100 µg/mL	200 µg/mL
1.	*E. coli*	9	8	9.2	8	9
2.	*B. subtilis*	8.5	7	9.5	7	8.3

ZI of methanolic leaf extract of *A. lanata* against *E. coli*

ZI of methanolic leaf extract of *A. lanata* against *B. subtilis*



ZI of methanolic leaf extract of *M. charantia* against *E. coli*

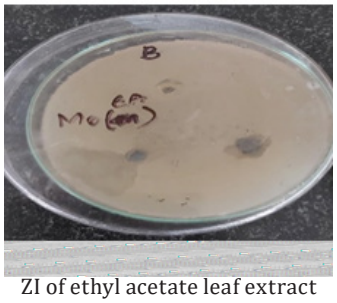


ZI of methanolic leaf extract of *M. charantia* against *B. subtilis*

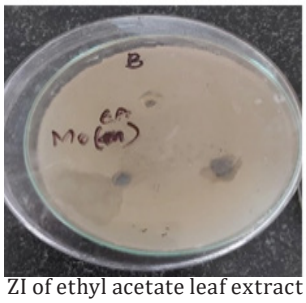
Fig. 1: Photographic results showing ZI of test methanolic extracts

ZI of ethyl acetate leaf extract of *A. lanata* against *E. coli*

ZI of ethyl acetate leaf extract of *A. lanata* against *B. subtilis*



ZI of ethyl acetate leaf extract of *M. charantia* against *E. coli*



ZI of ethyl acetate leaf extract of *M. charantia* against *B. subtilis*

Fig. 2: Photographic results showing ZI of test ethyl acetate extracts

doses for ethanolic extracts of *M. charantia* and *A. lanata* are 100 and 200 µg/mL. An increasing dose-response was observed and *A. lanata* leaf extract showed a maximum ZI of 9.5 mm against *B. subtilis* (Table 3; Fig. 2).

Discussion

Ethyl acetate extracts of both the plant leaves showed little lesser antimicrobial activity than methanol extracts, better antimicrobial action. This is due to the polarity of active antimicrobial constituents, like alkaloids, glycosides, volatile oils, or tannins, in leaves of *M. charantia* and *A. lanata*.[16,17] Momordin, alpha- and beta-momorcharin, cucurbitacin B1, and oleanolic acid in *M. charantia*; quercetin and betulin in *A. lanata* are the active constituents.[18-21] The results of the phytochemical screening states that the selected plant extracts confirmed the presence of all the above-mentioned constituents. It is well proved that the antimicrobial activities of triterpenes are based on the interactions of lipids with the net charge on bacterial membranes. In addition, they pass through bacterial membranes, piercing into the cell and acting on intracellular components vital for antibacterial action.[20]

An increasing dose-response was observed with the methanolic extract of both *M. charantia* and *A. lanata*. Both extracts showed similar activity with the methanolic extract. The higher dose showed greater ZI against both *E. coli* and *B. subtilis*. Both the plant extracts showed potent antibacterial activity. Both ethyl acetate and methanolic leaf extract of *A. lanata* showed slightly better activity than *M. charantia* leaf extracts. The cup plate method and the pour plate method postulated similar results. The ZI produced by test extracts was similar to the standard ZI indicating potent antibacterial action of test extracts. Thus, the *in vitro* antibacterial assays confirm the antibacterial action of methanolic and ethyl acetate extracts of both *M. charantia* and *A. lanata*.

Conclusion

This research confirms the antimicrobial potential of the extracts of *M. charantia* and *A. lanata* against bacterial strains that are concerned with opportunistic and hospital-acquired infections. Both the plant extracts showed potent antibacterial activity. Both ethyl acetate and methanolic leaf extract of *A. lanata* showed slightly better activity than *M. charantia* leaf extracts. Additional work is recommended that confirms the *in vitro* results, isolation of active constituents from crude extracts, and purify the active antimicrobial constituents. Futuristic

plans also involve conducting toxicity studies for determining their safety.

References

1. Mariswamy Y, Gnaraj WE, Antonisamy JM. Chromatographic fingerprint analysis on flavonoids constituents of the medicinally important plant *Aerva lanata* L. by HPTLC technique. *Asian Pac J* Trop *Biomed*. 2011;1(1):S8-12.
2. Goyal M, Pareek A, Nagori BP, Sasmal D. *Aerva lanata*: A review on phytochemistry and pharmacological aspects. Pharmacognosy reviews. 2011; 5(10):195.
3. Appapalam ST, Panchamoorthy R. *Aerva lanata* mediated phytofabrication of silver nanoparticles and evaluation of their antibacterial activity against wound associated bacteria. J Taiwan Inst Chem E. 2017; 78:539-551.
4. Welihinda J, Karunanayake EH, Sheriff MH, Jayasinghe KS. Effect of *Momordica charantia* on the glucose tolerance in maturity onset diabetes. J. Ethnopharmacol. 1986; 17(3):277-282.
5. Leelaprakash G, Rose JC, Gowtham BM, Javvaji PK, Prasad SA. *In vitro* antimicrobial and antioxidant activity of *Momordica charantia* leaves. Pharmacophore. 2011;2(4):244-252.
6. Parkash A, Ng TB, Tso WW. Purification and characterization of charantin, a napin-like ribosome-inactivating peptide from bitter gourd (*Momordica charantia*) seeds. Int. J. Pept. Res. Ther. 2002;59(5):197-202.
7. Ambasta SS. The useful plants of India. CSIR, New Delhi, India: Publications and Information Directorate; 1986.
8. Okabe H, Miyahara Y, Yamauchi T, Miyahara K, Kawasaki T. Studies on the constituents of *Momordica charantia* LI Isolation and characterization of momordicosides A and B, glycosides of a pentahydroxy-cucurbitane triterpene. Chem Pharm Bull. 1980;28(9):2753-2762.
9. Ahmed I, Lakhani MS, Gillett M, John A, Raza H. Hypotriglyceridemic and hypocholesterolemic effects of anti-diabetic *Momordica charantia* (karela) fruit extract in streptozotocin-induced diabetic rats. Diabetes Res. Clin. Pract. 2001;51(3):155-161.
10. Semiz A, Sen A. Antioxidant and chemoprotective properties of *Momordica charantia* L.(bitter melon) fruit extract. Afr. J. Biotechnol. 2007;6(3).
11. Ahmad N, Hassan MR, Halder H, Bennoor KS. Effect of *Momordica charantia* (Karolla) extracts on fasting and postprandial serum glucose levels in NIDDM patients. *Bangladesh* Med Res Counc Bull. 1999;25(1):11-13.
12. Grover JK, Yadav SP. Pharmacological actions and potential uses of *Momordica charantia*: a review. J. Ethnopharmacol. 2004;93(1): 123-132.
13. Begum S, Ahmed M, Siddiqui BS, Khan A, Saify ZS, Arif M. Triterpenes, a sterol and a monocyclic alcohol from *Momordica charantia*. Phytochemistry. 1997;44(7):1313-1320.
14. Chang CI, Chen CR, Liao YW, Cheng HL, Chen YC, Chou CH. Cucurbitane-type triterpenoids from the stems of *Momordica charantia*. J. Nat. Prod;2007;71(8):1327-1330.
15. Akihisa T, Higo N, Tokuda H, Ukiya M, Akazawa H, Tochigi Y, Kimura Y, Suzuki T, Nishino H. Cucurbitane-type triterpenoids from the fruits of *Momordica charantia* and their cancer chemopreventive effects. J. Nat. Prod. 2007;70(8):1233-1239.
16. Tenaillon O, Skurnik D, Picard B, Denamur E. The population genetics of commensal *Escherichia coli*. Nat. Rev. Microbiol. 2010;8(3):207-217.
17. Jördening HJ, Winter J, editors. Environmental biotechnology: concepts and applications. John Wiley and Sons; 2005;24.
18. Mba-Jonas A, Culpepper W, Hill T, Cantu V, Loera J, Borders J, *et al.* A multistate outbreak of human Salmonella agona infections associated with consumption of fresh, whole papayas imported from Mexico-United States, 2011. Clin. Infect. Dis. 2018;66(11): 1756-1761.
19. Vogt RL, Dippold L. *Escherichia coli* O157: H7 outbreak associated with consumption of ground beef, June–July 2002. Public health reports. 2005;120(2):174-178.
20. Bentley R, Meganathan R. Biosynthesis of vitamin K (menaquinone) in bacteria. Microbiol. Rev. 1982;46(3):241.
21. Hudault S, Guignot J, Servin AL. *Escherichia coli* strains colonising the gastrointestinal tract protect germfree mice against *Salmonella typhimurium* infection. Gut. 2001 ;49(1):47-55.

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