International Journal of Pharmacy and Pharmaceutical Science

ISSN Print: 2664-7222
ISSN Online: 2664-7230
IJPPS 2025; 7(2): 465-471
www.pharmacyjournal.org
Received: 07-08-2025
Accepted: 09-09-2025

Kapil Pandey
Research Scholar, Lords University, Alwar, Rajasthan, India

Dr. Mukesh Gupta
Research Scholar, Lords University, Alwar, Rajasthan, India

Dr Abhay Gupta
Professor, Lords University, Alwar, Rajasthan

Corresponding Author:
Mr Kapil Pandey
Research Scholar, Lords University, Alwar, Rajasthan, India

Evaluation of anti-microbial potential of *Celosia argentea* leaf extract against resistant microbial strains

Kapil Pandey, Mukesh Gupta and Abhay Gupta

DOI: https://www.doi.org/10.33545/26647222.2025.v7.i2f.239

Abstract
Background: The diminishing efficacy of conventional antibiotics against multidrug-resistant (MDR) pathogens, coupled with limited medicinal access in developing nations, demands the exploration of alternative therapeutics derived from medicinal plants.
Knowledge Gap: While *Celosia argentea* is used in traditional medicine, a systematic investigation of its antibacterial activity against MDR bacterial strains and the specific phytochemicals responsible is absent from the literature.
Objective: This study aims to fill this critical void by comprehensively evaluating the antibacterial properties of *Celosia argentea* extracts against clinically relevant MDR strains and correlating this activity with its phytochemical composition through advanced analytical techniques.
Significance: The findings are expected to provide a scientific foundation for developing standardized herbal formulations or novel antimicrobial compounds derived from this promising plant.

Keywords: *Cassia angustifolia*, nanoparticles, copper oxide, antimicrobial

1. Introduction

The 80% people of worldwide, primarily in developing and impoverished nations rely on traditional plant-based medicines for their basic medical requirements, according to the WHO. [1] For a variety of reasons, the lag phase for plant-based therapy is currently changing quickly. Drug-resistant microbes, the negative effects of contemporary medications, and newly emerging diseases have no treatments available to have reignited interest in plants as a major source of novel therapeutics.[2-3] However, because to improved cultural acceptance, improved bodily compatibility, and fewer side effects hence its use has been increased significantly in the industrialized world in recent years.[4]

Numerous adverse effects are possible with antibiotics. Before using antibiotics, a number of cautions must be taken. Globally, antibiotics are being misused. One of the causes of the rising number of bacterial illnesses that are developing resistance to antibacterial drugs is the abuse of antibiotics.[5] The rise of multi-drug resistant bacteria presents a critical challenge to global health, severely compromising the efficacy of conventional antibiotics.[6] This urgent threat has catalyzed the search for alternative therapeutic modalities, among which herbal extract and their isolates represent a promising frontier in antimicrobial innovation. The global crisis of antimicrobial resistance (AMR) necessitates the urgent development of novel antibacterial agents. This need is particularly acute in developing nations, where access to essential medicines remains limited.[7-9]

C. argentea is a well-known weed that is both edible and decorative. It belongs to member of the Amaranthaceae family. *C. argentea* has been use for treatment of snakebite, diarrhoea, bleeding piles, gastrointestinal disorders, lesions, ulcers, and an abortifacient.[10-12] *C. argentea* has pharmacological uses, including anti-inflammatory, antidiabetic, antibacterial, anti-hepatotoxic, diuretic, antimiotic, and antioxidant properties. [13-15]

This study investigates Celosia argentea as a source of alternative therapeutics, targeting a critical research gap: its efficacy against multidrug-resistant (MDR) bacterial strains remains largely unexplored and uncharacterized.[16-18]We systematically evaluate the antibacterial activity of its extracts against MDR pathogens and employ phytochemical analyses to

identify the bioactive constituents responsible, thereby laying the groundwork for future drug development.

2. Materials and Methods

2.1. Chemicals: Every material and chemical utilized is of analytical grade. These solvents, which were purchased from Merck in Germany, included diethyl ether, chloroform, ethyl acetate, acetone, ethanol, hexane, cyclohexane, carbon tetrachloride and methanol. Himedia, India, supplied the Muller Hinton Agar No. 2 and Nutrient Broth solution.

2.2. Antibacterial Activity Determination

The streak plate method was used in laboratories to purify bacteria, and Hans Christian Gram created the Gram staining technique in 1884 to distinguish between two sizable categories of bacteria: Gram-+Ve and Gram--Ve bacteria. The technique used is agar well diffusion method was used to ascertain the plant extracts' antibacterial activity in accordance with the established protocol. The bacterial inoculums were dispersed over the media to inoculate nutrient agar with the specified microorganisms. Plant extracts were added to 6 mm wells that were punched in the agar. In the same plate, parallel control wells with neat solvents (control) were also run. Following a 24-hour incubation period at 37°C, the diameter of the zone of inhibition was used to measure the antibacterial activity. The extract's antibacterial activity was evaluated by comparing ZOI of antibiotic Rifampicin.

2.3 Statistical analysis

Values were expressed as Mean ± SD for each group and statistical significant differences between mean values were determined by one way analysis of variance (ANOVA) followed by the Duncan's test for multiple comparisons (Harvey and Paige, 1998).

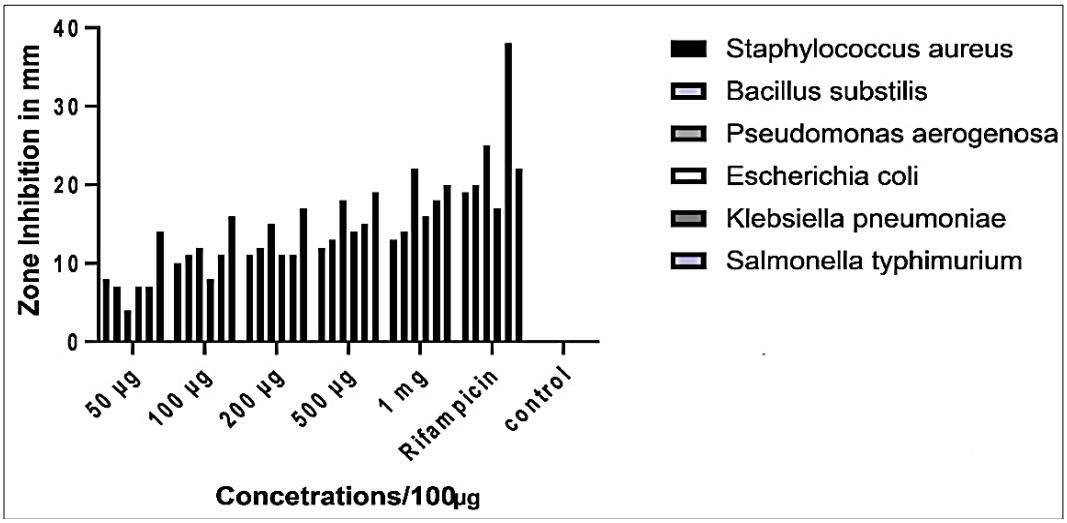
3. Results & Discussion

3.1 Antimicrobial Activity

The antibacterial and antifungal activity all *Celosia argentea* extracts ranged from moderate to excellent. Tables 1 to 6 summarized the antimicrobial study observation and displayed the average of the triplicates. The inhibition zone was showed by the hydro-alcoholic extract, methanol extract, and ethyl acetate extract.

Table 1: Antibacterial Activity of Hexane Extract of *Celosia Argentea*

Concentrations /100 µl	Zone of Inhibition in mm					
	Staphylococcus aureus	***Bacillus substilis***	***Pseudomonas aerogenosa***	***Escherichia coli***	***Klebsiella pneumoniae***	***Salmonella typhimurium***
50 µg	8	7	4	7	7	14
100	10	11	12	8	11	16
200	11	12	15	11	11	17
500	12	13	18	14	15	19
1mg	13	14	22	16	18	20
Rifampicin	19	20	25	17	38	22
Control	0		0	0	0	0



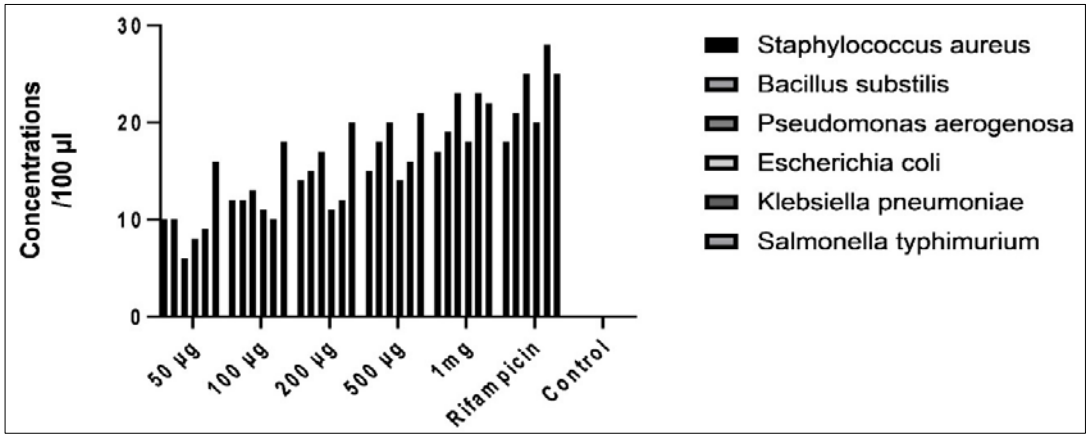
Graph 1: Antibacterial Activity of Hexane Extract of *Celosia Argentea*

The highest inhibition zone against bacteria and fungus was observed by the hydroalcoholic extract of *Celosia argentea*. *Escherichia coli* (18mm), *Pseudomonas aerogenosa* (23mm), *Staphylococcus aureus* (19mm), *Salmonella typhimurium* (23mm), *Candida utilis* (12mm), *Candida bombii* (18mm) and *Candida tropicalis* (13mm).

The inhibition zone of Rifampicin 50µg/100 µl was found in the *Escherichia coli* (20mm), *Staphylococcus aureus* (20mm), *Pseudomonas aerogenosa* (25mm), *Candida bombii* (21mm) and *Candida tropicalis* (23mm)

Table 2: Antibacterial Activity of Ethyl Acetate Extract of *Celosia Argentea*

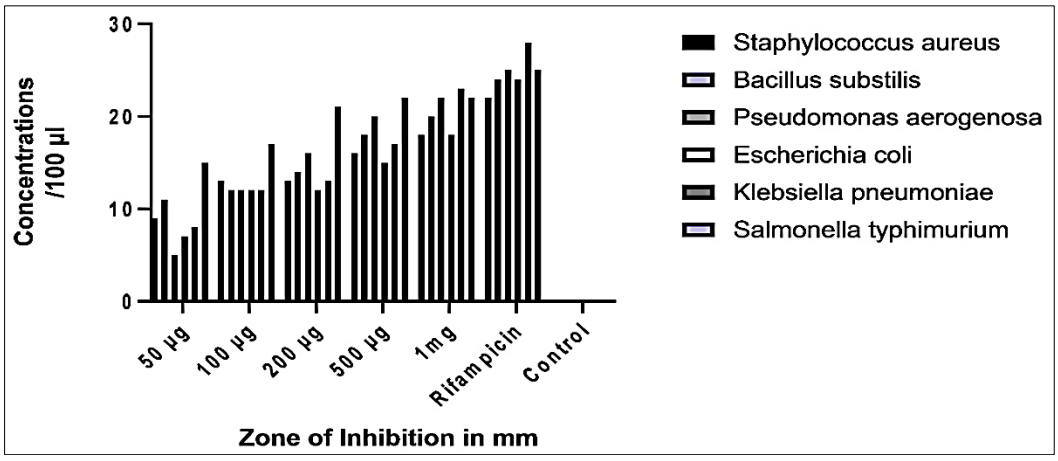
Conc /100 µl	Zone of Inhibition in mm					
	S. aureus	***Bacillus substilis***	***Pseudomonas aerogenosa***	***E, coli***	***Klebsiella pneumoniae***	***S. typhimurium***
50 µg	10	10	6	8	9	16
100	12	12	13	11	10	18
200	14	15	17	11	12	20
500	15	18	20	14	16	21
1mg	17	19	23	18	23	22
Rifampicin	18	21	25	20	28	25
Control	0	0	0	0	0	0



Graph 2: Antibacterial Activity of Ethyl Acetate Extract of *Celosia Argentea*

Table 3: Antibacterial Activity of Methanol Extract of *Celosia Argentea*

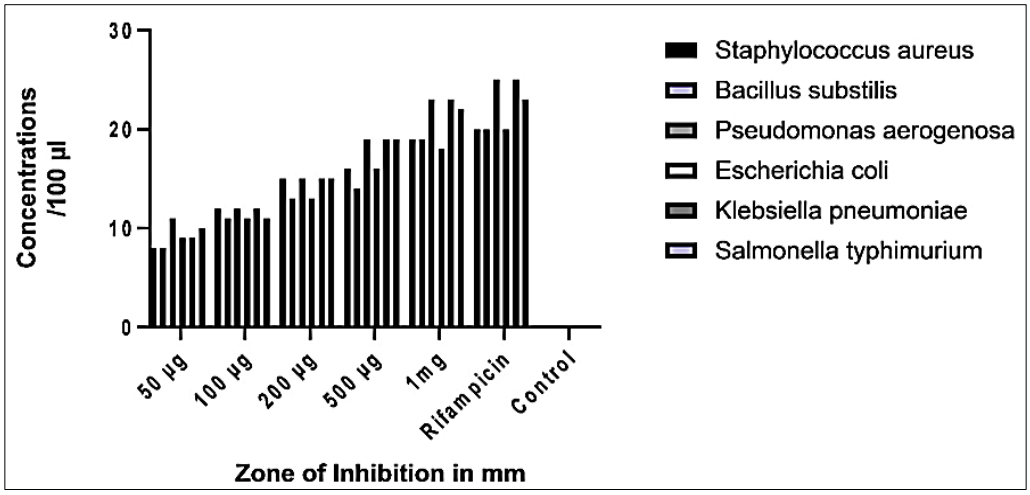
Conc /100 µl	Zone of Inhibition in mm					
	S. aureus	**B. substilis**	**P. aerogenosa**	**E. coli**	**K. pneumoniae**	**S. t**
50 µg	9	11	5	7	8	15
100	13	12	12	12	12	17
200	13	14	16	12	13	21
500	16	18	20	15	17	22
1mg	18	20	22	18	23	22
Rifampicin	22	24	25	24	28	25
Control	0	0	0	0	0	0



Graph 3: Antibacterial Activity of Methanolic extract of *Celosia Argentea*

Table 4: Antibacterial Activity of Hydroalcoholic Extract of *Celosia Argentea*

Conc /100 µl	Zone of Inhibition in mm					
	S. aureus	**B. substilis**	**P. aerogenosa**	**E. coli**	**K. pneumoniae**	**S. typhimurium**
50 µg	8	8	11	9	9	10
100	12	11	12	11	12	11
200	15	13	15	13	15	15
500	16	14	19	16	19	19
1mg	19	19	23	18	23	22
Rifampicin	20	20	25	20	25	23
Control	0	0	0	0	0	0

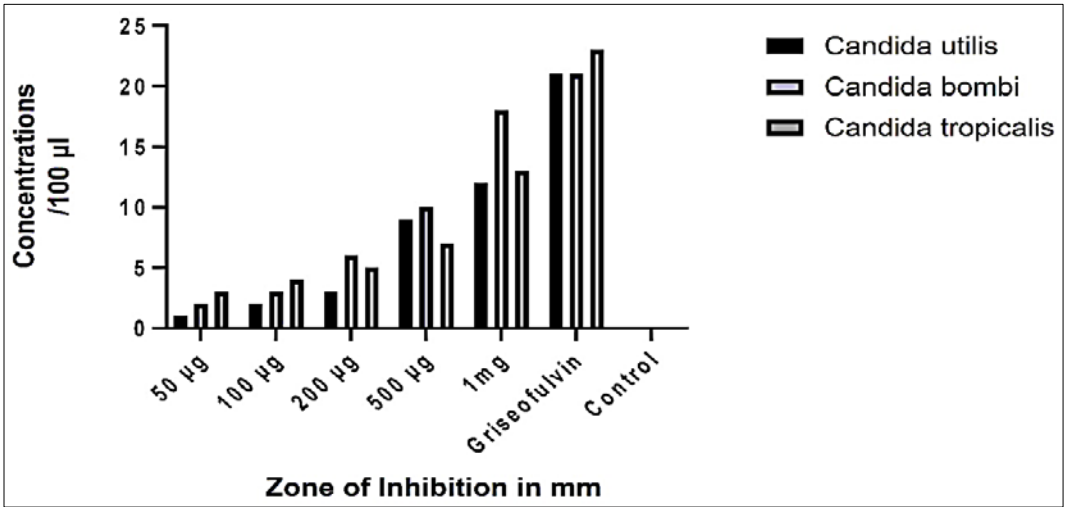


Graph 4: Antibacterial Activity of Hydroalcoholic Extract of *Celosia Argentea*

The hydro-alcoholic extract exhibited good zone of inhibition against fungi. At a dose of 500 µg /100 µl and 1mg/100 µl concs the zone of inhibition was showed by hydro-alcoholic extract were equal to standard Griseofulvin (50µg/100µl). *Candida bombii* and *Pseudomonas aerogenosa* were very susceptible to the various extracts. *Celosia argentea* extracts had the least effect on *Klebsiella pneumoniae.*

Table 5: Antifungal Activity of Hexane Extract of *Celosia Argentea*

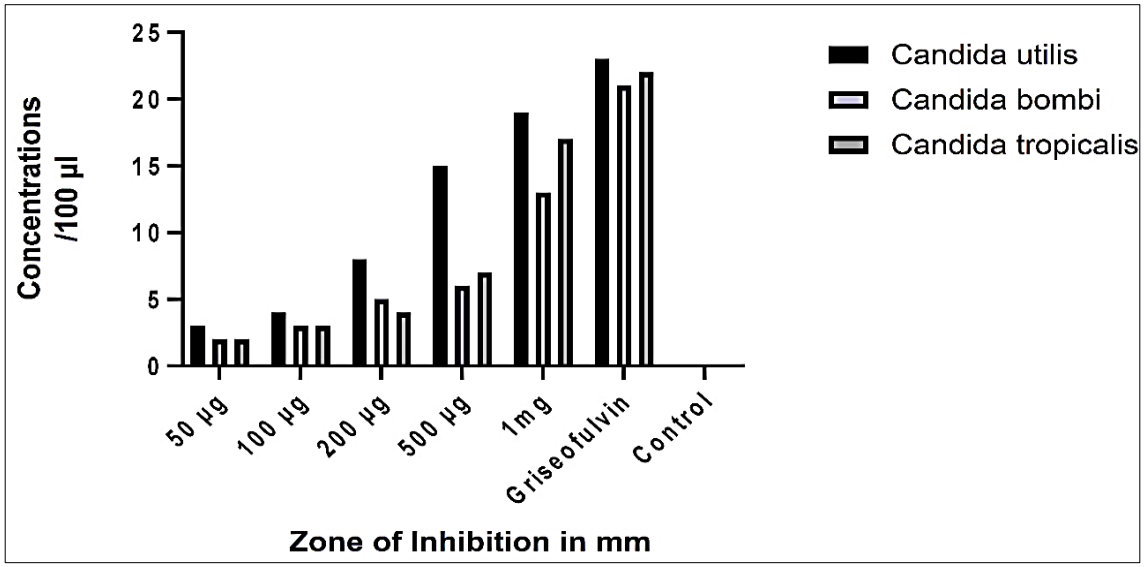
Concentrations /100 µl	**Inhibition Zone in mm**		
	Candida utilis	*Candida bombi*	*Candida tropicalis*
50 µg	1	2	3
100	2	3	4
200	3	6	5
500	9	10	7
1mg	12	18	13
Griseofulvin	21	21	23
Control	0	0	0



Graph 5: Antifungal Activity of *Celosia Argentea* Hexane Extract

Table 6: Antifungal Activity of *Celosia argentea* Ethyl Acetate Extract

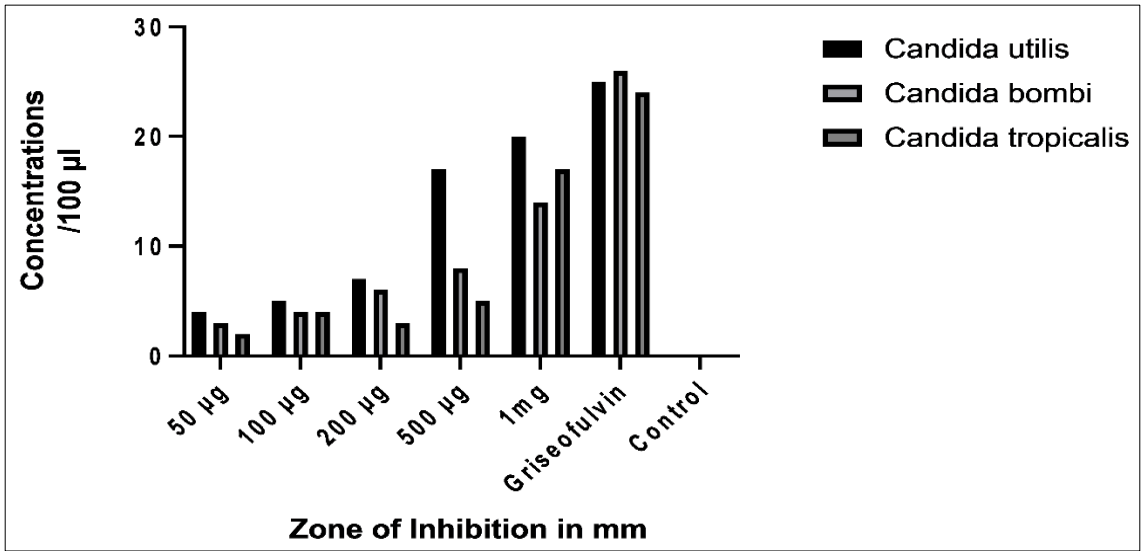
Concentrations /100 µl	**Inhibition Zone in mm**		
	Candida utilis	***Candida bombi***	***Candida tropicalis***
50 µg	3	2	2
100 µg	4	3	3
200 µg	8	5	4
500 µg	15	6	7
1mg	19	13	17
Griseofulvin	23	21	22
Control	0	0	0



Graph 6: Antifungal Activity of Ethyl Acetate Extract of *Celosia Argentea*

Table 7: Antifungal Activity of Methanol Extract of *Celosia argentea*

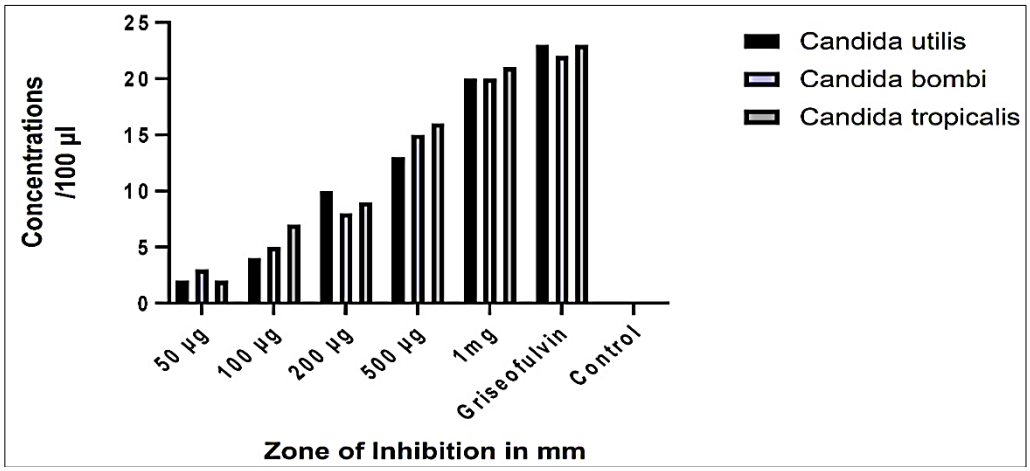
Concentrations /100 µl	Inhibition Zone in mm		
	Candida utilis	***Candida bombi***	***Candida tropicalis***
50 µg	4	3	2
100 µg	5	4	4
200 µg	7	6	3
500 µg	17	8	5
1mg	20	14	17
Griseofulvin	25	26	24
Control	0	0	0



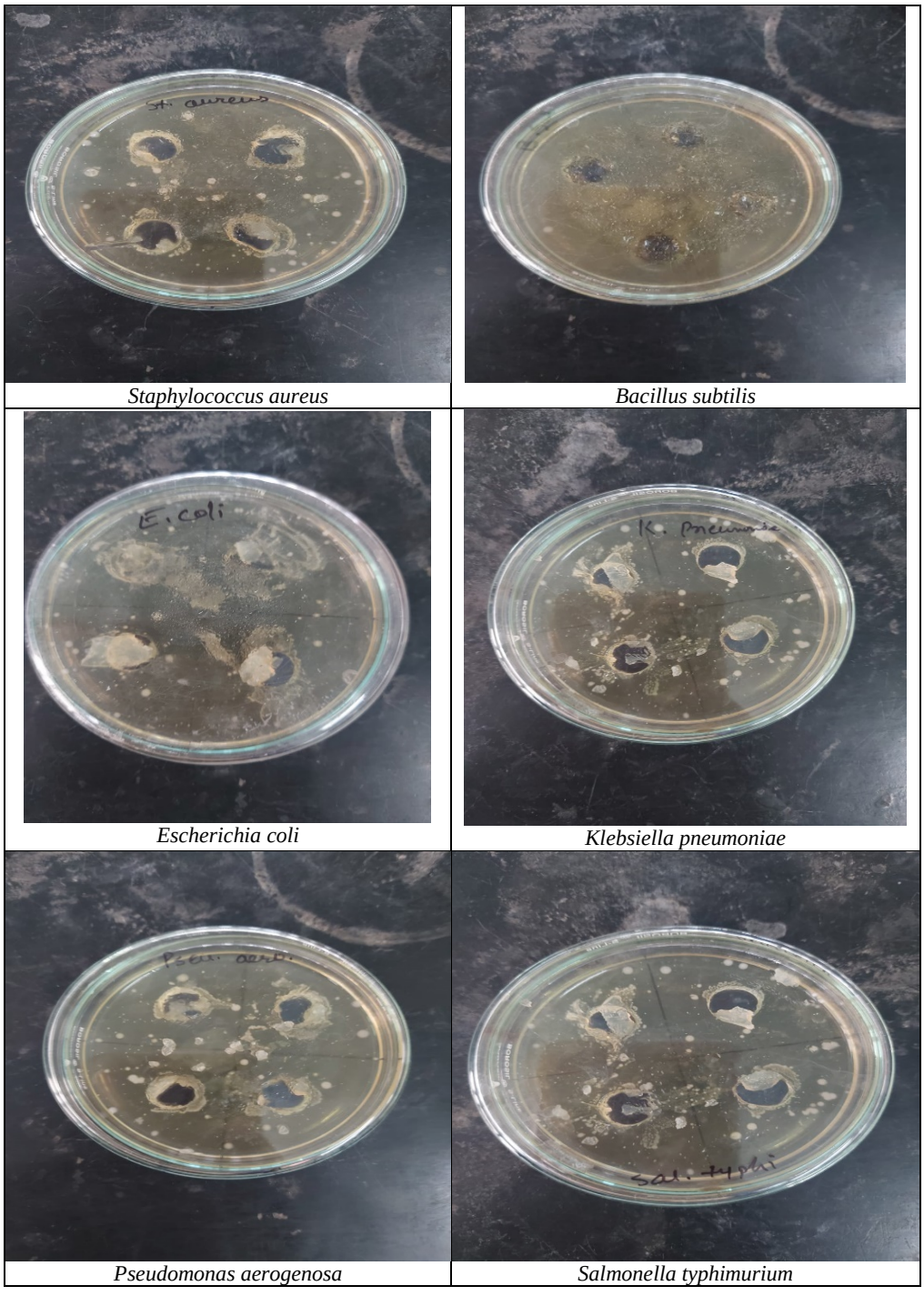
Graph 7: Antifungal Activity of Methanol Extract of *Celosia argentea*

Table 8: Antifungal Activity of Hydroalcoholic Extract of *Celosia argentea*

Concentrations /100 µl	Inhibition Zone in mm		
	Candida utilis	*Candida bombi*	*Candida tropicalis*
50 µg	2	3	2
100 µg	4	5	7
200 µg	10	8	9
500 µg	13	15	16
1mg	20	20	21
Griseofulvin	23	22	23
Control	0	0	0



Graph 8: Antifungal Activity of Hydroalcoholic Extract of *Celosia argentea*



Staphylococcus aureus | *Bacillus subtilis*

Escherichia coli | *Klebsiella pneumoniae*

Pseudomonas aerogenosa | *Salmonella typhimurium*

Fig 1: Zone Inhibition of Bacteria

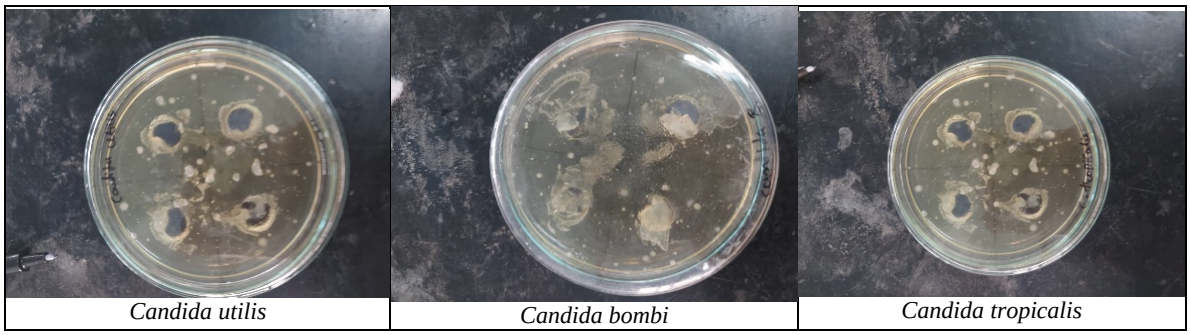


Fig 2: Zone inhibition of Fungi

4. Conclusion

The studies suggested that the extracts of *Celosia argentea* having significant anti- antimicrobial activities. The different extracts of Celosia *argentea* were useful for the treatment as an antimicrobial agent. Future studies in pharmacology, phytochemistry, ethnobotany, and other biological activities for drug development might benefit from an expansion of the information about the botanical preparation of traditional sources of medicinal plants. Before being properly distributed, these regional ethnomedical concoctions and plant-based prescriptions have to be subjected to a scientific assessment.

Conflicts of Interest

Regarding the publishing of this work, the authors state that they have no conflicts of interest.

References

1. Azevedo MJ. The state of health system(s) in Africa: challenges and opportunities. In: Historical Perspectives on the State of Health and Health Systems in Africa, Volume II. Cham: Springer; 2017. p.1–73. doi:10.1007/978-3-319-32564-4_1.
2. Anand U, Jacobo-Herrera N, Altemimi A, Lakhssassi N. A comprehensive review on medicinal plants as antimicrobial therapeutics: potential avenues of biocompatible drug discovery. Metabolites. 2019;9(11):258. doi:10.3390/metabo9110258.
3. Jahan I, Onay A. Potentials of plant-based substances to inhibit and probable cure for COVID-19. Turk J Biol. 2020;44(3):228–241. doi:10.3906/biy-2005-114.
4. O'Neill J. Tackling drug-resistant infections globally: final report and recommendations. The Review on Antimicrobial Resistance. London (UK): Wellcome Trust & HM Government; 2016.
5. Leijen I, van Herk H. Health and culture: the association between healthcare preferences for non-acute conditions, human values, and social norms. Int J Environ Res Public Health. 2021;18(23):12808. doi:10.3390/ijerph182312808.
6. Salam MA, Al-Amin MY, Salam MT, Pawar JS, Akhter N, Rabaan AA, et al. Antimicrobial resistance: a growing serious threat for global public health. Healthcare (Basel). 2023;11(13):1946. doi:10.3390/healthcare11131946.
7. SeyedAlinaghi S, Mehraeen E, Roozbahani MM, Jahanfar S. A systematic review on natural products with antimicrobial potential against WHO's priority pathogens. Eur J Med Res. 2025;30(1):525. doi:10.1186/s40001-025-02717-x.
8. Tenover FC. Mechanisms of antimicrobial resistance in bacteria. Am J Med. 2006;119(6 Suppl 1):S3–S10; discussion S62–S70. doi:10.1016/j.amjmed.2006.03.011.
9. Syed Sulthan Ahamed SN, Shekshavali T, Syed Shafeeq R. *Celosia argentea*: a review. Res J Pharmacol Pharmacodyn. 2018;10(2):83–86. doi:10.5958/2321-5836.2018.00015.0.
10. Rukhsana AR, Manohar JP, Priyanka G, Areej S. Evaluation of antioxidant potential of *Celosia argentea* extracts. Pharmacogn J. 2013;5(1–2):1–2.
11. Santosh SB, Sohan SC, Anupama AS, Devanand BS, Manohar JP. Anti-inflammatory activity of an isolated flavonoid fraction from *Celosia argentea* Linn. J Med Plants Res. 2008;2(3):52–54.
12. Priya KS, Arumgam G, Rethinam B, Wells A, Babu M. *Celosia argentea* Linn. leaf extract improves wound healing in a rat burn wound model. Wound Repair Regen. 2004;12(6):618–625.
13. Santosh G, Prakash T, Kotresha D, Roopa K, Surendra V, Divakar G. Antidiabetic activity of *Celosia argentea* root in streptozotocin-induced diabetic rats. Int J Green Pharm. 2012;6(3):243–248.
14. Xue QA, Sun ZL, Guo ML, Wang Y, Zhang G, Wang XK. Two new compounds from *Semen celosia* and their protective effects against CCl_4-induced hepatotoxicity. Nat Prod Res. 2011;25(8):772–780.
15. Kirtikar KR, Basu BD. Indian Medicinal Plants. Vol. III. Dehradun: Bishen Singh Mahendra Pal Singh; 1995. p.2053–2054.
16. Jain GC. Hepatoprotective activity of ethanolic extract of *Celosia argentea* Linn. seeds in rats. J Phytol Res. 2005;18(1):87–90.
17. Aladesanwa RD, Adenawoola AR, Olowolafe OG. Effects of atrazine residue on the growth and development of *Celosia argentea* under screen house conditions in Nigeria. Crop Prot. 2001;20(4):321–324.