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ANTIMICROBIAL ACTIVITY OF SOME PLANT EXTRACTS AGAINST THE BACTERIAL AND FUNGAL STRAINS

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ABSTRACT: The increasing prevalence of drug-resistant pathogens underscores the need for alternative antimicrobial agents, particularly plant-derived phytochemicals. This study evaluated the antimicrobial potential of *Soleirolia soleirolii*, *Arctium lappa* (Burdock), and *Psidium guajava* using two extraction methods: decoction and percolation. Extraction yields varied, with decoction producing 25.0% (A. lappa) to 44.8% (*P. guajava*) and percolation yielding 33.2% to 49.7%, indicating improved recovery of thermolabile compounds in percolation. Antimicrobial activity was assessed *in-vitro* against Gram-positive (*Bacillus cereus*, *Staphylococcus aureus*), Gram-negative (*Salmonella*, *Escherichia coli*, *Pseudomonas aeruginosa*), and fungal (*Candida albicans*, Clostridia) strains. *A. lappa* showed broad-spectrum activity across both methods (zones: 8.5–11.0 mm), while *P. guajava* exhibited selective antibacterial effects, particularly against *S. aureus* and *Salmonella*, and strong antifungal activity against Clostridia. *S. soleirolii* displayed moderate, selective inhibition, with percolation enhancing activity against Salmonella. These findings highlight that extraction technique significantly influences yield and bioactivity. Overall, *A. lappa* is a promising natural antimicrobial, whereas *P. guajava* and *S. soleirolii* merit further bioassay-guided fractionation to identify active phytoconstituents for potential therapeutic applications against resistant pathogens.

INTRODUCTION: In an era marked by the increasing prevalence of drug-resistant pathogens and the emergence of new infectious diseases, the search for alternative antimicrobial agents has become a paramount concern in global healthcare. Medicinal plants have long been recognized as a valuable source of bioactive compounds with the potential to combat microbial infections. These plants have evolved a multitude of secondary metabolites as a defense mechanism against pathogens, making them a promising reservoir of novel antimicrobial agents.

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To harness their therapeutic potential effectively, it is essential to explore and understand the antimicrobial properties of these medicinal plants [1-3]. The field of medicinal plant research has witnessed a surge in interest over the past few decades, with a focus on identifying and characterizing bioactive compounds responsible for their antimicrobial activities. However, the effectiveness of these compounds often depends on various factors, including the extraction methods used to isolate them.

Additionally, many medicinal plants are used in traditional medicine as combinations or mixtures, suggesting that interactions among multiple compounds may contribute to their antimicrobial efficacy [4-5]. The study encompasses a multidisciplinary approach that combines botany, pharmacology, microbiology, and chemistry to

provide a holistic understanding of this complex subject [6-7]. The aim of this research is to delve into the intricate world of medicinal plants, specifically focusing on their antimicrobial properties. In an era marked by the escalating threat of drug-resistant pathogens and the emergence of new infectious diseases, this research holds paramount importance [8].

The overarching aim is to compare and evaluate the antimicrobial activity of selected medicinal plants using diverse extraction techniques and mediums. By doing so, we aim to harness the therapeutic potential of these plants effectively. The objectives set forth in this research encompass a multidimensional approach. Firstly, we intend to meticulously prepare plant extracts using various extraction techniques in different mediums, ensuring a comprehensive exploration of their bioactive compounds. Subsequently, the pivotal antimicrobial activity studies of these plant extracts, in conjunction with antibiotics, will be conducted. This not only enables us to gauge the intrinsic antimicrobial potential of these plants but also offers insights into possible interactions between plant extracts and antibiotics. Finally, a rigorous data analysis using mathematical and statistical models will be undertaken to derive meaningful conclusions from the research findings [9-11].

The selected plants include Burdock (*Arctium lappa*), *Psidium guajava*, and Soleirolia (Babytear), each with distinct taxonomic classifications and medicinal importance. Burdock (*Arctium lappa*), belonging to the family Asteraceae, contains phenolic acids, flavonoids, and alkaloids, and is reported to exhibit antimicrobial, anti-inflammatory, and antioxidant activities. *Psidium guajava*, from the family Myrtaceae, is rich in flavonoids, phenolic acids, and vitamins, and is traditionally used for its antidiarrheal, antidysentery, antioxidant, and antiulcer properties. *Soleirolia soleirolii*, a member of the Urticaceae family, is a delicate creeping herb with small bright green or yellow leaves and tiny pink flowers. Though mainly grown as an ornamental plant, it also contains phenolic acids, flavonoids, and alkaloids, with descriptions highlighting its ground-covering growth pattern and reproductive features such as pollen-producing male flowers and seed-bearing female flowers [12-15]. The significance of this research lies in its potential to unveil novel antimicrobial agents sourced from nature, a crucial endeavor in the face of escalating antimicrobial resistance. By comparing extraction methods, we can potentially enhance the efficacy of existing antibiotics, paving the way for more effective treatments against drug-resistant pathogens. Moreover, this research bridges the gap between traditional medicinal practices and modern science, offering scientific validation for the traditional use of medicinal plants. Ultimately, the outcomes of this study have far-reaching implications, from advancing drug discovery to promoting sustainable resource management and bolstering global public health efforts.

This study aims to compare different extraction methods to determine their impact on the antimicrobial activities of medicinal plant extracts. By isolating bioactive compounds using various techniques, we can elucidate which method optimally preserves the compounds responsible for antimicrobial effects, thereby informing future extraction protocols for medicinal plant-derived antimicrobial agents. The proposed study addresses critical research gaps in the field of antimicrobial therapy by exploring the potential of plant-derived phytochemicals, the enhancement of antibiotic efficacy. This research is essential in the ongoing battle against antimicrobial resistance and has the potential to lead to innovative and more effective treatments for drug-resistant infections [16-18].

MATERIAL AND METHODS: In this research, essential laboratory equipment and instruments were employed to support various experimental procedures. These included an incubator (Lab India) for maintaining precise temperature conditions during microbial cultures, and an oven (Tempo Instruments) for sterilizing glassware. To ensure aseptic conditions, a Labtop Horizontal Laminar Air Flow system was used to minimize the risk of contamination. Quantification of microbial growth was facilitated by a Colony Count instrument (Labcare), while Micropipettes (Thermoscientific) enabled accurate liquid handling. Autoclaves (Metalab) were essential for sterilizing equipment and media. Various chemicals and reagents, such as methanol and ethanol, were utilized in sample preparation. Microbes like

Staphylococcus aureus, *Escherichia coli*, and antibiotic discs (Gentamycin, Ketoconazole) were employed to assess the antimicrobial properties of medicinal plant extracts.

Extraction of Plant: Two distinct extraction techniques were employed to prepare medicinal plant extracts with precision. The decoction method involved selecting specific plant materials known for their medicinal properties. These materials were cleaned, chopped or crushed, and simmered in water, with the simmering time varying based on the plant type. After thorough simmering, the decoction was strained, and the liquid extract was stored. The percolation technique allowed for efficient extraction of bioactive compounds from medicinal plants. The plant material was selected, weighed, and placed in a percolator, with layers moistened using a chosen solvent. The percolator was then set up, and solvent was poured into the reservoir. A controlled percolation rate ensured optimal extraction, and the resulting extract was collected, filtered, and stored [19-20].

Determination of *In-vitro* Microbial Activity by agar well Diffusion Assay: The agar well diffusion assay, a widely used method, is employed to determine the *in-vitro* antimicrobial activity of various substances, including antibiotics, plant extracts, or synthetic compounds. The procedure involves several key steps. Initially, nutrient agar plates are meticulously prepared, serving as the growth medium for the microorganisms. Following this, the microbial cultures, such as bacteria or fungi, are inoculated onto the agar plates, forming an even, cultured lawn. Subsequently, wells are crafted into the agar medium using a sterile cork borer, and these wells accommodate the test substances. The test substances, typically prepared as solutions, are gently dispensed into the wells, with one well reserved for a negative control containing only the solvent or medium. The plates are then inverted and incubated at the appropriate temperature for the targeted microorganism's growth, typically ranging from 16 to 24 hours. After incubation, the plates are scrutinized for clear zones surrounding the wells, indicating inhibition of microbial growth. The diameters of these clear zones, known as the zones of inhibition, are meticulously measured in millimetres [21-22].

RESULTS AND DISCUSSION:

Extractive Yields: Extraction yield is a critical parameter in natural product research as it reflects the efficiency of a given extraction technique in isolating bioactive phytoconstituents. In this study, two methods decoction and percolation were applied to *Soleirolia*, *Arctium lappa*, and *Psidium guajava*, and their yields are presented in **Table 1** and **2.**

Decoction Method: The decoction process, which involves prolonged boiling of plant materials in water, yielded 34.9% for *Soleirolia*, 25.0% for *Arctium lappa*, and 44.8% for *Psidium guajava*. The highest yield from *P. guajava* may be attributed to its richness in water-soluble compounds such as polyphenols, flavonoids, and glycosides, while the lower yield from *A. lappa* suggests the predominance of less polar constituents less soluble in aqueous media under heat.

TABLE 1: EXTRACTIVE YIELD FROM DECOCTION METHOD

Plant	Replicate 1	Replicate 2	Replicate 3	Average	Observation
Soleirolia	35.4 %	37.5 %	31.7 %	34.9 %	Satisfactory
Arctium lappa	24.6 %	28.4 %	22.1 %	25.0 %	Satisfactory
Psidium guajava	46.1 %	43.4 %	44.8 %	44.8 %	Satisfactory

Percolation Method: Percolation utilizing continuous solvent flow at ambient temperature produced yields of 33.4% for *Soleirolia*, 33.2% for *A. lappa*, and 49.7% for *P. guajava*. All three plants showed comparable or improved yields compared to decoction, particularly *A. lappa*, which exhibited an 8.2% increase. This suggests that percolation preserves thermolabile constituents while ensuring efficient solvent penetration and diffusion.

TABLE 2: EXTRACTIVE YIELD FROM PERCOLATION METHOD

Plant	Replicate 1	Replicate 2	Replicate 3	Average	Observation
Soleirolia	33.5 %	32.3 %	34.4 %	33.4 %	Satisfactory
Arctium lappa	31.5 %	34.9 %	33.4 %	33.2 %	Satisfactory
Psidium guajava	49.5 %	51.7 %	47.9 %	49.7 %	Satisfactory

Comparative Analysis: Overall, percolation demonstrated superior performance for *A. lappa* and *P. guajava*, whereas *Soleirolia* showed a marginally higher yield with decoction, possibly due to enhanced release of mucilaginous components upon heating. These findings highlight the influence of extraction methodology on yield and suggest that method selection should be guided by the physicochemical nature of the target phytochemicals.

***In-vitro* Antimicrobial Activity:** Antimicrobial activities of the extracts were evaluated via agar well diffusion against Gram-positive and Gram-negative bacteria, as well as fungal pathogens (*Candida albicans* and *Clostridia*). Results are summarized in **Table 3–6**.

Antibacterial Activity of Decoction Extracts: Among the decoction extracts, *A. lappa* displayed the broadest and most potent antibacterial activity, inhibiting all tested bacterial strains with zones ranging from 9.0 to 11.0 mm. *P. guajava* exhibited selective activity, notably against *S. aureus* (9.5 mm) and *Salmonella* (7.5 mm), while *Soleirolia* demonstrated limited inhibition, with measurable zones only against *S. aureus* (8.0 mm) and *E. coli* (10.0 mm).

TABLE 3: ANTIBACTERIAL ACTIVITY OF DIFFERENT PLANT DECOCTION EXTRACTS

Sr. no.	Plant Name	*Bacillus cereus* (mm)	*Staphylococcus aureus* (mm)	*Salmonella* (mm)	*Escherichia coli* (mm)	*Pseudomonas aeruginosa* (mm)
1	*Soleirolia*	0.0 ± 0.0	8.0 ± 0.0	0.0 ± 0.0	10.0 ± 0.0	0.0 ± 0.0
2	*Arctium lappa*	9.5 ± 0.45	10.0 ± 0.0	9.0 ± 0.64	11.0 ± 0.23	10.5 ± 0.75
3	*Psidium guajava*	0.0 ± 0.0	9.5 ± 0.34	7.5 ± 0.61	0.0 ± 0.0	0.0 ± 0.0

Antifungal Activity of Decoction Extracts: All decoction extracts exhibited antifungal activity. *A. lappa* again showed the most consistent effect (9.5 mm for *C. albicans*, 10.0 mm for *Clostridia*), followed by *P. guajava*, which demonstrated strong inhibition of *Clostridia* (11.0 mm) but moderate activity against *C. albicans* (8.5 mm).

TABLE 4: ANTIFUNGAL ACTIVITY OF DIFFERENT PLANT DECOCTION EXTRACTS

Sr. no.	Name of Plant	Fungi	
		Candida albicans	*Clostridia*
1.	*Soleirolia*	10± 0.64	9± 0.83
2.	*Arctium lappa*	9.5± 0.75	10.0± 0.56
3.	*Psidium guajava*	8.5± 0.34	11± 0.32

Antibacterial Activity of Percolation Extracts: Percolation extracts displayed altered antibacterial profiles compared to decoctions. *Soleirolia* showed improved activity against *Salmonella* (10.5 mm) and *S. aureus* (10.0 mm), while *A. lappa* maintained strong activity against *B. cereus* (8.5 mm), *S. aureus* (10.5 mm), and *E. coli* (10.5 mm), but lost activity against *Salmonella*. *P. guajava* exhibited significant inhibition against *Salmonella* (10.5 mm) and moderate activity against *B. cereus* and *P. aeruginosa*.

TABLE 5: ANTIBACTERIAL ACTIVITY OF DIFFERENT PLANT PERCOLATION EXTRACTS

Sr. no.	Name of Plant	Gram Positive		Gram Negative		
		Bacillus cereus	*Staphylococcus aureus*	*Salmonella*	*Escherichia coli*	*Pseudomonas aeruginosa*
1.	*Soleirolia*	3.5± 0.34	10.0± 0.75	10.5± 0.75	8.0± 0.12	0.0± 0.00
2.	*Arctium lappa*	8.5± 0.34	10.5± 0.34	0.0± 0.00	10.5± 0.53	8.0± 0.32
3.	*Psidium guajava*	6.5± 0.34	8.5± 0.23	10.5± 0.45	0.0± 0.00	6.0± 0.75

Antifungal Activity of Percolation Extracts: Percolation generally reduced antifungal potency, particularly for *Soleirolia* and *P. guajava*, suggesting that certain antifungal constituents may require heat-assisted extraction. *A. lappa* retained notable activity (9.5 mm against *C. albicans*), indicating stability of its antifungal compounds across extraction methods.

TABLE 6: ANTIFUNGAL ACTIVITY OF DIFFERENT PLANT PERCOLATION EXTRACTS

Sr. no.	Name of Plant	Fungi	
		Candida albicans	*Clostridia*
1.	*Soleirolia*	6.5± 0.64	8.0± 0.74
2.	*Arctium lappa*	9.5± 0.23	8.5± 0.23
3.	*Psidium guajava*	4.0± 0.35	9.5± 0.65

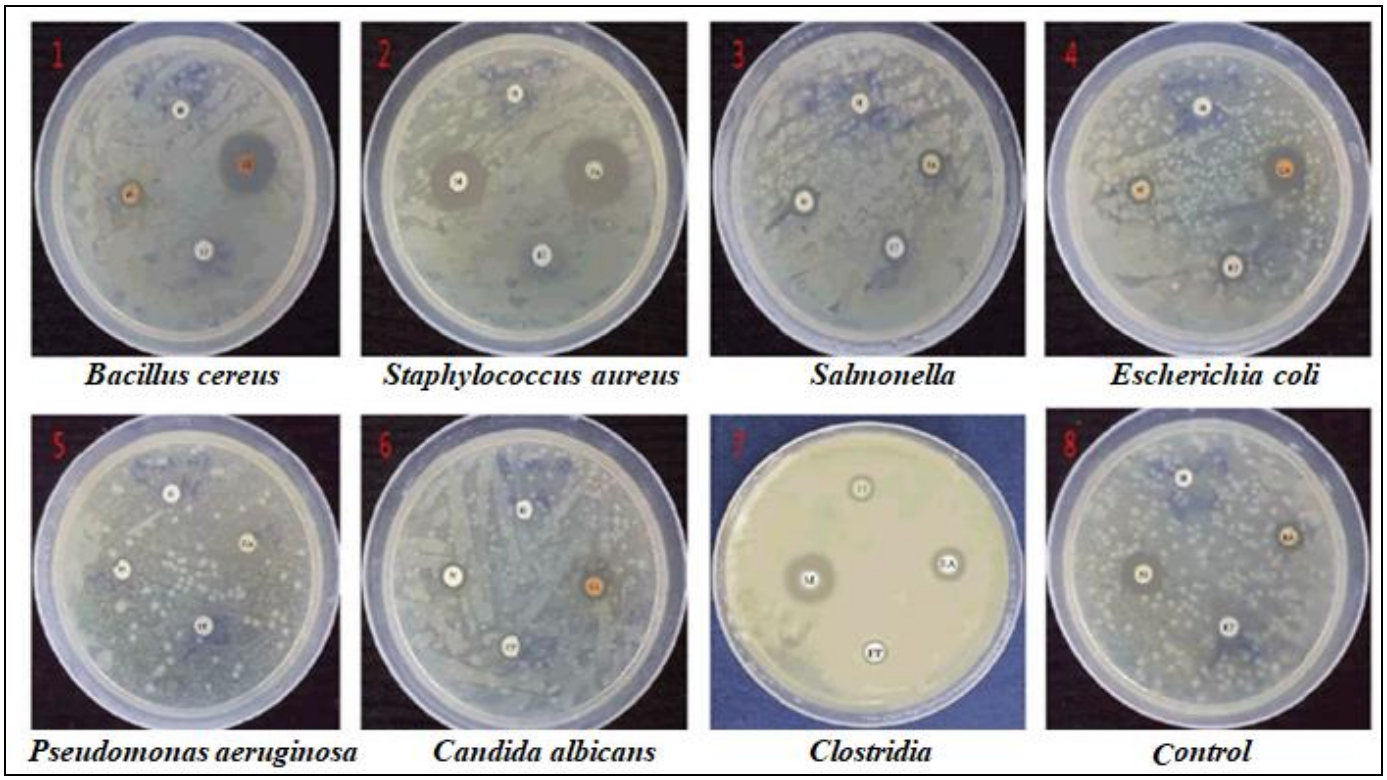

FIG. 1: DISC DIFFUSION PLATE

The present study demonstrates that extraction method significantly influences both yield and antimicrobial activity of *Arctium lappa*, *Psidium guajava*, and *Soleirolia*. *Arctium lappa* exhibited broad-spectrum antibacterial and antifungal activity across both decoction and percolation methods, consistent with previous reports showing inhibition zones of 9–12 mm against pathogens such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* (Pereira *et al.*, 2005). *Psidium guajava* showed selective antibacterial activity, notably against *S. aureus* and *Salmonella*, aligning with earlier studies reporting inhibition zones of 6–12 mm for leaf extracts (Biswas *et al.*, 2013).

Soleirolia displayed moderate, selective activity, with heat-sensitive constituents likely contributing to reduced efficacy in percolation extracts, as observed in similar reports. Overall, these findings confirm the pharmacological relevance of these plants and emphasize the need for bioassay-guided fractionation and phytochemical profiling to identify the active compounds responsible for their antimicrobial effects.

CONCLUSION: The present study highlights the significant impact of extraction methodology on both yield and antimicrobial efficacy of *Soleirolia*, *Arctium lappa*, and *Psidium guajava*. Decoction and percolation methods yielded variable extractive efficiencies, with percolation generally providing higher yields for *A. lappa* and *P. guajava*, while *Soleirolia* showed a slightly better yield with decoction, likely due to enhanced release of mucilaginous components. Antimicrobial evaluation revealed that *Arctium lappa* exhibited broad-spectrum antibacterial and antifungal activity across both extraction methods, establishing its potential as a robust natural antimicrobial agent. *Psidium guajava* demonstrated selective antibacterial activity, particularly against *S. aureus* and *Salmonella*, along with notable antifungal activity against *Clostridia*. *Soleirolia* displayed moderate and selective antimicrobial effects, with

efficacy influenced by the extraction method, suggesting that its bioactive constituents may be more thermolabile. Overall, these findings underscore the importance of selecting an appropriate extraction technique tailored to the physicochemical properties of target phytochemicals. The results further support the pharmacological relevance of these plants and emphasize the need for bioassay-guided fractionation and detailed phytochemical characterization to isolate and identify the compounds responsible for their antimicrobial activity.

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REFERENCES:

1. Rios JL and Recio MC: Medicinal plants and antimicrobial activity. Journal of Ethnopharmacology 2005; 100(1-2): 80-4.
2. Mothana RA and Lindequist U: Antimicrobial activity of some medicinal plants of the island Soqotra. Journal of Ethnopharmacology 2005; 96(1-2): 177-81.
3. Sen A and Batra A: Evaluation of antimicrobial activity of different solvent extracts of medicinal plant: *Melia azedarach* L. Int J Curr Pharm Res 2012; 4(2): 67-73.
4. Dabur R, Gupta A, Mandal TK, Singh DD, Bajpai V, Gurav AM and Lavekar GS: Antimicrobial activity of some Indian medicinal plants. African J of Traditional Complementary and Alternative Med 2007; 4(3): 313-8.
5. Dubale S, Kebebe D, Zeynudin A, Abdissa N and Suleman S: Phytochemical screening and antimicrobial activity evaluation of selected medicinal plants in Ethiopia. Journal of Experimental Pharmacology 2023; 51-62.
6. Gonzalez-Pastor R, Carrera-Pacheco SE, Zúñiga-Miranda J, Rodríguez-Pólit C, Mayorga-Ramos A, Guamán LP and Barba-Ostria C: Current Landscape of Methods to Evaluate Antimicrobial Activity of Natural Extracts. Molecules 2023; 28(3): 1068.
7. Balouiri M, Sadiki M and Ibnsouda SK: Methods for *in-vitro* evaluating antimicrobial activity: A review. Journal of Pharmaceutical Analysis 2016; 6(2): 71-9.
8. Vaou N, Stavropoulou E, Voidarou C, Tsakris Z, Rozos G, Tsigalou C and Bezirtzoglou E: Interactions between medical plant-derived bioactive compounds: focus on antimicrobial combination effects. Antibiotics 2022; 11(8): 1014.
9. Huie CW: A review of modern sample-preparation techniques for the extraction and analysis of medicinal plants. Analytical and Bioanalytical Chemistry 2002; 373: 23-30.
10. Nostro A, Germano MP, D'angelo V, Marino A and Cannatelli MA: Extraction methods and bioautography for evaluation of medicinal plant antimicrobial activity. Letters in Applied Microbiology 2000; 30(5): 379-84.
11. Azwanida NN: A review on the extraction methods use in medicinal plants, principle, strength and limitation. Med Aromat Plants 2015; 4(196): 2167-0412.
12. Rasul MG: Conventional extraction methods use in medicinal plants, their advantages and disadvantages. Int J Basic Sci Appl Comput 2018; 2: 10-4.
13. Rahman S and Parvin R: Therapeutic potential of *Aegle marmelos* (L.)-An overview. Asian Pacific Journal of Tropical Disease 2014; 4(1): 71-7.
14. Sharma GN, Dubey SK, Sharma P and Sati N: Medicinal values of bael (*Aegle marmelos*) (L.) Corr.: A review. Int J Curr Pharm Rev Res 2011; 2(1): 12-22.
15. Akinboro A and Bakare AA: Cytotoxic and genotoxic effects of aqueous extracts of five medicinal plants on *Allium cepa* Linn. Journal of Ethnopharmacology 2007; 112(3): 470-5.
16. Tabak S, Bendif H, Miara MD, Mediouni RM and Blake P: Physico-Chemical analysis of some medicinal plants growing in Algeria: *Allium sativum*, *Allium cepa* and *Foenuculum vulgare*. Genetics & Biodiversity Journal 2022; 6(1): 149-66.
17. Biswas K, Chattopadhyay I, Banerjee RK and Bandyopadhyay U: Biological activities and medicinal properties of neem (*Azadirachta indica*). Current Science 2002; 1336-45.
18. Atangwho IJ, Ebong PE, Eyong EU, Williams IO, Eten MU and Egbung GE: Comparative chemical composition of leaves of some antidiabetic medicinal plants: *Azadirachta indica*, *Vernonia amygdalina* and *Gongronema latifolium*. African Journal of Biotechnology 2009; 8(18).
19. Acharjee M, Zerin N, Ishma T and Mahmud MR: *In-vitro* anti-bacterial activity of medicinal plants against Urinary Tract Infection (UTI) causing bacteria along with their synergistic effects with commercially available antibiotics. New Microbes and New Infections 2023; 51: 101076.
20. Kousar F, Khanem A, Ullah I and Younas F: Phytochemical analysis and synergistic antimicrobial potential of extracts from *Carica papaya* and *Beta vulgaris*. Kuwait Journal of Science 2023; 22.
21. Gideon M and Ladan Z: Synergistic combinatorial strategy for combating Antimicrobial Resistance (AMR) in clinical bacteria by combining antibiotics with plant extracts. Fine Chemical Engineering 2023; 1-2.

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