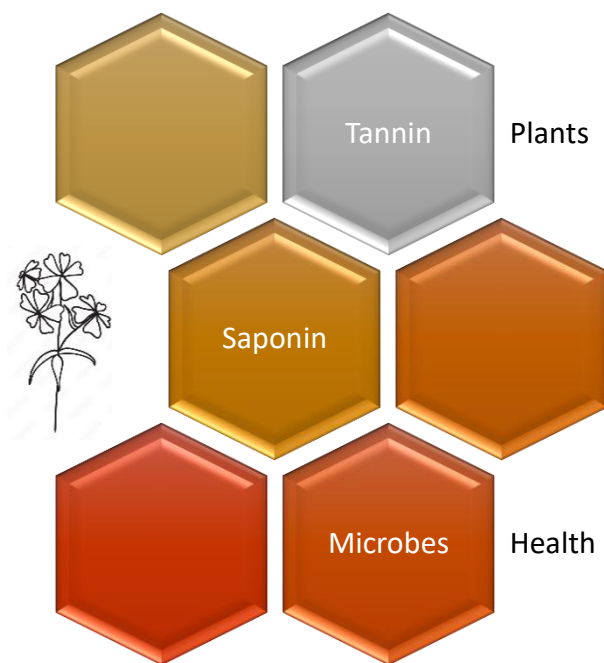


PLANTS & SECONDARY METABOLITES

VOLUME X

J. Jeline Rani • Saraswati Majhi • Sangeeta Bhogal



Plants and Secondary Metabolites

Volume 10

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PREFACE

The study of plant secondary metabolites has gained significant attention in recent years due to their potential therapeutic applications. Plants have been a rich source of bioactive compounds, and their phytochemical analysis has led to the discovery of numerous compounds with medicinal properties. This book, "**Plants & Secondary Metabolites, Volume 10**," presents a collection of research articles focused on the phytochemistry and pharmacological activities of various plant species. The chapters in this volume cover a range of topics, including phytochemical analysis, antimicrobial activity, antioxidant potential, and pharmacological evaluation of different plant extracts. The plant species studied in this volume are diverse, including *Arisaema tortuosum*, *Leucas cephalotes*, *Sesamum indicum*, and *Martynia annua*, among others. Each chapter provides an in-depth analysis of the plant's phytochemical profile and its potential therapeutic applications. This book aims to contribute to the growing body of knowledge on plant secondary metabolites and their potential uses in medicine. It is hoped that the research presented in this volume will inspire further studies on the phytochemistry and pharmacology of plant-based compounds, ultimately leading to the development of new therapeutic agents. The book is intended for researchers, scientists, and students interested in phytochemistry, pharmacology, and natural product research.

(Editors)

BACKGROUND

The increasing prevalence of antibiotic-resistant pathogens and the growing demand for natural and sustainable healthcare solutions have sparked a renewed interest in plant-based medicines. Plants have been a rich source of bioactive compounds, and their secondary metabolites have been found to possess a wide range of therapeutic properties, including antimicrobial, antioxidant, and anti-inflammatory activities. Despite the vast potential of plant secondary metabolites, there is a need for comprehensive and systematic documentation of their phytochemical profiles and pharmacological activities. The current situation demands a multidisciplinary approach to explore the therapeutic potential of plant secondary metabolites. Researchers, scientists, and healthcare professionals require access to reliable and up-to-date information on the phytochemistry and pharmacology of plant-based compounds. An edited book like "**Plants & Secondary Metabolites**" aims to fill this knowledge gap by providing a platform for experts to share their research findings and insights on the latest developments in this field. The need for such a book is further underscored by the growing recognition of the importance of natural products in modern medicine. As the world grapples with the challenges of emerging diseases and antibiotic resistance, plant secondary metabolites offer a promising avenue for the discovery of new therapeutic agents. By compiling cutting-edge research on the phytochemistry and pharmacology of plant secondary metabolites, this book aims to contribute to the advancement of natural product research and its applications in healthcare.

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Chapter 1

Phytochemistry and antimicrobial activity of fruits of *Arisaema tortuosum* (Wall.) Schott

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ABSTRACT

Present study investigated the secondary metabolites and antimicrobial properties of *Arisaema tortuosum* fruit extract. Qualitative phytochemical analysis revealed the presence of tannins, saponins, flavonoids, reducing sugars, and alkaloids in the hydroethanolic extract. The extract exhibited antimicrobial activity against *E. coli*, with a minimum inhibition concentration (MIC) between 12.5-25 mg/mL. Thin-layer chromatography (TLC) analysis using different mobile phases separated multiple compounds, indicating the presence of diverse bioactive molecules. These findings suggest that *Arisaema tortuosum* fruit extract has potential applications in traditional medicine and warrants further investigation into its therapeutic properties.

Keywords: Antibacterial activity, secondary metabolites, tuberous plants

INTRODUCTION

Wild tuberous plants have been a vital component of traditional medicine and food sources for centuries, particularly in regions with rich biodiversity (Chandrasekara and Josheph, 2016). These plants, often overlooked and underutilized, possess unique phytochemical properties that make them valuable for various applications. *Arisaema tortuosum*, (Figure 1) a wild

tuberous plant species, is one such example that has been used in traditional medicine for its therapeutic properties (Ritta et al., 2020). The importance of wild tuberous plants like *A. tortuosum* lies in their potential to provide novel bioactive compounds that can be used to develop new medicines, food additives, and other products. These plants have evolved complex chemical defense mechanisms to survive in their environments, resulting in a diverse array of phytochemicals with potential applications in human health and nutrition. By studying these plants, researchers can uncover new leads for drug discovery, nutritional supplements, and other products. Despite their potential, wild tuberous plants like *A. tortuosum* are often neglected in favor of more well-known plant species. However, the growing interest in traditional medicine and natural products has sparked renewed attention to these plants. Present study aims to investigate the phytochemical composition and antimicrobial properties of *A. tortuosum* fruit extract, shedding light on its potential applications and contributing to the growing body of research on wild tuberous plants.

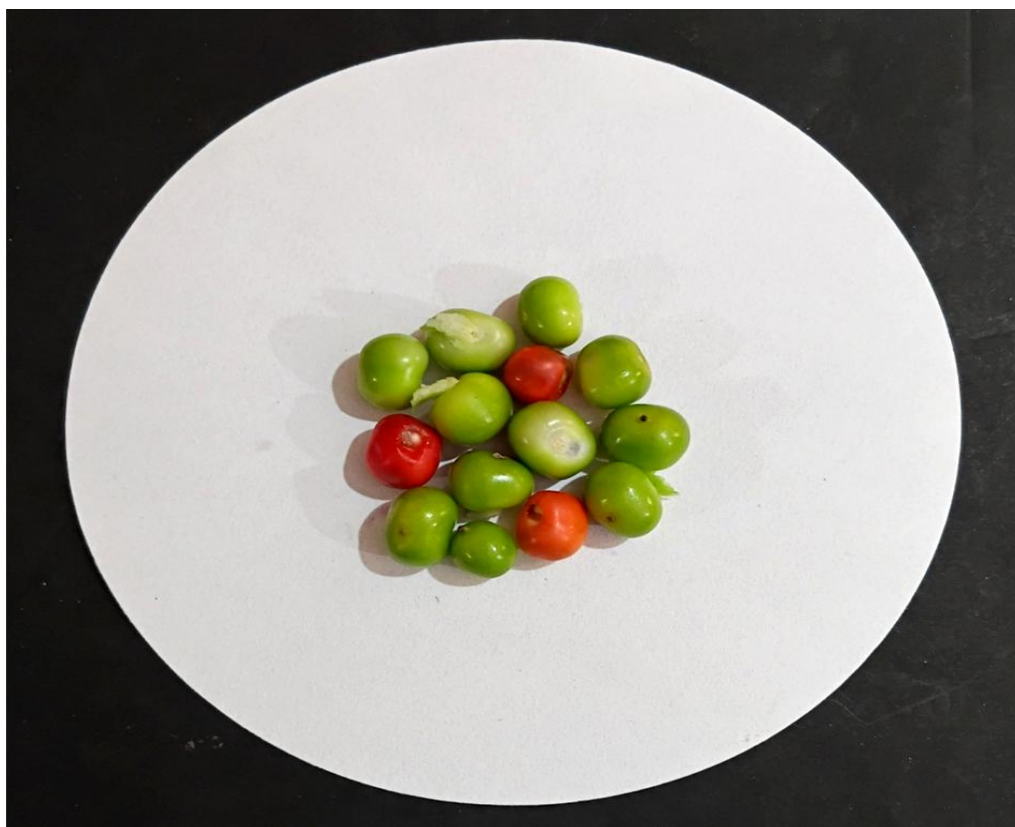


Figure 1: Collected fruits of *Arisaema tortuosum*

METHODOLOGY

Fruits of *A. tortuosum* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (N 20°.44785 E 85°.746068). The plant species was identified by Dr. Sanjeet Kumar. Fruits were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Phytochemical screening was carried out using standard method (Jena et al., 2025). Antibacterial activity was done against *Escherichia coli* (MTCC 45) using standard method (Kumar et al., 2017; Naik et al., 2022). Chromatographic analysis was carried out using standard methods to evaluate the secondary metabolites (Kumar et al. 2013).

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic fruit extract of *A. tortuosum* confirmed the selective presence of some bioactive compounds *i.e.* tannin, saponin, flavonoid, alkaloid and reducing sugars (Table 1; Figure 2). The MIC results show that the hydroethanolic fruit extract of *Arisaema tortuosum* inhibited *E. coli* growth at concentrations of 100 mg/mL and 50 mg/mL, with visible growth at lower concentrations (25 and 12.5 mg/mL). The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability (Table 2). The TLC analysis of the hydroethanolic fruit extract of *Arisaema tortuosum* using different mobile phases revealed variations in compound separation efficiency. The methanol:chloroform (1:1) system showed four distinct spots (R_f 0.663–0.852) while Ethyl acetate:water:acetic acid (8:1:1) produced two high R_f spots and ethyl acetate:chloroform (1:9) showed a single spot. Overall, the extract contains a range of moderately to highly polar constituents (Table 3; Figure 3).

Table 1: Qualitative phytochemical analysis of fruits of *Arisaema tortuosum* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Present
Flavonoids	Present

Terpenoids	Absent
Phenolic compounds	Absent
Reducing sugars	Present
Steroids	Absent
Alkaloids	Present
Carbonyl compounds	Absent

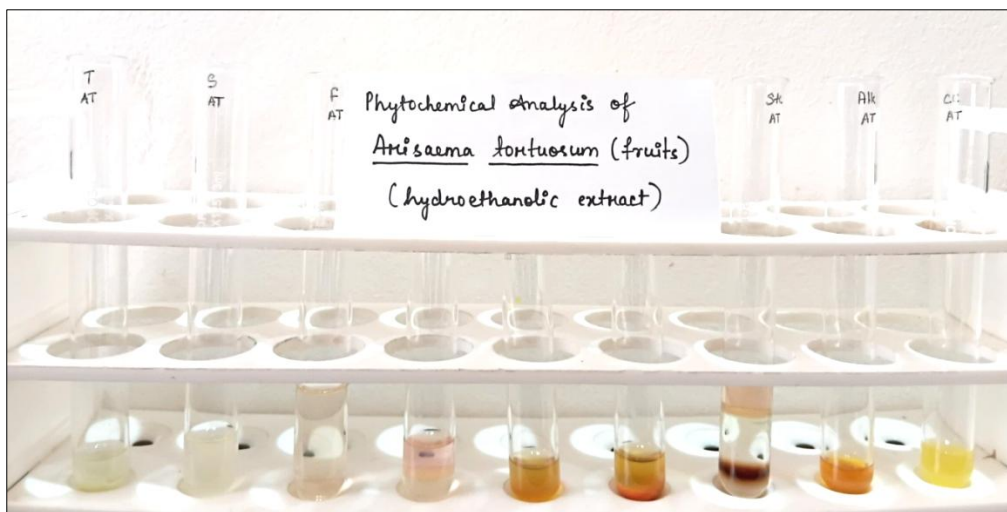


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) hydroethanolic fruit extract of *Arisaema tortuosum* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Arisaema tortuosum</i>	NG	NG	G	G	50
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

Table 3: TLC analysis of hydroethanolic fruit extract of *Arisaema tortuosum* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	S4
Hydroethanolic	Methanol: Chloroform (1:1)	0.663	0.757	0.789	0.852
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.904	0.917	-	-
	Ethyl acetate: Chloroform (1:9)	0.742	-	-	-

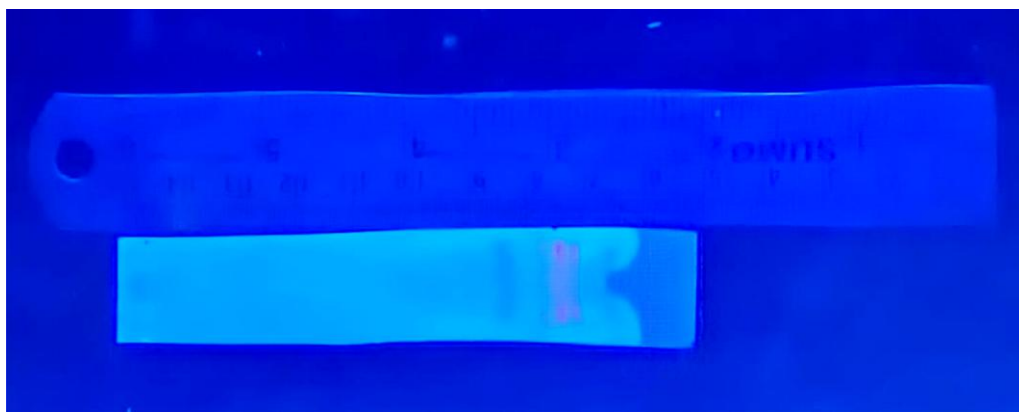


Figure 3: TLC analysis using (Methanol: Chloroform) mobile phase

Other researchers have also worked in experimental plant parts on different pharmacological aspects. In treatment of snake bites and wound healing in cattle for killing parasite, the use of dried powder and juice of *A. tortuosum* tuber has been surveyed by Choudhary et al. (2008). The rhizomes of this plant were reviewed to be used as antihelmentic and tubers as anti-nematodal and in wound healing (Verma et al. 2012). Study conducted by Nile and Park, (2014) reported the TLC and HPTLC analysis of *A. tortuosum* tuber extract showed the presence of quercetin, rutin, luteolin and lectin with Rf values 0.97, 0.53, 0.59 and 1.58, respectively. Methanolic and organic solvent extracts of *A. tortuosum* showed broad-spectrum antibacterial activity in crude methanol and chloroform fractions, demonstrating inhibitory zones against *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus vulgaris*, and *Staphylococcus aureus*, as reported by Azam et al. (2016). Tubers of *Arisaema tortuosum* has

been documented to be used as a contraceptive by Paulsamy et al. (2017). Ali and Yaqoob, (2021) reviewed *A. tortuosum* to be traditionally used in treatment of rheumatism, stomachache, snake-bite, piles, and digestive tract ailments including constipation, indigestion, abdominal pain and dysentery. Its tubers and leaves have been reported to show the presence of flavonoids (quercetin, rutin, luteolin), alkaloids, saponins, triterpenoids, and lectins.

CONCLUSION

Present study highlighted the phytochemical richness and antimicrobial potential of *A. tortuosum* fruit extract, underscoring the importance of exploring wild tuberous plants for novel bioactive compounds. The presence of tannins, saponins, flavonoids, and alkaloids in the extract suggests its potential applications in traditional medicine and pharmaceutical industries. The extract's antimicrobial activity against *E. coli* further supports its therapeutic potential, warranting further research to isolate and characterize the bioactive compounds responsible for its efficacy. These findings contribute to the growing body of evidence on the significance of wild tuberous plants in human health and nutrition.

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Chapter 2

Phytochemistry and Antimicrobial activity of *Leucas cephalotes* (Roth) Spreng.

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ABSTRACT

Present study investigated the phytochemical analysis and antimicrobial activity of *Leucas cephalotes*, documenting the presence of tannins and reducing sugars in its hydroethanolic extract. The extract showed potential antimicrobial activity against *Escherichia coli*. Thin Layer Chromatography (TLC) analysis revealed that the presence of multiple compounds in the extract, with varying R_f values depending on the mobile phase used. These findings provide a foundation for future research on the therapeutic potential of *L. cephalotes* and its potential applications in traditional medicine.

Keywords: Antibacterial activity, secondary metabolites, tuberous plants

INTRODUCTION

The use of medicinal plants dates back to thousands of years, with many traditional systems of medicine relying on plant-based remedies to treat various ailments (Pradhan et al., 2025). Despite the significant progress

made in modern medicine, plants continue to play a vital role in healthcare, particularly in rural and underserved areas where access to conventional medical facilities is limited (Marndi et al., 2024). The World Health Organization (WHO) estimates that a substantial portion of the global population still relies on traditional medicine, which is often based on plant-based therapies (Smith-Hall et al., 2012). Wild medicinal plants have been a rich source of bioactive compounds and have contributed significantly to the development of modern medicines (Devi et al., 2023). These plants have evolved over millions of years to produce complex chemical compounds that help them adapt to their environment, and many of these compounds have been found to possess medicinal properties (Riaz et al., 2023). However, most plant species remain unexplored for their medicinal potential, and there is a pressing need to screen wild medicinal plants to identify new leads for the treatment of various diseases (Sak, 2022). The need to screen wild medicinal food plants is particularly important in the context of emerging diseases and the growing threat of antimicrobial resistance (Chandrashekar et al., 2025). With the screening of such plants, researchers can identify new compounds with potential therapeutic applications, which can help to address the growing need for innovative treatments. Keeping this in view, an attempt has been made to phytochemical screening, antimicrobial activity, and TLC analysis of *Leucas cephalotes* whole plant. It is a wild food plants having medicinal uses but still unexplored.

METHODOLOGY

Whole plants of *Leucas cephalotes* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Sanjeet Kumar. Whole plant was thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Phytochemical screening was carried out using standard method (Jena et al., 2025). Antibacterial activity was done against *Escherichia coli* (MTCC 45) using standard method (Kumar et al., 2017; Naik et al., 2022). Chromatographic analysis was carried out using standard methods to evaluate the secondary metabolites (Kumar et al. 2013).



Figure 1: Collected sample of *L. cephalotes*

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic whole plant extract of *Leucas cephalotes* confirmed the presence of two bioactive compounds *i.e.* Tannin and Reducing sugars (Table 1; Figure 2). The hydroethanolic whole plant extract of *L. cephalotes* exhibited strong antibacterial activity against *E. coli*, as no bacterial growth (NG) was observed in any of the tested concentrations (100, 50, 25, and 12.5 mg/mL). This indicated that the extract was effective in completely inhibiting the growth of *E. coli* even at the lowest concentration, showing the Minimum Inhibitory Concentration (MIC) at 12.5 mg/mL. The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability (Table 2; Figure 3). The TLC analysis of the hydroethanolic extract of whole plant of *L. cephalotes* using different mobile phases showed well-separated spots (Table 3; Figure 4). The methanol: chloroform (1:1) system produced nine distinct spots ($R_f = 0.542\text{--}0.971$), the

ethyl acetate: water: acetic acid (8:1:1) system showed two higher-Rf bands (0.885 and 0.957) and the ethyl acetate: chloroform (1:9) system showed two spots, one at low Rf (0.306) and another at high Rf (0.973).

Table 1: Qualitative phytochemical analysis of whole plant of *Leucas cephalotes* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Absent
Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Absent
Reducing sugars	Present
Steroids	Absent
Alkaloids	Absent
Carbonyl compounds	Absent

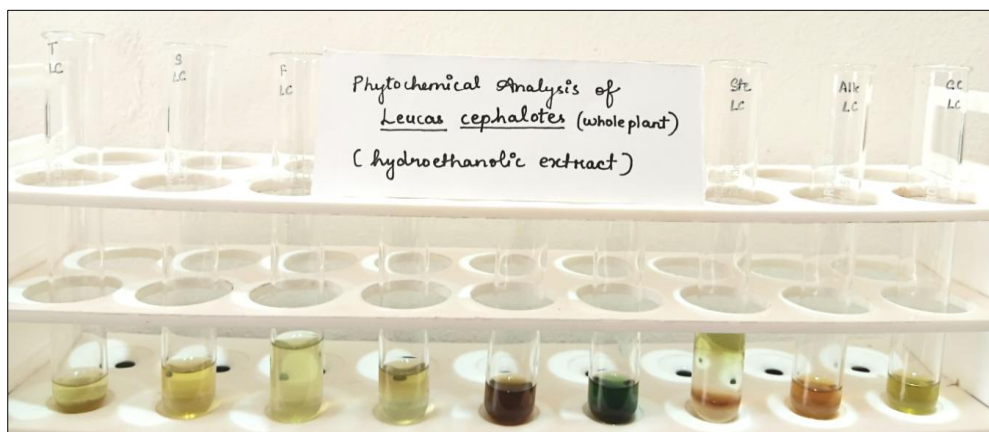


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic whole plant extract of *Leucas cephalotes* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	

<i>Leucas cephalotes</i>	NG	NG	NG	NG	12.5
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)



Figure 3: Estimation of Minimum Inhibition Concentration (MIC) against *E. coli*

Table 3: TLC analysis of hydroethanolic whole plant extract of *Leucas cephalotes* using different mobile phases

Hydroetha nolic	Mobile Phases	Rf value of Spots								
		S1	S2	S3	S 4	S5	S6	S7	S8	S9
	Methan ol: Chlorof	0.5 42	0.5 85	0.6 85	0. 7	0.7 71	0.8 14	0.8 42	0.8 57	0.9 71

	orm (1:1)									
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.8 85	0.9 57	-	-	-	-	-	-	-
	Ethyl acetate: Chlorof orm (1:9)	0.3 06	0.9 73	-	-	-	-	-	-	-

(Rf: Retention factor)

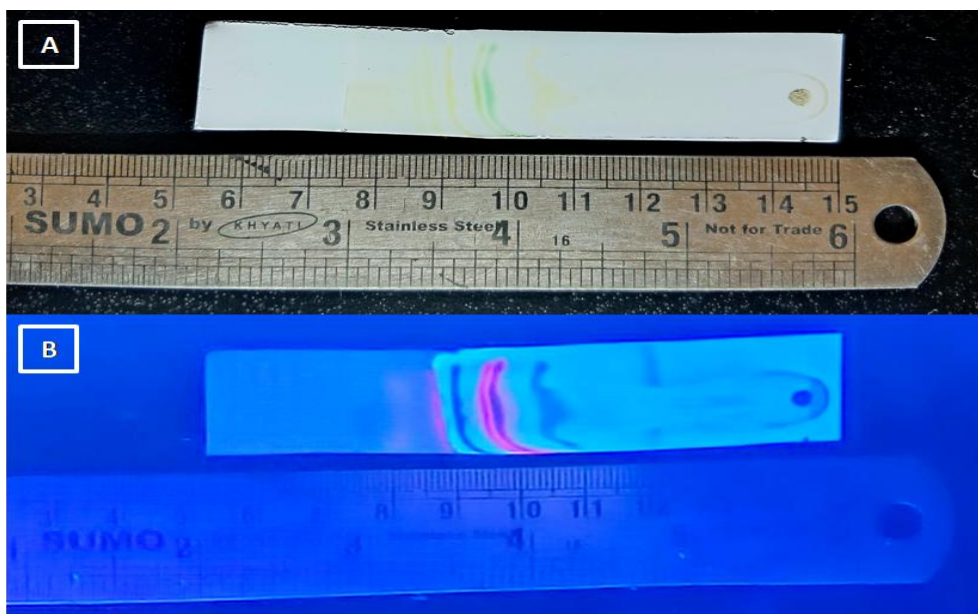


Figure 4: TLC analysis using Methanol: Chloroform (1:1) medium; A) Without UV and B) Under UV light

Leucas cephalotes is traditionally used across India in various forms for treating common ailments. Methanol and hexane extracts of *Leucas cephalotes* leaves as reported by Madhukiran et al. (2002) have exhibited inhibitory effects against *S. aureus*, *E. coli*, *P. aeruginosa*, *P. vulgaris*, and

K. pneumoniae, with MIC values of approximately 0.625 mg/mL for *S. aureus*, up to 5 mg/mL for *E. coli*. Preliminary phytochemical screening done by Sailor et al. (2010) confirmed methanolic extract of *L.cephalotes* to contain flavonoids, phenolics, phytosterols and tannins. Chouhan and Singh, (2011) reviewed that its leaf paste is applied to snake bites, while flower syrup is used to relieve cough and cold. Leaf decoction or paste is chewed or massaged to treat mouth ulcers and headaches. Additionally, a leaf decoction mixed with *Boerhavia diffusa* is consumed daily for a week to alleviate burning sensation and painful urination. Phytochemical investigation showed the presence of flavanoids, phenol, phytosterol and tannins in whole plant extract of *L. cephalotes* as reported by Itoria et al. (2011). Das et al. (2012) reported hot water extract of dried flowers of *L. cephalotes* is used for treating cough. Unripe fruit juice is used to treat scabies and decoction of entire plant is taken orally for reducing fever. Oleanolic acid was successfully isolated from *L. cephalotes* by Kaushik et al. (2021) using preparative TLC and further characterized by HPTLC, UV–Vis, FT-IR, and NMR spectroscopy, with an R_f value around 0.19 in HPTLC chromatograms.

CONCLUSION

Present study highlights the potential of *Leucas cephalotes* as a valuable source of bioactive compounds with antimicrobial properties. The findings of this research provide a foundation for further investigation into the therapeutic applications of this plant. Future studies can focus on isolating and characterizing the specific compounds responsible for its antimicrobial activity, as well as exploring its efficacy in vivo and potential uses in traditional medicine. Additionally, conservation efforts and sustainable harvesting practices should be implemented to ensure the long-term availability of this valuable plant resource.

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Chapter 3

Qualitative phytochemical analysis, TLC, and antibacterial activity of *Sesamum indicum* L.

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ABSTRACT

Present study investigated the phytochemical composition and antimicrobial activity of *Sesamum indicum* flowers and revealed the presence of tannins and reducing sugars in its hydroethanolic extract. The extract exhibited antimicrobial activity against *E. coli*, with a Minimum Inhibition Concentration (MIC) of 50 mg/mL. Thin Layer Chromatography (TLC) analysis confirmed the presence of bioactive compounds in the extract. These findings suggest the potential of *S. indicum* flowers as a source of natural antimicrobial agents, warranting further research into their therapeutic applications.

Keywords: Antibacterial activity, secondary metabolites, medicinal plants

INTRODUCTION

Sesamum indicum, commonly known as sesame or Til, is a widely cultivated crop known for its nutritional and medicinal properties. Beyond its culinary uses, sesame has been employed in traditional medicine for centuries,

particularly in Ayurvedic and Unani systems (Wei et al., 2022). Its seeds, oil, and leaves are utilized to treat various ailments, ranging from skin conditions to digestive issues, highlighting the plant's versatility and potential therapeutic value. In traditional medicine, *S. indicum* is valued for its anti-inflammatory, antioxidant, and antimicrobial properties (Subrahmaniyan et al., 2024). The plant's seeds and oil are often used to promote health and prevent disease, with applications including wound healing, skin care, and relief from constipation (Langyan et al., 2022). The flowers of the sesame plant, though less studied than its seeds, are also believed to possess medicinal properties, making them a subject of interest for phytochemical and pharmacological research. The growing interest in natural products and traditional medicine has led to increased scrutiny of its phytochemical composition and biological activities (Yuan et al., 2016). As antimicrobial resistance becomes a global health concern, plants like sesame are being explored for their potential to provide new antimicrobial agents. This study aims to investigate the phytochemical profile and antimicrobial activity of *S. indicum* flowers, contributing to the understanding of their therapeutic potential and supporting the development of natural, plant-based remedies.

METHODOLOGY

Whole plant of *Sesamum indicum* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Sanjeet Kumar. Whole plant was thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Phytochemical screening was carried out using standard method (Jena et al., 2025). Antibacterial activity was done against *Escherichia coli* (MTCC 45) using standard method (Kumar et al., 2017; Naik et al., 2022). Chromatographic analysis was carried out using standard methods to evaluate the secondary metabolites (Kumar et al. 2013).



Figure 1: Collected flowers of *Sesamum indicum*

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic flower extract of *S. indicum* confirmed the presence of four bioactive compounds (Table 1; Figure 2). The hydroethanolic flower extract of *S. indicum* inhibited *E. coli* growth at concentrations of 100 mg/mL and 50 mg/mL, with visible growth at lower concentrations (25 and 12.5 mg/mL) establishing the Minimum Inhibition Concentration (MIC) at 50mg/mL. The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability (Table 2; Figure 3). The TLC analysis of the hydroethanolic extract of *S. indicum* flowers using

different mobile phases revealed variations in compound separation efficiency. No visible spots were observed with methanol: chloroform (1:1) system. However, ethyl acetate: water: acetic acid (8:1:1) produced a distinct spot with a high R_f value of 0.985 and ethyl acetate: chloroform (1:9) showed two spots at R_f 0.971 and 0.985 (Table 3).

Table 1: Qualitative phytochemical analysis of flowers of *Sesamum indicum* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Absent
Flavonoids	Present
Terpenoids	Absent
Phenolic compounds	Present
Reducing sugars	Present
Steroids	Absent
Alkaloids	Absent
Carbonyl compounds	Absent

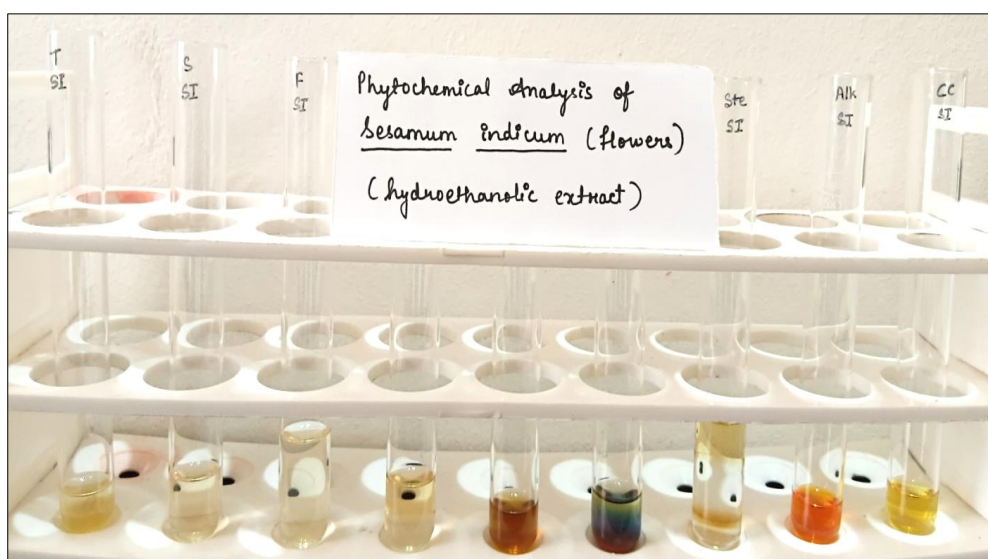


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic flower extract of *Sesamum indicum* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Sesamum indicum</i>	NG	NG	G	G	50
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)

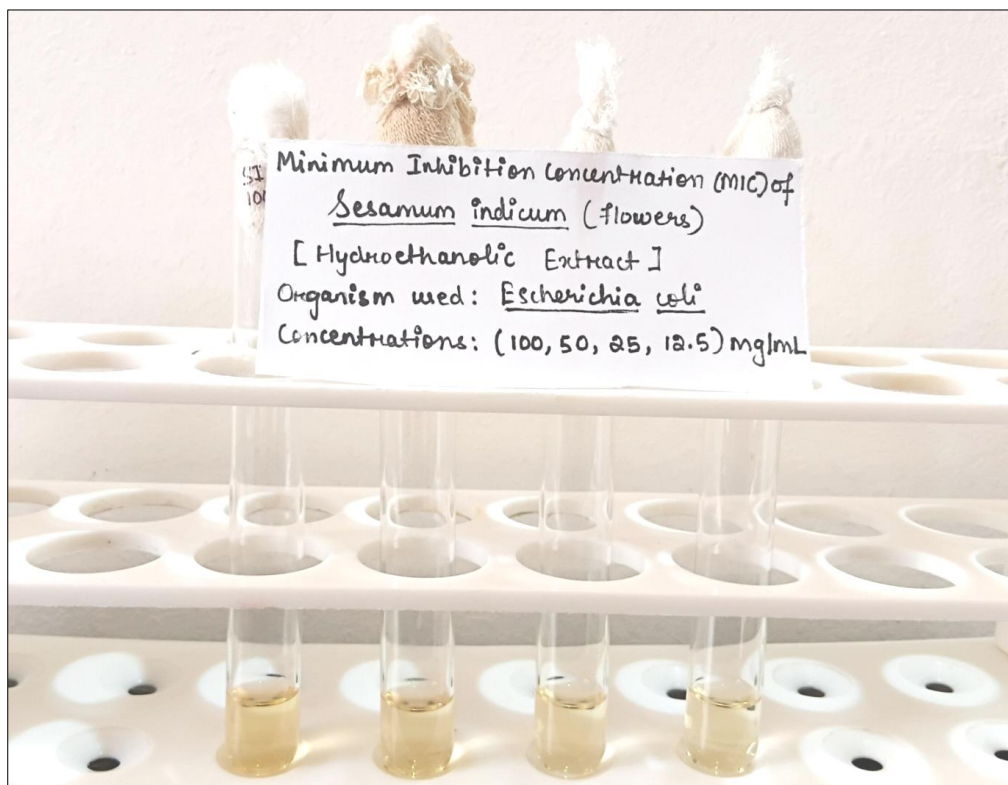


Figure 3: Estimation of Minimum Inhibition Concentration against *E. coli* bacteria

Table 3: TLC analysis of hydroethanolic flower extract of *Sesamum indicum* using different mobile phases

Hydroethanolic	Mobile Phases	Rf value of Spots	
		S1	S2
	Methanol: Chloroform (1:1)	-	-
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.985	-
	Ethyl acetate: Chloroform (1:9)	0.971	0.985

(Rf: Retention factor)

The preliminary screening by Narasimhan et al. (2012) confirms the presence of alkaloids, flavonoids, glycosides, phenols, tannins, steroids, diterpenes, and proteins using standard phytochemical assays. Doppalapudi et al. (2014) evaluated MIC that found to range between approximately 88–95 µg/mL for both aqueous and ethanolic extracts of *S.indicum* seeds against used pathogens *Bacillus subtilis* and *Escherichia coli*. Nigam et al. (2014) performed standard qualitative tests and found that *S. indicum* seed extract contains glycosides, flavonoids, alkaloids, tannins, phenols, phytosterols, amino acids, and proteins. Antibacterial assays using the disc diffusion method showed inhibitory effects on *Escherichia coli* and *Staphylococcus aureus*. At 500 mg/mL concentration, *S. aureus* displayed a zone of inhibition of $\sim 13.0 \pm 0.9$ mm, while *E. coli* showed $\sim 10.2 \pm 0.95$ mm. Mili et al. (2021) reviewed that sesame oil is topically used to treat wounds, mouth ulcers, and burns, and to support oral health. HPLC, HPTLC, GC-MS, and LC-MS Analyses techniques have identified over 160 bioactive constituents from seeds and oil of *S.indicum*, including: Phenolic acids, Lignans (sesamin, sesamolin, sesamol), Phytosterols and Fatty acids (oleic, linoleic, palmitic) reported by Shah et al. (2024). Biju et al. (2025) reviewed that various parts of *Sesamum indicum* i.e. oil, seeds, and paste, have therapeutic properties used in skin care, wound healing, bone, and teeth strengthening.

CONCLUSION

Present study demonstrates the potential of *Sesamum indicum* flowers as a source of bioactive compounds with antimicrobial properties. The presence of tannins and reducing sugars, along with the observed antimicrobial activity against *E. coli*, highlights the therapeutic potential of these flowers. Further research is warranted to isolate and characterize the specific compounds responsible for this activity, as well as to explore their applications in traditional medicine and modern healthcare.

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Chapter 4

Phytochemistry and antimicrobial activity of *Croton bonplandianus* (Euphorbiaceae)

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ABSTRACT

Present study investigated the phytochemical composition and antimicrobial activity of the hydroethanolic extract of *Croton bonplandianus* apical parts. Qualitative phytochemical analysis revealed the presence of tannins, saponins, phenolic compounds, reducing sugars, and alkaloids. The extract exhibited antimicrobial activity against *Escherichia coli*, with a minimum inhibition concentration (MIC) of 100 mg/mL. Thin layer chromatography (TLC) analysis using different mobile phases showed distinct separation of compounds with R_f values ranging from 0.9 to 0.98. These findings suggest the potential of *C. bonplandianus* as a source of bioactive compounds with antimicrobial properties, warranting further research into its therapeutic applications.

Keywords: Bioactive compounds, medicinal plants, pharmacology

INTRODUCTION

Croton bonplandianus is a plant species known for its medicinal properties and potential therapeutic applications (Baliyan and Sharma, 2025). In traditional medicine, various parts of the plant are used to treat different

ailments, highlighting its importance in folk remedies (Basak et al., 2021). Phytochemical analysis of plants like *Croton bonplandianus* can reveal the presence of bioactive compounds with potential therapeutic properties. These compounds can include alkaloids, flavonoids, phenolic compounds, and others, each with unique biological activities (Chandrashekar et al., 2025). By identifying and characterizing these compounds, researchers can better understand the plant's medicinal properties and explore its potential applications (Jena et al., 2025). The growing concern over antimicrobial resistance has led to increased interest in plant-based antimicrobial agents (Jena et al., 2024). *C. bonplandianus*, with its reported medicinal properties, is a promising candidate for investigation (Baliyan and Sharma, 2025). Present study aims to evaluate the phytochemical composition and antimicrobial activity of the plant's apical parts, contributing to the understanding of its therapeutic potential and supporting the development of natural, plant-based remedies.



Figure 1: Collected apical part sample of *Croton bonplandianus*

METHODOLOGY

Apical part of *C. bonplandianus* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Sanjeet Kumar. Collected parts were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Phytochemical screening was carried out using standard method (Kumar and Jena, 2014). Antibacterial activity was done against *Escherichia coli* (MTCC 45) using standard method (Kumar et al., 2013). Chromatographic analysis was carried out using standard methods to evaluate the secondary metabolites (Kumar and Jena, 2014).

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic apical part extract of *C. bonplandianus* confirmed the selective presence of five bioactive compounds *i.e.* Tannin, Saponin, Phenol, Alkaloid and Reducing sugars (Table 1; Figure 2). The MIC results show that the hydroethanolic extract of apical part of *C. bonplandianus* inhibited *E. coli* growth at the highest given concentration establishing MIC at 100 mg/mL with visible growth at all the lower concentrations (50, 25 and 12.5 mg/mL). The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability (Table 2). The TLC analysis of the hydroethanolic apical part extract of *C. bonplandianus* using different mobile phases showed single, high R_f spots in all three solvent systems, with values ranging from 0.9 to 0.98 (Table 3).

Table 1: Qualitative phytochemical analysis of apical part of *Croton bonplandianus* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Present

Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Present
Reducing sugars	Present
Steroids	Absent
Alkaloids	Present
Carbonyl compounds	Absent

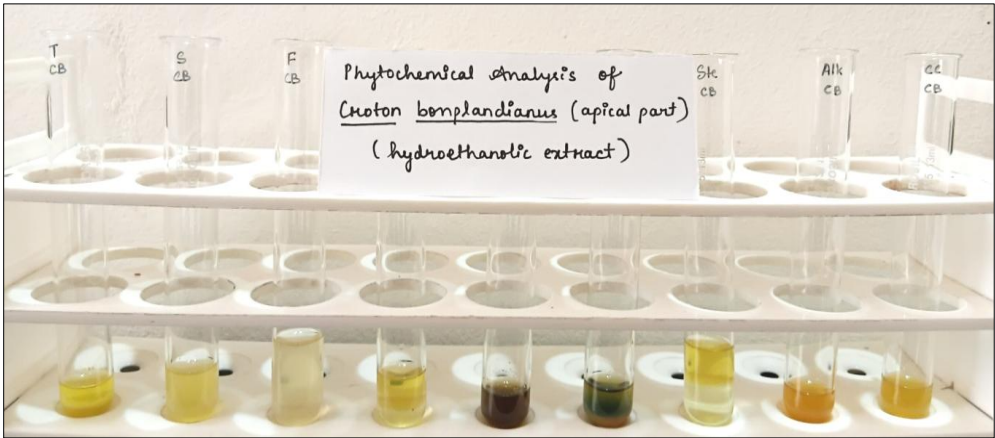


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic apical part extract of *Croton bonplandianus* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Croton bonplandianus</i> (Apical part)	NG	G	G	G	100
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)

Table 3: TLC analysis of hydroethanolic apical part extract of *Croton bonplandianus* using different mobile phases

Hydroethanolic	Mobile Phases	Rf value of Spots
		S1
	Methanol: Chloroform (1:1)	0.9
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.95
	Ethyl acetate: Chloroform (1:9)	0.98

(Rf: Retention factor)

C. bonplandianus has been also reviewed by Ghosh et al., (2018) to be used traditionally for curing gastro intestinal disorders, cold, cough, lungs infection, bronchitis, asthma, and hepatic problems. Its leaf extract was also used for treatment of cancer, venereal diseases, and ulcer.

CONCLUSION

Present study demonstrates the potential of *Croton bonplandianus* apical parts as a source of bioactive compounds with antimicrobial properties. The presence of tannins, saponins, phenolic compounds, reducing sugars, and alkaloids, along with the observed antimicrobial activity against *E. coli*, highlights the therapeutic potential of this plant. Further research is warranted to isolate and characterize the specific compounds responsible for this activity, as well as to explore their applications in traditional medicine and modern healthcare.

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Chapter 5

Phytochemistry and antimicrobial activity of flowers of *Pedalium murex* L.

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ABSTRACT

Present study investigated the bioactive compounds and antimicrobial activity of *Pedalium murex* flowers, extracted using hydroethanolic solvent. The extract was found to contain tannins, phenolic compounds, reducing sugars, and alkaloids. The antimicrobial activity against *Escherichia coli* revealed a minimum inhibition concentration (MIC) of 50 mg/mL, indicating moderate efficacy. Thin layer chromatography (TLC) analysis using different mobile phases showed distinct separation of compounds with varying retention factor (R_f) values. These findings suggest the potential of *P. murex* flowers as a source of bioactive compounds with antimicrobial properties, warranting further research into their therapeutic applications.

Keywords: Bioactive compounds, flowers, medicinal plants

INTRODUCTION

For centuries, flowers have been integral to traditional medicine, with numerous plant species showcasing valuable therapeutic properties (Shahane et al., 2023). In pharmacology, flowers are valued for their diverse array of bioactive compounds, which can be used to develop novel treatments for various diseases. The unique combination and concentration of these compounds in flowers can provide a rich source of potential therapeutic agents (Cruz et al., 2023), making them an important area of research in the field of pharmacology. *Pedaliium murex*, a plant species known for its medicinal properties, has been used in traditional medicine to treat various ailments. Its flowers, in particular, are believed to possess therapeutic potential due to the presence of bioactive compounds (Rathore et al., 2024). The phytochemical composition of *Pedaliium murex* flowers is likely to include a range of compounds with potential antimicrobial, anti-inflammatory, and antioxidant properties, making them an interesting subject for scientific investigation. The growing need for novel antimicrobial agents has led to increased interest in plant-based compounds. With the rise of antimicrobial resistance, it is essential to explore new sources of therapeutic agents (Vaou et al., 2021). *Pedaliium murex* flowers, with their potential antimicrobial properties, offer a promising area of research. This study aims to investigate the phytochemical composition and antimicrobial activity of *Pedaliium murex* flowers, contributing to the understanding of their therapeutic potential and supporting the development of natural, plant-based remedies.

METHODOLOGY

Flowers of *P. murex* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Sanjeet Kumar. Flowers were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Qualitative phytochemical analysis, antibacterial activity against *Escherichia coli* and chromatographic analysis was carried out using standard methods (Jena et al., 2025; Kumar et al., 2017; Naik et al., 2022; Kumar et al. 2013).



Figure 1: Collected inflorescence of *Pedalium murex*

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic flower extract of *Pedalium murex* confirmed the selective presence of some bioactive compounds (Table 1; Figure 2). The hydroethanolic flower extract of *Pedalium murex* inhibited *E. coli* growth at concentrations of 100 mg/mL and 50 mg/mL, with visible growth at lower concentrations (25 and 12.5 mg/mL; Table 2; Figure 3). The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability. The TLC analysis of the hydroethanolic extract of *Pedalium murex* flowers using different mobile phases revealed variations in

compound separation efficiency. All the solvent systems produced two distinct higher spots ranging from R_f (0.885-0.986; Table 3).

Table 1: Qualitative phytochemical analysis of flowers of *Pedaliium murex* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Absent
Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Present
Reducing sugars	Present
Steroids	Absent
Alkaloids	Present
Carbonyl compounds	Absent

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic flower extract of *Pedaliium murex* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Pedaliium murex</i> (flowers)	NG	NG	G	G	50
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)

Table 3: TLC analysis of hydroethanolic flower extract of *Pedaliium murex* using different mobile phases

Hydroethanolic	Mobile Phases	R _f value of Spots	
		S1	S2

	Methanol: Chloroform (1:1)	0.921	0.932
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.885	0.9
	Ethyl acetate: Chloroform (1:9)	0.972	0.986

(Rf: Retention factor)

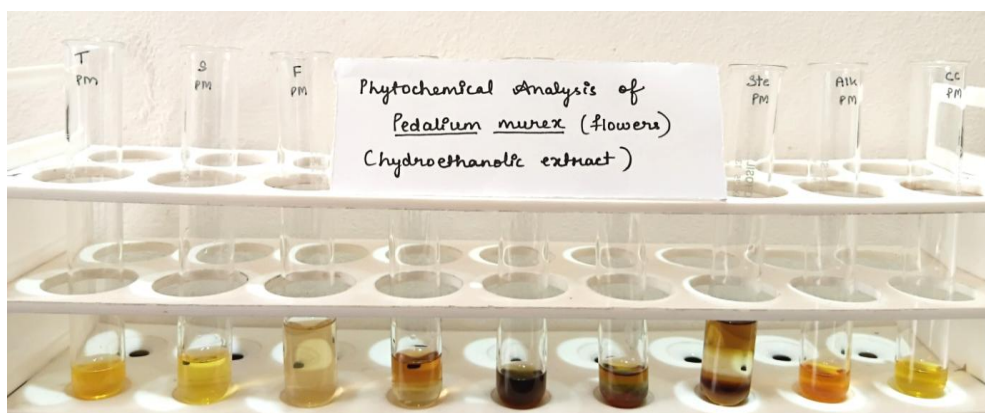


Figure 2: Detection of secondary metabolites



Figure 3: Estimation of Minimum Inhibition Concentration against *E. coli* bacteria

The qualitative phytochemical analysis of petroleum ether extract of *P. murex* was reported to contain higher concentrations of steroids and sterols, and moderate concentrations of flavanoids, phenols, glycosides, alkaloids as reviewed by Patel et al., (2011). The different parts of *Pedaliium murex* were reported by Imran et al., (2015) to contain a variety of useful compounds: fruits are rich in alkaloids (3.5–5%), oils, glycosides, and saponins. Stems contain plant steroids, tannins, saponins, and carbohydrates. Roots have natural sugars, proteins, alkaloids, and antioxidants like flavonoids and phenolics while leaves are rich in alkaloids, flavonoids, resins, saponins, proteins, and plant steroids. *Pedaliium murex* is widely used to manage urinary tract disorders, including dysuria, gonorrhea, and ulcers, due to its demulcent and diuretic properties (Devanesan et al., 2018). Kaleeswaran et al., (2019) reviewed that it is also used to relieve inflammation, reduce fever, and ease pain in conditions involving the urinary and reproductive systems. Triterpenoids, fatty acids, steroids, flavonoids, tannins, saponins, vitamins, proteins, sugars, vanillin, ursolic acid are reported to be present in *P. murex*. Traditional systems describe it as an aphrodisiac; young shoots or leaves are sometimes boiled in milk and consumed to promote male fertility as documented by Bora and Goswami, (2020). Methanolic leaf extracts of *P. murex* showed antibacterial activity against *Staphylococcus epidermidis* and *Escherichia coli* in disc diffusion assays, with zones of inhibition (ZOI) ranging from 11 to 16 mm depending on concentration as experimented by Khan et al., (2022). Tyagi and Ranjan, (2022) systematically evaluated the presence of diosgenin (a steroidal sapogenin) in the roots, leaves, fruits, and stems of *Pedaliium murex* using TLC profiling.

CONCLUSION

Present study demonstrated the potential of *Pedaliium murex* flowers as a source of bioactive compounds with antimicrobial properties. The presence of tannins, phenolic compounds, reducing sugars, and alkaloids in the hydroethanolic extract, along with its moderate antimicrobial activity against *E. coli*, highlights the therapeutic potential of this plant. These findings provide a foundation for further research into the isolation and characterization of specific bioactive compounds, and their potential applications in traditional medicine and modern healthcare.

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Chapter 6

Qualitative phytochemical analysis, TLC and antibacterial activity of leaves of *Oplismenus burmanni* (Retz.) P. Beauv.

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ABSTRACT

Present study highlighted the bioactive compounds, antimicrobial potential, and chromatographic profile of the hydroethanolic leaf extract of *Oplismenus burmanni*. It is a grass species and lot of grasses are unexplored in these aspects. Qualitative screening revealed the presence of tannins, saponins, reducing sugars, and alkaloids. Antimicrobial testing against *Escherichia coli* showed complete inhibition at all tested concentrations. Thin Layer Chromatography (TLC) analysis under different solvent systems exhibited multiple distinct spots with R_f values ranging from 0.114 to 0.957. These findings suggest that *O. burmanni* contains bioactive constituents with promising antibacterial potential and could serve as a basis for further phytochemical and pharmacological investigations.

Keywords: Antibacterial activity, Qualitative screening, Phytochemical.

INTRODUCTION

Creeping grass species that grows abundantly in moist and shaded habitats, often carpeting the forest floor and plays an important role in soil stabilization and ground cover (Halli et al., 2022). Although commonly overlooked as a wild grass, *Oplismenus burmanni* has been traditionally valued in folk medicine for its soothing and healing properties. In several local systems of medicine in Asia and Africa, plants of the genus *Oplismenus* have been used in the treatment of wounds, skin irritations, and minor infections, highlighting their potential as natural remedies (Satpathy et al., 2019). In recent years, attention has shifted towards lesser-known grasses as alternative sources of pharmacologically active compounds and as a food resource within ecosystems, particularly in the context of rising antibiotic resistance and a source of nourishment for various organisms (Woo et al., 2023; Manjula et al., 2023).

Exploring the phytochemical composition and antimicrobial potential of *O. burmanni* can provide new insights into its medicinal relevance. By combining existing traditional knowledge with phytochemical screening, antimicrobial assays, and chromatographic profiling, this study aims to uncover the therapeutic promise of *O. burmanni* and contribute to the growing search for plant-based bioactive agents.

METHODOLOGY

Leaves of *Oplismenus burmanni* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Sanjeet Kumar. Leaves were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Qualitative phytochemical analysis, antibacterial activity against *Escherichia coli* and Chromatographic analysis was carried out using standard methods (Jena et al., 2025; Kumar et al., 2017; Naik et al., 2022; Kumar et al. 2013).



Figure 1: Collected leaves of *Oplismenus burmanni*

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic leaf extract of *Oplismenus burmanni* confirmed the selective presence of some bioactive compounds *i.e.* Tannin, Saponin, Alkaloid and Reducing sugars (Table 1; Figure 2). The hydroethanolic leaf extract of *O. burmanni* exhibited strong antibacterial activity against *E. coli*, as no bacterial growth (NG) was observed in any of the tested concentrations (100, 50, 25, and 12.5 mg/mL). This indicates that the extract was effective in completely inhibiting the growth of *E. coli* even at the lowest concentration, showing the Minimum Inhibitory Concentration (MIC) at 12.5 mg/mL (Table 2; Figure 3). The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability. The TLC analysis of the hydroethanolic leaf extract of *O. burmanni* using different mobile phases

revealed variations in compound separation efficiency (Table 3; Figure 4). The methanol: chloroform (1:1) system showed the most distinct separation, with four visible spots (R_f 0.642 to 0.957). The ethyl acetate: water: acetic acid (8:1:1) phase produced three moderates to high R_f spots (0.670, 0.731, 0.829). In contrast, the ethyl acetate: chloroform (1:9) system produced two lower R_f values except one spot at 0.957.

Table 1: Qualitative phytochemical analysis of leaves of *Oplismenus burmanni* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Present
Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Absent
Reducing sugars	Present
Steroids	Absent
Alkaloids	Present
Carbonyl compounds	Absent

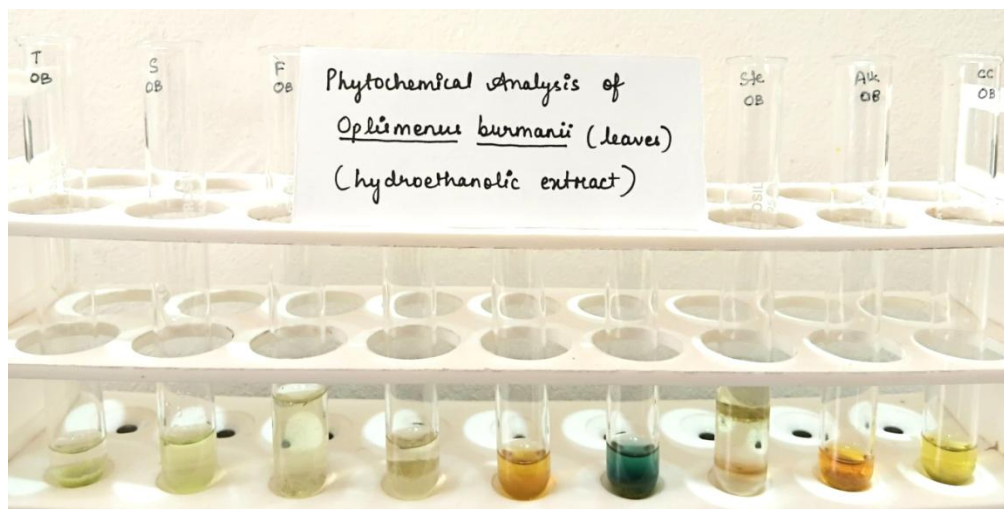


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic leaf extract of *Oplismenus burmanni* against *E.coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Oplismenus burmanni</i>	NG	NG	NG	NG	12.5
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)

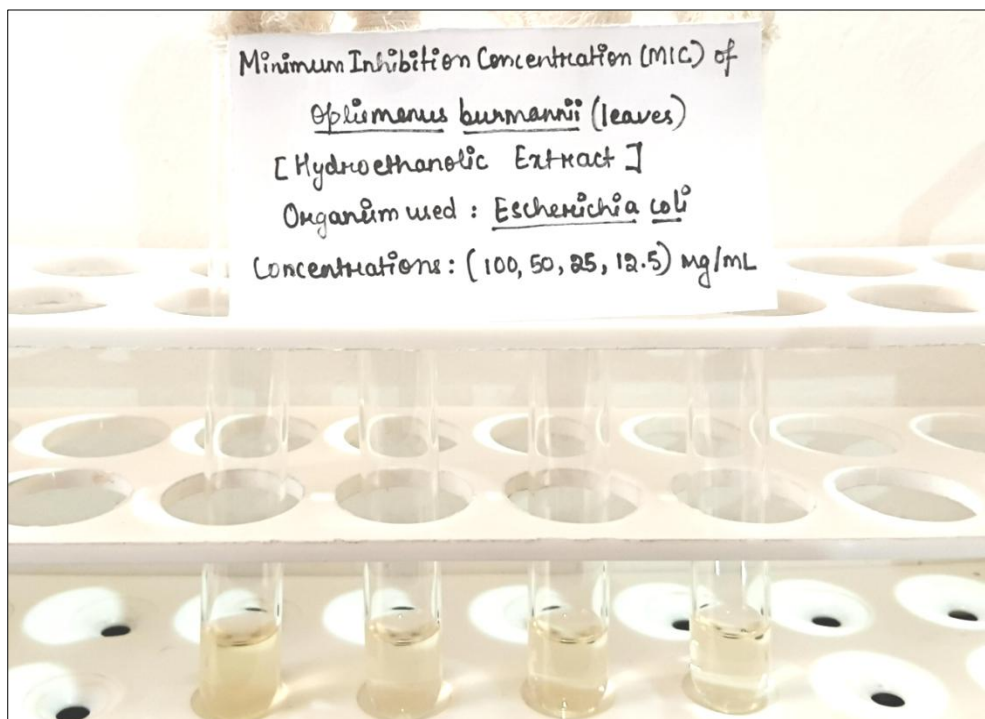


Figure 3: Estimation of Minimum Inhibition Concentration (MIC) against *E. coli*

Table 3: TLC analysis hydroethanolic leaf extract of *Oplismenus burmanni* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	S4
Hydroethanolic	Methanol: Chloroform (1:1)	0.642	0.885	0.9	0.957
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.670	0.731	0.829	-
	Ethyl acetate: Chloroform (1:9)	0.114	0.271	0.957	-

(Rf: Retention factor)

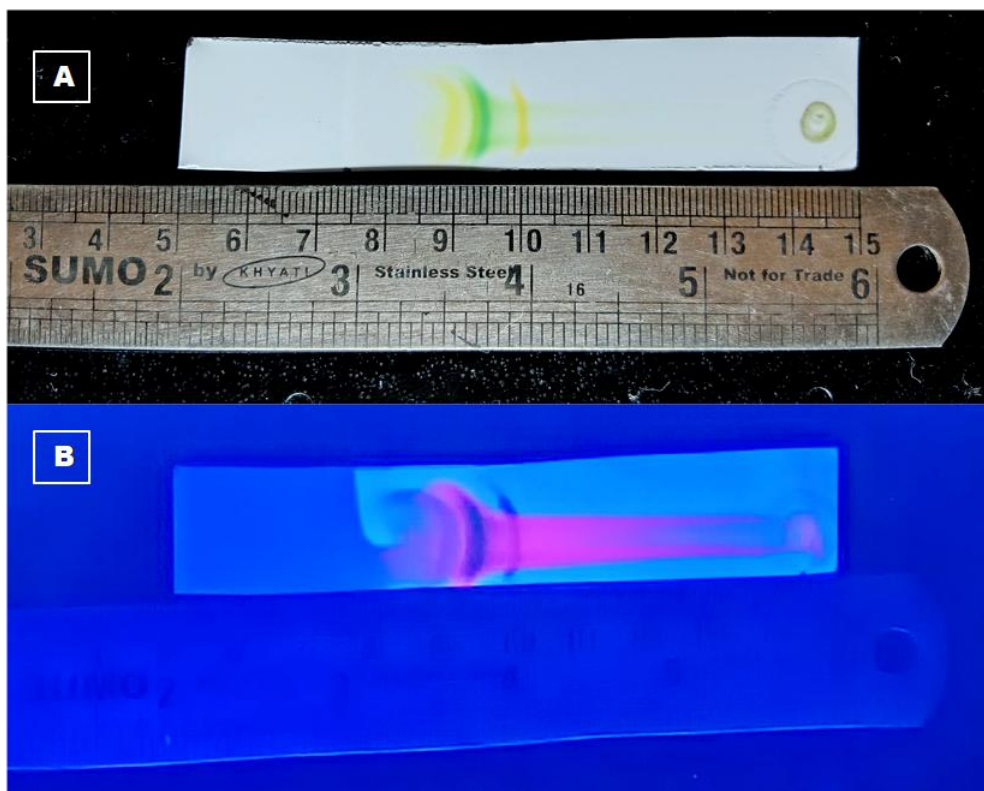


Figure 4: TLC analysis using (Methanol: Chloroform) mobile phase A) Without UV light B) Under UV light

Verma et al. (2015) reported isolation of sterol glycosides and included antibacterial screening of methanol extracts, indicating potential antimicrobial properties of *Oplismenus burmannii*. Again, Verma et al. (2015) isolated key glycolipids from *O. burmannii* and validated a reverse-phase HPLC method, confirming presence of bioactive metabolites. Satpathy et al. (2019) reported that *O. burmannii* is used in the treatment of galactogauge and used during pregnancy. Kumar, Mishra, and Sahu (2024) reported *O. burmannii* as a traditionally used medicinal grass, commonly applied for treating fever, wounds, and skin infections by tribal communities. The plant is reported to contain phenols, tannins, and saponins, suggesting antioxidant and antimicrobial potential.

CONCLUSION

The current study of hydroethanolic leaf extract of *Oplismenus burmannii* was found to contain secondary metabolites including tannins, saponins, reducing sugars, and alkaloids, which are traditionally associated with antimicrobial and therapeutic activities. The extract demonstrated significant antibacterial activity against *E. coli*, with a MIC of 12.5 mg/mL, highlighting its potency compared to other studied species. TLC profiling further confirmed the presence of diverse phytoconstituents, supporting its role as a potential source of natural antibacterial agents. However, the absence of major classes such as flavonoids, terpenoids, and phenolics in the preliminary screening suggests that its activity may rely on a narrower range of compounds. But future studies focusing on bioactive compound extraction, structural characterization, and broader antimicrobial screening are necessary to fully explore its pharmacological relevance.

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Chapter 7

***Portulaca pilosa* L. (Portulacaceae): Bioactive compounds, Thin Layer Chromatography and Antibacterial profiling**

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ABSTRACT

The present study investigated the secondary metabolites, antibacterial activity, and chromatographic profile of the hydroethanolic whole plant extract of *Portulaca pilosa*. Qualitative phytochemical screening revealed the presence of tannins, saponins, reducing sugars, and alkaloids, while flavonoids, terpenoids, phenolic compounds, steroids, and carbonyl compounds were absent. Antimicrobial evaluation against *Escherichia coli* showed a minimum inhibitory concentration (MIC) of 100 mg/mL. Thin Layer Chromatography (TLC) analysis with different mobile phases produced distinct spots with R_f values. Present finding highlights the potential of *P. pilosa* as a source of secondary metabolites with antibacterial significance and provides a basis for further isolation and characterization of its active constituents.

Keywords: Bioactive compounds, Antibacterial activity, TLC

INTRODUCTION

Portulaca pilosa, commonly known as hairy purslane, pink purslane, or 'kiss-me-quick', is a succulent herb that thrives in tropical and subtropical regions,

forming a lush ground cover. Traditionally, this plant has been embraced as both a food and a medicine (Lohale et al., 2024). In Brazil, extracts were used to treat malaria, gastrointestinal problems, as well as serving as diuretics, analgesics, and vermifuges agent. In Cuba, the fresh juice has been applied to heal skin infections and indigestion, while in Peru it lent itself to hair care and general health tonics (Bradley, 2022). Today, *P. pilosa* is stepping into the spotlight of modern medical research. Laboratory studies are essential to validate its traditional claims by uncovering bioactive constituents like alkaloids, saponins, and tannins that may underlie its healing effects (Barros et al., 2017; Devi et al., 2023; Abdallah et al., 2023). Keeping the need of awareness on commonly available plants in wild, an attempt has been made to document the pharmacological importance of *P. pilosa*.



Figure 1: Collected plant parts of *Portulaca pilosa*

METHODOLOGY

Whole plants of *P. pilosa* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Rajkumari Supriya Devi, Ambika Prasad Research Foundation, India. Whole plant was thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Qualitative phytochemical analysis (Jena et al., 2025), antibacterial activity (Kumar et al., 2017) against *Escherichia coli* and Chromatographic analysis (Kumar et al., 2013) was carried out using standard methods (Naik et al., 2022).

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of secondary metabolites in hydroethanolic whole plant extract of *P. pilosa* confirmed the selective presence of four bioactive compounds *i.e.* Tannin, Saponin, Alkaloids and Reducing sugars (Table 1; Figure 2). The hydroethanolic whole plant extract of *P. pilosa* exhibited moderate antibacterial activity against *E. coli*. Among the tested concentrations, only the highest dose (100 mg/mL) was able to inhibit bacterial growth, while growth was observed at lower concentrations (50, 25, and 12.5 mg/mL), showing the Minimum Inhibitory Concentration (MIC) at 100 mg/mL (Table 2; Figure 3).

Table 1: Qualitative phytochemical analysis of whole plant of *Portulaca pilosa* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Present
Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Absent
Reducing sugars	Present
Steroids	Absent
Alkaloids	Present
Carbonyl compounds	Absent

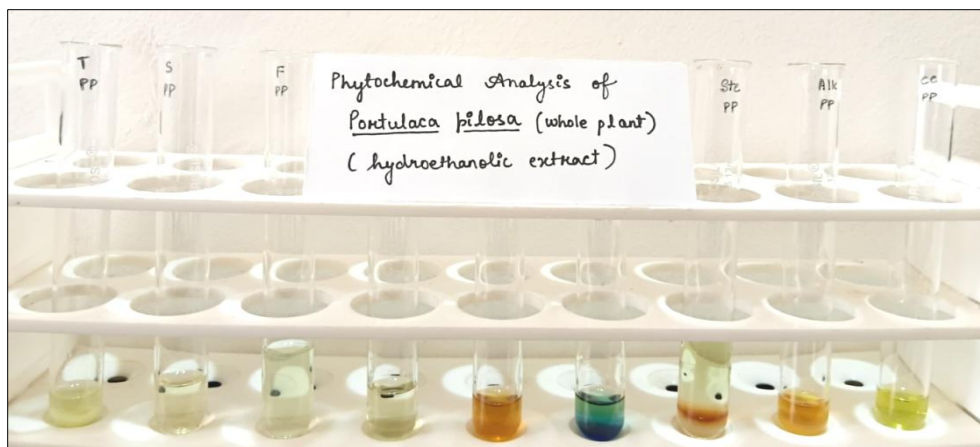


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic whole plant extract of *Portulaca pilosa* against *E.coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Portulaca pilosa</i>	NG	G	G	G	100
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)

The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability. The TLC analysis of the hydroethanolic whole plant extract of *P. pilosa* showed efficient separation of constituents across different solvent systems (Table 3). Methanol: chloroform (1:1) showed two distinct spots at R_f values 0.805 and 0.902. Ethyl acetate: water: acetic acid (8:1:1) showed a single high R_f spot at 0.971. Similarly, ethyl acetate: chloroform (1:9) resulted in two closely present high R_f spots i.e. 0.971 and 0.985.

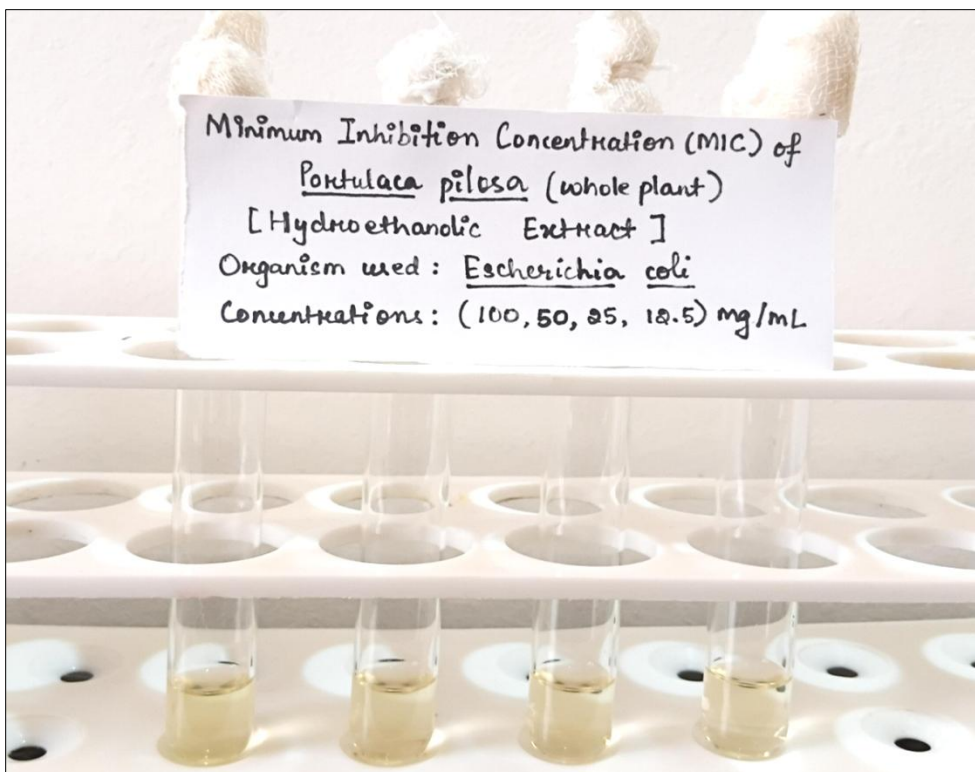


Figure 3: Estimation of Minimum Inhibition Concentration (MIC) against *E. coli*

Table 3: TLC analysis of hydroethanolic whole plant extract of *Portulaca pilosa* using different mobile phases

	Mobile Phases	Rf value of Spots	
		S1	S2
Hydroethanolic	Methanol: Chloroform (1:1)	0.805	0.902
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.971	-
	Ethyl acetate: Chloroform (1:9)	0.971	0.985

(Rf: Retention factor)

Qualitative phytochemical analysis of *P. pilosa* leaf and stem extracts by Gatea et al., (2017), showed the presence of reducing sugars, phenols, tannins, steroids, terpenoids, and cardiac glycosides. Suman et al., (2017) reviewed that the 70% methyl alcohol extract, have been tested against both Gram-positive (*Staphylococcus aureus*, *Bacillus subtilis*, *Streptococcus faecalis*) and Gram-negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Neisseria gonorrhea*) bacteria, as well as fungal strains like *Candida albicans* and the zones of inhibition observed in agar well diffusion assay ranged from 12 mm to 15 mm. Tahir et al., (2020) reported that FTIR analysis and ethnopharmacological studies of *P. pilosa* showed that it contains a diverse range of compounds including alkaloids, flavonoids, terpenoids, tannins, saponins, and fatty acids.

CONCLUSION

The hydroethanolic whole plant extract of *Portulaca pilosa* was found to contain important secondary metabolites such as tannins, saponins, reducing sugars, and alkaloids, which may contribute to its traditional medicinal uses. The extract exhibited antibacterial activity against *E. coli* with a minimum inhibitory concentration of 100 mg/mL, indicating moderate efficacy. TLC profiling further confirmed the presence of distinct phytoconstituents with different R_f values, supporting its potential as a source of bioactive compounds. Overall, this study validates the ethnomedicinal relevance of *P. pilosa* and suggests that further phytochemical isolation and pharmacological evaluation could uncover new leads for natural drug development.

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Chapter 8

Pharmacological evaluation of *Ipomoea carnea* Jacq.

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ABSTRACT

Present study investigated the hydroethanolic flower extract of *I. carnea* for its phytochemical profile, antibacterial efficacy, and chromatographic characters. The analysis confirmed the presence of tannins, saponins, phenolic compounds, reducing sugars, and alkaloids. Antibacterial analysis against *Escherichia coli* revealed a good activity with moderate minimum inhibitory concentration. Complementary TLC (Thin Layer Chromatography) analysis produced several distinct bands with R_f values, reflecting diversity of secondary metabolites within the extract. Taken together, these findings indicated that the flowers of *I. carnea* harbor bioactive constituents that could be explored further for potential therapeutic applications, despite the plant's reputation as a toxic and invasive species.

Keywords: Phytochemical profile, Invasive species, Antibacterial analysis

INTRODUCTION

Several invasive flowering plants, while ecologically disruptive, have been shown to possess rich phytochemical profiles (Božac et al., 2025). Their aggressive growth and adaptability may be linked to the production of bioactive compounds that deter competitors and herbivores, a trait that also makes them useful in pharmacological research (Akbar et al., 2024). *Ipomoea carnea* is a perennial shrub belonging to the Convolvulaceae family. It grows abundantly in tropical and subtropical regions, often colonizing roadsides, wetlands, and disturbed habitats (Bachheti, 2013). Its rapid growth and hardy nature have led to its recognition as an invasive species in many parts of the world. Despite this reputation, the plant holds deep roots in traditional medicine, where different parts—particularly the leaves and flowers—have been used for treating ailments such as skin diseases, inflammation, and microbial infections (Akshaya et al., 2023). Ethnobotanical records suggest that *I. carnea* has long been valued in folk healing systems, even while it is known to contain toxic alkaloids that can be harmful to grazing livestock (Diaz, 2015). The paradox of its toxicity and medicinal usefulness has made it a plant of particular scientific interest. In recent years, rising concerns over antibiotic resistance and the search for plant-based bioactive compounds have brought neglected species like *I. carnea* into the spotlight (Angelini, 2024). By exploring its phytochemical composition, antimicrobial potential, and chemical diversity through techniques such as Thin Layer Chromatography (TLC), researchers can uncover its true potential beyond its invasive image. Thus, *I. carnea* represents a fascinating example of how plants considered ecologically problematic may also serve as valuable reservoirs for modern drug discovery.

METHODOLOGY

Flowers of *Ipomoea carnea* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Rajkumari Supriya Devi, Ambika Prasad Research Foundation, India. Flowers were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Qualitative phytochemical analysis, antibacterial

activity against *Escherichia coli* and Chromatographic analysis was carried out using standard methods (Kumar et al. 2013; Kumar et al., 2017; Naik et al., 2022; Jena et al., 2025).



Figure 1: Collected flowers of *Ipomoea carnea*

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic flower extract of *Ipomoea carnea* confirmed the selective presence of five bioactive compounds *i.e.* tannin, saponin, phenol, alkaloid and reducing sugars (Table 1; Figure 2). The MIC results show that the hydroethanolic extract of flower of *I. carnea* exhibited strong antibacterial activity against *E. coli*, as no bacterial growth (NG) was observed in any of the tested concentrations (100, 50, 25, and 12.5 mg/mL). This indicates that the extract was effective in completely inhibiting the

growth of *E. coli* even at the lowest concentration, showing the Minimum Inhibitory Concentration (MIC) at 12.5 mg/mL (Table 2; Figure 3). The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability.

Table 1: Qualitative phytochemical analysis of flowers of *Ipomoea carnea* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Present
Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Present
Reducing sugars	Present
Steroids	Absent
Alkaloids	Present
Carbonyl compounds	Absent

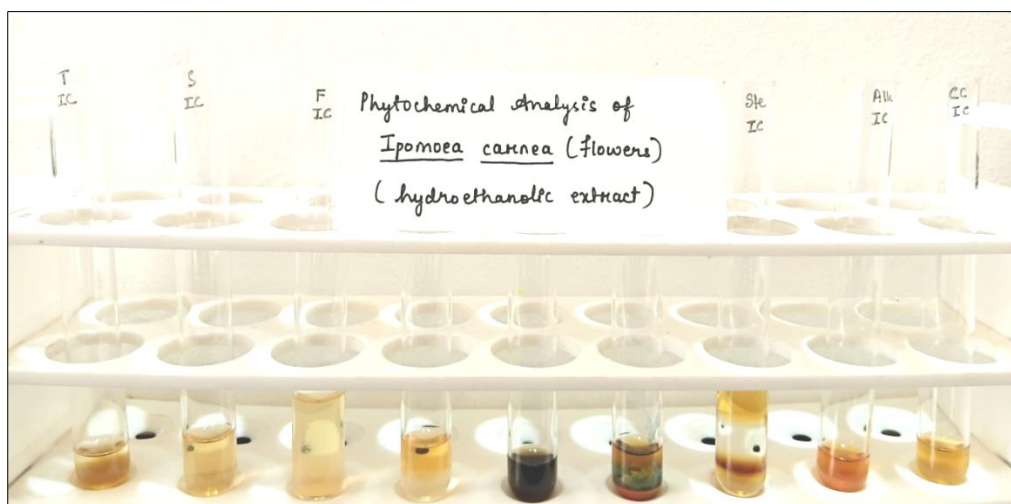


Figure 1: Detection of secondary metabolites

The TLC analysis of the hydroethanolic extract of flower of *I. carnea* using different mobile phases showed no spots with the methanol: chloroform (1:1)

mobile phase. However, the ethyl acetate: water: acetic acid (8:1:1) combination showed two prominent spots with Rf values of 0.614 and 0.814 while, ethyl acetate: chloroform (1:9) system provided better resolution, producing four spots (Table 3; Rf = 0.642, 0.8, 0.885, and 0.914).

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic flower extract of *Ipomoea carnea* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	
<i>Ipomoea carnea</i>	NG	NG	NG	NG	25
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No growth)



Figure 2: Estimation of Minimum Inhibition Concentration (MIC) against *E. coli*

Table 3: TLC analysis of hydroethanolic flower extract of *Ipomoea carnea* using different mobile phases

	Mobile Phases	Rf value of Spots			
		S1	S2	S3	S4
Hydroethanolic	Methanol: Chloroform (1:1)	-	-	-	-
	Ethyl acetate: Water: Acetic acid (8:1:1)	0.614	0.814	-	-
	Ethyl acetate: Chloroform (1:9)	0.642	0.8	0.885	0.914

(Rf: Retention factor)

Tomar et al., (2012) documented that the milky sap extracted from the bark of *I. carnea* is used in treating Leucoderma and other associated skin conditions. Fatima et al., (2014) reviewed hot water leaf extract of *I. carnea* to possess antirheumatic qualities. Zafar et al., (2018) conducted a HPLC–DAD-based profiling of *I. carnea* flower extracts, quantifying six distinct polyphenolic compounds (ranging from ~0.08 to ~38 µg/mg extract). They also recorded antioxidant and antiproliferative activities related to these phenolic compounds. A review by Ambika and Nair, (2019) have documented different secondary metabolites in *I. carnea* aerial parts, including glycosidic saponins, alkaloids, phytosterols, proteins, and polysaccharides such as ipomose, alongside high levels of phenols, flavonoids, and tannins. The essential oil (EO) of *Ipomoea carnea* showed antibacterial activity against eight bacterial strains as reported by Ahmed et al., (2022). Among the Gram-negative bacteria, *Klebsiella pneumoniae* showed the highest sensitivity (MIC: 84 mg/mL), followed by *E. coli*, *P. aeruginosa*, and *S. typhimurium*. For Gram-positive strains, *Staphylococcus xylosus* and *S. haemolyticus* were most susceptible (MIC: 82 mg/mL). The latex of *I. carnea* is used as an antiseptic in wound healing and leaves of the plant is used for treating rheumatic pain and piles as reviewed by Nazim et al., (2024). Preliminary phytochemical screening reported in Sahayaraj and Ravi, (2024) identified phenols, saponins, tannins, flavonoids, xanthoproteins, and triterpenoids in the leaves of *I. carnea*.

CONCLUSION

The hydroethanolic flower extract of *Ipomoea carnea* was found to contain key secondary metabolites, particularly tannins, saponins, phenolic compounds, and alkaloids, which may contribute to its antimicrobial activity. The extract exhibited antibacterial activity against *E. coli* with an MIC of 25 mg/mL, indicating moderate efficacy compared to other studied plant species. TLC profiling showcased the presence of diverse phytoconstituents, supporting the traditional medicinal relevance of *I. carnea*. However, the absence of flavonoids and terpenoids suggests limited phytochemical diversity in certain classes. To better establish its pharmacological significance, further fractionation and characterization of active compounds, as well as testing against a broader spectrum of pathogens, are recommended, even though the plant is notorious as an invasive species.

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Chapter 9

Pharmacological values of flowers of *Martynia annua* L. (Martyniaceae)

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ABSTRACT

Unlocking the secrets of nature's pharmacy, present study sheds light on the phytochemical profile and antimicrobial properties of *Martynia annua* flowers. The present analysis revealed a rich presence of bioactive compounds, including tannins, saponins, and phenolic compounds, which may hold the key to novel therapeutic applications. The hydroethanolic extract exhibited antibacterial activity against *Escherichia coli* and the identification of specific compounds through TLC (Thin Layer Chromatography) analysis suggests potential medicinal properties. Present study paves the way for further exploration of *M. annua* flowers as a valuable resource for traditional medicine and modern drug discovery.

Keywords: Antibacterial activity, bioactive compounds, traditional medicine

INTRODUCTION

Though native to tropical America, *Martynia annua* popularly known as Tiger's claw or Devil's claw has been widely naturalized in India for centuries and gradually became a part of local traditions and folk practices

(Gupta and Deogade, 2020). In many rural areas, where access to formal healthcare was once limited, the plants served as household remedies. *M. annua* flowers were boiled into soothing decoctions for coughs, throat infections, and respiratory troubles, while pastes from the leaves were applied to wounds, skin eruptions, and painful swellings (Gupta and Deogade, 2018). Fruits and seeds, though bitter, were used for easing inflammation and joint pain (Kaushik et al., 2021). These practices reveal how generations relied on *M. annua* as a simple but trusted aid in daily life. Plants also contribute indirectly to human well-being through their ecological interactions. The nectar-rich flowers attract bees, butterflies, and other pollinators, helping sustain insect populations that are vital for agriculture and food production (Nepi et al., 2018). Secondary metabolites play a vital role in traditional medicine, as they are responsible for the therapeutic properties of many plants (Hossain et al., 2025). In the context of modern drug discovery due to increasing global demand for plant-based medicines and the rise of antibiotic resistance, natural products are being reconsidered as important candidates for pharmaceutical development (Nasim et al., 2022). The study of *M. annua* flowers, therefore, not only validates the ethno-medicinal claims associated with the plant but also opens avenues for isolating new phytoconstituents that may play a role in designing drugs against microbial infections, inflammation, and other chronic diseases (Anand et al., 2019). Thus, the plant stands at the intersection of traditional wisdom and modern biomedical research.

METHODOLOGY

Flowers of *Martynia annua* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India (Figure 1). The plant species was identified by Dr. Sanjeet Kumar, Ambika Prasad Research Foundation, India. Flowers were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using hydroethanolic solvent to obtain extract for further experimental analysis. Phytochemical screening was carried out using standard method. Antibacterial activity was done against *Escherichia coli* (MTCC 45) using standard method. Chromatographic analysis was carried out using standard methods to evaluate the secondary metabolites (Kumar and Jena, 2014; Marndi et al., 2024; Chandrashekar et al., 2025).



Figure 1: Collected inflorescence of *Martynia annua*

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in hydroethanolic flower extract of *M. annua* confirmed the selective presence of some bioactive compounds i.e. Tannin, Saponin, Phenol and Reducing sugars (Table 1; Figure 2). The hydroethanolic flower extract of *M. annua* exhibited strong antibacterial activity against *E. coli*, as no bacterial growth (NG) was observed in any of the tested concentrations (100, 50, 25, and 12.5 mg/mL). This indicates that the extract was effective in completely inhibiting the growth of *E. coli* even at the lowest concentration, showing the Minimum Inhibitory Concentration (MIC) at 12.5 mg/mL. The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability (Table 2, Figure 3). The TLC analysis of the

hydroethanolic extract of *M. annua* flowers using different mobile phases revealed variations in compound separation efficiency. No spot was observed with the methanol: chloroform (1:1) system. In contrast, both ethyl acetate: water: acetic acid (8:1:1) and ethyl acetate: chloroform (1:9) systems produced a prominent spot with an R_f value of 0.985 (Table 3).

Table 1: Qualitative phytochemical analysis of flowers of *Martynia annua* using hydroethanolic extract

Bioactive compounds	Hydroethanolic extract
Tannin	Present
Saponin	Present
Flavonoids	Absent
Terpenoids	Absent
Phenolic compounds	Present
Reducing sugars	Present
Steroids	Absent
Alkaloids	Absent
Carbonyl compounds	Absent

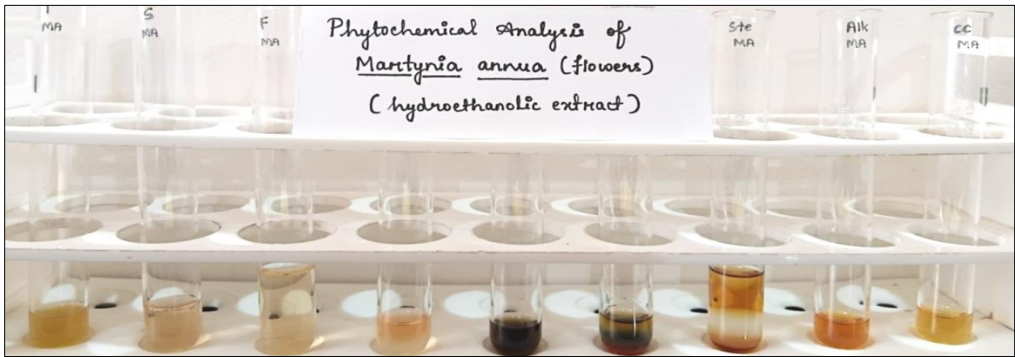


Figure 2: Detection of secondary metabolites

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic flower extract of *Martynia annua* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	

<i>Martynia annua</i>	NG	NG	NG	NG	12.5
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No Growth)

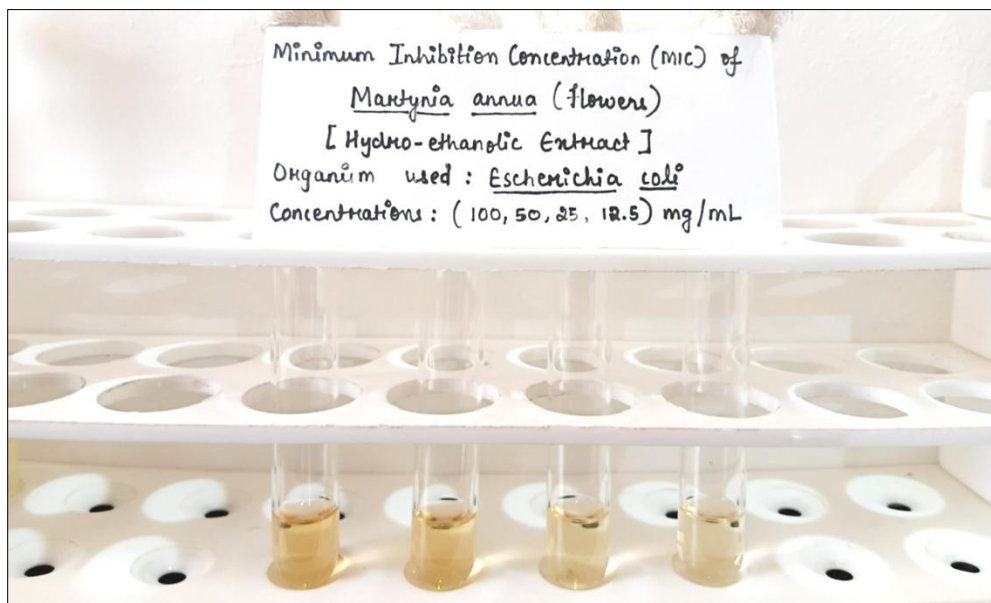


Figure 3: Estimation of Minimum Inhibition Concentration against *E.coli* bacteria

Table 3: TLC analysis of hydroethanolic flower extract of *Martynia annua* using different mobile phases

	Mobile Phases	Rf value of Spots
		S1
	Methanol: Chloroform (1:1)	Nil
Hydroethanolic	Ethyl acetate: Water: Acetic acid (8:1:1)	0.985

	Ethyl acetate: Chloroform (1:9)	0.985
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(Rf: Retention Factor)

Acetone leaf extracts of *M. annua* has been reported by Sermakkani and Thangapandian, (2010) to show active antimicrobial action against *Klebsiella pneumoniae*, *Proteus mirabilis*, and *Proteus vulgaris*. Kenwat et al., (2013) documented *M. annua* to be used in Indian traditional medicine in treatment of diseases like epilepsy, inflammation, tuberculosis, sore throat, and in wound healing. Also, acetone extracts of *M. annua* leaves has been reported to show the presence of alkaloids, tannins, saponin, glycosides, flavonoids, anthocyanin, amino acid, steroids, and phenols. While, the ethanolic extract of *M. annua* contain flavonoids (Lodhi et al., 2016). Phytochemical screening executed by Kalaichelvi and Dhivya, (2016) of acetone, petroleum ether, ethanolic and aqueous extract of *M. annua* leaves indicated the presence Alkaloids, Saponinis, Tannins, Amino acids, Flavanoids and Terpenoids. Agar well diffusion of Ethanolic extract showed maximum zone of inhibition i.e. 30mm at 100 µg/mL against *Staphylococcus aureus* followed by *Klebsiella pneumonia* (29 mm), *Bacillus subtilis* and *Proteus mirabilis* (28 mm). The fruit of *M. annua* has been documented by Gupta and Deogade, (2018) to be used as local sedative and antidote for scorpion stings, venomous bites, and stings. Seed powder is also administered for treating Asthma and Itching in folk medicine. Kaushik et al., (2021) reported the presence of flavonoids, terpenoids, saponins, tannins, steroids, glycosides, proteins, carbohydrates, amino acids and polysaccharides in ethanolic fruit extract of *M. annua*. Verma et al., (2021) investigated the ethyl acetate extract of *M. annua* fruits and its phytochemical analysis confirmed the presence of alkaloids, steroids, carbohydrates, fat, volatile oil, tannin, flavonoid and phenolic compound. The TLC results showcased the Rf value of Alkaloids, steroid, carbohydrates, tannin and Phenol to be 0.97, 0.41, 0.30, 0.82 and 0.84, respectively. The whole plant of *M. annua* has been reviewed to be used by Santal tribe in treatment of fever, scabies, sores, hair loss, and carbuncles on the back by Sharma et al., (2024). The above documentation highlights the pharmacological values of this plant.

CONCLUSION

Present study provided valuable insights into the secondary metabolites of *Martynia annua* flowers. The hydroethanolic extract exhibited antimicrobial activity against *Escherichia coli* and the identification of specific bioactive compounds through TLC analysis suggests potential medicinal properties. These findings suggest that *M. annua* flowers may possess medicinal properties worthy of further exploration, and additional researches are needed to fully elucidate their therapeutic potential and applications in traditional medicine and beyond.

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Chapter 10

Qualitative phytochemical analysis, antibacterial activity and antioxidant potential of *Eriochloa procera* (Retz.) C. E. Hubb.

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ABSTRACT

Present study investigated the phytochemical profile, antibacterial efficacy, and antioxidant potential of *Eriochloa procera* whole plant extracts. Qualitative phytochemical screening revealed the presence of tannins, saponins, and reducing sugars across all extracts, while phenolics, flavonoids, and alkaloids were solvent-specific. The hydroethanolic extract exhibited significant antibacterial activity against *Escherichia coli*, with a Minimum Inhibitory Concentration (MIC) of 12.5 mg/mL. Thin Layer Chromatography (TLC)-based antioxidant analysis revealed a prominent antioxidant-active spot ($R_f = 0.927$). These findings suggest that *E. procera*, although often overlooked as a wild grass species, harbors bioactive compounds with potential therapeutic applications, particularly as antibacterial and antioxidant agents.

Keywords: Phytochemical profile, Antioxidant analysis, Antibacterial agent

INTRODUCTION

Members of family *Poaceae* infamous as ‘grasses’ are common occurrence in moist areas and disturbed landscapes. They play a vital ecological role in soil stabilization and erosion prevention (Damor et al., 2021). While often overlooked, grass species serves as supplemental forage for livestock and wild herbivores, demonstrating their importance in both natural and agricultural ecosystems (Boval and Dixon, 2012). Grasses from the *Poaceae* family are known to harbor bioactive substances including tannins, saponins, and phenolic compounds with antimicrobial and anti-inflammatory properties (Fatima et al., 2018). This suggests that *Eriochloa procera* (Figure 1) may share similar therapeutic potential. Traditionally, certain grasses have also been employed in ethnomedicine, either as decoctions, poultices, or crude extracts to address ailments such as fevers, skin irritations, and digestive disorders (Anand et al., 2022). These practices point toward an underexplored reservoir of pharmacologically active compounds that are often disregarded due to the humble status of grasses as mere fodder or ground cover (Raza et al., 2024). In this context, *E. procera*, though poorly studied, stands out as a candidate worth scientific attention. In recent years, advancements in phytochemical analysis and bioassay-guided screening have allowed researchers to systematically evaluate wild grasses for secondary metabolites with therapeutic relevance (Sapunyo et al., 2023). Investigating the phytochemical diversity and antimicrobial capacity of *E. procera* not only contributes to ethnopharmacological knowledge but also broadens the scope for discovering affordable, plant-based alternatives in combating microbial resistance. Such research highlights how neglected species may hold the key to addressing modern biomedical challenges.

METHODOLOGY

Whole plants of *Eriochloa procera* were collected from nearby Mahanadi areas of Cuttack district, Odisha, India. The plant species was identified by Dr. Sanjeet Kumar, Ambika Prasad Research Foundation, India. Plants were thoroughly washed under running tap water to remove dust. Further, they were cut into small pieces and macerated with the help of mortar and pestle by using different solvents (n-Hexane, Ethanol and Aqueous) to obtain extract for further experimental analysis (Jena et al., 2025).



Figure 1: Collected sample of *Eriochloa procera*

Qualitative phytochemical analysis, antibacterial activity against *Escherichia coli* and antioxidant analysis was carried out using standard methods (Kumar and Jena, 2014; Pattnaik and Bhatnagar, 2024), with slight modifications to suit the present experimental conditions.

RESULTS AND DISCUSSION

The qualitative phytochemical screening for the detection of nine secondary metabolites in whole plant extract of *Eriochloa procera* using different solvents confirmed the selective presence of various bioactive compounds (Table 1; Figure 2-4). Tannins, saponins, and reducing sugars were detected across all solvent extracts (n-Hexane, Ethanol, and Aqueous). Phenolic compounds were detected only in the ethanol and aqueous extracts, whereas flavonoids and alkaloids were exclusively observed in the aqueous and ethanol extract respectively. Steroids, terpenoids, and carbonyl compounds were absent in all extracts showcasing broader phytochemical diversity of aqueous and ethanol extracts when compared to n-Hexane. The MIC (Minimum Inhibitory Concentration) results showed that the hydroethanolic extract of whole plant of *E. procera* exhibited strong antibacterial activity against *E. coli*, as no bacterial growth (NG) was observed in any of the tested concentrations (100, 50, 25, and 12.5 mg/mL). This indicates that the extract was effective in completely inhibiting the growth of *E. coli* even at the lowest concentration, showing the Minimum Inhibitory Concentration (MIC) at 12.5 mg/mL (Table 2; Figure 5). The negative control (nutrient broth) showed no growth, confirming sterility, while the positive control (microbial broth without extract) showed growth, confirming bacterial viability. The TLC (Thin Layer Chromatography) assay of the hydroethanolic extract of whole plant of *E. procera* demonstrated antioxidant activity in only one solvent system. A prominent spot with an R_f value of 0.927 was observed in Ethyl acetate: Methanol: Water (40:5.4:1), indicating the presence of antioxidant-related phytochemicals. In contrast, no detectable spots were obtained in when Chloroform: Ethyl acetate: Formic acid (5:4:1) and n-Hexane: Petroleum ether: Ethanol (90:10:1) were used as mobile phases. These results suggest that polar solvent systems are more effective in resolving antioxidant compounds in *E. procera*.

Table 1: Qualitative phytochemical analysis of *Eriochloa procera* (whole plant) using different extracts

Bioactive compounds	n-hexane	Ethanol	Aqueous
Tannin	Present	Present	Present
Saponin	Present	Present	Present
Flavonoids	Absent	Absent	Present
Terpenoids	Absent	Absent	Absent
Phenolic compounds	Absent	Present	Present
Reducing sugars	Present	Present	Present
Steroids	Absent	Absent	Absent
Alkaloids	Absent	Present	Absent
Carbonyl compounds	Absent	Absent	Absent

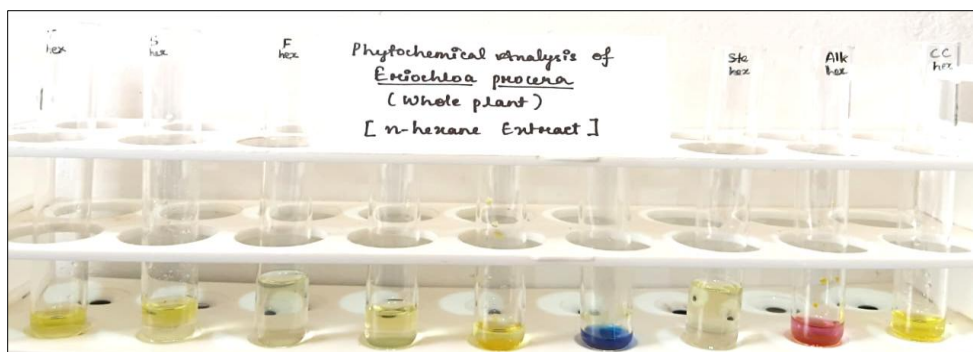


Figure 2: Phytochemical analysis using n-Hexane extract

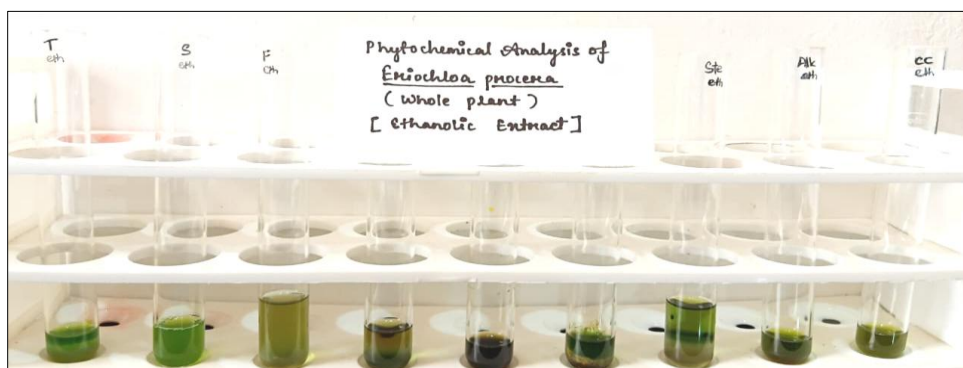


Figure 3: Phytochemical analysis using Ethanolic extract



Figure 4: Phytochemical analysis of *Eriochloa procera* (whole plant) using Aqueous extract

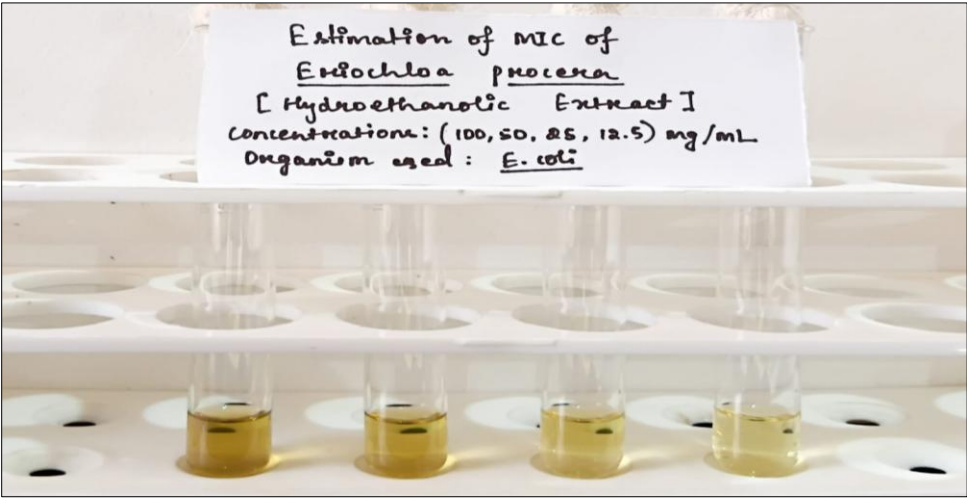


Figure 5: Estimation of Minimum Inhibition Concentration (MIC) against *E. coli*

Table 2: Estimation of Minimum Inhibition Concentration (MIC) of hydroethanolic extract of whole plant of *Eriochloa procera* against *E. coli*

Extract	Concentration (mg/mL)				MIC (mg/mL)
	100	50	25	12.5	

<i>Eriochloa procera</i>	NG	NG	NG	NG	12.5
Nutrient broth	NG	NG	NG	NG	-
Microbial broth	G	G	G	G	-

(G: Growth of bacteria; NG: No Growth)

Table 3: TLC-based Antioxidant analysis of hydroethanolic flower extract of *Eriochloa procera* using different mobile phases

	Mobile Phases	Rf value of Spots
		S1
Hydroethanolic	Ethyl acetate: Methanol: Water (40: 5.4: 1)	0.927
	Chloroform: Ethyl acetate: Formic acid (5:4: 1)	-
	n-Hexane: Petroleum ether: Ethanol (90:10:1)	-

(Rf: Retention factor)

E. procera is recognized as a wild grass with potential use as fodder, yet it has received little scientific attention compared to other forage species. Research on its nutritional value and bioactive potential remains scarce, making the present findings a first step toward understanding its broader significance.

CONCLUSION

Present study highlights *Eriochloa procera* as a promising source of natural bioactive metabolites. The consistent presence of tannins, saponins, and reducing sugars, along with solvent-dependent detection of phenolics, flavonoids, and alkaloids, underscores the plant's phytochemical diversity. Its hydroethanolic extract demonstrated notable antibacterial efficacy against *E. coli* and exhibited antioxidant activity in TLC assays, suggesting its potential role in natural medicine and drug discovery. Further fractionation

and characterization of active compounds, alongside broader pharmacological screening, are recommended to establish its medicinal significance and practical applications.

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Editors' Profile



Dr. J. Jeline Rani

She is an accomplished academic and researcher in the field of Botany. She currently serves as an Assistant Professor of Botany, bringing a wealth of knowledge and expertise to her students and peers. Dr. Jeline Rani's educational journey is marked by dedication and excellence. She earned her Bachelor of Science in Botany from Lady Doak College, Madurai, in 2000, and further pursued her Master of Science in Botany with gold medal proficiency at The American College, Madurai, and graduated in 2002. Her quest for knowledge did not stop there; she completed her M.Phil. in Botany from Thiagarajar College, Madurai, in 2004 as an academic topper. She earned her Ph.D in Phytochemistry, Histochemistry, Pharmacological and Molecular Studies in *Vanda spathulata* at National College, Trichy, in 2025. She has specialized in Phytochemistry and Molecular Biology, areas in which she has made significant contributions through her research and publications. Her prolific academic career includes the publication of 18 book chapters, 11 research articles, and contributions to 5 conference proceedings. She has presented five papers at international conferences and received Best Presentation awards, showcasing her research to a broader audience. Her career as an educator began at Auxilium College of Education, where she served as an Assistant Professor starting in 2006. Since June 2013, she has been an integral part of Bishop Heber College as an Assistant Professor of Botany. Dr. Jeline Rani is a lifelong learner and an active participant in professional development. She has attended 14 national and international workshops, continually updating her knowledge and skills. Her research endeavors include a minor research project titled "*In vitro* Scratch Assay and Antidiabetic Potential of *Aristolochia indica* L., a traditional medicinal plant of southern India," funded by Bishop

Heber College for the period 2023-2024. Guiding the next generation of scientists, she has supervised 14 M.Sc. dissertations, fostering a spirit of inquiry and research among her students. She is also actively involved in several professional bodies, serving as a member of both the Global Forum for Sustainable Rural Development (GFSRD) and the Society for Environment and Sustainable Development (SESD). Dr. Jeline Rani's dedication to her field, her students, and the community stands as a testament to her passion for botany and her commitment to making a positive impact through education and research.



Smt. Saraswati Majhi

She serves as an Assistant Professor in the Postgraduate Department of Botany at S.B. Women's Autonomous College in Cuttack, bringing over seventeen years of teaching and academic experience to her position. She is a Life Member of both the Odisha Botanical Society and the Ambika Prasad Research Foundation.

Currently, she is pursuing her Ph.D. in Life Sciences at Rama Devi Women's University in Bhubaneswar. In addition to her teaching responsibilities, Smt. Majhi actively participates in national and international conferences, seminars, and workshops, contributing to her ongoing academic development and professional growth. She has authored numerous research articles and book chapters published in esteemed journals and edited volumes. She earned her Master of Science (M.Sc.) degree in Botany from Utkal University, Bhubaneswar, and remains deeply engaged in research and academic pursuits within the field of plant sciences. Her research interests encompass Ethnobotany, Biochemistry, and Plant Physiology, where she investigates the intricate relationships between plants and their ecosystems. She is passionate about inspiring young minds, frequently mentoring students and encouraging their involvement in research and innovation in botany. Through her work, she aims to make a meaningful impact on the scientific community and society at large, fostering a deeper understanding and appreciation of the natural world.



Dr. Sangeeta Bhogal

She is an Assistant Professor of Chemistry at ICFAI University, Himachal Pradesh, where she combines her passion for teaching with active research engagement. She earned both her Doctor of Philosophy (Ph.D.) and Master of Philosophy (M.Phil.) in Chemistry from Shoolini University, Himachal Pradesh, a globally recognized institution for higher education and research. Her research expertise lies primarily in coordination chemistry, spectroscopy, analytical techniques, material sciences, cytotoxicity, and environmental chemistry, and she has published over twenty research and review papers in reputed national and international journals. Her academic contributions reflect a commitment to advancing chemical sciences and promoting interdisciplinary learning. Beyond classroom teaching, Dr. Bhogal actively guides postgraduate research, mentors young scholars, and fosters innovation in laboratory practices. She is a regular participant in national and international conferences, symposia, and workshops, where she presents her research findings and engages in scholarly dialogue with peers across disciplines. She is also dedicated to academic collaboration and curriculum development, ensuring that students are exposed to both fundamental and emerging areas of chemistry. With a vision to integrate research with real-world applications, she encourages her students to think critically and pursue solutions to contemporary scientific and environmental challenges. Through her academic journey, Dr. Bhogal strives not only to contribute to the growth of scientific knowledge but also to inspire the next generation of scientists. Her teaching philosophy emphasizes curiosity, creativity, and research-oriented learning, aiming to cultivate a deeper appreciation for chemistry in both academic and societal contexts.

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'Plants & Secondary Metabolites, Volume 10' offers a comprehensive exploration of ten lesser-known plants, unveiling their botany, phytochemistry, traditional medicinal uses, and potential pharmacological applications, making it an invaluable resource for researchers and botanists.



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