

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

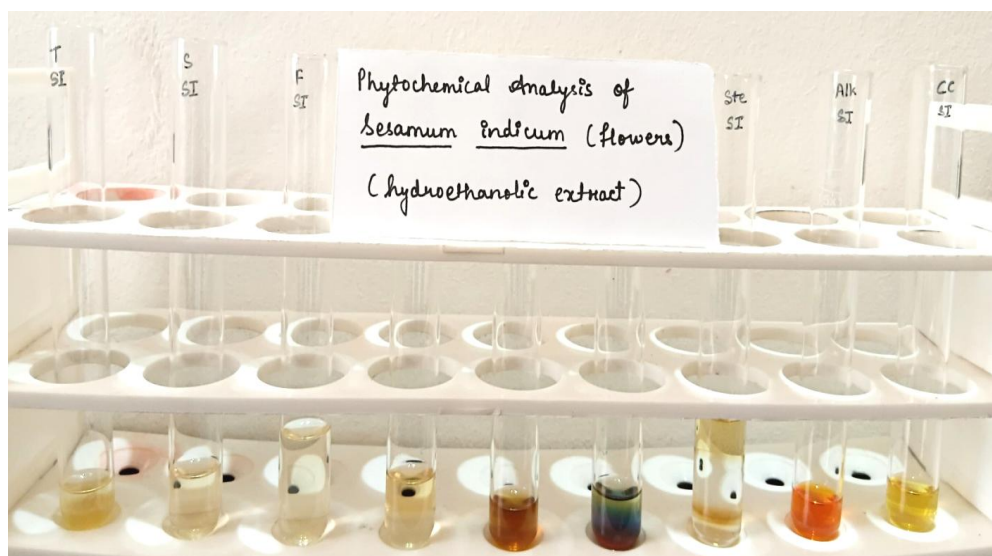


Figure 2: Detection of secondary metabolites

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)

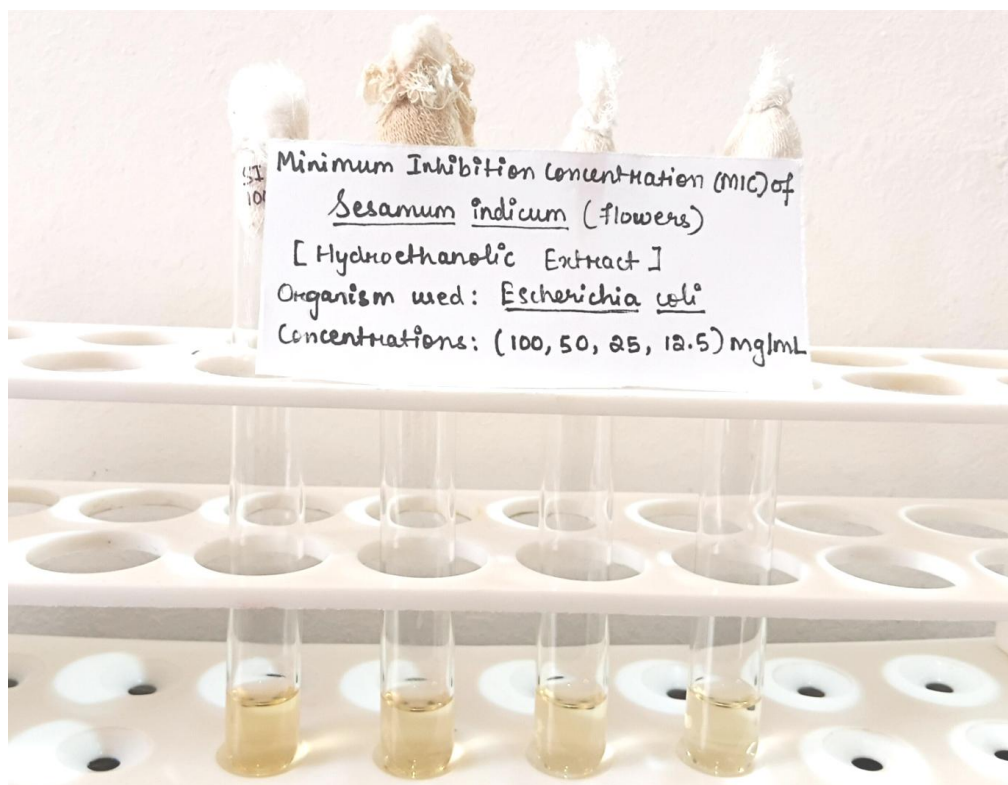


Figure 3: Estimation of Minimum Inhibition Concentration against *E. coli* bacteria

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

	Mobile Phases	Rf value of Spots	
		S1	S2
Hydroethanolic	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. Ant`ibacterial 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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