RESEARCH PAPER

COMPARATIVE PHYTOCHEMICAL SCREENING AND ANTIMICROBIAL POTENTIAL OF DIFFERENT EXTRACTS OF *PLUCHEA LANCEOLATA* WITH HPTLC-BASED QUERCETIN ESTIMATION

Ajay Pratap Singh*, Naveen Gupta, Ganesh Prasad Patel, Pinky Singh
Department of Pharmaceutical Science, Faculty of Pharmacy, Madhyanchal Professional University, Bhopal (M.P.)
Corresponding author mail id: Kaurav12091998@gmail.com

Abstract
The present study aimed to conduct comparative phytochemical screening and evaluate the antimicrobial potential of different extracts of *Pluchea lanceolata*, along with HPTLC-based estimation of quercetin. Phytochemical screening revealed the presence of various phytoconstituents, including flavonoids, diterpenes, phenolic compounds, and saponins. Among the extracts, the aqueous extract showed the highest extraction yield of 14.4%, whereas the methanolic extract exhibited the highest total phenolic content (1.59 mg/100 mg) and total flavonoid content (2.17 mg/100 mg). The methanolic extract demonstrated concentration-dependent antimicrobial activity against *Staphylococcus aureus, Pseudomonas aeruginosa*, and *Escherichia coli*. Furthermore, HPTLC analysis indicated the possible presence of quercetin, with a reported average content of 0.262%. The findings suggest that *P. lanceolata* is a potential source of bioactive phytoconstituents with antimicrobial properties. Further studies are required to isolate and characterize its active compounds and establish their biological efficacy.

Keywords: *Pluchea lanceolata*, phytochemical screening, antimicrobial activity, HPTLC, Quercetin, total phenolic content, total flavonoid content, plant extracts.

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Introduction

Medicinal plants have been an important source of therapeutic agents for the prevention and management of various diseases since ancient times (Aye *et al.,* 2019). Plant-derived secondary metabolites, including flavonoids, phenolic compounds, alkaloids, terpenoids, tannins, and saponins, exhibit a wide range of biological activities and have attracted considerable attention in pharmaceutical research (Thakur and Sharma, 2018). The identification and characterization of these phytoconstituents are essential for understanding the therapeutic potential of medicinal plants and supporting their scientific validation. In recent years, increasing interest in natural products has encouraged researchers to investigate plant extracts for their phytochemical composition, antimicrobial properties, and potential applications in drug discovery.

Pluchea lanceolata is a medicinal plant belonging to the family Asteraceae and is traditionally known for its use in various systems of herbal medicine. Different parts of the plant have been investigated for their potential pharmacological properties (Basule *et al.,* 2023). Like other medicinal plants, its biological activities may be associated with the presence of diverse secondary metabolites, particularly flavonoids and phenolic compounds. These phytoconstituents are of considerable interest because of their potential antioxidant, antimicrobial, and anti-inflammatory properties (Sharma and Goyal, 2011). However, the chemical composition and biological activity of a plant extract may vary depending on the plant material, extraction solvent, extraction procedure, and analytical conditions (Arya and Patni, 2013). Therefore, systematic phytochemical investigation is necessary to establish the chemical characteristics and biological potential of *P. lanceolata*.

Extraction is a fundamental step in phytochemical research because the nature and polarity of the solvent influence the quantity and type of compounds recovered from plant material. Solvents such as chloroform, ethyl acetate, methanol, and water differ in their polarity and extraction characteristics, resulting in variations in extraction yield and phytochemical composition. Comparative evaluation of these extracts can provide useful information regarding the distribution of different classes of phytoconstituents. Preliminary phytochemical screening is commonly employed to identify major groups of plant constituents, while quantitative estimation of total phenolic and flavonoid contents provides additional information regarding the relative abundance of these compounds. Such investigations

help in selecting suitable extracts for further biological evaluation and chemical characterization.

Flavonoids constitute an important group of plant polyphenolic compounds associated with several biological activities (Adamczak *et al.,* 2019). Quercetin, a naturally occurring flavonoid, has been widely investigated for its antioxidant, anti-inflammatory, and antimicrobial potential (Kumar *et al.,* 2004). Its identification and quantification in medicinal plant extracts are important for chemical profiling and quality assessment. High-performance thin-layer chromatography (HPTLC) is a useful analytical technique for the separation, identification, and quantification of phytoconstituents in complex plant extracts (Salam *et al.,* 2025). The technique offers advantages such as relatively simple sample preparation, simultaneous analysis of multiple samples, reproducible chromatographic separation, and densitometric quantification. Comparison of the retention factor (Rf) and chromatographic response of a plant extract with those of an authentic reference standard can provide preliminary evidence for the presence of a specific constituent.

Antimicrobial resistance and the continuing occurrence of bacterial infections have increased interest in exploring natural products as potential sources of antimicrobial compounds (Radhia *et al.,* 2018). Plant extracts containing flavonoids, phenolic compounds, terpenoids, and other secondary metabolites may exhibit inhibitory effects against different bacterial species. Evaluation of antimicrobial activity against representative Gram-positive and Gram-negative bacteria, such as *Staphylococcus aureus, Pseudomonas aeruginosa*, and *Escherichia coli*, can provide preliminary evidence of the biological activity of a plant extract (Dinesh *et al.,* 2015). However, the observed activity depends on factors such as extract concentration, composition, microbial susceptibility, and experimental conditions. Consequently, antimicrobial screening should be supported by appropriate controls and standardized experimental procedures.

In view of the importance of medicinal plants as sources of biologically active compounds, the present study was designed to investigate the phytochemical composition and antimicrobial potential of different extracts of *Pluchea lanceolata*. The study involved determination of extraction yield, preliminary phytochemical screening, estimation of total phenolic and flavonoid contents, and evaluation of the antimicrobial activity of the methanolic extract against selected bacterial strains. Furthermore, HPTLC analysis was performed using quercetin as a reference standard to investigate its presence and estimate its content in the methanolic extract. The findings are intended to contribute to the phytochemical characterization of *P. lanceolata* and provide preliminary analytical and biological evidence to support further investigation of this medicinal plant.

Material and Methods

Material

The plant material of *Pluchea lanceolata* was collected and authenticated before extraction. Chloroform, methanol, ethyl acetate, toluene, formic acid, and other analytical-grade chemicals were procured from Merck Life Science Pvt. Ltd., Mumbai, India, and Loba Chemie Pvt. Ltd., Mumbai, India. Quercetin was used as the reference standard for HPTLC analysis. Precoated silica gel 60 F_{254} HPTLC plates were obtained from Merck (Merck KGaA, Darmstadt, Germany).Distilled water was used for aqueous extraction and preparation of solutions. Ferric chloride, lead acetate, and other reagents were used for preliminary phytochemical screening.

Methods

Extraction using soxhlet extraction method

Extraction is an essential step in phytochemical processing for the finding of bioactive secondary metabolite from plant materials.

Defatting of plant material

50 gram of leaves of *Pluchea lanceolata* shade dried plant material were coarsely powdered and subjected to extraction with Petroleum ether by Soxhlet apparatus. The extraction was continued till the defatting of the material had taken place (Khandelwal, 2005).

Successive extraction of *Pluchea lanceolata*

Defatted leaves of *Pluchea lanceolata* were extracted with chloroform, ethyl acetate, methanol and water solvents by soxhlet extraction method (Mukherjee, 2007). Each extraction process was carried out for 24 hours. The filtrate was separated from the residue using Whatmann filter paper. The filtrate from each solvent was collected and evaporated using a water bath at 50°C until a thick extract was obtained. Finally, the percentage yields were calculated of the dried extract.

Determination of percentage yield

% yield is calculated using the formula below:

$$\textbf{Percentage Yield} = \frac{Weight\ of\ Extract}{Weight\ of\ Powder\ drug\ taken} x\ 100$$

Qualitative phytochemical screening of *Pluchea lanceolata* extracts

Qualitative phytochemical screening is carried out to investigate the various classes of natural compounds present in the extract. This is accomplished using standard methods (Tiwari *et al.,* 2011). The classes of compounds identified in the extract included

phenolics, flavonoids, tannins, saponins, alkaloids and protein.

Quantitative studies of phytoconstituents in extract of *Pluchea lanceolata*

Estimation of total phenol content

Folin-Ciocalteu technique was used to identify the extracts' total phenol concentration (Gaur Mishra *et al.,* 2017). Different aliquots of 10–50µg/ml were formed in methanol after 10 milligram of gallic acid was dissolved in 10 ml of methanol. After dissolving 10 mg of dried extracts in 10 ml of methanol, the mixture was filtered. This extract was used to estimate phenol in two milliliters (1 mg/ml). One milliliter of folin-ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and one milliliter (7.5g/L) of sodium carbonate were combined with two milliliters of each extract and standard. For color development, the mixture was vortexed for 15 seconds and then left to stand for 10 minutes. A spectrophotometer was used to measure the absorbance at 765 nm.

Estimation of total flavonoids content

The aluminum chloride technique was used to determine the total flavonoid content (Parkhe and Bharti, 2019). After dissolving 10 mg of quercetin in 10 ml of methanol, several aliquots containing 5–25 µg/ml were developed. After dissolving 10 mg of dried extract in 10 ml of methanol, the mixture was filtered. This extract was used to measure flavonoids in three milliliters (1 mg/ml). Absorbance was measured at 420 nm after 1 ml of a 2% $AlCl_3$ solution was added to 3 ml of extract or each standard and left for 15 minutes at room temperature.

In vitro* antimicrobial activity of methanolic extract of *Pluchea lanceolata

The antibacterial activity of the methanolic extract of *Pluchea lanceolata* was assessed using the Agar well-diffusion method (Gupta and Kalaiselvan, 2022). Fresh broth cultures of bacteria were used to swab nutrient agar plates using sterile cotton swabs. Using a sterile cork borer, wells (6 mm in diameter) were created in each of these plates. A solution containing 100 mg/ml, 50 mg/ml, and 25 mg/ml was made using various extracts. After adding roughly 100 µl of various extract concentrations using a sterile micropipette into each well, the wells were left to diffuse for 2 hours at room temperature. Distilled water inoculums were used in control studies.

For 24 hours, the plates were cultured for bacterial pathogens at 37°C. In addition to calculating the activity index, the inhibition zone diameter (mm) was assessed. The experiment was conducted three times, maintaining triplicates. For each replicate, readings were obtained in three fixed directions, and the average values were noted.

Quantitative estimation of Quercetin by HPTLC in Methanolic extract of *Pluchea lanceolata*

Standard Solution Preparation

Standard stock solutions were prepared by accurately weighing 10 mg each of Quercetin transferring them into separate 10 ml volumetric flasks. The volume was adjusted with methanol to obtain a concentration of 1mg/ml. The solutions were stored in tightly closed containers under refrigerated conditions. From this stock solution, 1ml was further diluted to 10 mL with methanol to obtain stock solution A. Calibration curves were prepared in accordance with the International Conference on Harmonization (ICH) guidelines.

Sample Preparation

A stock solution of the sample was prepared by dissolving 10 mg of the dried extract in methanol and making up the volume to 10 ml in a volumetric flask. The solution was stored under refrigerated conditions until analysis.

Calibration Curve

Calibration curves were constructed in accordance with ICH guidelines (Jain *et al.,* 2021). Standard Quercetin solutions in the concentration range of 1–5 µl were applied in triplicate as bands of 6.0 mm width on aluminum-backed HPTLC plates precoated with silica gel 60 F_{254} (10.0 × 10.0 cm). The bands were applied using a CAMAG Linomat V applicator, maintaining a distance of 11.7 mm between adjacent tracks, 12 mm from the plate edge, and 8 mm from the bottom of the plate. The application rate was kept constant at 15µl/s.

Chromatographic development was carried out in a CAMAG twin-trough chamber pre-saturated for 20 min with the mobile phase consisting of toluene: ethyl acetate: formic acid (5:4:1, v/v/v). The plates were developed to a distance of 70 mm, followed by air-drying. Densitometric scanning was performed using a CAMAG TLC Scanner III at a wavelength of 254 nm in absorption mode. Quercetin was well resolved with an Rf value of 0.72. Peak areas were recorded, and calibration curves were generated by plotting peak area against applied concentration. Linear regression analysis was employed to establish the calibration equation and assess linearity.

Sample Assay

Methanolic extract of *Pluchea lanceolata* and standard solutions were applied to the TLC plates and developed under identical chromatographic conditions. After development and drying, the analytes were well resolved from other constituents. Densitometric scanning was performed at 254nm, and peak areas corresponding to Quercetin were recorded for quantitative estimation.

Results and Discussion

Table 1: % Yield of *Pluchea lanceolata*

Sr. No	Extracts	Weight of Extracts	% Yield (w/w)
1.	Chloroform	1.09	2.18
2.	Ethyl acetate	1.47	2.94
3.	Methanolic	3.96	7.92
4.	Aqueous	7.20	14.4

The percentage yields of the different extracts of *Pluchea lanceolata* are presented in Table 1. The extraction yield varied considerably depending on the solvent used. The chloroform extract showed a yield of 2.18% (w/w), whereas the ethyl acetate extract yielded 2.94%. The methanolic extract exhibited a higher yield of 7.92%, while the aqueous extract showed the maximum yield of 14.4%. The higher yield obtained with water suggests that a considerable proportion of the plant material consisted of water-soluble constituents. These may include polar phytochemicals and other extractable substances. Methanol also demonstrated effective extraction, probably because of its ability to dissolve a broad range of polar and moderately polar constituents. In comparison, chloroform and ethyl acetate produced lower yields, indicating comparatively lower recovery of extractable constituents under the conditions employed.

Table 2: Result of phytochemical screening of chloroform extract of *Pluchea lanceolata*

S. No.	Constituents	Chloroform extract	Ethyl acetate extract	Methanolic extract	Aqueous extract
1.	**Alkaloids** Hager's Test:	-ve	+ve	-ve	-ve
2.	**Glycosides** Conc. H_2SO_4 Test:	-ve	-ve	-ve	-ve
3.	**Flavonoids** Lead acetate Test: Alkaline reagent test:	+ve	+ve	+ve	+ve
4.	**Diterpenes** Copper acetate Test:	-ve	-ve	+ve	+ve
5.	**Phenol** Ferric Chloride Test:	-ve	-ve	+ve	-ve
6.	**Proteins** Xanthoproteic Test:	+ve	+ve	+ve	+ve
7.	**Carbohydrate** Fehling's Test: Benedict's Test	-ve -ve	+ve -ve	+ve -ve	-ve -ve
8.	**Saponins** Froth Test:	-ve	-ve	+ve	+ve
9.	**Tannins** Gelatin test:	-ve	-ve	-ve	-ve
10.	**Sterols** Salkowski Test:	-ve	-ve	-ve	-ve

+Ve = Positive, -Ve= Negative

The results of preliminary phytochemical screening of the chloroform, ethyl acetate, methanolic, and aqueous extracts of *Pluchea lanceolata* are summarized in Table 2. The screening was performed using standard qualitative chemical tests to identify the major classes of phytoconstituents present in the extracts. Flavonoids were detected in all four extracts, as indicated by positive results in the lead acetate and alkaline reagent tests. This finding suggests that flavonoid compounds are distributed across extracts obtained using solvents of different polarities. Flavonoids are important plant secondary metabolites that have been investigated for their antioxidant and other biological activities. Alkaloids

were detected only in the ethyl acetate extract, while glycosides and tannins were not detected in any of the extracts using the specified tests. Diterpenes were detected in the methanolic and aqueous extracts but were absent in the chloroform and ethyl acetate extracts. Phenolic compounds were detected only in the methanolic extract, as indicated by the ferric chloride test. This result supports the selection of the methanolic extract for further investigation of its phenolic constituents. The Xanthoproteic test produced positive results for proteins in all four extracts. Saponins were detected in the methanolic and aqueous extracts, whereas the chloroform and ethyl acetate extracts showed negative results. Carbohydrate screening using Fehling's and Benedict's tests showed a positive result with Fehling's test only for the ethyl acetate and methanolic extracts; all extracts showed negative results with Benedict's test.

Table 3: Estimation of total phenol and flavonoids content of *Pluchea lanceolata*

S. No.	Extracts	Total phenol content	Total flavonoids content
		(mg/ 100 mg of dried extract)	
1	Chloroform	-	0.41
2	Ethyl acetate	-	0.96
3	Methanolic	1.59	2.17
4	Aqueous	-	0.62

The estimated total phenolic and flavonoid contents of the different extracts are presented in Table 3. The methanolic extract showed a total phenolic content of 1.59 mg/100 mg of dried extract and a total flavonoid content of 2.17 mg/100 mg of dried extract. The total flavonoid content of the ethyl acetate extract was 0.96 mg/100 mg, while the aqueous and chloroform extracts showed values of 0.62 and 0.41 mg/100 mg of dried extract, respectively.

The methanolic extract exhibited the highest estimated flavonoid content among the investigated extracts. Its flavonoid content was greater than that of the ethyl acetate, aqueous, and chloroform extracts. The presence of flavonoids in all four extracts during preliminary screening, as shown in Table 2, is consistent with the quantitative results presented in Table 3.

The methanolic extract also showed the highest reported phenolic content. This observation is consistent with the positive ferric chloride test obtained for the methanolic extract during preliminary phytochemical screening. The quantitative findings therefore support the use of the methanolic extract for further investigation of flavonoid constituents, particularly quercetin.

Table 4: Antimicrobial activity of methanolic extract of *Pluchea lanceolata*

S. No.	Name of microbes	Zone of inhibition (mm)		
		25mg/ml	50 mg/ml	100mg/ml
1.	*Staphylococcus aureus*	6.33±0.5	7±0.74	13±0.33
2.	*Pseudomonas aeruginosa*	6.66±0.47	8±0.0.57	12±0.94
3.	*Escherichia coli*	7±0.5	10±0.33	13±0.57

***Average of three determination, Mean ± SD**

The antimicrobial activity of the methanolic extract of *Pluchea lanceolata* against Staphylococcus aureus, Pseudomonas aeruginosa, and Escherichia coli was evaluated at concentrations of 25, 50, and 100 mg/mL. The results, expressed as the mean zone of inhibition ± standard deviation, are presented in Table 4. Against Staphylococcus aureus, the extract produced inhibition zones of 6.33 ± 0.50 mm, 7.00 ± 0.74 mm, and 13.00 ± 0.33 mm at concentrations of 25, 50, and 100 mg/mL, respectively. The results indicate an increase in the inhibition zone with increasing extract concentration, with the maximum inhibition observed at 100 mg/mL.

For Pseudomonas aeruginosa, the inhibition zones were 6.66 ± 0.47 mm, 8.00 ± 0.57 mm, and 12.00 ± 0.94 mm at the respective concentrations. Similarly, Escherichia coli exhibited inhibition zones of 7.00 ± 0.50 mm, 10.00 ± 0.33 mm, and 13.00 ± 0.57 mm. Among the tested microorganisms, Escherichia coli and Staphylococcus aureus showed the largest reported inhibition zones at 100 mg/mL, while Pseudomonas aeruginosa showed a slightly smaller zone at the same concentration. The findings

presented in Table 4 indicate a concentration-dependent increase in the observed antimicrobial activity of the methanolic extract under the experimental conditions. This activity may be associated with the phytochemical constituents detected during preliminary screening, including flavonoids, phenolic compounds, diterpenes, and saponins. Nevertheless, the contribution of individual constituents cannot be established from the present results alone.

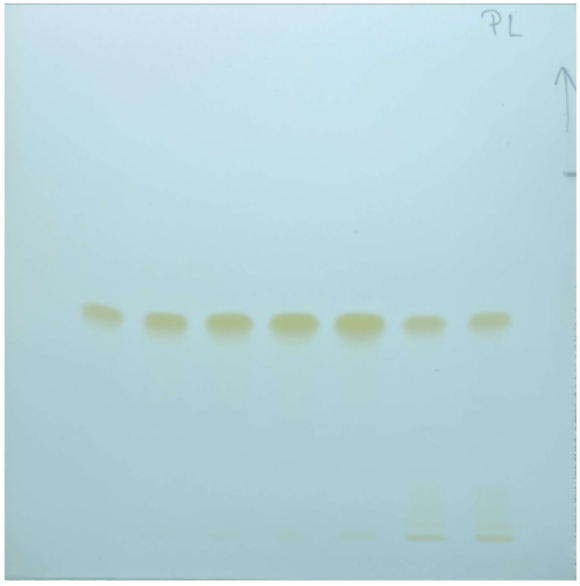


Figure 1: Normal Light standard Quercetin and Methanolic extract of *Pluchea lanceolata*

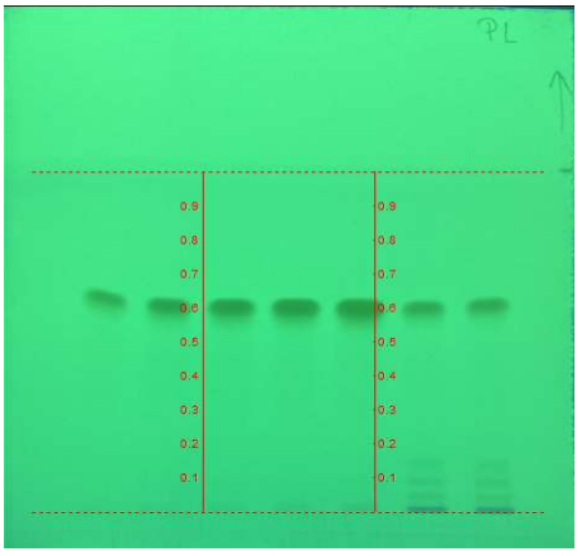


Figure 2: Ultraviolet mode at 254 nm standard Quercetin and Methanolic extract of *Pluchea lanceolata*

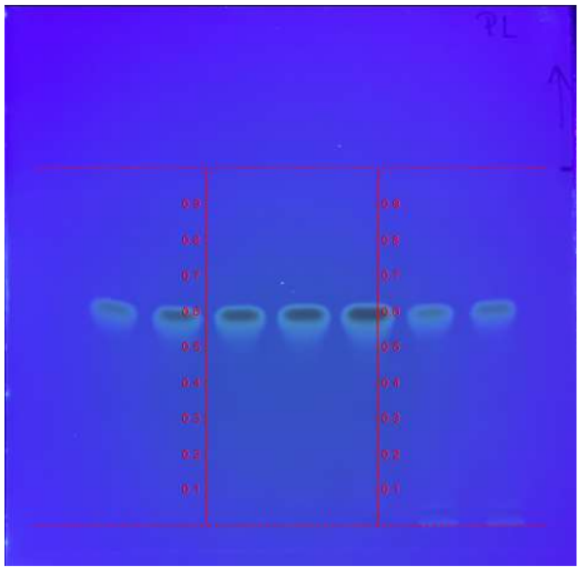


Figure 3: Fluorescence mode at 365 nm standard Quercetin and Methanolic extract of *Pluchea lanceolata*

The chromatographic behaviour of standard quercetin and the methanolic extract of *Pluchea lanceolata* was examined under different visualization conditions. The plates were observed under normal light, ultraviolet light at 254 nm, and fluorescence mode at 365 nm. The plate observed under normal light is shown in Figure 1, which presents the standard quercetin and methanolic extract. This observation provides a visual assessment of the applied samples and the appearance of the chromatographic zones after development. Differences in spot intensity and appearance may reflect variations in the concentration and nature of the separated constituents.

The ultraviolet image at 254 nm is presented in Figure 2. Ultraviolet visualization at this wavelength is commonly used to detect UV-absorbing compounds separated on HPTLC plates containing a fluorescent indicator. The observed chromatographic zones provide information about the separation pattern of the standard and the plant extract. The fluorescence-mode image at 365 nm is presented in Figure 3. Visualization under this condition can provide additional information about the optical behaviour of the separated compounds. Comparing the three images allows the chromatographic appearance of the standard and extract to be examined under different illumination conditions. The visual observations in Figures 1–3 are useful for preliminary comparison; however, visual similarity alone is insufficient to confirm the identity of quercetin in the plant extract. Confirmation requires

comparison of the retention factor, densitometric response, and other relevant chromatographic characteristics with those of the authentic standard.

Table 5: Optimized chromatographic conditions for Quercetin and extract

Parameter	Conditions
Mobile phase	Toluene: ethyl acetate: Formic acid (5:4:1v/v)
Stationary phase	Precoated silica gel 60 F_{254} HPTLC plates (100 mm × 100 mm, layer thickness 0.2 mm)
Plate size	10.0 × 10.0 cm
Chamber saturation time	20 min
Distance run	70 mm
Temperature	27 ± 2°C
Application mode	Band
Band length	6.0 mm
Distance between tracks	11.6 mm
Detection wavelength	254 nm
Scanning speed	20 mm/s
Data resolution	100 µm/step
Light source	Deuterium–Tungsten (D_2 & W) lamp
Measurement mode	Absorption
Retardation factor (Rf) of Quercetin	0.60
Diluent	Methanol

The optimized HPTLC conditions used for the analysis of standard quercetin and the methanolic extract are presented in Table 5. The mobile phase consisted of toluene, ethyl acetate, and formic acid in a ratio of 5:4:1 (v/v). Precoated silica gel 60 F_{254} HPTLC plates measuring 10.0 × 10.0 cm, with a layer thickness of 0.2 mm, were used as the stationary phase. The chamber saturation time was maintained at 20 minutes, and the development distance was 70 mm. Chromatographic separation was performed at 27 ± 2°C. Samples were applied as bands with a length of 6.0 mm and a distance of 11.6 mm between tracks. Detection was carried out at 254 nm, with a scanning speed of 20 mm/s and a data resolution of 100 µm per step. A deuterium–tungsten lamp was used as the light source, and the measurement mode was absorption. Methanol was used as the diluent. Under the specified chromatographic conditions, standard quercetin exhibited an \(R_f\) value of 0.60, as reported in Table 5. The mobile phase composition was used to achieve the separation of quercetin and the other extract constituents. The presence of formic acid in the mobile phase may influence the migration and separation behaviour of compounds by modifying interactions with the stationary phase.

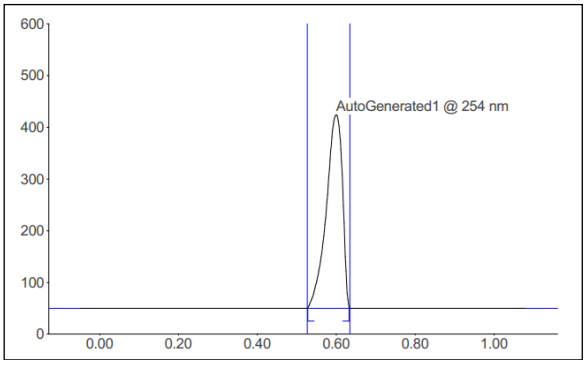


Figure 4: Chromatogram of standard Quercetin

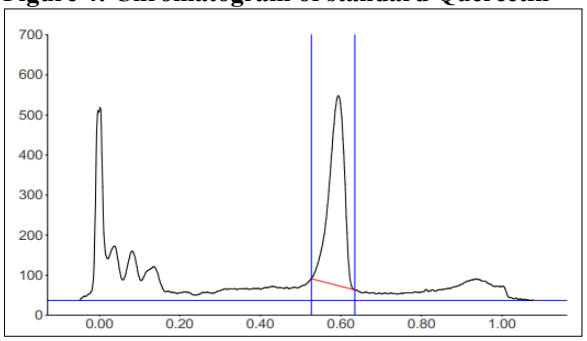


Figure 5: Chromatogram of Methanolic extract of *Pluchea lanceolata* (Replicate 1)

Table 6: Results of % Quercetin content in *Pluchea lanceolata* extract

Extrac	Replic	Area	Rf	Regress	%

t	ate			ion Equation	Quercetin content
***Pluchea lanceolata* extract**	1	12811.4	0.60	y = 4373.9x + 1759.9	0.253
	2	13663.9	0.60	y = 4373.9x + 1759.9	0.272
	Average % Quercetin content				0.262

The quantitative HPTLC results for quercetin in the methanolic extract of *Pluchea lanceolata* are presented in Table 6. Two replicate measurements were reported, with peak areas of 12,811.4 and 13,663.9. Both replicates exhibited an \(R_f\) value of 0.60, corresponding to the reported migration of standard quercetin.

The regression equation used for the analysis was \(y = 4373.9x + 1759.9\). Based on the reported calculations, the quercetin content was 0.253% for replicate 1 and 0.272% for replicate 2. The average quercetin content was reported as 0.262%. The small difference between the two replicate results indicates a degree of agreement between the measurements. The average value suggests that quercetin represents a measurable constituent of the analysed methanolic extract. These results are consistent with the qualitative detection of flavonoids in the extract, as presented in Table 2, and the higher estimated total flavonoid content reported in Table 3. The findings presented in Table 6 demonstrate the potential utility of HPTLC for the quantitative estimation of quercetin in *Pluchea lanceolata*. However, the reported percentage should be interpreted in accordance with the calibration range, sample preparation procedure, dilution factor, and calculation method used. The replicate results also represent only two measurements; additional replicates and formal method validation would be required to establish the precision, accuracy, and reliability of the method.

Conclusion

The present study demonstrated that *Pluchea lanceolata* contains various phytoconstituents, including flavonoids, diterpenes, phenolic compounds, and saponins. The aqueous extract showed the highest extraction yield (14.4%), whereas the methanolic extract exhibited the highest reported total phenolic content (1.59 mg/100 mg) and total flavonoid content (2.17 mg/100 mg). The methanolic extract also demonstrated concentration-dependent antimicrobial activity against *Staphylococcus aureus, Pseudomonas aeruginosa*, and *Escherichia coli.* HPTLC analysis indicated the possible presence of quercetin, with a reported average content of 0.262%. These findings support further investigation of *P. lanceolata* for its phytochemical and antimicrobial potential.

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