Phytochemical Profiling and Ash Analysis of *Majidea zanguebarica* J.Kirk ex Oliv Stem and Leaf Extracts

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Abstract

The present study focuses on the phytochemical profiling, GC–MS analysis and ash value determination of the stem and leaf extracts of *Majidea zanguebarica* (Sapindaceae), an underexplored medicinal plant traditionally used for the treatment of fever, wound infections, and intestinal disorders. Preliminary phytochemical screening of ethanolic and aqueous extracts revealed the presence of bioactive constituents such as alkaloids, flavonoids, saponins, tannins, phenols, and glycosides, which are known to exhibit diverse pharmacological activities. Quantitative estimation indicated a higher concentration of total phenols and flavonoids in ethanolic extracts compared to aqueous extracts, suggesting their potential antioxidant capacity. GC–MS analysis of the leaf and stem extracts identified several important bioactive compounds, including (E)-cinnamaldehyde, phytol, and octadecanoic acid, which have reported antimicrobial and anti-inflammatory properties. Physicochemical parameters such as moisture content, ash value, and extractive value were also evaluated to establish quality control standards for the plant material. The study highlights the medicinal significance of *M. zanguebarica* and supports its potential use as a source of natural therapeutic agents for drug development and formulation.

Keywords: *Majidea zanguebarica*, phytochemical, bioactive, anti-inflammatory, Physicochemical

Introduction

Plants are an abundant source of diverse bioactive compounds that play both direct and indirect roles in the treatment of various human diseases. Since ancient times, human civilizations have explored and utilized different plants and their derivatives to combat a wide range of serious ailments. (Kuldip S Dogra et al., 2015). Medicinal plants have been played an essential role in the development of human culture. Medicinal plants have similar properties as conventional

pharmaceutical drugs that human have used throughout history to either cure or lessen symptoms from the illness. Medicinal plants are the backbone of traditional medicines (Deepa and priya 2019).

Phytochemicals are non-nutritive chemical compounds derived from plants that play a significant role in the prevention of human diseases. These include secondary metabolites and antioxidants, which possess important medicinal properties. In some plants, specific phytochemicals serve as a natural defense mechanism, protecting them from insect attacks and grazing animals. Conversely, other phytochemicals contribute to the plant's color, aroma, and flavor, thereby attracting potential consumers (Abhijeet Kasarkar et al., 2018). Phytochemical analysis serves as a key approach in the discovery of new and effective drugs. Plants are among the richest reservoirs of medicinal compounds, providing valuable phytochemical intermediates and chemical entities that form the basis for both traditional medicines and modern synthetic drugs (Hammer et al., 1999).

The Sapindaceae family is well known for its wide range of traditional medicinal applications, including use as a diuretic, stimulant, expectorant, natural surfactant, sedative, vermifuge and in the treatment of stomachache and dermatitis across many parts of the world. Phytochemical investigations of this family have led to the isolation of various secondary metabolites such as saponins, diterpenes, and flavonoids. Several saponins, as well as acyclic sesquiterpene and diterpene oligosides, have been identified as the major secondary metabolites in several Sapindaceae species used in traditional medicine (Perry., 1980).

Majidea zanguebarica is a small tree belonging to the family Sapindaceae, native to East Africa and typically grows up to 5 meters (16 feet) in height. The plant is commonly known as the "Black Pearl Tree" or "Velvet Seed Tree" due to its highly ornamental seeds. It bears dense clusters of small, fragrant greenish-red flowers at the ends of panicles. The fruit is spherical with three lobes, about 3 cm (1.2 inches) long, which split open to reveal a bright red interior containing three smooth, velvety blue-black seeds. Traditionally, various parts of the plant are used to treat fever, wound infections, and intestinal disorders, as the pods and leaves are known to possess antibacterial properties (Aksharadev et al., 2022).

Materials and Methods

Majidea zanguebarica J.Kirk ex Oliv is collected from Rani Anna Govt College campus, Tirunelveli. Mature and healthy plants were collected naturally from the campus after the rainy season (December-January).

Botanical name: *Majidea zanguebarica* J.Kirk ex Oliv

Commen name: Black pearl tree, Magambo tree, Valvet seed tree.

Synonyms: Harpullia zanguebarica

Systematic Position

Kingdom : Plantae

Division : Dicotyledons

Class : Magnoliopsida

Order : Sapindales

Family : Sapindaceae

Genus : *Majidea*

Species : *zanguebarica*

Methods

Taxonomical and analytical characters were studied in the plant *Majidea zanguebarica* J.Kirk ex Oliv

Macroscopic Observation (Taxonomy)

Fresh plants of *M. zanguebarica* were collected from their natural habitat and brought to the laboratory for taxonomical observation and identification. Morphological characters such as leaf arrangement, venation pattern, flower morphology, fruit and seed characteristics, and stem features were examined carefully. The specimens were studied using a Wexwox Digital Computerized Microscope (Model: BXL-DG 65725). Taxonomical and morphological characters were recorded in standard botanical terms according to relevant floras and taxonomic manuals.

Analytical Studies

For analytical evaluation, the shade-dried leaf and stem powders, along with solvent extracts of the powdered materials, were used. Physico–chemical parameters such as total ash, acid-insoluble ash, water-soluble ash, sulphated ash, moisture content, alcohol-soluble extractive and water-soluble extractive values were determined using standard procedures recommended in the Pharmacopoeia of India (Anonymous, 1996). The extractive values in different solvents were calculated and recorded for comparative evaluation.

A. Determination of Total Ash

Two grams of accurately weighed powdered plant material were placed in a previously ignited and tarred silica dish. The sample was incinerated gradually at a temperature not exceeding dull red heat until it became carbon-free. The dish was cooled and weighed. The total ash content was expressed as a percentage

with reference to the shade dried material.

B. Determination of Acid-Insoluble Ash

The total ash obtained above was boiled with 25 mL of dilute hydrochloric acid for five minutes. The insoluble residue was collected on ashless filter paper (Whatman No. 41), washed with hot water, ignited, cooled and weighed. The percentage of acid-insoluble ash was calculated with reference to the shade dried sample.

C. Determination of Water-Soluble Ash

A known weight of the total ash was boiled for five minutes with 25 mL of distilled water, filtered, and the insoluble matter was collected and ignited. The weight difference between total ash and insoluble matter represented the water-soluble ash percentage.

D. Determination of Sulphated Ash

Two grams of powdered plant material were moistened with concentrated sulphuric acid in a nickel crucible and ignited gently. The procedure was repeated until a white residue was obtained. The crucible was cooled and weighed. The percentage of sulphated ash was determined with reference to the shade dried material.

E. Determination of Moisture Content

Two grams of fresh plant material were accurately weighed and dried in a hot-air oven at 105°C. The weight was measured at one-hour intervals until a constant weight was obtained. The loss in weight represented the moisture content.

F. Determination of Alcohol-Soluble Extractive Value

Five grams of the shade dried, powdered sample were macerated with 100 mL of alcohol in a closed flask for 24 hours, with frequent shaking for the first six hours. The mixture was filtered, and 25 mL of the filtrate was evaporated to dryness in a tared dish. The residue was dried at 105°C and weighed. The percentage of alcohol-soluble extractive value was calculated relative to the air-dried sample.

G. Determination of Water-Soluble Extractive Value

Five grams of the powdered plant material were macerated with 100 mL of chloroform water for 24 hours with occasional shaking. The extract was filtered, and 25 mL of the filtrate was evaporated to dryness, dried at 105°C and weighed. The percentage of water-soluble extractive value was calculated with reference to the sample.

H. Determination of Successive Solvent Extractive Values

Ten grams of coarsely powdered plant material were successively extracted in a Soxhlet apparatus using petroleum ether, benzene, chloroform, and methanol until the extract became colourless. After each extraction, the residue was dried below 50°C to remove the remaining solvent. The collected extracts were concentrated by distillation and the yield of each solvent extract was calculated as a percentage of the air-dried sample.

Preliminary Phytochemical Analysis

The powdered plant material was extracted successively using ethanol and distilled water in a Soxhlet apparatus until the extracts became colourless. The extracts were concentrated and subjected to qualitative phytochemical screening following the standard procedures described by Trease and Evans (1989), Harborne (1998), and Brindha et al., (1981).

This analysis aimed to identify the presence of major classes of phytoconstituents such as alkaloids, flavonoids, saponins, tannins, phenolics, steroids, triterpenoids, carbohydrates, catechins, amino acids, and anthraquinones. Observations were recorded as per the standard reaction indications.

Table- 1 Preliminary phytochemical analysis

S.No	Test	Observation	Inference
1	Test solution + a few drops of $CHCl_3$ + 3-4 drops of acetic anhydride and one drop of con.H_2SO_4	Purple colour changing to blue or green	Presence of steroids
2	Test solution + piece of tin + 3 drops of thionyl chloride	Violet or purple colour	Presence of triterpenoids
3	Test solution + 2 ml of Fehling's reagent + 3 ml of H_2O and boil.	Red orange colour	Presence of reducing sugars
4	Test solution + very small quantity of anthrone + few drops of con.H_2SO_4	Green to purple colour	Presence of sugars
5	Test solution taken with (2N) HCl. Aqueous layer formed decanted and to which are added one or two drop of Mayer's reagent	White turbidity or precipitate	Presence of alkaloids
6	Test solution in alcohol + one drop of neutral ferric chloride	Intense colour	Presence of phenolic compounds

7	Test solution in alcohol + a bit of magnesium and one drop of con.HCl and heat	Red and orange	Presence of flavonoids
8	Test solution in alcohol + Ehlrich reagent and a few drops of con.HCl	Pink colour	Presence of catechins
9	Test solution + H_2O and shake	Foamy lather	Presence of saponins
10	Test solution + H_2O + lead acetate	White precipitate	Presence of tannins
11	Test solution + magnesium acetate solution	Pink colour	Presence of anthroquinones
12	Test solution + 1% Ninhydrin reagent	Blue or violet colour	Presence of aminoacids

Quantitative Estimation of Phytochemicals

Quantitative estimation was carried out to determine the total concentration of selected phytochemical groups such as flavonoids, tannins, carbohydrates, amino acids, proteins, lipids, phenolics, and pigments.

A. Estimation of Total Flavonoids

Flavonoid content was determined according to the method of Boham and Kocipal-Abyazan (1974). Ten grams of powdered plant sample were extracted with 80% methanol, filtered and evaporated to dryness. The final residue weight represented the total flavonoid content.

B. Estimation of Tannins (Burade et al., 2005)

Tannins were quantified by the Folin-Denis method based on the reduction of phosphotungsto–molybdic acid in an alkaline medium to a blue complex, with absorbance measured at 700 nm.

C. Estimation of Carbohydrates (Yemm and Willis, 1954)

Carbohydrates were hydrolyzed and reacted with anthrone reagent to form a green chromogen measurable at 630 nm. Glucose was used as the standard.

D. Estimation of Amino Acids (Moore and Stein, 1948)

Free amino acids were estimated using the ninhydrin method, forming a purple complex measured at 550 nm. Results were expressed as glycine equivalents per gram of dry weight.

E. Estimation of Lipids (Bligh and Dyer, 1959)

Lipids were extracted using a chloroform: methanol (2:1) solvent system and quantified gravimetrically after evaporation of the solvent.

F. Estimation of Protein (Lowry et al., 1951)
Protein content was determined using the Folin–Ciocalteu reagent, with absorbance read at 650 nm against a BSA standard curve.

G. Estimation of Phenolic Compounds (Bray and Thorpe, 1954)
Total phenolics were quantified by the Folin–Ciocalteu method, forming a blue complex measurable at 630 nm.

H. Estimation of Chlorophyll and Carotenoids (Arnon, 1949)
Pigments were extracted in 80% acetone, and the absorbance values were measured at 663, 645, and 480 nm to calculate chlorophyll and carotenoid concentrations.

Gas Chromatography–Mass Spectrometry (GC–MS) Analysis

Sample Preparation
Mature and healthy plants were collected, washed and shade-dried for two weeks. The dried samples (leaf, stem, and root) were powdered and subjected to Soxhlet extraction using ethanol. About 60 g of each sample was refluxed with 250 mL of solvent for five hours. The extracts were concentrated and stored for GC–MS analysis.

Instrumental Conditions
GC–MS analysis was performed using a Shimadzu GC–MS–QP 2010 system equipped with a DB1 capillary column (30 m × 0.25 mm i.d.). Helium was used as the carrier gas at a flow rate of 0.7 mL/min. The column temperature was programmed from 70°C (held for 5 min) to 280°C at variable ramp rates. Injector and detector temperatures were set at 280°C and 290°C, respectively. One microlitre of the extract was injected in split mode (ratio 3:1). The ionization voltage was 70 eV, and mass spectra were recorded in the 30–600 amu range.

Compound Identification
The compounds were identified by comparing their mass spectra and retention indices with those from the NIST ’98 and Wiley MS libraries, as well as data available in the literature. The identity of each compound was confirmed based on its unique mass fragmentation pattern.

Results and Discussion

Phytochemical Screening
Active components of different parts of *M. zanguebarica* were extracted and analyzed qualitatively and quantitatively. The plant extract contained several active components and secondary metabolites that play an important role in its pharmacological potential. Since different phytochemicals show variable

solubility in solvents, the extraction was performed using solvents of different polarities ethanol and distilled water.

The phytochemical screening of both stem and leaf extracts revealed the presence of alkaloids, flavonoids, tannins, saponins, terpenoids, and phenolic compounds in varying concentrations. The ethanolic extract showed a higher intensity of secondary metabolites compared to the aqueous extract, indicating that ethanol effectively solubilizes most bioactive components. These compounds are known for their antioxidant, antimicrobial, and anti-inflammatory activities, which support the traditional medicinal uses of *Majidea zanguebarica*. Similar findings were reported by AK Choudhury et al., (2017), who observed that solvent polarity significantly influences the extraction efficiency of phytoconstituents from medicinal plants.

Table- 2 Preliminary phytochemical analysis of stem and leaf of Majidea zanguebarica.

Solvent	Plant part	Alkaloids	carbohydrates	Phenol	Saponin	Flavonoids	Protein	Amino acid	Catechins	Coumarin	Quinone	Tannin
Ethanol	Stem	-	+	+	+	+	+	_	+	+	+	-
	Leaf	-	-	+	-	+	-	_	-	+	+	-
Distilled water	Stem	-	-	#	+	#	-	-	+	#	_	-
	Leaf	-	+	-	+	+	-	-	+	-	_	-

(+)-present, (#)-slightly present, (-)-Absent

The diversity of phytochemicals found in *M. zanguebarica* reflects the plant's adaptability and defence mechanism against environmental stress. These compounds together play an important role in the plant's pharmacological and therapeutic value, making it a potential source for the development of novel herbal formulations.

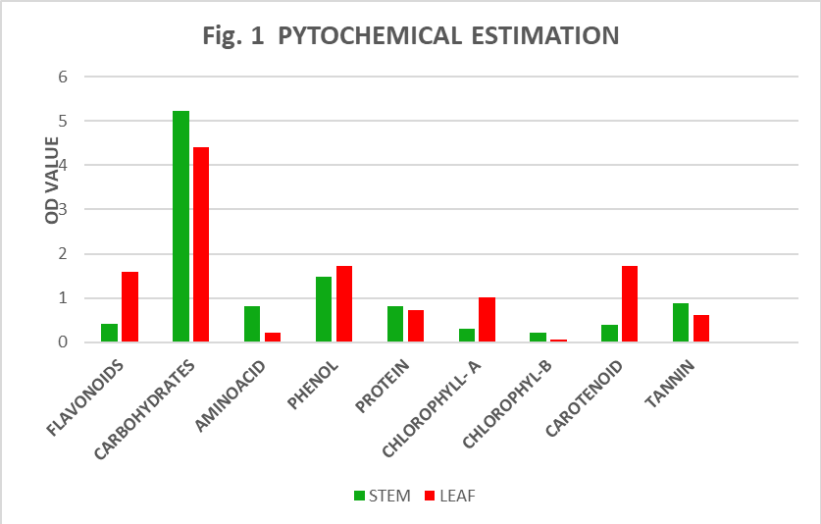
Quantitative Estimation of Phytoconstituents

Quantitative estimation was carried out to determine the concentration of major phytochemical groups in both stem and leaf extracts of *M. zanguebarica*. The leaf extract exhibited a higher amount of phenols, flavonoids and tannins compared to the stem, confirming its strong antioxidant potential. Alkaloids and saponins were moderately present in both parts. These findings indicate that the leaf may serve as a potent source of bioactive compounds for pharmacological and cosmetic applications.

The results correlate with studies on other medicinal plants, where higher concentrations of secondary metabolites were observed in the leaf portions due to enhanced metabolic activity and sunlight exposure (Krishnaiah et al., 2009).

Quantitative phytochemical analysis of Majidea zanguebarica

S.NO	Estimation	*Majidea zanguebarica*	
		Stem	Leaf
1.	Carbohydrates (mg/g/dry wt.)	4.41	5.22
2.	Proteins (mg/g/dry wt.)	0.81	0.72
3.	Amino acids (mg/g/dry wt.)	0.82	0.21
4.	Phenols (mg/g/dry wt.)	1.48	1.72
5.	Tannins(mgkg-1)	0.89	0.61
6.	Flavonoids(mgkg-1)	0.42	1.60
7.	Chlorophyll A (mg/g/dry wt.)	0.31	1.01
8.	Chlorophyll B (mg/g/dry wt.)	0.22	0.07
9.	Carotenoids (moles/g/dry wt.)	0.40	1.73



The quantitative estimation of phytoconstituents highlights that *M. zanguebarica* is a rich source of natural compounds with significant biological importance. These bioactive molecules may act synergistically to produce antioxidant, antimicrobial, and anti-inflammatory effects.

Physicochemical Analysis

The physicochemical parameters Analysis of the stem and leaf powders of *M. zanguebarica* were analyzed to determine ash values, extractive values, and moisture content. These parameters serve as essential diagnostic tools for the standardization and quality control of crude drugs.

The ash analysis revealed that the total ash content was higher in the stem (11.4%) than in the leaf (6.9%). The acid-insoluble ash (4.58%) was also greater than the water-soluble ash (3.10%) in the stem, suggesting the presence of siliceous matter. The sulphated ash value was 14.5% for the stem and 12.7% for the leaf. The moisture content was comparatively higher in the leaf (9.3%) than in the stem (1.35%), indicating a higher tendency for microbial growth in leaf powders if not properly dried.

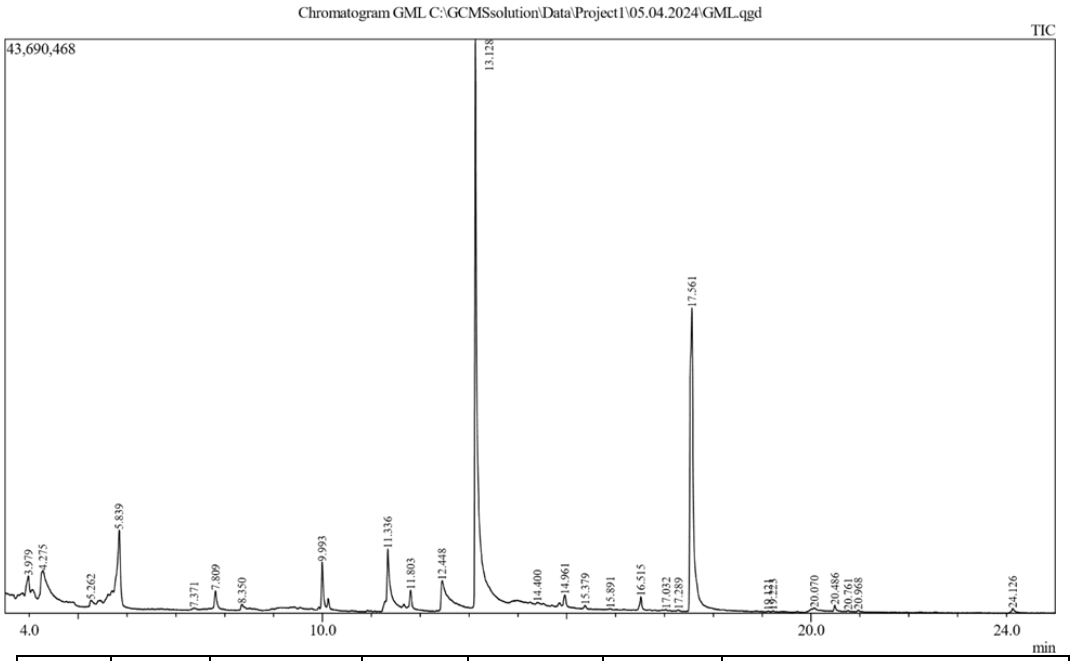
The water-soluble extractive value was found to be 5.1% in the stem and 11.5% in the leaf, while the alcohol-soluble extractive value was 5.6% in the stem and 4.5% in the leaf. These results suggest that polar compounds are more abundant in the leaf extract.

Physico-chemical analysis of Majidea zanguebarica

S.NO	TEST	*MAJIDEA ZANGUEBARICA*	
		STEM %	LEAF %
1.	Total ash	11.4	6.9
2.	Water soluble ash	3.10	2.58
3.	Acid insoluble ash	4.58	4.03
4.	Sulphated ash	14.5	12.7
5.	Moisture content	1.35	9.3
6.	Water soluble extractive value	5.1	11.5
7.	Alchocol soluble extractive value	5.6	4.5

These parameters provide useful data for standardization, quality control, and storage stability of the plant material, ensuring its suitability for further pharmacological and industrial studies.

Fig-2 GC-MS Analysis in Ethanol Extract of Leaf (M.Zanguebarica)



Peak #	*R.Time*	*Area*	*Area %*	*Height*	*Height %*	*Name*
1	*3.979*	*9342764*	*2.27*	*1581931*	*1.70*	*3-Hexanol, 3-methyl-*

2	4.275	17757288	4.31	2064160	2.22	Dimethyl Sulfoxide
3	5.262	2925378	0.71	425740	0.46	Butanoic acid, 2-hydroxy-2-methyl-, methyl ester
4	5.839	33704812	8.18	5679724	6.10	Pyrrolidine-2,4-dione
5	7.371	589660	0.14	135384	0.15	Tetraethyl silicate
6	7.809	4043995	0.98	1317891	1.41	2,2-Dimethylcyclopropancarboxylic acid,cyanomethyl ester
7	8.350	1644415	0.40	417227	0.45	2-Butenamide, N-(aminocarbonyl)-2-ethyl-, (Z)-
8	9.993	10764105	2.61	3488168	3.74	Linalool
9	11.336	23186447	5.63	4636762	4.98	Benzoic acid, ethyl ester
10	11.803	3787166	0.92	1309668	1.41	Dodecane
11	12.448	15963477	3.87	2144578	2.30	3-Phenylpropanol
12	13.128	165643229	40.19	43221593	46.39	Cinnamaldehyde, (E)-
13	14.400	830081	0.20	139259	0.15	Phenol, 2-methoxy-4-(2-propenyl)-, acetate
14		3974013	0.96	905369	0.97	Tetradecane

	14.961					
15	15.379	525839	0.13	201238	0.22	Caryophyllene
16	15.891	43099	0.01	34561	0.04	9-Oxabicyclo [3.3.1] nona-2,6-diene
17	16.515	2871766	0.70	997645	1.07	2,4-Di-tert-butylphenol
18	17.032	145562	0.04	66965	0.07	Octane, 2-methyl-
19	17.289	245512	0.06	90197	0.10	Hexadecane, 2-methyl-
20	17.561	109541531	26.58	22994537	24.68	Diethyl Phthalate
21	19.121	149736	0.04	62880	0.07	2-(4'-Hydroxyphenyl)-2-(4'-methoxyphenyl) propane
22	19.223	157265	0.04	75826	0.08	3-Methyl-4-(phenylthio)-2-prop-2-enyl-2,5-dihydrothiophene 1,1-dioxide
23	20.070	1417483	0.34	215619	0.23	Tetradecane, 1-chloro-

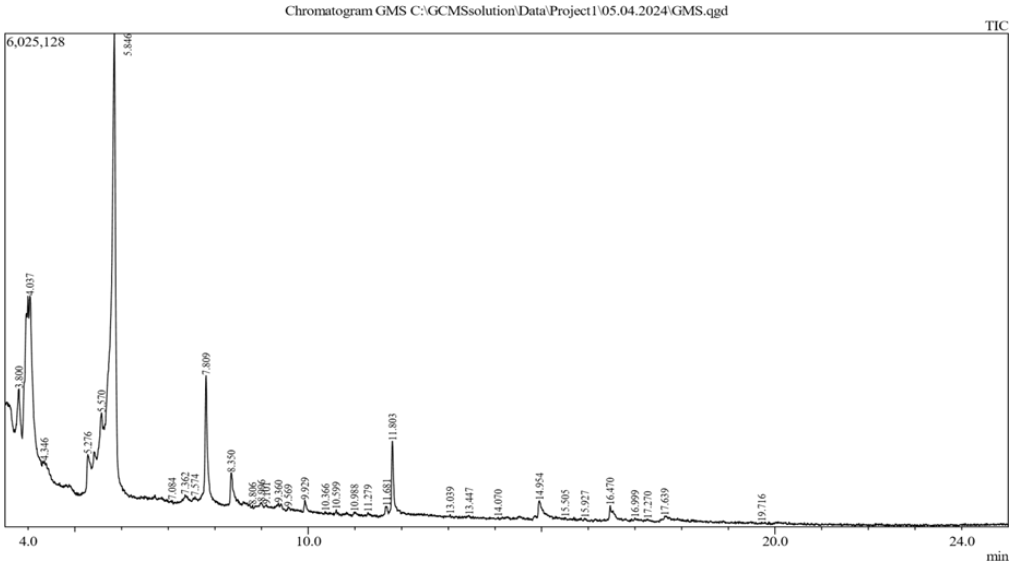
The GC–MS chromatogram of the ethanol extract of *M. zanguebarica* leaf revealed a total of 23 peaks (Table X). The major compounds identified included (E)-cinnamaldehyde (RT 13.128 min; 40.19%), diethyl phthalate (RT 17.561 min; 26.58%), and pyrrolidine-2,4-dione (RT 5.839 min; 8.18%). Other notable constituents were linalool (2.61%), benzoic acid ethyl ester (5.63%), and 3-

phenylpropanol (3.87%).

The presence of (E)-cinnamaldehyde is particularly significant as this compound is well-documented for its antimicrobial, antioxidant, and anti-inflammatory properties (Guo et al., 2024). Similarly, the identification of pyrrolidine-2,4-dione—a compound belonging to the pyrrolidine scaffold family—indicates potential pharmacological relevance, since pyrrolidine derivatives are known to exhibit antibacterial, antiviral, and anticancer activities (Poyraz et al., 2023).

Overall, the leaf extract demonstrated a diverse chemical profile containing both aromatic and heterocyclic bioactives, supporting the plant's traditional medicinal applications. These findings justify further analytical work to isolate, purify, and characterize the major bioactive constituents through advanced chromatographic and spectroscopic techniques.

Fig-3 GC-MS Analysis in Ethanol Extract of Stem (M. Zanguebarica)



Peak Report TIC

Peak#	R.Time	Area	Area%	Height	Height%	Name
1	3.800	2079847	3.24	553191	4.50	2,2,4-Trimethyl-3-pentanol
2	4.037	17178778	26.78	1800145	14.63	3-Hexanol, 3-methyl-
3	4.346	56072	0.09	47962	0.39	3-Octyn-1-ol

4	5.276	1233111	1.92	342620	2.78	2-Methylbutane-1,4-diol, 3-(1-ethoxyethoxy)-
5	5.570	912285	1.42	297203	2.42	Pyrrolidine-2,4-dione
6	5.846	28803393	44.90	5186581	42.15	Pyrrolidine-2,4-dione
7	7.084	-94	-0.00	20919	0.17	4-Methylfurazan-3-carboxylic acid
8	7.362	228569	0.36	65672	0.53	Tetraethyl silicate
9	7.574	203352	0.32	55212	0.45	Decane, 3,4-dimethyl-
10	7.809	5123003	7.99	1495801	12.16	4-Ethyl-5-hydroxy-3,5-dimethylfuran-2-one
11	8.350	1461201	2.28	377394	3.07	1-(2-Ethylcrotonoyl) urea
12	8.806	31586	0.05	35974	0.29	4,5-Dimethoxy-6-nitropyridin-2-ol
13	8.996	164517	0.26	55122	0.45	2,4,6-Octatrienal
14	9.101	27172	0.04	25877	0.21	5-Allyl-6-methyl-2-phenyl-5,6-dihydro-4H-oxazolo[4,5-c] pyridin-7-one
15	9.360	264927	0.41	58040	0.47	3a,4,5,6,7,7a-Hexahydro-4,7-methanoindene
16	9.569	64556	0.10	31353	0.25	4-Piperidinol, 4-ethynyl-1-methyl-
17	9.929	386798	0.60	138747	1.13	3-Buten-1-ol, TMS derivative

18	10.366	40688	0.06	29181	0.24	3-(Aminomethyl)-1-ethylpyrazol-4-amine
19	10.599	86053	0.13	51535	0.42	Cyclopentasiloxane, decamethyl-
20	10.988	86251	0.13	33909	0.28	Nonane, 4,5-dimethyl-
21	11.279	45743	0.07	33067	0.27	Carbonic acid, di(decyl) ester
22	11.681	286554	0.45	87550	0.71	1-Undecene
23	11.803	2494065	3.89	863154	7.02	Dodecane

Similarly, the GC–MS chromatogram of the ethanol extract of the *M. zanguebarica* stem displayed 23 peaks. The predominant compounds were pyrrolidine-2,4-dione (RT 5.846 min; 44.90%), 3-hexanol, 3-methyl (RT 4.037 min; 26.78%), and 4-ethyl-5-hydroxy-3,5-dimethylfuran-2-one (RT 7.809 min; 7.99%). Other minor compounds such as dodecane (3.89%), 1-undecene, and various decane derivatives were also detected.

The recurring detection of pyrrolidine-2,4-dione in both leaf and stem extracts reinforces its significance as a potentially active compound, consistent with the known pharmacological versatility of pyrrolidine-based molecules (Poyraz et al., 2023). The presence of aliphatic alcohols, furanones, and hydrocarbons further suggests that the stem extract may contain compounds contributing to antimicrobial, antioxidant, and allelopathic activities. Previous reports have demonstrated that the hexane bark extract of M. zanguebarica exhibited significant antidermatophytic activity, indicating its potential for use in the development of novel antifungal drugs (Shyamala gowri Shanmugasundaram., 2020). Moreover, the methanolic flower extract has shown cytotoxic effects against cervical cancer cells, confirming the plant's anticancer potential (Aksaradevi et al., 2022). These findings support the traditional and ethnomedicinal uses of the species in treating various ailments.

The test plant showed both leaf and stem extracts of Majidea zanguebarica exhibit a rich diversity of bioactive secondary metabolites, validating its

traditional therapeutic use. The GC–MS results provide a chemical basis for its pharmacological potential and highlight the need for bioassay-guided fractionation and in vitro/in vivo testing to confirm biological activities

Summary and Conclusion

The present study focused on the phytochemical screening and GC–MS analysis of the leaf and stem extracts of M. zanguebarica using ethanol and distilled water as solvents of differing polarity. The extracts revealed the presence of several bioactive phytoconstituents, including alkaloids, flavonoids, tannins, phenolics, saponins, steroids, glycosides, and terpenoids, which are responsible for a wide range of pharmacological activities such as antioxidant, antimicrobial, and anti-inflammatory effects.

The present investigation confirmed that the ethanol extracts of M. zanguebarica contain valuable phytochemicals such as steroids, tannins, and cardiac glycosides, validating their medicinal importance. Based on these findings, it can be concluded that Majidea zanguebarica is a promising medicinal plant with broad-spectrum pharmacological significance. The leaf and stem extracts may serve as rich sources of antioxidant and antimicrobial agents, making them useful in drug formulation and development. Overall, the study provides scientific evidence supporting the traditional uses of M. zanguebarica and highlights its potential for pharmaceutical, nutraceutical, and biotechnological applications.

Future work involving HPTLC profiling, antioxidant assays, and antimicrobial studies will further elucidate the plant's bioactive components and mechanisms of action. To date, no clinical trials have been reported, suggesting that the plant remains an underexplored source of potential therapeutic agents. However, further studies are required for the isolation, purification, and structural characterization of the individual active compounds responsible for these effects.

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