IJBPAS, December, 2026, 15(12): 6267-6275

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

GC–MS ANALYSIS OF THE STEM EXTRACT OF *RHYNCHOTECHUM PERMOLLE* (NEES) B.L. BURTT

MIDHUN NK[1], SARAVANAMOORTHY MD[2*] AND ABDUSSALAM AK[3]

1: Research Scholar, PG & Research Department of Botany, Thanthai Periyar Govt. Arts and Science College (Autonomous, Affiliated to Bharathidasan University) Tiruchirapally, PIN 620023, Tamil Nadu, India

2: Associate Professor in Botany, PG & Research Department of Botany, Thanthai Periyar Govt. Arts and Science College (Autonomous, Affiliated to Bharathidasan University) Tiruchirapally, PIN 620023, Tamil Nadu, India

3: Assistant Professor, Department of Botany, Sir Syed College (Affiliated to Kannur University), Taliparamba, Kannur, PIN 670142, Kerala, India

***Corresponding Author: Dr. Saravanamoorthy M.D: E Mail: callmedrmds@gmail.com**

Received 25th June 2026; Revised 28th July 2026; Accepted 12th Oct. 2026; Available online 1st Dec. 2026

https://doi.org/10.31032/IJBPAS/2026/15.12.10736

ABSTRACT

The family Gesneriaceae represents a diverse group of flowering plants with significant ornamental and medicinal value. Many species belonging to this family are cultivated worldwide as ornamental plants due to their attractive foliage and vibrant flowers. In addition to their ornamental importance, several members of Gesneriaceae have been traditionally used in various medicinal systems for the treatment of different health conditions. Phytochemical studies have revealed that these plants contain a wide range of secondary metabolites, including glycosides, steroids, saponins, flavonoids, and terpenoids, which are associated with various biological and pharmacological activities. The composition and abundance of these phytoconstituents may vary considerably among different species and plant parts, such as leaves, stems, roots, and flowers, contributing to variations in their biological potential. Several investigations have highlighted the diverse pharmacological properties of Gesneriaceae members, including antioxidant, antimicrobial, anti-inflammatory, and wound-healing activities. These biological effects are largely

attributed to the presence of diverse bioactive compounds that may play important roles in combating oxidative stress, microbial infections, and inflammatory responses. Consequently, extracts and isolated phytoconstituents from this family have gained increasing attention as potential sources of natural therapeutic agents. The remarkable phytochemical diversity and biological potential of Gesneriaceae underscore its importance in natural-product research and highlight the need for further systematic investigations to identify, characterize, and evaluate its bioactive constituents for possible pharmaceutical and medicinal applications.

Keywords: GCMS, Gesneriaceae, methanol, hexane

INTRODUCTION

Rhynchotechumpermolle is commonly found in moist, shaded habitats, particularly in tropical forests, along streams, and on riverbanks. The plant typically grows to a height of approximately 18–65 cm and possesses alternate leaves with serrate to denticulate margins. Its flowers are characterized by a white, distinctly bilabiate corolla .The genus *Rhynchotechum* has considerable ethnobotanical importance, with several species traditionally utilized by indigenous communities, particularly in Northeast India. The fleshy fruits of these plants are dispersed by birds, suggesting that avian fauna play an important role in their natural propagation and ecological distribution. In *R. permolle*, the inflorescence is relatively inconspicuous. Species of *Rhynchotechum* have been traditionally employed by various indigenous communities for diverse purposes, including food, medicinal applications, smoking materials, and fibre production, reflecting their ecological and ethnobotanical significance.

Phytochemistry is a branch of science concerned with the investigation of chemical constituents derived from plants, particularly secondary metabolites, including their isolation, identification, characterization, chemical properties, and biological activities. Plant-derived compounds have gained considerable importance owing to their applications in pharmaceutical, agricultural, cosmetic, fragrance, and other industrial sectors. Analytical techniques such as Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC) are widely employed for the separation, detection, and characterization of chemical constituents present in plant extracts. Gas Chromatography is particularly useful for analysing volatile and semi-volatile compounds based on their interaction with the stationary phase and their distribution within the mobile gas phase. When coupled with Mass Spectrometry (GC–

MS), this technique enables the identification of chemical constituents based on their chromatographic retention behaviour and mass spectral fragmentation patterns, providing valuable information about the phytochemical composition of plant extracts.

Fresh plant materials, including leaves, stems, roots, and flowers, generally contain considerable moisture, which may interfere with solvent extraction and reduce the efficiency of extracting phytoconstituents. Therefore, plant materials are commonly subjected to preliminary drying before extraction to reduce moisture content and improve extraction efficiency. Soxhlet extraction is a conventional and widely employed technique for extracting soluble phytochemicals from dried plant materials. It facilitates continuous extraction through repeated cycles of solvent evaporation, condensation, and contact with the plant material, allowing efficient recovery of extractable compounds with relatively limited solvent consumption. However, the prolonged exposure of plant materials to elevated temperatures during Soxhlet extraction, particularly when high-boiling-point solvents are employed, may adversely affect thermolabile constituents. Such conditions can potentially cause thermal degradation, chemical transformation, or loss of heat-sensitive compounds, which may influence the overall phytochemical composition and biological properties of the resulting extract.

MATERIALS AND METHODS

GC - MS analysis

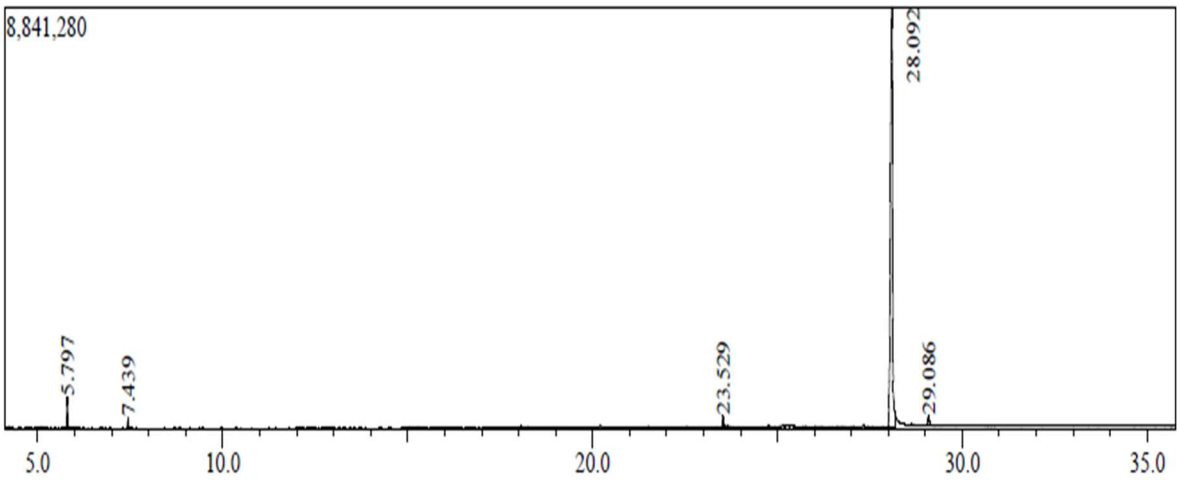
Rhynchotechum permolle is commonly found in moist, shaded habitats, particularly in tropical forests, along streams, and on riverbanks. The plant typically grows to a height of approximately 18–65 cm and possesses alternate leaves with serrate to denticulate margins. Its flowers are characterized by a white, distinctly bilabiate corolla **[3]**. The genus *Rhynchotechum* has considerable ethnobotanical importance, with several species traditionally utilized by indigenous communities, particularly in Northeast India. The fleshy fruits of these plants are dispersed by birds, suggesting that avian fauna play an important role in their natural propagation and

ecological distribution **[4]**. In *R. permolle*, the inflorescence is relatively inconspicuous **[5]**. Species of *Rhynchotechum* have been traditionally employed by various indigenous communities for diverse purposes, including food, medicinal applications, smoking materials, and fibre production, reflecting their ecological and ethnobotanical significance.

Phytochemistry is a branch of science concerned with the investigation of chemical constituents derived from plants, particularly secondary metabolites, including their isolation, identification, characterization, chemical properties, and biological activities. Plant-derived compounds have gained considerable importance owing to their applications in pharmaceutical, agricultural, cosmetic, fragrance, and other industrial sectors. Analytical techniques such as Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC) are widely employed for the separation, detection, and characterization of chemical constituents present in plant extracts. Gas Chromatography is particularly useful for analysing volatile and semi-volatile compounds based on their interaction with the stationary phase and their distribution within the mobile gas phase. When coupled with Mass Spectrometry (GC–MS), this technique enables the identification of chemical constituents based on their chromatographic retention behaviour and mass spectral fragmentation patterns, providing valuable information about the phytochemical composition of plant extracts. Fresh plant materials, including leaves, stems, roots, and flowers, generally contain considerable moisture, which may interfere with solvent extraction and reduce the efficiency of extracting phytoconstituents. Therefore, plant materials are commonly subjected to preliminary drying before extraction to reduce moisture content and improve extraction efficiency. Soxhlet extraction is a conventional and widely employed technique for extracting soluble phytochemicals from dried plant materials. It facilitates continuous extraction through repeated cycles of solvent evaporation, condensation, and contact with the plant material, allowing efficient recovery of extractable compounds with relatively limited solvent consumption. However, the prolonged exposure of plant materials to elevated temperatures during Soxhlet extraction, particularly when high-boiling-point solvents are employed, may adversely affect thermolabile constituents. Such conditions can potentially cause thermal degradation, chemical transformation, or loss of heat-sensitive compounds, which may influence the overall phytochemical composition and biological properties of the resulting extract.

Hexane stem

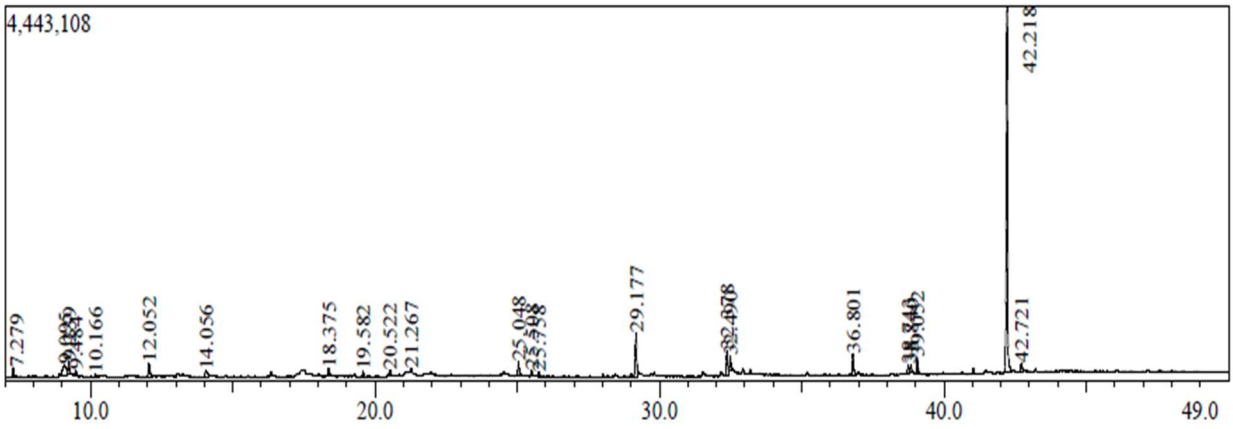
Peaks	RT	Area %	Name of compound	Biological activity
1	5.797	2.82	Undecane	Anti-bacterial activity (Bhattacharjee *et al*., 2006) [1]
2	7.439	1.00	Dodecane	Anti-microbial, anti-bacterial, anti-fungal activities (Keke *et al*., 2023) [2]
3	23.529	1.31	Hexanedioic acid, bis (2-ethylhexyl) ester	-
4	28.092	93.48	Dioctyl isophthalate	-
5	29.086	1.92	Squalene	-



5 bioactive compounds have been identified in the hexane stem extract of *Henckelia humboltiana*. The major bio active compounds Undecane which shows anti-bacterial activity, Dodecane has anti-bacterial and anti-fungal activities. Other compounds include Hexanedioic acid, bis(2-ethylhexyl) ester, Dioctyl isophthalate and Squalene.

Methanol stem

Peaks	RT	Area %	Name of compound	Biological activity
1	9.239	1.84	4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl-	Anti-oxidant activity (Chen *et al*., 2021) [3]
2	9.484	0.79	3-Pyridinecarboxamide, N-methyl-	Vascular and anti-thrombotic effects Przygodzki, *et al*., 2012) [4]
3	10.166	0.48	2-Pyrrolidinone, 5-(hydroxymethyl)-	-
4	12.052	2.81	1,2,3-Propanetriol, 1-acetate	-
5	14.056	1.43	2-Methoxy-4-vinylphenol	Anti-inflammatory and anti-oxidant (Asami, *et al*., 2023) [5]
6	18.375	1.38	1-(4-Ethoxyphenyl)propan-1-ol	-
7	19.582	0.82	Benzoic acid, 4-ethoxy-, ethyl ester	-
8	20.522	1.29	Dodecanoic acid	Anti-cancer activity (Wongtangtintharn *et al*., 2004) [6]
9	21.267	0.54	n-Tridecan-1-ol	-
10	25.048	2.00	Tetradecanoic acid	Anti-bacterial activity (Desbois *et al*., 2010) [7]
11	25.508	0.86	Triallyl cyanurate	-
12	25.758	0.54	1-Heneicosanol	Anti-microbial activity (Kumar *et al*., 2010) [8]
13	32.378	4.08	9,12-Octadecadienoic acid (Z,Z)-	Anti-Inflammatory and Immunomodulatory (Hagr *et al*., 2018) [9]
14	32.490	1.90	cis-9-Hexadecenal	Anti-Biofilm Effects & Cytotoxicity (Hoda *et al*., 2019) [10]
15	38.743	1.35	Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl)ethyl ester	Anti-microbial activity (Tyagi *et al*., 2017) [11]
16	38.840	1.09	Homopterocarpin	Anti-cancer, cytotoxic activity (Ajaegbu *et al*., 2023) [12]
17	39.052	2.04	Bis(2-ethylhexyl) phthalate	Anti-microbial and larvicidal properties (Javed *et al*., 2022) [13]
18	42.218	56.30	1,3-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester	Anti-tumor and cytotoxic activity (Habib *et al*., 2012) [14]
19	42.721	1.72	13-Docosenamide, (Z)-	Anti-microbial activity (Lake *et al*., 1991) [15]



19 bioactive compounds have been identified in the methanol stem extract of *Henckelia humboltiana*. The major bio active compounds include 4H-Pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- has anti oxidant activity, 2-Methoxy-4-vinylphenol has anti-inflammatory and anti-oxidant activity, Dodecanoic acid has anti-cancer activity, Tetradecanoic acid has anti-bacterial activity, 1-Heneicosanol has anti microbial activity, 1-Heneicosanol shoes antioxidant activity, 9,12-Octadecadienoic acid (Z,Z)- has anti iflammatoty and immune modulatory activity, Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester has anti-microbial activity, Homopterocarpin has anti-cancer ,cytotoxic activity, 13-Docosenamide, (Z)- has anti microbial activity.

DISCUSSION

GC–MS analysis of the hexane and methanolic stem extracts of *Henckelia humboldtiana* revealed the presence of several bioactive compounds with potential biological activities. A total of five compounds were identified in the hexane extract, while the methanolic extract contained 19 compounds, indicating greater chemical diversity in the methanolic extract. In the hexane extract, the major compounds identified included undecane and dodecane, which have been reported to possess antibacterial properties. Dodecane is also associated with antifungal activity. Other identified compounds included hexanedioic acid, bis(2-ethylhexyl) ester, dioctyl isophthalate and squalene, which are reported in association with various biological and chemical properties. The methanolic extract showed a wider range of phytochemical constituents. Among these, 4H-pyran-4-one, 2,3-dihydro-3,5-dihydroxy-6-methyl- and 2-methoxy-4-vinylphenol are associated with antioxidant activity. Dodecanoic acid has been reported to possess anticancer potential, while tetradecanoic acid and 1-heneicosanol are associated with antimicrobial activity. Additionally, 9,12-octadecadienoic acid (Z,Z)- has been reported to exhibit anti-inflammatory and immunomodulatory properties. Hexadecanoic acid, 2-hydroxy-1-(hydroxymethyl) ethyl ester and 13-docosenamide, (Z)- are also associated with antimicrobial activity. Homopterocarpin is particularly noteworthy because of its reported anticancer and cytotoxic properties.

REFERENCE

[1] Bhattacharjee, I., *et al*. (2006). "Antibacterial potential of essential oils against human pathogens." *Indian Journal of Experimental Biology*, 44(8), 626-629.

[2] Keke, C. O., Nsofor, W. N., Kumabia, F. K. R., Iloabuchi, G. C., Ejiofor, J. C., & Osuagwu, O. L. (2023). GCMS and FTIR analysis of ethanol and methanol leave extract of *Urena lobata* (*Caesar weed*) for bioactive phytochemical constituents. *Journal of Drug Delivery and Therapeutics*, *13*(1), 99-115.

[3] Chen, Z., Xi, G., Fu, Y., Wang, Q., Cai, L., Zhao, Z., & Ma, Y. (2021). Synthesis of 2, 3-dihydro-3, 5-dihydroxy-6-methyl-4H-pyran-4-one from maltol and its taste identification. *Food Chemistry*, *361*, 130052.

[4] Przygodzki, T., Grobelski, B., Kazmierczak, P., & Watala, C. (2012). N-Methyl-2-pyridone-5-carboxamide is 1-methylnicotinamide metabolite of low cyclooxygenase-dependent vasodilating activity. *Journal of physiology and biochemistry*, *68*(3), 329-334.

[5] Asami, E., Kitami, M., Ida, T., Kobayashi, T., & Saeki, M. (2023). Anti-inflammatory activity of 2-methoxy-4-vinylphenol involves inhibition of lipopolysaccharide-induced inducible nitric oxidase synthase by heme oxygenase-1. *Immunopharmacology and Immunotoxicology*, *45*(5), 589-596.

[6] Wongtangtintharn S. *et al*., "Medium-chain fatty acids suppress proliferation of human breast cancer cells in vitro." *J Nutr*. 2004;134(6):1419–1424.

[7] Desbois, A. P., & Smith, V. J. (2010). Antibacterial free fatty acids: activities, mechanisms of action and biotechnological potential. *Applied Microbiology and Biotechnology*, 85(6), 1629–1642.

[8] Kumar, P. P., *et al*. (2010). *Antioxidant and cytotoxic activities of fatty acids isolated from medicinal plants.* Journal of Pharmacy Research, 3(11)**,** 2752–2756.

[9] Hagr, T. E., Ali, K. S., Satti, A. A. E., & Omer, S. A. (2018). GC-MS analysis, phytochemical, and antimicrobial activity of sudanese *Nigella sativa* (L) oil. *Eur. J. Biomed. Pharmaceut. Sci*, *5*(4), 23-29.

[10] Hoda, S., Gupta, L., Agarwal, H., Raj, G., Vermani, M., & Vijayaraghavan, P. (2019). Inhibition of Aspergillus fumigatus Biofilm and Cytotoxicity Study of Natural Compound Cis-9-Hexadecenal. *Journal of Pure & Applied Microbiology*, *13*(2).

[11] Tyagi, T., & Agarwal, M. (2017). GC-MS analysis of invasive aquatic weed, Pistia stratiotes L. and Eichhornia crassipes (Mart.) Solms. *Int. J. Curr. Pharm. Res*, *9*(3), 111-117.

[12] Ajaegbu, E. E., Eboka, C. J., Okoye, F. B. C., & Proksch, P. (2023). Cytotoxic effect and antioxidant activity of pterocarpans from *Millettia aboensis* root. *Natural product research*, *37*(5), 829-834.

[13] Javed, M. R., Salman, M., Tariq, A., Tawab, A., Zahoor, M. K., Naheed, S., ... & Ali, H. (2022). The antibacterial and larvicidal potential of bis-(2-ethylhexyl) phthalate from *Lactiplanti bacillus* plantarum. *Molecules*, *27*(21), 7220.

[14] Habib, M. R., & Karim, M. R. (2012). Antitumour evaluation of di-(2-ethylhexyl) phthalate (DEHP) isolated from *Calotropis gigantea* L. flower. *Acta Pharm*, *62*(4), 607-615.

[15] Lake, B. G., *et al*. (1991). "Peroxisome proliferation and hepatocarcinogenicity of di(2-ethylhexyl) adipate and related compounds." *Toxicology and Applied Pharmacology*, 111(3), 455–468.