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GC-MS analysis of methanolic extract of flowers of *Polianthes tuberosa L*

Chantra I*, Pravin Kumar S, Daniel Raj N, Lokeswari P, Gayathri S, Sevvanthi D
Department of Pharmaceutical Chemistry, College of Pharmacy, Madurai Medical College, Madurai, Tamil Nadu, India

Abstract
The present study aimed to identify the phytochemical constituents of the methanolic flower extract of *Polianthes tuberosa L.*, using Gas Chromatography–Mass Spectrometry (GC–MS). Fresh flowers were collected from Srivilliputtur, Tamil Nadu, authenticated, and subjected to methanolic extraction. The GC–MS analysis revealed 69 phytoconstituents belonging to different chemical classes, including flavonoids, terpenoids, fatty acids, sterols, and tocopherols. Major compounds such as 4′,5-dihydroxy-7-methoxyflavanone (23.40%), cis-9-hexadecenal (22.11%), n-hexadecanoic acid (14.18%), octadecanoic acid (6.37%), γ-sitosterol (4.69%), squalene (3.91%), and phytol (3.62%) were identified as key constituents. These compounds are associated with significant pharmacological activities such as antioxidant, anti-Alzheimer's, antimicrobial, and cytoprotective effects. The findings suggest that *Polianthes tuberosa L.*, is a valuable source of bioactive molecules and supports its traditional medicinal applications, providing a scientific foundation for future studies focused on its therapeutic potential and compound isolation.

Keywords: *Polianthes tuberosa L*, GC–MS analysis, methanolic extract, phytoconstituents

Introduction

Polianthes tuberosa L., is a fragrant flowering plant that belongs to the family Agavaceae, though some taxonomists classify it under Asparagaceae or Amaryllidaceae. Commonly referred to in English as the Double Pearl Tuberose, it is locally known as 'Rojonigondha'. It is a grass-like plant with underground storage bulb. Leaves are green; the flowering stem rises taller than the leaves and bears white fragrant flowers [1]. The plant is used for gonorrhoea, insomnia and low sex drive by people of Kolli hills, Namakkal district, Tamil Nadu, India. In the Dominican Republic, Polianthes tuberosa flowers are consumed as tea to support women's health [1]. The species, originally native to Mexico, is valued for its fragrant blooms. The single-flowered varieties (with a single row of perianth segments) are primarily used for essential oil extraction, garland making, and loose flower trade, while the double-flowered types (with multiple rows of perianth segments) are preferred for cut flower arrangements and ornamental gardening. The single varieties possess a stronger fragrance and yield about 0.08–0.14% concrete, which is an important ingredient in premium perfumes. In India, tuberose is commercially cultivated across several regions, including West Bengal (Bagnan, Kolaghat, Midnapur, Panskura, Ranaghat, Krishnanagar), Tamil Nadu (Coimbatore, Dindigul, Kadalur, Krishnagiri, Dharmapuri, Sathyamangalam, Virudhunagar, Theni, and Madurai), Maharashtra (Pune, Nashik, Ahmednagar, Thane, Sangli), and Andhra Pradesh (East Godavari, Guntur, Chittoor, and Krishna districts) [2].

Taxonomic Hierarchy of *Polianthes tuberosa L*, [1]

Kingdom	Plantae
Sub-kingdom	Tracheobionta
Division	Magnoliophyta
Class	Liliospida
Sub-class	Liliidae
Order	Liliales
Family	Agavaceae
Genus	Polianthes
Species	*Polianthes tuberosa L.*

Materials and Methods

Plant Collection and Authentication

Polianthes tuberosa L., flowers were collected from Srivilliputtur, Tamil Nadu during the month of May 2025. The plant species used in the present study was identified and verified by Dr. Stephen, Professor, Department of Botany American College, Madurai - 625 002.

Preparation of Plant material

The flowers of the plant washed thoroughly in tap water to remove soil particles and other adhered debris and finally rinsed with sterile distilled water. The flowers were air dried for extraction air dried under shade at room temperature and coarsely powdered in a mixer. The powdered sample was either stored for later use or directly utilized for the extraction process.

Extraction of Plant Material

Flower extraction (Methanolic extraction)

For each powder samples (150 g) were macerated successively at room temperature using methanol (1.5 L) for 3 x 24 hours respectively. Each extract was evaporated using rotary evaporator at 50oC, dried completely and stored in tight container [3].

Gc-Ms Instrument

The GC–MS analysis of the methanolic flower extract of *Polianthes tuberosa L.*, was performed using a Shimadzu GC–MS QP2020NX system under the following conditions: the sample was injected in split mode (split ratio 10:1) at an injection temperature of 250 °C. Separation was achieved on an SH-5Sil MS capillary column operated under linear velocity flow control with a column flow rate of 1.50 mL/min. The oven temperature was programmed to increase from 50 °C to 280 °C at a rate of 10 °C/min. The ion source

and interface temperatures were maintained at 250 °C and 270 °C, respectively, with a solvent cut time of 3 minutes.

Results and Discussion

The bioactive compounds present in methanolic extract of *Polianthes tuberosa L.,* were identified by GC-MS analysis. The methanolic extracts of *Polianthes tuberosa L.*, indicated the presence of different types of Phytoconstituents Table 1 screened under different retention times (R.T) and Area. A total of 69 Phytoconstituents were observed with Retention times and Area for *Polianthes tuberosa L.,* methanolic flower extract as shown in Fig.1 Phytoconstituents were identified using spectral database in the GC–MS. The compounds prediction is based on Pubchem [4]. The compound name with R.T (Retention Time), molecular formula, molecular weight, Area percentage (Area %) in the methanolic extract of flower of *Polianthes tuberosa L.,* are presented in Table 1. The compound with the highest area percentage (23.40 %) in the GC-MS analysis of *Polianthes tuberosa L.,* flower extract is 4', 5-Dihydroxy-7-methoxyflavanone, which has a retention time of 23.928 minutes. This compound exhibits the largest peak in the chromatogram, indicating its dominant presence in the sample. Followed by, the compounds exhibit Phytol, Genkwanin, Squalene, n-Hexadecanoic acid, cis-9-Hexadecenal, Octadecanoic acid, Campesterol, Gamma -Sitosterol, Bis(2-ethylhexyl) phthalate the area % of 3.62%, 1.73%, 3.91%, 14.18%, 22.11%, 6.37%, 3.16%, 4.69%, 1.49% and with the retention time of 19.424, 25.099, 25.218, 18.012, 19.702, 19.892, 24.560, 26.535, 22.979 respectively.

Bioactive compounds identified in the methanolic extract of flower of *Polianthes tuberosa L.*, By Gc-Ms Analysis

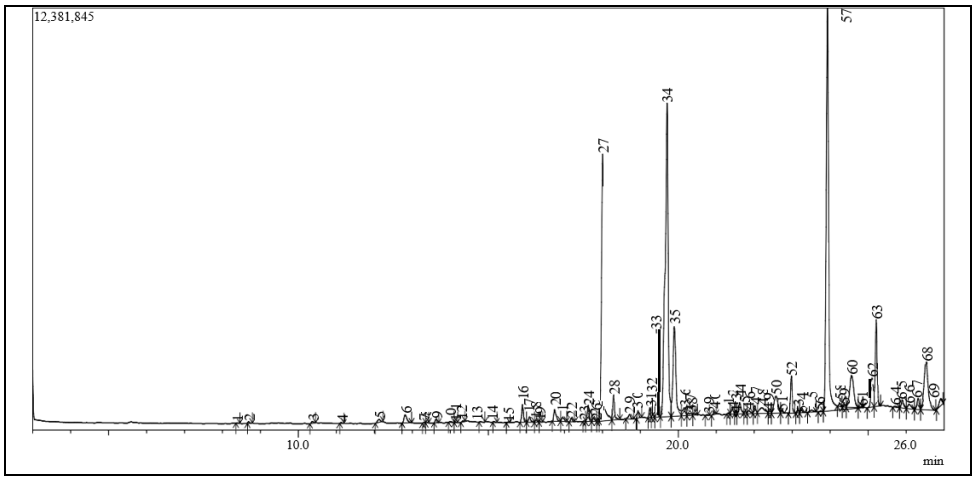

Fig 1: GC-MS Chromatogram of methanolic extract of flower of *Polianthes tuberosa L.*

Table 1: GC-MS Analysis and Mass Spectral Data of Methanolic extract of *Polianthes tuberosa L.,* flower Showing Molecular formula, Molecular weight, Retention time, Area %

Peak#	Mol. Formula	Mol. Weight	Name of the Bioactive Compounds	Retention time	Area%
1	$C_8H_{16}O_2$	144	Octanoic acid	8.381	0.02
2	C_6H_9NO	111	4-Methyl-2-oxopentanenitrile	8.689	0.07
3	$C_9H_{20}O$	114	3-Ethyl-3-heptanol	10.367	0.09
4	$C_{11}H_{22}O_2$	172	n-Decanoic acid	11.125	0.04
5	$C_{12}H_{22}O_{11}$	342	Sucrose, alpha-D-Glucopyranoside, beta-D -fructofuranosyl	12.121	0.20
6	$C_6H_{10}O_5$	162	beta-D-Glucopyranose, 1,6-anhydro-	12.810	0.57
7	$C_{10}H_8O_2$	160	4H-1-Benzopyran-4-one, 2-methyl-	13.303	0.03
8	$C_{11}H_{16}O_2$	180	2(4H)-Benzofuranone, 5,6,7,7a-tetrahydro-4,4,7a -trimethyl-	13.378	0.03
9	$C_{12}H_{24}O_2$	200	n-Dodecanoic	13.623	0.14
10	$C_{12}H_{14}O_4$	222	Diethyl Phthalate, 1,2-Benzenedicarboxylic acid, diethyl ester	13.985	0.06
11	$C_{17}H_{36}$	226	Hexadecane, n-Cetane	14.127	0.03
12	$C_7H_{14}O_6$	194	beta-D-Glucopyranoside, methyl	14.331	0.05
13	$C_{17}H_{30}O_2$	266	Undec-10-ynoic acid, hexyl ester	14.780	0.01
14	$C_{14}H_{20}O_3$	236	- Spirio-10-(2,11- dioxabicyclo [4.4.1] undeca-3,5-diene)-2'-(oxirane), 1,3,7,7-tetramethyl	15.145	0.04
15	$C_{15}H_{30}O_2$	242	Methyl tetradecanoate	15.519	0.02
16	$C_{14}H_{28}O_2$	228	Tetradecanoic acid	15.897	0.73
17	$C_{11}H_{16}O_3$	196	6-Hydroxy-4,4,7a-trimethyl-5,6,7,7a-tetrahydro benzo furan-2(4H)-one	16.082	0.28
18	$C_{13}H_{26}O_2$	214	Undecanoic acid, ethyl ester	16.262	0.12
19	$C_{16}H_{34}$	226	Hexadecane	16.354	0.04
20	$C_{20}H_{38}$	278	Neophytadiene, 7,11,15-Trimethyl-3-methylene hexadec-1-ene	16.743	0.66
21	$C_{15}H_{30}O_2$	242	Pentadecanoic acid	16.952	0.25
22	$C_{20}H_{38}$	278	Neophytadiene	17.186	0.15
23	$C_{18}H_{30}O$	262	5,9,13-Pentadecatrien-2-one, 6,10,14-trimethyl	17.505	0.03
24	$C_{17}H_{34}O_2$	270	Hexadecanoic acid, methyl ester	17.628	0.66
25	$C_{16}H_{30}O_2$	254	6-Pentadecenoic acid, 13-methyl-, (6Z)-	17.775	0.16

26	$C_{12}H_{22}O$	182	13-Oxabicyclo [10.1.0] tridecane	17.865	0.01
27	$C_{16}H_{32}O_2$	256	n-Hexadecanoic acid	18.012	14.18
28	$C_{18}H_{36}O_2$	284	Hexadecanoic acid, ethyl ester	18.297	1.09
29	$C_{16}H_{26}O$	234	cis, cis, cis-7,10,13-Hexadecatrienal	18.715	0.25
30	$C_{17}H_{34}O_2$	270	Heptadecanoic acid	18.939	0.29
31	$C_{19}H_{34}O_2$	294	9,12-Octadecadienoic acid (Z, Z)-, methyl ester	19.251	0.34
32	$C_{19}H_{36}O_2$	296	6-Octadecenoic acid, methyl ester, (Z)-	19.312	0.70
33	$C_{20}H_{40}O$	296	Phytol	19.424	3.62
34	$C_{16}H_{30}O$	238	cis-9-Hexadecenal	19.702	22.11
35	$C_{18}H_{36}O_2$	284	Octadecanoic acid	19.892	6.37
36	$C_{20}H_{40}O_2$	312	Octadecanoic acid, ethyl ester	20.157	0.56
37	$C_{22}H_{42}O_2$	338	2-Hexadecen-ol, 3,7,11,15-tetramethyl-, acetate	20.330	0.19
38	$C_{21}H_{38}O_2$	322	8,11-Eicosadienoic acid, methyl ester	20.430	0.09
39	$C_{19}H_{38}O_2$	298	Nonadecanoic acid	20.760	0.03
40	$C_{22}H_{43}NO_2$	353	Dimethyl aminoethyl palmitate	20.947	0.09
41	$C_{21}H_{42}O_2$	326	Eicosanoic acid, methyl ester	21.324	0.05
42	$C_{16}H_{32}O_3S$	304	1,2-Oxathiane, 6-dodecyl-, 2,2-dioxide	21.420	0.28
43	$C_{21}H_{40}O_2$	324	4,8,12,16-Tetramethylheptadecan-4-olide	21.520	0.05
44	$C_{20}H_{40}O_2$	312	Eicosanoic acid	21.618	0.65
45	$C_{14}H_{26}O$	210	Tetradecahydrocyclododeca[c]furan	21.755	0.12
46	$C_{20}H_{38}O_2$	310	Ethyl Oleate	21.860	0.22
47	$C_{16}H_{14}O_4$	270	4H-1-Benzopyran-4-one, 2,3-dihydro-5-hydroxy-7 -methoxy-2-phenyl	22.014	0.37
48	$C_{27}H_{56}O$	396	1-Heptacosanol	22.199	0.80
49	$C_{22}H_{43}NO_2$	353	2- (Dimethyl amino) ethyl vaccenoate	22.395	0.14
50	$C_{29}H_{50}O_2$	430	dl-alpha-Tocopherol	22.572	1.65
51	$C_{25}H_{52}$	352	Pentacosane	22.730	0.12
52	$C_{24}H_{38}O_4$	390	Bis(2-ethylhexyl) phthalate	22.979	1.49
53	$C_{16}H_{14}O_4$	270	9-9-Methoxy-6a,11a-dihydro-6H-benzofuro[3,2-c] chromen-3-ol	23.155	0.10
54	$C_{22}H_{44}O_2$	340	Docosanoic acid	23.243	0.13
55	$C_{29}H_{60}$	408	Nonacosane	23.509	0.18
56	$C_{32}H_{48}O_6$	528	Dodecanoic acid, 1a,2,5,5a,6,9,10,10a-octahydro -5a-hydroxy-4-(hydroxymethyl)-1	23.730	0.04
57	$C_{16}H_{14}O_5$	286	4',5-Dihydroxy-7-methoxyflavanone	23.928	23.40
58	$C_{27}H_{56}$	380	2-Methylhexacosane	24.250	0.12
59	$C_{30}H_{50}O$	426	Cholest-5-en-3-ol, 24-propylidene-, (3beta.)-	24.390	0.12
60	$C_{28}H_{48}O$	400	Campesterol	24.560	3.16
61	$C_{20}H_{36}O_2$	308	Undec-10-ynoic acid, nonyl ester	24.825	0.05
62	$C_{16}H_{12}O_5$	284	Genkwanin, (Apigenin 7)	25.099	1.73
63	$C_{30}H_{50}$	410	Squalene	25.218	3.91
64	$C_{29}H_{50}O_4$	462	alpha-Tocospiro B	25.706	0.08
65	$C_{17}H_{14}O_6$	314	4H-1-Benzopyran-4-one, 5-hydroxy-2-(4-hydroxyphenyl)-6,7- dimethoxy	25.897	0.47
66	$C_{18}H_{35}Cl$	286	cis-1-Chloro-9-octadecene	26.079	0.36
67	$C_{18}H_{20}O_4Si$	328	Silane, dimethyldi(4-acetylphenoxy)-	26.314	0.63
68	$C_{29}H_{50}O$	414	gamma-Sitosterol	26.535	4.69
69	$C_{29}H_{48}O$	412	Stigmasta-5,24(28)-dien-3-ol, (3 beta.,24Z)-	26.918	0.50

The present GC–MS analysis revealed the presence of various classes of phytoconstituents including flavonoids, terpenoids, fatty acids, sterols, and tocopherols. Tables 1 is rich in structurally diverse metabolites that exhibit significant biological activities such as antioxidants [5, 6], Cytotoxicity activity [7], anthelmintic activity [8], antimicrobial activity [9], antihyperglycemic [10], Anti-Alzheimer's properties [11].

Conclusion

The GC–MS analysis of the methanolic flower extract of *Polianthes tuberosa L.*, revealed a diverse array of 69 bioactive compounds belonging to various phytochemical classes such as flavonoids, terpenoids, fatty acids, and sterols. Among these, 4′,5-dihydroxy-7-methoxyflavanone, cis-9-hexadecenal, and n-hexadecanoic acid were found in significant concentrations, indicating their major contribution to the plant's biological potential.

The presence of these compounds supports the traditional medicinal use of *Polianthes tuberosa L.*, and highlights its potential as a valuable source of natural Cytotoxicity activity [7], antioxidants [5, 6], Anti-Alzheimer's [11] and antimicrobial agents [9]. These findings provide a strong scientific foundation for further pharmacological investigations, isolation, and characterization of individual constituents. Future research focusing on *in vitro* and *in vivo* biological evaluations may establish *Polianthes tuberosa L.*, as a promising candidate for the development of novel herbal and therapeutic formulations.

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