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Investigations on the Availability of Bioactive Compounds in *Glycosmis mauritiana* (Lam.) Tanaka

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The present investigation was carried out to determine the available possible bioactive components of *Glycosmis mauritiana* (Lam.) Tanaka. The chemical composition of leaf, stem bark and root samples of *Glycosmis mauritiana* was investigated using GC MS, while the mass spectra of the compounds found in the extract was matched with the National Institute Standard and Technology (NIST) library. Totally, seventeen compounds were identified from the ethanolic leaf extract of *G. mauritiana*, of which 10 compounds were aliphatic and 7 were aromatic. In aromatic compounds, two belonged to fatty acids and sesquiterpenes, while one compound was alkaloid, alcohol and benzofuran. Among aliphatic compounds; four 4 compounds were belonged to fatty acids, two amide and remaining compounds belonged to carbinol, cyclic amino acids, spiro-compound and steroid respectively. This is the first report about the identification of active compounds from the leaf of *G. mauritiana*.

Keyword: *Glycosmis mauritiana*, Bioactive Compounds, GC-MS Analysis.

1. Introduction

Historically plants have played an important role in medicine. Through observations and experimentations, human beings have learnt that plants promote health and well-being. The use of these herbal remedies is not only cost effective but also safe and almost free from serious side effects[1]. Knowledge of plants and of healing properties has been closely linked from the time of human being's earliest social and cultural groupings[2]. Around 1700 species have been documented for their biological properties and drug action[3] and data is available for approximately 1200 species, especially those which are most frequently used in traditional Indian Systems of Medicines (ISM), resulting in a reasonable knowledge base. Because people in Indian villages often rely on traditional healing methods as their sole source of healthcare, collaboration between traditional ISM and modern biomedicine is essential for optimum improvements in the treatment of various diseases in these resource-poor settings[4].

1.1 Traditional Medicine

Knowledge of the medicinal plants used in the drugs of Traditional Systems of Medicine (TSM) has been of great significance, especially as a lead for the discovery of new single-molecule medicines for modern system of medicine. To determine the chemical nature of such compounds, isolation of a substance in pure form using various separation techniques, chemical properties and spectral characteristics are a prerequisite for establishing its correct structure. Thus, medicinal plants are used in crude or purified form in the preparation of drugs in different systems. In this context, *Glycosmis mauritiana* (Lam.) Tanaka (an important medicinal plant) was chosen to investigate

phytochemicals, their therapeutic values in order to prove its traditional usages for various ailments such as roots for dysentery and snake bite[5], leaves for gastritis[6], headache[7], eczema and skin diseases[8,9] by different tribals of India.

2. Materials and Methods

2.1 Collection of Plant Materials

The plant materials (leaves, stem bark and roots) of *Glycosmis mauritiana* belonging to the family Rutaceae, were collected from the Madras Christian College Campus, Tambaram, Tamil Nadu and its botanical identity was confirmed at French Institute Herbarium, Pondicherry. The herbarium specimens were deposited in the Department of Botany, Kanchi Mamunivar Centre for Post Graduate Studies, Lawspet, Pondicherry for further reference (Voucher no. DK & TE195).

2.2 Preparation of Plant Extract

The air dried powdered plant materials of leaf, was extracted successively in soxhlet extractor with ethanol. The material was dried in hot air oven at 40°C. Finally, the material was macerated using hot water with occasional stirring for 16 h and the water extract was filtered. The solvent extract was evaporated to remove the final traces of the solvent and then concentrated to use it for GC-MS Analysis.

2.3 Gas Chromatographic – Mass Spectrophotometric Analysis (GC-MS Analysis)

GC-MS analysis is the main research tool commonly employed to determine the composition of plant volatiles[10] and can identify pure compounds present at less than 1 nanogram level. GC-MS analysis was performed with GC Clarus 500 Perkin Elmer equipment. Compounds were separated on Elite-1 capillary column (100% Dimethylpolysiloxane). Oven temperature was programmed as follows: isothermal temperature at 50ºC for 2 min, then increased to 200ºC at the rate of 10ºC/min, then increased up to 280ºC at the rate of 5ºC/min held for 9 min. Ionization of the sample components was performed in the EI mode (70 eV). The carrier gas was helium (1.0 ml/min) and the sample injected was 2 µl. The detector was Mass detector turbo mass gold-Perkin Elmer. The total running time for GC was 36 min and software used was Turbomass 5.2. The individual constituents were identified by comparing their mass spectra with the spectra of known compounds stored in the spectral database, National Institute of Standards and Technology (NIST version year 2005).

3. Results and Discussion

The phytochemical components present in the ethanolic extracts of leaf, stem bark and root of *Glycosmis mauritiana* were identified by GC-MS analysis. Totally 17 compounds were identified in the ethanolic extracts of leaf (Table 1) of which 10 compounds were aliphatic and 7 compounds were aromatic groups. Among the 7 aromatic compounds 2 fatty acids, 2 sesquiterpenes and remaining were identified as alkaloid, alcohol and benzofuran. Air-dried leaves of *G. citrifolia* and *G. elongata* were individually extracted with chloroform by[11]. The extract of *G. citrifolia* yielded 5(6)-glutene-3α-ol, two sets onformers, (E)-dambullin and (Z)-dambullin, and (E)-methyldambullin and (Z)-methyldambullin by column chromatographic separation. *G. elongata* gave skimmianine and arborinine through similar treatment and methods.

Table 1: Phytochemical constituents of ethanol extract of leaf of *Glycosmis mauritiana*.

S.No.	Compounds in Leaves	Molecular Weight	Molecular formula	Type	Class
1	Octadecanoic acid	284	$C_{18}H_{36}O_2$	Aliphatic	Fatty acid
2	1, 19-Eicosadiene	278	$C_{20}H_{38}$	Aliphatic	Fatty acid
3	Methyl 8,11,14 Heptadecatrienoate	278	$C_{18}H_{30}O_2$	Aliphatic	Fatty acid

4	n-Hexadecanoic acid	256	$C_{16}H_{32}O_2$	Aliphatic	Fatty acid
5	3(5)-[[1,2-Dihydroxy-3-propoxy]hyl]-4-hydroxy-1H-pyrazole-5(3)-carboxamide rboxamide	231	$C_{15}H_{21}NO$	Aliphatic	Amide
6	Phenylacetic acid,2-methylphenyl ester	226	$C_{15}H_{14}O_2$	Aromatic	Fatty acid
7	(-)-Spathulenol	220	$C_{15}H_{24}O$	Aromatic	Sesquiterpene
8	Caryophyllene oxide	220	$C_{15}H_{24}O$	Aromatic	Sesquiterpene
9	Adrenalone	181	$C_9H_{11}NO_3$	Aliphatic	Steroid
10	3,7-Benzofurandiol, 2,3-dihydro-2,2-dimethyl-	180	$C_{10}H_{12}O_3$	Aromatic	Benzofuran
11	4-Acetamido-1-pentanol	145	$C_7H_{15}NO_2$	Aliphatic	Amide
12	4-Hydroxy-2-methylpyrrolidine-2-carboxylic acid	145	$C_6H_{11}NO_3$	Aliphatic	Cyclic amino acids
13	5-Hydroxypipecolic acid	145	$C_6H_{11}NO_3$	Aromatic	Alkaloid
14	Spiro[4.4]nonan-2-one	138	$C_9H_{14}O$	Aliphatic	Spiro Compound
15	Benzeneacetic acid	136	$C_8H_8O_2$	Aromatic	Fatty acid
16	3,4-Demethylcyclohexanol	112	C_8H_{16}	Aromatic	Alcohol
17	Cycloproply methyl carbinol	86	$C_5H_{10}O$	Aliphatic	Carbinol

From the stem bark 12 compounds were identified, of which 11 compounds were aliphatic and 5 compounds were aromatic (Table 2)[12]. isolated three quinolinone alkaloids, two acridone alkaloids and a flavones glycoside were isolated from the aerial parts of *G. mauritiana* and characterized by UV, IR and N. M. R. techniques.

Table 2: Phytochemical constituents of ethanol extract of stem bark of *Glycosmis mauritiana*.

S.No.	Compounds in Stem Bark	Molecular Weight	Molecular formula	Type	Class
1	Folic Acid	441	$C_{19}H_{19}N_7O_6$	Aromatic	Vitamin
2	Diisooctyl adipate	370	$C_{22}H_{42}O_4$	Aliphatic	Fatty acid
3	6-(Acridin-9-ylamino)-hexanoic acid	308	$C_{19}H_{20}N_2O_2$	Aliphatic	Fatty acid
4	Phytol	296	$C_{20}H_{40}O$	Aliphatic	Diterpene alcohol
5	Hexadecanoic acid, ethly ester	284	$C_{18}H_{36}O_2$	Aliphatic	Fatty acid
6	Oleic Acid	282	$C_{18}H_{34}O_2$	Aliphatic	Fatty acid
7	Ethyl 9-hexadecenoate	282	$C_{18}H_{34}O_2$	Aliphatic	Fatty acid
8	3-Choloro-5-methoxy-10H-acridin-9-one	259	$C_{14}H_{10}ClNO_2$	Aromatic	Acridine
9	2,4,5,6 - Tetrachloro-nicotinamide	259	$C_6H_2C_{l4}N_2O$	Aromatic	Vitamin
10	n-Hexadecanoic acid	256	$C_{16}H_{32}O_2$	Aliphatic	Fatty acid
11	Benzeneacetic acid, phenyl ester	212	$C_{14}H_{12}O_2$	Aromatic	Fatty acid
12	3,7-Benzofurandiol, 2,3-dihydro, 2-dimethyl-	180	$C_{10}H_{12}O_3$	Aromatic	Benzofuran

13	Benzeneacetic acid, ethyl ester	164	$C_{10}H_{12}O_2$	Aliphatic	Fatty acid
14	Cyclopentane,1,2-dimethyl-3-(1-methylethenyl)-	138	$C_{10}H_{18}$	Aliphatic	Fatty acid
15	Benzeneacetic acid	136	$C_8H_8O_2$	Aliphatic	Fatty acid
16	N-Isobutyl-sec-butylamine	129	$C_8H_{19}N$	Aliphatic	Amine

From the root extract totally 9 compounds were identified, of which 7 compounds were aromatic and two belonged to aliphatic groups (Table 3)[13]. Reported sulfur-containing amides from *Glycosmis* Species.

Table 3: Phytochemical constituents of ethanol extract of root of *Glycosmis mauritiana*.

S.No.	Compounds in Root	Molecular Weight	Molecular formula	Type	Class
1	3-Isoxazolecarboxamide, 5-phenyl-	278	$C_{17}H_{14}N_2O_2$	Aromatic	Amide
2	p-Bis(phenylethynyl)benzene	278	$C_{22}H_{14}$	Aromatic	hydrocarbon
3	Benzidine, 3,3'dimethoxy	244	$C_{14}H_{16}N_2O_2$	Aromatic	Amine
4	Cyclohexanemethanol, 4-ethenyl-α,α,4-trimethyl-3-(1-methylethenyl)-, [1R-(1α,3α,4β)]-	222	$C_{15}H_{26}O$	Aromatic	Alcohol
5	Benzonitrile, 2-[1,5-dihydro-3-(	184	$C_{10}H_8N_4$	Aromatic	Polyphenolic cyanide
6	Benzene, 1-butyl-4-methoxy-	164	$C_{11}H_{16}O$	Aromatic	hydrocarbon
7	4-(1H-Pyrazol-1-yl)benzeneamine	159	$C_9H_9N_3$	Aromatic	Amine
8	Ethanamine 2-phenoxy	137	$C_8H_{11}NO$	Aliphatic	Amine
9	1-Octanamine	129	$C_8H_{19}N$	Aliphatic	Amine

From the present study, it is concluded the leaves, stem bark and root extracts of *G. mauritiana* are very rich in variety of secondary metabolites/phytochemicals, which might be responsible for various pharmacological properties. It is strongly suggested that this medicinal plant needs further research in multifaceted arena of natural products to isolate, characterize and elucidate the structure of bioactive molecules to undergo the clinical trials to develop a safety and efficacious plant-based natural drug for various ailments in the point of health security.

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