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Original Research Article

GC-MS Determination of Bioactive Compounds of *Dendrophthoe falcata* (L.F) Ettingsh: An Epiphytic Plant

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ABSTRACT

In this study, the bioactive compounds of *D.falcata* leaf and stem have been evaluated using GC-MS techniques. The Chemical composition of the ethanol extract of leaf and stem of *D.falcata* was, investigated using Perkin - Elmen has chromatography mass spectrometry. This analysis revealed the presence of Dendrophthoe falcata Dibutyl phthalate (13.26%), n-Hexadecanoic acid (13.02%), 1,3,4,5 - Tetrahydroxy-Cyclohexan (8.43%), 2,4-Imidazolidinedione, 1 – [[5-Nitro-2-(uranyl)Methylene] Amino] (6.36%), Z,E-2-Methyl-3, 13-Octadecadien-1-o1 (6.19%), Geranyl linalool Isomer-B (4.82%), Phthalic acid, 5-methylhex-2-yl butyl ester (4.28%), 1,2,3-Benzenetriol (Pyrogallol) (4.17%), 1-Octadecanol (3.99%), 9-Octadecenoic acid (Z) (3.99%), Phthalic acid, bis-(10-hydroxy decyl ester) (3.71%), 2,6,10-Trimethyl, 14-Ethylene-14-pen (3.52%), in the leaf and squalene (68.70%), 1,2-Benzenedicarboxylic acid, Diethyl ester (5.51%), 1,2-Benzenedicarboxylic acid (3.42%), 3-Methylhenicosane (3.15%), Phthalic acid, butyl oct-3-yl ester (2.42%), 2,6-Dimethylbenzenenethiol, S-(tert-butyldimethylsilyl) (1.75%), in the stem. The compounds found in the study are reported to possess antioxidants, anti-inflammatory, anticancer, cytotic, diuretic and antimicrobial activities. The results of this study offer a platform to reconfirm the properties of the components in *D.falcata* that are used as different ailments.

Keywords: *Dendrophthoe falcata*, Bioactive Compounds, Dibutyl phthalate, Squalene.

INTRODUCTION

The plant that possess therapeutic properties or exert beneficial pharmacological effects on the animal body are generally designated as “Medicinal plants”. According to WHO consultative group on medicinal plants, “A medicinal plant is any plant which, is one or more of its organs contains substances that can be used for therapeutic purposes or which, is a precursor for synthesis of useful drugs. The constitutions of the plants are numerous in every sector of human life. [1] Many naturally occurring chemicals from plants exhibit a broad spectrum of pharmacological profile. These plant chemicals are classified as primary or secondary metabolites. The primary metabolites include the common sugars, amino acids, proteins, purines and pyrimidines of nucleic acids and chlorophyll. Secondary metabolites are the remaining plant chemicals which are produced from the primary metabolites.

These includes alkaloids (derived from amino acids), terpenoids (a group of lipids), phenolics (derived from carbohydrate) tannins, steroids and volatile oil. [2]

Dendrophthoe falcata is a large bushy evergreen parasitic plant species generally found growing on various host plants in tropical and sub-tropical regions of the world. It belongs to the Loranthaceae family. It is a partial stem parasite which depends on the host for water and minerals. *D. falcata* has a wide range of host and is known to parasitize on 401 plant species. *D. falcata* is a plant of immense medicinal value. It is useful in the treatment of pulmonary tuberculosis, asthma, menstrual disorders, constipation, insanity, diarrhea, dysentery, arthritis, leucorrhoea, rheumatism, skin diseases, impotency, wound swelling, paralysis, ulcers, hemorrhage, miscarriage, kidney and gall bladder stone. This parasitic plant is reported to contain biological active substances such as flavonoid, quercetin, kaempferol, rutin, tannins, sit sterol, stigmasterol, amyrin and oleanolic acid. Taking into consideration of the medicinal importance of this plant, the ethanol extract of stem and leaf of *Dendrophthoe falcata* were analyzed for the first time using GC-MS. Persual of literature reveals that information on the GC-MS analysis of *D. falcata* is totally lacking. Hence, the objective of the present study is to identify the phytoconstituents with the aid of GC-MS technique.

RELATED WORK

The presence of diverse secondary metabolites has been reported from species of *Dendrophthoe falcate*. It has been shown that *in vitro* screening methods could provide the needed preliminary observations necessary to elect crude plant extracts with potentially useful properties for further chemical and pharmacological investigations.

MATERIALS AND METHODS

The whole plant of *Dendrophthoe falcata* (L.F) Ettingsh was collected from the Puthalam, Kanyakumari Dist, Tamil Nadu. The Leaf and Stem were shaded dried and pulverized to powder in a mechanical grinder. Required quantity of powder was weighed and transferred to stoppered flask, and treated with ethanol until the powder is fully immersed. The flask was shaken every hour for the first 6 hours and then it was kept aside and again shaken after 24 hours. This process was repeated for 3 days and then the extract was filtered. The extract was collected and evaporated to dryness by using a vacuum distillation unit. The final residue thus obtained was then subjected to GC-MS analysis.

GC-MS analysis

GC-MS analysis of leaf and stem extracts were performed using a Perkin - Elmer GC Clarus 500 system and gas chromatograph interfaced to a mass spectrometer (GC-MS) equipped with a Elite-I, fused silica capillary column (30mm X 0.25mm 1D X 1µMdf, composed of 100% Dimethyl poly siloxane). For GC-MS detection, an electron ionization system with ionizing energy of 70 eV was used. Helium gas (99.999%) was used as the carrier gas at constant flow rate 1ml/min and an injection volume of 2µL was employed (split ratio of 10:1); injector temperature 250^{o}C; Ion-source temperature 280^{o}C. Mass spectra were taken at 70 eV; a scan interval of 0.5 Seconds and fragments from 45 to 450 Da. Total GC running time was 36 minutes. The relative % amount of each component was calculated by comparing its average peak area to the total areas, software adopted to handle mass spectra and chromatograms was a Turbomass.

Interpretation on mass spectrum GC-MS was conducted using the database of National Institute Standard and Technology (NIST) having more than 62,000 patterns. The spectrum of the unknown component was compared with the spectrum of the known components stored in the NIST library. The name, molecular weight and

structure of the components of the test materials were ascertained.

RESULTS

Twenty six compounds were identified in the ethanol extract of *D.falcata* leaf by GC-MS analysis. (Figure 1& 2). The active principle, molecular formula (MF), molecular weight (MW), concentration (peak area %), and retention time (RT) are present in Table 1. It indicates that the predominant compounds are Dibutyl phthalate (13.26%), n-Hexadecanoic acid (13.02%), 1,3,4,5 – Tetrahydroxy-Cyclohexan (8.43%), 2,4-Imidazolidinedione, 1 – [[5-Nitro-2-(uranyl)Methylene] Amino] (6.36%), Z,E-2-Methyl-3, 13-Octadecadien-1-o1 (6.19%), Geranyl linalool Isomer-B (4.82%), Phthalic acid, 5-methylhex-2-yl butyl ester (4.28%), 1,2,3-Benzenetriol (Pyrogallol) (4.17%), 1-Octadecanol (3.99%), 9-Octadecenoic acid (Z) (3.99%), Phthalic acid, bis-(10-hydroxy decyl ester) (3.71%), 2,6,10-Trimethyl, 14-Ethylene-14-pen (3.52%), Glycine, N-[N-(2-Hydroxybenzoyl) – beta (2.67%), Di-n-octyl phthalate (2.22%), 1,2,Dibromo -1-Chloro-1,2,2 - trifluoroethane (2.02%) and 1,2-Benzenedicarboxylic acid, Dimethylester (1.96%). Table 2 liked the major phytocomponents and its biological activities obtained through GC-MS study of *D.falcata* leaf. Similar twenty nine components were identified in the ethanol extract of *D.falcata* stem by GC-MS analysis (fig 3 & 4). The active principle, molecular formula (MF), molecular weight (MW), concentration (Peak area %), and retention time (RT) are present in Table 3. The prevailing compound in ethanol extract of stem were squalene (68.70%), 1,2-Benzenedicarboxylic acid, Diethyl ester (5.51%), 1,2-Benzenedicarboxylic acid (3.42%), 3-Methylhenicosane (3.15%), Phthalic acid, butyl oct-3-yl ester (2.42%), 2,6-Dimethylbenzenenethiol, S-(tert-butyldimethylsilyl) (1.75%), 1,4-Phenylene bis (3.nitrobenzoate) (1.64%), Silane, trimethyl [(4-Octylcyclohexyl)methoxy]-, trans (1.29%), and 1,3-Doxolo [4,5-c] pyran -7-ol,2,2- dimethylpenhydro-4-(bromomethyl) (1.25%). Figure 5 shows structure of some important compounds detected in the GC-MS analysis of *D.falcata* stem and leaf. Table 3 listed the major phytocompounds and its biological activities obtained through GC-MS study of *D.falcata* leaf.

Table 1: Compounds detected in the leaf ethanol extract of *D. falcata*

No	RT	Name of the Compound	Formula	M.W	Peak Area %
1	13.592	1,2,3-Benzenetriol [Pyrogallol]	C6H6O3	126	4.17
2	13.800	1,2-Benzenedicarboxylic acid, dimethyl ester	C10H10O4	194	1.96
3	15.565	2,4-Imidazolidinedione, 1-[[(5-Nitro-2-Furanyl)Methylene] Amino]-	C8H6N4O5	238	6.36
4	16.072	1,3,4,5-Tetrahydroxy-Cyclohexan.	C7H12O6	192	8.43
5	16.167	Methyl 4,6-ethylidene-.alpha.-d-galactopyranoside	C9H16O6	220	1.37
6	16.250	Methyl (2-Naphthyloxy)acetate	C13H12O3	216	1.64
7	16.435	9-Heptadecene-4,6-diyn-8-ol, (Z)-	C17H26O	246	1.39
8	18.226	2,6,10-Trimethyl,14-Ethylene-14-pen	C20H38	278	3.52
9	18.713	Glycine, N-[N-(2-Hydroxybenzoyl)-.beta	C13H16N2O5	280	2.67
10	19.426	Phthalic acid, bis(7-methyloctyl) ester	C26H42O4	418	1.79
11	19.619	n-Hexadecanoic acid	C16H32O2	256	13.02
12	19.732	Dibutyl phthalate	C16H22O4	278	13.26
13	19.935	Phthalic acid, 5-methylhex-2-yl butyl ester	C19H28O4	320	4.28
14	20.008	1,2-Dibromo-1-chloro-1,2,2-trifluoroethane	C2Br2ClF3	274	2.02
15	20.209	Phthalic acid, bis-(10-hydroxy-decyl ester	C28H46O6	478	3.71
16	20.275	Phthalic acid, heptylundecyl ester	C26H42O4	418	1.40
17	20.342	Geranyl Linalool Isomer-B.	C20H34O	290	4.82
18	20.708	Phthalic acid, hexyl propyl ester	C17H24O4	292	1.49
19	20.827	1-Octadecanol	C18H38O	270	3.99
20	21.006	9-Octadecenoic acid (E), methyl ester	C19H36O2	296	1.30
21	21.167	Phytol	C20H40O	296	1.30
22	21.588	Z,E-2-Methyl-3,13-octadecadien-1-ol	C19H36O	280	6.19
23	21.650	11,12-Dibromo-tetradecan-1-ol acetate	C16H30Br2O2	412	1.69
24	21.711	9-Octadecenoic acid (Z)-	C18H34O2	282	3.99
25	21.900	Phthalic acid, isohexyl2-(2-methoxyethyl) hexyl ester.	C23H36O5	392	0.63
26	28.678	Di-n-octyl phthalate	C24H38O4	390	2.22

** Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

Table 2: Activity of phytocomponents identified in the ethanol extract of leaf of *D.falcata*

No	Name of the Compound	Peak Area%	Compound Nature	**Activity
1	1,2,3-Benzenetriol [Pyrogallol]	4.17	Polyphenol compound.	Antimicrobial, Anti-inflammatory, Antioxidant, Analgesic, Insecticide, Anticancer, Cytotoxic
2	1,2-Benzenedicarboxylic acid, dimethyl ester	1-96	Plasticizer Compound	Antimicrobial, Antifouling
3	2,4-Imidazolidinedione, 1-[[(5-Nitro-2-Furanyl) Methylene] Amino]-	6.36	Amino compound	Antimicrobial, Anti-inflammatory Herbicidal, Insecticide
4	1,3,4,5-Tetrahydroxy-Cyclohexan.	8.43	Phenolic acid	Antimicrobial, Anti-inflammatory Antioxidant, Analgesic
5	Methyl 4,6-ethylidene-.alpha.-d-galactopyranoside	1.37	Sugar moiety	Preservative
6	Methyl (2-Naphthyloxy)acetate	1.64	Aromatic compound	No activity reported
7	9-Heptadecene-4,6-diyn-8-ol, (Z)-	1.39	Unsaturated alcoholic compound	No activity reported
8	2,6,10-Trimethyl,14-Ethylene-14-pen	3.52	Unsaturated compound	No activity reported
9	Glycine, N-[N-(2-Hydroxybenzoyl)-.beta	2.67	Amino acid compound	Antimicrobial
10	Phthalic acid, bis(7-methyloctyl) ester	1.79	Plasticizer compound	Antimicrobial Antifouling
11	n-Hexadecanoic acid	13.02	Palmitic acid	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor,Hemolytic,5-Alphareductase inhibitor
12	Dibutyl phthalate	13.26	Plasticizer compound	Antimicrobial Antifouling
13	Phthalic acid, 5-methylhex-2-yl butyl ester	4.28	Plasticizer compound	Antimicrobial Antifouling
14	1,2-Dibromo-1-chloro-1,2,2-trifluoroethane	2.02	Halogen compound	Antimicrobial Antifouling
15	Phthalic acid, bis-(10-hydroxy-decyl ester	3.71	Plasticizer compound	Antimicrobial Antifouling
16	Phthalic acid, heptylundecyl ester	1.40	Plasticizer compound	Antimicrobial Antifouling
17	Geranyl Linalool Isomer-B.	4.82	Terpene alcohol	Antimicrobial Anti-inflammatory, Fragrance
18	Phthalic acid, hexyl propyl ester	1.49	Plasticizer compound	Antimicrobial Antifouling
19	1-Octadecanol	3.99	Saturated alcoholic compound	Antimicrobial
20	9-Octadecenoic acid (E), methyl ester	1.30	Oleic acid methyl ester	Anti-inflammatory, Anti-androgenic Cancer preventive, Dermatitigenic, Hypocholesterolemic, 5-Alpha reductase inhibitor, Anemiagenic Insectifuge, Flavor
21	Phytol	1.30	Diterpene	Antimicrobial Anti-inflammatory AnticancerDiuretic
22	Z,E-2-Methyl-3,13-octadecadien-1-ol	6.19	Unsaturated alcoholic compound	No activity reported
23	11,12-Dibromo-tetradecan-1-ol acetate	1.69	Bromine compound	Antimicrobial
24	9-Octadecenoic acid (Z)-	3.99	Oleic acid	Anti-inflammatory, Antiandrogenic, Cancerpreventive, Dermatitigenic Hypocholesterolemic, 5-Alpha reductase inhibitor, Anemiagenic Insectifuge, Flavor
25	Phthalic acid, isohexyl 2-(2-methoxyethyl)hexyl ester.	1.63	Plasticizer compound	Antimicrobial Antifouling
26	Di-n-octyl phthalate	2.22	Plasticizer compound	Antimicrobial Antifouling

** Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

Table – 3 Compounds detected in the stem ethanol extract of *D. falcata*

No	RT	Name of the Compound	Formula	M.W	Peak Area %
1	15.609	1,2-Benzenedicarboxylic acid, Diethyl ester	C12H14O4	222	5.51
2	15.792	1,4-Phenylene bis(3-nitrobenzoate)	C20H12N28	408	1.64
3	17.756	Benzenemethanamine, N,N-dimethyl-	C9H13N	135	0.58
4	18.236	Ethyl (Z)-non-3-enyl carbonate	C12H22O3	214	0.49
5	19.208	Hexanoic acid, 2-Methyl	C7H14O2	130	0.85
6	19.458	Cyclohexanecarboxylic acid, 4-butyl-, 4-cyanophenyl ester, trans	C18H23NO2	285	0.42
7	19.792	Phthalic acid, butyl oct-3-yl ester	C20H30O4	334	2.42
8	19.900	Silane, trimethyl[(4-Octylcyclohexyl) methoxy]-, trans	C18H38OSi	298	1.29
9	21.367	3-(Dimethoxy-phosphoryl)-3-hydroxy-butyric acid ethyl ester	C8H17O6P	240	0.94
10	21.558	1,2-Benzendiol, O-pivaloyl-O'-valeryl	C16H22O4	278	0.31
11	21.683	2,4(1H,3H)-Pyrimidinedione, 6-amino-1,3-di-2	C10H13N32	207	0.32
12	22.159	Penta-2,4-dienamide, 2-cyano-3-methyl-5-dimethylamino	C9H13N3O	179	0.57
13	22.230	Pyrimido[5,4-E][1,2,4]triazine-5,7(1H,6H)-dione-	C8H9N5O2	207	0.76
14	22.367	4(3H)-Pteridinone, 3-hydroxy-6,7-dimethyl-	C8H8N4O2	192	0.57
15	22.433	3-Ethyl-3-methylnonadecane	C22H4	310	0.29
16	22.483	trans-(2-(4-Cyanophenyl)-5-pyrimidinyl)-4-hexylcyclohexane-1-carboxylate	C24H29N32	391	0.48
17	22.957	1-Benzyl- 5-Methyl 2-({5-(Benzyloxy)-2-[(tert-butoxycarbonyl)Amino]-5-Oxopentanoyl} Pentanemino) dioate	C30H38N29	570	0.35
18	23.092	1,3-Dioxolo[4,5-c]pyran-7-ol, 2,2-dimethylperhydro-4-(bromomethyl)	C9H15BrO4	266	1,25
19	23.808	Cyclohexane, 1-(cyclohexylmethyl)-2-ethyl-, trans	C15H28	208	0.98
20	26.452	Squalene	C30H50	410	68.70
21	27.350	Benzoic acid, 3-methyl-2-trimethylsilyloxy-, trimethylsilyl	C14H24O3S2	296	0.29
22	27.575	Pentasiloxane, 1,1,3,3,5,5,7,7,9,9-decamethyl-	C10H32O4S5	356	0.32
23	27.776	3,5-Cyclohexadiene-1,2-dione, 3,5-bis	C14H20O2	220	0.82
24	27.943	2,6-Dimethylbenzenethiol, S-(tert-butyldimethylsilyl)	C14H24SSi	252	1.75
25	28.192	4-Methoxy-1-ethenyl(dimethyl) Silyloxy methylbenzene	C12H18O2Si	222	0.94
26	28.706	1,2-Benzenedicarboxylic acid	C24H38O4	390	3.42
27	28.808	Benzene, 1-(1,1-dimethylethyl)-4-(2-ethoxyethoxy	C14H22O2	222	0.41
28	29.702	Benzenamine, N,N,4- Trimethyl-2-(Trimethylsilyl)	C12H21NSi	207	0.40
29	30.308	3-Methylhenicosane.	C22H46	310	3.15

** Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

Table – 4 Activity of phytocomponents identified in the ethanol extract of stem of *D.falcata*

No	Name of the Compound	Formula	Peak Area %	Compound Nature	**Activity
1	1,2-Benzenedicarboxylic acid, Diethyl ester	C12H14O4	5.51	Plasticizer compound	Antimicrobial Antifouling
2	1,4-Phenylene bis(3-nitrobenzoate)	C20H12N2O8	1.64	Aromatic compound	Antifungal Antimicrobial
3	Benzenemethanamine, N,N-dimethyl-	C9H13N	0.58	Aromatic amino compound. Catalyst for formation of polyurethane and epoxy resins.	Antimicrobial
4	Ethyl (Z)-non-3-enyl carbonate	C12H22O3	0.49	Unsaturated alkaline compound	Fragrance agent
5	Hexanoic acid, 2-Methyl	C7H14O2	0.85	Palmitic acid compound	Antioxidant, Hypocholesterolemic Nematicide, Pesticide, Lubricant, Antiandrogenic, Flavor, Hemolytic 5-Alpha reductase inhibitor
6	Cyclohexanecarboxylic acid, 4-butyl-, 4-cyanophenyl ester, trans	C18H23NO2	0.42	Aromatic compound	No activity reported
7	Phthalic acid, butyl oct-3-yl ester	C20H30O4	2.42	Plasticizer compound	Antimicrobial Antifouling
8	Silane, trimethyl[(4-Octylcyclohexyl) methoxy]-, trans	C18H38OSi	1.29	Aromatic silica compound	No activity reported
9	3-(Dimethoxy-phosphoryl)-3-hydroxy-butyric acid ethyl ester	C8H17O6P	0.94	Ester compound	Antimicrobial
10	1,2-Benzendiol, O-pivaloyl-O'-valeryl	C16H22O4	0.31	Catechol compound. Phenolic in nature	Antimicrobial Anti-inflammatory Antioxidant
11	2,4(1H,3H)-Pyrimidinedione, 6-amino-1,3-di-2	C10H13N3O2	0.32	Alkaloid	Antimicrobial Anti-inflammatory Antioxidant
12	Penta-2,4-dienamide, 2-cyano-3-methyl-5-dimethylamino	C9H13N3O	0.57	Amide compound	Antimicrobial Anti-inflammatory Antioxidant

Table 4 to be continued…					
13	Pyrimido[5,4-E][1,2,4] triazine-5,7(1H,6H)-dione-	C8H9N5O2	0.76	Triazine compound	Insecticide Antimicrobial Antifungal
14	4(3H)-Pteridinone, 3-hydroxy-6,7-dimethyl-	C8H8N4O2	0.57	Alkaloid	Antimicrobial Anti-inflammatory Antioxidant
15	3-Ethyl-3-methylnonadecane	C22H4	0.29	Saturated alkane compound	No activity reported
16	trans-(2-(4-Cyanophenyl)-5-pyrimidinyl)-4-hexylcyclohexane-1-carboxylate	C24H29N3O2	0.48	Alkaloid	Antimicrobial Anti-inflammatory Antioxidant
17	1-Benzyl- 5-Methyl 2-({5-(Benzyloxy)-2-[(tert-butoxycarbonyl)Amino]-5-Oxopentanoyl} Pentanemino) dioate	C30H38N2O9	0.35	Aromatic compound	No activity reported
18	1,3-Dioxolo[4,5-c]pyran-7-ol, 2,2-dimethylperhydro-4-(bromomethyl)	C9H15BrO4	1,25	Bromine compound	Antimicrobial
19	Cyclohexane, 1-(cyclohexylmethyl)-2-ethyl-, trans	C15H28	0.98	Aromatic compound	No activity reported
20	Squalene	C30H50	68.70	Triterpene	Antibacterial, Antioxidant, Antitumor, Cancer preventive, Immunostimulant, Chemo preventive, Lipoxygenase-inhibitor, Pesticide
21	Benzoic acid, 3-methyl-2-trimethylsilyloxy-, trimethylsilyl	C14H24O3S2	0.29	Benzoic acid compound	Antimicrobial Preservative
22	Pentasiloxane, 1,1,3,3,5,5,7,7,9,9-decamethyl-	C10H32O4S5	0.32	Silica compound	No activity reported
23	3,5-Cyclohexadiene-1,2-dione, 3,5-bis	C14H20O2	0.82	Aromatic Quinone compound	Antimicrobial Antioxidant Anti-inflammatory
24	2,6-Dimethylbenzenethiol, S-(tert-butyldimethylsilyl)	C14H24SSi	1.75	Aromatic sulfur compound	Antimicrobial
25	4-Methoxy-1-ethenyl(dimethyl) Silyloxy methylbenzene	C12H18O2Si	0.94	Aromatic silica compound	No activity reported
26	1,2-Benzenedicarboxylic acid	C24H38O4	3.42	Plasticizer compound	Antimicrobial Antifouling
27	Benzene, 1-(1,1-dimethylethyl)-4-(2-ethoxyethoxy	C14H22O2	0.41	Aromatic compound	No activity reported
28	Benzenamine, N,N,4-Trimethyl-2-(Trimethylsilyl)	C12H21NSi	0.40	Aromatic amine compound	Antimicrobial
29	3-Methylhenicosane.	C22H46	3.15	Saturated alkane compound	No activity reported

** Source: Dr. Duke's Phytochemical and Ethnobotanical Databases

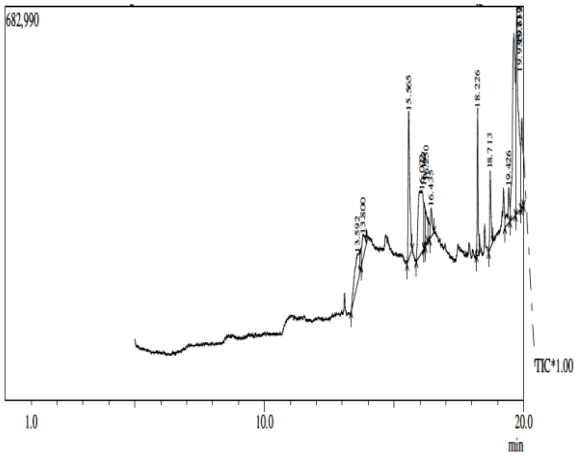


Figure 1a: GC-MS Chromatogram of the ethanol extract *Dendrophthoe falcate* leaf enlarged version.

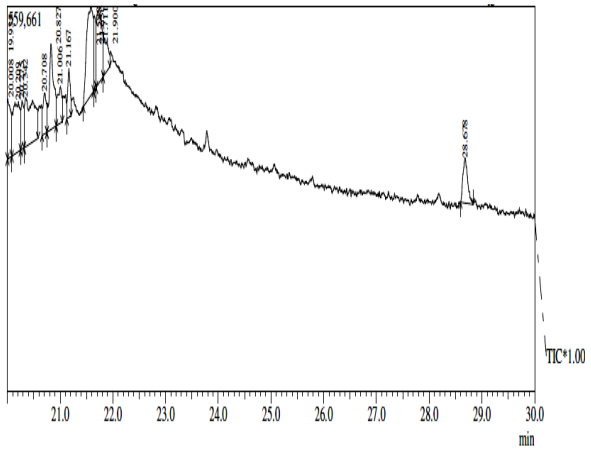


Figure 1b: GC-MS Chromatogram of the ethanol extract *Dendrophthoe falcate* leaf enlarged version.

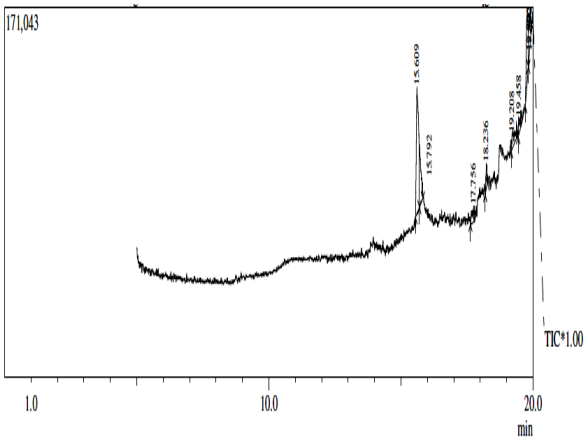


Figure 2a: GC-MS Chromatogram of the ethanol extract *Dendrophthoe falcate* stem enlarged version.

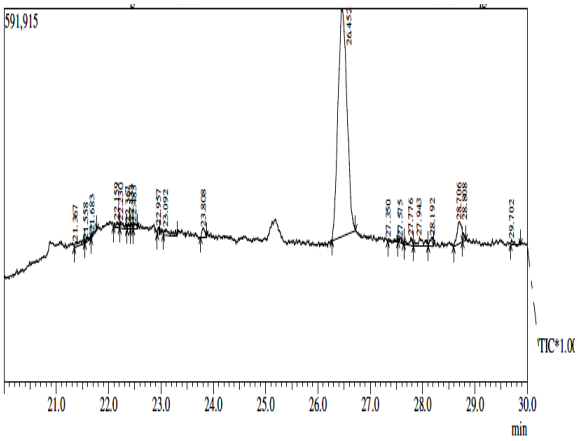
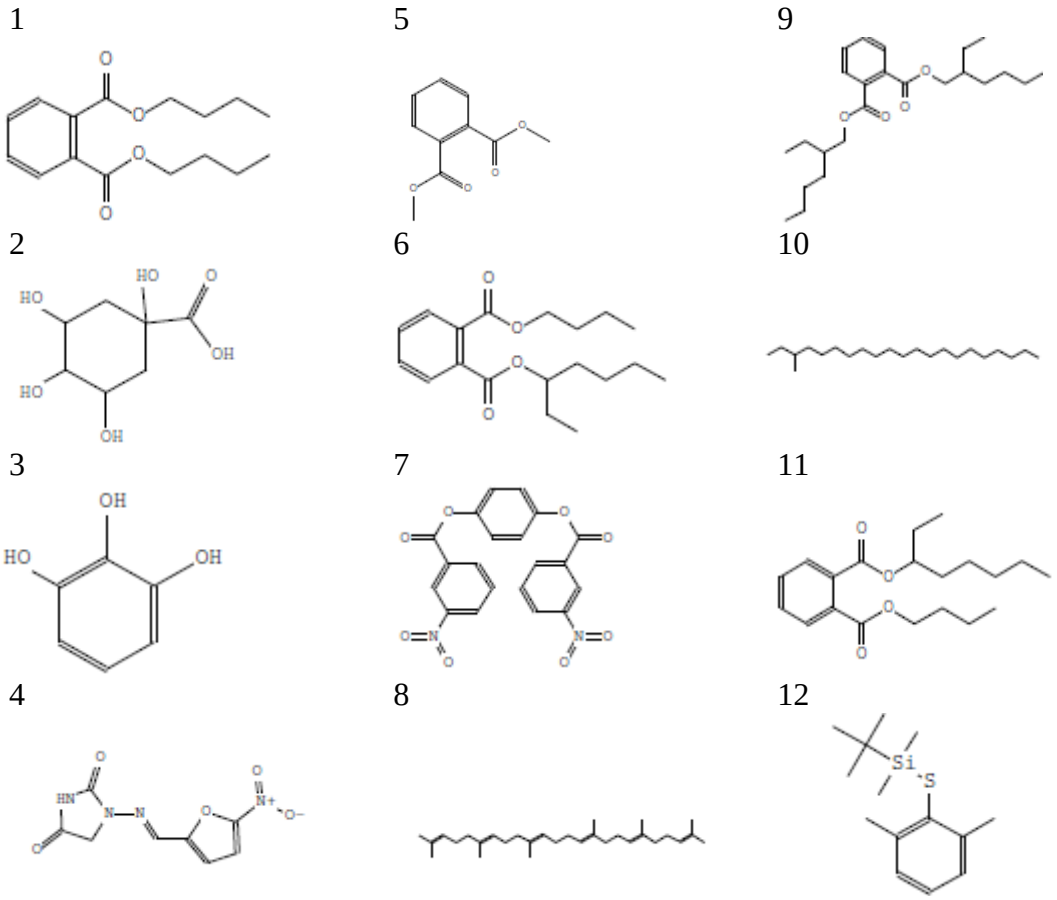


Figure 2b: GC-MS Chromatogram of the ethanol extract *Dendrophthoe falcate* stem enlarged version.



Dibutyl Phthalate
1,3,4,5-Tetrahydroxy-Cyclohexan
1,2,3-Benzenetriol [Pyrogallol]
2,4-Imidazolidinedione, 1-[[(5-Nitro-2-Furanyl)Methylene]Amino]-
Phthalic Acid, 5-Methylhex-2-Yl Butyl Ester
1,2-Benzenedicarboxylic Acid, Diethyl Ester
1,4-Phenylene Bis(3-Nitrobenzoate)
Squalene
3-Methylhenicosane
1,2-Benzenedicarboxylic acid
Phthalic acid, butyl oct-3-yl ester
2,6- Dimethylbenzenethiol,S-(tert-butyldimethylsilyl)

DISCUSSION

In the present study 26 and 29 compounds have been identified from the ethanol extract of leaf and stem of *D.falcata* by GC-MS analysis. Among the identified phytocompounds, 1,2-Benzenedicarboxylic acid and dibutyl phthalate posses antimicrobial and antifouling properties. Dibutyl phthalate exhibited wide spectra of antimicrobial activity with MICs between 50 and 120 mg/ml. [3] Antimicrobial activity was tested with gram positive, gram negative, unicellular and filamentous fungi. Foster *et al*. [4] observed that male rats decreases in fertility with reduced sperm counts and reproduction tract malfunctions Gestational and lactational exposure to dibutyl phthalate at 250mg/kg/day disrupts male reproductive development and function. [5] Dibutyl phthalate also modulates the function of phagocytic cells. [6] n-Hexadecanoic acid and squalene have the property of antioxidant activity. Squalene is a naturally occurring polyphenyl compound primarily known for its key role as an intermediate in cholesterol synthesis. It receives its name because of its occurrence in shark liver oil (Squalus species) which contains large quantities and considered the richest source of squalene. Squalene is a natural antioxidant, a unique oxygen generator, power immune stimulator, antibiotic, anticoagulant, antihistamine and antiallergics. [7] It has been proposed to be an important part of the Mediterranean diet as it may be a chemopreventive substance that protects people from cancer. [7,8]

Phytol is detected in *D.falcata* leaf, which was also found to be effective at different stages of the arthritis. It was found to give good as well as preventive and therapeutic results against arthritis. The results show that reactive oxygen species promoting substances such as phytol constitute a promising novel class of pharmaceuticals for the treatment of rheumatoid possibly other chronic inflammatory diseases. [9,10] Phytol was observed to have antibacterial activity against *Staphylococcus aureus* by causing damage to cell membranes as a result there is a leakage of potassium ions from bacterial cells. [11] Phytol is a key acyclic diterpene alcohol that is precursor for vitamins E and k1.

Thus each compound identified in leaf and stem extracts of *D.falcata* has its own biological importance and further study of phytochemicals present in this plant can prove its medicinal importance in future and can be an effective and efficient drug source in cheaper rate as it has better availability.

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