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GC-MS analysis, collected from Kavalkinaru area, Tirunelveli District, Tamil Nadu, India.

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ABSTRACT

The bioactive components of Dendrophthoe falcata (L.f) Ettingsh leaves have been evaluated using GC-MS analysis. The phytochemicals were determined using Shimadzu GC-MS QP2010 ultra model apparatus. The GC-MS analysis report of D.falcata revealed the presence of 1,2-Benzenedicarboxilic acid, DIE, Hexadecanoic acid, methyl ester, n-Hexadecanoic acid, Glycidol stearate, Cis-10-Heptadecenoic acid, methyl ester, Heptadecanoic acid, methyl ester, Methyl 2-octylcyclopropene-1-heptanoate, Campesterol, 9-Octadecenoic acid, methyl ester, 9,12-Octadecadienoic acid (Z,Z)-, Pentadecanoic acid, 14-Methyl-, methyl ester, Cis-13,16-Docasadienoic acid, Octadecanoic acid, Ethyl 2-dibromomethyl-6-cyano-7-ethoxy-5 phenyl-1,8-n aphthyridine-3-carboxylate, cis-10-Nonadecenoic acid, methyl ester, Ethyl 9,12,15-octadecatrienoate, Eicosanoic acid, methyl ester, (R)-(-)-14-Methyl-8-hexadecyn-1-ol, Docasonoic acid, methyl ester, Docosanoic acid, methyl ester, 9-Hexadecanoic acid in the leaves. These phytochemicals possess antimicrobial activity, anticarcinogenic properties, anti-inflammatory, lowering cholesterol, a reduction in atherosclerosis, a heart disease, and used anti-fungal activities etc. These properties indicate that D. falcata phytochemicals are the alternate natural source to be used in modern system of medicines.

Key words: Dendrophthoe falcata, Phytochemicals, Bioactive components, Campesterol, 9-Hexadecanoic acid.

INTRODUCTION

Dendrophthoe falcata (L.f) Ettingsh is one of the hemi parasitic plant on *Azadirachta indica* A.Juss that belongs to the mistletoe family Loranthaceae. It is the most common of all the mistletoes that occur in India. *D.falcata* bears grey bark, thick coriaceous leaves variable in shape with stout flowers (Wealth of India. 2002). The inflorescence of *D.falcata* was described formerly as axillary or as developing from the scars of fallen leaves. To date, *D.falcata* bears the distinction of being the mistletoe species with the largest global host range (Calvin and Wilson, 2009) , a range which is continuously and rapidly widening to include more and more host species. Among angiosperms, parasitic relationship through the formation of haustoria linkages is known to be widespread (Wilson and Calvin, 2006). The host branches infected with *D.falcata* show a gradual reduction in growth and diameter as compared to other healthy uninfected branches (Karunaichamy *et al*., 1999). This mistletoe does not have an indigenous rooting system and is dependent on the host for water and minerals. Nutrient dynamics have shown that a higher liter of N, P, K, Mg and Na in the leaves of mistletoe than the leaves of uninfected and infected hosts which may be due to differential translocation of elements within the host phloem. The haustoria connections of the parasite with the plant are devoid of any efficient translocation system (Smith and Stewart, 1990). *D. falcata* is used

as traditional medicine through South and Central Asia. GC-MS is the separation technique of choice for smaller and volatile molecules such as benzenes, alcohols and aromatics, and simple molecules such as steroids, fatty acids and hormones. It is widely used for chemical analysis, and especially for drugs identification. These bioactive components are used in curing various human ailments. It possesses remarkable potential as a medicinal plant, as is evident from the wound healing, anti-microbial, anti-oxidant and antinociceptive properties of its ethanolic extracts (Pattanayak and Sunita, 2008, Shihab *et al*., 2006).

Medicinal properties of this hemiparasite may vary in effects respective to different hosts it establishes a relation with (Mallavadhani *et al*., 2006). The whole plant is used in indigenous system of medicine as cooling, bitter, astringent, aphrodisiac, narcotic and diuretic (Alekutty *et al*., 1993) and is useful in treating pulmonary tuberculosis, asthma, menstrual disorders, swelling wounds, ulcers, renal and vesical calculi and vitiated conditions of kapha and pitta (Anarthe et al., 2008; Sastry, 1952; Pattanayak *et al*., 2008). Also, the decoction of plant used by women as an anti-fertility agent has been evidenced to possess anticancer activity (Nadkarni, 1993). The leaf ethanolic extract significantly and dose dependently inhibits the acetic acid induced writhing in mice (Shihab *et al*., 2006) and has indicated as low toxicity in the brine shrimp lethality assays. Besides, a more recent work by Pattanayak *et al*. (2008) shows significant tumor reduction in induced mammary carcinogenesis in Wistar female rats when fed with hydroalcoholic extracts of *D. falcata*. From a conservation biologists' viewpoint mistletoes are considered as a keystone resource of biodiversity (Watson, 2001) and from that of an ethnobiologist's and or pharmacologist's (Pattanayak *et al*., 2008), they possess numerous ethnomedicinal assets with prospects extending to promises even for use as an anti-tumor agent. So it is evident that *D.falcata* is a potential plant to cure various ailments without treating with modern medicines.

MATERIALS AND METHODS

Healthy samples of *D.falcata* were collected from the surroundings of Kavalkinaru, Tirunelveli District. Leaves were separated from the plant and shade dried. Dried leaves were pulverized into fine powder and filtered through a nylon mesh. The extraction was made using distilled water.

GC-MS analysis

GC-MS analysis of leaves was performed using Shimadzu GC-MS QP2010 ultra model. The gas chromate gram interfaced to a mass spectrometer equipped with Rxi-5Sil MS (30 m, 0.2 mm, 0.25 um columns (low-polarity phase; cross bond composed of 1,4-bis (dimethylsiloxy) phenylene dimethyl polysiloxane; temperature 800c, increase 50c/min up to 100c, further increase 100c/min up to 280^0 C holding time 4 minutes. Using TIC peak in each spectrum were foundout.

MS parameters

Ion source temperature 240^0C interfaced temperature 230^0C start m/z:40 End m/z:800. Total program time was 31 minutes. Interpretation on mass spectrum was conducted using the data base 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 known components stored in NIST library.

RESULTS

Twenty compounds were determined in the aqueous extract of *D.falcata* leaves by GC-MS. (Table 1 and 2). These bioactive compounds are campesterol (20.79%), 9-Octadecenoic acid, methyl ester (14.24%), cis-13,16-Docasadienoic acid (12.11%), Methyl 2-octylcyclopropene-1-heptanoate (9,90%), Hexadecanoic acid, methyl ester (8.71%), n-Hexadecanoic acid (7.89%), Pentadecanoic acid, 14-methyl-, methyl ester (6.53%), Ethyl 2-dibromomethyl-6-cyano-7-ethoxy-5 phenyl-1,8-n aphthyridine-3-carboxylate (5.38%), cis-10-Nonadecenoic acid, methyl ester (3.44%), (R)-(-)-14-Methyl-8-hexadecyn-1-ol (1.80%), Octadecanoic acid (1.79%), Glycidol stearate (1.16%), Ethyl 9,12,15-octadecatrienoate (1.14%), 9,12-Octadecadienoic acid (Z,Z)- (1.13%), Eicosanoic acid, methyl ester (1.13%), cis-10-Heptadecenoic acid, methyl ester(1.06%), 1,2-Benzenedicarboxylic acid, DIE (0.63%), Docosanoic acid, methyl ester (0.47%), Heptadecanoic acid, methyl ester (0.36%) and 9-Hexadecenoic

acid, methyl ester (0.35%) in the leaves. The retention time, peak area%, peak height%, F-Time, L-time were given in the table.

TABLE -1

Determination of compounds using TIC and GC-MS

Peak #	R.Time	I.Time	F.Time	Area %	Height%	A/H	Mark	Name
1	15.545	15.500	15.617	0.63	0.71	2.79		1,2-Benzenedicarboxilic acid, DIE
2	18.979	18.942	19.025	0.35	0.45	2.47		9-Hexadecenoic acid, methyl ester
3	19.167	19.025	19.192	8.71	14.48	1.91	V	Hexadecanoic acid, methyl ester
4	19.588	19.517	19.708	7.89	7.29	3.44		n-Hexadecanoic acid
5	19.943	19.892	19.967	1.16	1.48	2.49		Glycidol stearate
6	19.992	19.967	20.058	1.06	1.49	2.26	V	cis-10-Heptadecenoic acid, methyl ester
7	20.202	20.133	20.250	0.36	0.32	3.55		Heptadecanoic acid, methyl ester
8	20.716	20.650	20.817	9.90	11.62	2.70		Methyl2-octylcyclopropene-1-heptanoate
9	20.994	20.817	21.017	20.79	17.64	3.74	V	Campesterol
10	21.032	21.017	21.125	14.24	17.42	2.60	V	9-Octadecenoic acid, methyl ester
11	21.163	21.125	21.200	1.13	1.03	3.50	V	9,12-Octadecadienoic acid (Z,Z)-
12	21.250	21.200	21.342	6.53	7.47	2.78	V	Pentadecanoic acid, 14-methyl-,ME
13	21.469	21.342	21.642	12.11	5.81	6.62	V	cis-13,16-Docasadienoic acid
14	21.688	21.642	21.758	1.79	1.10	5.14	V	Octadecanoic acid
15	21.813	21.758	21.942	5.38	5.33	3.20	V	Ethyl2-dibromomethyl-6-cyano-7-ethoxy-5 phenyl-1,8-n aphthyridine-3-carboxylate
16	22.298	22.233	22.417	3.44	3.30	3.31		cis-10-Nonadecenoic acid, methyl ester
17	23.492	23.433	23.600	1.14	0.79	4.60		Ethyl 9,12,15-octadecatrienoate
18	23.874	23.817	23.950	1.13	1.04	3.44		Eicosanoic acid, methyl ester
19	26.781	26.692	26.917	1.80	0.85	6.71		(R)-(-)-14-Methyl-8-hexadecyn-1-ol
20	27.876	27.825	27.967	0.47	0.38	3.97		Docosanoic acid, methyl ester
				100.00	100.00			

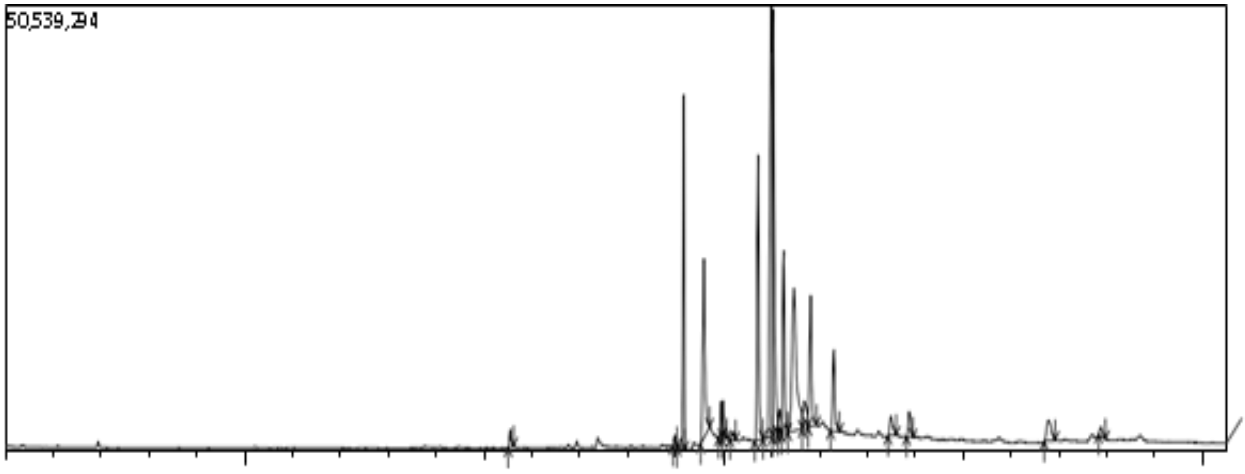
TABLE -2

Bioactivities of *D.falcata* leaves components determined by GC-MS analysis

SI.NO	NAMES	BIOACTIVITIES

1	1,2-Benzenedicarboxylic acid, DIE	Antimicrobial activity
2	Hexadecanoic acid, methyl ester	Antibacterial, antifungal
3	n-Hexadecanoic acid	**A**ntiinflammatory activity
4	Glycidol stearate	Decrease in mammary tumor
5	cis-10-Heptadecenoic acid, methyl ester	-
6	Heptadecanoic acid, methyl ester	Mosquito repellent
7	Methyl 2-octylcyclopropene-1-heptanoate	-
8	Campesterol	Anticancer activity
9	9-Octadecenoic acid, methyl ester	Antioxident, anticancer
10	9,12-Octadecadienoic acid (Z,Z)-	-
11	Pentadecanoic acid, 14-methyl-, methyl ester	Antimicrobial, antifungal
12	cis-13,16-Docasadienoic acid	-
13	Octadecanoic acid	Lower LDL cholesterol
14	cis-10-Nonadecenoic acid, methyl ester	-
15	Ethyl 9,12,15-octadecatrienoate	-
16	Eicosanoic acid, methyl ester	Repair neuron
17	(R)-(-)-14-Methyl-8-hexadecyn-1-ol	-
18	Docosanoic acid, methyl ester	-
19	9-Hexadecanoic acid	Antiinflammatory
20	Ethyl 2-dibromomethyl-6-cyano-ethoxy -5 phenyl-1,8-naphthyridine-3 carboxylate	-

Chromatogram



DISCUSSION

In this study 20 compounds have been identified from the aqueous extract of leaves of *D.falcata* by GC-MS analysis. Among the identified compounds, 1,2 Benzenedicarboxylic acid, Phthalic acid derivatives were the main constituents of Elaeagnaceae plant which could cure chronic cardiovascular and cerebrovascular diseases and also antitumor, antiinflammatory &andantibacterial activities (Tinsley *et al*., 1981). Glycidol stearate, dietary stearate has been associated with a decrease in mammary tumor development and incidence in spontaneous carcinogenesis models (Bennet, 1984, Avorinde *et al.,* 1982). Hectadecenoic acid or margaric acid is an attractant of the khapra beetle (*Trogoderma granarium* (Bernier et.al., 1995). and the yellow fever mosquito (Aedes aegypti) but as a repellent of the common house mosquito (*Culex pipiens)* (Aparna *et.al*., 2012). Anti-inflammatory property

of n-hexadecanoic acid has structural evidence and kinetic assessment (Darios *et al*., 2006). Eichosonoic acid or ARA also activates syntaxin-3 (STX-3), a protein involved in the growth and repair of neurons (Chandrasekaran *et al*., 2011). Pentadecenoic acid showing its antibacterial activity and antifungal activity (Syeda *et al*., 2011). and 9-Octadecenoic acid antioxidant and anticancer activity are a remarkable one (Hema R. Choudhary SP, 2011). The campesterol molecules are thought to compete with cholesterol, thus reducing the absorption of cholesterol in human' intestine (Ju YH, *et al*., 2004). The above compounds identified in *D.falcat*a leaves have its own bioactivities and diverse medicinal values.

CONCLUSION

The present investigation suggests that the plant has many bioactivities. As the components cure chronic cardiovascular and cerebrovascular diseases and have anti-tumor, anti-inflammatory, antibacterial activities, a decrease in mammary tumor development, antifungal activity, antioxidant and anticancer activities, cholesterol-lowering actions and the mounting evidence suggests that phytosterols possess anti-cancer effects against cancer of the lung, stomach, ovary and estrogen-dependent human breast cancer, the plant proved its medicinal importance for its costly drug source's better availability.

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