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GC-MS ANALYSES OF ETHANOLIC LEAF EXTRACT OF MEDICINAL PLANT *SOLANUM NIGRUM*

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ABSTRACT

Solanum nigrum is widely distributed weed and use as a food material as well as common element of traditional Indian medicines. Current study is analysed the natural bioactive compounds from whole plant extract of *S. nigrum* in Ethanolic solvent by applying GC-MS (Gas chromatography and Mass spectroscopy). GC-MS reviled that extract has total 43 bioactive compounds. The GC-MS shows the occurrence of numerous compounds such as Vitamin E, Hexadecanoic Acid, dodeconoic acids, Gamma.-Tocopherol and Squalene etc. in dry plant powder of *S. nigrum*. Hence, due to the presence of their active secondary metabolites *S. nigrum* could have Biological activity, antioxidant potential, Anti-inflammatory, antiviral and anti-diabetic activity.

KEYWORDS: Solanum Nigrum, Antioxidant, Bioactive Compound.

INTRODUCTION

Makoi is a native of Eurasia, is a widespread weed belongs to the Solanaceae family **(Schilling 1981)**. Some of the major species within the *S. nigrum* complex are *S. nigrum, S. americanum, S. douglasii, S. opacum, S. ptychanthum, S.retroflexum, S. sarrachoides, S.scabrum, and S. villosum* (**Edmonds *et al.*, 1997**). It grows well on loamy soil with good moisture holding capacity. It is found in dry parts of India at 2100 m above sea level. Commonly it is found in Sri Lanka, China, India, Madagascar, South Africa, Zimbabwe and some Europian countries (**Sreeramu *et al.*, 2005**). *S. nigrum* has been widely used as a food since early times **(B.E. *et al.*, 1977)**. In India, the berries are casually grown and eaten, but

not cultivated for commercial use. In South India, the leaves and berries are routinely consumed as food after cooking with tamarind, onion, and cumin seeds (**Ignacimuthu *et al.*, 2006**). For the treatment of liver cirrhosis plant extract of *Solanum nigrum* is used and it also acts as antidote against opium poisoning **(Dhar *et al.*, 1968)**. The berries are effective against heart diseases and possess tonic, diuretic and cathartic properties **(Raju *et al.*, 2003; Son *et al.*, 2003)**. *Solanum nigrum* is an important aspect of medicinal plant resources for treatment of primary health care **(Gogoi *et al.*, 2012)**. *Solanum nigrum* commonly known as "Black night shade" belongs to solanacae family. It is called as Manathakkali in Tamil. It shows medicinal properties like antimicrobial, anti-oxidant, cytotoxic properties, antiulcerogenic, and hepatoprotective activity. It is an African pediatric plant utilized for several ailments that are responsible for infant mortality especially feverish convulsions, eye diseases, hydrophobia and chronic skin ailments. It is a potential herb that acts as an anti-cancer agent (**Jain *et al.*, 2011**). *S. nigrum* is an important ingredient in traditional Indian medicines. Infusions are used in dysentery, stomach complaints, and fever. The juice of the plant is used on ulcers and other skin diseases. The fruits are used as a tonic, laxative, appetite stimulant, and for treating asthma **(Jain *et al.*, 1968)**. S. nigrum is a widely used plant in oriental medicine where it is considered to be antitumorigenic, antioxidant, anti-inflammatory, hepatoprotective, diuretic, and antipyretic **(Jain *et al.*, 2011)**. The plant can be taken in the form of a decoction to relieve dropsy. Syrup made of the leaves of this plant is useful in relieving fevers.

MATERIALS AND METHODS

Plant collection: Mature plants of *Solanum nigrum* was collected from local nursary of Dehradun and identified by Botany department K.L.DAV (PG) College, Roorkee.

Extract Preparation: Plant extract of plant *Solanum nigrum* was used for estimation of GC-MS analysis and antioxidant profiling. 10 g of dry plant was macerated in Ethanol for 24 hour. The extract was filtered and then concentrated in a rotary evaporator for 15 min and dried in lyophilizer. Powder was weighed to calculate the yield and kept at – 20℃ for further utilization. For each experiment, the powder was dissolved in 2 ml ethanol.

GC-MS analysis: GC-MS analysis of plant extracts was performed using a regular Perkin Elmer Auto System XL GC-MS analyzer. For GC-MS detection, an electron ionization energy system with ionization energy of 70eV was used. Helium gas (99.999%) was used as the carrier gas at a constant flow rate of 1.51 ml/min and an injection volume of 2µl was

employed. Total GC running time was 22 min. Software adopted to handle mass spectra and chromatograms were Turbo Mass (**Sharma *et al*., 2015**).

Identification of compounds was based on the molecular structure, molecular mass. Interpretation on mass spectrum GC-MS was conducted using the database of NIST (National Institute Standard and Technology) having more than 62,000 patterns and Wiley library. The name, molecular weight and structure of the components of the test material were ascertained by correlating with the library. The relative percentage amount of each component was calculated by comparing its average peak area to the total areas (**Sharma *et al*., 2016; 2017 and Rautela *et al*., 2018).**

RESULTS AND DISCUSSION

GC-MS analysis of ethanolic plant extract obtained from plants *Solanum nigrum* revealed the presence of many phytochemical compounds in plant (Table 1-4). In ethanolic extract major phytochemical compounds identified were Oxetane, 3-(1methylethyl) (15.16%), 2 Hexadecen-1-ol,3,7,11,15-Tetramethyl (12.06%), Vitamin E (11.93%) and with retention time 8.522, 25.674, 39.028 respectively. Among these Oxetane, 3-(1methylethyl) was most abundant. Compound such as hexadecanoic acid, ethyl ester (0.51%), (0.35%), Ergost-5-EN-3-ol (0.48%) and 2-Acetyl-2-hydroxy, gamma-butyrol acetone (0.34%) with retention time 11.84,14.37,32.95 and 6.34 respectively. The compounds identified were found to belong to different classes such as steroids, acid, phytosterols, alkaloids, ketones, ester, etc. Irrespective of the amount or concentration (high or low) in which these compounds were found to be present, almost all these compound have been reported to possess some pharmacological or biological activity **(Table 1 and 2)**. Almost all the compound identified have been reported to exhibit antibacterial, antifungal, Antioxidant and Antiviral activities against several pathogenic bacteria, fungal and viral species (**Karuppasamy *et al*., 2016**, **Raza *et al*., 2013, Soosairaj *et al*., 2016, Ertas *et al*., 2014**). Antioxidant property is one of the crucial properties possessed by plant, in the present study compounds such as Hexadecanoic Acid Hexadecanoic Acid, Ethyl Ester, cis, cis, cis-7, 10, 13-Hexadecatrienal, beta.-Tocopherol and Tetratetracontane identified to be present in both plant extract of *S. nigrum* have been reported to possess potential antioxidant activity (**Karuppasamy *et al*., 2016, Gowdhami *et al*., 2014, Venkata *et al*., 2012, Ertas *et al*., 2014**). Identified compounds Squalene, 9-Octadecenal, gamma tocopherol, vitamin Ehave been reported as Anticancer and antitumor

agent (**Santhanaraj *et al*., 2016, Revathi *et al*., 2014, Parveen *et al*., 2016; Rautela *et al* 2018)**.

Table 1: Identified Compound, Area and Retention Time of *Solanum nigrum* Ethanol extract.

Peak	R.Time	Area	Area%	Name
1	8.522	20617326	15.16	Oxetane, 3-(1-Methylethyl)-
2	9.866	954287	0.70	2-Propenoic Acid, Octyl Ester
3	15.104	366229	0.27	1-[2-(1,3-Cyclopentadien-1-Yl)Ethyl]
4	15.970	485919	0.36	3,5-Dimethyl-2(5h)-Furanone
5	17.111	670835	0.49	1-Methyl-1-(2-Tridecyl)Oxy-1-Silacyclopentane
6	18.306	913492	0.67	1-Methyl-1-(3-Tetradecyl)Oxy-1-Silacyclopentane
7	21.043	436770	0.32	2(4h)-Benzofuranone, 5,6,7,7a-Tetrahydro-6-H
8	21.701	775213	0.57	2-Hexadecene, 3,7,11,15-Tetramethyl-, [R-[R*,R*-(E)]]-
9	21.807	10611923	7.80	2,6,10-Trimethyl,14-Ethylene-14-Pentadecne
10	21.890	1312805	0.97	(2e)-3,7,11,15-Tetramethyl-2-Hexadecene
11	22.167	2394439	1.76	3,7,11,15-Tetramethyl-, [R-[R
12	22.443	3664963	2.69	2-Hexadecen-1-Ol
13	23.461	2009115	1.48	5,10-Diethoxy-2,3,7,8-Tetrahydro-1H,6H-Dipyrrolo[1,2-A:1',2
14	23.758	8720322	6.41	Hexadecanoic Acid
15	24.063	696482	0.51	Ethyl Ester
16	25.509	460783	0.34	1-Decene, 3,3,4-Trimethyl-
17	25.674	16401390	12.06	2-Hexadecen-1-Ol
18	26.053	161344	0.12	1,4-Benzodioxin,
19	26.147	3153249	2.32	Cis,Cis,Cis-7,10,13-Hexadecatrienal
20	26.377	405584	0.30	Ethyl (9z,12z)-9,12-Octadecadienoate #
21	26.433	627322	0.46	Octadecanoic Acid
22	27.515	634739	0.47	Cyclo hexane ethanamine,
23	27.855	1907307	1.40	Octanoic Acid, 2-Dimethylaminoethyl Ester
24	28.312	543459	0.40	9-Octadecenal, (Z)-
25	28.679	321752	0.24	4,8,12,16-Tetramethylheptadecan-4-Olide
26	29.980	631721	0.46	3-Cyclopentylpropionic Acid,
27	30.087	3827836	2.81	2-Dimethylaminoethyl Ester
28	30.650	1448962	1.07	Didecyl Ester
29	31.144	406797	0.30	1,2-Benzenedicarboxylic Acid
30	31.284	400714	0.29	Hahnfett
31	32.788	671550	0.49	Methyl (Z)-5,11,14,17-Eicosatetraenoate
32	33.019	667994	0.49	Octane, 1,1'-Oxybis-
33	34.213	1612266	1.19	Squalene
34	35.326	1161796	0.85	N-Tetracosanol-1
35	35.963	2454482	1.80	2,8-Dimethyl-2-(4,8,12-Trimethyltridecyl)-6-Ch
36	37.291	1158622	0.85	.Beta.-Tocopherol
37	37.598	12341455	9.07	.Gamma.-Tocopherol
38	38.304	2045574	1.50	Stigmast-5-En-3-Ol, (3.Beta.)-
39	39.028	16228553	11.93	Vitamin E
40	43.315	3678790	2.70	.Gamma.-Sitosterol
41	44.533	835193	0.61	Phytol, Acetate

42	47.581	1272775	0.94	Dl-.Alpha.-Tocopherol
43	52.418	5940239	4.37	Phytol, Acetate
		136032368	100.00	

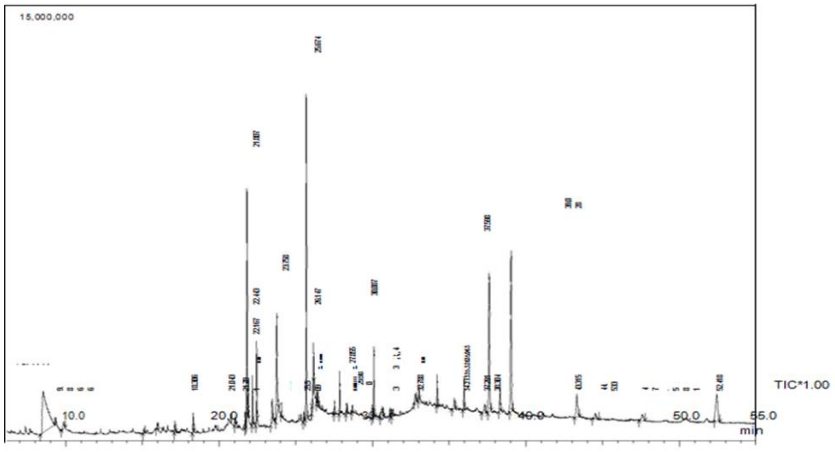

Figure 1: GC-MS Chromatogram of Ethanol leaf extract of *Solanum nigrum*.

Table 2: Biological Activity of Identified Compound in Ethanol leaf extract of S*olanum nigrum*.

S. No.	Compound	Biological Activity	Reference
1	2-Propenoic Acid, Octyl Ester	antimicrobial	**Karuppasamy *et al.*, 2016**
2	2(4h)-Benzofuranone, 5,6,7,7a-Tetrahydro-6-H	Pesticide, Ant-Repellent, Nematicide	**Santhanaraj *et al.*, 2016**
3	2,6,10-Trimethyl,14-Ethylene-14-Pentadecne	Anti-proliferative	**Selvamangai *et al.*, 2012**
4	(2e)-3,7,11,15-Tetramethyl-2-Hexadecene	Cancer-Preventive Antimicrobial anti-inflammatory anti-diuretic	**Shibula *et al.*, 2015**
5	2-Hexadecen-1-Ol, 3,7,11,15-Tetramethyl-, [R-[R	Anti-tuberculosis, Insecticidal, Anti- Inflammatory, Antioxidant, Antimicrobial	**Santhanaraj *et al.*, 2016**
6	Hexadecanoic Acid	Antioxidant; Hypocholesterolemic Nematicide; Pesticide, Lubricant; Antiandrogenic Flavor; Hemolytic	**Karuppasamy *et al.*, 2016**
7	Hexadecanoic Acid, Ethyl Ester	Antioxidant; Hypocholesterolemic Nematicide; Pesticide, Lubricant; Antiandrogenic Flavor; Hemolytic	**Karuppasamy *et al.*, 2016**
8	Cis,Cis,Cis-7,10,13-Hexadecatrienal	Antioxidant activity	**Gowdhami *et al.*, 2015**
9	Octadecanoic Acid	Antioxidant activity	**Santhanaraj *et al.*, 2016**
10	Octanoic Acid, 2-Dimethylaminoethyl Ester	Anti inflammatory	**Raza *et al.*, 2013**
11	9-Octadecenal, (Z)-	anti-alopcic, Antitumour, Cholerectic, Dermatitigenic, immunostimulant,	**Revathi *et al.*, 2015**

		Anti leukotriene, anti- androgenic, Haemolytic, Hypercholesterolemic, Lubricant, Nimoticide, Pesticide, irritant, Flavour, 5 α reductase inhibitor, Percutanea-stimulant,	
12	1,2-Benzenedicarboxylic Acid	No activity reported	**Kanimozhi *et al*., 2012**
13	Methyl (Z)-5,11,14,17-Eicosatetraenoate	No activity reported	**Devakumar *et al*., 2017**
14	Octane, 1,1'-Oxybis-	Antistatic agent	**Amudha and Rani 2014**
15	Squalene	Antimicrobial, Antioxidant, Anticancer, Neutralize different xenobiotics, Anti-Inflammatory, Anti-Atherosclerotic and Anti-Neoplastic, Role In Skin Aging And Pathology, and Adjuvant Activities	**Santhanaraj et al., 2016**
16	N-Tetracosanol-1	Anti-bacterial activity	**Rukachaisirikul et al., 2004**
17	Beta.-Tocopherol	Antioxidant, anti-inflammatory, antimicrobial, insecticidal, oestrogenic	**Venkata *et al*., 2012**
18	Gamma.-Tocopherol	Anticancer, antioxidant, antitumor, anti-inflammatory, hypocholesterolemic, cardioprotective	**Parveen *et al*., 2016**
19	Stigmast-5-En-3-Ol, (3.Beta.)-	Antihepatotoxic, Antiviral, Antioxidant, Cancer preventive, Hypocholesterolemic	**Meenakshi *et al*., 2015**
20	Vitamin E	Antiageing, Analgesic, Antidiabatic, Antiinflammatory, Antioxidant, Antidermatitic, Antileukemic, Antitumor, Anticancer, Hepatoprotective, Hypocholesterolemic Antiulcerogenic, Vasodilator, Antispasmodic, Antibronchitic, Anticoronary	**Karuppasamy *et al*., 2016**
21	Gamma.-Sitosterol	No activity reported	**Kanimozhi *et al*., 2012**
22	Phytol, Acetate	Antimicrobial; Anti-inflammatory, Anticancer; Diuretic	**Karuppasamy *et al*., 2016**
23	Dl-.Alpha.-Tocopherol	Antioxidant, anti-inflammatory, antimicrobial, radical scavenging and anti plasmodic	**Venkata *et al*., 2012**

CONCLUSION

An insight into the active components of plant belonging to family Solanaceae was obtained from the results generated. Also the several phytochemical compounds were being identified which were present in ethanolic plant leaf extract of *Solanum nigrum* with several biological properties revealing medicinal potential of the plant.

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