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Studies on bioactive Compounds of *GANODERMA LUCIDUM* Lingzhi from Baramati Tahsil of Pune District

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ABSTRACT

The present investigation is focusing on bioactive compounds of *Ganodermalucidum* Lingzhi from Baramati tahsil of Pune District. The entire fungal fruiting bodies of *Ganodermalucidum* Lingzhiwere collected using the sterilized polythene bags from study area (Baramati Tahsil of Pune District). The fungalmaterialwere dried under shade condition and then powdered. The 05g of *G.lucidum* powder was added in 50ml pure solvents *viz*. methanol, ethanol, acetic acid and chloroform. The qualitative analysis of bioactive compounds wereinvestigated byusing routine laboratory methods as well asmethanolic extract was used for LC-MS and GC-MS analysis. During the investigation qualitative bioactive compounds *viz*. carbohydrates, starch, proteins, reducing sugars, carboxylicacid, alkaloids, flavonoids, phenols,tannins,terpenoids,saponins,glycosides,coumarins,steroids, anthraquinones, lignins, emodins, acetogenins and cinnamic acid were reported.On the contrary amino acids, gum and mucilage as well as resins were completely absent in all the solvents tested. The LC-MS analysis showed16bioactive compounds were qualitatively extracted andGC-MSanalysis showed total 61bioactive compoundsandout of these33compounds were found to be biologicallyimportant. It is important to noticed that, methanolic extract was suitable for any group of bioactive compounds investigation such as fatty acids, ethers, fatty alcohols, esters, alkanes, flavonoids, steroids, saturated fatty acids and carbonyl derivatives.

KEYWORDS: *Ganodermalucidum* Lingzhi, qualitative and quantitative analysis bioactive compounds, LC-MS and GC-MS.

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INTRODUCTION

The *Ganoderma* belongs to the order Aphyllophorales, taxonomic studies reported more than 418 species of genus *Ganoderma* distributed in world-wide and tropical to subtropical regions in India[1]. India is reported with more than 300 species distributed all around in different states[2]. *G.lucidum* is a saprophytic as well as parasitic in nature, it causes the diseaseslike root rot, basal stem rot and wood-decay[3]. It grows on trees, especially oak trees causing their wood rot. The basidiocarps of *G. lucidum* appears singly or in groups having various shapes such as consol and hoof shape[4]. The fungus is a large, dark glossy surface including a red-varnished and kidney-shaped cap with woody texture (Fig.1).

*G. lucidum*has been used in medicine for treating of mushroom poisoning, hypercholesterolemia, heart related disease, chronic hepatitis, hypertension, neurasthenia,debility of prolonged illness, chronic bronchitis, asthma, allergy and cancer[5,6]. Ganocelium capsule is world widely produced by DXN group these capsules are derived from the mycelium of *G. lucidum*whichis rich in oleic acid, cyclooctasulfur, LZ-8, polysaccharides, organic germanium and vitamins etc. It help improve body function, immunity, improves blood circulation, relieves stressand promotes neurological functions[7].

The *G. lucidum* is unique due to its significant pharmaceutical value and itsproducts are available in various forms including protein powders, dietary supplements and tea derived from its mycelia, spores and entire fruiting bodies[8]. Secondary metabolites of *Ganoderma* that can used to different biological activites such as antioxidant, antidiabetic and anticancer[9].Thebiological activities of *G. lucidumviz.*antitumor, anti-inflammatory effects, as well as cytotoxicity to hepatoma cell[10].

Table-1: List of bioactive compounds and their pharmaceutical properties present in *G. lucidum* studied by many workers.

Name of fungus	Name of bioactive compound	Pharmaceutical properties	Reference
G. lucidum	Alkaloids	Healthcare aspects of immuno-modulatory, brain, kidney, liver and skin diseases.	11
	Ganoderic acid	Functional food and nutraceuticals.	12
	Ketones and esters oflanostones	Anti-viral, antiplatelet and antihistamine properties.	13
	Proteins	Dietary supplements.	13
	Steroids, tannins, terpenoids, aldehydes and flavonoids	Cure epilepsy, anxiety, sedation and depression.	14
	Triterpenes, polysaccharides and especially beta glucans	Stimulate immune system, coagulation in blood, reduce cholesterol level in blood, regulate blood pressure, lipid and glucose level of blood.	15
	Ganolucidic acid A, lucidumol B, ganoderic acid-β, ganodermanondiol and ganodermanontriol	Anti-HIV-1 protease activity and inhibit HIV-1 reverse transcriptase	16

Considering these pharmaceutical potential of *G. lucidum*the present work is aimed to studies on bioactive compounds of *G.lucidum*Lingzhi from Baramati Tahsil of Pune District. This work particularly focusing on survey, collection,photography, identification, qualitative and quantitative analysis of bioactive compoundsusing routine laboratory methods and advanced LC-MS, GC-MS methods.The various medicinal applicationsof *G.lucidum*were also studied.

MATERIAL AND METHODS

Sample Collection:

The entire fruiting bodies of *G. lucidum*were collected using sterilized polythene bags from Baramati tahsil during June, 2023 to October, 2023. While collection the habitat, habit, type of substratum, colour and size of *G. lucidum* were recorded. Field photography of fungi was also done by using digital Canon 200D camera. Collected fungal material was brought to the laboratory for further analysis. The fungal material was identified and confirmed by literature[17, 18].

Sample Preparation:

The fungalmaterial was dried under shade conditions and then powdered. The 05gof powder was added in 50ml pure solvents*viz*. methanol, ethanol, acetic acid and chloroform for study of qualitative and quantitative bioactive compounds.

Qualitative Analysis:

The qualitative analysis of starch, reducing sugar and carboxylic acids were performed[19]. The test for carbohydrates were done by Dubois method[20], total proteins by Lowry[21] and lipid[22]. The preliminary phytochemical tests such as phenolics, flavonoids, terpenes and alkaloids will done by Mayer's, Wagner's, Dragendroff and Hager's reagents and anthraquinones, coumarins and saponins were find out using the methods of Harborne[29].

LCMS Analysis:

Liquid Chromatography Mass Spectrometry (LC-MS) analysis were done at ATAL Incubation Centre AIC-ADT Baramati foundation, Baramati, Dist. Pune. The 02ml of *G. lucidum*extract was used for qualitative analysis of primary and secondary bioactive compounds.Detailed chromatographic conditions showed in Table-2 (a) &2 (b).

Table-2 (a): Chromatographic conditions of LC.

Sr. No	Items	Details
1.	LC-MS/MS	SHIMADZU-8045
2.	Columndetails	Shim-packC18,100*4,6mm, 5µm
3.	Mobile Details	5mmAmmoniaFormate
4.	Methanol	20:80
5.	Gradient	Binary FlowRate
6.	Flow rate	0.700ml/min
7.	Runtime	32.00min

Table-2 (b): Chromatographic conditions of MS.

Sr. No	Items	Details
1.	Polarity	NegativeandPositiveMode
2.	Nebulizergas	3.00ml/min
3.	CID gas	230pka
4.	HeatBlocktemperature	520^0C
5.	Gas 1	-15volt
6.	Gas2	-30volt
7.	Q1Prebias	-20
8.	Q3prebias	-25
9.	CollisionEnergy	-28

GC-MS Analysis:

The quantification studies of bioactive compounds were done by Gas Chromatography and Mass Spectroscopy (GC-MS) from Progenome Lifescience, Sambhajinagar, Maharashtra. Detailed chromatographic conditions showed in Table-3 (a) & 3 (b).

GC-MS/MS : GCMS-TQ8040 NX

Auto-injector : AOCTM-20i + s

Column : SH-Rxi-5Sil MS (30m × 0.25mm I.D., df = 0.25µm)

Liner : Topaz Liner, Splitless Single Taper w/Wool

Table-3 (a): Chromatographic conditions of GC.

Sr. No	Items	Details
1.	Injector temp.	280^0C
2.	Column oven temp.	60^0C (1 min), 40^0C/min to 170^0C (0 min), 10^0C/min to 310^0C (7.25 min)
3.	Run time	25min
4.	Injection mode	Splitless (High pressure at 250kPa)
5.	Injection volume	1µL
6.	Carrier gas	He
7.	Linear Velocity	36.5 cm/sec (Constant mode)
8.	Column oven temp	60^0C (1 min), 40^0C/min to 170^0C (0 min), 10^0C/min to 310^0C (7.25 min)

Table-3 (b): Chromatographic conditions of MS.

Sr. No	Items	Details
1.	**Interface temp.**	300^0C
2.	**Ion source temp.**	230^0C
3.	**Ionization mode**	EI
4.	**Solvent cut time**	3.5min
5.	**Loop Time**	0.5sec

Plate-1 Entire fruiting body, dried pieces and fine powder of *G. lucidum*.

A: Fruiting body of *G. lucidum*

B: Drying pieces of *G. lucidum*

C: Prepared dry powder of *G. lucidum*

RESULTS AND DISCUSSION

Qualitative analysis:

The mycochemical qualitative screening of methanol, ethanol, acetic acid and chloroform extracts of *G. lucidum* revealed the presence of primary bioactive compounds *viz*. carbohydrates, proteins, starch, reducing sugar, carboxylic acid and secondary bioactive compounds *viz*. alkaloids, flavonoids, phenols, tannins, steroids, glycosides, coumarins, lignins, cinnamic acid, emodins, acetogenins, saponins and alkaloids (Table 1). On the contrary amino acids (primary bioactive compound),resins, gum and mucilage (secondary bioactive compounds) were found completely absent (Table-4). The results showed that the polar compounds like alkaloids, terpenoids, steroids, carbohydrates and phenolic compounds were present in comparatively all solvents extracts(Table-5).

Table 4: List of primary bioactive compounds extracted from *G. lucidum* Lingzhiby using different pure solvents *viz.* Methanol, Ethanol, Acetic acid and Chloroform.

Sr. No.	Test	Observation	MeOH	EtOH	OAc	TCM
1.	Carbohydrates	Reddish violet ring	+	+	+	+
2.	Proteins	Violet pink	+	+	-	-
3.	Amino acids	Violet purple	-	-	-	-
4.	Starch	Canary	+	+	+	+
5.	Reducing sugar	Green/ yellow/ red	+	+	+	+
6.	Carboxylic acid	Appearances of effervesces	+	+	+	+
7.	Lipids	Irritating smell acrolein is felt	+	+	+	+

*Methanol-MeOH, Ethanol- EtOH, Acetic acid - OAc and Chloroform- TCM (Test Presence: +& TestAbsence: -)

Table 5: List of secondary bioactive compounds extracted from *G. lucidum* Lingzhiby using different pure solvents *viz.* Methanol, Ethanol, Acetic acid and Chloroform.

Sr. No.	Test	Observation	MeOH	EtOH	OAc	TCM
1.	Alkaloids	Radish brown	+	+	+	-
2.	Flavonoids	Yellow	+	+	+	+
3.	Phenols	Turbidity	+	+	+	+
4.	Tannins	Bluish black	+	+	+	+
5.	Steroids	Upper layer red	+	+	+	+
6.	Terpenoids	Blue green	+	+	+	+
7.	Saponins	Honey comb like	-	-	+	-
8.	Glycosides	Yellow	+	+	+	+
9.	Coumarins	Yellow	+	+	+	+
10.	Anthraquinones	Pink/ violet red	+	-	+	-
11.	Lignins	Olive green	+	+	+	+
12.	Emodins	Red	-	+	-	+
13.	Gum and Mucilage	Cloudy	-	-	-	-
14.	Resins	Turbidity	-	-	-	-
15.	Acetogenins	Disappearing violet colour	+	+	-	+
16.	Cinnamic acid	No discolouration $KMNO_4$	+	+	+	+

*Methanol-MeOH, Ethanol- EtOH, Acetic acid- OAc and Chloroform- TCM (Test Presence: +& Test Absence: -)

LC-MS Analysis:

The analytical LC-MS technique was used for the identification and confirmation of the bioactive compounds present in the methanolic extract of *G. lucidum*. Our investigation revealed the presence of a total 16 soluble bioactive compounds and identification of the bioactive compounds was assured by observing the retention time, m/z ratio and peak area of the data (Table-6).

Table-6: List of bioactive compounds extracted from methanolic extract of *G. lucidum* using LC-MS.

Peak#	Compound Name	RT	m/z	Area	A/H
1	Trisjuglone	4.331	516.0381	65583	5.073
2	Sulfadiazine	10.657	250.0527	11468	33.157
3	Dinoseb acetate	11.054	282.0816	13151	10.495
4	L-Formylkynurenine	13.930	236.08	16959	10.234
5	Trans-Resveratrol 3,5-disulfate	16.961	387.997	15727	-
6	Trisjuglone	4.375	516.0378	2109641	10.472
7	L-Formylkynurenine	4.936	236.0804	759700	14.959
8	Methylphenanthrene	5.679	192.0959	205089	35.368
9	Sinapoylglucoside	6.760	630.196	1086758	17.244
10	Dixanthogen	7.888	241.955	145167	31.526
11	2-oxo-3- butenoate	5.125	272.0036	243583	25.798
12	4-hydroxyphenyl)ethane	7.121	315.9889	161734	-
13	Myricoside	7.432	756.2431	341732	29.876
14	Caffeic acid 3-sulfate	10.992	260.330	210468	12.756
15	Hydroxydantrolene	13.537	330.590	153727	22.584
16	Hydroxydantrolene	4.464	268.0655	185295	-

***RT: Retention time, m/z: specific mass-to-charge ratio and A/H: Area height.**

GC-MS Analysis:

GC-MS analysis of methanolic extracts showed total 61 bioactive compounds were extracted from *G. lucidum.* The chromatograms of peaks were combined and compared with database of known component spectra in the GC-MS, NISP library. The results showed the presence of various fatty acids, ethers, fatty alcohols, esters, alkanes, flavonoids, steroids, saturated fatty acids and carbonyl derivatives. The detailed tabulations of GC-MS analysis of methanolic extract is given in Table -7. Outofthe33bioactive compounds *viz.*, Eicosane, Pentacosane, Hexadecane, 1-iodo, Tridecane 6-methyl, Heneicosane 3- methyl, Tetracosane, Heneicosane were as alkane group.Carbonic acid, eicosyl vinyl ester, Pthalic acid di (2-Propyl pentyl ester, Sulforous acid, octadecyl 2-Propyl ester, Tricyclo[4.4.0.0(2,7)]dec-3-ene-methanol,1-methyl-8-(1-methylethyl) Oxirane, [dodecyloxy] methyl, 1,3-Propanediol,dodecyl ethyl ether, Decyl octyl ether, Oxiraneundecanoic acid, 3-pentyl,methylester,trans were as ethers group. 2-(2-Hydroxy-5-Phenoxyphenyl) Propionic acid, Pentanoic acid, 5-hydroxy-, 2,4-di-t-butylphenyl esters, Tetradecanoic acid, Hexadecanoic acid, methyl ester were found as fatty acids. Tridecanol,2-ethyl-2-methyl (fatty alcohols), 7,9-Di-tert-butyl-1-

oxaspiro(4,5)deca-6,9-diene-2,8-dione (flavonoids), Heptosiloxane, hexadecamethy (functional), Butanenitrile (nitrile), 2, 7-Diethoxy-fluoren-9-one as organic compound. Phenol 2,6-bis(1-dimethyl ethyl) is phenolics, Didocyldimethylammonium bromide is quaternary ammonium salt, Octadecanoic acid, n-Hexadecanoic acid and Tridecanoic acid, 4,8,12-trimethyl methyl ester are saturated fatty acid, 3-19-Epoxyandrost-8-en-7-ol,17-acetoxy-4,4-dimethyl-3-methoxy are steroids (Table-7). The some important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure were detailed showed in Fig. 1 to Fig. 9.

The rigorous study of *Ganoderma* literature noticed that the presence of carbohydrates can possibly increase the therapeutic potency of many important component. The fungal steroids are reported to possess significant pharmaceutical and agrochemical properties mainly antibacterial, immunosuppressive, hepatoprotective, anti-tumor, sex hormone, cytotoxic, cardiotonic, antihelminthic activitesand plant growth hormone regulator[23]. The LC-MS was used to identify the chemical constituents presents in the *G. lucidum.* The three major bioactive compounds *viz*. caffeic acid 3-sulfate, formylkynurenine and myricoside have been reported to process various biologicaland medicinal effects, including photo-protective, anti-angiogenic, anti-cancer, anti-diabetic, antioxidant and anti-inflammatory properties.

Table 7: List of bioactive compounds extracted from methanolic extractof *G. lucidum* using GC-MS.

Peak	Name of Compound	RT	Height	Area	Area %
1	Trichloromethane	4.49	59221.91	48662.71	0.27
2	Benzaldehyde, 2,4,6-trimethyl	22.68	18543.15	172835.57	0.97
3	Decyl octyl ether	24.87	19696.2	387306.36	2.17
4	Tricyclo[4.4.0.0(2,7)]dec-3-ene-3-methanol, 1-methyl-8-(1-methylethyl)	26.23	28564.89	313810.2	1.76
5	Carbonic acid, eicosyl vinyl ester	26.86	32111.24	325730.94	1.83
6	Pentanoic acid, 5-hydroxy-, 2,4-di-t-butylphenyl esters	27.55	58925.21	870877.21	4.89
7	Hexadecane, 1-iodo	27.96	51502.09	537409.57	3.02
8	Oxirane, [(dodecyloxy)methyl	29.51	35983.61	672381.62	3.77
9	Butanenitrile	30.96	12048.26	6867.83	0.04
10	Tridecane, 6-methyl	31.74	57054.67	400023.27	2.24
11	Tridecanol, 2-ethyl-2-methyl	32.66	64561.95	447428.78	2.51
12	Sulfurous acid, octadecyl 2-propyl ester	33.81	57281.01	897861.82	5.04
14	Tetradecanoic acid	34.59	30044.91	300389.64	1.69
15	Dibutyl phthalate	35.2	15648.07	57632.46	0.32
16	7,9-Di-tert-butyl-1-oxaspiro(4,5)deca-6,9-diene-2,8-dione	36.15	381716.59	2711813.4	15.22
17	Hexadecanoic acid, methyl ester	36.41	526828.48	9561530.32	53.65

18	1,3-Propanediol, dodecyl ethyl ether	36.91	41892.34	117113.36	0.66
19	Tridecanoic acid, 4,8,12-trimethyl-, methyl ester	37.12	26050.28	182795.55	1.03
21	3-Methyl-2-(trimethylsilyl)oxybenzoicacidtrimethylsilyl ester	37.29	31224.88	27714.93	0.16
22	n-Hexadecanoic acid	37.67	549225.83	17823173.8	100
23	5,5-Dibutylnonane	39.46	72237.78	558223.28	3.13
24	Methyl stearate	40	1041619	10579924.8	59.36
25	Eicosane	40.62	47245.59	106659.99	0.6
26	Octadecanoic acid	40.96	344109.27	2427610.88	13.62
27	Fenpipramide	41.56	50383.48	229741.3	1.29
28	Heptasiloxane, hexadecamethyl	41.99	217580.62	819127.83	4.6
29	Tetracosane	42.21	426457.5	2395823.06	13.44
33	Tetracosane	43.29	843609.99	4207211.82	23.61
34	Heptasiloxane, hexadecamethyl	43.54	307159.06	1101323.73	6.18
35	4-Hexyl-1-(7-methoxycarbonylheptyl)bicyclo[4.4.0]deca-2,5,7-triene	44.11	284657.9	1202268.77	6.75
36	Pentacosane	44.26	1089395.7	4869261.89	27.32
37	Didodecyldimethylammonium bromide	44.45	599520.62	2991781.91	16.79
38	Phthalic acid, di(2-propylpentyl) ester	44.77	165595.3	443877.87	2.49
39	Heptasiloxane, hexadecamethyl	44.85	432176.75	1756381.89	9.85
40	Tetracosane	45.14	999613.96	4908491.84	27.54
41	Heneicosane, 3-methyl	45.75	53913.35	396865.87	2.23
42	Heneicosane, Heptasiloxane, hexadecamethyl	45.96	696837	2069761.89	11.61
43	2-(2-Hydroxy-5-phenoxyphenyl)propionic acid	46.02	419300.77	1199699.19	6.73
47	Tetracosane	46.78	675898.73	2854718.62	16.02
48	Heptasiloxane, hexadecamethyl	47.21	247179.97	1076202.42	6.04
50	Sulfurous acid, octadecyl 2-propyl ester	47.48	142562.6	753749.04	4.23
51	Tetracosane	47.72	493876.1	2180225.51	12.23
52	2,7-Diethoxy-fluoren-9-one	47.92	132185.87	619273.96	3.47
55	Heneicosane	48.82	259121.82	1135360.84	6.37
56	1,2,4-Cyclopentanetrione, 3,3-bis(3-methyl-2-butenyl)-5-(2-methyl-1-oxopropyl)	49.3	222672.33	1691472.63	9.49
57	Oxiraneundecanoic acid, 3-pentyl-, methyl ester, trans	49.84	464900.71	3694252.97	20.73
58	Heneicosane	50.15	75080.24	244195.26	1.37
59	Molybdenum, [(1,2,3,4,5-.eta.)-1-(1,1-dimethylethyl)-2,4-cyclopentadien-1-yl]bis(.eta.3-2-propenyl)	50.45	304377.2	3912694.74	21.95
60	Phenol, 2,6-bis(1,1-dimethylethyl)	51.08	601050.36	10212432.3	57.3
61	3-19-Epoxyandrost-8-en-7-ol, 17-acetoxy-4,4-dimethyl-3-methoxy	51.73	187500.48	2235104.89	12.54

The presence of mycochemicalsin the methanolic extract of *G. lucidum*possiblyindicates its numerous medicinal properties such as anti-inflammatory, anti-ulcer and anti-oxidative[24]. Triterpenoids isolated from *Ganoderma* showed significant biological activities and Ganoderic acids showed anticancer, antiviral, hepatoprotective, antiplatelet aggregation, antioxidant, hypocholesterolemic and inhibition of histamine release activities[15]. *G. lucidum* isolates ganolucidic acid, ganoderic acid,

ganodermanondiol, lucidumol and ganodermanontriol showed anti-HIV-1 protease activity[25]. *Ganoderma* has effectivein improving pancreatic blood circulation, reducing blood glucose, reducing blood lipids and improving various symptoms of hyperlipidemia[26].Pharmacological studies have confirmed that *Ganoderma* triterpenes (GTs) can inhibits tumor cells, lowers blood pressure, protects the liver, lowers cholesterol and resists biological activities such as human immunodeficiency virus[27].*Ganoderma* extract (GEs) and *Ganoderma* spore oil (GSO) proved definite anti-tumor effects in the *in-vitro* and *in-vivo* studies. GEs and GSO inhibited the growth of human leukaemia cells (K562 and HL60) and human gastric cancer cells (SGC-7901)[28].

Fig. 1: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Carbonic acid, eicosyl vinyl ester.

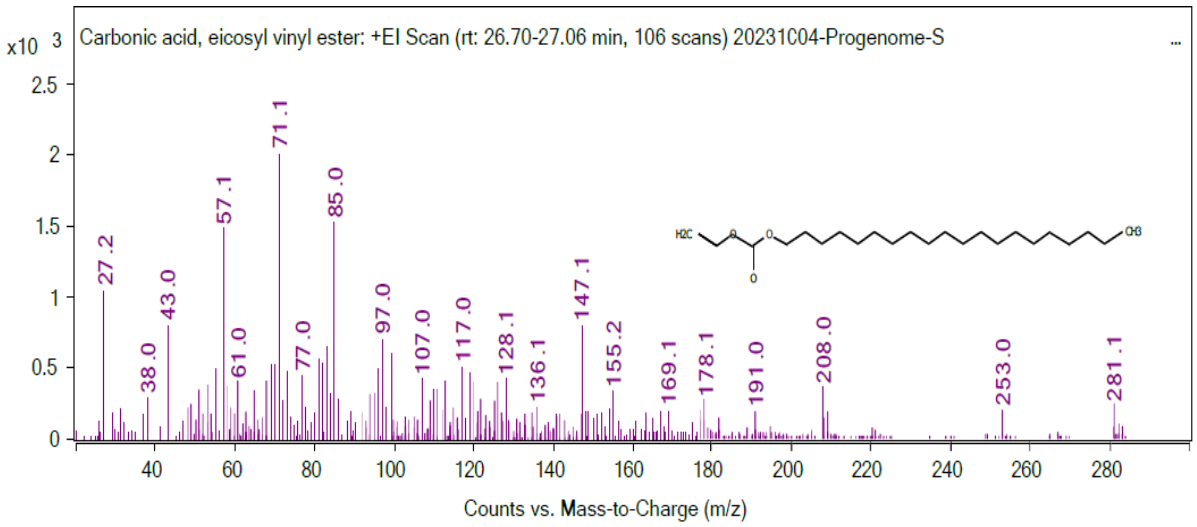


Fig. 2: GC-MS analysis of important bioactive compounds from methanolic extract of *G. Lucidum* and their spectrum with structure of Pentanoic acid, 5-hydroxy-, 2, 4-di-t-butylphenyl esters.

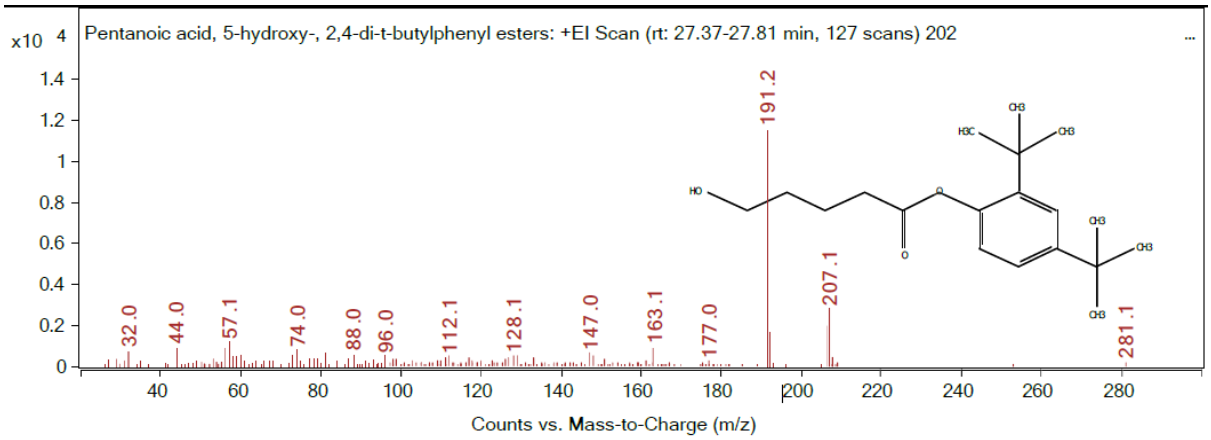


Fig. 3: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Oxirane, [(dodecyloxy) methyl].

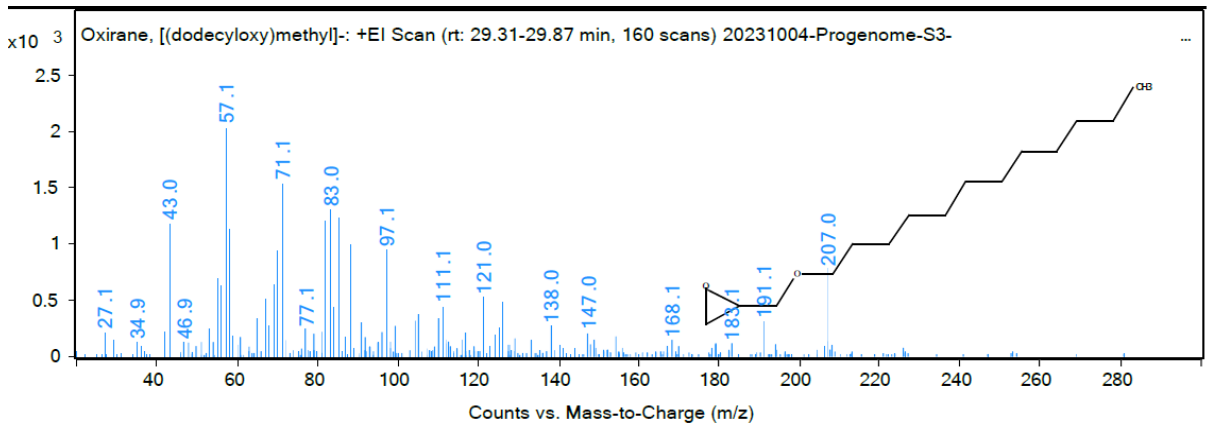


Fig. 4: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Tetradecanoic acid.

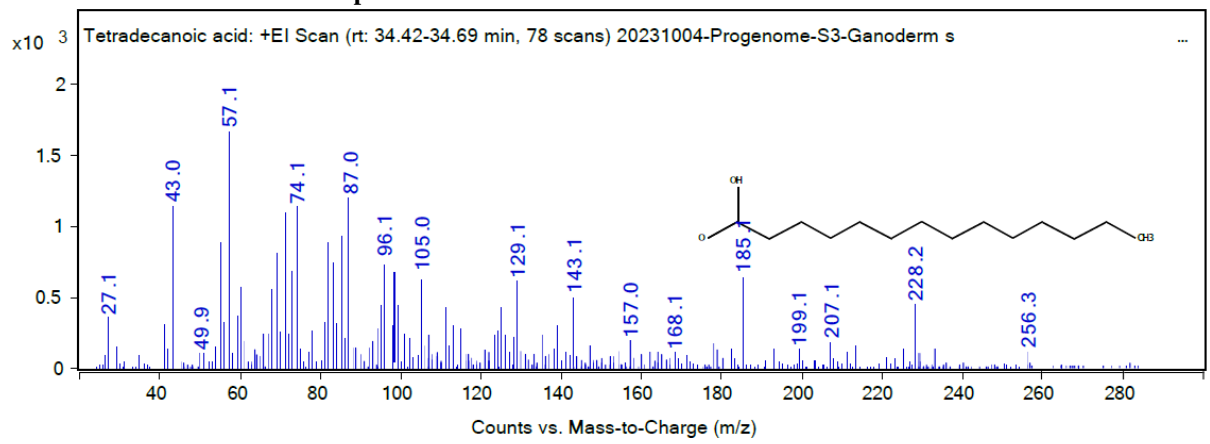


Fig. 5: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of n-Hexadecanoic acid.

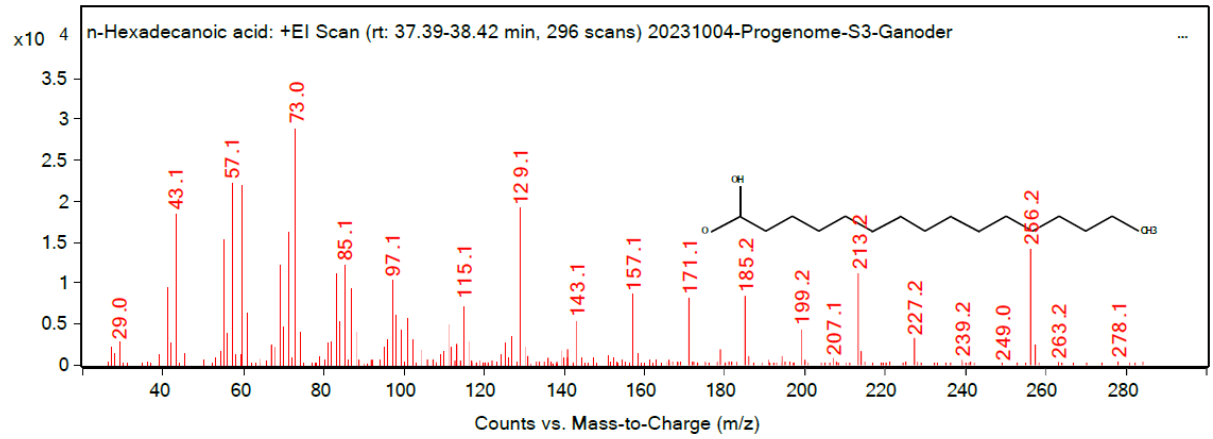


Fig. 6: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Sulfurous acid, octadecyl 2-propyl ester.

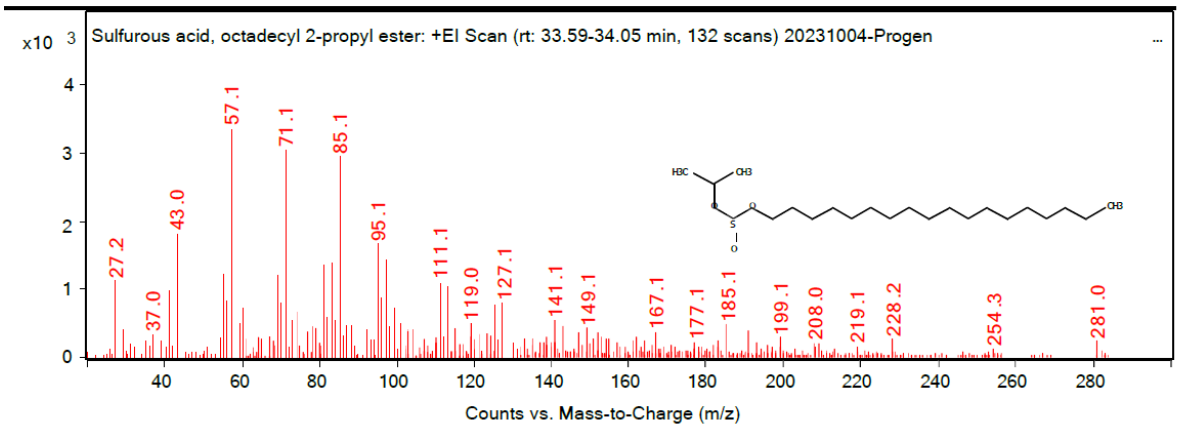


Fig. 7: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Heptasiloxane, hexadecamethyl.

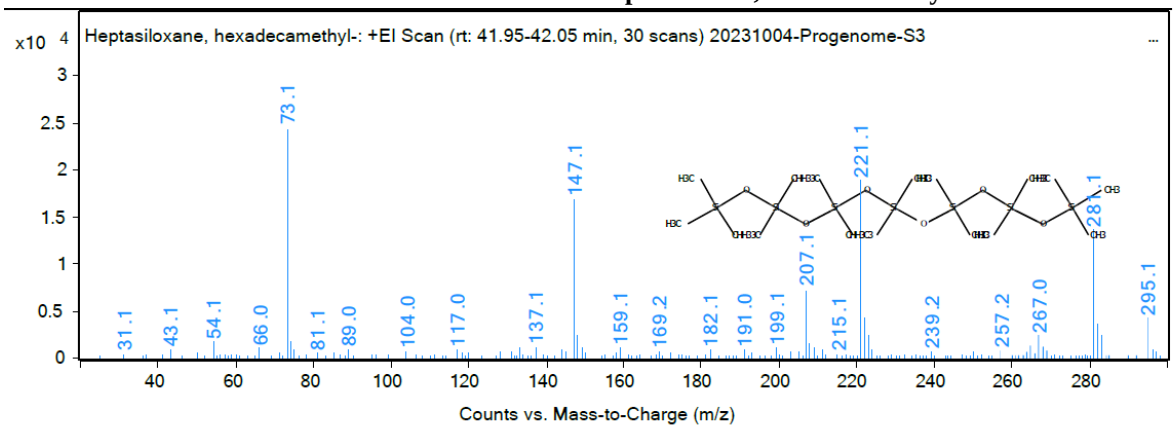


Fig. 8: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Phthalic acid, di(2-propylpentyl) ester.

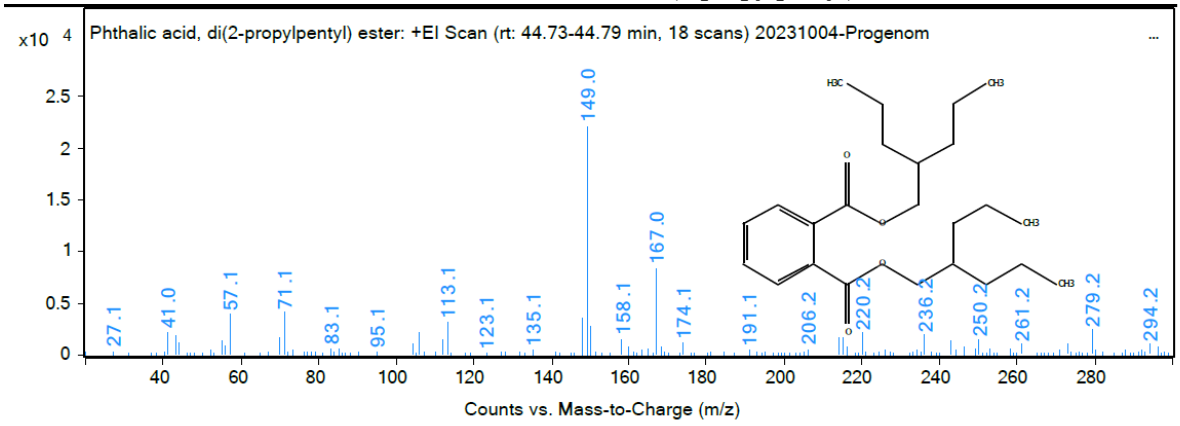
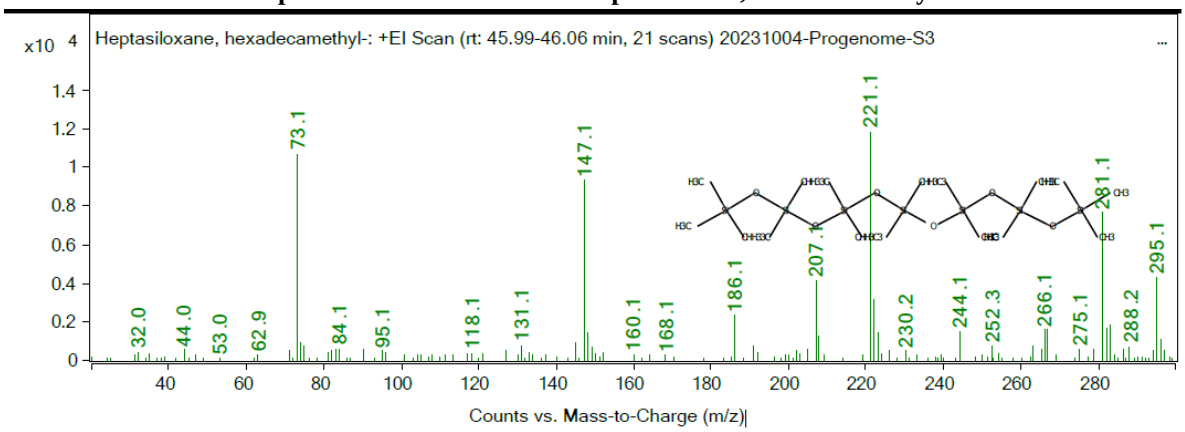


Fig. 9: GC-MS analysis of important bioactive compounds from methanolic extract of *G. lucidum* and their spectrum with structure of Heptasiloxane, hexadecamethyl.



CONCLUSION

G.lucidum, a mushroom of biomedical importance, contains a number of bioactive components, many of them biological response modifiers which activate our immune systems for a multitude of defensive functions. However, *G. lucidum* appears to serve as an effective role in the treatment of cancer. The identified bioactive compounds in *G. lucidum* of known molecular structures account for a wide range of beneficial biomedical effects, most notably in prevention of diverse physiological disorders and diseases. The *G. lucidum* is a golden medicinal fungus and is yet to be exploited commercially. In the search for bioactive compounds (qualitatively and quantitatively) from *G. lucidum*, the majority of research had been focussed on extracts from the fruiting body. It appears that there are a number of biologically active compounds to be explored in the fruiting body and the future research may depth investigation toward the discovery of efficient biomolecules of *G. lucidum*.

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