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Taxonomic characterization and GC-MS analysis of two edible mushrooms

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ABSTRACT

Mushroom specimens were collected during August 2024 from Mantha tahsil of Jalna district of Maharashtra. Based on taxonomic characterization, the specimens were identified as*Calocybe indica* Purkay & A. Chandra and *Volvariella volvocea* (Bull.) Singer. For analysis of their biochemical analysis, methanolic extract were prepared and Gas Chromatography-Mass Spectrometry (GC-MS) analysis showed the presence of biotic compounds such as Dimethyl sulfide, Dodecane, Tetradecane, Diethyl Phthalate, Tetradecanal, 2-Pentadecanone, Pentadecanal, 1-Nonadecene, 2-Nonadecanone, Methyl 13-methyltetradecanoate, 7-Hexadecenal, (Z)-Hexadecanoic acid, methyl ester, Hexadecanoic acid, 15-methyl-, methyl ester, 9-Octadecenoic acid, methyl ester, (E)- 2(3H)-Furanone, 5-dodecyldihydro-, Hexadecanoic acid, pentyl ester, etc in both mushrooms. The identified compounds reportedly show diverse bioactivities such as insecticide, antiviral, anticancer, antimicrobial, antioxidant, antitubercular hypocholesterolemic, anti-inflammatory and antiandrogenic. The presented results may provide baseline information about bioactive constituents of above-mentioned mushrooms in providing valuable compounds for medicinal and agricultural importance.

Keywords: Mushroom, *Calocybe indica, Volvariella volvocea,* bioactive compounds, GC-MS

Mushrooms are a diverse and omnipresent group of fungi, belonging to both Ascomycotina and Basidiomycotina. Over 2000 species are reported to be edible worldwide, with about 283 of these species available in India (Adhikari, 1981). Mushrooms are valuable, healthy foods, being low in calories and rich in non-animal proteins, vitamins, iron, zinc, and potassium (Ouzouni *et al*., 2009). Mushrooms are a valuable source of dietary fiber supporting digestive health due to the unique composition of their cell walls, which contain chitin, hemicelluloses, and mannans. Additionally, bioactive components in mushrooms such as beta-glucans, which have been shown to enhance immune function and offer other health benefits. Beta-glucans are known for their role in managing cholesterol levels and supporting heart health, making mushrooms a nutrient-dense food that provides both fiber and functional health-promoting properties (Manzi and Pizzoferrato, 2000). Phenolic content in mushroom are reported to be excellent antioxidants (Cheung *et al.*, 2003). While many synthetic antioxidants have limited effects on living systems (Botterweck *et al.*, 2000), natural sources of antioxidants, such as mushrooms, can be valuable in addressing oxidative stress and preventing health issues caused by free radicals.

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Volvariella volvocea, commonly known as the straw mushroom, is notable for its tolerance to high temperatures, thriving best at around 30°C. This mushroom contains a range of bioactive compounds with medicinal properties, including polysaccharides (anticancer activity), proteins (immunosuppressive effects) and agglutinins (immunoregulation), etc. These properties make *V. volvacea* a valuable mushroom not only as a food source but also for its potential health benefits (Mathew *et al.*, 2008; Wu *et al.*, 2011; Sun *et al.*, 2014). *Calocybe indica* also known as milky mushroom has considerable nutritional value and has been extensively explored for its medicinal properties like antidiabetic, anti-tumour and anti-inflammatory (Selvi *et. al.*, 2011; Subbiah and Balan, 2015).

Geographic conditions of Mantha tahsil are highly favorable for the growth of *Calocybe indica* and *Volvariella volvocea* to grow on agro waste. However, proper scientific identification of these two mushrooms based on micro and macro characteristics, its bioactive compounds and antioxidant properties are yet to be carried out in Mantha and its adjoining regions of Jalna district, which make this study more important and essential due to common practice of mycophagy in this region.

Gas chromatography-mass spectrometry (GC-MS) has recently become a crucial platform for profiling secondary metabolites in both plant and non-plant species, establishing itself as an essential tool in metabolite analysis (Sharmila *et al.*, 2017). This study aimed to explore the bioactive volatiles in the methanolic extracts of *Volvariella volvacea* and *Calocybe indica* from Mantha in Jalna district, Maharashtra, using the GC-MS technique. The findings will help to guide future research into the pharmaceutical, nutraceutical, and agricultural applications of these mushroom species.

MATERIAL AND METHODS

Collections

Samples of *Calocybe indica* and *Volvariella volvocea* were collected from during August 2024 from Mantha tahsil of Jalna district of Maharashtra (Lat. 19.61229^0 Alt. 76.424532^0; Lat. 19.612033^0 Alt. 76.0423885^0). Locality, habitat, date of collection, and vegetation type were recorded. To confirm the identity of collected specimens, a detailed study on macroscopic and microscopic characters were carried out alongside the descriptions of the pileus (including diameter, shape, and color), cuticle (general and marginal characters), lamellae, and stipe (covering position, shape, length, thickness and color).

Taxonomic examination

The basidiocarps were studied in detail for various macroscopic features, including shape, size, color, type of gills, and margin. Microscopic examination focused on the hyphal system, basidia, and basidiospores (Singer 1986; Atri and Kaur, 2003; Upadhyay and Kaur, 2004). Color descriptions were based on the Methuen Handbook of Colours (Kornerup and Wanscher, 1978). Anatomical details of the specimens, including hyphae, basidia, and basidiospores, as well as their arrangements, were examined using crush mounts and hand-cut sections. The samples were stained with Congo red, cotton blue, and Melzer's reagent. Photomicrographs of the gills, mycelium, and spores were captured and measured with an Olympus BX53 microscope.

GC-MS analysis

GC-MS analysis of *Calocybe indica* and *Volvariella volvocea* was performed using the equipment Thermo GCTrace Ultra Version: 5.0 and Thermo MS DSQ II. The equipment had a DB 35 –

MS Capillary Standard non-polar column with dimensions of 30 mm×0.25 mm ID×0.25 µm film. The carrier gas used was Helium with a flow rate of 1.0 ml/min. The injector was operated at 250°C and the oven temperature was programmed as 50°C for 02 min, then gradually increased up to 260°C. The identification of components was based on computer library (NIST and Willey) attached to the GC-MS instrument as well as a comparison of their retention indices.

RESULTS AND DISCUSSION

Calocybe indica Purkay. & A. Chandra (GM 01) [Plate 1]

Fructification: 16 cm; Pileus: 11 cm, convex to plano-convex without umbo, surface dry, white when young to lightly white at maturity, margin regular, involute; scales: appressed fibrillose; Cuticle: fully peeling; Gills: Sinuate, unequal, crowded; width of lamellae: 0.5cm; Gill edge: Smooth; Colour: white; Stipe: central 10 cm long, 5.8 cm wide cylindric with sub bulbous base and white; Surface: fibrillose; Basidiospore: 6.64-7.47×4.98-5.81 µm, broadly ellipsoid, Inamyloid, Smooth, thin walled, apiculate; Basidia: 24.42 – 31.54 × 6.64 – 9.96 µm, clavate with basal clamps, granular tetra-sterigmata; Cystidia absent (both pleurocystidia & cheilocystidia). The microscopic and macroscopic details closely resemble those provided by Purkayastha and Chandra (1974) as well as Bedi *et al.* (2017), indicating a strong alignment in observations. This species is easily identified by its silky white cap, which ranges from campanulate to convex in shape, along with short, decurrent lamellae and a whitish stipe that completes its appearance.

Volvariella volvacea (Bull.) Singer (GM 02) [Plate 2]

Cap: 11 cm, convex, campanulate gradually streated with scaly hairs gray when young to brownish gray

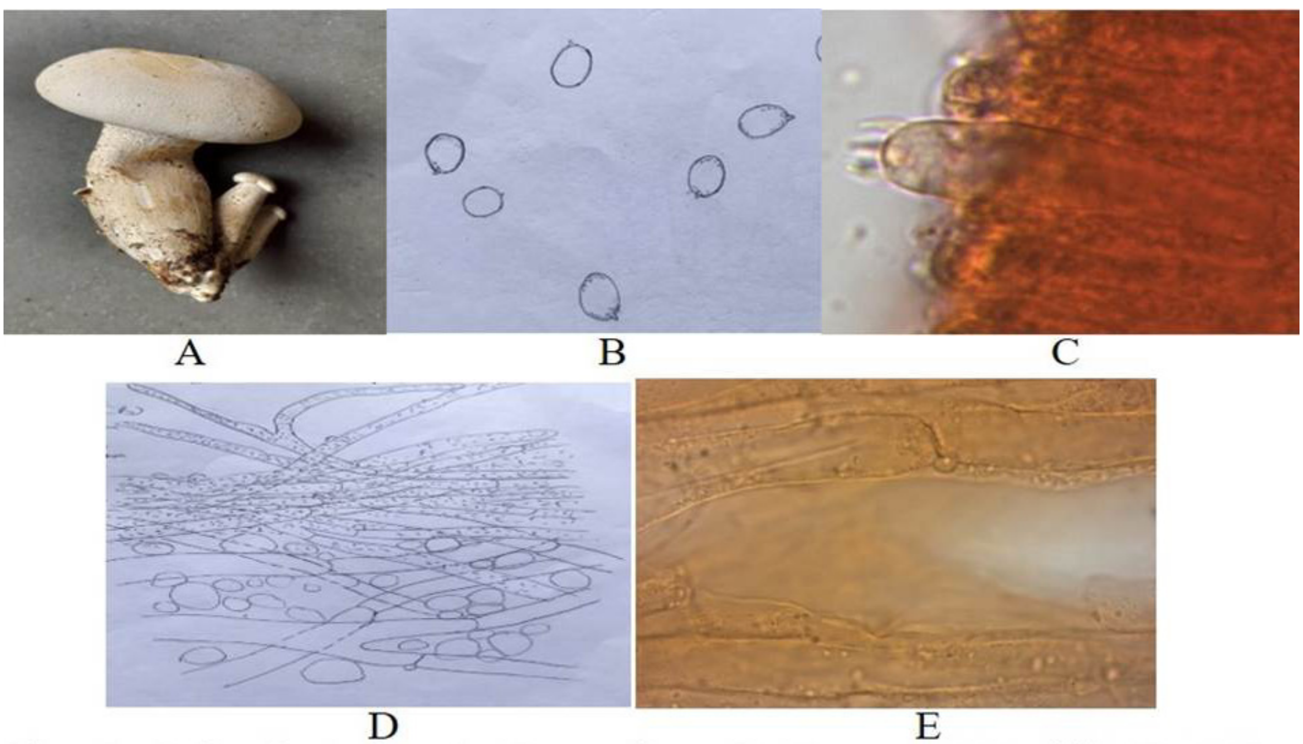

Plate 1. *Calocybe indica.* A: Carpophore; B: Spores; C: Basidia; D: C.S. through pileus cuticle and context; E: C.S. through stipe cuticle and context

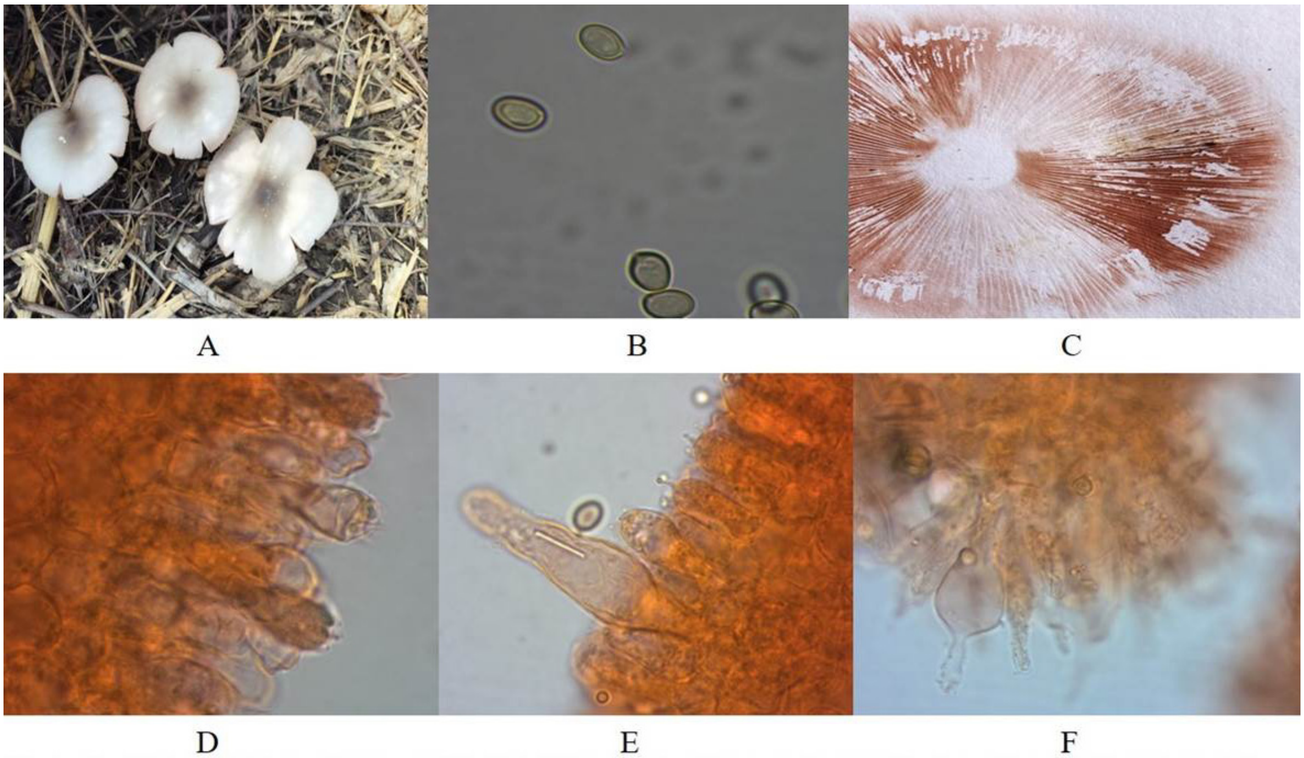

Plate 2. *Volvariella volvacea* (Bull.) Singer. A: Carpophore; B: Spores; C: Spore print; D: Basidia; E: Pleurocystidia; F: Chielocystidia

to grayish brown at center at maturity with pale margins; Gills: free, grayish orange to brownish orange, unequal; Gills edge: smooth; Stipe 13 cm long and 2 cm wide white volvo at base, saccate volvo, volvo brownish, gray to black above and white at base; basidia: 19.92 - 26.56 × 8.3 - 11.62 µm. clavate, tetra sterigmata; Basidiospore: 6.64 - 8.3 × 4.98 - 5.81 µm ellipsoid to avoid, smooth, thick walled, inamyloid; Pleurocystidia: 49.8 - 83 × 9.96 - 19.92 µm, lageniform, hyaline, smooth, thin walled. Microscopic and macroscopic descriptions show full similarity with details given by Breitenbach and Kranzlin (1991), Bedi *et al*., (2017) and Ali *et al.*, (2017).

GC-MS analysis

GC-MS analysis of the crude extract of the two specimens was performed to identify the bioactive compounds. The GC-MS chromatogram revealed various peaks corresponding to compounds with different retention times. These compounds were identified by comparing their spectral fingerprints with the NIST library, allowing for the identification of 82 major compounds in *Calocybe indica* and 99 in *Volvariella volvocea* at specific retention times. The GC-MS spectra confirmed the presence of bioactive compounds in the methanolic extract obtained from the *Calocybe indica* (Fig. 1) and *Volvariella volvocea* (Fig. 2). The chromatogram profile of the crude extract and the identified volatile compounds are presented. The molecular weights of the bioactive compounds were also determined, along with the major compounds listed in Table 1 and Table 2. Dimethyl sulfide, Dodecane, Tetradecane, Diethyl Phthalate, Tetradecanal, 2-Pentadecanone 6,10,14-trimethyl-Pentadecanal, 1-Nonadecene, 2-Nonadecanone, Methyl 13-methyltetradecanoate, 7-Hexadecenal, (Z)-Hexadecanoic acid, methyl ester, Hexadecanoic acid, 15-methyl-, methyl ester, 9-Octadecenoic acid, methyl ester, (E)- 2(3H)-

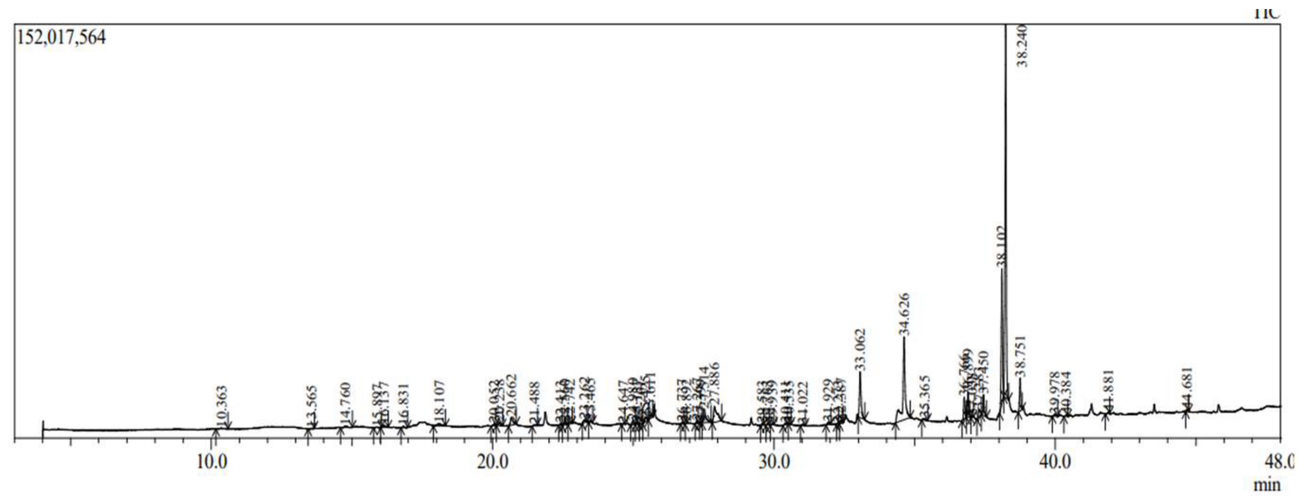

Fig. 1. GC-MS spectra of *Calocybe indica*

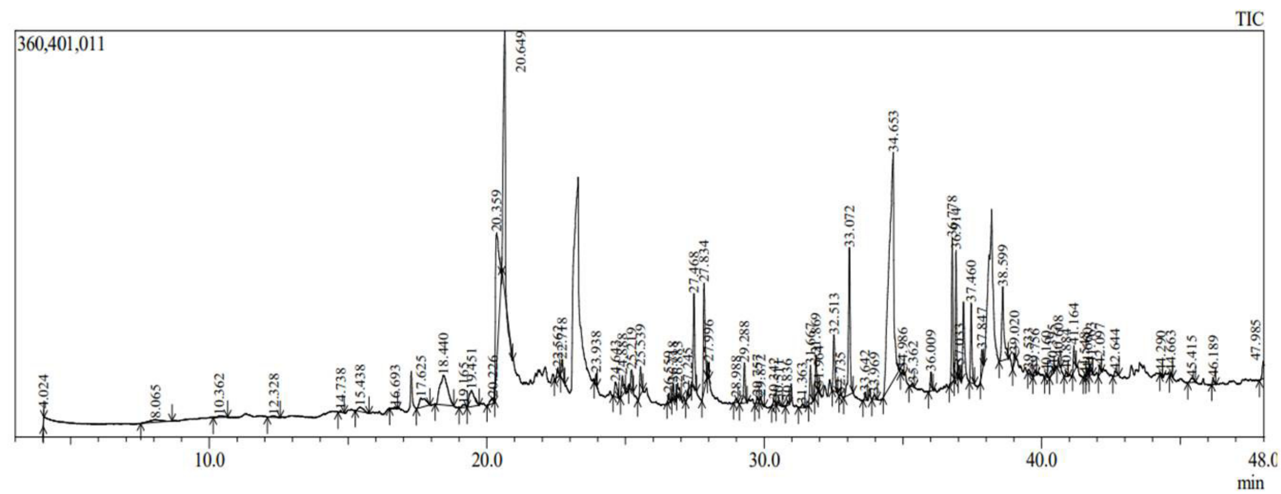

Fig. 2. GC-MS spectra of *Volvariella volvocea*

Furanone, 5-dodecyldihydro-, Hexadecanoic acid, pentyl ester, etc were known to be biologically active and protect mushrooms from attacks by microbes, insects, and other herbivores (Mithöfer and Maffei, 2017; Navarro and Amanda, 2019). This suggests that the studied mushrooms have pharmaceutical, agricultural and confectionery potentials (Pelin, *et. al*., 2013; Kevin *et al*., 2019). The compounds identified in this study from mushrooms are reported to have diverse pharmaceutical and nutritive roles such as Dimethyl sulfide act in cytoprotection and prevent aging (Guan *et al.*, 2017), 2 Nonadecanone used as insecticide and contributes to anti-inflammatory, antidepressant and anti-dementia effects (Lee and Hyun 2018). Dodecane was reported to have antibacterial activity (Togashi *et al*. 2007). Hexadecene showed antimicrobial activity (Octarya *et al*., 2021). Tetradecanal reported to have antibacterial activity against *Salmonella aureus* (Bittencourt *et al*., 2015). Pentadecanone showed hypocholesterolemic activity, antioxidant, and lubrication activity (Kumar *et al.*, 2010). Nonadecene showed antitubercular activity (Amudha *et al.*, 2018) whereas, 2-Nonadecanone proved to show antibacterial activity (Muthulakshmi *et al.*, 2012). Methyl 13-methyltetradecanoate act as antioxidant,

Table 1. Bioactive compounds identified in the methanolic extract of *Calocybe indica*

	RT (min.)	Compound	Molecular formula	Molecular Weight g/mol	Peak Area %
1.	0.165	4-Methyl-N-(2-morpholin-4-yl-2-oxo-ethyl)-benzenesulfonamide	C13H18N2O4S	298	2.1139
2.	0.215	3-Methylthio-4-methyl-6-phenyl-5-thio-4,5-dihydro-1,2,4-triazine	C11H11N3S2	249	3.9355
3.	0.415	2-Oxa-6-azatricyclo [3.3.1.1(3,7)]decane, 6-(phenylsulfonyl)	C14H17NO3S	279	1.9179
4.	1.215	Molybdenum, tricarbonyl-.eta.-6-spiro[1,3-dioxolane-2,1'-benzocyclobutene]-	C13H10MoO5	344	2.4444
5.	1.406	Dimethyl sulfide	C2H6S	62	32.8664
6.	2.337	trans-2-Decen-1-ol, pentafluoropropionate	C13H19F5O2	302	2.6747
7.	5.503	(4-Benzooxazol-2-ylpiperazin-1-yl)(pyridin-3-yl)methanone	C17H16N4O2	308	2.5753
8.	6.295	4,7-Bis(4-morpholino-1,2,5-thiadiazol-3-yloxymethyl)-1,3-dioxepane-5,6-diol	C19H28N6O8S2	532	1.7859
9.	7.116	Sulfimine, N-(2-methoxy-4-nitrophenyl)-S,S-dimethyl	C9H12N2O3S	228	1.8468
10.	9.244	1-Methyl-1,1,4,4-tetrachloro-4-vinyldisilethylene	C5H10Cl4Si2	266	2.5012
11.	10.875	Dimethylmalonic acid, 2,5-dichlorophenyl tridecyl ester	C24H36Cl2O4	458	3.9727
12.	11.854	4-[5-(Pyridin-2-yl)-1H-1,2,4-triazol-3-yl]aniline	C13H11N5	237	1.8417
13.	19.591	Bufa-20,22-dienolide, 14,15-epoxy-3-hydroxy-19-oxo-, (3.beta., 5.beta.,15.beta.)-	C24H30O5	398	2.2395
14.	22.129	Citramalic acid, 3TBDMS derivative	C23H50O5Si3	490	2.2269
15.	25.613	Phosphonic acid, (3-methyl-2-oxo-3-pentenyl)-, diethyl ester, (E)	C10H19O4P	234	2.3720
16.	25.925	2,3-Dihydroxypropyl 5-fluoroorotate	C8H9FN2O6	248	2.0289
17.	26.934	Piperacetazine, TMS derivative	C27H38N2O2SSi	482	2.7224
18.	27.080	Benzonitrile, 2-(5-bromo-2-thenylidenamino)	C12H7BrN2S	290	1.7526
19.	27.805	3-[5-(3-Chlorophenyl)-1H-1,2,4-triazol-3-yl] pyridine	C13H9ClN4	256	2.7519
20.	27.900	Isoindole-1,3,5-trione, perhydro-2-phenyl	C14H13NO3	243	1.7286
21.	28.407	2,4-Dinitro-4'-methyksulfonyldiphenylsulfoxide	C13H10N2O7S2	370	1.7384
22.	29.023	Pyrrolo[1,2-c][1,3,2]diazaphosphorine-4-carbonitrile, 1,5,6,7-tetrahydro-1-(methylthio)-3-(4-morpholinyl)-, 1-sulfide	C12H17N4OPS2	328	1.9552
23.	29.093	4(equaorialt)-Ethenyl-1,2(equatorial)-dimethyl-trans-decahydro-quinol-4-ol,N-oxide	C13H23NO2	225	2.3035
24.	30.385	1,2-Benzisothiazol-3-amine, TMS derivative	C10H14N2SSi	222	1.9562
25.	30.635	1,1,2,2,4,4-Hexa-t-butyl-3,5-dioxa-1,2,4-trisilolane	C24H54O2Si3	458	1.8756
26.	32.009	Tetracosamethyl-cyclododecasiloxane	C24H72O12Si12	888	2.7612
27.	32.830	Ethyl 2-acetamido-3,3,3-trifluoro-2-(4-fluoroanilino) propionate	C13H14F4N2O3	322	1.7697
28.	32.975	2,4,6-Cycloheptatrien-1-one, 3,5-bis-trimethylsilyl	C13H22OSi2	250	2.7447
29.	33.315	Benzenamide, N-cyano-3,4,5-trimethoxy	C10H12N2O3	208	2.5686
30.	34.570	Cyclotrisiloxane, hexamethyl	C6H18O3Si3	222	2.0278
31	10.363	Dodecane, 2,6,10-trimethyl-	C15H32	212	0.20
32	13.565	(Dimethylamino) ethyl methacrylate	C8H15NO2	157	-0.02
33	14.760	Dodecane	C12H26	170	0.16
34	15.897	5,5-Dimethyl-cyclohex-3-en-1-ol	C8H14O	126	0.06
35	16.137	Benzene, 1,3-bis(1,1-dimethylethyl)-	C14H22	190	0.33
36	16.831	Dodecane, 2,6,11-trimethyl-	C15H32	212	0.14
37	18.107	Undecanal	C11H22O	170	0.67
38	20.052	1-Tridecene	C13H26	182	0.16

	RT (min.)	Compound	Molecular formula	Molecular Weight g/mol	Peak Area %
39	20.238	Tetradecane	C14H28O	212	0.47
40	20.662	Caryophyllene	C15H24	204	1.39
41	21.488	Octane, 2-cyclohexyl-	C14H28	196	0.12
42	22.413	Eicosane	C20H42	282	0.13
43	22.560	n-Tridecan-1-ol	C13H28O	200	0.40
44	22.742	Octadecane	C18H38	254	0.29
45	23.262	Tridecanal	C13H26O	198	0.46
46	23.465	Dodecanoic acid, methyl ester	C13H26O2	214	0.23
47	24.647	7-Hexadecene, (Z)-	C16H32	224	0.06
48	24.980	E-14-Hexadecenal	C16H30O	238	0.35
49	25.137	Hexadecane	C16H34	226	0.26
50	25.261	2-Tetradecanone	C14H28O	212	0.05
51	25.425	Diethyl Phthalate	C12H14O4	222	0.81
52	25.611	Tetradecanal	C14H28O	212	0.91
53	26.737	(Z)6-Pentadecen-1-ol	C15H30O	226	0.15
54	26.892	Oxirane, decyl-	C12H24O	184	0.05
55	27.267	n-Nonadecanol-1	C19H40O	284	0.27
56	27.399	Heptadecane	C17H36	240	0.07
57	27.514	2-Pentadecanone	C15H30O	226	2.70
58	27.886	Pentadecanal-	C15H30O	226	4.40
59	29.583	1-Nonadecene	C19H38	266	0.16
60	29.763	Tridecanol, 2-ethyl-2-methyl-	C16H34O	242	0.12
61	29.939	2-Nonadecanone	C19H38O	282	0.09
62	30.411	Hexadecanal	C16H32O	240	0.25
63	30.535	Methyl 13-methyltetradecanoate	C16H32O2	256	0.04
64	31.022	2-Pentadecanone, 6,10,14-trimethyl-	C18H36O	268	0.26
65	31.929	Z,Z-6,27-Hexatriactontadien-2-one	C36H68O	516	0.32
66	32.273	Pentadecanoic acid, ethyl ester	C17H34O2	270	0.06
67	32.387	7-Hexadecenal, (Z)-	C16H30O	238	0.35
68	33.062	Hexadecanoic acid, methyl ester	C17H34O2	270	5.95
69	34.626	Hexadecanoic acid, ethyl ester	C18H36O2	284	15.59
70	35.365	Hexadecanoic acid, 15-methyl-, methyl ester	C18H36O2	284	0.34
71	36.766	9,12-Octadecadienoic acid (Z,Z)-, methyl ester	C19H34O2	294	2.19
72	36.899	9-Octadecenoic acid, methyl ester, (E)-	C19H34O2	294	2.45
73	37.038	Octadecanoic acid, 17-oxo-, methyl ester	C19H36O3	312	0.08
74	37.283	2(3H)-Furanone, 5-dodecyldihydro-	C16H30O2	254	1.09
75	37.450	Methyl stearate	C19H38O2	298	2.20
76	38.102	Linoleic acid ethyl ester	C20H36O2	308	13.04
77	38.240	(E)-9-Octadecenoic acid ethyl ester	C20H38O2	310	36.61
78	38.751	Octadecanoic acid, ethyl ester	C20H40O2	312	3.28
79	39.978	n-Propyl 9,12-octadecadienoate	C21H38O2	322	0.27
80	40.384	Hexadecanoic acid, pentyl ester	C21H42O2	326	0.11
81	41.881	Oleic Acid	C18H34O2	282	0.11
82	44.681	3',8,8'-Trimethoxy-3-piperidyl-2,2'-binaphthalene	C28H25NO7	487	0.18

Table 2. Bioactive compounds identified in the methanolic extract of *Volvariella volvacea*

	RT (min.)	Compound	Molecular formula	Molecular Weight g/mol	Peak Area %
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27.	32.830	Ethyl 2-acetamido-3,3,3-trifluoro-2-(4-fluoroanilino) propionate	C13H14F4N2O3	322	1.7697
28.	32.975	2,4,6-Cycloheptatrien-1-one, 3,5-bis-trimethylsilyl	C13H22OSi2	250	2.7447
29.	33.315	Benzenamide, N-cyano-3,4,5-trimethoxy	C10H12N2O3	208	2.5686
30.	34.570	Cyclotrisiloxane, hexamethyl	C6H18O3Si3	222	2.0278
31	4.024	Hydroperoxide, 1-methylpenty	C6H14O2	118	0.09
32	8.065	Cyclohexene, 1-methyl-4-(1-methylethylidene)-	C10H16	136	0.52
33	10.362	Tridecane, 1-iodo-	C13H27I	310	0.15
34	12.328	Nonanal	C9H18O	142	0.14
35	14.738	Dodecane	C12H26	170	0.04
36	15.438	Octanoic acid	C8H16O2	144	0.54
37	16.693	Cyclohexanol, 2-methylene-3-(1-methylethyl)-, ci	C10H18O	154	0.08
38	17.625	2,4-Dodecadienal, (E,E)-	C12H20O	180	1.22

	RT (min.)	Compound	Molecular formula	Molecular Weight g/mol	Peak Area %
39	18.440	3-Methyl-2-(2-methyl-2-butenyl)furan	C10H14O	150	4.80
40	19.165	7-Hexadecenal, (Z)-	C16H30O	238	0.20
41	19.451	2-Dodecenal, (E)-	C12H22O	182	1.74
42	20.226	Tetradecane	C14H30	198	0.36
43	20.359	2-Allyl-4-methylphenol	C10H12O	148	9.41
44	20.649	1H-3a,7-Methanoazulene, octahydro-1,9,9-trimethyl-4-methylene-, (1.alpha.,3a.alpha.,7.alpha.,8a.beta.)-	C15H24	204	10.20
45	22.562	Pentadecafluorooctanoic acid, octadecyl ester	C26H37F15O2	666	0.21
46	22.718	Tetradecane	C14H30	198	0.76
47	23.938	2'-Hydroxy-5'-methoxyacetophenone, isopropy	C12H16O3	208	0.21
48	24.643	Cyclohexanebutanal, 2-methyl-3-oxo-, cis-	C11H18O2	182	0.79
49	24.888	1,2-cis-1,5-trans-2,5-dihydroxy-4-methyl-1-(1-hyd	C10H18O3	186	0.88
50	25.219	Diethyl Phthalate	C12H14O4	222	0.76
51	25.539	Tetradecanal	C14H28O	212	0.91
52	26.559	1,8,11-Heptadecatriene, (Z,Z)-	C17H30	234	0.23
53	26.718	cis-7-Tetradecen-1-yl acetate	C16H30O2	254	0.45
54	26.883	3-Heptadecene, (Z)-	C17H34	238	0.54
55	27.245	1-Nonadecene	C19H38	266	0.21
56	27.468	2-Pentadecanone, 6,10,14-trimethyl-	C18H36O	268	3.12
57	27.834	Pentadecanal-	C15H30O	226	3.85
58	30.511	Methyl 13-methyltetradecanoate	C22H44O2	340	0.12
59	30.836	(1aR,4S,4aR,7R,7aS,7bS)-1,1,4,7-Tetramethyldecahydro-1H-cyclopropa[e]azulen-4-o	C15H26O	222	0.13
60	31.363	(R)-(-)-14-Methyl-8-hexadecyn-1-ol	C17H32O	252	0.13
61	31.667	cis,cis-7,10,-Hexadecadienal	C16H28O	236	1.26
62	31.869	Z,Z-6,28-Heptatriactontadien-2-one	C37H70O	530	1.18
63	31.964	E,E,Z-1,3,12-Nonadecatriene-5,14-diol	C19H34O2	294	0.07
64	32.513	2-Heptadecanone	C17H34O	254	2.08
65	32.735	Oxirane, hexadecyl-	C18H36O	268	0.03
66	33.072	Methyl 14-methyl-eicosanoate	C22H44O2	340	5.60
67	33.642	1,8,11-Heptadecatriene, (Z,Z)-	C17H30	234	0.24
68	33.969	Dispiro[4.2.4.2]tetradecane	C14H24	192	0.20
69	34.653	n-Hexadecanoic acid	C16H32O2	256	24.20
70	34.986	2(3H)-Furanone, 5-dodecyldihydro-	C16H30O2	254	0.10
71	35.362	Hexadecanoic acid, 15-methyl-, methyl ester	C18H36O2	284	0.13
72	36.009	Phenanthrene, 1,2,3,4,4a,9,10,10a-octahydro-1,1	C20H30	270	0.56
73	36.778	9-Octadecynoic acid, methyl ester	C19H34O2	294	3.86
74	36.914	9-Octadecynoic acid, methyl ester,(E)-	C19H36O2	296	3.17
75	37.033	11-Octadecenoic acid, methyl ester	C19H36O2	296	0.32
76	37.460	Heptadecanoic acid, 16-methyl-, methyl ester	C19H38O2	298	2.37
77	37.847	2H-Pyran-2-one, tetrahydro-6-undecyl-	C16H30O2	254	0.74
78	38.599	Octadecanoic acid	C18H36O2	284	3.63
79	39.020	Hexadecanamide	C16H33NO	255	0.29
80	39.533	2-Cyclopenten-1-one, 2-pentyl-	C10H16O	152	0.16

81	39.756	Edulan II	C13H20O	192	0.17
82	40.160	4-Isopropyl-7,11-dimethyl-3,7,11-cyclotetradec	C19H30O	274	0.11
83	40.395	Hexadecanoic acid, pentyl ester	C21H42O2	326	0.19
84	40.608	(Z)-9-octadecen-4-olide	C18H32O2	280	0.23
85	40.884	2-Nonadecanone	C19H38O	282	0.14
86	41.164	2(3H)-Furanone, dihydro-5-tetradecyl-	C18H34O2	282	0.84
87	41.548	1-Eicosene	C20H40	280	0.06
88	41.660	4,8,12,16-Tetramethylheptadecan-4-olide	C21H40O2	324	0.15
89	41.763	2H-Pyran-2-one, tetrahydro-6-tridecyl-	C14H26O2	226	0.36
90	42.097	Hexadecanoic acid, hexyl ester	C22H44O2	340	0.27
91	42.644	Octadecanamide	C18H37NO	283	0.25
92	44.290	2-Pentacosanone	C25H50O	366	0.05
93	44.663	Bis(2-ethylhexyl) phthalate	C24H38O4	390	0.12
94	45.415	Stigmasta-4,7,22-trien-3.alpha.-ol	C29H46O	410	0.32
95	46.189	Palmitic acid vinyl ester	C18H34O2	282	0.19
96	47.985	Cholesta-4,6-dien-3-ol, (3.beta.)-	C27H44O	384	0.73
97	48.323	Tetracosanoic acid, methyl ester	C25H50O2	382	0.26
98	49.933	2,2,4-Trimethyl-3-(3,8,12,16-tetramethyl-heptadec	C30H52O	428	0.10
99	44.290	2-Pentacosanone	C25H50O	366	0.05

cancer-preventive, hypercholesterolemic, lubricant and nematicide (Gapalakrisnan and Valdivel, 2011). 9-Octadecenoic acid, methyl ester showed anti-inflammatory, antiandrogenic, and anemiagenic properties (Surender *et al.*, 2008; Silva, *et al.*, 2014). 2(3H)-Furanone, 5-dodecyldihydro reported to have antioxidant and anti-inflammatory activity (Ramya *et al.*, 2015) and Hexadecanoic acid, pentyl ester showed antifungal properties (Abubacker and Deepalakshmi, 2013).

CONCLUSION

Mushroom specimens collected from Mantha tahsil of Jalna district of Maharashtra were identified as *Calocybe indica* Purkay & A. Chandra and *Volvariella volvocea* (Bull.) Singer. GC-MS analysis showed the presence of several bioactive compounds. The identified compounds reportedly show diverse bioactivities such as insecticide, antiviral, anticancer, antimicrobial, antioxidant, antitubercular hypocholesterolemic, anti-inflammatory and antiandrogenic. Results of the present study shows that besides being edible the two mushrooms also have a number of bioactive compounds and may be used as health supplements. The study also provides baseline information about bioactive constituents of above-mentioned mushrooms for further studies for medicinal and agricultural applications of these mushroom varieties.

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