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Metabolite Profiling of Extract and Fractions of Bidara Upas (*Merremia Mammosa (Lour.) Hallier F.)* Tuber Using UPLC-QToF-MS/MS

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Bidara upas (Merremia mammosa (Lour.) Hallier f.) tuber is empirically used to treat respiratory disorders and tuberculosis. The pharmacological effect is due to the activity of various secondary metabolites. This study aims to determine the metabolite profile of M. mammosa tuber ethanol extract, n-hexane fraction, ethyl acetate fraction, and n-butanol fraction. The dried powder of the tuber of M. mammosa was extracted with 96% ethanol. Then, liquid-liquid fractionation was performed using n-hexane, ethyl acetate, and butanol as solvents. As much as 5 μl of each sample was injected into the UPLC-QToF-MS/MS and analyzed using the MassLynx 4.1 software and the ChemSpider and MassBank online databases. After identifying each compound, information regarding its activity was retrieved from the scientific literature. Metabolite profiling revealed that the 96% ethanol extract of M. mammosa yielded 61 compounds, with the n-hexane fraction yielding 64 compounds, the ethyl acetate fraction yielding 54 compounds, and the butanol fraction yielding 44 compounds. According to the findings of this study, the metabolite profiles of each M. mammosa tuber extract and fractions were distinct. Several compounds in these extracts and fractions may have antiviral, antioxidant, anti-inflammatory, and other properties; hence, more studies are required to determine their potential.

Keywords: Metabolite profiling; Merremia mammosa (Lour.) Hallier f; tuber; UPLC-QToF-MS/MS.

Acute Respiratory Syndrome, Severe Coronavirus 2 (SARS-CoV2), causes COVID-19, a severe acute respiratory disease[1]. In December 2019, the COVID-19 pandemic was first detected in Wuhan, Hubei Province, China. As of 2 August 2022, the World Health Organization (WHO) has recorded 575,887,049 confirmed COVID-19 cases, including 6,398,412 deaths[2]. The SARS-CoV-2 virus attacks humans via breathing and damages ciliary cells in the lungs. Coronavirus infection causes fever, dry cough, vertigo, nausea, shortness of breath, and diarrhea[3].

According to the World Health Organization (WHO), there are no viable antiviral for SARS-CoV2. Diverse efforts, including social distancing, testing, and tracking, as well as research and development of medicines and vaccines, are employed to prevent the fast spread of this coronavirus [4]. The basic treatment for SARS-CoV2 is supportive care supplemented with broad-

spectrum antibiotics, antivirals, corticosteroids, and convalescent plasma. The recent medication, Avigan (favipiravir) and Chloroquine, have severe adverse effects and have not yet been approved as a primary treatment[5,6]. To combat SARS-CoV2, a chemical-based, natural, effective, and safe alternative medicine is required.

Our ancestors have used herbal medicine derived from medicinal plants for centuries against different diseases and pandemics. As mentioned in several ancient manuscripts, textbooks, and pharmacopeias, medicinal plants or herbs have effectively treated and cured various diseases for hundreds or even thousands of years. Herbal medications are considered one of the alternative COVID-19 treatments[7-9]. The contribution of Traditional Chinese Medicine (TCM) to the recovery of COVID-19 patients inspires the optimism that Indonesian medicinal plants can also prevent COVID-19 infection and promote the healing of COVID-19 patients[10,11].

M. mammosa belongs to the Convolvulaceae family and is synonymous with *Convolvulus mammosus* Lour. This plant can reach 3-6 m and grow to creep or twist. The tubers resemble sweet potatoes and are edible. Place the harvested tubers in the ground. The tuber has yellow-brown, thick, and gelatinous skin. When dry, the tubers become brown[12]. *M. mammosa* tuber is used empirically to treat respiratory illnesses and tuberculosis[12,13]. The anti-tuberculosis efficacy has been proven in vitro, showing that *M. mammosa* tuber extract can serve as an inhibitor of *Mycobacterium tuberculosis* and has no toxicity to experimental animals[13]. According to its phytochemical study, this plant possesses glycoside resins, tropane alkaloids, polyphenols, and flavonoids [14]. Researchers discovered that glycoside resins and flavonoids block cyclooxygenase and lipoxygenase cycles in the inflammatory process[15,16]. In addition, the flavonoid content of *M. mammosa* tubers has an antioxidant effect by boosting the activity of Superoxide Dismutase (SOD) and glutathione transferase, thereby decreasing the number of reactive oxygen species (ROS) that can cause cell damage. In addition, alkaloids, flavonoids, and tannins have antibacterial properties by inhibiting bacterial cell proliferation[17].

Metabolite profiling, one of the metabolomics-based analyses that describes the profile of secondary metabolites in plants, was performed to determine the metabolite components in the *M. mammosa* tuber[18]. UPLC-QToF-MS/MS was utilized to characterize the metabolite profiles in this study. UPLC-QToF-MS/MS is a chemical analysis method that integrates the physical separation capabilities of liquid chromatography and mass spectrometry. This apparatus has various advantages, such as increasing the efficiency of compound separation; lowering the analysis time; requiring fewer samples; offering more accurate monoisotopic mass measurements, having high-resolution spectra for compound confirmation; and producing results[19,20]. Using UPLC-QToF-MS/MS to study the metabolite profiles of 96% ethanol extract, n-hexane fraction, ethyl acetate fraction, and butanol fraction from *M. mammosa* tuber can serve as a database for future studies.

MATERIALS AND METHODS

Plant material

The *M. mammosa* tuber was collected in Sumenep, Indonesia. The plants were subsequently identified and characterized at UPT Materia Medika, Batu, Indonesia with specimen No 074/674/102.20-A/2022. The tuber was cut into slices, dried, and ground into powder.

Chemicals substances

The 96% ethanol, n-hexane, ethyl acetate, butanol, acetonitrile, and formic acid used as solvents, and mobile phases in UPLC-QToF-MS/MS were purchased from Merck (Darmstadt, Germany).

Extraction

The powder of the *M. mammosa* tuber was extracted for 3 x 2 minutes using 96% ethanol and an ultrasonic process (Soltec Sonica 5300EP S3, Italy). The filtrate was then evaporated at 50 °C and 70 revolutions per minute using a Heidolph G3 rotary evaporator.

Fractionation

The 96% ethanol *M. mammosa* tuber extract was suspended in water at a 1:10 ratio. The water suspension (aqueous phase) was then mixed with n-hexane at a 1:1 ratio on a separating funnel for liquid-liquid fractionation. Multiple times of

shaking were performed. The n-hexane fraction of *M. mammosa* tuber was obtained by rotational evaporation of the n-hexane phase, which had been separated from the aqueous phase. The aqueous phase, extracted and separated from the n-hexane phase, is mixed with ethyl acetate at a 1:1 ratio on a separating funnel for liquid-liquid fractionation using the same techniques. In addition, the same techniques were utilized to extract the butanol fraction from the *M. mammosa* tuber.

Metabolite profiling

Metabolites profile utilizing the UPLC-QToF-MS/MS equipment and metabolite profiling were conducted at the Forensic Laboratory Center of the Indonesian National Police Criminal Investigation Agency. Extracts and fractions were obtained using the Solid Phase Extraction (SPE) method. As much as 5 µl of each sample was then injected into an MS Xevo G2-S QToF detector-equipped ACQUITY UPLC® H-Class System (Waters, USA) (Waters, USA). At a flow rate of 0.2 ml/min, the samples were separated on an ACQUITY BEH C18 column (1.7 m; 2.1 50 mm) using acetonitrile + 0.1% formic acid and water + 0.1% formic acid as the mobile phase. Using the MassLynx 4.1 software, chromatogram data and m/z spectra were retrieved from the UPLC-QToF-MS/MS analysis results for each observed peak. ChemSpider and MassBank were utilized to validate the newly found chemicals.

RESULTS AND DISCUSSION

The chemical content of the *M. mammosa* tuber extract and fractions was predicted using metabolite profiling[48]. Utilizing the UPLC-QToF-MS/MS instrument, metabolite profiling was performed. Previously, *M. mammosa* tuber extract and fractions were produced using Solid Phase Extraction (SPE). This technique is the most common sample preparation method for studying novel pharmaceutical chemicals and metabolites in biological matrices. It is utilized to purify a sample before employing chromatographic or another analytical technique to quantify the number of analytes in the sample[49]. SPE is quite helpful because it removes contaminants from the sample, increasing the spectral sensitivity[50,51].

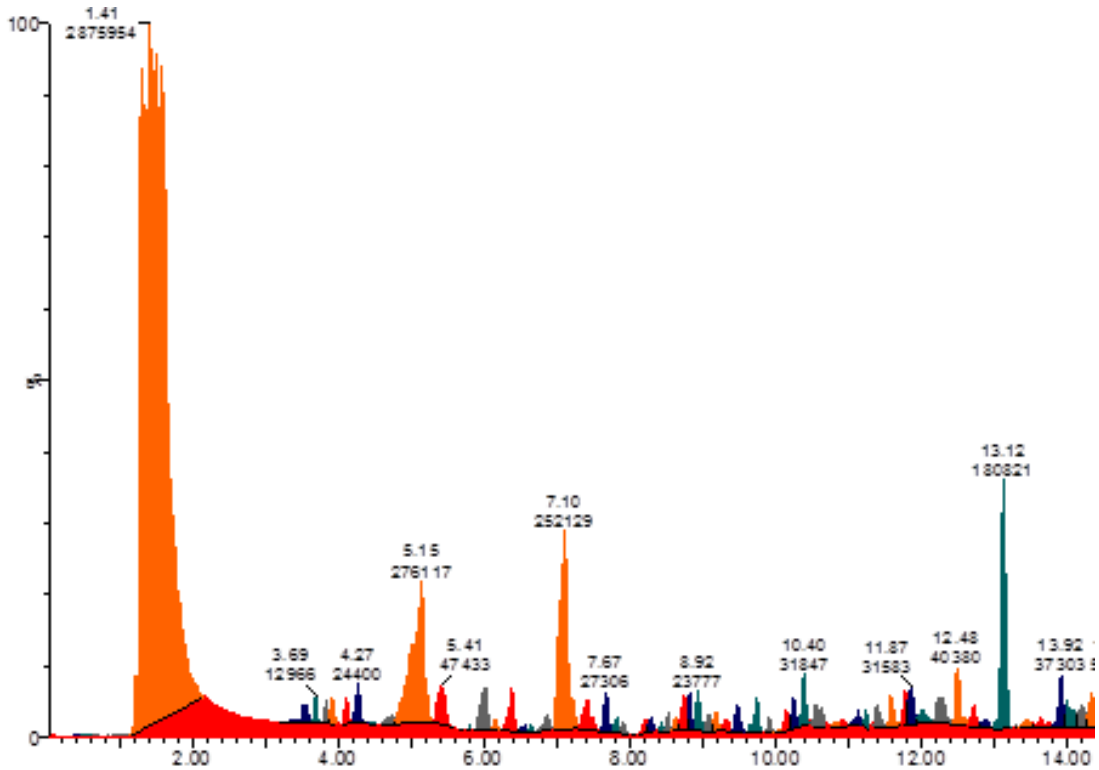

Fig. 1. TIC of 96% ethanol extract of *M. mammosa* tuber

Table 1. Prediction of compounds in 96% ethanol extract of *M. mammosa* tuber

No.	RT	%Area	Measured Mass	Molecular Formula	Compound Name	Activity
1	3.546	0.8061	366.1430	$C_{17}H_{22}N_2O_7$	Ethyl 1-(4,5-dimethoxy-2-nitrobenzoyl)-4-piperidinecarboxylate	-
2	3.692	0.4881	187.0637	$C_{11}H_9NO_2$	Indoleacrylic acid	Intestinal epithelial barrier functions andmitigates inflammatory responses[21].
3	3.826	0.3900	354.0944	$C_{21}H_{14}N_4S$	2,3-Diphenyl-6-(2-thienyl)imidazo[1,2-b][1,2,4]triazine	-
4	3.918	0.5582	192.0421	$C_{10}H_8O_4$	Scopoletin	Antioxidant, anti-proliferative, anti-inflammation, etc[22].
5	4.115	0.5562	143.0740	$C_{10}H_9N$	Naphthylamine	Antibacterial and antifungal 23.
6	4.270	0.9185	216.0908	$C_6H_{18}N_4Cl_2$	2,2'-[(E)-1,2-Diazenediyl]di(2-propanamine) dihydrochloride	-
7	4.726	0.4346	498.1178	$C_{26}H_{18}N_4O_7$	N,N'-(Oxydi-4,1-phenylene)bis(4-nitrobenzamide)	-
8	5.148	10.3936	192.0433	$C_3H_8N_6O_2S$	N,N-Dimethyl-N'-1H-tetrazol-5-ylsulfuric diamide	-
9	5.408	1.7855	516.1279	$C_{26}H_{20}N_4O_8$	N,N'-(5,6,7,12,13,14-Hexahydro-4,11-Dimethoxy-6,7,13,14-Tetraoxoquino(2,3-B)Acridine-1,8-Diyl)Bisacetamide	-
10	5.801	0.0561	145.0518	Unknown	Unknown	-
11	6.006	2.6356	236.1784	$C_8H_{24}N_6S$	Unknown	-
12	6.153	0.2567	512.1342	$C_{28}H_{24}N_4O_2S_2$	N-[(3-Cyano-5,6-dihydro-4H-cyclopenta[b]thiophen-2-yl) carbamothioyl]-2-(3-isopropoxyphenyl)-4-quinolinecarboxamide	-
13	6.379	1.3913	387.2411	$C_{23}H_{33}NO_4$	Retinoylserine	-
14	6.554	0.2028	406.1741	$C_{20}H_{26}N_2O_7$	2,5-Dioxo-1-pyrrolidinyl O-benzyl-N-{[(2-methyl-2-propanyl) oxy]carbonyl}threoninate	-
15	6.638	0.1552	313.1308	$C_{13}H_{20}N_5O_2Cl$	2-Amino-6-chloroquine dioxolane	Antiviral[24].
16	6.856	0.5587	526.1498	$C_{29}H_{26}N_4O_2S_2$	2-[(8,8-Dimethyl-7,10-dihydro-8H-pyrano[3'',4'':5',6']pyrido [3',2':4,5]thieno[3,2-d]pyrimidin-4-yl)sulfanyl]-N-(diphenylmethyl)acetamide	-
17	7.103	9.4906	308.0805	$C_{10}H_{12}N_8O_2S$	1,3,7-Trimethyl-8-[(2H-tetrazol-5-ylmethyl)sulfanyl]-3,7-dihydro-1H-purine-2,6-dione	-
18	7.412	1.3771	544.1589	$C_{28}H_{24}N_4O_8$	N'-[(E)-{3-Allyl-5-ethoxy-4-[(4-nitrobenzyl)oxy]phenyl} methylene]-5-nitro-1-benzofuran-2-carbohydrazide	-
19	7.672	1.0278	202.1723	$C_{15}H_{22}$	Curcumene	Antimicrobial and antibiotics [25].
20	7.827	0.4229	502.1831	$C_{31}H_{26}N_4OS$	1-[3'-(2-Methylphenyl)-4-(4-methylphenyl)-2-phenyl-2H,3'H-spiro[phthalazine-1,2'-[1,3,4]thiadiazol]-5'-yl]ethanone	-
21	7.911	0.2442	857.3794	$C_{52}H_{51}N_5O_7$	Dibenzyl 5-{[N-({6-[(adamantan-1-ylmethyl)carbamoyl]-1-methyl-1H-benzimidazol-5-yl}carbonyl)-L-phenylalanyl]amino} isophthalate	-
22	8.065	0.0042	150.0677	$C_9H_{10}O_2$	Hydratropic acid	-
23	8.199	0.3662	371.2437	$C_{19}H_{29}N_7O$	N''-Isopropyl-N'''-{4-[(6-methoxy-8-quinolinyl)amino]butyl} imidodicarbonimidic diamide	-
24	8.291	0.3571	372.1337	$C_{18}H_{25}O_6Cl$	Diethyl {2-[2-(4-chloro-2-methylphenoxy)ethoxy]ethyl}malonate	-
25	8.438	0.1358	395.1616	$C_{19}H_{26}N_3O_4Cl$	Ethyl 3-({4-[(3-chloro-2-methylphenyl)amino]-4-oxobutanoyl} hydrazono)-2-ethylbutanoate	-

26	8.530	0.3075	1086.5438	$C_{52}H_{74}N_{14}O_{10}S$	D-Phenylalanyl-L-glutaminyl-L-tryptophyl-L-alanyl-L-valylglycyl-L-histidyl-L-leucyl-L-methioninamide	-
27	8.643	0.3218	284.0794	$C_{15}H_{12}N_2O_4$	1-Amino-5-(N-methylamino)-4,8-dihydroxyanthraquinone	-
28	8.747	1.0468	268.1673	$C_{15}H_{24}O_4$	Trichotriol	-
29	8.818	0.9263	924.4906	$C_{40}H_{72}N_6O_{18}$	Unknown	-
30	8.923	0.8950	924.4916	$C_{41}H_{68}N_{10}O_{14}$	L-Valyl-L-seryl-L-isoleucyl-L-prolyl-L-á-glutamyl-L-asparaginyl-L-alanyl-L-prolyl-L-valine	-
31	9.078	0.6131	191.1302	Unknown	Unknown	-
32	9.191	0.7716	210.0800	Unknown	Unknown	-
33	9.296	0.3736	248.1415	$C_{15}H_{20}O_3$	Pterosin A	Antidiabetic[26].
34	9.471	0.8306	248.1421	$C_8H_{20}N_6OS$	1-[4-(Methylsulfanyl)-2-butanyl]-3-(2-methyl-5-tetrazolidinyl)urea	-
35	9.739	0.9558	336.1111	$C_{19}H_{16}N_2O_4$	Benzobarbital	Anticonvulsant [27].
36	10.049	0.0932	924.4910	$C_{41}H_{76}N_6O_{13}S_2$	Unknown	-
37	10.133	0.9072	477.3309	$C_{25}H_{51}NO_3S_2$	Unknown	-
38	10.245	0.8206	976.5244	$C_{48}H_{80}O_{20}$	(3â,11á,14â,20R)-11,12,14,20-Tetrahydroxypregn-5-en-3-yl â-D-glucopyranosyl-(1->4)-6-deoxy-3-O-methyl-â-D-allopyranosyl-(1->4)-2,6-dideoxy-3-O-methyl-â-D-ribo-hexopyranosyl-(1->4)-2,6-dideoxy-3-O-methyl-â-D-ribo-hexopyranoside	-
39	10.400	1.1988	423.3113	$C_{24}H_{37}N_7$	6-[(4-Amino-2-methyl-6-quinolinyl)amino]-2-{[(2S)-5-(diethylammonio)-2-pentanyl]amino}-4-methylpyrimidin-1-ium	-
40	10.547	0.9146	382.2716	$C_{22}H_{38}O_5$	Unoprostone	Antiglaucoma[28].
41	10.836	0.1701	758.4475	$C_{41}H_{58}N_8O_6$	(2S,3aS,7aS)-1-[(2S)-2-({(2S)-2-Cyclohexyl-2-[(2-pyrazinylcarbonyl)amino]acetyl}amino)-3,3-dimethylbutanoyl]-N-[(3S)-1-(2-methyl-2-phenylhydrazino)-1,2-dioxo-3-hexanyl]octahydro-1H-indole-2-carboxamide	-
42	10.928	0.1914	978.5402	$C_{48}H_{82}O_{20}$	Merremoside-D	Antiinflamasi[14].
43	11.229	0.4193	236.2133	Unknown	Unknown	-
44	11.384	1.0534	946.5132	$C_{45}H_{66}N_{14}O_9$	L-Seryl-N5-(diaminomethylene)-L-ornithyl-N5-(diaminomethylene)-L-ornithyl-L-prolyl-L-valyl-L-tryptophyl-L-phenylalanine	-
45	11.581	1.1753	960.5263	$C_{44}H_{76}N_6O_{17}$	Unknown	-
46	11.777	0.7291	960.5289	$C_{48}H_{80}O_{19}$	Notoginsenoside G	Immunological adjuvant activity andimmunostimulatory activity [29]
47	11.869	1.7448	960.5282	$C_{38}H_{72}N_{16}O_{11}S$	N5-(Diaminomethylene)-L-ornithyl-N5-(diaminomethylene)-L-ornithyl-L-alanyl-L-seryl-L-leucyl-L-glutaminyl-L-cysteinyl-L-lysine	-
48	12.263	1.2992	974.5444	$C_{39}H_{74}N_{16}O_{11}S$	N5-(Diaminomethylen)-L-ornithyl-N5-(diaminomethylen)-L-ornithyl-L-threonyl-L-alanyl-L-leucyl-L-glutaminyl-L-cysteinyl-L-lysin	-
49	12.480	1.5200	519.3349	$C_{33}H_{45}NO_4$	Hexadecyl 2-(3,4-dimethylphenyl)-1,3-dioxo-5-isoindolinecarboxylate	-
50	12.706	0.8499	988.5596	$C_{47}H_{76}N_{10}O_{13}$	Unknown	-
51	12.861	0.5503	974.5415	$C_{50}H_{74}N_{10}O_8S$	Unknown	-
52	13.121	9.7963	495.3316	$C_{11}H_{41}N_{15}O_7$	Unknown	-
53	13.296	0.0516	842.4989	$C_{39}H_{74}N_2O_{17}$	Unknown	-
54	13.451	0.4961	974.5403	$C_{49}H_{78}N_6O_{12}S$	Unknown	-
55	13.627	0.5754	282.2562	$C_{18}H_{34}O_2$	Oleic acid	Immunomodulation, treatment andprevention of different types of disorders, such as cardiovascularor autoimmune

						diseases, metabolic disturbances, skin injuryand cancer [30].
56	13.916	1.4042	509.3478	$C_{28}H_{43}N_7O_2$	7,8-Dimethyl-3-{(2-methyl-1-[1-(2-methyl-2-butanyl)-1H-tetrazol-5-yl]propyl}[2-(4-morpholinyl)ethyl]amino)methyl]-2(1H)-quinolinone	-
57	13.999	1.5073	352.2636	$C_{21}H_{28}N_{16}O$	Unknown	-
58	14.196	1.2619	393.3410	Unknown	Unknown	-
59	14.330	1.5913	393.3402	$C_{13}H_{39}N_{15}O$	Unknown	-
60	14.548	3.0537	393.3388	$C_{20}H_{47}N_3O_2S$	Unknown	-
61	14.661	3.1888	523.3637	$C_{29}H_{45}N_7O_2$	(2E)-2-{4-[3-(Diethylamino)propoxy]benzylidene}-N'-[(E)-{4-[3-(diethylamino)propoxy]phenyl}methylene]hydrazinecarbohydrazonamide	-

In order to avoid introducing bias into the sample identification, the total ion chromatogram (TIC) of the compound of the sample was first determined. Each TIC peak corresponds to the presence of a single chemical. The mass spectrum of each TIC peak was examined using MassLynx 4.1 and confirmed using the internet databases ChemSpider and MassBank.

Figures 1, 2, 3, and 4 display the findings of UPLC-QToF MS/MS metabolite profiling of M. mammosa tuber extracts and fractions as TIC. Tables 1, 2, 3, and 4 present the retention time (RT), percent area, m/z, chemical formula, compound name, and activity values based on literature studies. In the TIC figure, the x-axis (horizontal line) represents retention time, and the y-axis (vertical line) represents signal intensity or relative signal intensity. RT is the time required by a sample component of a compound to pass through the column to the detector. The measured mass is the mass obtained from the identified compound. This value is utilized to determine the molecular formula and name of the compound obtained. The metabolite profiling results on a 96% ethanol extract revealed a total of 61 compounds, including 43 known and 18 unknown compounds. The n-hexane fraction revealed a total of 64 compounds, including 49 known compounds and 15 unknown compounds. The ethyl acetate fraction showed 54 compounds, including 44 known and 10 unknown compounds. The butanol fraction revealed a total of 44 compounds, including 33 known compounds and 11 unknown compounds.

The metabolite profiling results revealed 208 metabolites throughout the l extract and fractions, including 160 known and 48 unknown compounds. According to the metabolite profiling, the peak retention time of the compound ranged from 0 to 14 minutes. Typically, peaks with RTs greater than 14 minutes are impurity peaks, such as those arising from solvent blanks or degradants, and are thus ignored. In separating, identifying, and calculating compounds in a mixture of compounds, RT is a crucial parameter. RT is affected by a variety of variables, including instrument specifications. The longer the reading time, the more fluctuations in system pressure and temperature the instrument will experience, which can affect the results of sample readings. To obtain optimal results, the Retention Time Locked (RTL) approach is

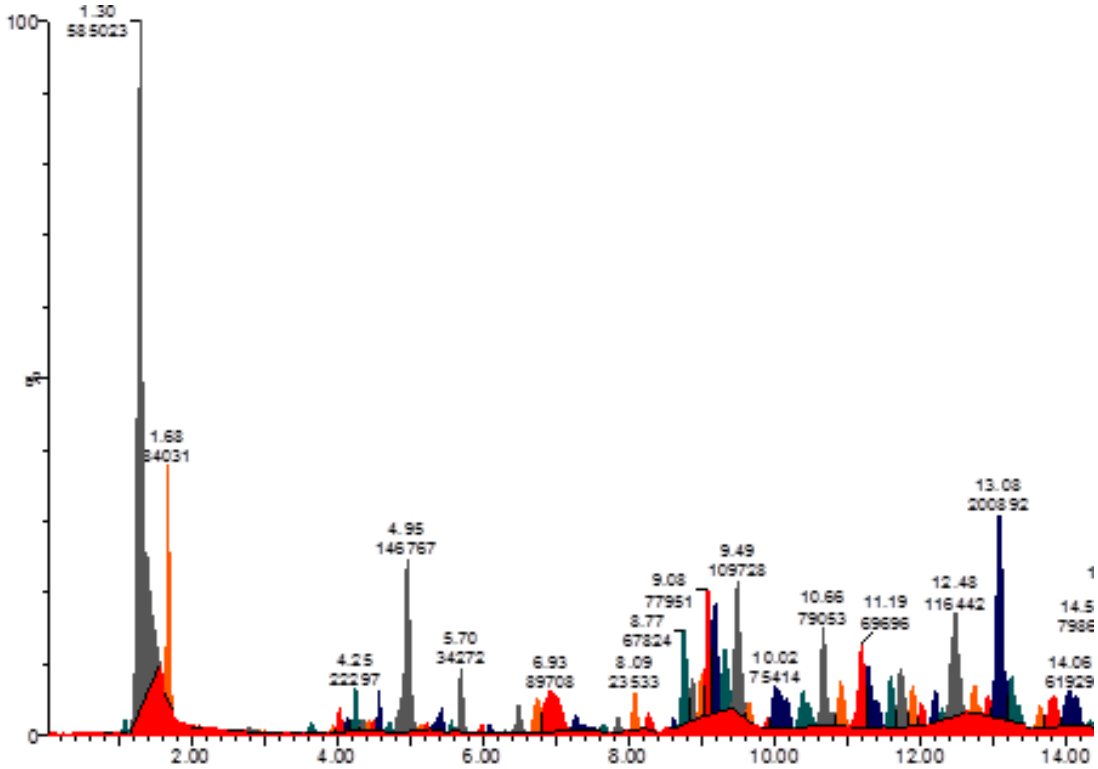

Fig. 2. TIC of n-hexane fraction of *M. mammosa* tuber

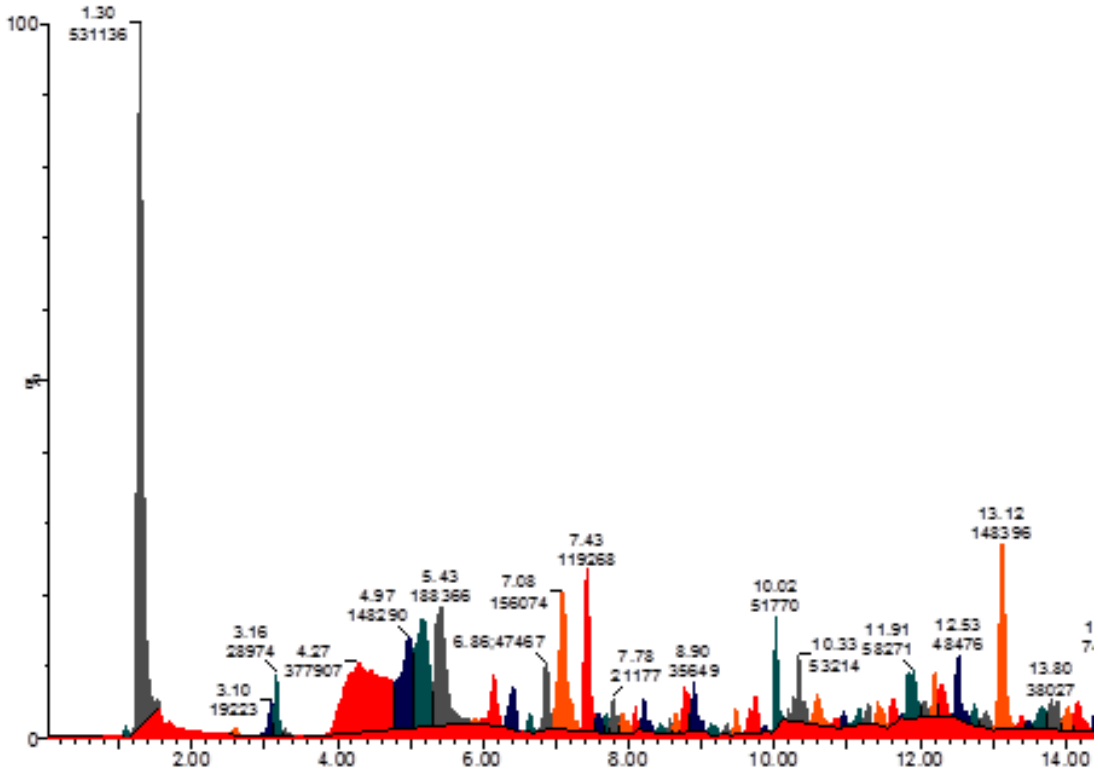

Fig. 3. TIC of ethyl acetate fraction of *M. mammosa* tuber

Table 2. Prediction of compounds in n-hexane fraction of *M. mammosa* tuber

No.	RT	% Area	Measured Mass	Molecular Formula	Compound Name	Activity
1	1.085	0.3255	166.0058	$C_{11}H_2O_2$	Unknown	-
2	1.675	3.5124	157.1109	Unknown	Unknown	-
3	2.792	0.0897	165.0792	$C_9H_{11}NO_2$	D-Phenylalanine	Reduce pain (analgesic) [31].
4	3.236	0.0056	156.0687	$C_{10}H_8N_2$	2,2'-Bipyridine	-
5	3.433	0.0203	162.0320	$C_9H_6O_3$	3 Hydroxycoumarin	Antioxidant[32].
6	3.629	0.2217	126.0319	$C_6H_6O_3$	Pyrogallol	Antioxidant[33].
7	3.826	0.0098	442.1964	$C_{21}H_{26}N_6O_5$	Threonyltryptophylhistidine	-
8	3.939	0.0911	354.0963	$C_{17}H_{14}N_4O_5$	4-Benzyloxy-2-butynal 2,4-dinitrophenylhydrazone	-
9	4.136	0.2467	136.1000	$C_8H_{12}N_2$	Cyclobutane pyrimidine	-
10	4.249	0.7579	216.0903	$C_{12}H_{12}N_2O_2$	Lycoperodine-1	-
11	4.353	0.1345	122.0841	$C_7H_{10}N_2$	4-Dimethylaminopyridine	-
12	4.424	0.1098	168.0686	$C_{11}H_8N_2$	Carboline	Antioxidant [34].
13	4.487	0.1074	143.1671	$C_9H_{21}N$	Tripropylamine	-
14	4.571	0.5128	203.1313	$C_{13}H_{17}NO$	Crotamiton	Anti-scabies [35].
15	4.726	0.2191	191.1445	$C_{10}H_{22}NCl$	Propylhexedrine hydrochloride	Nasal congestion[36].
16	4.952	5.4469	192.0426	$C_{10}H_8O_4$	Scopoletin	Antioxidant, anti-proliferative, anti-inflammation, etc[22].
17	5.232	0.0744	236.1775	$C_{15}H_{24}O_2$	Curcumol	Anti-tumor, anti-proliferative, anti-inflammatory, antimicrobial, antioxidant, anticancer [37].
18	5.429	0.5821	387.2411	$C_{23}H_{33}NO_4$	Retinoylserine	-
19	5.563	0.3055	220.1466	$C_{14}H_{20}O_2$	2,6-Di-tert-butyl-1,4-benzoquinone	Antimicrobial[38].
20	5.697	1.1650	226.1468	$C_{15}H_{18}N_2$	N-Isopropyl-N'-phenyl-1,4-benzenediamine	-
21	5.872	0.0349	226.0815	$C_{15}H_{14}S$	Trimethyldibenzothiophene	-
22	5.977	0.1408	202.1723	$C_{15}H_{22}$	Curcumene	Antimicrobial and antibiotics [25].
23	6.090	0.1921	240.0925	$C_6H_{17}N_6SCl$	Unknown	-
24	6.308	0.0420	192.0787	$C_{11}H_{12}O_3$	5,6-Dimethoxy-1-indanone	Antimicrobial [39].
25	6.484	0.6913	265.1575	$C_{17}H_{19}N_3$	Mirtazapine	Antidepressant[40].
26	6.927	4.2723	240.0896	$C_{14}H_{12}N_2O_2$	Ethyl 9H-â-carboline-3-carboxylate	Antioxidant [34].
27	7.258	0.7702	256.1809	Unknown	Unknown	-
28	7.630	0.1809	207.0898	$C_{11}H_{13}NO_3$	N-Acetylphenylalanine	Antimicrobial[41].
29	8.086	0.7999	150.0683	$C_9H_{10}O_2$	Hydratropic acid	-
30	8.262	0.4420	326.1354	$C_{13}H_{14}N_{10}O$	1,3-Bis(6-amino-9H-purin-9-yl)-2-propanol	-
31	8.768	2.3055	268.1686	$C_{16}H_{20}N_4$	Bis(4-pyridylmethyl)piperazine	-
32	8.860	0.7371	201.0796	$C_5H_{11}N_7S$	2-{2-[(Diaminomethylene)hydrazono] propylidene}hydrazinecarbothioamide	-

33	8.994	0.6931	180.1154	$C_{11}H_{16}O_2$	3-BHA	Antioxidant [42].
34	9.078	2.6497	191.1309	$C_{12}H_{17}NO$	DEET	Insect repellent[43].
35	9.191	3.1931	210.0792	$C_{13}H_{10}N_2O$	Pyocyanin	Antibacterial and antifungal 44.
36	9.317	1.7534	248.1405	$C_{10}H_{21}N_4OCl$	2-(5-Methyl-3-pyrazolidinyl)-1-(1-piperazinyl) ethanone hydrochloride (1:1)	-
37	9.492	3.7299	248.1421	$C_8H_{20}N_6OS$	1-[4-(Methylsulfanyl)-2-butanyl]-3-(2-methyl-5-tetrazolidinyl)urea	-
38	9.647	0.4799	234.1633	Unknown	Unknown	-
39	9.915	0.2164	248.1413	$C_{15}H_{20}O_3$	Pterosin A	Antidiabetic[26].
40	10.020	3.1522	477.3301	$C_{24}H_{47}NO_8$	Unknown	-
41	10.400	1.5211	423.3101	$C_{23}H_{41}N_3O_4$	Cyclohexyl 4-(2-{[(cyclohexyloxy)carbonyl] (isopropyl)amino}ethyl)-1-piperazinecarboxylate	-
42	10.660	2.6872	252.1728	$C_{15}H_{24}O_3$	Walleminone	-
43	10.899	1.5603	190.1364	Unknown	Unknown	-
44	11.187	2.9132	190.1367	Unknown	Unknown	-
45	11.279	2.8664	317.2940	Unknown	Unknown	-
46	11.602	1.2932	303.2930	$C_{21}H_{37}N$	2-Hexyl-3,5-dipentylpyridine	-
47	11.735	1.9365	272.0950	$C_{18}H_{12}N_2O$	Aposafranone	-
48	11.890	1.2857	960.5306	$C_{49}H_{76}N_4O_{15}$	Unknown	-
49	12.003	0.6006	598.3712	$C_{32}H_{54}O_{10}$	(3â,4â,5á,6á,15â,22E,25R)-3,4,6,8, 15-Pentahydroxycholest-22-en-27-yl á-D-arabinofuranoside	-
50	12.200	0.7223	519.3336	$C_{28}H_{46}N_5O_2Cl$	N4-(5-Chloro-2,4-dimethoxyphenyl)-N6-hexadecyl-4,5,6-pyrimidinetriamine	-
51	12.305	0.1898	974.5442	$C_{46}H_{74}N_{10}O_{13}$	L-á-Aspartyl-L-leucyl-L-isoleucyl-L-phenylalanylglycyl-L-leucyl-L-asparaginyl-L -alanyl-L-leucine	-
52	12.480	3.9581	519.3323	$C_{29}H_{41}N_7O_2$	3-[(4-Cyclohexyl-1-piperazinyl)(1-cyclohexyl-1H-tetrazol-5-yl)methyl]-6-ethoxy-2(1H)-quinolinone	-
53	12.727	0.7101	294.2200	$C_{18}H_{30}O_3$	13-Oxooctadecadienoic acid	-
54	12.924	0.4814	294.2203	$C_{11}H_{30}N_6OS$	Unknown	-
55	13.079	8.3970	495.3335	$C_5H_{37}N_{25}OS$	Unknown	-
56	13.254	1.4412	278.1522	$C_{16}H_{22}O_4$	Dibutyl phthalate	Anti-androgenic effect [45].
57	13.514	0.0122	296.2344	$C_{13}H_{33}N_4OCl$	Unknown	-
58	13.627	0.6407	379.3453	$C_{24}H_{45}NO_2$	Cyanomethyldocosanoate	-
59	13.845	1.7493	509.3489	$C_{13}H_{39}N_{19}O_3$	Unknown	-
60	14.062	2.5886	304.2402	$C_{20}H_{32}O_2$	Arachidonic acid	-
61	14.330	0.1504	393.3399	$C_{28}H_{43}N$	p,p-Dioctyldiphenylamine	-
62	14.393	0.0831	960.5255	$C_{43}H_{80}N_2O_{21}$	Unknown	-
63	14.569	3.3381	523.3621	$C_{28}H_{49}N_3O_6$	1-(â-D-Arabinofuranosyl)-4-(nonadecanoylamino)-2(1H)-pyrimidinone	-
64	14.723	7.5074	306.2561	$C_{20}H_{34}O_2$	Dihomo-ã-linolenic acid	Anti-inflammation and anti-proliferation [46].

Table 3. Prediction of compounds in ethyl acetate fraction of *M. mammosa* tuber

No.	RT	%Area	Measured Mass	Molecular Formula	Compound Name	Activity
1	1.106	0.2005	124.9785	CH_3NO_4S	Nitromethanesulfinic acid	-
2	2.617	0.1647	155.0587	$C_7H_9NO_3$	2-Isocyanatoethyl methacrylate	-
3	3.102	0.7443	387.2401	$C_{18}H_{34}N_5O_2Cl$	N-[3-(1-Piperazinyl)propyl]-1-(1-pyrrolidinylcarbonyl) -4-piperidinecarboxamide hydrochloride (1:1)	-
4	3.165	1.1219	236.1779	$C_{15}H_{24}O_2$	Curcumol	Anti-tumor, anti-proliferative, anti-inflammatory, antimicrobial, antioxidant, anticancer [37].
5	3.278	0.1687	244.1218	$C_8H_{22}N_4Cl_2$	Piperazinium dichloride	-
6	3.671	0.0125	162.0312	$C_9H_6O_3$	3 Hydroxycoumarin	Antioxidant[32].
7	4.270	14.6323	192.0429	$C_3H_8N_6O_2S$	N,N-Dimethyl-N'-1H-tetrazol-5-ylsulfuric diamide	-
8	4.973	5.7417	192.0413	$C_5H_9N_4O_2Cl$	5,6-Diamino-1-methyl-2,4(1H,3H)-pyrimidinedione hydrochloride (1:1)	-
9	5.190	7.6206	498.1170	$C_{26}H_{26}O_6S_2$	2-(Di-1-naphthylmethyl)-1,3-propanediyl dimethanesulfonate	-
10	5.429	7.9746	516.1296	$C_{27}H_{16}N_8O_4$	Unknown	-
11	5.893	0.0977	516.1251	$C_{22}H_{24}N_6O_5S_2$	5,5'-[(4-Methoxyphenyl)methylene]bis{6-amino-2-[(2-oxopropyl) sulfanyl]-4(1H)-pyrimidinone}	-
12	6.153	1.7022	512.1314	$C_{26}H_{24}O_{11}$	Gemixanthone A	-
13	6.421	1.5617	530.1436	$C_{27}H_{22}N_4O_8$	2-[(Cyclopentylcarbamoyl)amino]-2-oxoethyl 4-(6-nitro-1, 3-dioxo-1H-benzo[de]isoquinolin-2(3H)-yl)benzoate	-
14	6.638	0.4216	313.1314	$C_{18}H_{19}NO_4$	Feruloyltyramine	-
15	6.856	2.5397	544.1559	$C_{23}H_{24}N_6O_{10}$	4-Nitrobenzyl 1-(2,4-dinitrophenyl)prolylglutaminate	-
16	7.082	6.0431	308.0805	$C_{10}H_{12}N_8O_2S$	1,3,7-Trimethyl-8-[(2H-tetrazol-5-ylmethyl)sulfanyl]-3, 7-dihydro-1H-purine-2,6-dione	-
17	7.433	4.6180	544.1580	$C_{27}H_{28}O_{12}$	Hydroxydoxorubicin	-
18	7.588	0.9758	202.1721	$C_{15}H_{22}$	Curcumene	Antimicrobial and antibiotics [25].
19	7.785	0.8200	502.1843	$C_{26}H_{30}O_{10}$	Phellodensin F	-
20	8.086	0.3267	371.2455	$C_{18}H_{34}N_5OCl$	N-Cyclopentyl-N2-{[5-(dimethylamino)-3-isopropyl-1-methyl-1H-pyrazol-4-yl]methyl}alaninamide hydrochloride (1:1)	-
21	8.199	0.8389	558.1741	$C_{28}H_{30}O_{12}$	1,3,4,6-Tetra-O-acetyl-2,5-di-O-benzoylhexitol	-
22	8.438	0.2468	356.1023	$C_{19}H_{12}N_6O_2$	9,11-Dimethylacenaphtho[1',2':5,6][1,2,4]triazino[3,2-f] purine-10,12(9H,11H)-dione	-
23	8.572	0.1632	389.2566	$C_{23}H_{35}NO_4$	3-Aminodigitoxigenin	-
24	8.643	0.4415	284.0801	$C_{15}H_{12}N_2O_4$	1-Amino-5-(N-methylamino)-4,8-dihydroxyanthraquinone	-
25	8.768	1.3291	268.1677	$C_{15}H_{24}O_4$	Trichotriol	-
26	8.902	1.3803	924.4898	$C_{53}H_{64}N_8O_7$	(3S)-2-(2,6-Dimethyl-L-tyrosyl)-N-(2-{5-[4-({[(3S)-2-(2,6-dimethyl-L -tyrosyl)-1,2,3,4-tetrahydro-3-isoquinolinyl]carbonyl}amino)butyl]-6-methyl-3-oxo-3,4-dihydro-2-pyrazinyl}ethyl)-1,2,3,4-	-

					tetrahydro- 3-isoquinolinecarboxamide	
27	9.120	0.4154	332.0794	$C_{19}H_{12}N_2O_4$	2-Benzyl-5-nitro-benzo[de]isoquinoline-1,3-dione	-
28	9.346	0.2379	938.5095	$C_{36}H_{66}N_{20}O_8S$	Unknown	-
29	9.472	0.4794	938.5073	$C_{42}H_{70}N_{10}O_{14}$	L-Threonyl-L-prolyl-L-leucylglycyl-L-prolyl-L-alanyl-L-seryl-L-seryl-L-leucyl-L-proline	-
30	9.739	1.3977	336.1108	$C_{11}H_{20}N_4O_6S$	Asparaginylcysteinylthreonine	-
31	9.873	0.1439	342.2872	Unknown	Unknown	-
32	10.020	2.1917	477.3298	$C_{24}H_{47}NO_8$	Unknown	-
33	10.329	2.0604	423.3110	$C_{24}H_{37}N_7$	6-[(4-Amino-2-methyl-6-quinolinyl)amino]-2-{[(2S)-5-(diethylammonio)-2-pentanyl]amino}-4-methylpyrimidin-1-ium	-
34	10.597	1.1102	382.2719	$C_{22}H_{38}O_5$	Unoprostone	Antiglaucoma[28].
35	10.857	0.2510	758.4467	$C_{40}H_{62}N_4O_{10}$	Benzyl 5-{3,5-bis[(3S)-4-hydroxy-3-({[(2-methyl-2-propanyl)oxy]carbonyl}amino)butyl]-4-pyridinyl}-N-{[(2-methyl-2-propanyl)oxy]carbonyl}-L-norvalinate	-
36	10.949	0.3068	978.5402	$C_{48}H_{82}O_{20}$	Merremoside-D	Antiinflamasi[14].
37	11.166	0.4203	946.5106	$C_{56}H_{66}N_8O_6$	Hexa(butoxy)phthalocyanine	-
38	11.279	0.4765	317.2921	Unknown	Unknown	-
39	11.426	0.7853	946.5130	$C_{35}H_{58}N_{30}OS$	Unknown	-
40	11.631	0.7419	960.5250	$C_{43}H_{80}N_2O_{21}$	Unknown	-
41	11.911	2.2562	960.5332	$C_{66}H_{72}O_6$	1,2,5,6,9,10-Hexabutoxy-3,7,12-triphenylcoronene	-
42	12.066	0.4785	960.5313	$C_{42}H_{76}N_{10}O_{13}S$	N-{(2S,3S)-3-[(L-Glutaminyl-L-isoleucyl-L-á-aspartyl)amino]-2-hydroxy-5-methylhexyl}-L-methionyl-L-valyl-L-leucyl-L-á-asparagine	-
43	12.200	1.0015	519.3316	$C_{13}H_{41}N_{15}O_7$	Unknown	-
44	12.305	1.1701	974.5455	$C_{49}H_{82}O_{19}$	(3â,11á,16â)-16,23,28-Trihydroxy-11-methoxyolean-12-en-3-yl â-D-glucopyranosyl-(1->2)-[â-D-glucopyranosyl-(1->3)]-6-deoxy-â-D-galactopyranoside	-
45	12.530	1.8770	519.3342	$C_{25}H_{49}N_3O_6S$	(2R)-3-{[(2S,3R,4R,5R,6R)-3-Acetamido-4,5-dihydroxy-6-(hydroxymethyl)tetrahydro-2H-pyran-2-yl]sulfanyl}-2-amino-N-tetradecylpropanamide	-
46	12.748	0.5128	988.5648	$C_{38}H_{76}N_{20}O_7S_2$	Unknown	-
47	12.903	0.8326	974.5437	$C_{46}H_{74}N_{10}O_{13}$	L-á-Aspartyl-L-leucyl-L-isoleucyl-L-phenylalanylglycyl-L-leucyl-L-asparaginyl-L-alanyl-L-leucine	-
48	13.121	5.7458	495.3318	$C_{27}H_{41}N_7O_2$	5,7-Dimethyl-3-[({1-[1-(2-methyl-2-butanyl)-1H-tetrazol-5-yl]propyl}[2-(4-morpholinyl)ethyl]amino)methyl]-2(1H)-quinolinone	-
49	13.388	0.3851	403.3460	$C_{19}H_{45}N_7S$	Unknown	-
50	13.669	0.9851	416.2328	$C_{24}H_{28}N_6O$	N-(Adamantan-1-yl)-4-{[(5-amino-6-cyano-2-pyrazinyl)methyl](methyl)amino}benzamide	-
51	13.803	1.4724	509.3481	$C_{28}H_{43}N_7O_2$	7,8-Dimethyl-3-[({2-methyl-1-[1-(2-methyl-2-butanyl)-1H-tetrazol-5-yl]propyl}[2-(4-morpholinyl)ethyl]amino)methyl]-2(1H)-quinolinone	-
52	14.020	0.8498	352.2611	$C_{21}H_{36}O_4$	Doxaprost	-
53	14.154	1.2968	890.4871	$C_{44}H_{74}O_{18}$	Trigoneoside IIA	-
54	14.414	1.2093	960.5283	$C_{45}H_{72}N_{10}O_{13}$	L-Alanyl-L-leucyl-L-á-aspartyl-L-leucyl-L-glutaminylglycyl-L-valyl-L-valyl-L-phenylalanine	-

utilized to eliminate sample reading variances that are restricted to RT 14 minutes[52]. As seen by the existence of unidentified chemicals in each extract and fraction, not all peaks in TIC can be recognized in the metabolite profiling technique utilizing the total number of detected metabolites. Compounds that cannot be found in the database are unidentified. These compounds could be impurities or degradation products that are still picked up by the instrument or new compounds that have not been recorded in the database, mainly unknown compounds with high concentrations[53,54].

The analysis of these metabolites reveals the presence of several dominant or principal compounds, i.e., those with higher concentrations (as indicated by percentage area) than other compounds in the sample. In the 96% ethanol extract, the major compounds were N, N-Dimethyl-N'-1H-tettetrazoleylsulfuric diamide with a percentage area of 14.9591%, Dihomo-linolenic acid in the n-hexane fraction with a percentage area of 7.5074%, N, N-Dimethyl-N'-1H-tetrazole-5-ylsulfuric diamide in the ethyl acetate fraction with a percent area of 15.9989%, and {[2-(3-Methoxy-2-propoxypheneethyl]imino}di-2,1-ethanediyl bis (butylcarbamate) in the butanol fraction with a percentage area of 14.0886%.

M. mammosa tuber extract and fractions contain the antimicrobial compound Curcumene[25]. 2-Amino-6-chloroquinedioxolane is reported to have antiviral activity[24]. Scopoletin, 3-Hydroxycoumarin, Pyrogallol, Carboline, Curcumol, Ethyl 9H-carboline-3-carboxylate, 3-BHA, and Cynarine are antioxidant compounds[22,32-34,37,42,47]. By increasing the activity of SOD and glutathione transferase, the antioxidant activity reduces the ROS that can cause cell damage[17]. Naphthylamine and Pyocyanin are both antibacterial compounds [23,44]. This antibacterial activity inhibits bacterial cell reproduction[17]. Scopoletin, Dihomo—linolenic acid, and Merremoside-D are anti-inflammatory compounds[14,22,46]. Anti-inflammatory drugs are crucial for surviving the cytokine storm, a severe inflammation caused by respiratory viral infections. Resin glycoside chemicals (merremoside) have anti-inflammatory activity; thus, it is expected that a synergistic effect will be established from

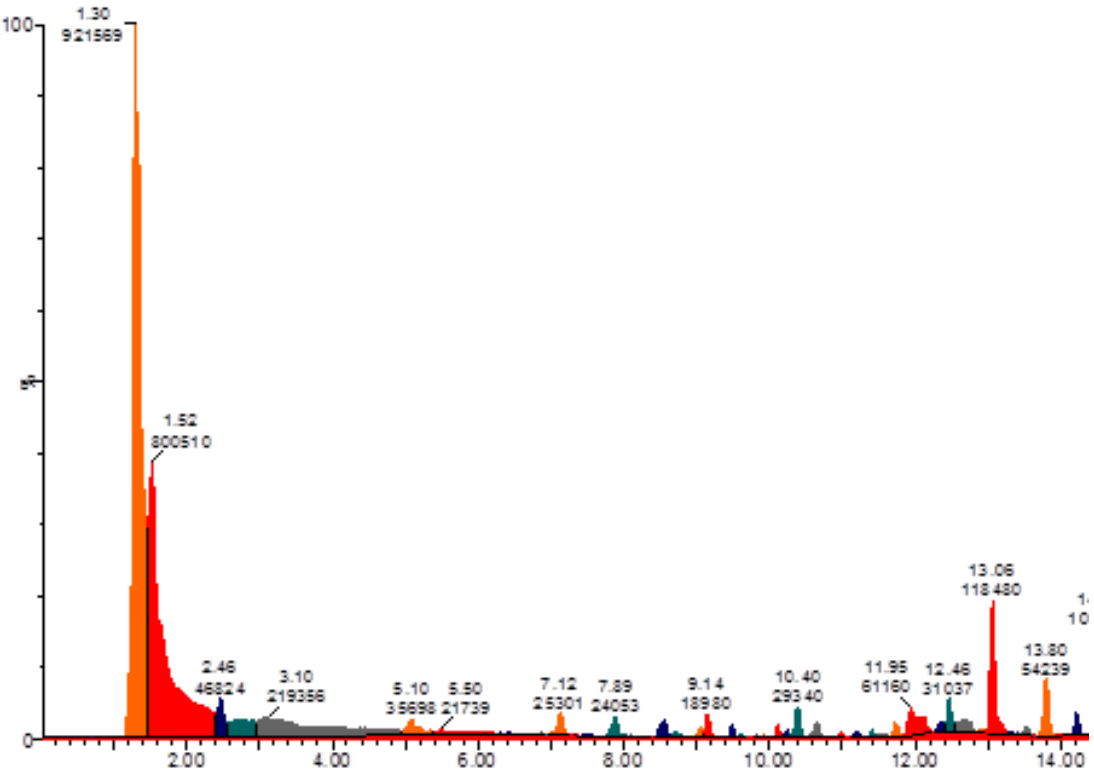

Fig. 4. TIC of n-butanol fraction of *M. mammosa* tuber

Table 4. Prediction of compounds in an n-butanol fraction of *M. mammosa* tuber

No.	RT	%Area	Measured Mass	Molecular Formula	Compound Name	Activity
1	2.462	4.0288	165.0789	$C_9H_{11}NO_2$	D-Phenylalanine	Reduce pain (analgesic) [31].
2	2.688	8.3197	141.1147	Unknown	Unknown	-
3	5.098	3.0715	516.1279	$C_{26}H_{28}O_7S_2$	2-{[2-(4-Hydroxyphenyl)ethyl]sulfanyl}-3-[4-(2-{4-[(methylsulfonyl)oxy]phenoxy}ethyl)phenyl] propanoic acid	-
4	5.500	1.8704	516.1265	$C_{25}H_{24}O_{12}$	Cynarine	Choleretic and cholesterol-lowering, hepatoprotective, anti-atherosclerotic, anti-HIV, antioxidative, anti-diabetic, anti-carcinogenic, and immune modulator activity [47].
5	6.421	0.3941	387.2380	$C_{19}H_{29}N_7O_2$	7-[3-(3,4-Dihydro-2H-pyrrol-5-ylamino)propyl] -1,3-dimethyl-8-(1-piperidinyl)-3,7-dihydro-1H -purine-2,6-dione	-
6	6.856	0.0909	683.3510	$C_{39}H_{49}N_5O_4S$	7-[4-(2-Butoxyethoxy)phenyl]-1-isobutyl-N -(4-{[(4-propyl-4H-1,2,4-triazol-3-yl)methyl]sulfinyl} phenyl)-2,3-dihydro-1H-1-benzazepine-4-carboxamide	-
7	7.124	2.1770	308.0815	$C_{16}H_{17}O_4Cl$	5-(4-Chlorophenoxy)pentyl 2-furoate	-
8	7.341	0.0763	752.4034	$C_{45}H_{56}N_2O_8$	3-Buten-1-yl [6a-(allyloxy)-4-(ethoxyimino)- 10-hydroxy-1,2-bis(4-hydroxybutyl)-1,2,4,5,6,6a,11b,	-
9	7.496	0.1773	395.1516	$C_{21}H_{22}N_5OCl$	1-(4-Chlorophenyl)-3-[4-(4-methyl-1-piperazinyl)-6-quinolinyl]urea	-
10	7.890	2.0695	270.0654	$C_8H_{16}N_4O_2Cl_2$	11c-octahydrobenzo[kl]xanthen-6-yl](1-naphthylmethyl)carbamate N-[(4,5-Dimethyl-4H-1,2,4-triazol-3-yl)methyl]-N- methylglycinedihydrochloride	-
11	8.086	0.1587	395.1534	$C_{19}H_{21}N_7OS$	8-Benzyl-N-(2-methoxyethyl)-6,7,8,9- tetrahydropyrido[4',3':4,5]thieno[3,2-e]tetrazolo[1,5-a] pyrimidin-5-amine	-
12	8.312	0.0715	254.0684	$C_6H_{14}N_4O_5S$	Sulfuric acid	-
13	8.572	1.7961	1086.5399	$C_{55}H_{70}N_{14}O_{10}$	D-Phenylalanyl-L-glutaminyl-N-{2-[1-(2-{[(2S)-1 -{[(2S)-1-{[(2S)-1-amino-4-methyl-1-oxo-2-pentanyl]amino}- 4-methyl-1-oxo-2-pentanyl]amino}-3-(1H-imidazol-5-yl)- 1-oxo-2-propanyl]amino}-2-oxoethyl)-2,4-d ioxo-1, 4-dihydro-3(2H)-chinazolinyl]ethyl}-L-tryptophanamid	-
14	8.726	0.5247	393.1576	$C_{23}H_{23}NO_5$	N-[4-(Benzyloxy)phenyl]-3,4,5-trimethoxybenzamide	-
15	8.860	0.0330	924.4895	$C_{30}H_{64}N_{22}O_{10}S$	Unknown	-
16	9.057	0.7997	379.1555	$C_{20}H_{26}NO_4Cl$	DL-Norlaudanosine Hydrochloride	-
17	9.141	1.6330	332.0794	$C_{19}H_{12}N_2O_4$	2-Benzyl-5-nitro-benzo[de]isoquinoline-1,3-dione	-
18	9.492	0.8726	288.0882	$C_{12}H_{17}N_2O_4Cl$	Methyl 4-[(N,N-dimethylglycyl)amino]- 2-hydroxybenzoate hydrochloride (1:1)	-
19	9.605	0.1566	268.1202	$C_{11}H_{17}N_6Cl$	4-(1-Chloroethyl)-6-(3,5,5-trimethyl-4,5-dihydro- 1H-pyrazol-1-yl)-1,3,5-triazin-2-amine	-
20	9.823	0.0995	639.3743	$C_{33}H_{49}N_7O_6$	N-{(2R)-2-Cyclohexyl-2-[(2-pyrazinylcarbonyl)	-

					amino]acetyl}-3-methyl-D-valyl-N-[(3S)-1-(cyclopropylamino) -1,2-dioxo-3-hexanyl]-L-prolinamide	
21	9.915	0.1437	342.2879	$C_{19}H_{38}N_2O_3$	Lauramidopropylbetaine	-
22	10.112	1.0649	477.3323	$C_{10}H_{39}N_{17}O_5$	Unknown	-
23	10.245	0.7078	231.1067	$C_5H_{17}N_3O_7$	Unknown	-
24	10.400	2.5244	423.3113	$C_{24}H_{37}N_7$	6-[(4-Amino-2-methyl-6-quinolinyl)amino]-2-{[(2S) -5-(diethylammonio)-2-pentanyl]amino}- 4-methylpyrimidin-1-ium	-
25	10.660	1.3237	355.0953	$C_{13}H_{17}N_5O_5S$	5'-S-(2-Carboxyethyl)-5'-thioadenosine	-
26	10.815	0.0645	1086.5440	$C_{47}H_{78}N_{10}O_{19}$	L-Lysyl-L-leucyl-L-threonyl-L-prolyl-L-á-glutamyl-L-á-glutamyl -L-á-glutamyl-L-á-glutamyl-L-isoleucine	-
27	10.969	0.3587	311.1066	$C_{11}H_{22}N_3O_3SCl$	4-(5-Chloropentanoyl)-N,N-dimethyl-1-piperazinesulfonamide	-
28	11.187	0.6646	981.5404	$C_{39}H_{71}N_{19}O_9S$	Unknown	-
29	11.405	0.5699	317.2919	Unknown	Unknown	-
30	11.560	0.3775	981.5510	$C_{45}H_{71}N_{15}O_{10}$	L-Histidyl-D-norleucyl-N5-(diaminomethylene)-L-ornithyl- L-tryptophylglycyl-L-lysyl-L-seryl-L-valine	-
31	11.714	1.6791	531.3806	$C_{15}H_{41}N_{21}O$	Unknown	-
32	11.953	5.2623	960.5294	$C_{48}H_{80}O_{19}$	Notoginsenoside G	Immunological adjuvant activity andimmunostimulatory activity
[29].						
33	12.376	0.8426	974.5444	$C_{39}H_{74}N_{16}O_{11}S$	N5-(Diaminomethylen)-L-ornithyl-N5-(diaminomethylen)- L-ornithyl-L-threonyl-L-alanyl-L-leucyl-L-glutaminyl- L-cysteinyl-L-lysin	-
34	12.459	2.6705	519.3336	$C_{28}H_{46}N_5O_2Cl$	N4-(5-Chloro-2,4-dimethoxyphenyl)-N6-hexadecyl -4,5,6-pyrimidinetriamine	-
35	12.656	2.4303	1009.5794	$C_{58}H_{75}N_9O_7$	N-{3-[18-(2-Carboxyethyl)-3,7,12,17-tetramethyl-8,13 -divinyl-2-porphyrinyl]propanoyl}leucyl-N-(11-methoxy- 11-oxoundecyl)histidinamide	-
36	12.924	0.3246	995.5600	$C_{45}H_{73}N_{17}O_7S$	Unknown	-
37	13.058	10.1941	495.3309	$C_{26}H_{45}N_3O_6$	{[2-(3-Methoxy-2-propoxyphenyl)ethyl]imino}di-2, 1-ethanediyl bis (butylcarbamate)	-
38	13.317	0.2499	278.1501	$C_5H_{18}N_{12}S$	Unknown	-
39	13.409	0.1162	521.3465	$C_{28}H_{47}N_3O_6$	N'-[(Z)-(2,3,4-Trimethoxy-6-nitrophenyl) methylene]octadecanehydrazide	-
40	13.535	0.7638	1009.5877	$C_{55}H_{83}N_3O_{14}$	2-{[(1R,2R,4R)-4-{(1E)-2-[(1R,9S,12S,13R,14S,17R,18E,21S,23S, 24R,25S,27R)-17-Ethyl-1,14-dihydroxy-23,25-dimethoxy-13,19, 21,27-tetramethyl-2,3,10,16-tetraoxo-11,28-dioxa-4-azatricyclo [22.3.1.04,9]oct acos-18-en-12-yl]-1-propen-1-yl}-2- methoxycyclohexyl]oxy}-N-[4-(4-morpholinyl)phenyl]acetamid	-
41	13.803	4.6668	509.3477	$C_{28}H_{43}N_7O_2$	7,8-Dimethyl-3-[({2-methyl-1-[1-(2-methyl-2-butanyl)- 1H-tetrazol-5-yl]propyl}[2-(4-morpholinyl)ethyl]amino)methyl]- 2(1H)-quinolinone	-
42	14.020	0.1850	843.6769	$C_{34}H_{81}N_{23}S$	Unknown	-
43	14.217	2.0541	523.3646	$C_{22}H_{45}N_{13}S$	Unknown	-
44	14.527	12.5480	523.3635	$C_{29}H_{45}N_7O_2$	(2E)-2-{4-[3-(Diethylamino)propoxy]benzylidene}-N '-[(E) -{4-[3-(diethylamino)propoxy]phenyl} methylene]hydrazinecarbohydrazonamide	-

the components in the *M. mammosa* tuber in conquering the SARS-CoV2 infection. In its application, multicomponent medicinal plants may be utilized as extracts or active fractions. Typically, plant fractions possess more excellent antiviral activity than pure substances, as medicinal plants typically include multiple physiologically active chemicals. To establish the potential of this activity, however, additional studies are required.

Antioxidant phenolic substances such as scopoletin and 3-Hydroxycoumarin can be expected based on the results. Furthermore, glycoside molecules such as merremosida-D and Notoginsenoside G were discovered in the ethyl acetate and butanol fractions. In the ethyl acetate fraction, flavonoid compounds such as Gemixanthone A and terpene compounds like Curcumene were found.

CONCLUSION

M. mammosa tuber extract and fractions have different metabolite profiles. The ethanol extract yielded 61 chemicals, with N, N-Dimethyl-N'-1H-tetrazol-5-ylsulfuric diamide being the most abundant. The n-hexane fraction produced 64 molecules, the most abundant of which was dihomo-linolenic acid. The ethyl acetate fraction yielded 54 compounds, with N, N-Dimethyl-N'-1H-tetrazole-5-ylsulfuric diamide being the most abundant. The butanol fraction yielded 44 compounds, the most abundant of which was [2-(3-Methoxy-2-propoxyphenyl)ethyl]iminodi-2,1-ethanediyl bis (butylcarbamate). Several substances may have antiviral, antioxidant, anti-inflammatory, and other effects; thus, additional studies are required to determine the extent of these actions.

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Conflict of Interest

All authors declare there is no conflict of interest in this manuscript.

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