

Supplementary material

Effect of Gamma Irradiation on Change of Chemical Composition and Antioxidant Activity of *Euphorbia maculata* Callus

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Figure S1. UPLC-QTOF/MS spectrum of *Euphorbia maculate* callus.

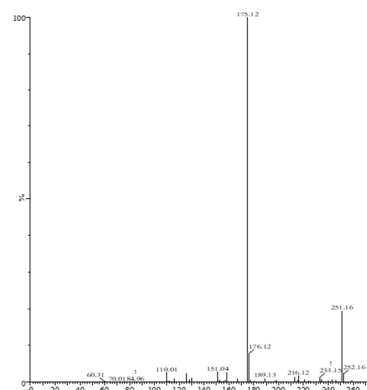
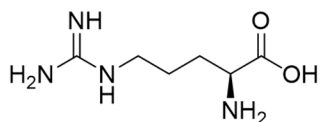
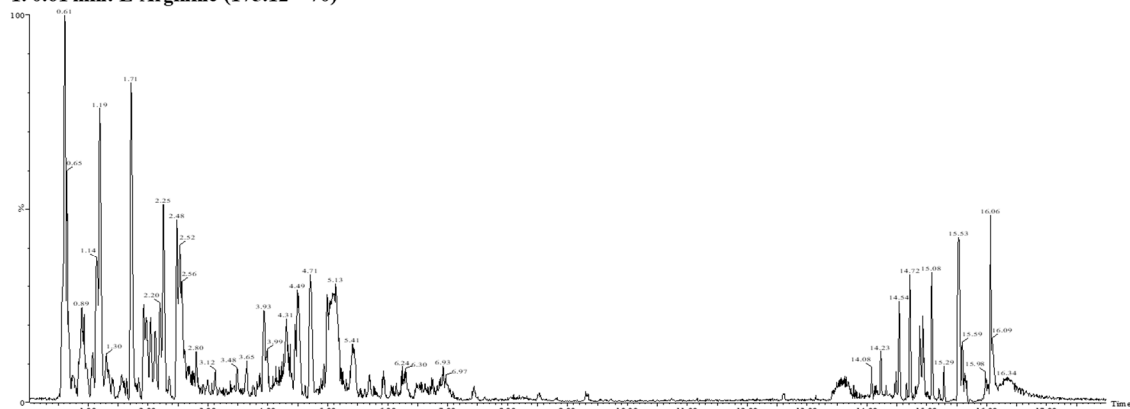
1. L-Arginine
2. Pteroside B
3. N-(1-deoxy-1-fructosyl)isoleucine
4. γ -Glutamyl lysine
5. Epicatechin 3-glucuronide
6. N-(1-deoxy-1-fructosyl)phenylalanine
7. L-Phenylalanine
8. Sinapic acid
9. Gallic acid 3-O-gallate
10. γ -Glutamylglutamic acid
11. N-(1-deoxy-1-fructosyl)tryptophan
12. L-Tryptophan
13. 2',7-Dihydroxy-4',5'-dimethoxyisoflavone
14. Epicatechin 4'-glucuronide
15. Quinic acid
16. Chlorogenic acid
17. Methyl gallate
18. Caffeic acid ethyl ester
19. Kaempferol 3-rhamnosyl-6''-(4''-acetylramnosyl)glucoside
20. Acetylpterisin C
21. 1,2,3,4,6-Pentagalloylglucose
22. Phenylalanylglycine
23. Leucocyanidin
24. Kaempferol 3-rhamnosyl-(6''-acetyl)galactosyl-7-glucoside
25. 7-Glucosyl-4''glucuronoyl epigallocatechin gallate
26. Quercetin 3,7-diglucosyl-4''-galactoside
27. Isoquercitrin
28. Quercetin 3-coumaroyl-triglucoside
29. Quercetin 3-(2''',6'''-digalloyl)galactoside
30. Quercetin 3-(2-galloyl)glucoside
31. Isorhamnetin 3-rutinoyl-4'-rhamnoside
32. Kaempferol 3-(2''-rhamnosyl-6''-acetyl)galactosyl-7-rhamnoside
33. Kaempferol 3-feruloyl-triglucoside
34. Isoorientin
35. Dehydrophytosphingosine
36. LysoPC(18:3)
37. LysoPC(18:2)
38. LysoPC(16:0)
39. LysoPC(18:1)
40. Phytosphingosine 1-phosphate
41. Methyl phaeophorbide B
42. Pheophorbide A
43. Pheophorbide B
44. PC(18:3/18:3)

Figure S2. Photographs of the three plant-derived calli

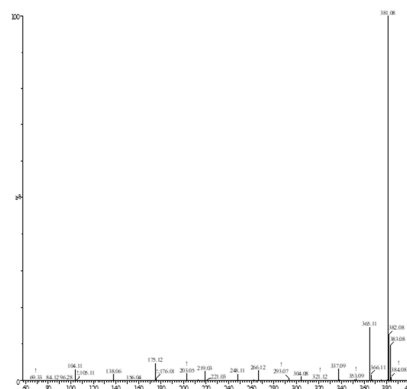
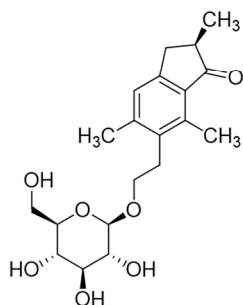
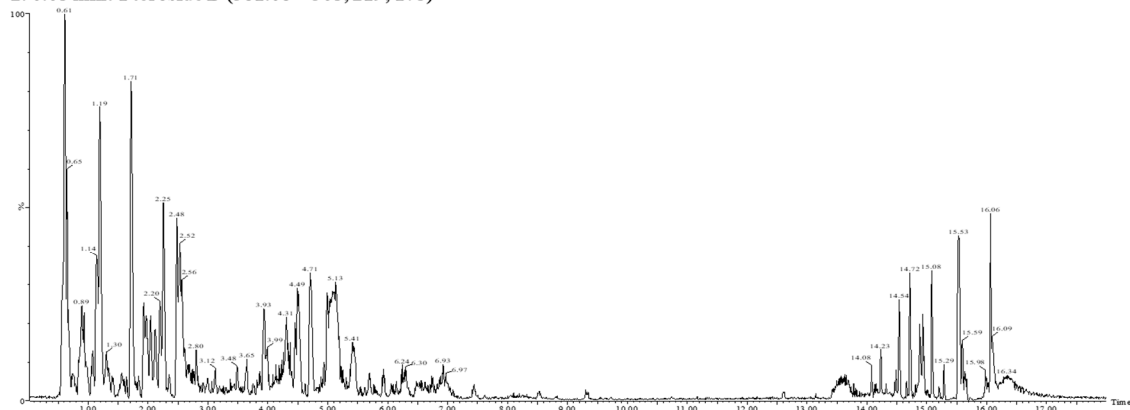
Table S1. Statistical analysis of *Euphorbia maculate* callus.

Figure S1. UPLC-QTOF/MS spectrum of *Euphorbia maculate* callus.

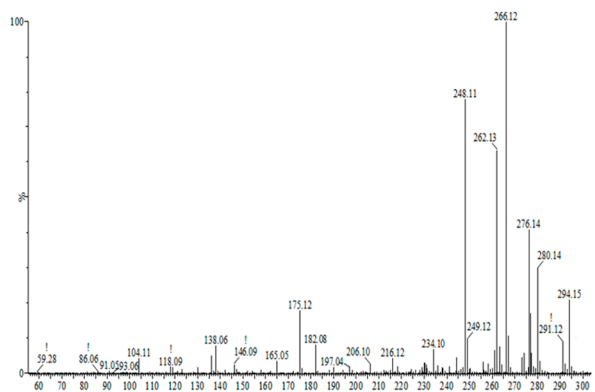
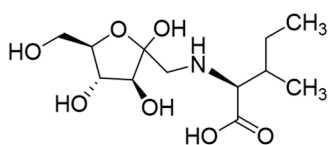
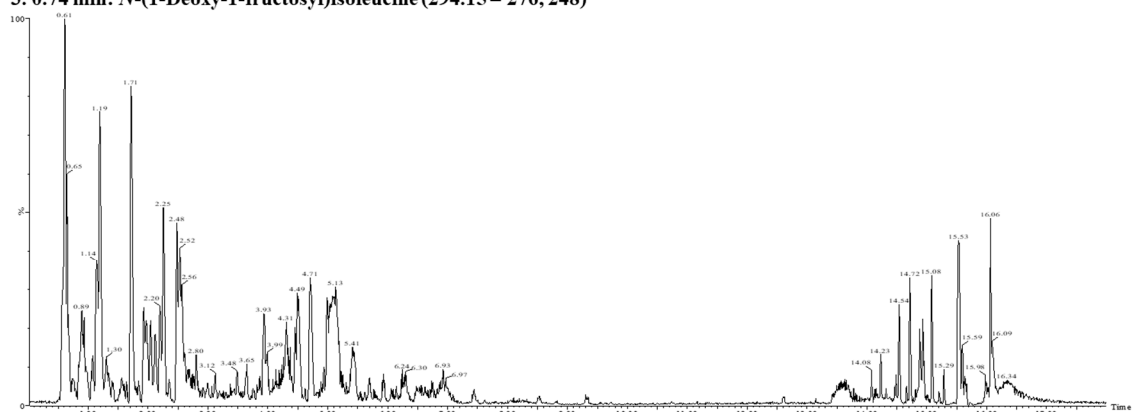
1. 0.61 min: L-Arginine (175.12 = 70)



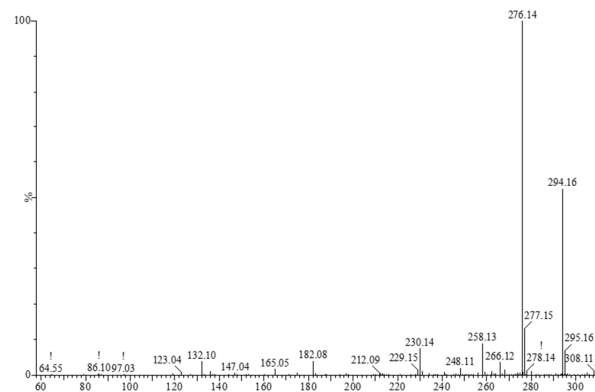
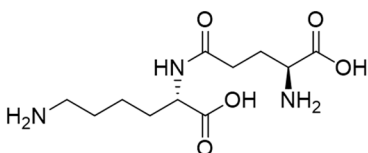
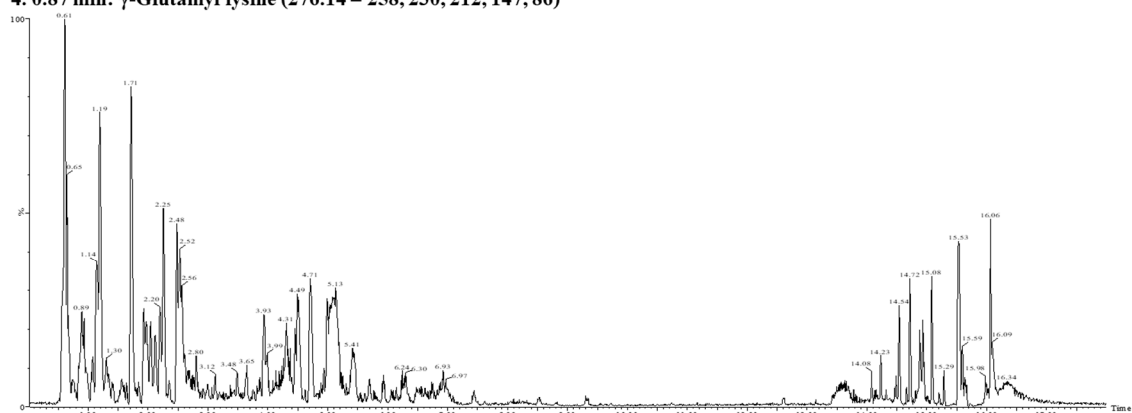
2. 0.65 min: Pteroside B (381.08 = 365, 219, 175)



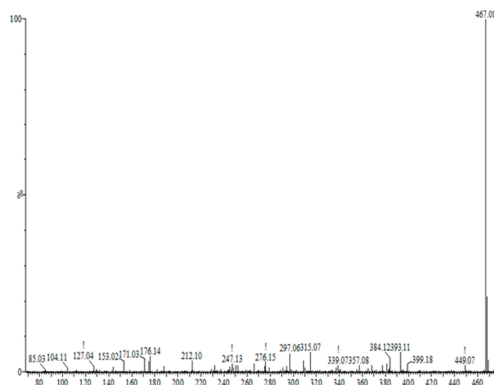
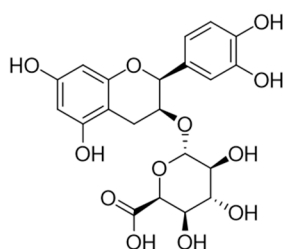
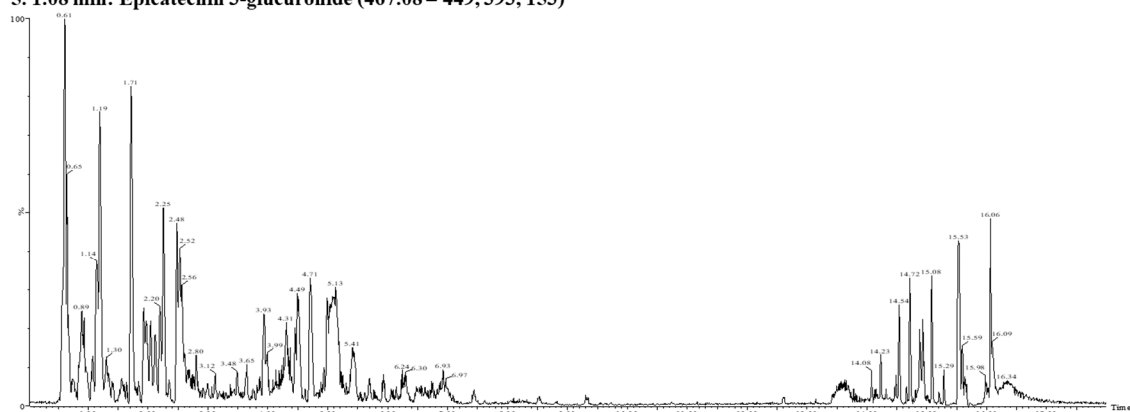
3. 0.74 min: *N*-(1-Deoxy-1-fructosyl)isoleucine (294.15 = 276, 248)



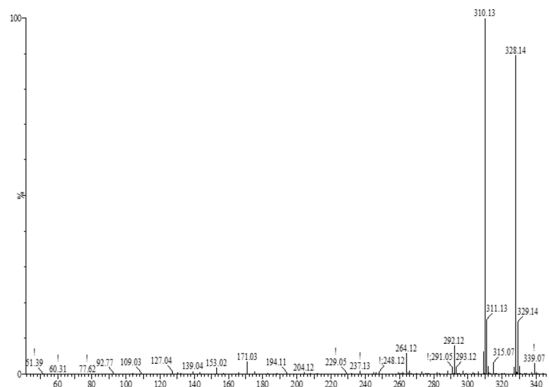
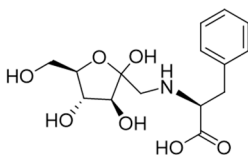
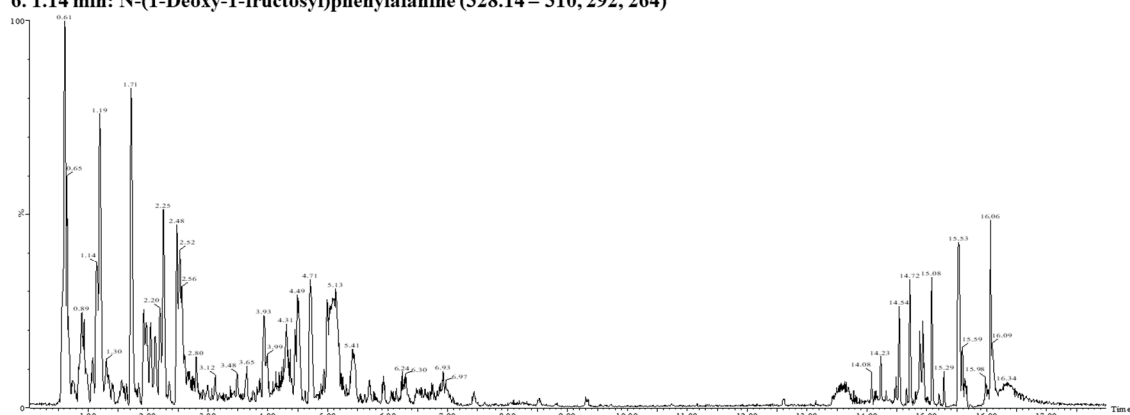
4. 0.87 min: γ -Glutamyl lysine (276.14 = 258, 230, 212, 147, 86)



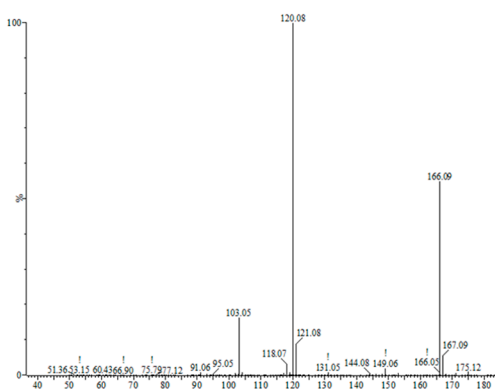
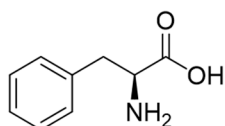
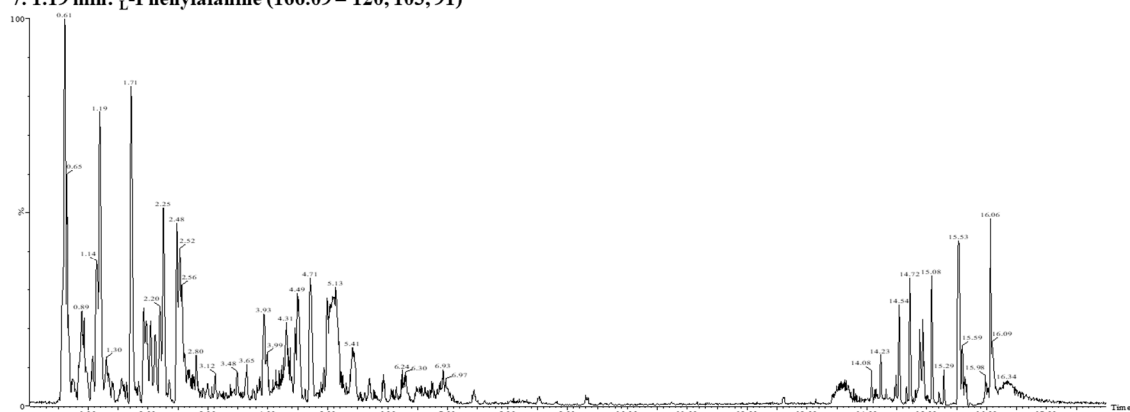
5. 1.08 min: Epicatechin 3-glucuronide (467.08 = 449, 393, 153)



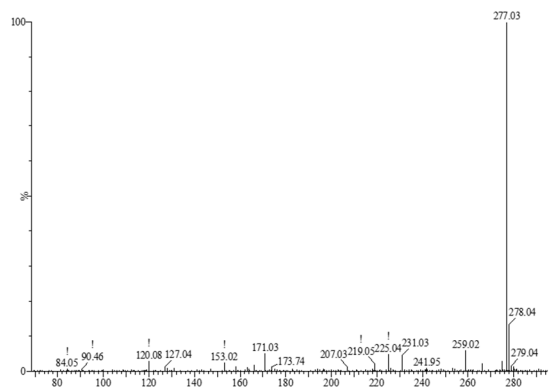
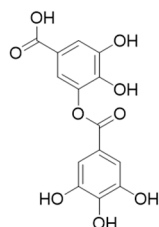
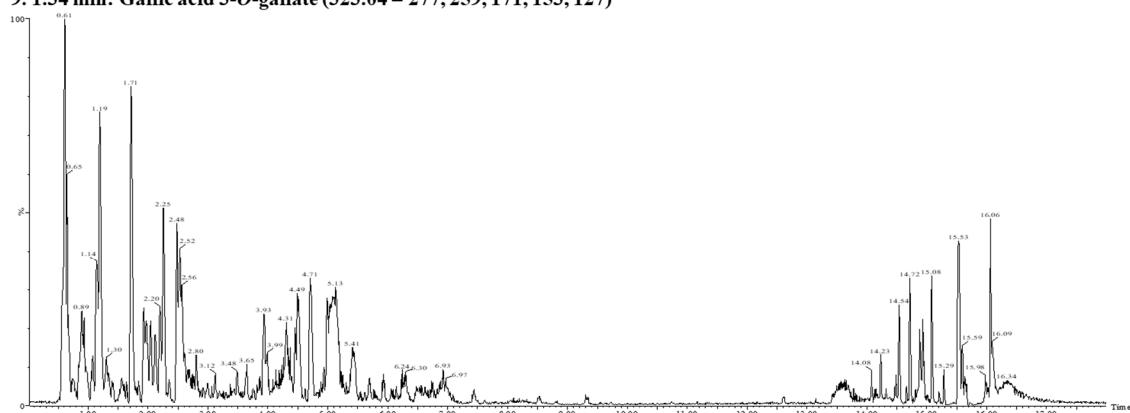
6. 1.14 min: N-(1-Deoxy-1-fructosyl)phenylalanine (328.14 = 310, 292, 264)



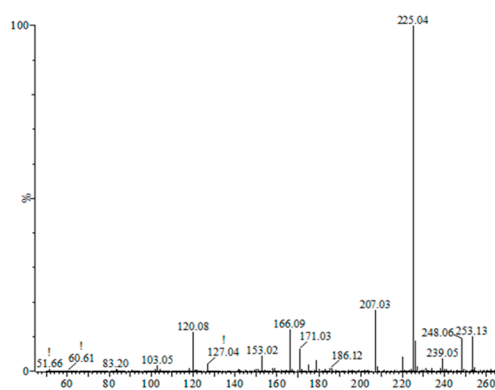
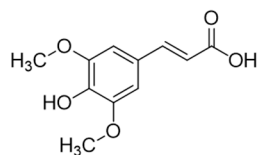
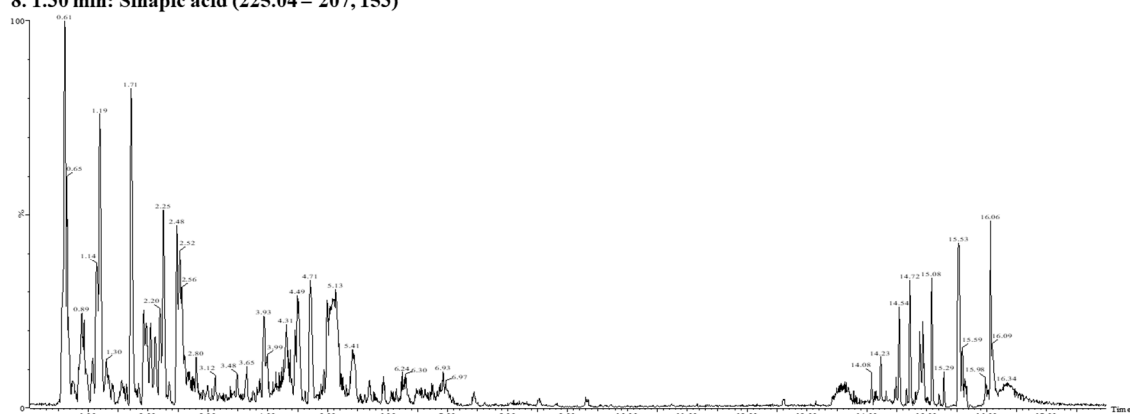
7. 1.19 min: L-Phenylalanine (166.09 = 120, 103, 91)



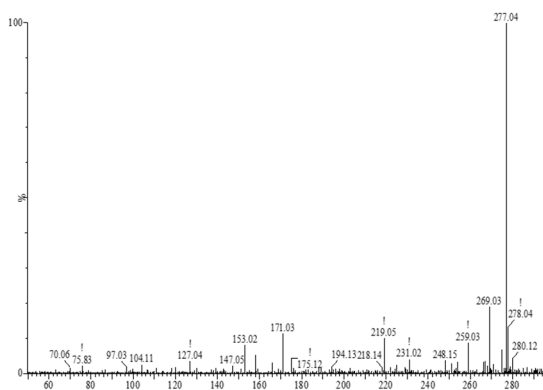
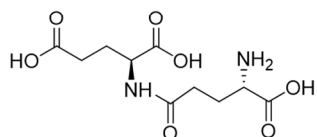
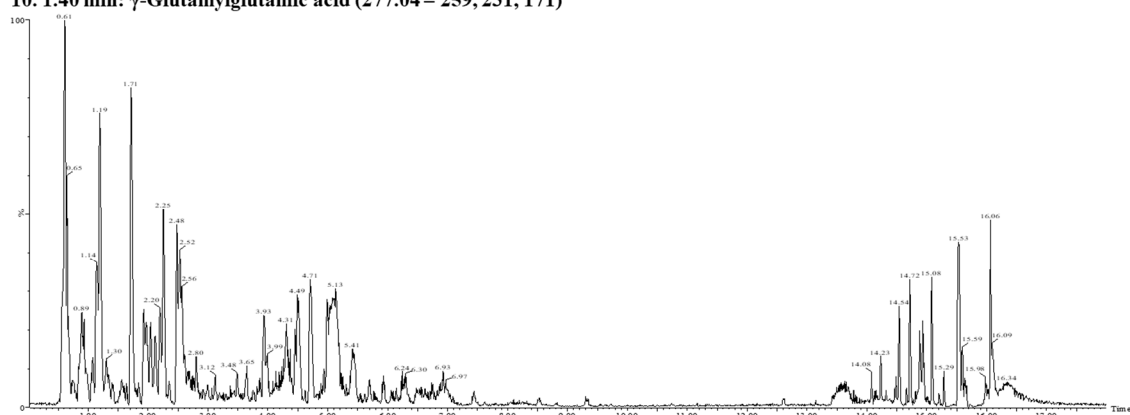
9. 1.34 min: Gallic acid 3-O-gallate (323.04 = 277, 259, 171, 153, 127)



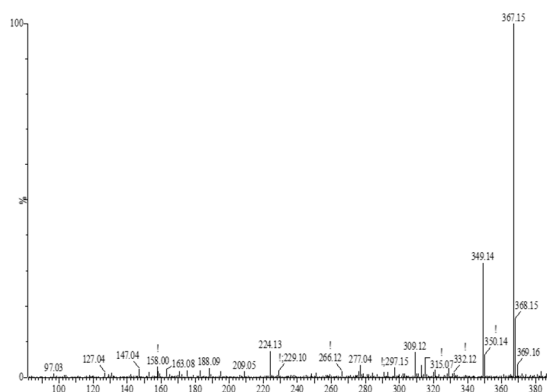
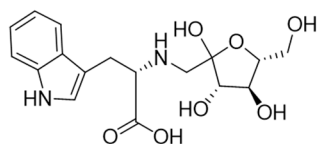
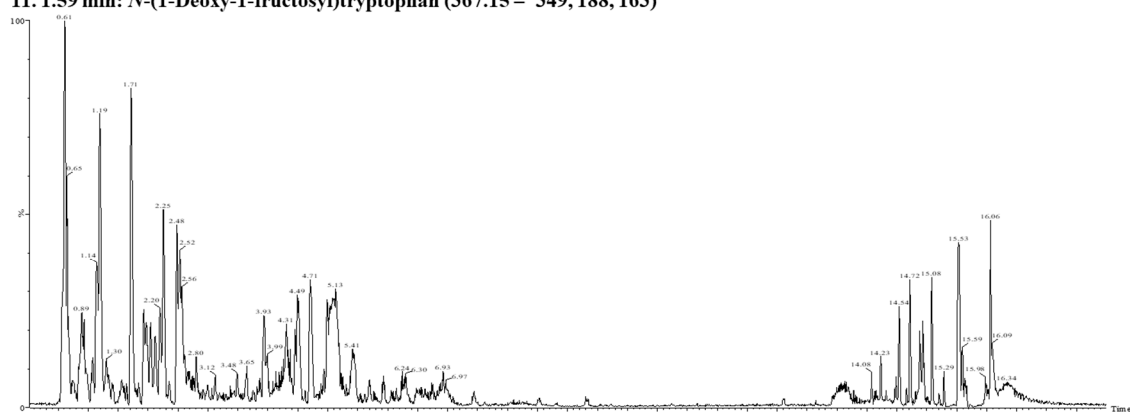
8. 1.30 min: Sinapic acid (225.04 = 207, 153)



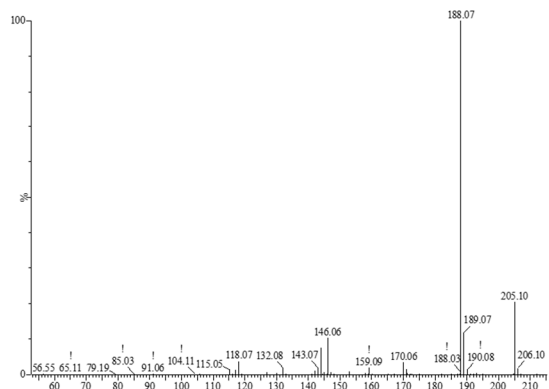
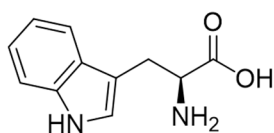
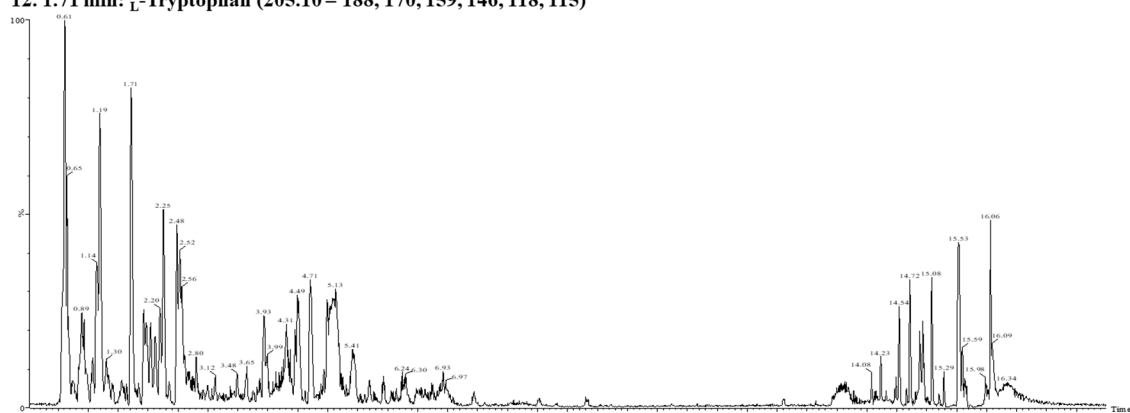
10. 1.40 min: γ -Glutamylglutamic acid (277.04 = 259, 231, 171)



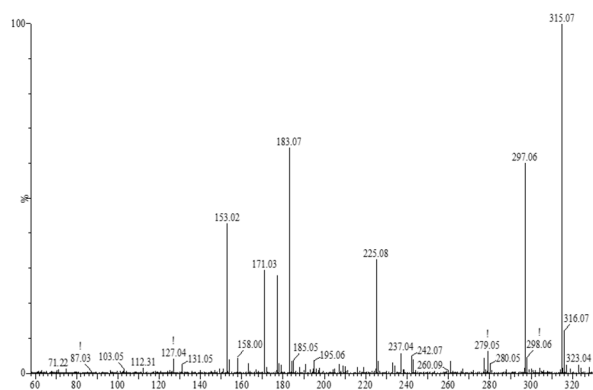
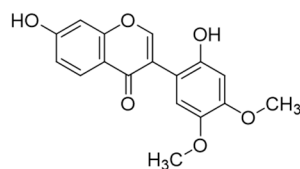
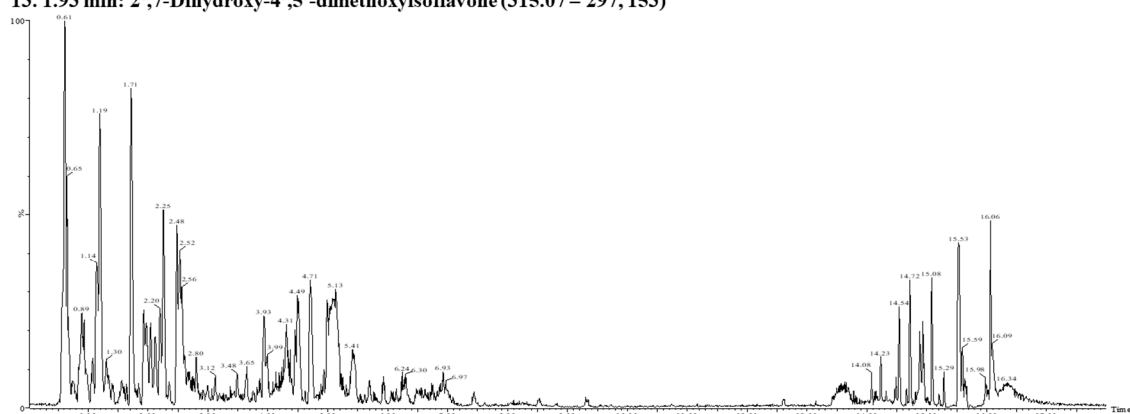
11. 1.59 min: *N*-(1-Deoxy-1-fructosyl)tryptophan (367.15 = 349, 188, 163)



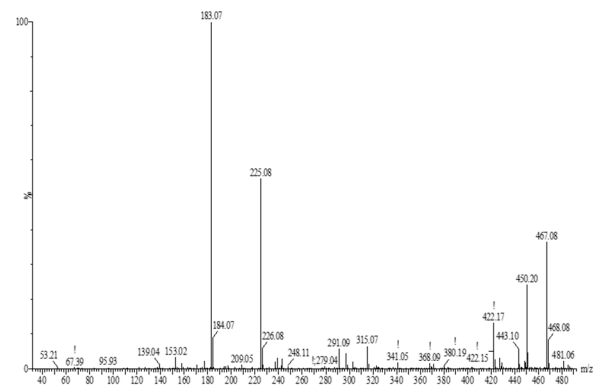
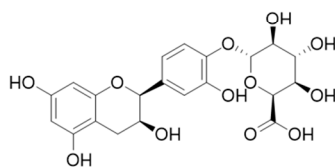
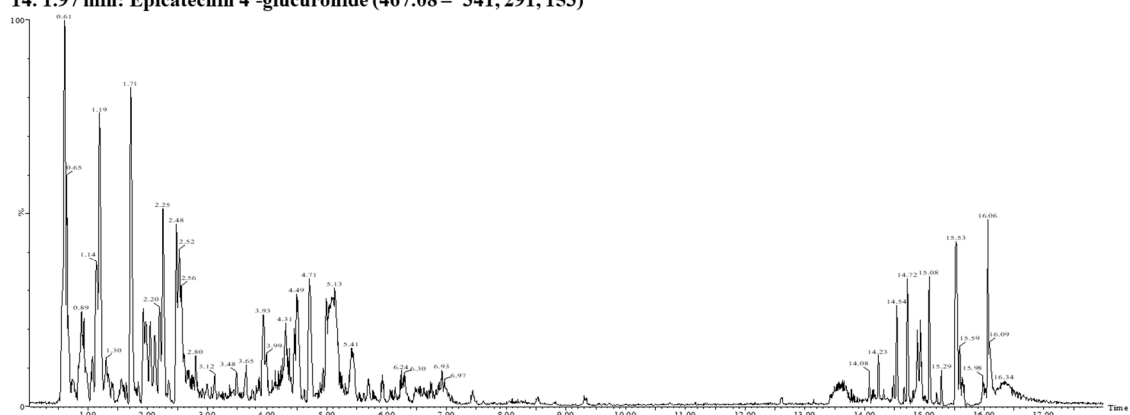
12. 1.71 min: *L*-Tryptophan (205.10 = 188, 170, 159, 146, 118, 115)



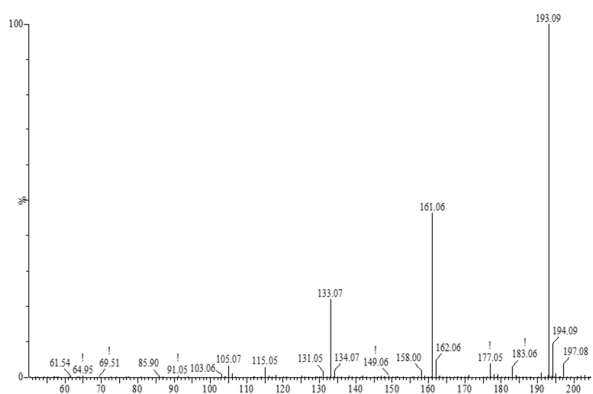
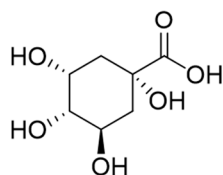
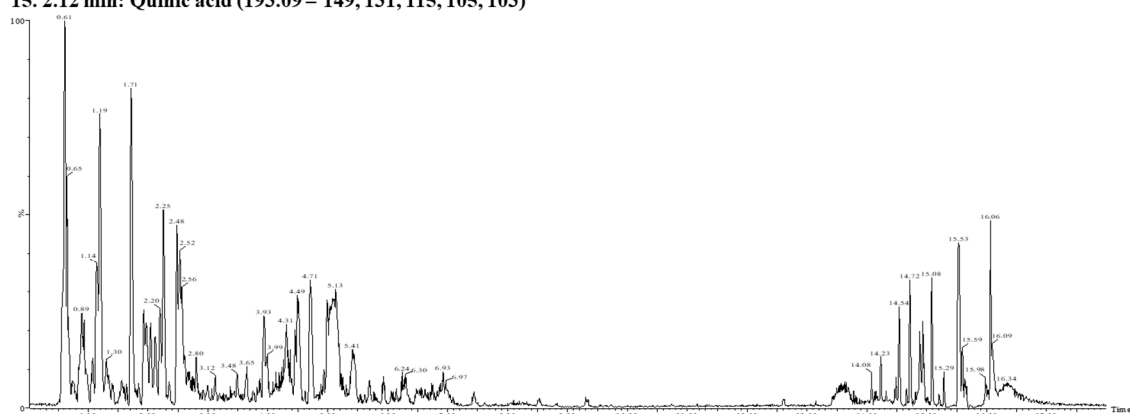
13. 1.93 min: 2',7-Dihydroxy-4',5'-dimethoxyisoflavone (315.07 = 297, 153)



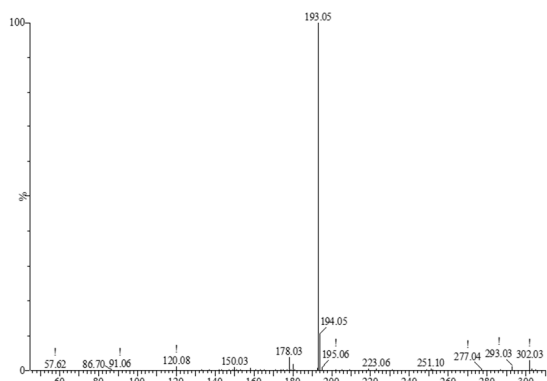
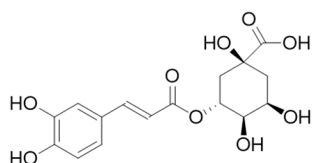
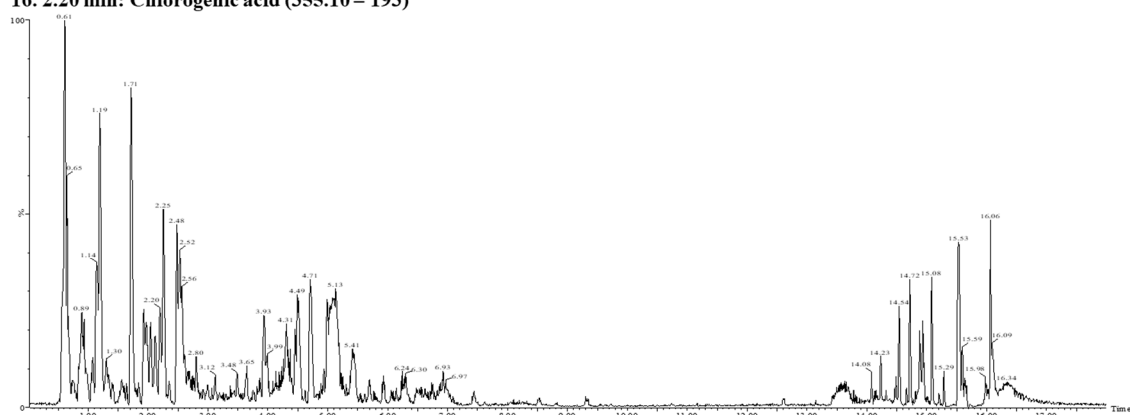
14. 1.97 min: Epicatechin 4'-glucuronide (467.08 = 341, 291, 153)



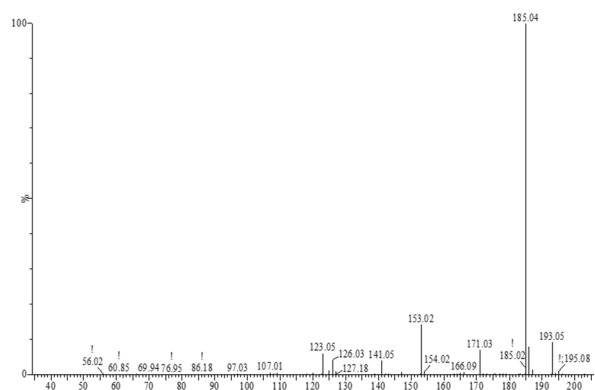
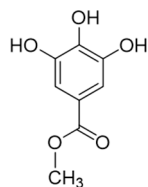
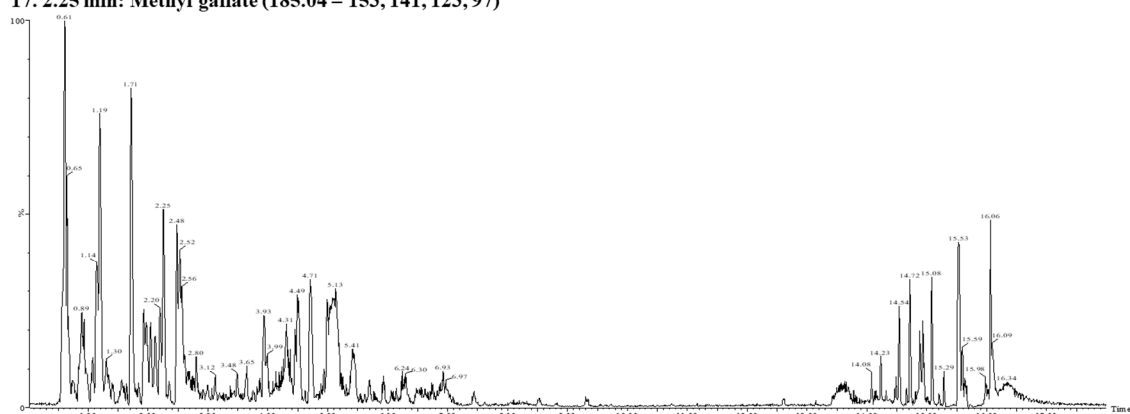
15. 2.12 min: Quinic acid (193.09 = 149, 131, 115, 105, 103)



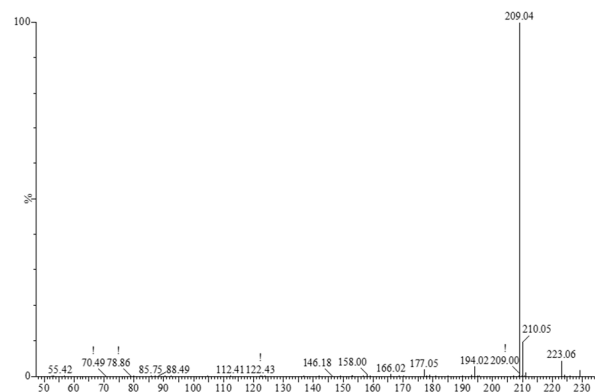
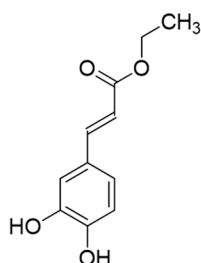
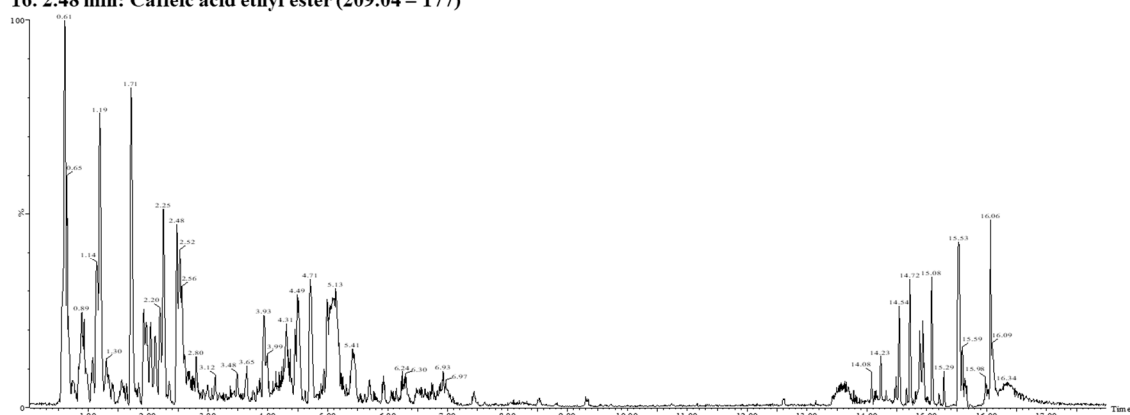
16. 2.20 min: Chlorogenic acid (355.10 = 193)



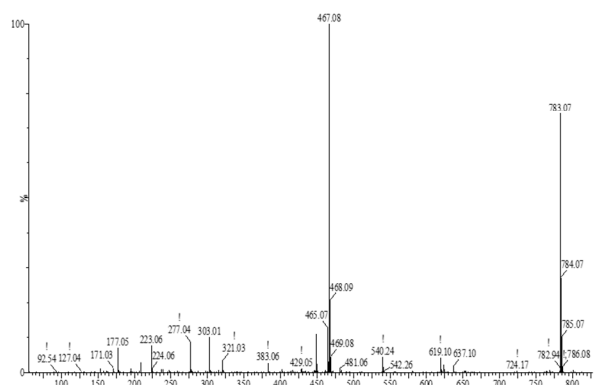
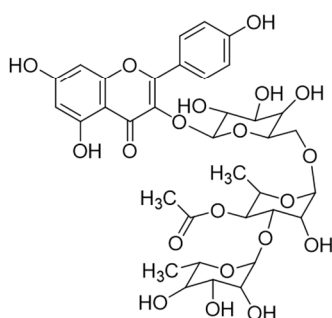
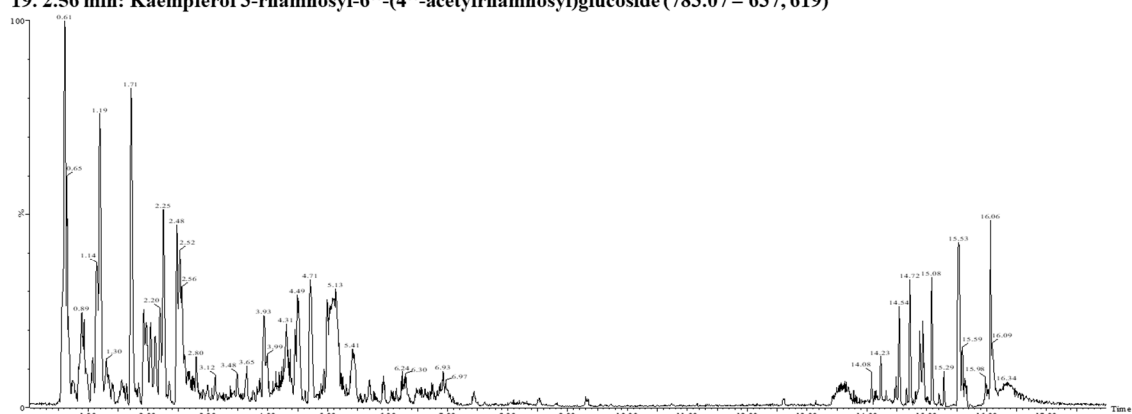
17. 2.25 min: Methyl gallate (185.04 = 153, 141, 123, 97)



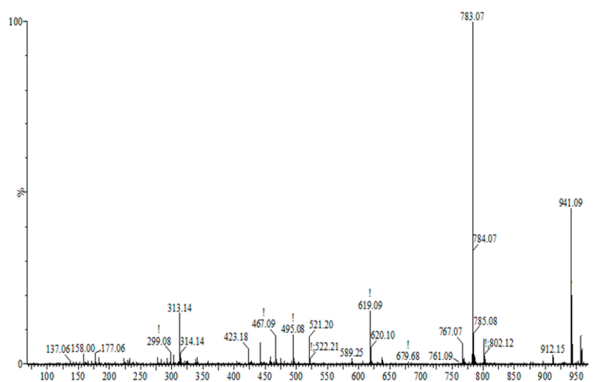
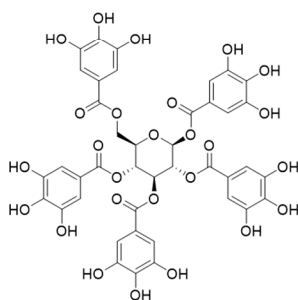
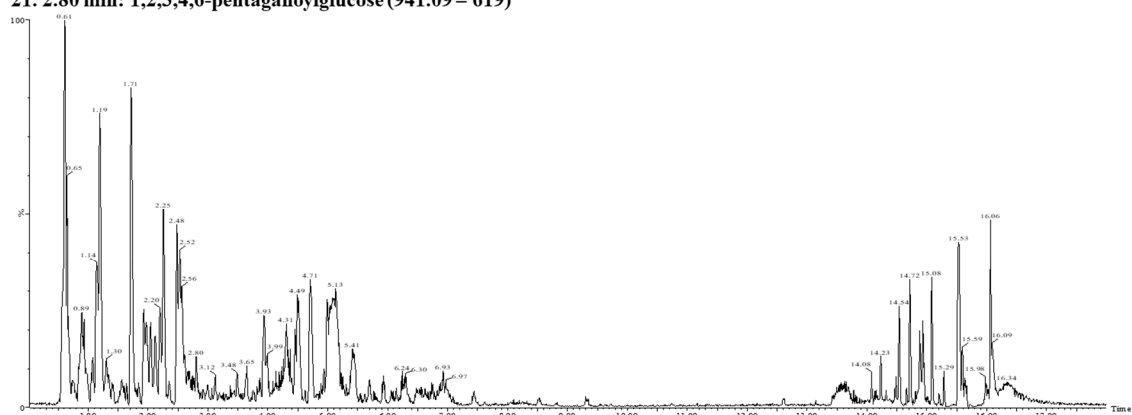
16. 2.48 min: Caffeic acid ethyl ester (209.04 = 177)



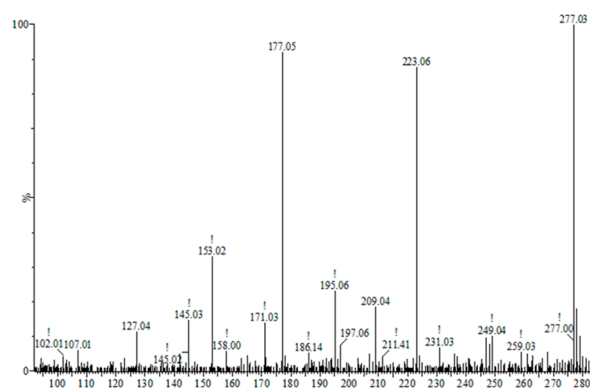
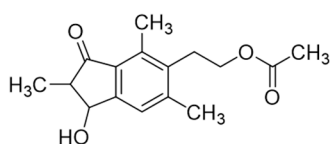
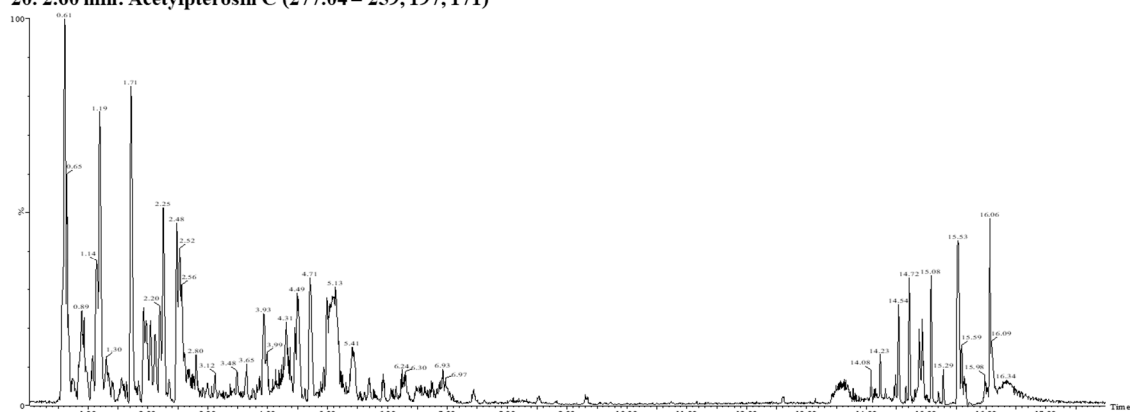
19. 2.56 min: Kaempferol 3-rhamnosyl-6''-(4''-acetylramnosyl)glucoside (783.07 = 637, 619)



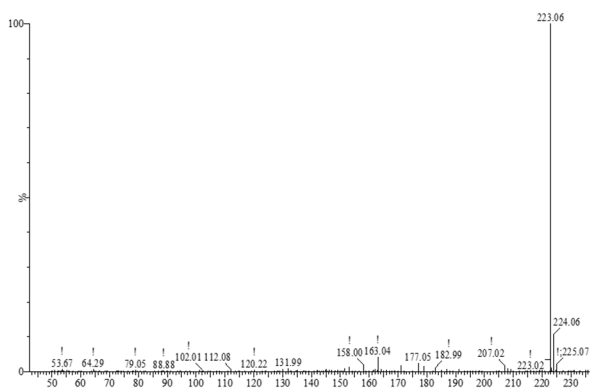
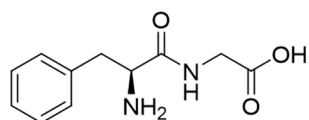
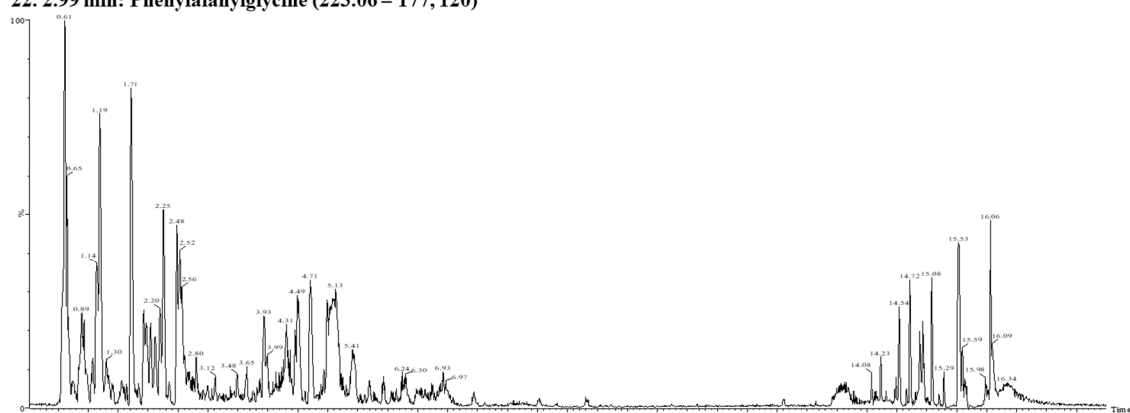
21. 2.80 min: 1,2,3,4,6-pentagalloylglucose (941.09 = 619)



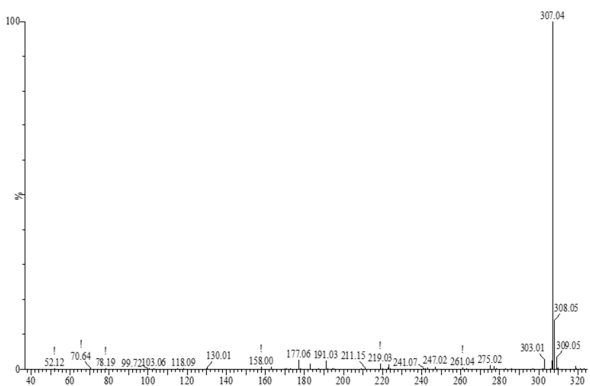
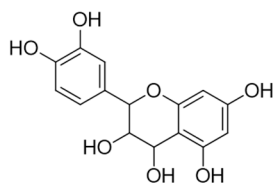
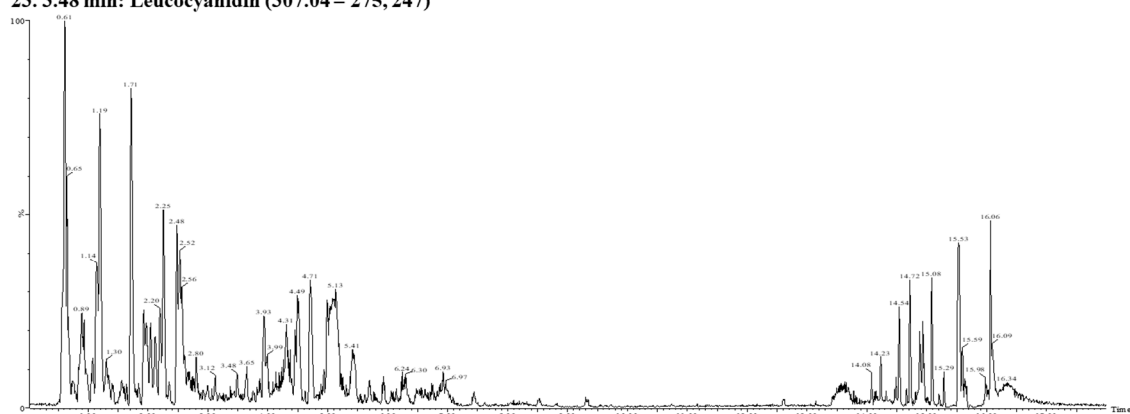
20. 2.60 min: Acetylpterosin C (277.04 = 259, 197, 171)



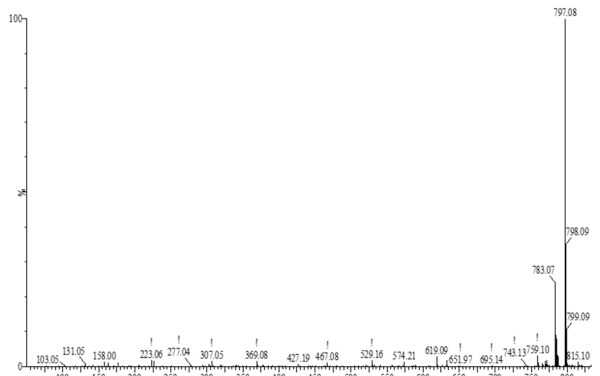
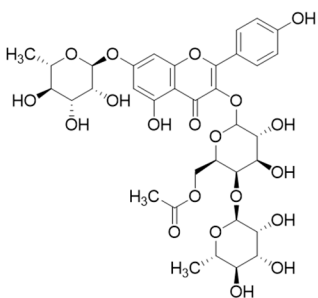
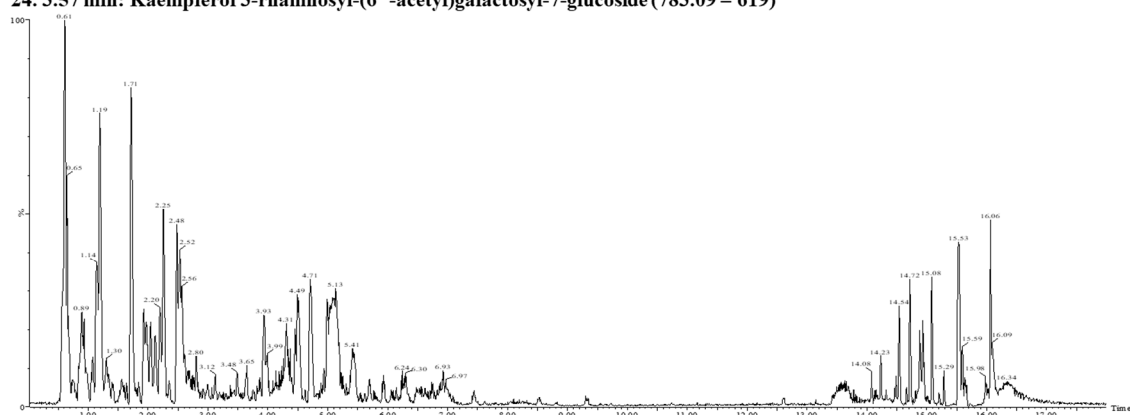
22. 2.99 min: Phenylalanylglycine (223.06 = 177, 120)



23. 3.48 min: Leucocyanidin (307.04 = 275, 247)

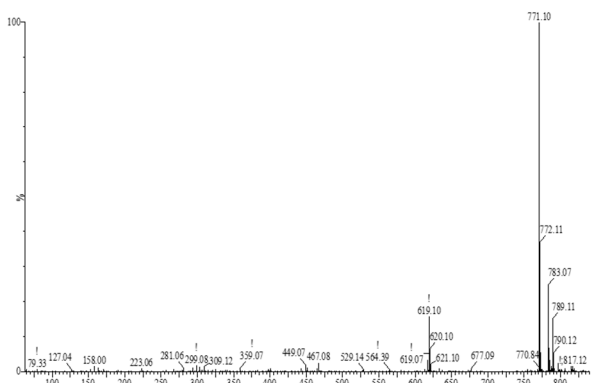
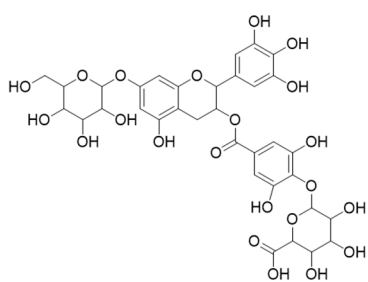
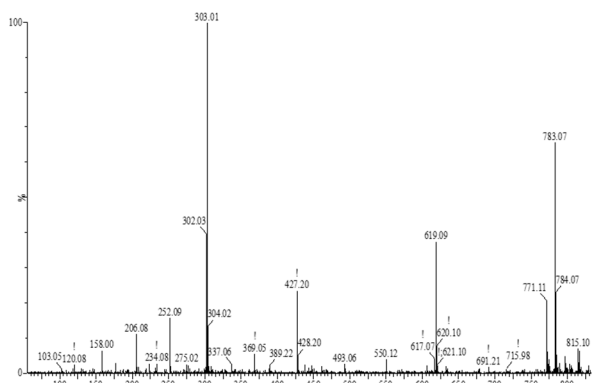
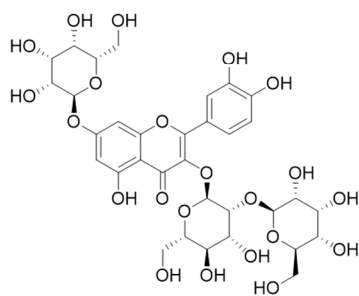


24. 3.57 min: Kaempferol 3-rhamnosyl-(6''-acetyl)galactosyl-7-glucoside (783.09 = 619)

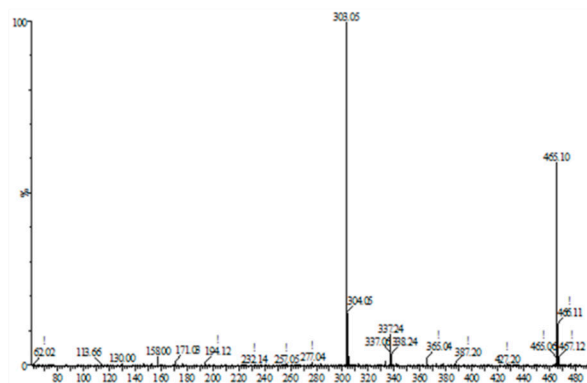
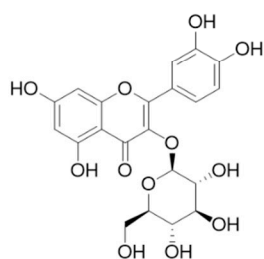
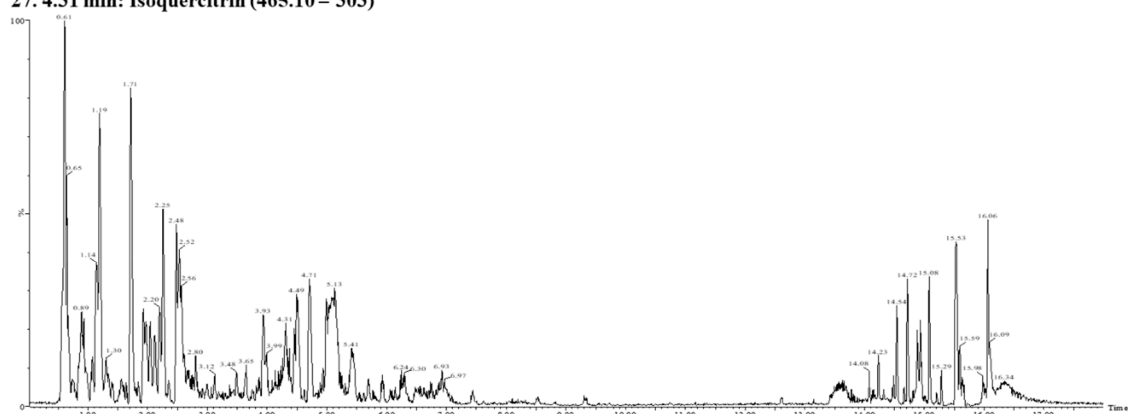


35.565 min.: 7-Glucosyl-4-glucuronylepigallocatechin gallate (77.16 – 81.2)

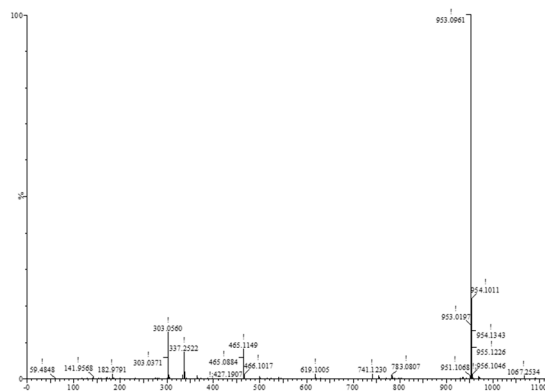
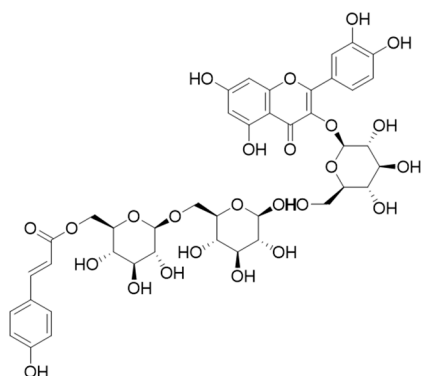
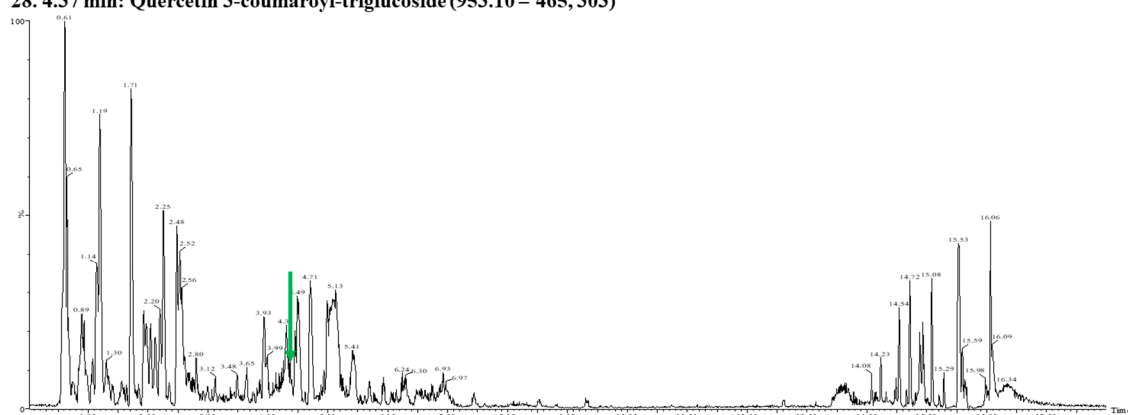
Chromatogram showing the separation of 7-Glucosyl-4-glucuronylepigallocatechin gallate (77.16 – 81.2). The x-axis represents Time (min) and the y-axis represents AU (Absorbance Units). The major peak is at 35.565 min. Other labeled peaks include: 0.00, 0.01, 0.65, 1.00, 1.30, 1.58, 1.70, 2.20, 2.25, 2.48, 2.52, 2.56, 2.80, 3.00, 3.48, 3.60, 3.90, 3.93, 4.21, 4.30, 4.71, 5.13, 5.41, 6.22, 6.30, 6.51, 6.97, 14.00, 14.23, 14.38, 14.72, 15.00, 15.29, 15.39, 15.46, 15.53, 15.69, 16.06, 16.24, and 16.34.

[illegible]

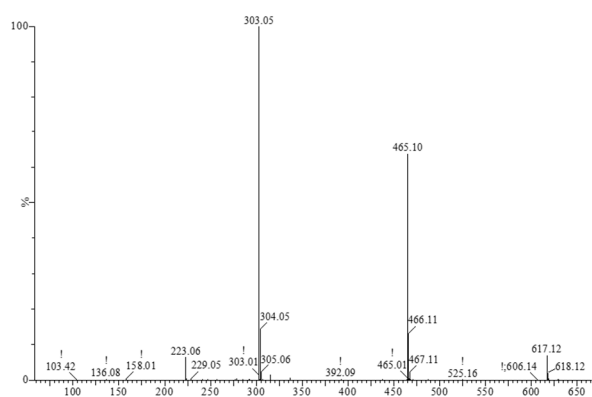
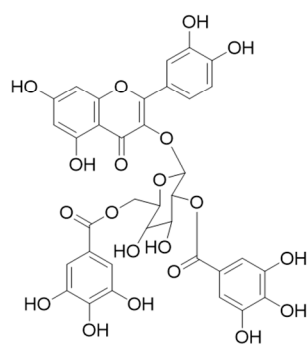
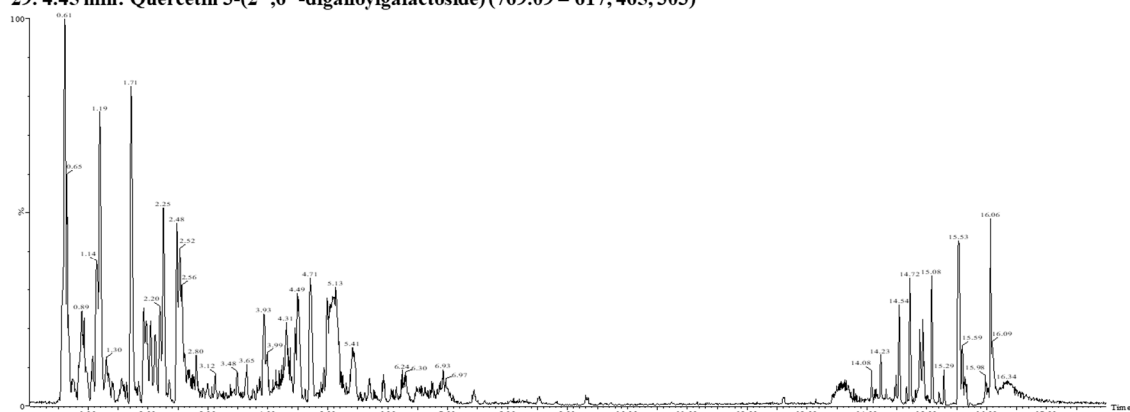
27. 4.31 min: Isoquercitrin (465.10 = 303)



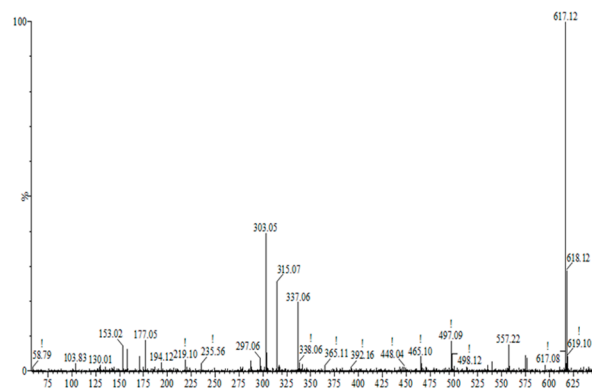
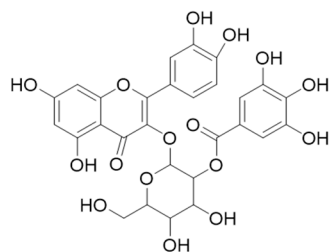
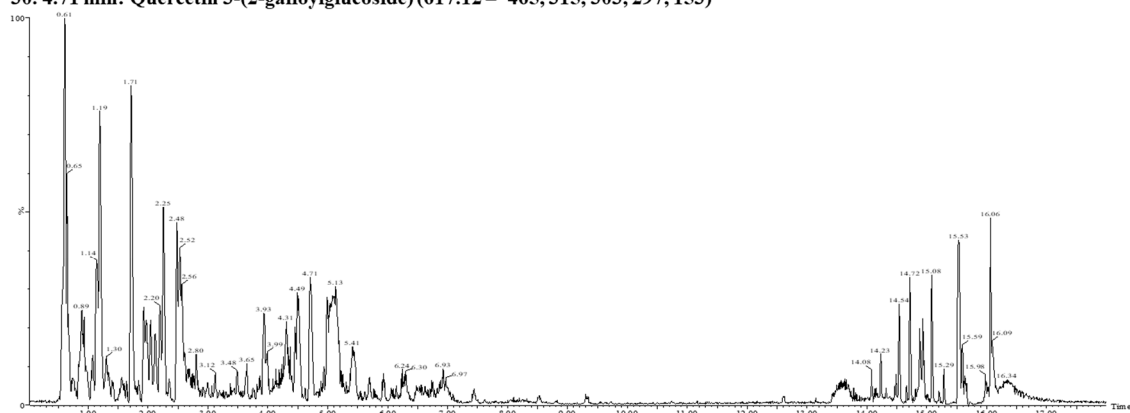
28. 4.37 min: Quercetin 3-coumaroyl-triglucoside (953.10 = 465, 303)



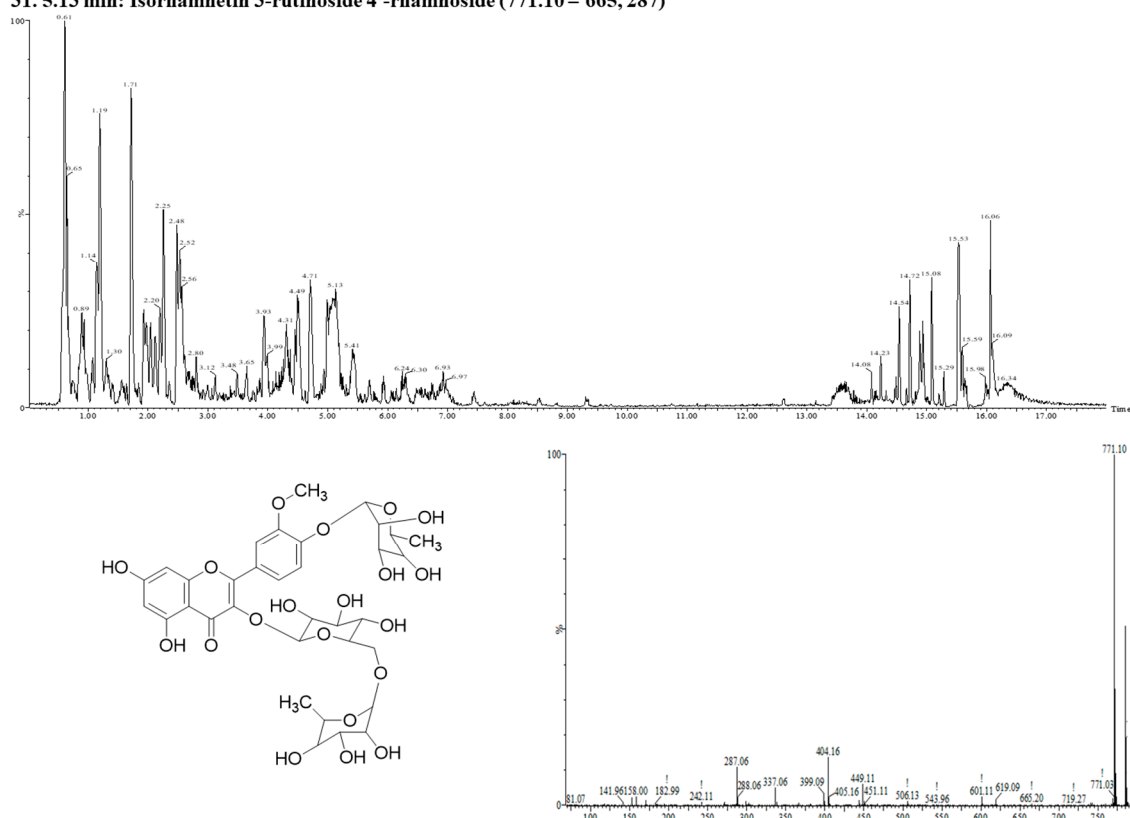
29. 4.45 min: Quercetin 3-(2'',6''-digalloylgalactoside) (769.09 = 617, 465, 303)



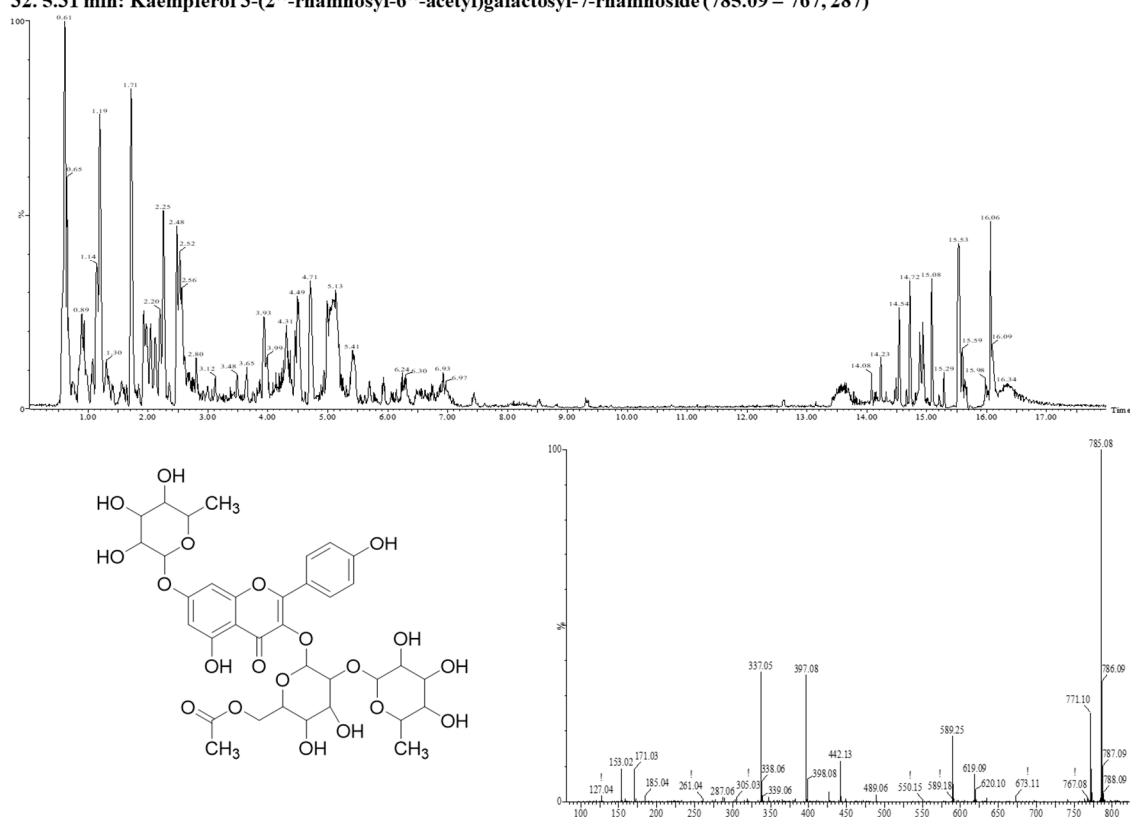
30. 4.71 min: Quercetin 3-(2-galloylglucoside) (617.12 = 465, 315, 303, 297, 153)



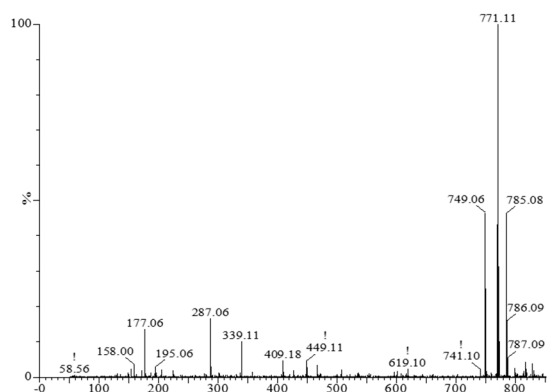
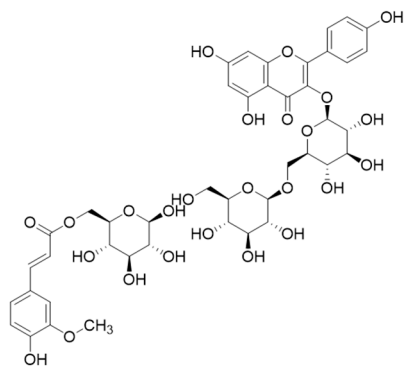
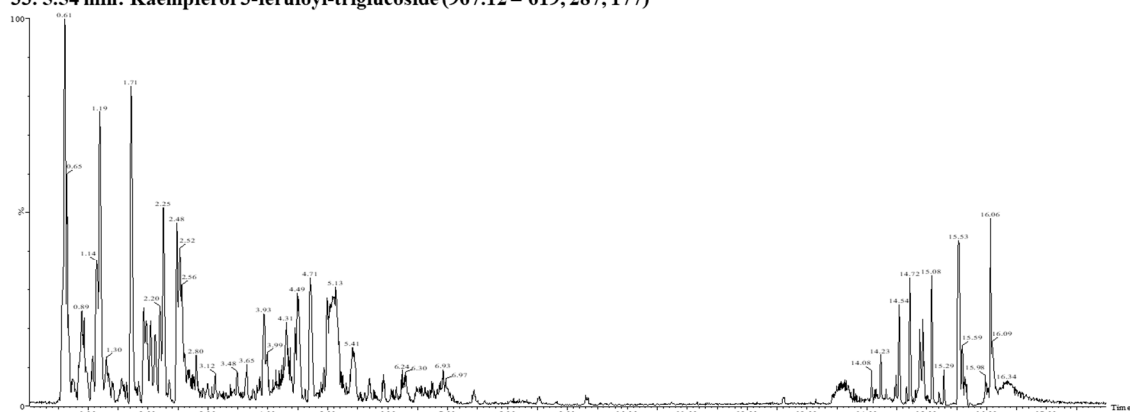
31. 5.13 min: Isorhamnetin 3-rutinoside 4'-rhamnoside (771.10 = 665, 287)



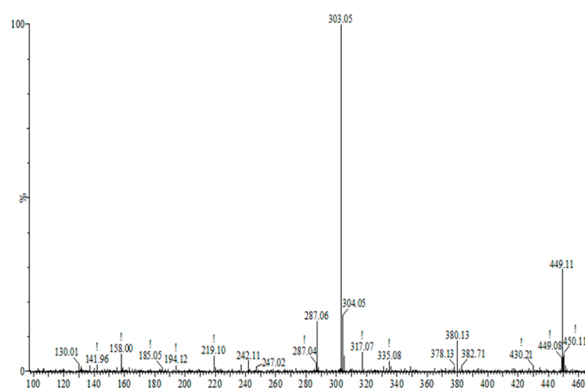
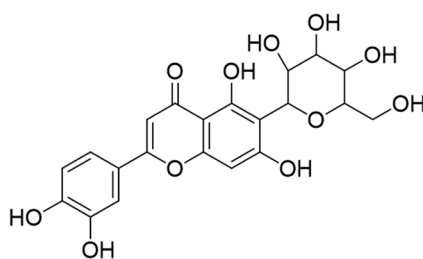
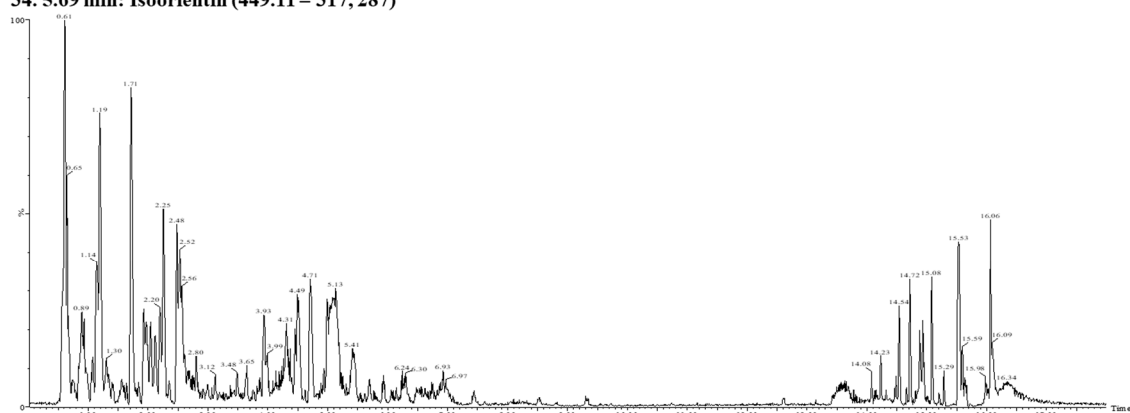
32. 5.31 min: Kaempferol 3-(2''-rhamnosyl-6''-acetyl)galactosyl-7-rhamnoside (785.09 = 767, 287)



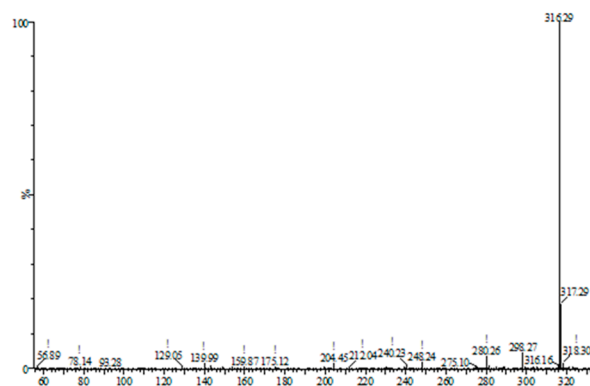
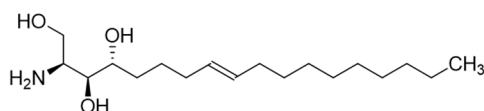
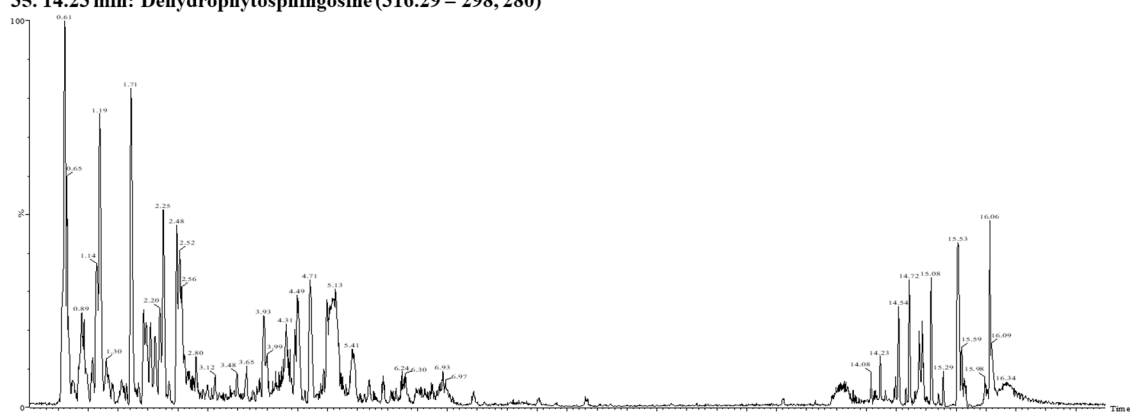
33. 5.54 min: Kaempferol 3-feruloyl-triglucoside (967.12 = 619, 287, 177)



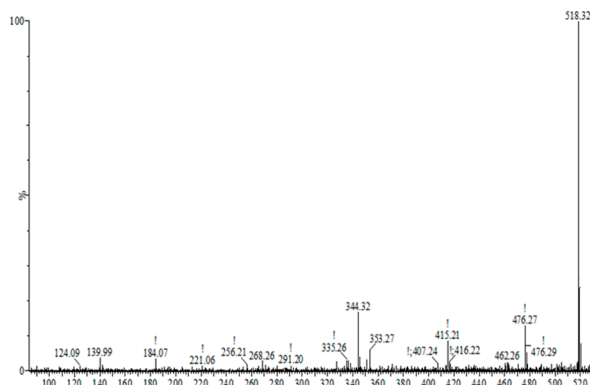
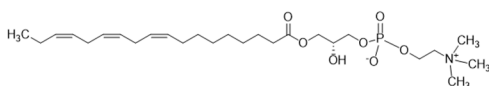
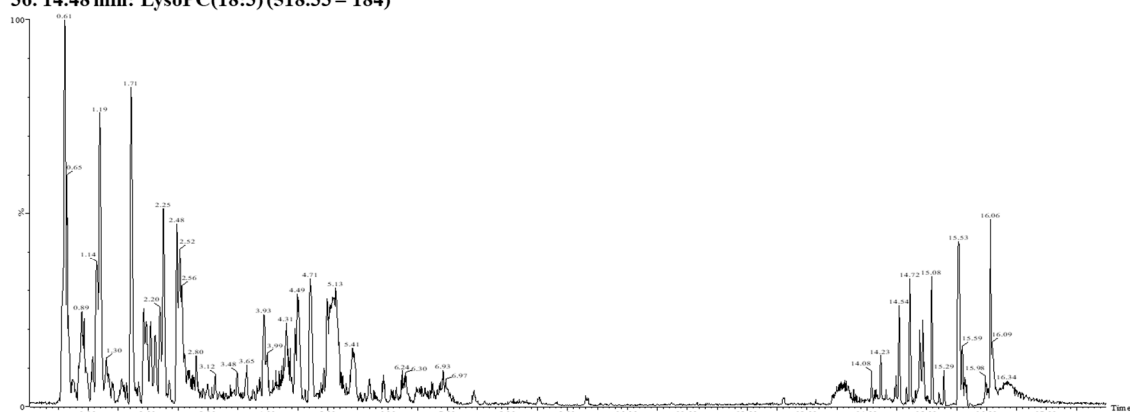
34. 5.69 min: Isoorientin (449.11 = 317, 287)



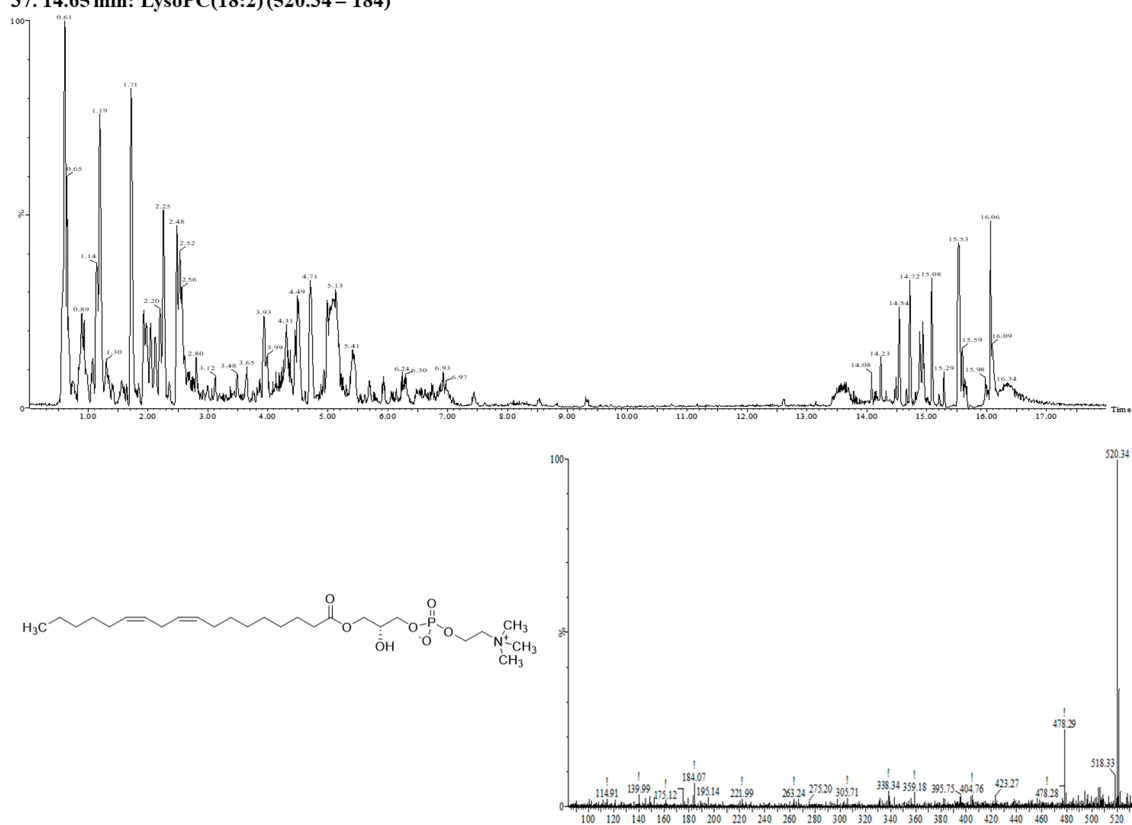
35. 14.23 min: Dehydrophytosphingosine (316.29 = 298, 280)



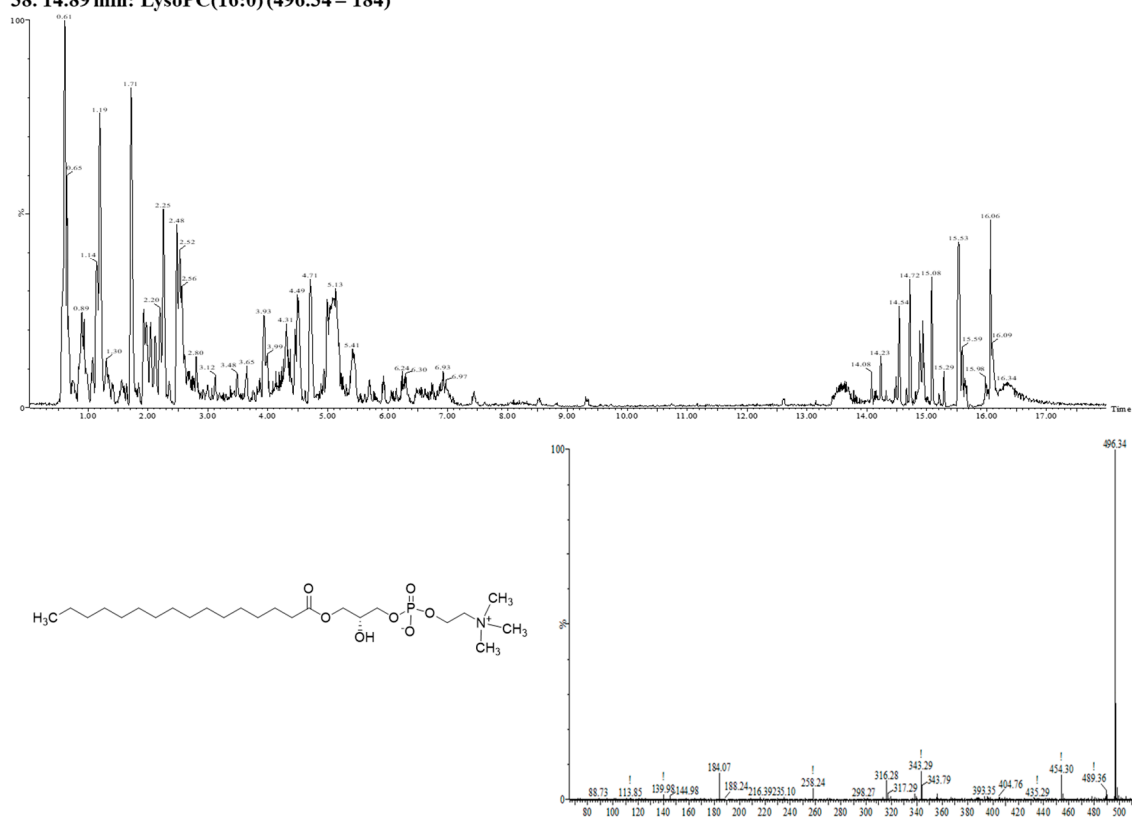
36. 14.48 min: LysoPC(18:3) (518.33 = 184)



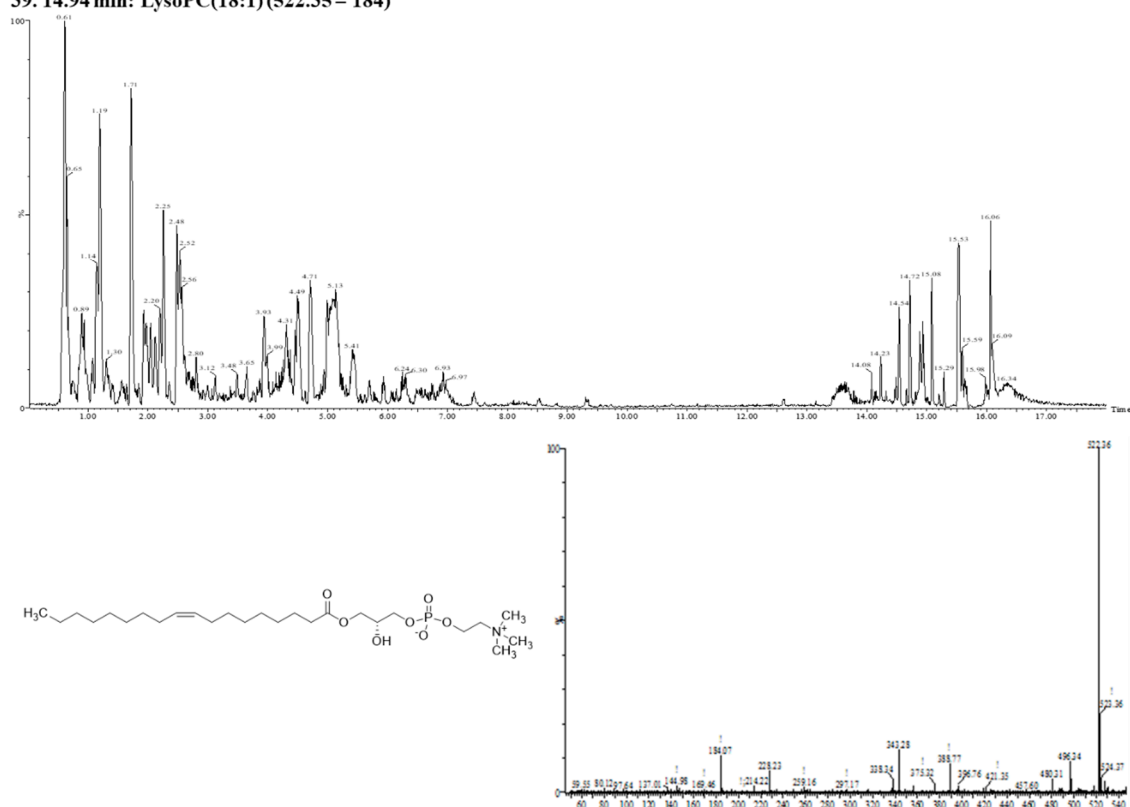
37. 14.65 min: LysoPC(18:2) (520.34 = 184)



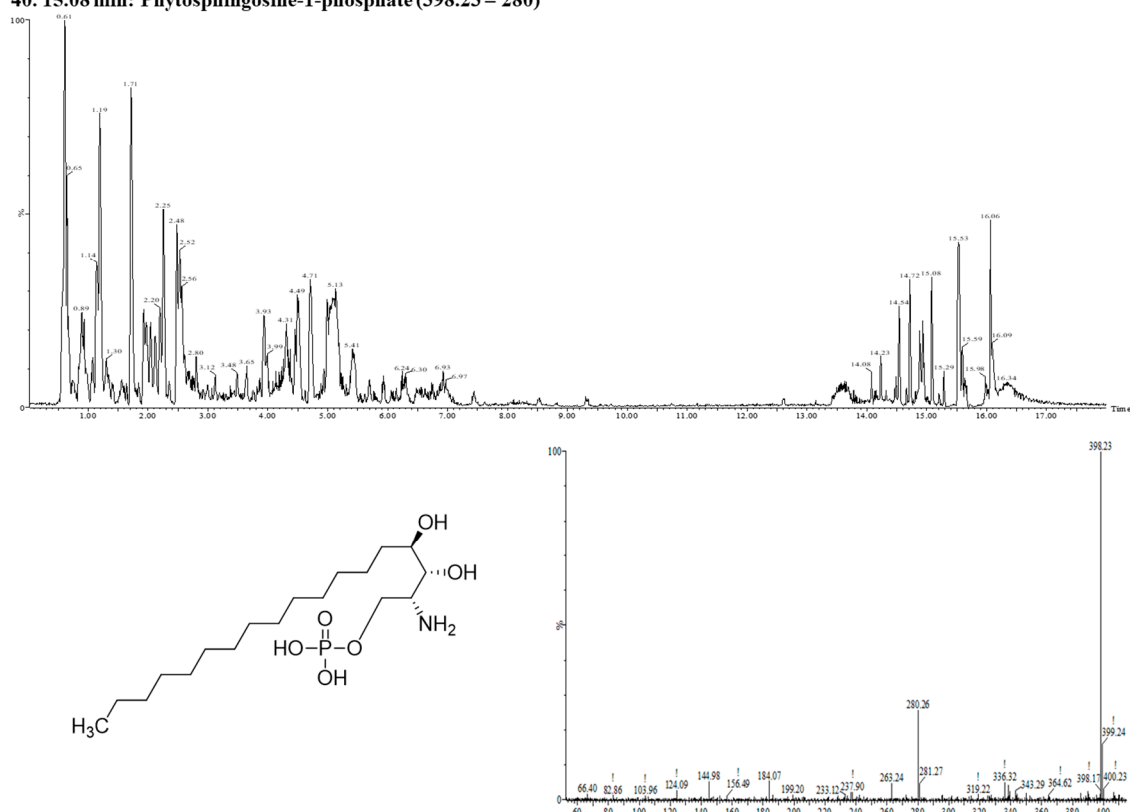
38. 14.89 min: LysoPC(16:0) (496.34 = 184)



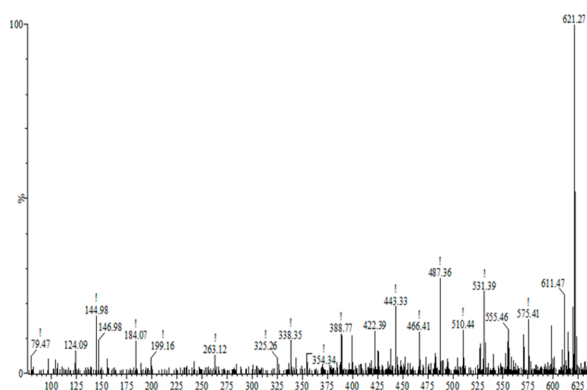
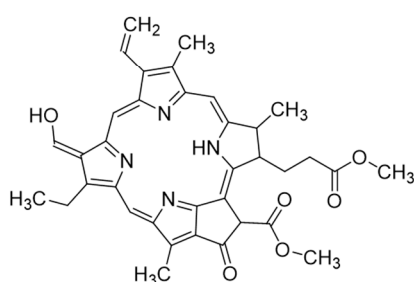
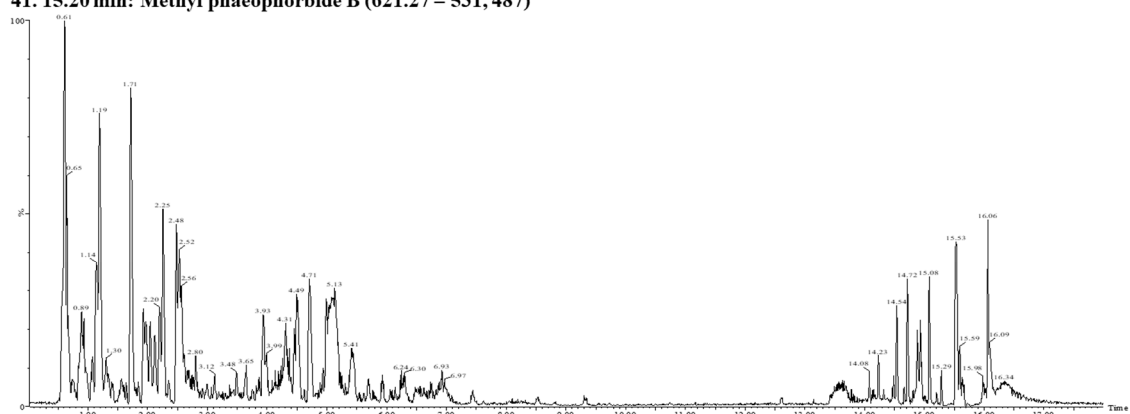
39. 14.94 min: LysoPC(18:1) (522.35 = 184)



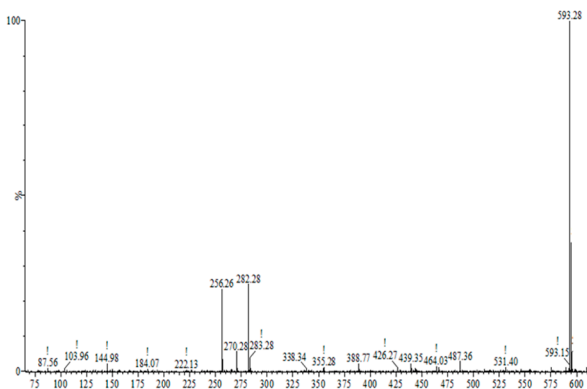
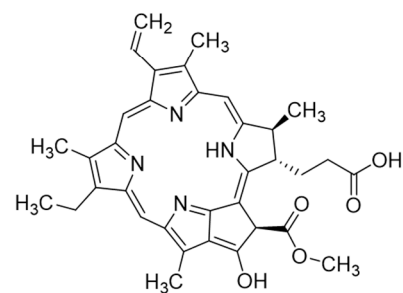
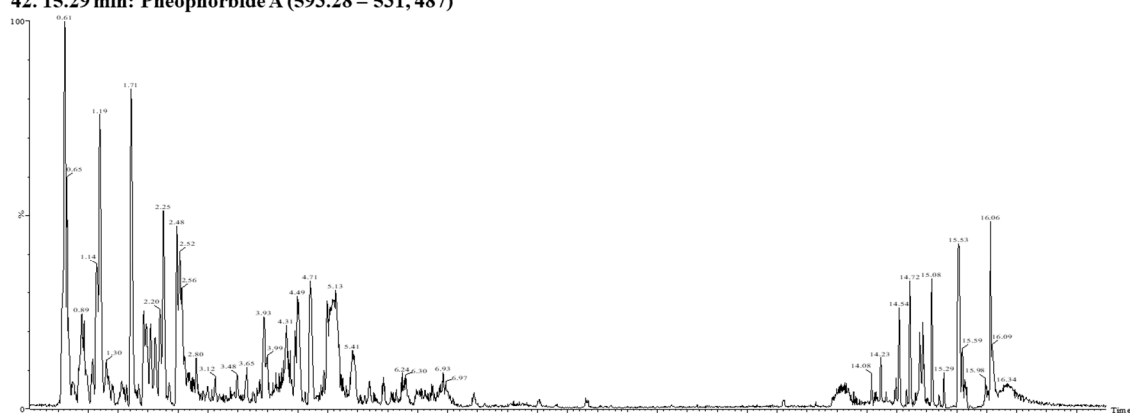
40. 15.08 min: Phytosphingosine-1-phosphate (398.23 = 280)



41. 15.20 min: Methyl phaeophorbide B (621.27 = 531, 487)

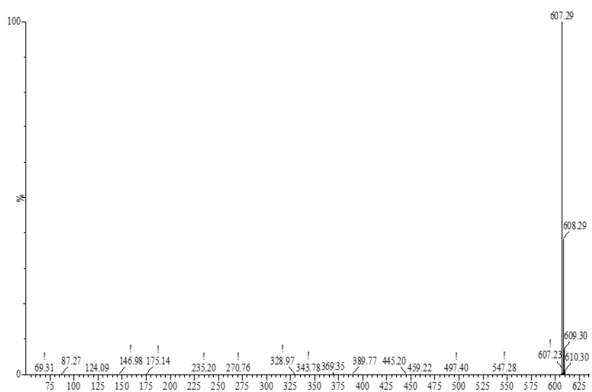
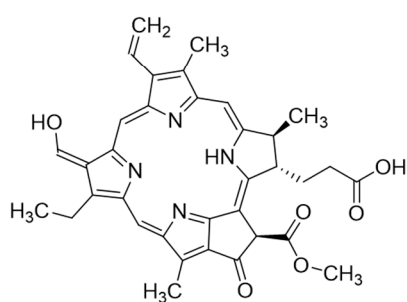


42. 15.29 min: Pheophorbide A (593.28 = 531, 487)



¹H NMR spectrum of compound 10b in CDCl₃. The x-axis represents chemical shift (δ) in ppm, ranging from 0 to 10. The y-axis represents intensity. The spectrum shows several sharp peaks in the aromatic region (6.5-7.5 ppm) and a cluster of peaks in the aliphatic region (1.2-2.5 ppm). Integration values are provided below the peaks.

Chemical Shift (ppm)	Integration
7.41	0.99
7.34	0.99
7.29	1.00
7.25	1.00
7.17	1.00
7.13	1.00
7.09	1.00
7.05	1.00
6.99	1.00
6.95	1.00
6.91	1.00
6.87	1.00
6.83	1.00
6.79	1.00
6.75	1.00
6.71	1.00
6.67	1.00
6.63	1.00
6.59	1.00
6.55	1.00
6.51	1.00
6.47	1.00
6.43	1.00
6.39	1.00
6.35	1.00
6.31	1.00
6.27	1.00
6.23	1.00
6.19	1.00
6.15	1.00
6.11	1.00
6.07	1.00
6.03	1.00
5.99	1.00
5.95	1.00
5.91	1.00
5.87	1.00
5.83	1.00
5.79	1.00
5.75	1.00
5.71	1.00
5.67	1.00
5.63	1.00
5.59	1.00
5.55	1.00
5.51	1.00
5.47	1.00
5.43	1.00
5.39	1.00
5.35	1.00
5.31	1.00
5.27	1.00
5.23	1.00
5.19	1.00
5.15	1.00
5.11	1.00
5.07	1.00
5.03	1.00
5.00	1.00
4.97	1.00
4.93	1.00
4.89	1.00
4.85	1.00
4.81	1.00
4.77	1.00
4.73	1.00
4.69	1.00
4.65	1.00
4.61	1.00
4.57	1.00
4.53	1.00
4.49	1.00
4.45	1.00
4.41	1.00
4.37	1.00
4.33	1.00
4.29	1.00
4.25	1.00
4.21	1.00
4.17	1.00
4.13	1.00
4.09	1.00
4.05	1.00
4.01	1.00
3.97	1.00
3.93	1.00
3.89	1.00
3.85	1.00
3.81	1.00
3.77	1.00
3.73	1.00
3.69	1.00
3.65	1.00
3.61	1.00
3.57	1.00
3.53	1.00
3.49	1.00
3.45	1.00
3.41	1.00
3.37	1.00
3.33	1.00
3.29	1.00
3.25	1.00
3.21	1.00
3.17	1.00
3.13	1.00
3.09	1.00
3.05	1.00
3.01	1.00
2.97	1.00
2.93	1.00
2.89	1.00
2.85	1.00
2.81	1.00
2.77	1.00
2.73	1.00
2.69	1.00
2.65	1.00
2.61	1.00
2.57	1.00
2.53	1.00
2.49	1.00
2.45	1.00
2.41	1.00
2.37	1.00
2.33	1.00
2.29	1.00
2.25	1.00
2.21	1.00
2.17	1.00
2.13	1.00
2.09	1.00
2.05	1.00
2.01	1.00
1.97	1.00
1.93	1.00
1.89	1.00
1.85	1.00
1.81	1.00
1.77	1.00
1.73	1.00
1.69	1.00
1.65	1.00
1.61	1.00
1.57	1.00
1.53	1.00
1.49	1.00
1.45	1.00
1.41	1.00
1.37	1.00
1.33	1.00
1.29	1.00
1.25	1.00
1.21	1.00
1.17	1.00
1.13	1.00
1.09	1.00
1.05	1.00
1.01	1.00
0.97	1.00
0.93	1.00
0.89	1.00
0.85	1.00
0.81	1.00
0.77	1.00
0.73	1.00
0.69	1.00
0.65	



¹H NMR spectrum of compound 10b in CDCl₃. The x-axis represents chemical shift (δ) in ppm, ranging from 0 to 10. The y-axis represents intensity. The spectrum shows several sharp peaks in the aromatic region (6.5-7.5 ppm) and a cluster of peaks in the aliphatic region (1.0-2.5 ppm). Integration values are provided below the baseline for many peaks.

Chemical Shift (ppm)	Integration
7.41	0.01
7.39	0.05
7.35	1.58
7.31	1.71
7.28	2.25
7.25	2.48
7.22	2.52
7.18	2.20
7.15	2.46
7.12	2.08
7.08	1.12
7.05	3.48
7.02	3.05
6.98	2.99
6.95	4.71
6.92	4.85
6.88	5.13
6.85	5.41
6.82	6.55
6.78	6.35
6.75	6.39
6.72	6.93
6.68	6.97
1.80	1.08
1.75	1.42
1.70	1.43
1.65	1.47
1.60	1.50
1.55	1.53
1.50	1.59
1.45	1.66
1.40	1.64
1.35	1.59
1.30	1.50
1.25	1.42
1.20	1.43
1.15	1.47
1.10	1.50
1.05	1.53
1.00	1.59
0.95	1.66
0.90	1.64
0.85	1.59
0.80	1.50
0.75	1.42
0.70	1.43
0.65	1.47
0.60	1.50
0.55	1.53
0.50	1.59
0.45	1.66
0.40	1.64
0.35	1.59
0.30	1.50
0.25	1.42
0.20	1.43
0.15	1.47
0.10	1.50
0.05	1.53
0.00	1.59

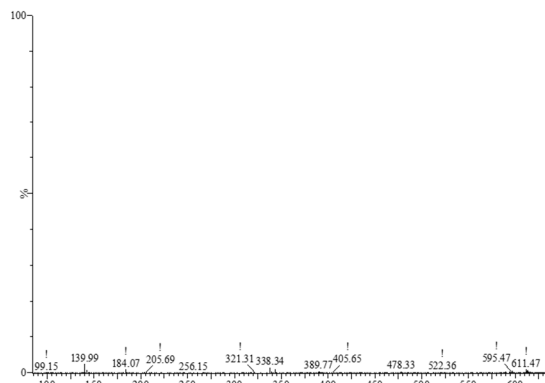
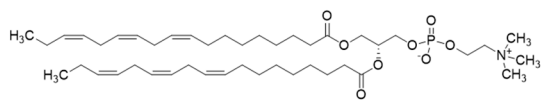


Figure S2. Photographs of the three plant-derived calli.

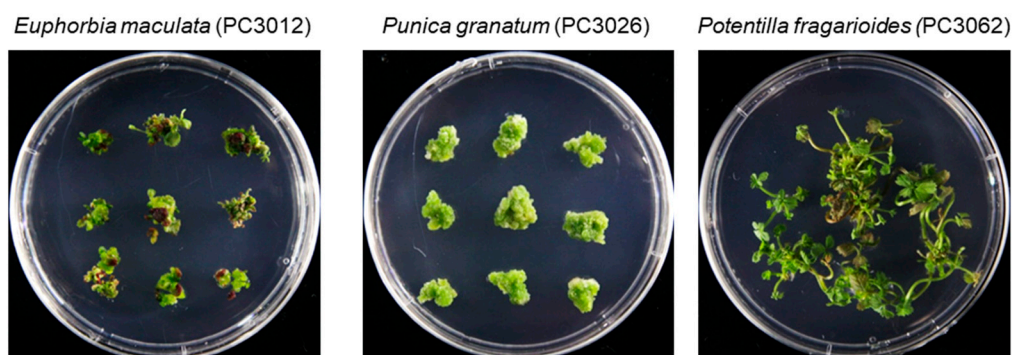


Table S1. Statistical analysis of *Euphorbia maculate* callus.

No.	Compounds	P-value	VIP
1	L -Arginine	4.8035E-05	1.1813
2	Pteroxide B	2.5926E-03	1.1820
4	γ -Glutamyllysine	1.2853E-06	1.1869
5	Epicatechin 3-glucuronide	3.0743E-05	1.1827
6	N-(1-deoxy-1-fructosyl)phenylalanine	9.0207E-06	1.1851
7	L-Phenylalanine	3.0275E-04	1.1712
8	Sinapic acid	6.3085E-06	1.1857
9	Gallic acid 3-O-gallate	2.4184E-06	1.1866
11	N-(1-deoxy-1-fructosyl)tryptophan	3.2280E-04	1.1706
12	L-Tryptophan	2.7843E-05	1.1829
13	2',7-Dihydroxy-4',5'-dimethoxyisoflavone	2.7938E-03	1.1364
14	Epicatechin 4'-glucuronide	4.8821E-04	1.1667
15	Quinic acid	1.1014E-03	1.1558
16	Chlorogenic acid	5.6233E-05	1.1807
17	Methyl gallate	4.3314E-03	1.1243
18	Caffeic acid ethyl ester	6.2065E-04	1.1643
19	Kaempferol 3-rhamnosyl-6''-(4''-acetylramnosyl)glucoside	2.1479E-04	1.1738
20	Acetylpterosin C	1.7324E-03	1.1476
21	1,2,3,4,6-Pentagalloylglucose	9.1111E-03	1.1673
22	Phenylalanyl glycine	1.4533E-04	1.1763
24	Kaempferol 3-rhamnosyl-(6''-acetyl)galactosyl-7-glucoside	3.9069E-03	1.1275
25	Quercetin 3,7-diglucosyl-4''-galactoside	2.6206E-02	1.0274
26	Isoquercitrin	4.7637E-04	1.1668
29	Quercetin 3-(2''',6'''-digalloyl)galactoside	9.1116E-03	1.0946
30	Quercetin 3-(2-galloyl)glucoside	5.7370E-03	1.1738
31	Isorhamnetin 3-rutinoyl-4'-rhamnoside	1.9066E-02	1.0531
35	Dehydrophytophingosine	2.2181E-02	1.0405
36	LysoPC(18:3)	2.2775E-05	1.1834
37	LysoPC(18:2)	1.5407E-03	1.1838
38	LysoPC(16:0)	4.5405E-04	1.1863
39	LysoPC(18:1)	1.0885E-05	1.1849
42	Phaephoribide A	2.9379E-03	1.1353
44	PC(18:3/18:3)	1.4380E02	1.0723

VIP = variable importance in projection.

P-value = the significance of the difference between irradiated callus and non-irradiated callus