Supplementary Information

Comprehensive profiling of phenolic compounds and triterpenoid saponins from *Acanthopanax senticosus* and their antioxidant, *α*-glucosidase inhibitory activities

Authors: Ryeong Ha Kwon [1,2], Hyemin Na [1], Ju Hyung Kim [1], So Ah Kim [1], Se Yeon Kim [2], Hyun-Ah Jung [2], Sang Hoon Lee [1], Chi-Do Wee [1], Kwang-Sik Lee [1], and Heon-Woong Kim [1*]

Affiliations

[1] Department of Agrofood Resources, National Institute of Agricultural Sciences, Rural Development Administration, 55365, Wanju, Republic of Korea; haha8447@gmail.com (R.H.K.); gpals9713@gmail.com (H.N.); juuhkim0128@gmail.com (J.H.K.); soah0726@gmail.com (S.A.K.); spprigan@korea.kr (S.H.L.); cdwee@korea.kr (C.-D.W.); kslee84@korea.kr (K.-S.L.).

[2] Department of Food Science and Human Nutrition, Jeonbuk National University, Jeonju 54896, Korea; ksy002253@naver.com (S.Y.K.); jungha@jbnu.ac.kr (H.-A.J.).

Corresponding author:

Heon-Woong Kim, National Institute of Agricultural Sciences, Rural Development Administration, 55365, Wanju, Republic of Korea

E-mail: ksharrier@korea.kr; Tel.: +82-63-238-3565

Supplementary Table S1. Optimized MRM condition in positive mode for 28 standards

Supplementary Table S2. Regression equation, linear range, coefficient of determination LOD and LOQ, and intra- and inter-day precision of 32 standard compounds

Supplementary Fig. S1 UPLC chromatograms of 37 standards. A) phenolic acid standards 15 mixture. B) flavonoid standards 10 mixture. C) saponin standards 12 mixture. P1, 1-*O*-caffeoylquinic acid; P2, neochlorogenic acid; P3, chlorogenic acid; P4, cryptochlorogenic acid; CA, caffeic acid; 1,3diCQA, cynarin; P9, 5-*O*-feruloylquinic acid; *p*CoA, *p*-coumaric acid; P13, chlorogenic acid methyl ester; FA, ferulic acid; P14, 1,4-di-*O*-caffeoylquinic acid; P15, isochlorogenic acid C; P16, 1,5-di-*O*-caffeoylquinic acid; P17, isochlorogenic acid A; P21, isochlorogenic acid B; F6, rutin; F7, hyperoside; F8, quercetin 3-*O*-glucuronide; F9, isoquercitrin; F12, guaijaverin; F14, quercetin 3-*O*-(6-*O*-malonyl)glucoside; F15, nicotiflorin; Q3Ara(f), avicularin; F16, astragalin; F19, quercitrin; CF, cauloside F; HC, hederacoside C; S22, cauloside D; DB, dipsacoside B; ASVI, asperosaponin VI; S39, ciwujianoside B; S46, ciwujianoside A_1; S57, hederasaponin B; S59, acanthopanaxoside B; S64, ciwujianoside C_3; S73, α-hederin; S80, calenduloside E.

Supplementary Fig. S2 UPLC chromatograms of 132 compounds from *Acanthopanax senticosus* A) shoots, B) leaves, C) fruits, and D) stems.

Supplementary Fig. S3 (+) ESI-MS spectra of phenolic acids.

Supplementary Fig. S4 (-) ESI-MS/MS spectra of phenolic acids acquired in IDA mode.

Supplementary Fig. S5 Proposed fragmentation patterns of 3-*O*-malonyl-1,5-di-*O*-caffeoylquinic acid.

Supplementary Fig. S6 (+) ESI-MS spectra of flavonoids

Supplementary Fig. S7. (+) ESI-MS spectra of triterpenoid saponins.

Supplementary Fig. S8 The shoots, leaves, fruits, and stems of *Acanthopanax senticosus*.

Table S1. Optimized MRM condition in positive mode for 28 standards

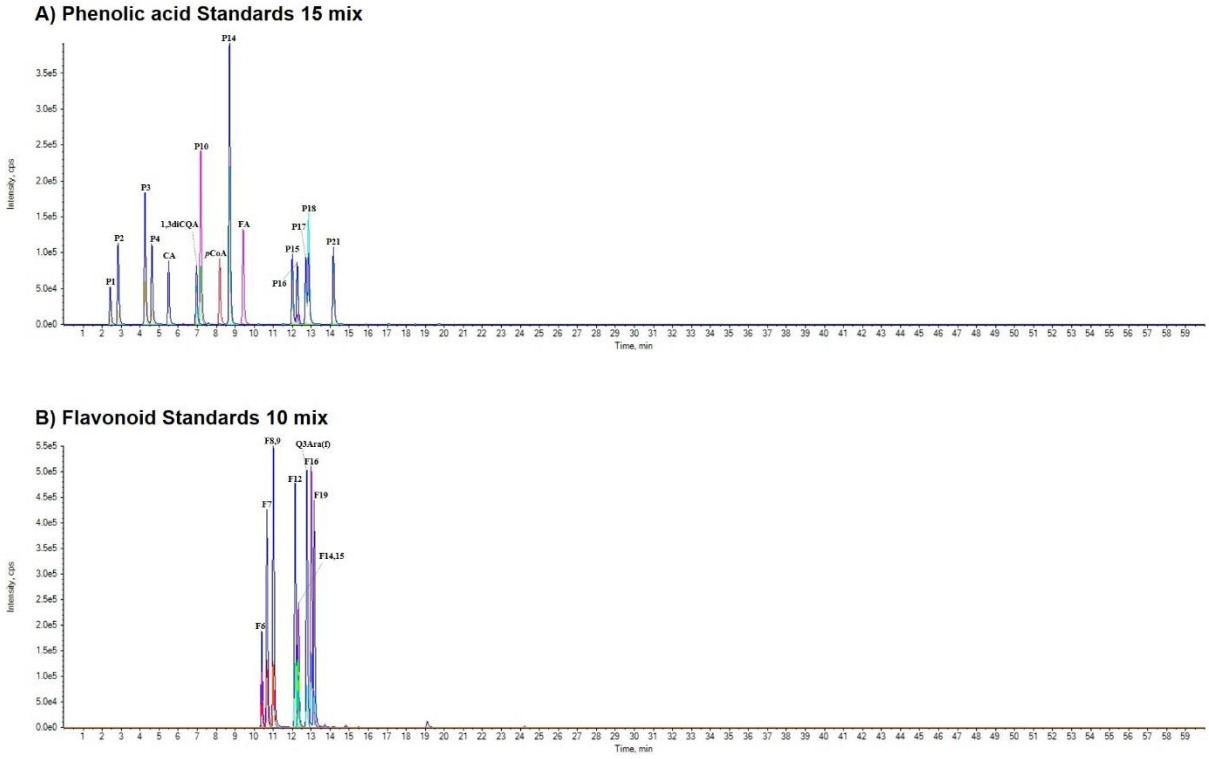
Paramethers	Transition	DP (volt)	CE (volt)
1CQA	355.0 → 135.0	76	51
3CQA	355.0 → 163.0	56	29
5CQA	355.0 → 135.0	76	55
4CQA	355.0 → 145.0	52	45
5CQA ME	369.0 → 135.0	64	55
5FQA	369.0 → 145.0	70	45
1,4diCQA	517.0 → 517.1	81	9
3,4diCQA	517.0 → 517.1	76	9
1,5diCQA	517.0 → 517.1	76	9
3,5diCQA	517.0 → 135.0	73	71
4,5diCQA	517.0 → 135.0	71	71
Q3Rut	611.0 → 611.1	20	11
Q3Gal	465.0 → 153.0	64	69
Q3Gluc	479.0 → 229.0	66	67
Q3Glu	465.0 → 465.0	71	9
Q3Ara	435.0 → 153.0	61	65
Q3(6Mal)Glu	551.0 → 127.0	81	37
K3Rut	595.0 → 595.1	20	11
K3Glu	449.0 → 153.0	57	69
Q3Rham	449.0 → 129.0	57	23
Cauloside D	1075.3 → 1075.5	116	11
Ciwujianoside B	1206.5 → 441.1	149	37
Ciwujianoside A_1	1238.5 → 1238.6	161	21
Hederasaponin B	1222.5 → 439.2	146	49
Acanthopanaxoside B	1280.5 → 1280.6	151	19
Ciwujianoside C_3	1076.4 → 439.2	129	43
α-hederin	751.3 → 455.3	101	11
Calenduloside E	650.2 → 633.4	106	15

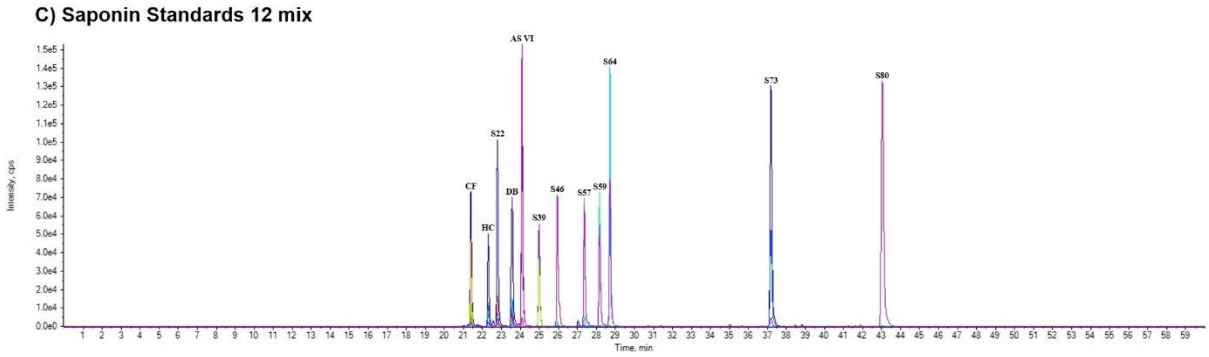
Table S2. Regression equation, linear range, coefficient of determination LOD and LOQ, intra- and inter-day precision of 32 standard compounds

Compounds	Calibration Curve[a]	R^2	Linear Range (μg/mL)	LOD (μg/mL)	LOQ (μg/mL)	RSD (%)	
						Intra-day (n =3)	Inter-day (n =3)
UPLC-Triple Q-MS/MS MRM analysis for targeted compounds quantification							
1CQA	y = 28958.75 x + 1075.952	0.99996	0.1-10	0.04	0.13	0.35	0.50
3CQA	y = 2123583 x + 84155.11	0.99974	0.05-10	0.02	0.07	1.78	3.41
5CQA	y = 260893.7 x + 10188.17	0.99949	0.05-10	0.02	0.05	0.13	0.88
4CQA	y = 723846.9 x + 36084.77	0.99945	0.05-10	0.01	0.03	0.33	1.57
5CQA ME	y = 1382176 x + 37626.27	0.99995	0.05-10	0.01	0.03	0.91	1.76
5FQA	y = 1581130 x + 57824.17	0.99953	0.05-10	0.01	0.02	0.19	1.02
1,4diCQA	y = 290693.6 x + 7226.979	0.99993	0.05-10	0.01	0.02	0.28	1.30
3,4diCQA	y = 402289.6 x – 8347.094	0.99978	0.05-10	0.01	0.04	0.24	1.76
1,5diCQA	y = 317324.9 x + 4428.527	0.99978	0.05-10	0.03	0.09	0.68	1.39
3,5diCQA	y = 359660.8 x + 2144.633	0.99977	0.05-10	0.12	0.35	0.73	0.80
4,5diCQA	y = 380932.2 x – 4100.144	0.99980	0.05-10	0.07	0.21	0.39	1.24

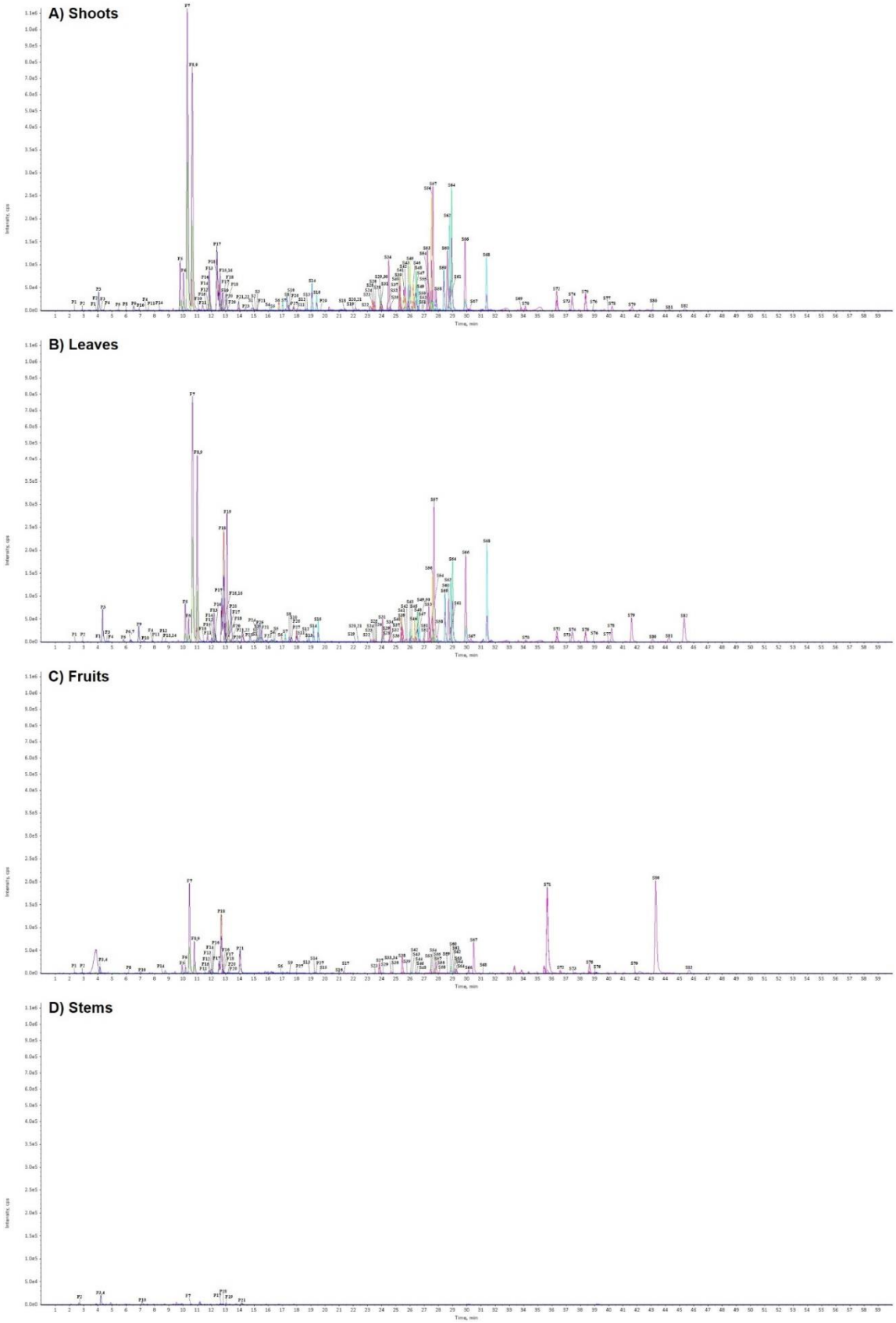
Q3Rut	$y = 2023062\,x + 18107.14$	0.99971	0.05-10	0.01	0.03	0.43	0.71
Q3Gal	$y = 245889.1\,x - 1299.478$	0.99989	0.05-10	0.01	0.03	0.34	1.66
Q3Gluc	$y = 214196.9\,x - 6151.910$	0.99980	0.05-10	0.02	0.05	1.08	1.21
Q3Glu	$y = 2646803\,x + 37189.37$	0.99961	0.05-10	0.04	0.12	0.33	0.74
Q3Ara	$y = 323809.3\,x - 16291.06$	0.99972	0.05-10	0.03	0.10	0.84	1.11
Q3(6Mal)Glu	$y = 119300.4\,x + 2852.487$	0.99993	0.1-5	0.04	0.12	1.07	1.33
K3Rut	$y = 2452443\,x + 62038.42$	0.99994	0.05-10	0.01	0.03	0.57	0.95
K3Glu	$y = 465035.7\,x + 13209.30$	0.99994	0.05-10	0.01	0.03	0.81	1.02
Q3Rham	$y = 318934.4\,x + 2585.448$	0.99998	0.05-10	0.01	0.02	0.32	0.46
Cauloside D	$y = 23701.60\,x - 664.8991$	0.99997	0.1-10	0.13	0.38	4.72	4.85
Ciwujianoside B	$y = 5618.569\,x - 1362.723$	0.99964	0.5-25	0.09	0.27	0.22	0.88
Ciwujianoside A_1	$y = 61816.38\,x - 2201.967$	0.99975	0.5-25	0.10	0.20	4.82	5.16
Hederasaponin B	$y = 20937.54\,x - 1726.401$	0.99973	0.5-25	0.09	0.26	2.35	3.03
Acanthopanaxoside B	$y = 57154.82\,x - 26880.97$	0.99953	0.5-25	0.17	0.52	3.97	4.00
Ciwujianoside C_3	$y = 152038.0\,x - 11817.80$	0.99998	0.5-25	0.07	0.22	1.33	1.82
α-hederin	$y = 10732.30\,x + 1639.170$	0.99940	0.1-10	0.13	0.39	2.20	2.23
Calenduloside E	$y = 1457.293\,x + 1263.165$	0.99991	0.5-10	0.07	0.20	3.70	4.95
UPLC-QToF-MS analysis for untargeted compounds relative quantification							
1,3diCQA	$y = 47676.96\,x + 1263.165$	0.99978	0.05-10	0.12	0.36	0.19	0.49
Q3Rut	$y = 91515.03\,x + 1972.455$	0.99970	0.05-10	0.01	0.03	0.85	1.64
Q3Ara(f)	$y = 283102.7\,x + 4076.632$	0.99952	0.05-10	0.01	0.03	0.19	1.52
Dipsacoside B	$y = 35485.25\,x + 5160.216$	0.99960	0.1-50	0.02	0.05	1.76	2.26
Asperosaponin VI	$y = 62862.88\,x + 1258.051$	0.99998	0.1-10	0.01	0.02	0.72	1.09
α-hederin	$y = 84176.51\,x + 9447.974$	0.99952	0.1-10	0.01	0.04	0.23	0.68

[a] *y*, peak area; *x*, concentration, ppm.



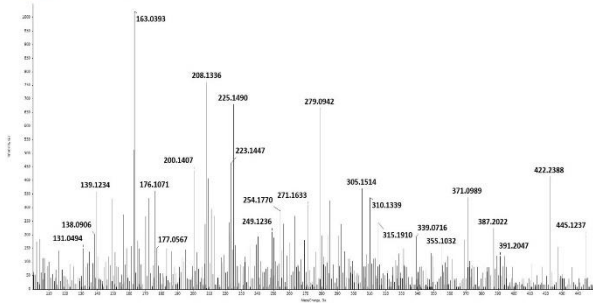


Supplementary Fig. S1 UPLC chromatograms of 37 standards. A) phenolic acid standards 15 mixture. B) flavonoid standards 10 mixture. C) saponin standards 12 mixture. P1, 1-*O*-caffeoylquinic acid; P2, neochlorogenic acid; P3, chlorogenic acid; P4, cryptochlorogenic acid; CA, caffeic acid; 1,3diCQA, cynarin; P9, 5-*O*-feruloylquinic acid; *p*CoA, *p*-coumaric acid; P13, chlorogenic acid methyl ester; FA, ferulic acid; P14, 1,4-di-*O*-caffeoylquinic acid; P15, isochlorogenic acid C; P16, 1,5-di-*O*-caffeoylquinic acid; P17, isochlorogenic acid A; P21, isochlorogenic acid B; F6, rutin; F7, hyperoside; F8, quercetin 3-*O*-glucuronide; F9, isoquercitrin; F12, guaijaverin; F14, quercetin 3-*O*-(6-*O*-malonyl)glucoside; F15, nicotiflorin; Q3Ara(f), avicularin; F16, astragalin; F19, quercitrin; CF, cauloside F; HC, hederacoside C; S22, cauloside D; DB, dipsacoside B; ASVI, asperosaponin VI; S39, ciwujianoside B; S46, ciwujianoside A_1; S57, hederasaponin B; S59, acanthopanaxoside B; S64, ciwujianoside C_3; S73, α-hederin; S80, calenduloside E.

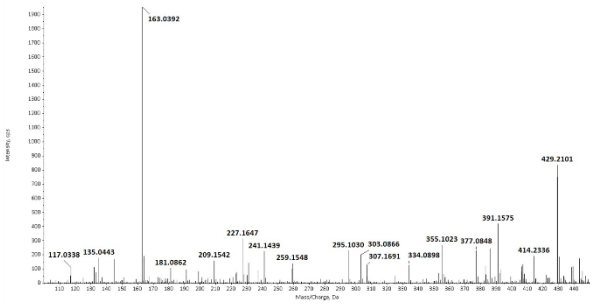


Supplementary Fig. S2 UPLC chromatograms of 132 compounds from *Acanthopanax senticosus* A) shoots, B) leaves, C) fruits, and D) stems.

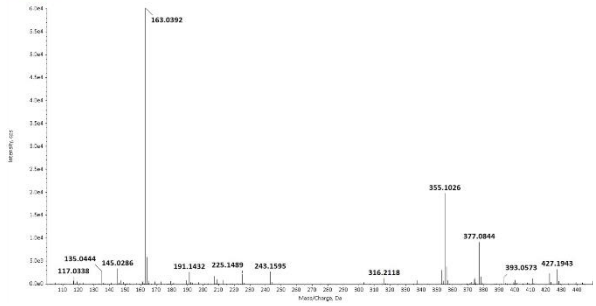
Peak P1. 1-*O*-caffeoylquinic acid



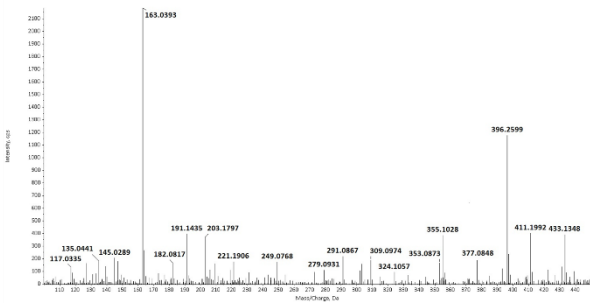
Peak P2. 3-*O*-caffeoylquinic acid **(neochlorogenic acid)**



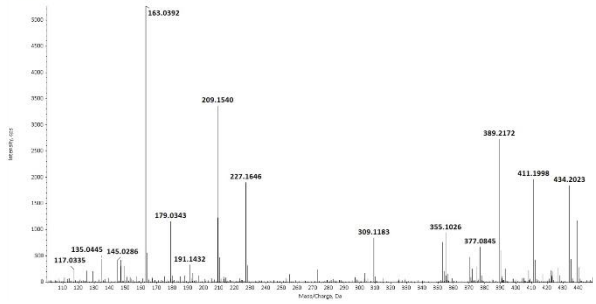
Peak P3. 5-*O*-caffeoylquinic acid **(chlorogenic acid)**



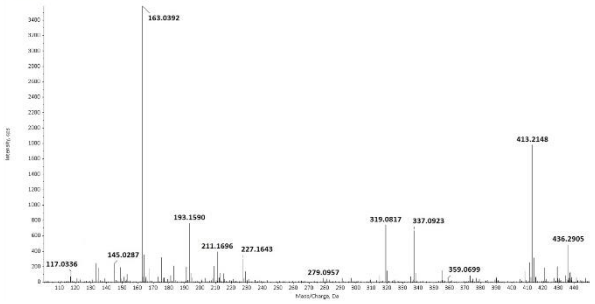
Peak P4. 4-*O*-caffeoylquinic acid **(cryptochlorogenic acid)**



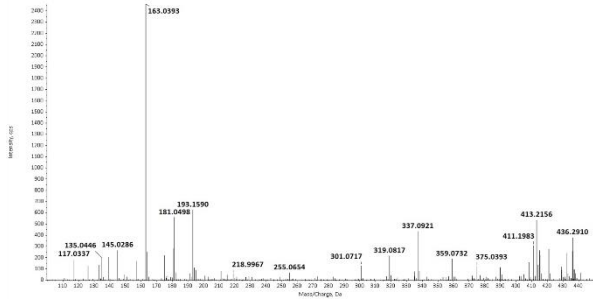
Peak P5. 5-*O*-*cis*-caffeoylquinic acid



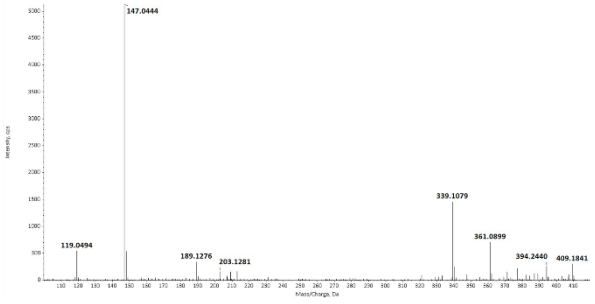
Peak P6. 4-*O*-caffeoylshikimic acid



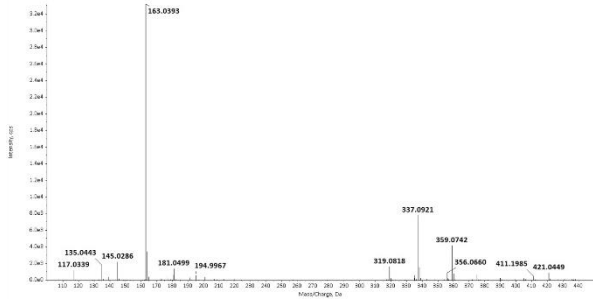
Peak P7. 5-*O*-caffeoylshikimic acid



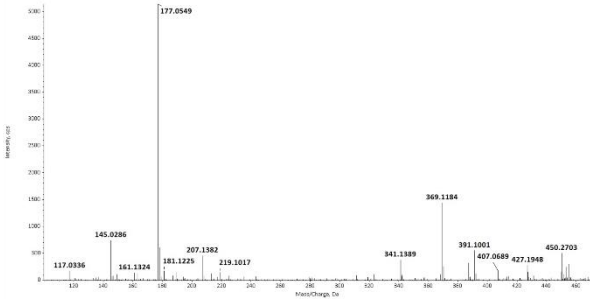
Peak P8. 5-*O*-*p*-coumaroylquinic acid



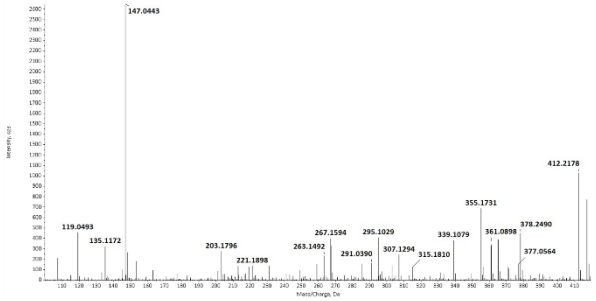
Peak P9. 3-*O*-caffeoylshikimic acid



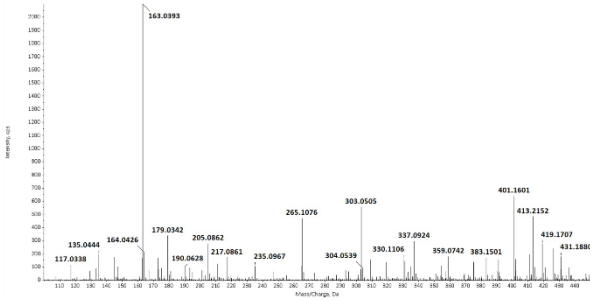
Peak P10. 5-*O*-feruloylquinic acid



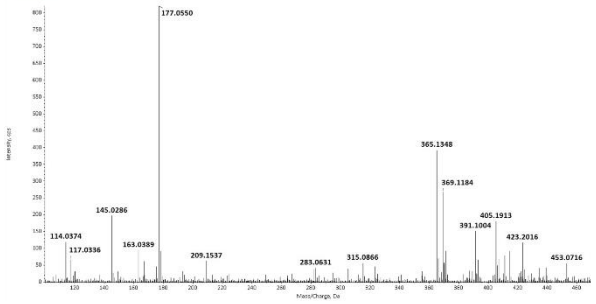
Peak P11. 5-*O*-*cis*-*p*-coumaroylquinic acid



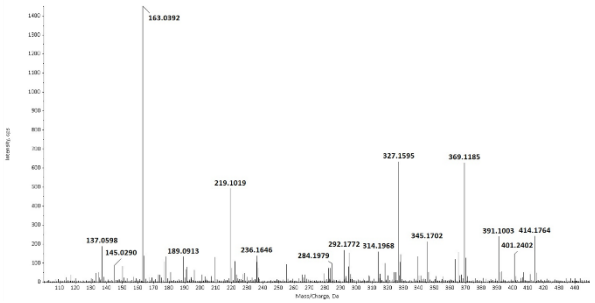
Peak P12. 3-*O*-*cis*-caffeoylshikimic acid



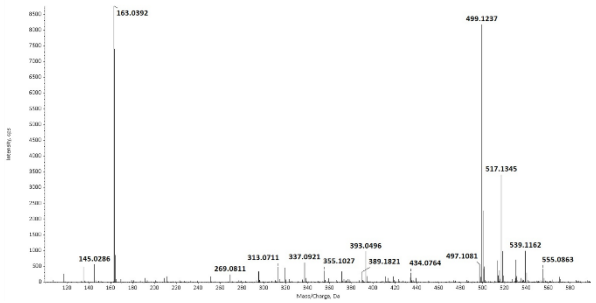
Peak P13. 5-*O*-*cis*-feruloylquinic acid



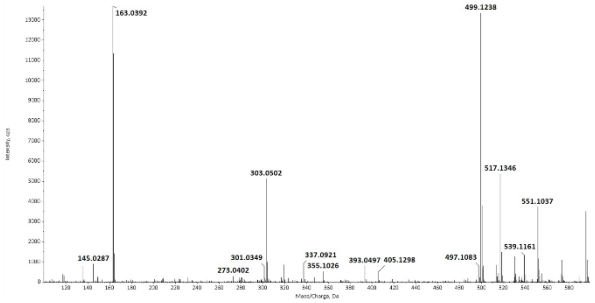
Peak P14. 5-*O*-caffeoylquinic acid methyl ester **(chlorogenic acid methyl ester)**



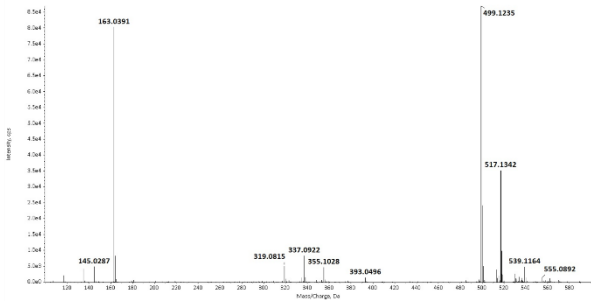
Peak P15. 1,4-di-*O*-caffeoylquinic acid



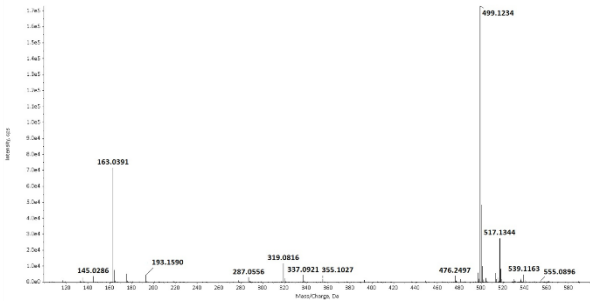
Peak P16. 3,4-di-*O*-caffeoylquinic acid **(isochlorogenic acid C)**



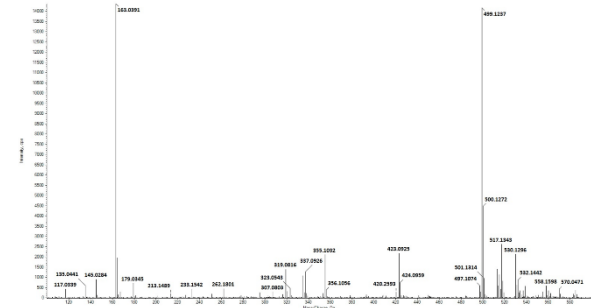
Peak P17. 1,5-di-*O*-caffeoylquinic acid



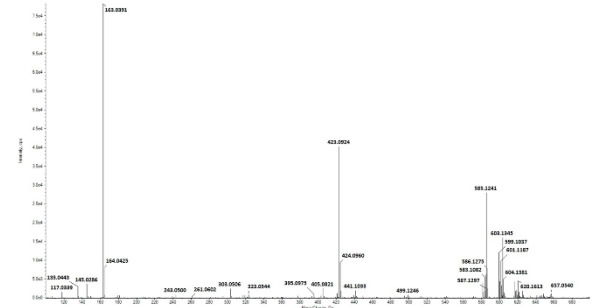
Peak P18. 3,5-di-*O*-caffeoylquinic acid **(isochlorogenic acid A)**



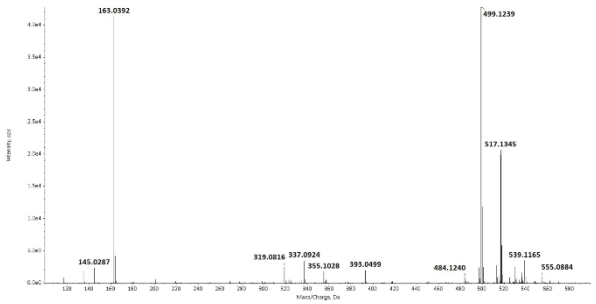
Peak P19. 3-*O*-*cis*-caffeoyl-5-*O*-caffeoylquinic acid



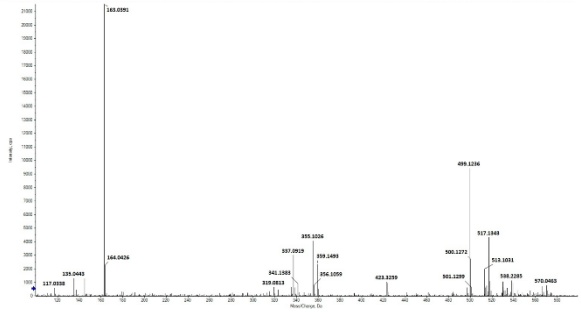
Peak P20. 3-*O*-malonyl-1,5-di-*O*-caffeoylquinic acid



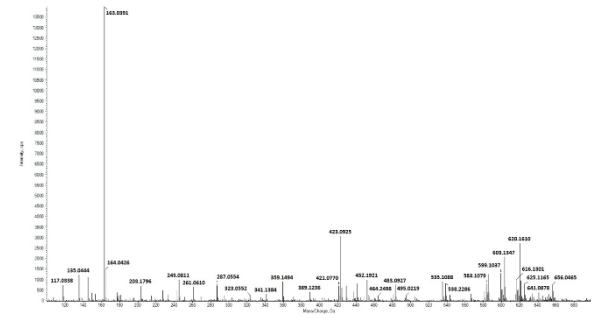
Peak P21. 4,5-di-*O*-caffeoylquinic acid **(isochlorogenic acid B)**



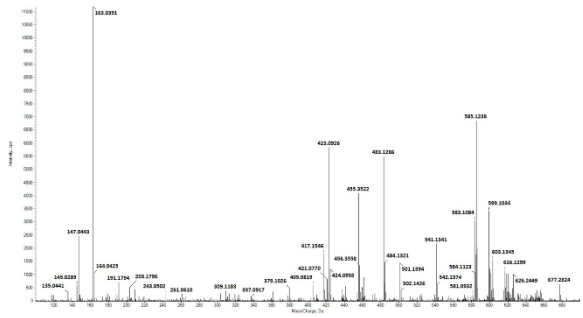
Peak P22. 1-*O*-caffeoyl-5-*O*-cis-caffeoylquinic acid



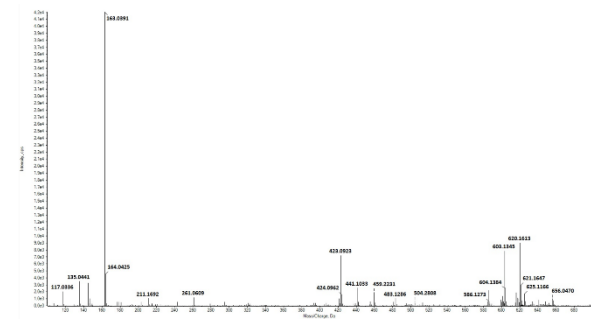
Peak P23. 3-*O*-malonyl-1-*O*-caffeoyl-5-*O*-cis-caffeoylquinic acid



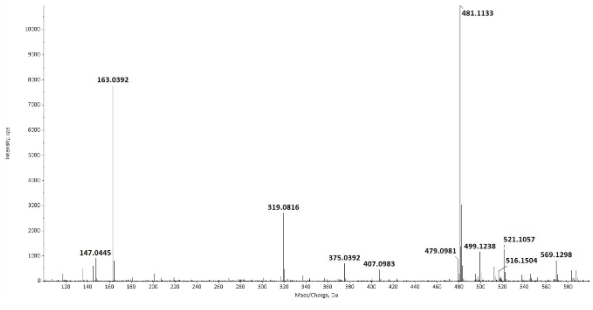
Peak P24. 4-*O*-malonyl-1,5-di-*O*-caffeoylquinic acid



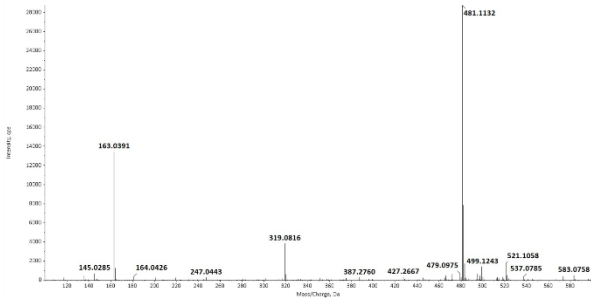
Peak P25. 4-*O*-malonyl-3,5-di-*O*-caffeoylquinic acid



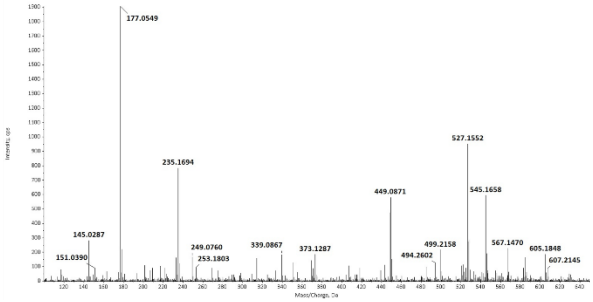
Peak P26. 3,5-di-*O*-caffeoylshikimic acid



Peak P27. 3,4-di-*O*-caffeoylshikimic acid

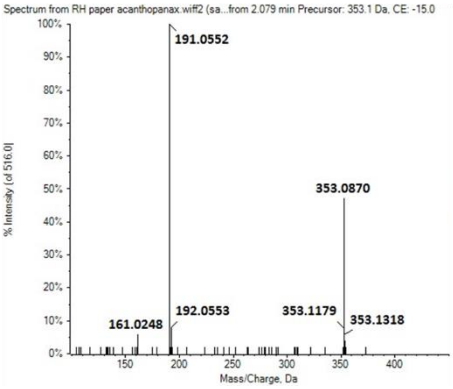


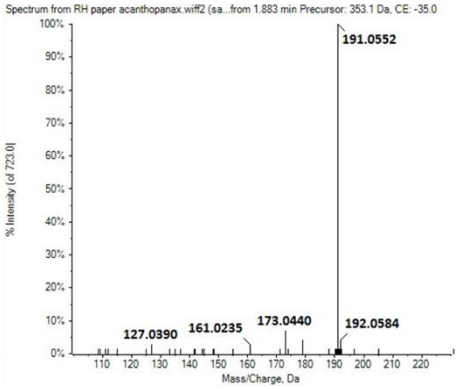
Peak P28. 3,5-di-*O*-feruloylquinic acid



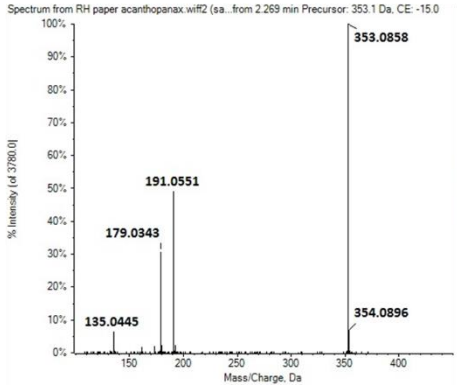
Supplementary Fig. S3. (+) ESI-MS spectra of phenolic acids.

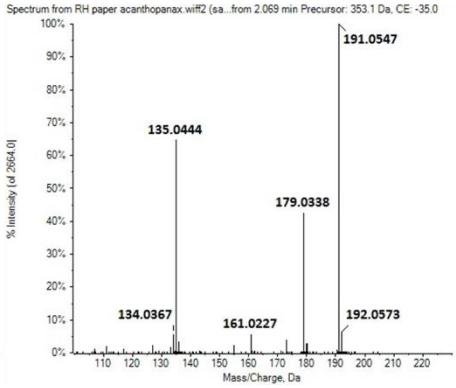
Peak P1. 1-*O*-caffeoylquinic acid



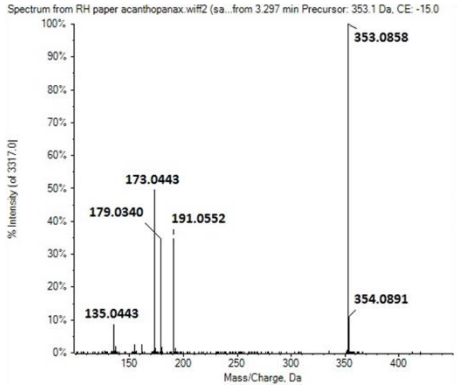


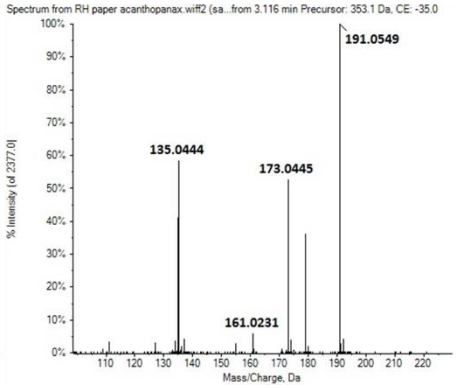
Peak P2. 3-*O*-caffeoylquinic acid **(neochlorogenic acid)**



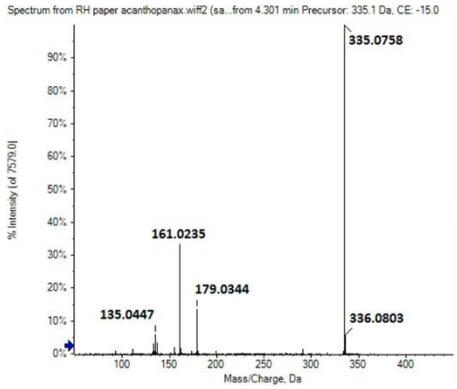


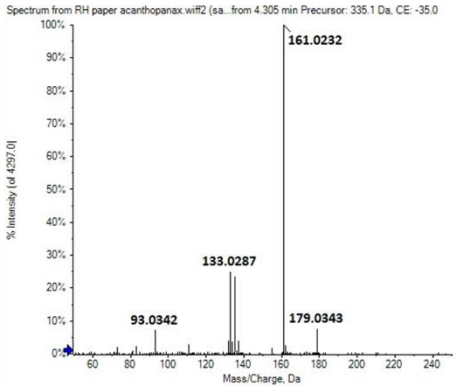
Peak P4. 4-*O*-caffeoylquinic acid **(cryptochlorogenic acid)**



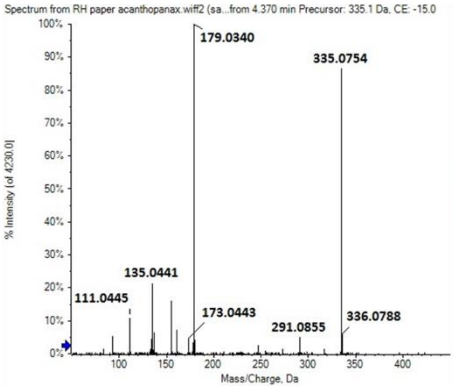


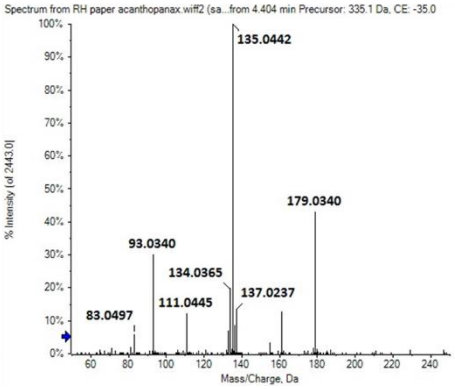
Peak P6. 4-*O*-caffeoylshikimic acid



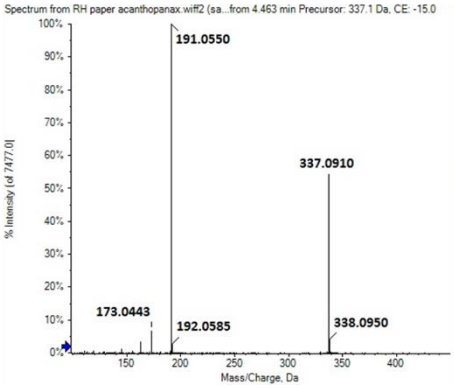


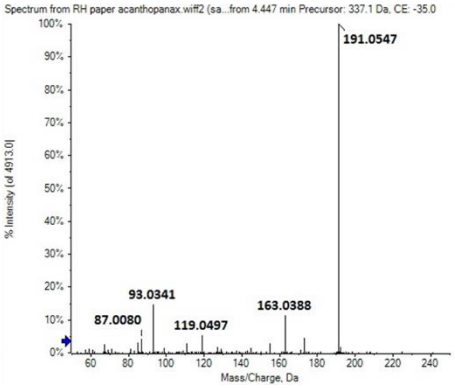
Peak P7. 5-*O*-caffeoylshikimic acid



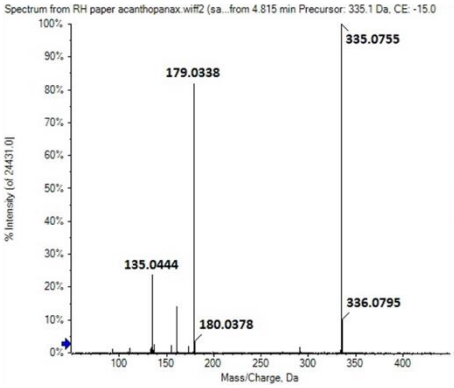


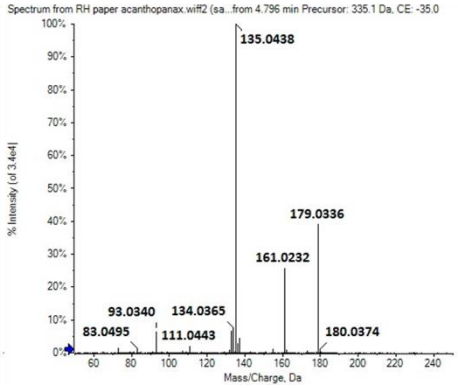
Peak P8. 5-*O*-*p*-coumaroylquinic acid



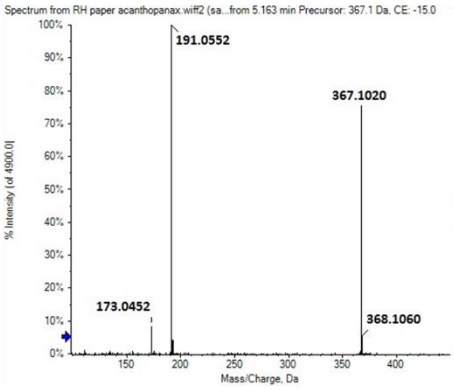


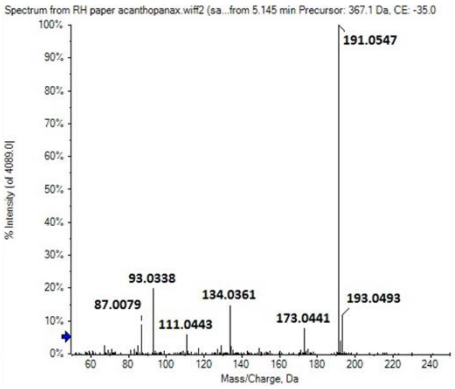
Peak P9. 3-*O*-caffeoylshikimic acid



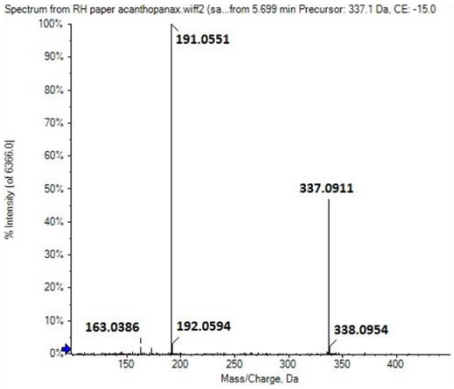


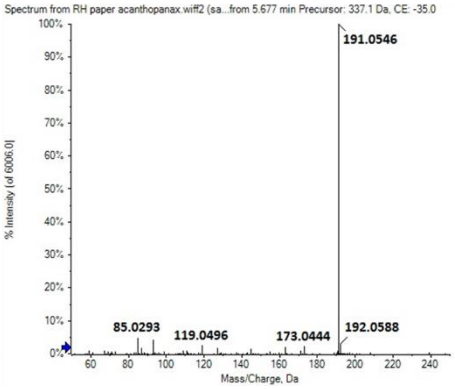
Peak P10. 5-*O*-feruloylquinic acid



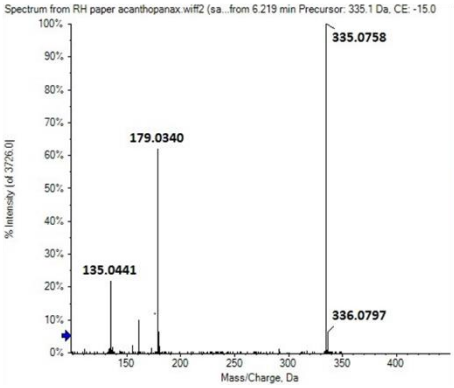


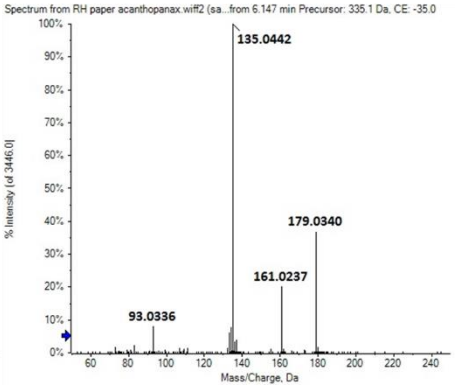
Peak P11. 5-*O*-*cis*-*p*-coumaroylquinic acid



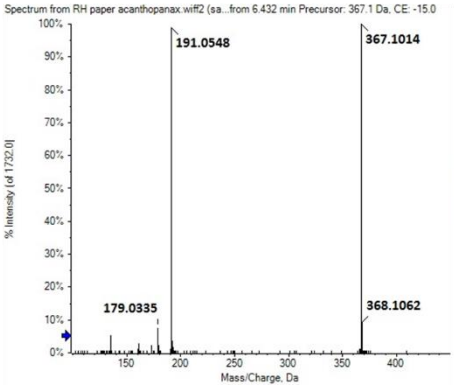


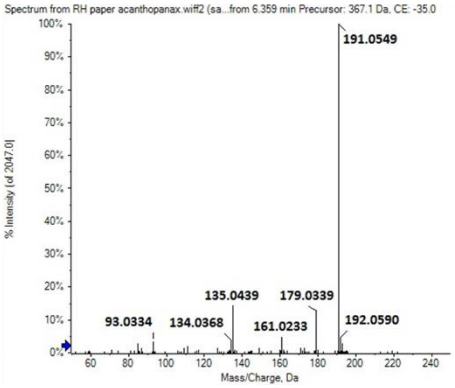
Peak P12. 3-*O*-*cis*-caffeoylshikimic acid



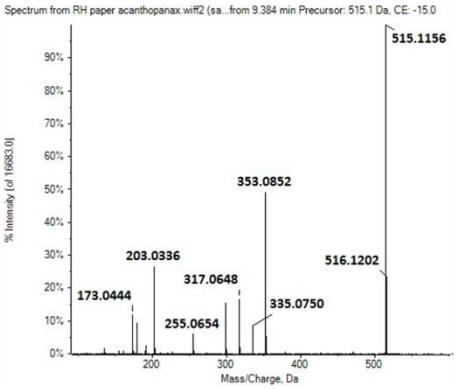


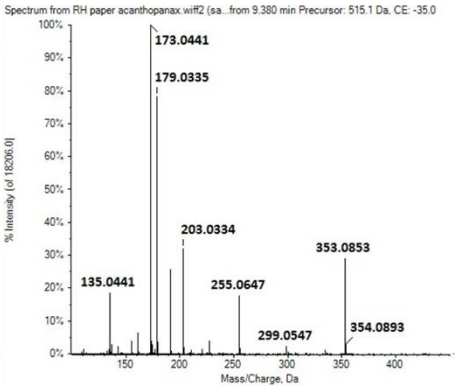
Peak P13. 5-*O*-*cis*-feruloylquinic acid



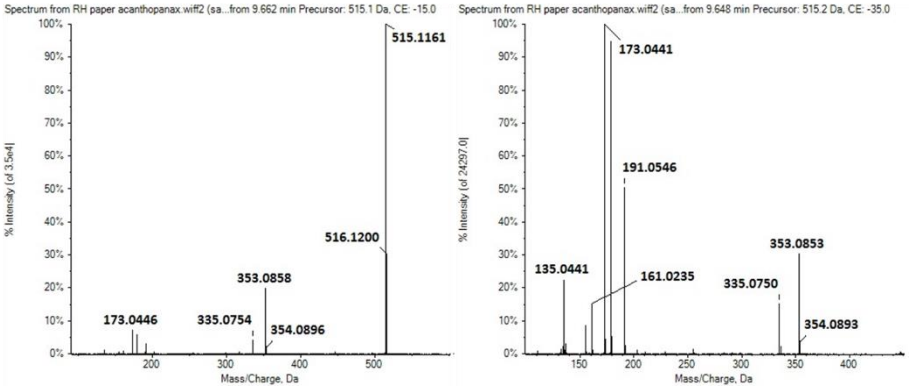


Peak P15. 1,4-di-*O*-caffeoylquinic acid

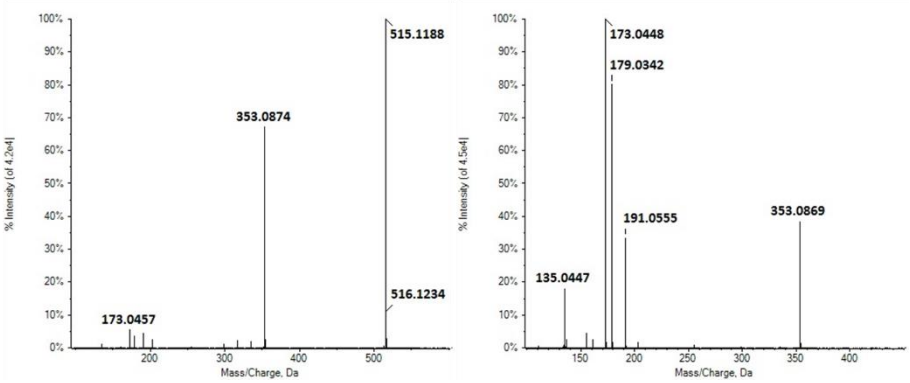




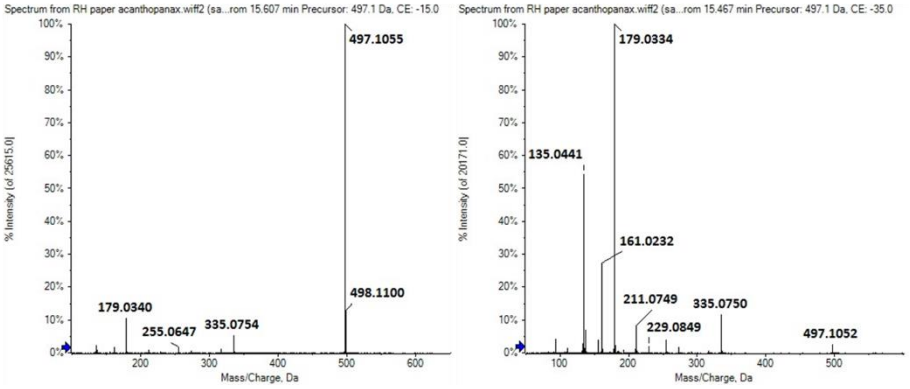
Peak P16. 3,4-di-*O*-caffeoylquinic acid **(isochlorogenic acid C)**



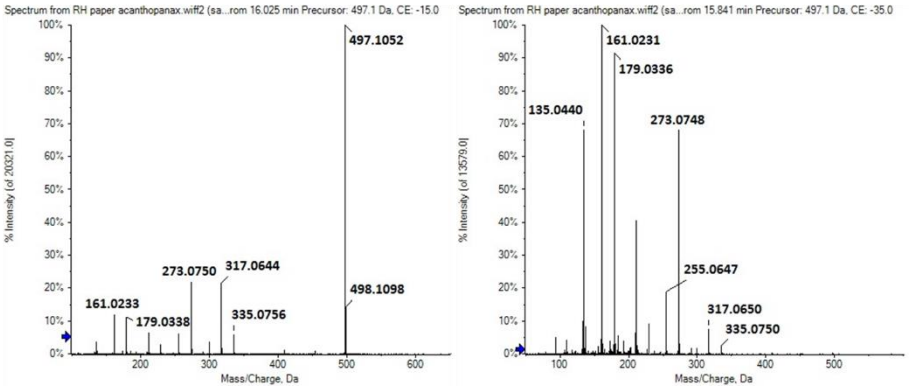
Peak P21. 4,5-di-*O*-caffeoylquinic acid **(isochlorogenic acid B)**

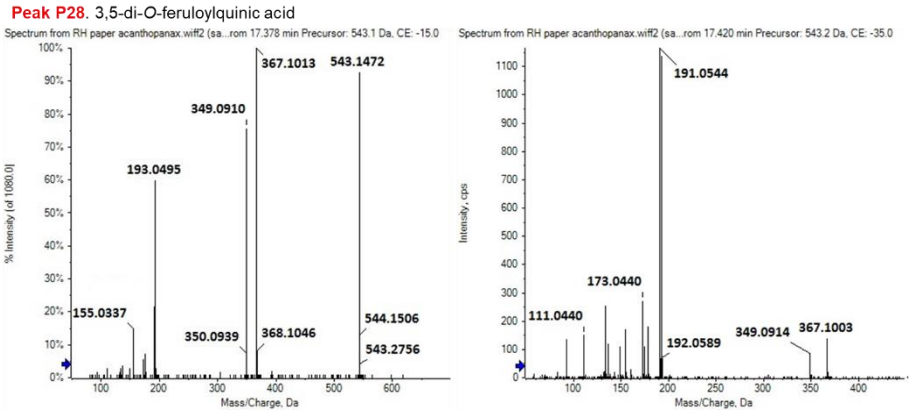


Peak P26. 3,5-di-*O*-caffeoylshikimic acid

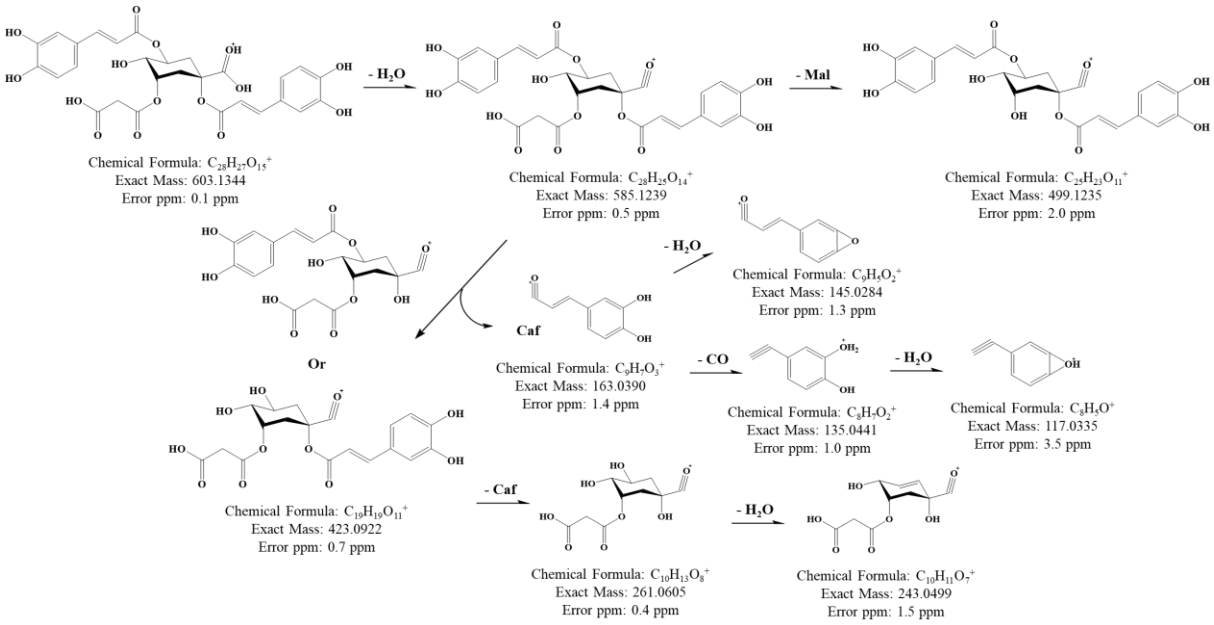


Peak P27. 3,4-di-*O*-caffeoylshikimic acid

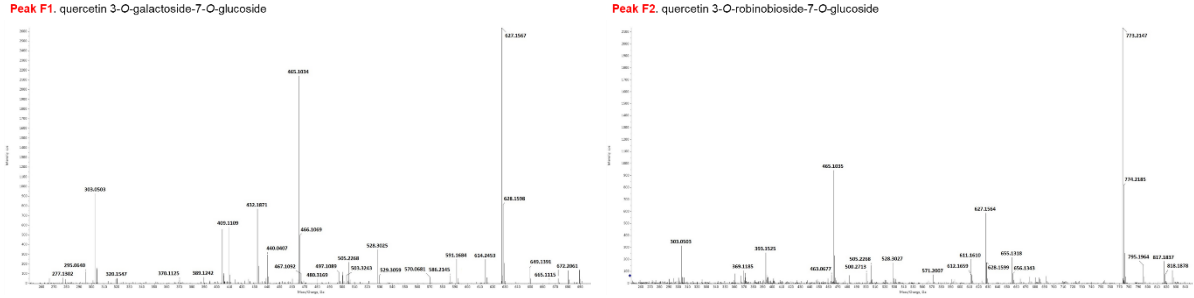




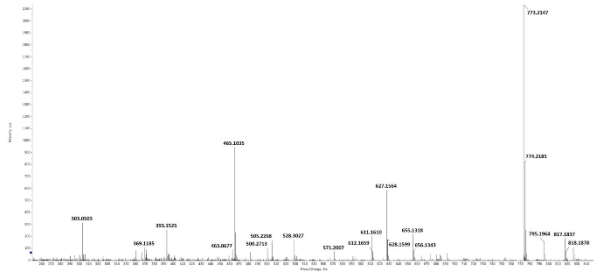
Supplementary Fig. S4 (-) ESI-MS/MS spectra of phenolic acids acquired in IDA mode.



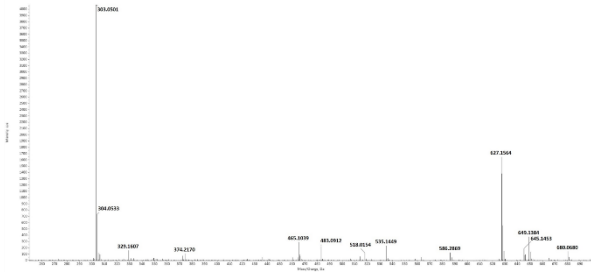
Supplementary Fig. S5 Proposed fragmentation patterns of 3-*O*-malonyl-1,5-di-*O*-caffeoylquinic acid



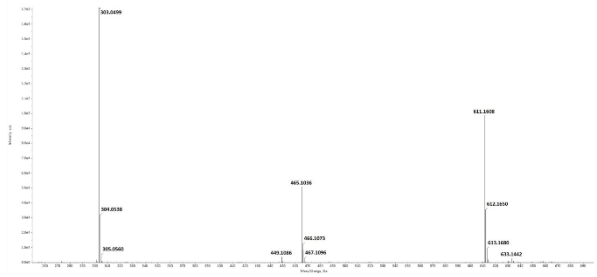
Peak F2. quercetin 3-*O*-robinobioside-7-*O*-glucoside



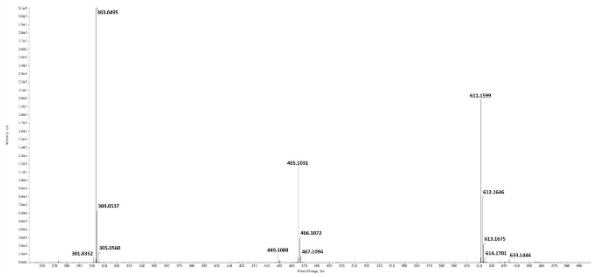
Peak F4. quercetin 3-*O*-sophoroside



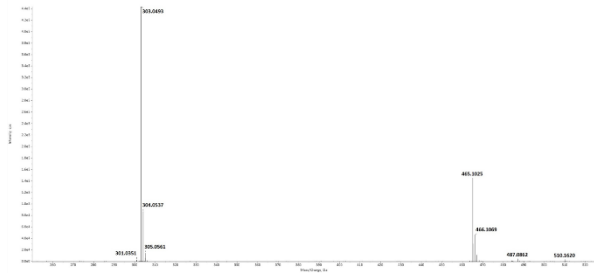
Peak F5. quercetin 3-*O*-robinobioside



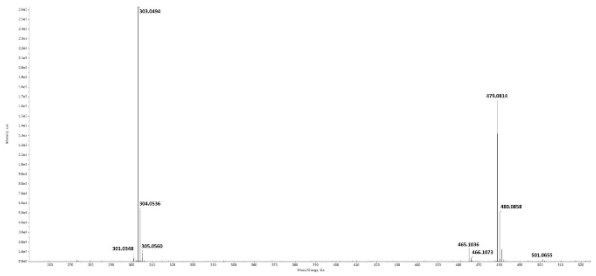
Peak F6. quercetin 3-*O*-rutinoside **(rutin)**



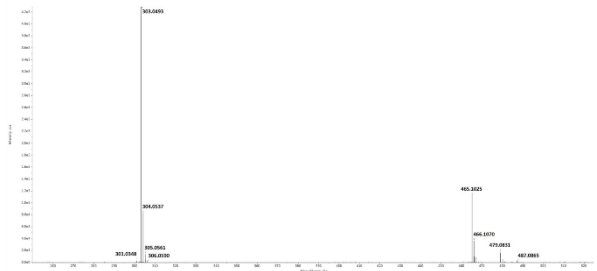
Peak F7. quercetin 3-*O*-galactoside **(hyperin, hyperoside)**



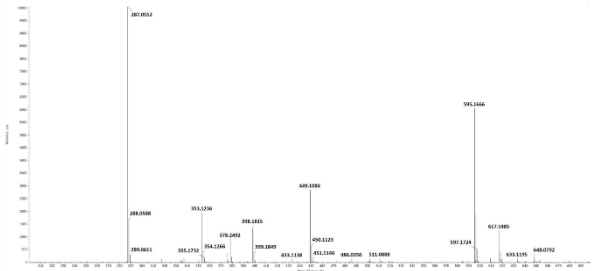
Peak F8. quercetin 3-*O*-glucuronide



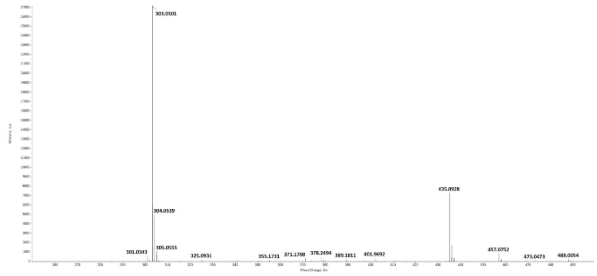
Peak F9. quercetin 3-*O*-glucoside **(isoquercitrin)**



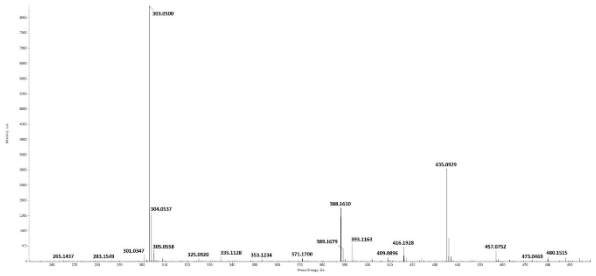
Peak F10. kaempferol 3-*O*-robinobioside **(biorobin)**



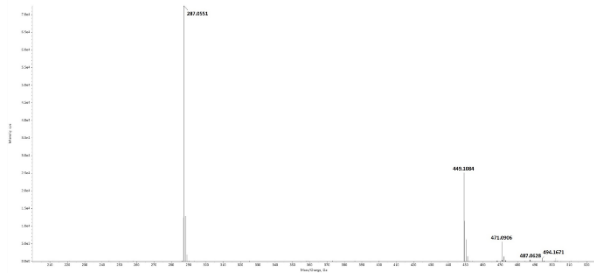
Peak F11. quercetin 3-*O*-xyloside **(reynoutrin)**



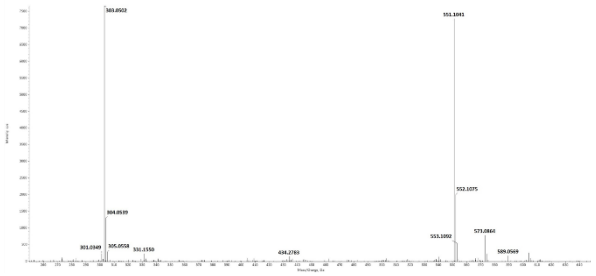
Peak F12. quercetin 3-*O*-arabinoside (**guaijaverin**)



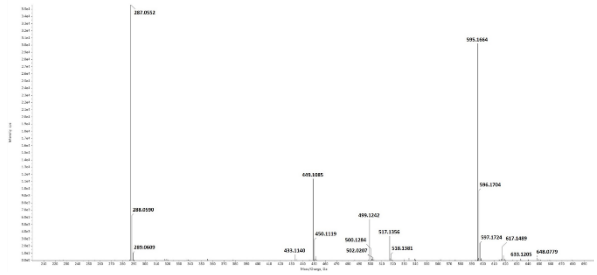
Peak F13. kaempferol 3-*O*-galactoside **(trifolin)**



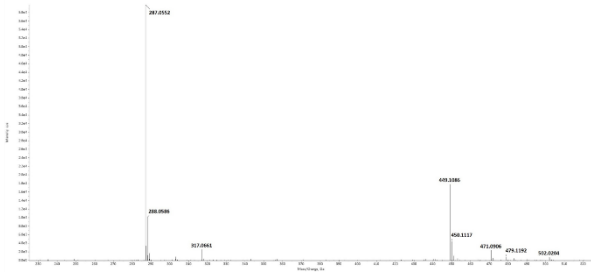
Peak F14. quercetin 3-*O*-(6-*O*-malonyl)glucoside



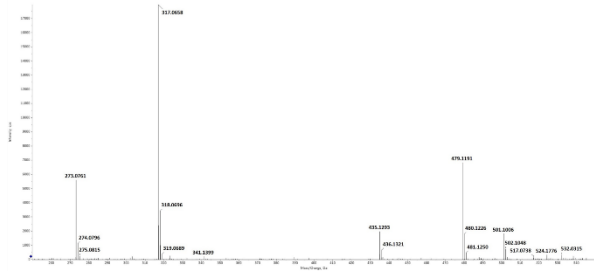
Peak F15. kaempferol 3-*O*-rutinoside **(nicotiflorin)**



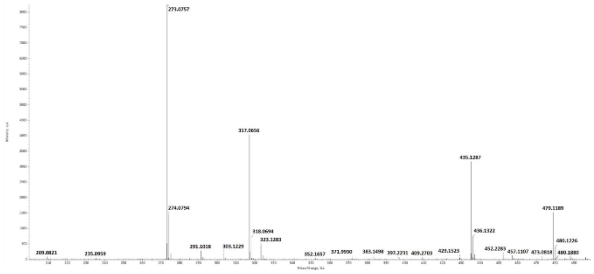
Peak F16. kaempferol 3-*O*-glucoside **(astragalin)**



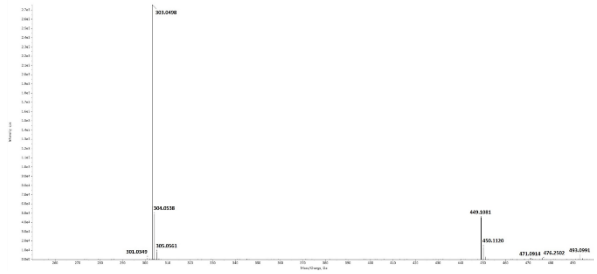
Peak F17. isorhamnetin 3-*O*-galactoside **(cacticin)**



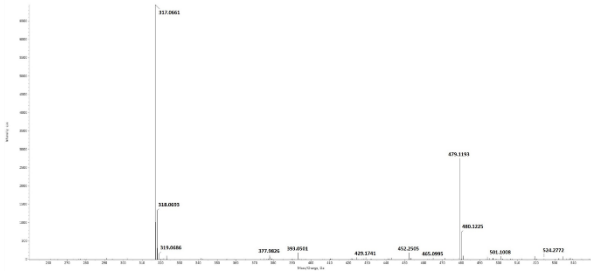
Peak F18. naringenin 7-*O*-glucoside **(prunin)**



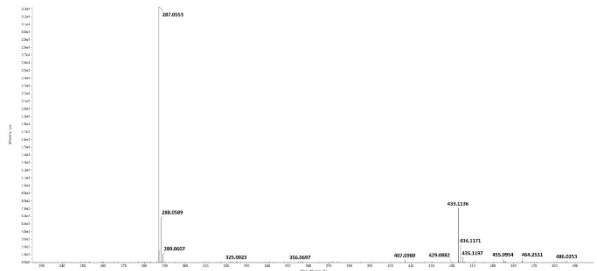
Peak F19. quercetin 3-*O*-rhamnoside **(quercitrin)**



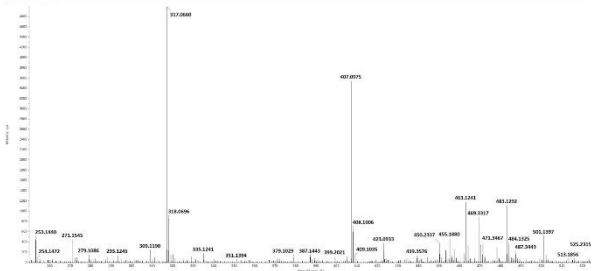
Peak F20. isorhamnetin 3-*O*-glucoside



Peak F21. kaempferol 3-*O*-rhamnoside **(afzelin)**

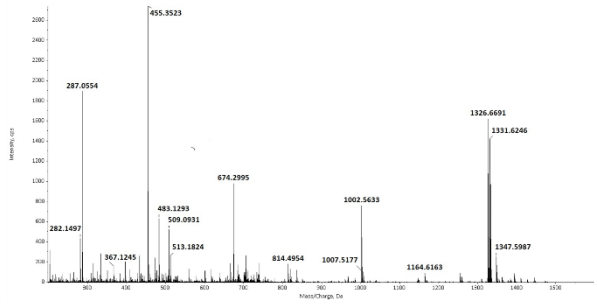


Peak F22. isorhamnetin 3-*O*-rhamnoside

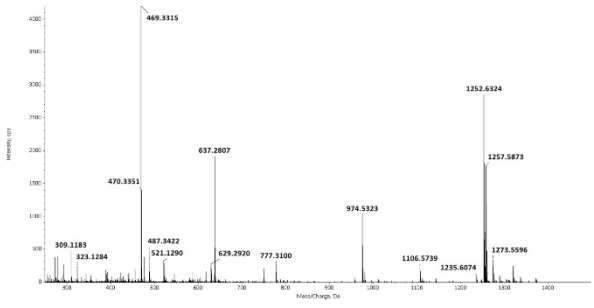


Supplementary Fig. S6 (+) ESI-MS spectra of flavonoids

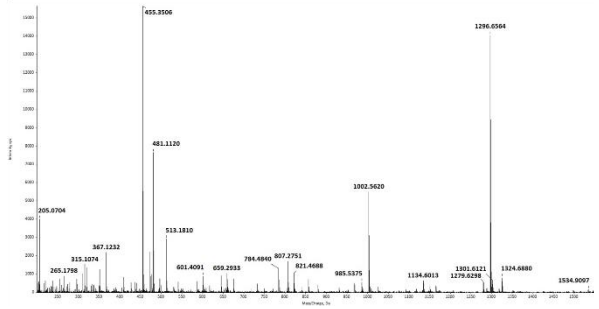
Peak S3. 3-*O*-sophorosyl-**mesembryanthemoidigenic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside



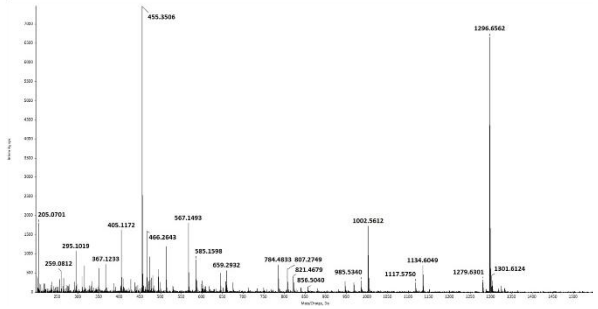
Peak S4. 3-*O*-rhamnosyl-(1→2)-arabinosyl-**serratagenic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside



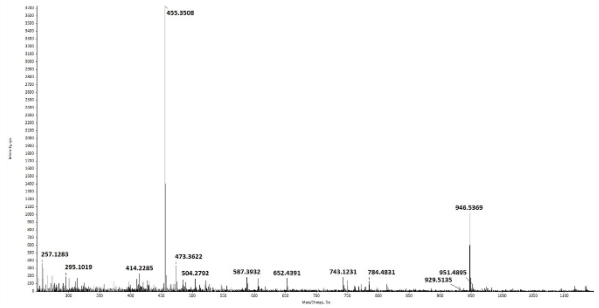
Peak S8. 3-*O*-glucosyl-(1→2)-arabinosyl-**mesembryanthemoidigenic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside **(ciwujianoside A_4)**



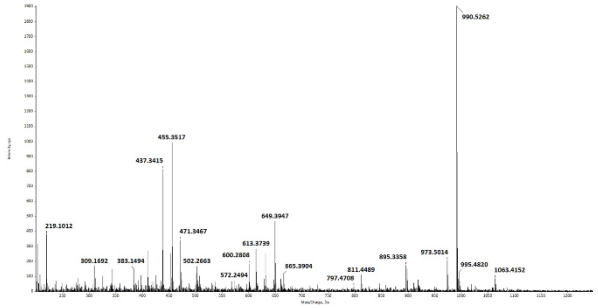
Peak S10. 3-*O*-glucosyl-(1→3)-arabinosyl-**mesembryanthemoidigenic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside



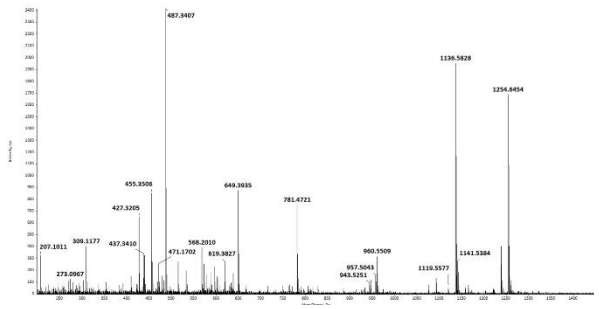
Peak S11. 3-*O*-glucosyl-(1→2)-arabinosyl-**mesembryanthemoidigenic acid** 28-*O*-glucoside



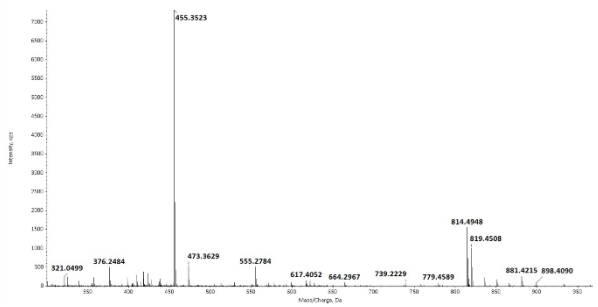
Peak S16. 3-*O*-glucuronyl-**echinocystic acid** 28-*O*-gentiobioside



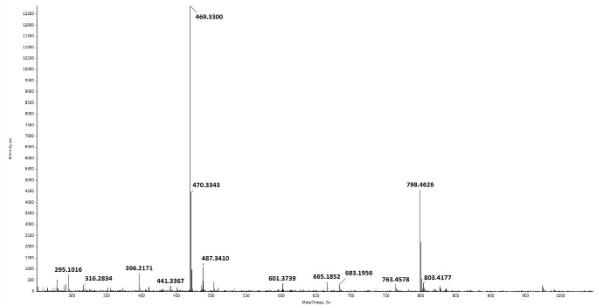
Peak S19. 3-*O*-glucosyl-**11-deoxy-anhydrochiisanogenoic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside



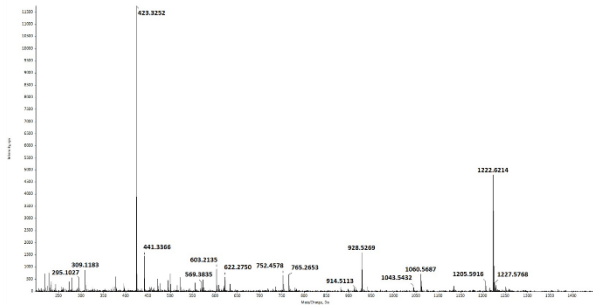
Peak S21. 3-*O*-sophorosyl-**mesembryanthemoidigenic acid**



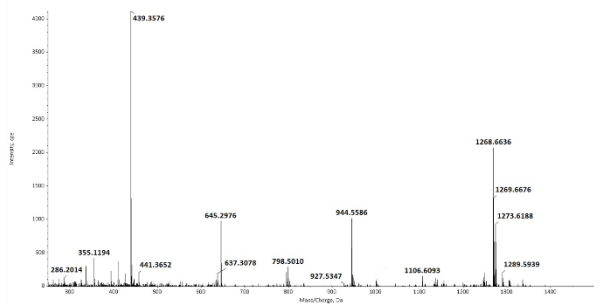
Peak S24. 3-*O*-glucosyl-(1→2)-arabinosyl-**serratagenic acid**



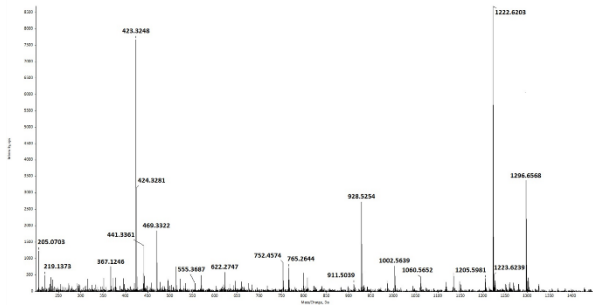
Peak S25. 3-*O*-glucosyl-(1→3)-arabinosyl-**akebonoic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside



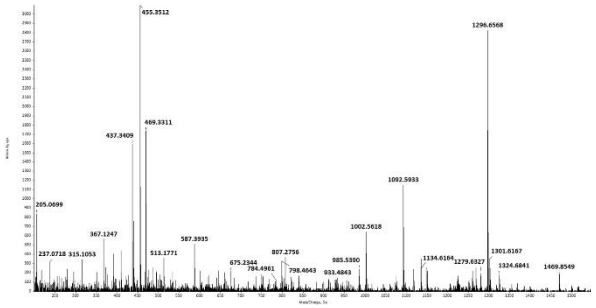
Peak S26. 3-*O*-sophorosyl-**oleanolic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside



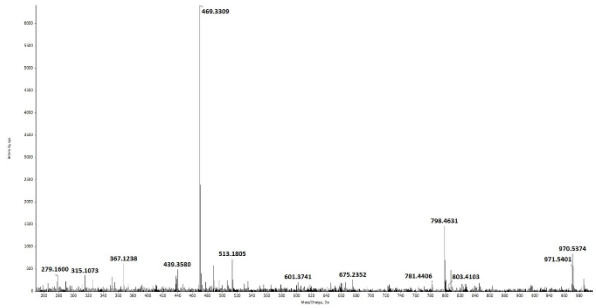
Peak S28. 3-*O*-glucosyl-(1→2)-arabinosyl-**akebonoic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside **(ciwujianoside A_2)**



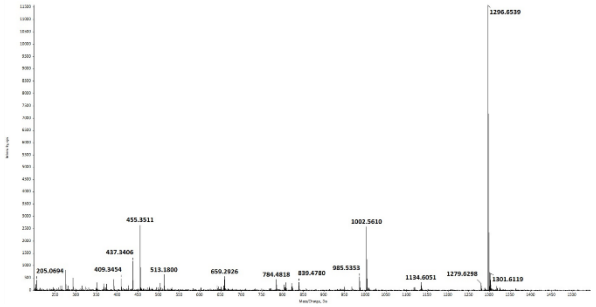
Peak S30. 3-*O*-glucosyl-(1→3)-arabinosyl-**echinocystic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside



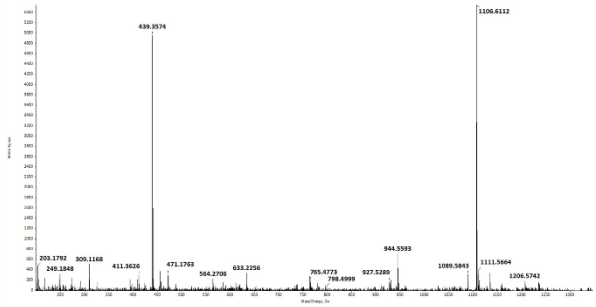
Peak S32. 3-*O*-glucosyl-(1→3)-arabinosyl-**serratagenic acid**



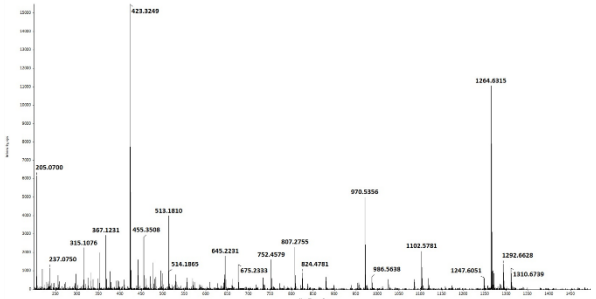
Peak S35. 3-*O*-glucosyl-(1→2)-arabinosyl-**echinocystic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside



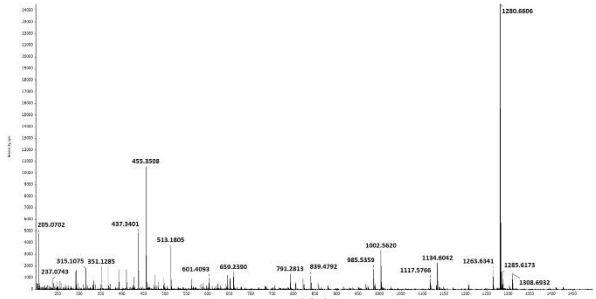
Peak S40. 3-*O*-glucosyl-**oleanolic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside **(nipponoside B)**



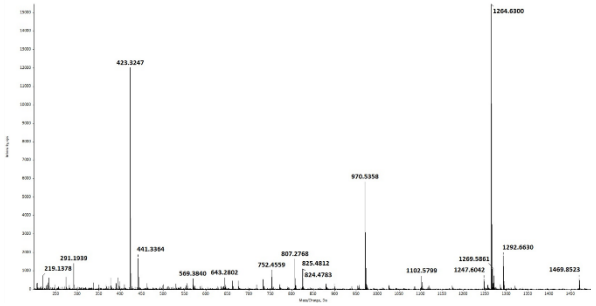
Peak S41. 3-*O*-glucosyl-(1→3)-arabinosyl-**akebonoic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside



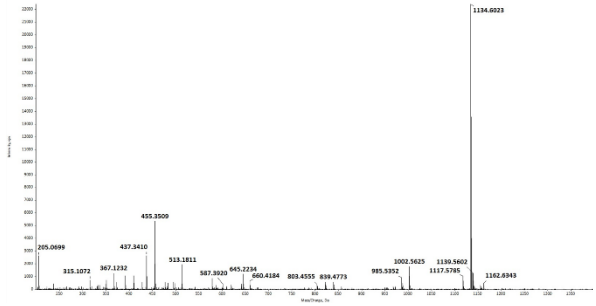
Peak S43. 3-*O*-rhamnosyl-(1→2)-arabinosyl-**echinocystic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside



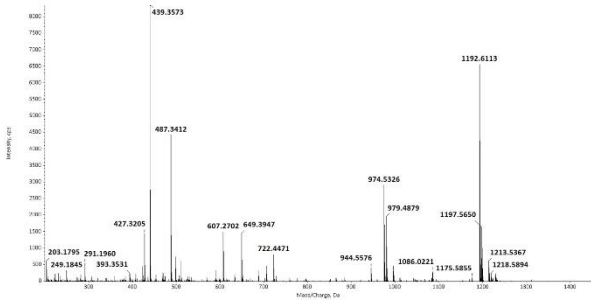
Peak S45. 3-*O*-glucosyl-(1→2)-arabinosyl-**akebonoic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside **(acanthopanaxoxside A)**



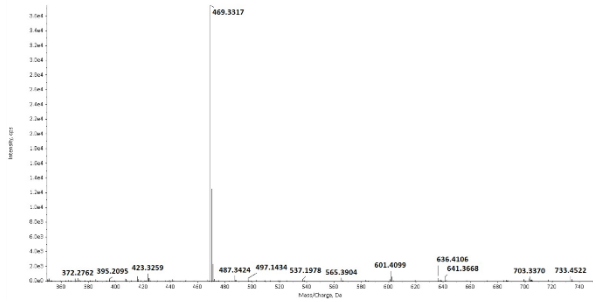
Peak S49. 3-*O*-arabinosyl-**echinocystic acid** 28-*O*-rhamnosyl-(1→4)-(6-*O*-acetyl)glucosyl-(1→6)-glucoside

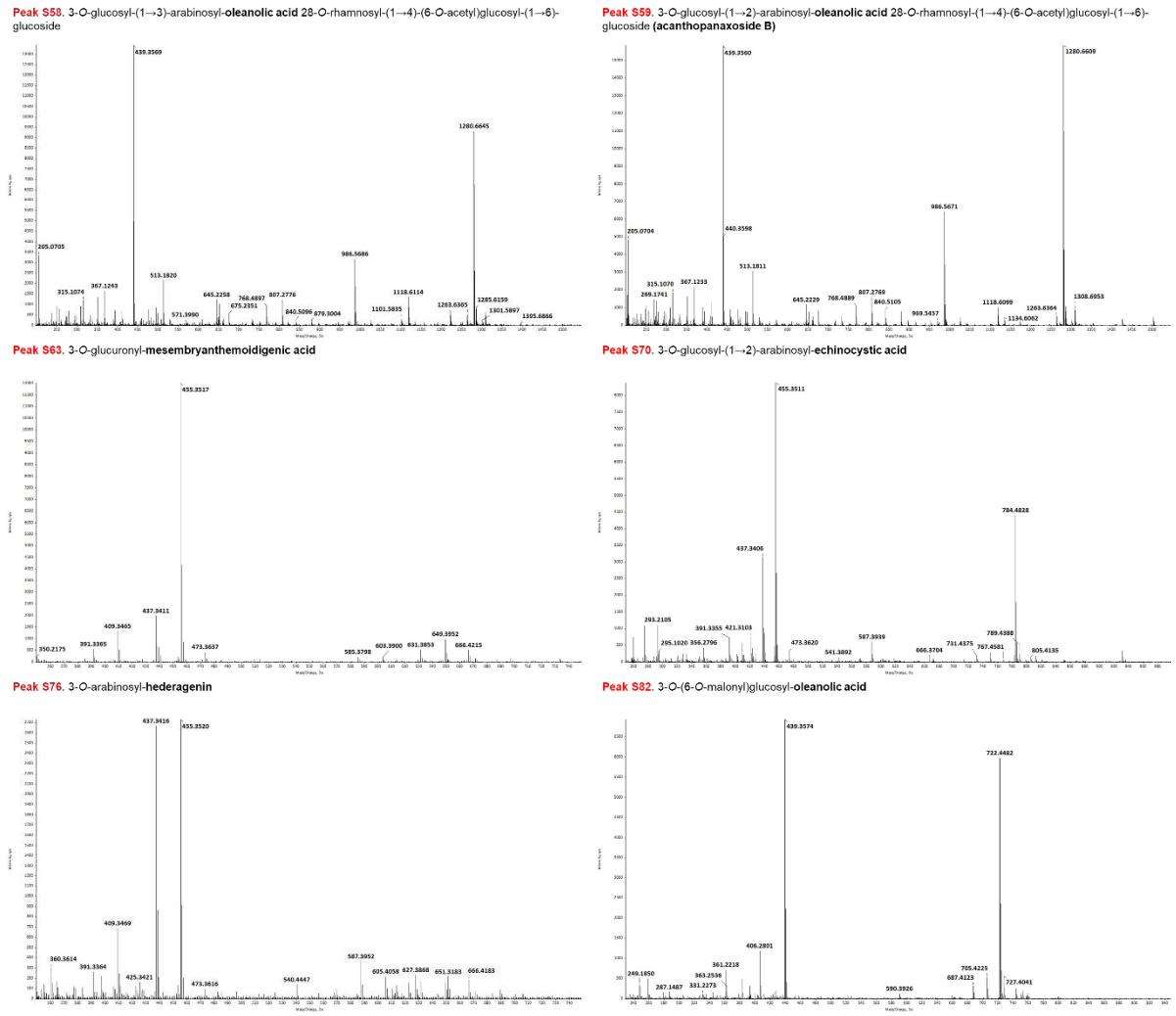


Peak S51. 3-*O*-(6-*O*-malonyl)glucosyl-**oleanolic acid** 28-*O*-rhamnosyl-(1→4)-glucosyl-(1→6)-glucoside

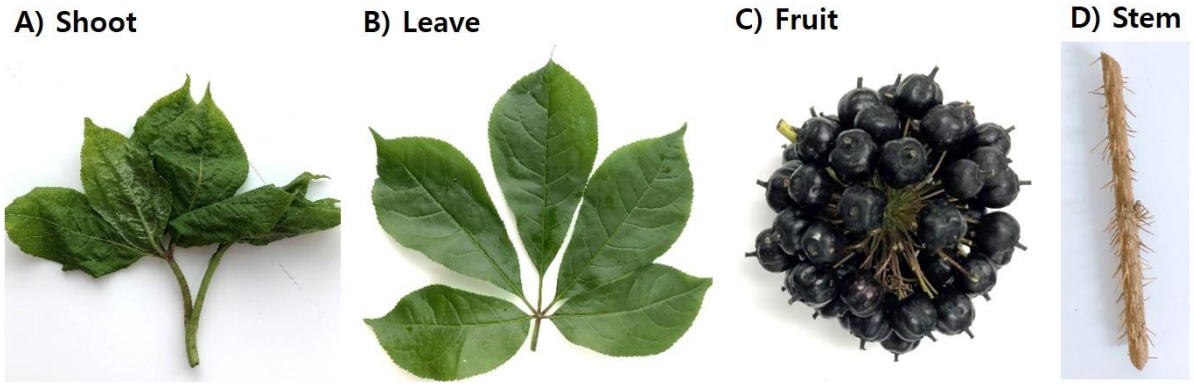


Peak S54. 3-*O*-arabinosyl-**serratagenic acid**





Supplementary Fig. S7 (+) ESI-MS spectra of triterpenoid saponins.



Supplementary Fig. S8 The shoots, leaves, fruits, and stems of *Acanthopanax senticosus*.