Supplementary Materials Clove and Lemongrass Essential Oils as Repellents Against *Halyomorpha halys*: From Behavioural Responses to Molecular Interactions and Controlled Release

Ivana Pajač Živković [1], Martina Pajač Beus [1], Helena Viric Gasparic [1,*], Marko Vinceković [2], Kristina Vlahoviček-Kahlina [2], Patrik Tišma [3,4], Višnja Stepanić [3,*] and Darija Lemic [1]

[1] Department of Agricultural Zoology, Faculty of Agriculture, University of Zagreb, Svetošimunska Cesta 25, HR-10000 Zagreb, Croatia; ipajac@agr.hr (I.P.Ž.); mpajacbeu23@student.agr.hr (M.P.B.); dlemic@agr.hr (D.L.)
[2] Department of Chemistry, Faculty of Agriculture, University of Zagreb, Svetošimunska Cesta 25, HR-10000 Zagreb, Croatia; mvincekovic@agr.hr (M.V.)
[3] Ruđer Bošković Institute, Division of Computing and Data Science, Bijenička Cesta 54, HR-10000 Zagreb, Croatia
[4] Department of Chemistry, Faculty of Science, University of Zagreb, Horvatovac 102A, HR-10000 Zagreb, Croatia

* Correspondence: hviric@agr.hr (H.V.G.); visnja.stepanic@irb.hr (V.S.); Tel.: +385-1-239-3804 (H.V.G.)

Gas Chromatography–Mass Spectrometry (GC-MS) Analyses

The Supplementary Materials provide the GC chromatograms and MS spectra of the components identified in the essential oils investigated in this study, presented in the following order: clove leaf EO and lemongrass EO. Each GC–MS analysis begins with a summary of the experimental parameters applied.

Sample Information

Analyzed	: 9/30/2026 2:41:22 AM
Sample Name	: kli5
Injection Volume	: 1.00
Data File	: C:\GCMSsolution\Data\LFOK\SENKA\kli5.qgd
Org Method File	: C:\GCMSsolution\Data\LFOK\SENKA\ulja_senka.qgm
Tuning File	: C:\GCMSsolution\System\Tune1\2026_9_29_NS.qgt

Method

===== Analytical Line 1 =====

[GC-2030]

Column Oven Temp.	:60.0 °C
Injection Temp.	:250.00 °C

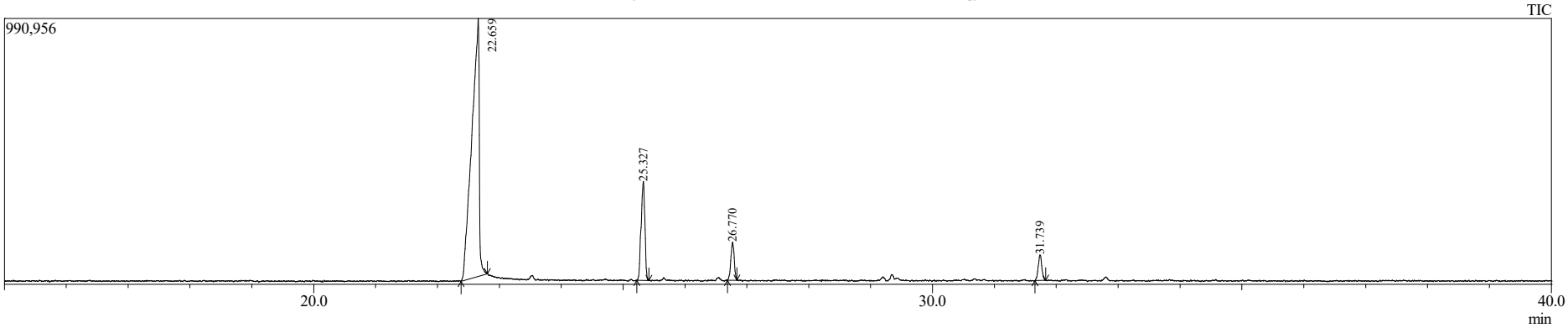
Oven Temp. Program

Rate	Temperature(°C)	Hold Time(min)
-	60.0	1.00
3.00	200.0	10.00

[GCMS-QP2020 NX]

IonSourceTemp	:230.00 °C
Interface Temp.	:210.00 °C
Solvent Cut Time	:2.50 min

Chromatogram kli5 C:\GCMSsolution\Data\LFOK\SENKA\kli5.qgd

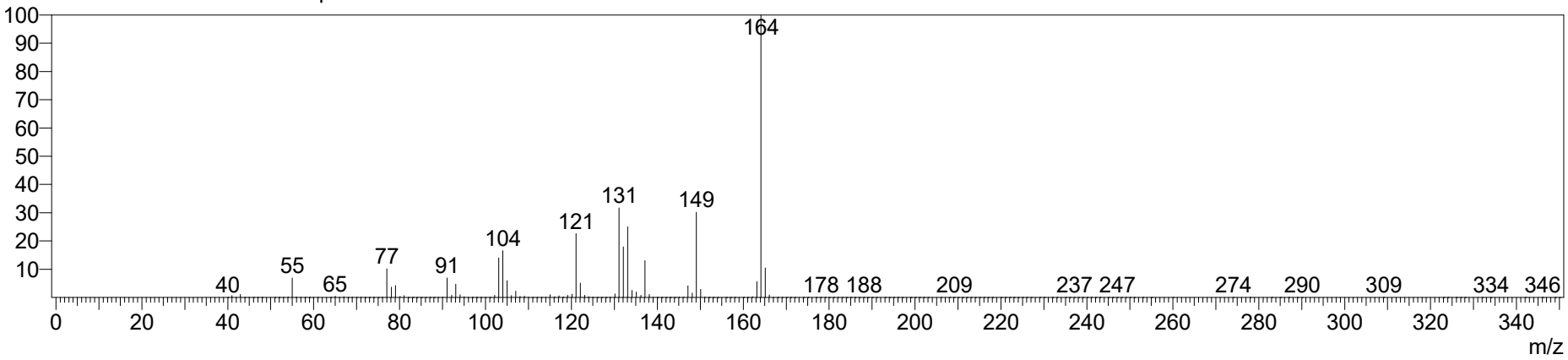


Peak Report TIC

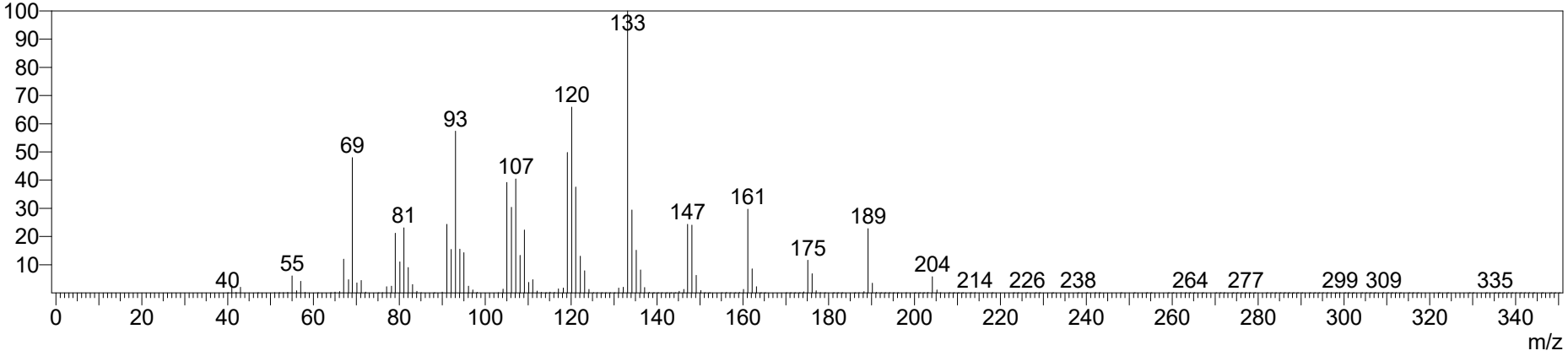
Peak#	R.Time	Area	Area%	Name
1	22.659	8069476	76.45	Eugenol
2	25.327	1571975	14.89	Caryophyllene
3	26.770	533456	5.05	Humulene
4	31.739	380305	3.60	14-Hydroxycaryophyllene
		10555212	100.00	

Spectrum

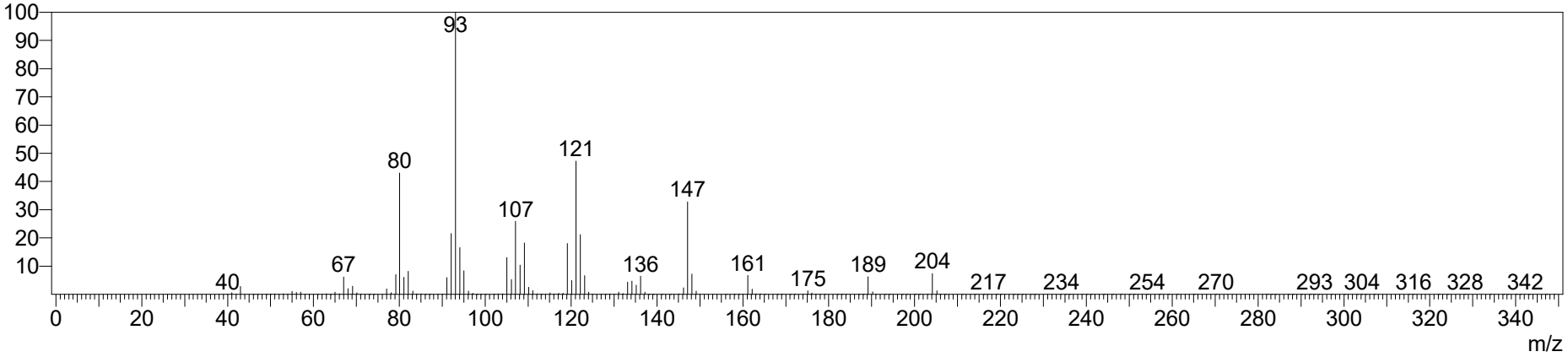
Peak#:1 R.Time:22.659(Scan#:4033)
MassPeaks:242
RawMode:Averaged 22.655-22.665(4032-4034)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



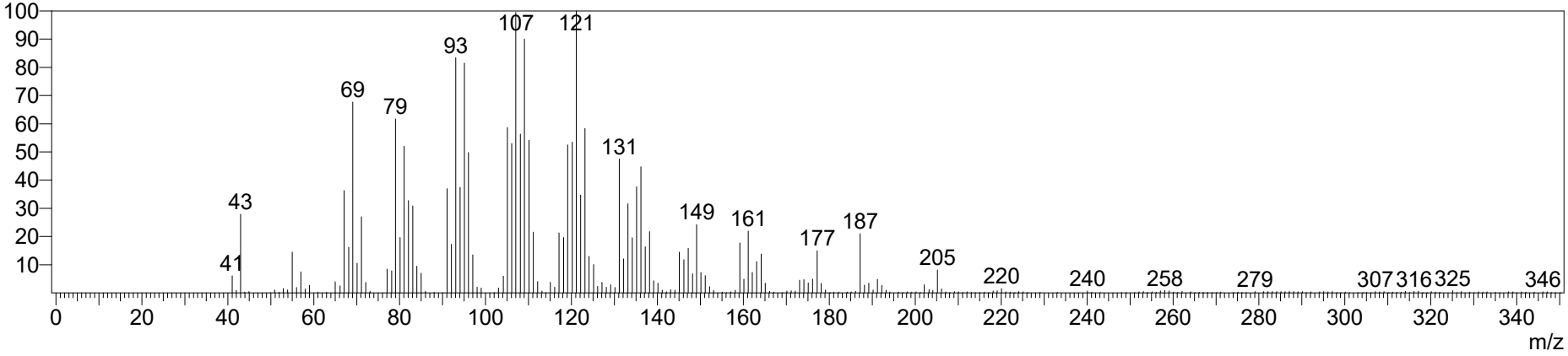
Peak#:2 R.Time:25.327(Scan#:4566)
MassPeaks:240
RawMode:Averaged 25.320-25.330(4565-4567)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



Peak#:3 R.Time:26.770(Scan#:4855)
MassPeaks:212
RawMode:Averaged 26.765-26.775(4854-4856)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



Peak#:4 R.Time:31.739(Scan#:5849)
MassPeaks:281
RawMode:Averaged 31.735-31.745(5848-5850)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



Sample Information

Analyzed : 9/30/2026 3:45:28 AM
Sample Name : lim6
Injection Volume : 1.00
Data File : C:\GCMSsolution\Data\LFOK\SENKA\lim6.qgd
Org Method File : C:\GCMSsolution\Data\LFOK\SENKA\ulja_senka.qgm
Tuning File : C:\GCMSsolution\System\Tune1\2026_9_29_NS.qgt

Method

===== Analytical Line 1 =====

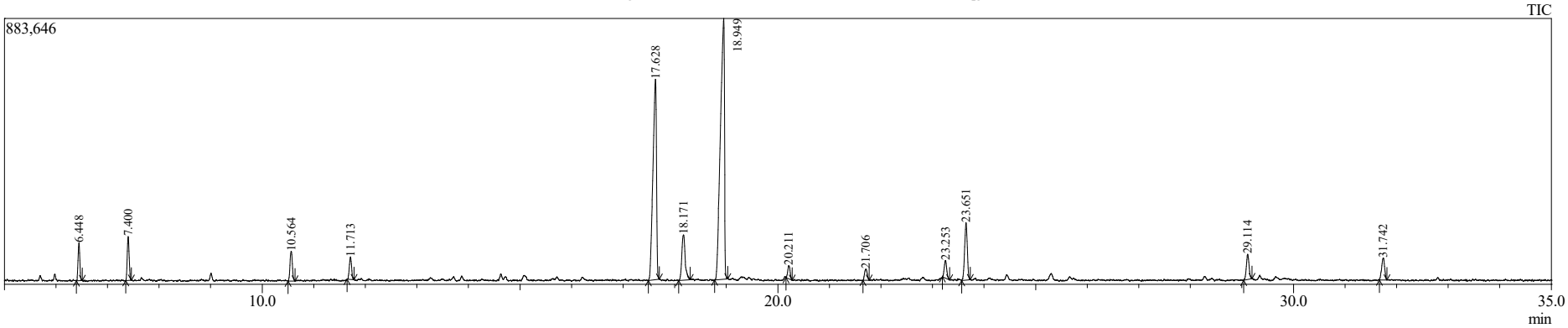
[GC-2030]
Column Oven Temp. :60.0 °C
Injection Temp. :250.00 °C

Oven Temp. Program

Rate	Temperature(°C)	Hold Time(min)
-	60.0	1.00
3.00	200.0	10.00

[GCMS-QP2020 NX]
IonSourceTemp :230.00 °C
Interface Temp. :210.00 °C
Solvent Cut Time :2.50 min

Chromatogram lim6 C:\GCMSsolution\Data\LFOK\SENKA\lim6.qgd

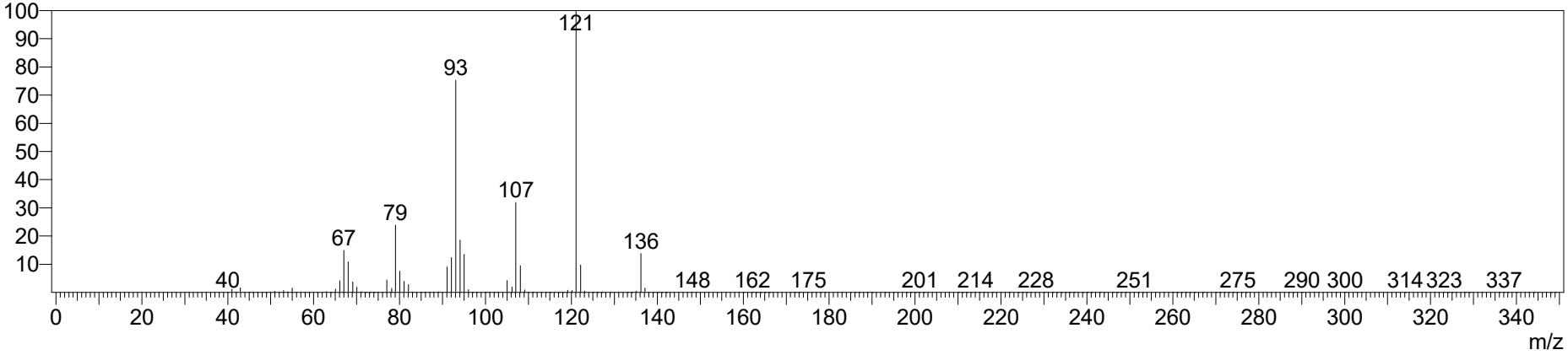


Peak Report TIC

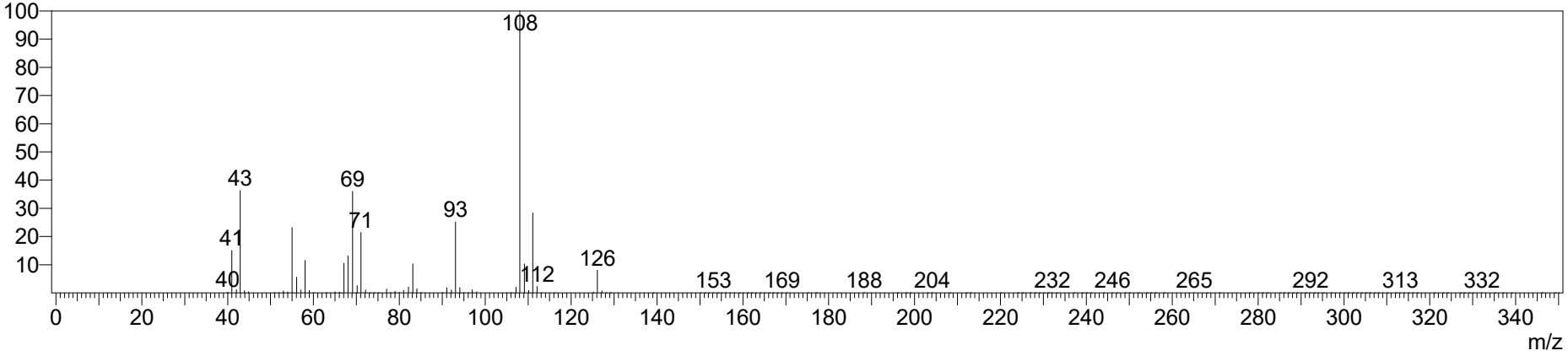
Peak#	R.Time	Area	Area%	Name
1	6.448	289905	2.54	Camphene
2	7.400	366906	3.22	5-Hepten-2-one, 6-methyl-
3	10.564	301430	2.64	4-Nonanone
4	11.713	216336	1.90	Linalool
5	17.628	3113174	27.32	Neral
6	18.171	674736	5.92	Geraniol
7	18.949	4709080	41.32	Citral
8	20.211	138657	1.22	Geranyl formate
9	21.706	132082	1.16	
10	23.253	190620	1.67	
11	23.651	663111	5.82	2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (Z)-
12	29.114	312935	2.75	.gamma.-Muurolene
13	31.742	287331	2.52	14-Hydroxycaryophyllene

Spectrum

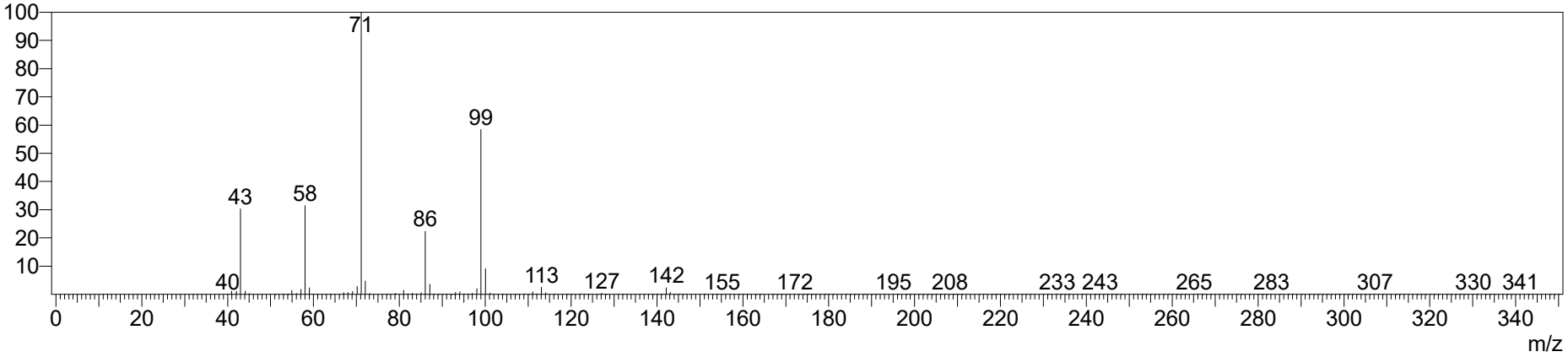
Peak#:1 R.Time:6.448(Scan#:791)
MassPeaks:204
RawMode:Averaged 6.445-6.455(790-792)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



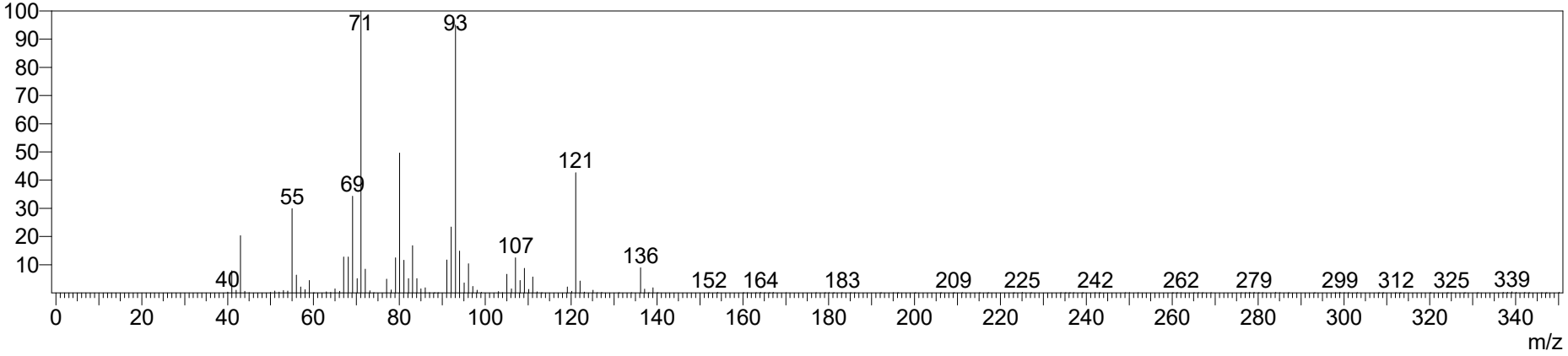
Peak#:2 R.Time:7.400(Scan#:981)
MassPeaks:182
RawMode:Averaged 7.395-7.405(980-982)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



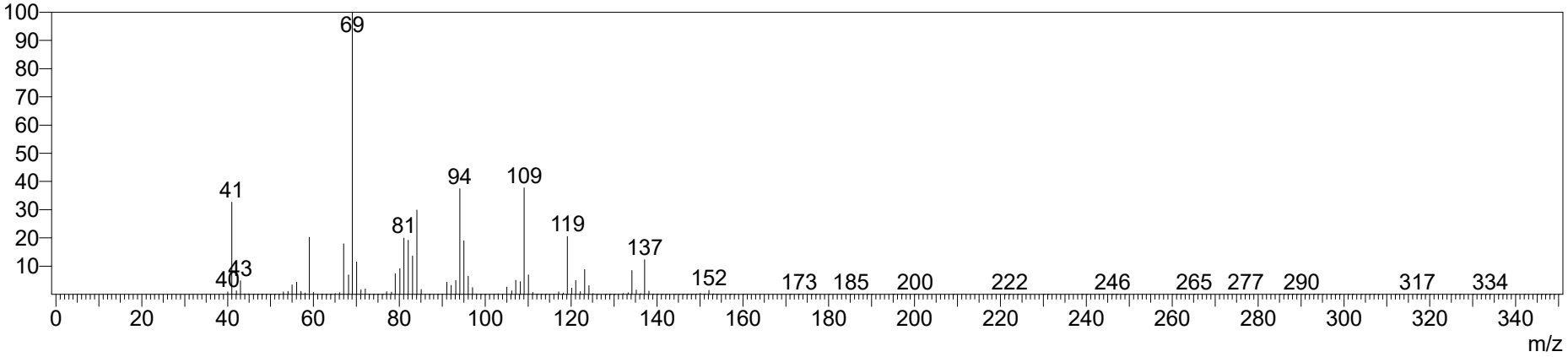
Peak#:3 R.Time:10.564(Scan#:1614)
MassPeaks:293
RawMode:Averaged 10.560-10.570(1613-1615)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



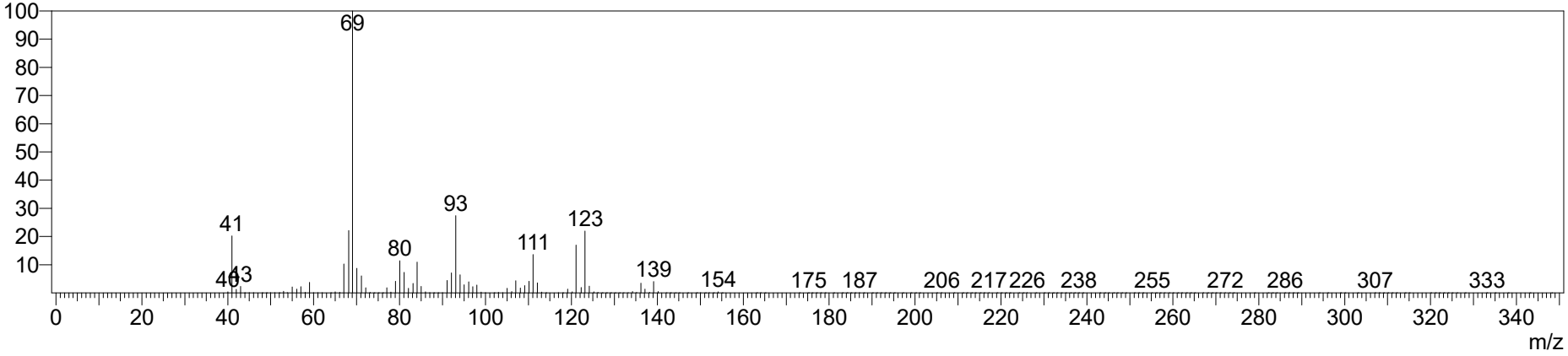
Peak#:4 R.Time:11.713(Scan#:1844)
MassPeaks:198
RawMode:Averaged 11.710-11.720(1843-1845)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



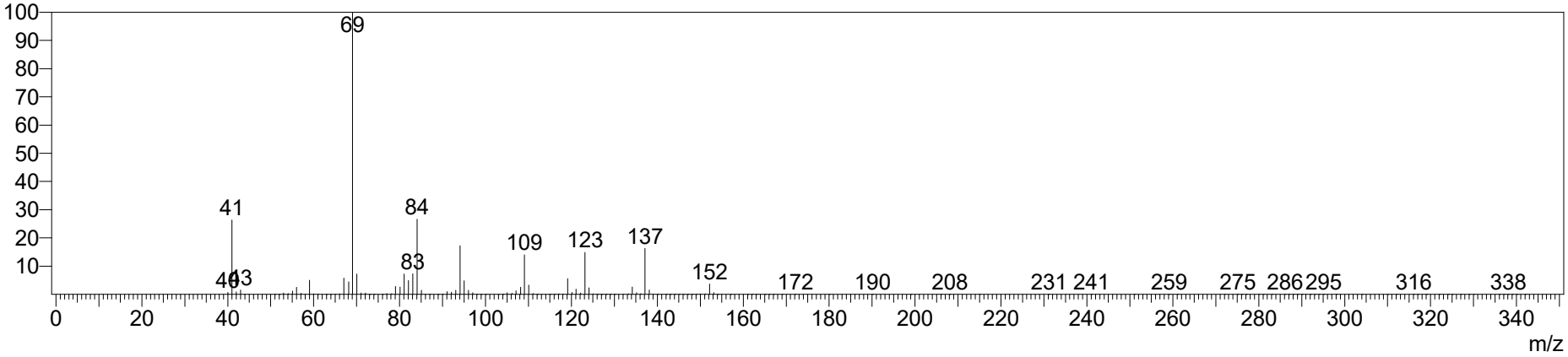
Peak#:5 R.Time:17.628(Scan#:3026)
MassPeaks:214
RawMode:Averaged 17.620-17.630(3025-3027)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



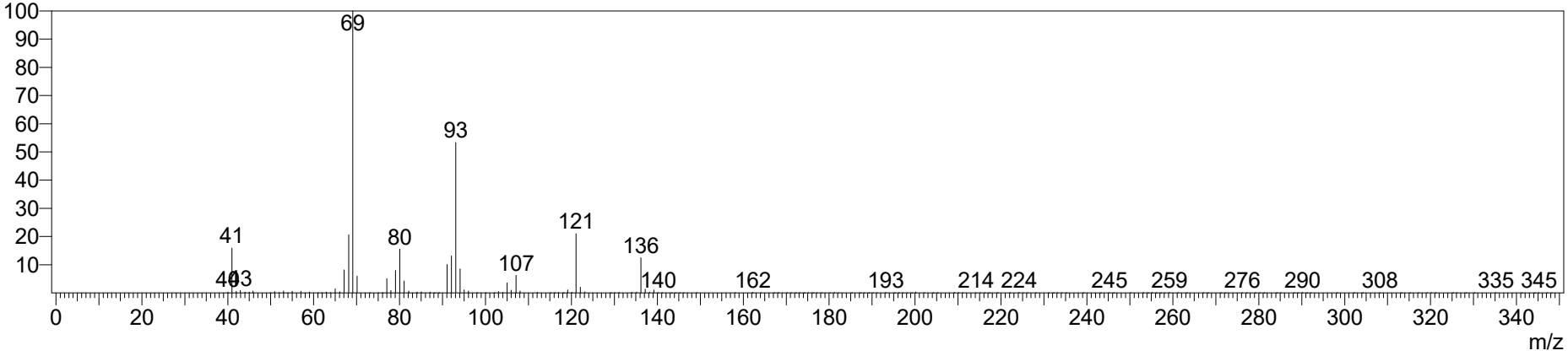
Peak#:6 R.Time:18.171(Scan#:3135)
MassPeaks:252
RawMode:Averaged 18.165-18.175(3134-3136)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



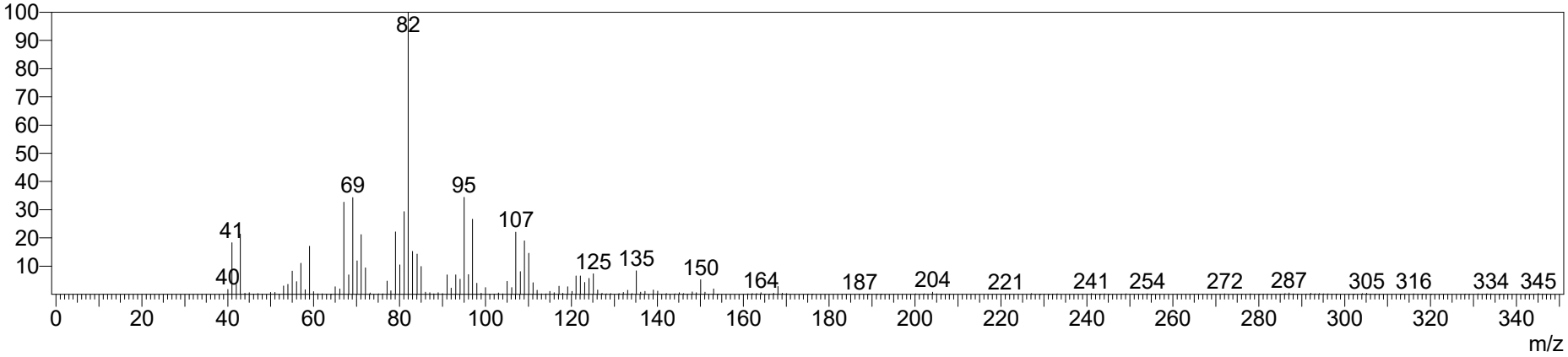
Peak#:7 R.Time:18.949(Scan#:3291)
MassPeaks:179
RawMode:Averaged 18.945-18.955(3290-3292)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



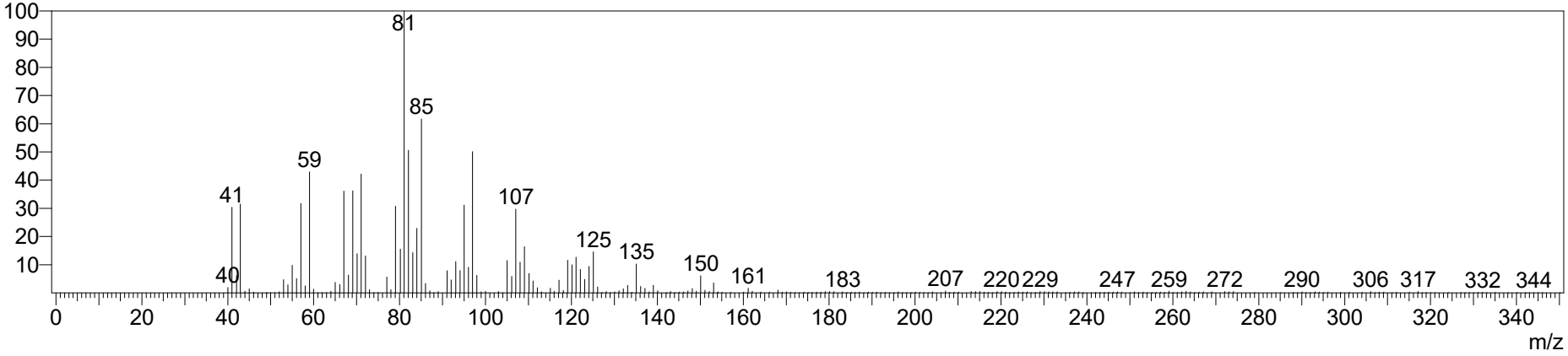
Peak#:8 R.Time:20.211(Scan#:3543)
MassPeaks:207
RawMode:Averaged 20.205-20.215(3542-3544)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



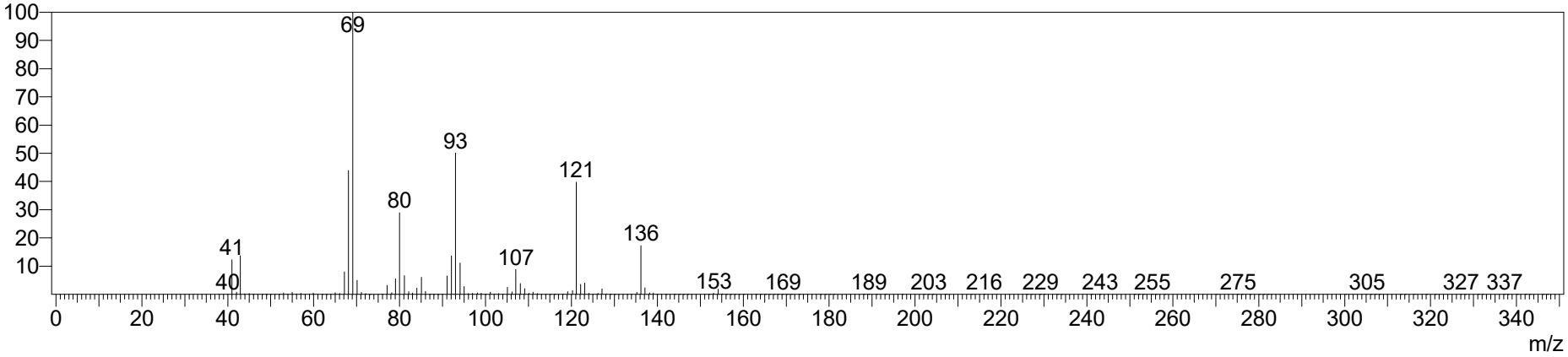
Peak#:9 R.Time:21.706(Scan#:3842)
MassPeaks:216
RawMode:Averaged 21.700-21.710(3841-3843)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



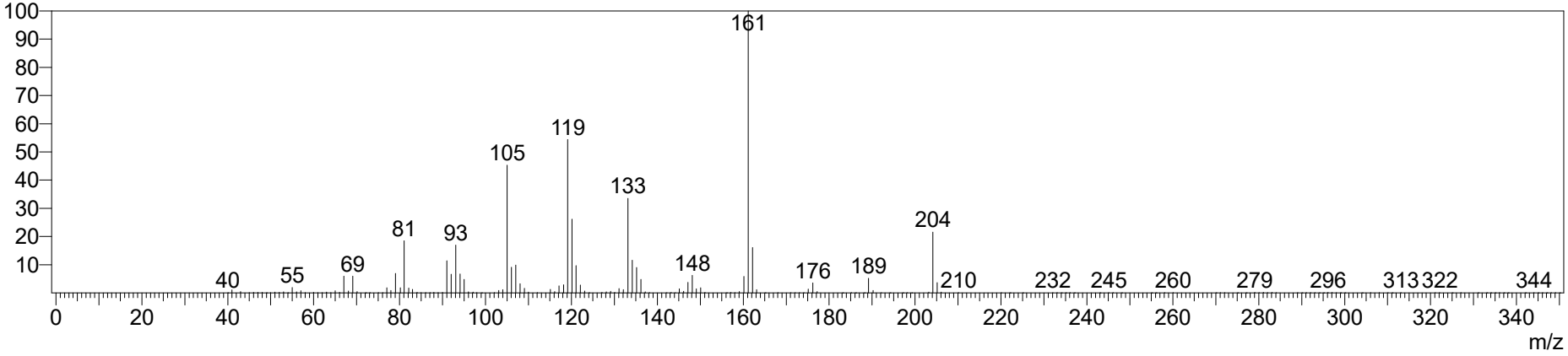
Peak#:10 R.Time:23.253(Scan#:4152)
MassPeaks:286
RawMode:Averaged 23.250-23.260(4151-4153)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



Peak#:11 R.Time:23.651(Scan#:4231)
MassPeaks:211
RawMode:Averaged 23.645-23.655(4230-4232)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



Peak#:12 R.Time:29.114(Scan#:5324)
MassPeaks:229
RawMode:Averaged 29.110-29.120(5323-5325)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan



Peak#:13 R.Time:31.742(Scan#:5849)
MassPeaks:207
RawMode:Averaged 31.735-31.745(5848-5850)
BG Mode:Calc. from Peak Group 1 - Event 1 Scan

