

**Sesquiterpenes from an Eastern African Medicinal
Mushroom Belonging to the Genus Sanghuangporus.**

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Sesquiterpenes from an Eastern African Medicinal Mushroom Belonging to the Genus *Sanghuangporus*

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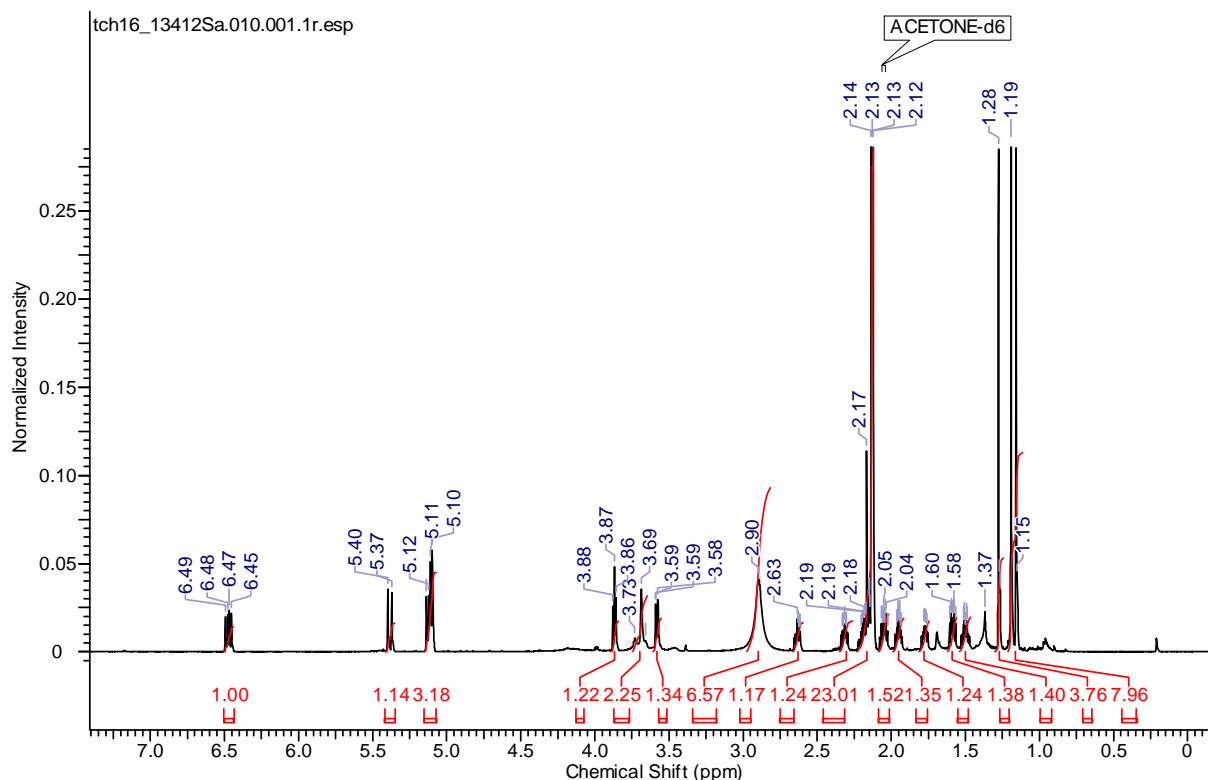


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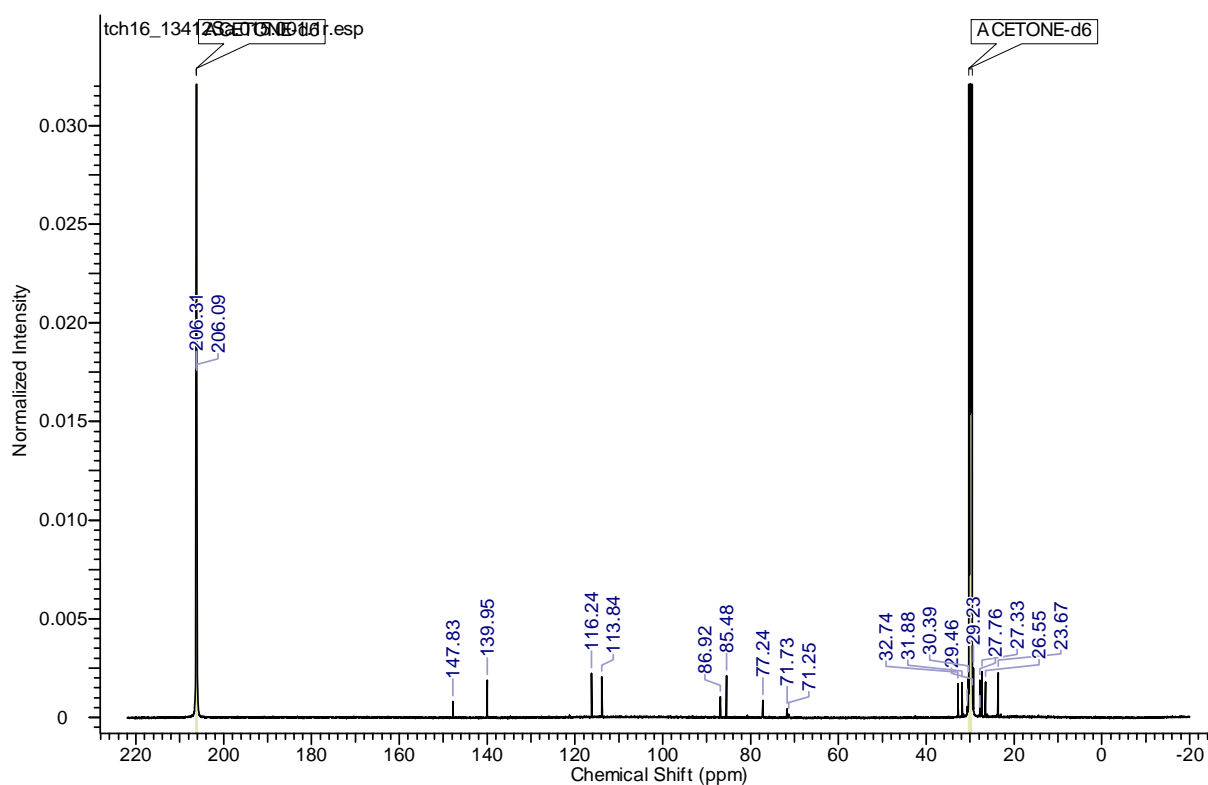


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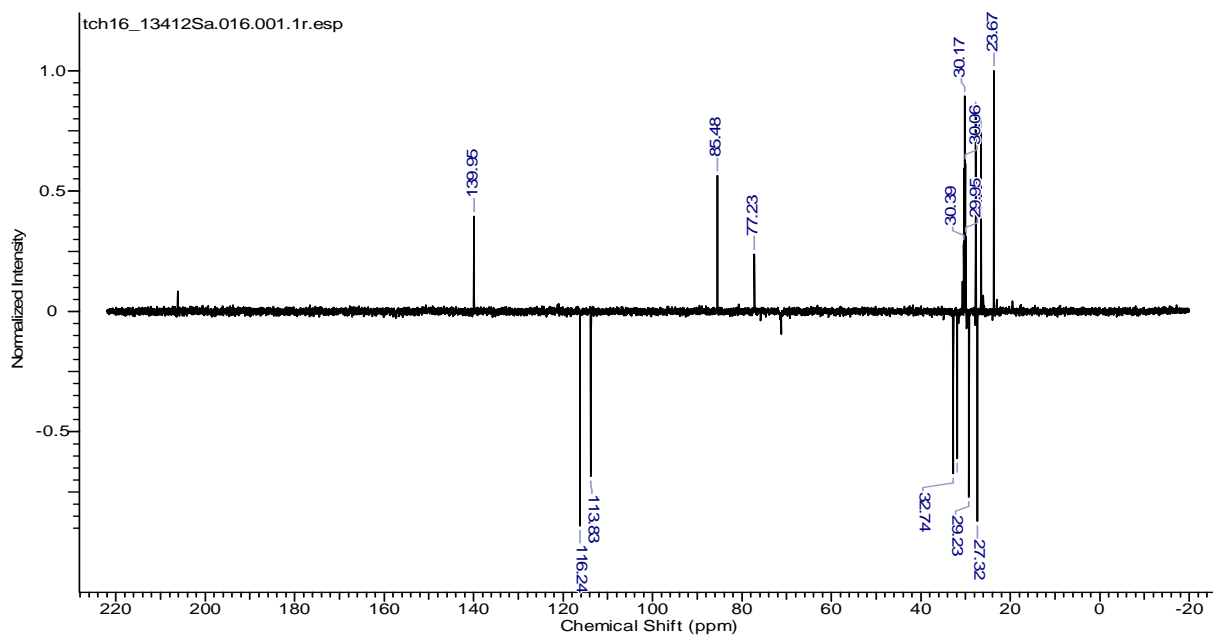


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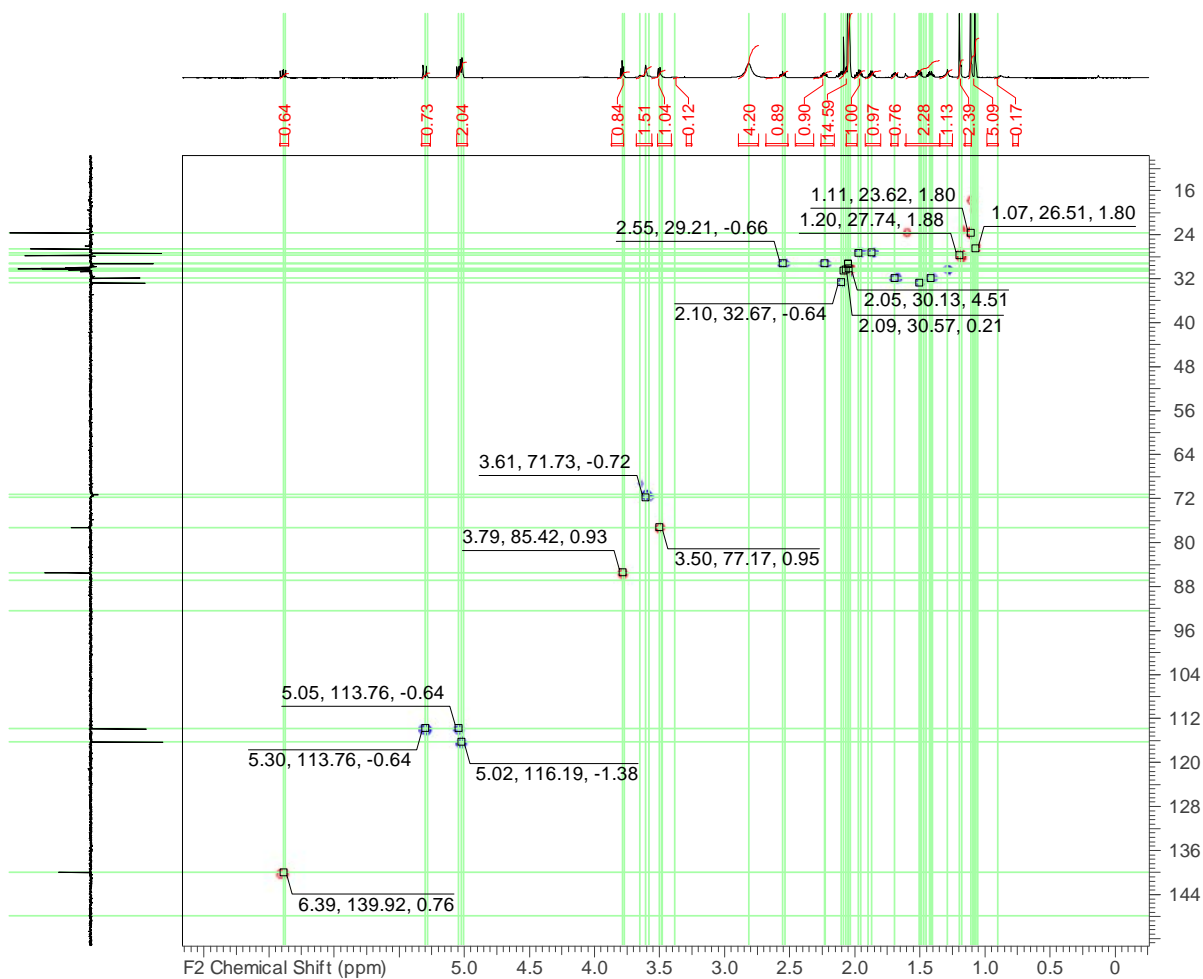


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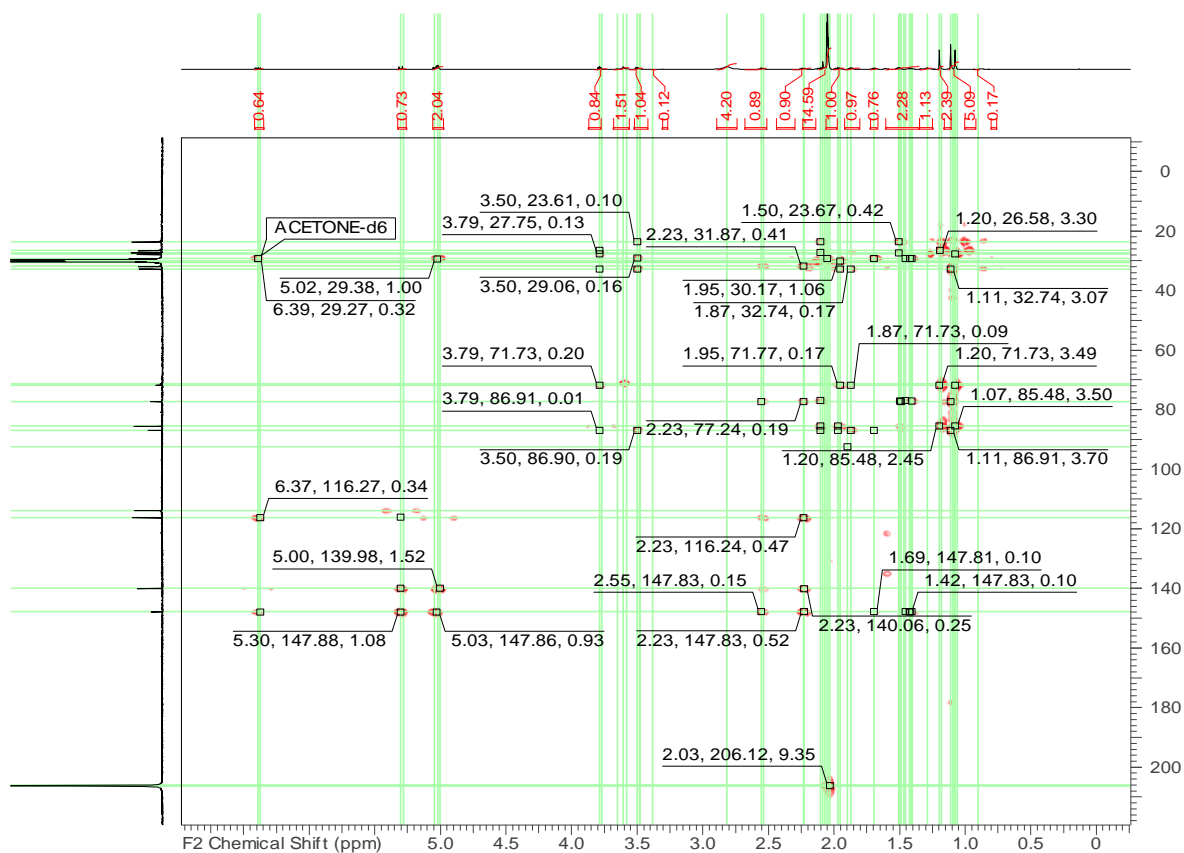


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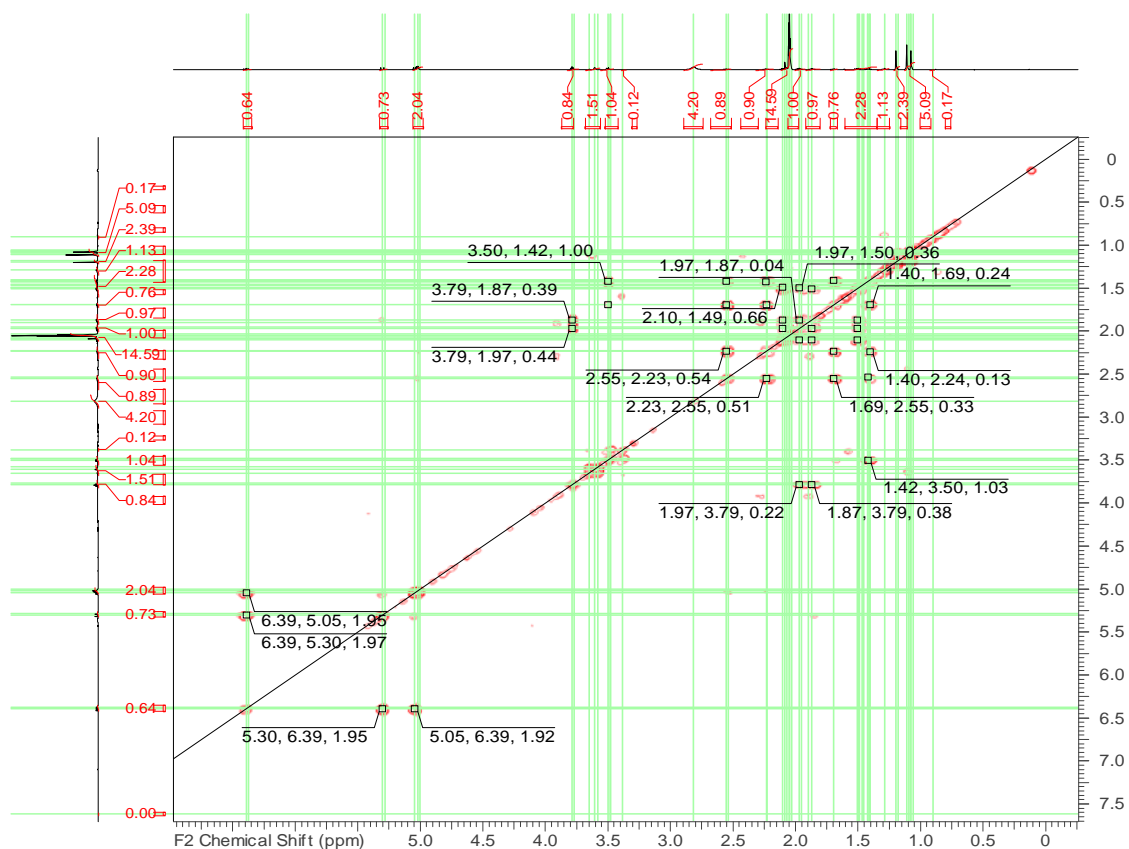


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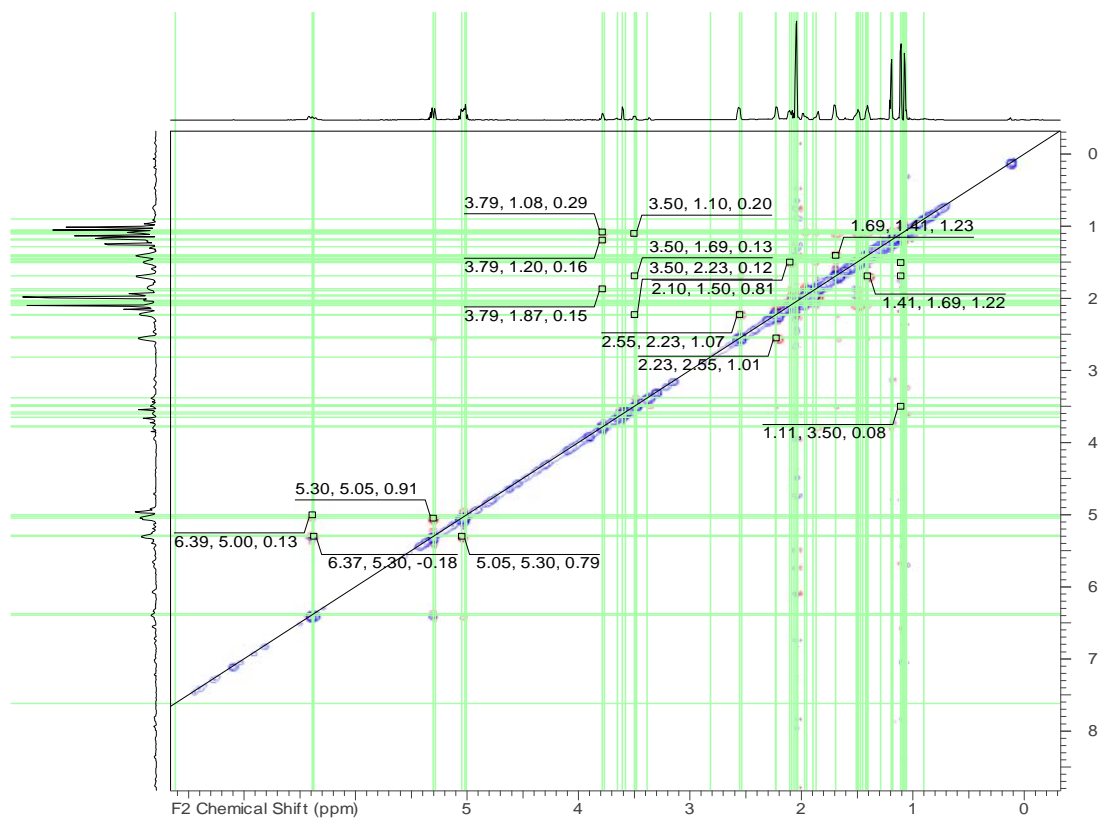


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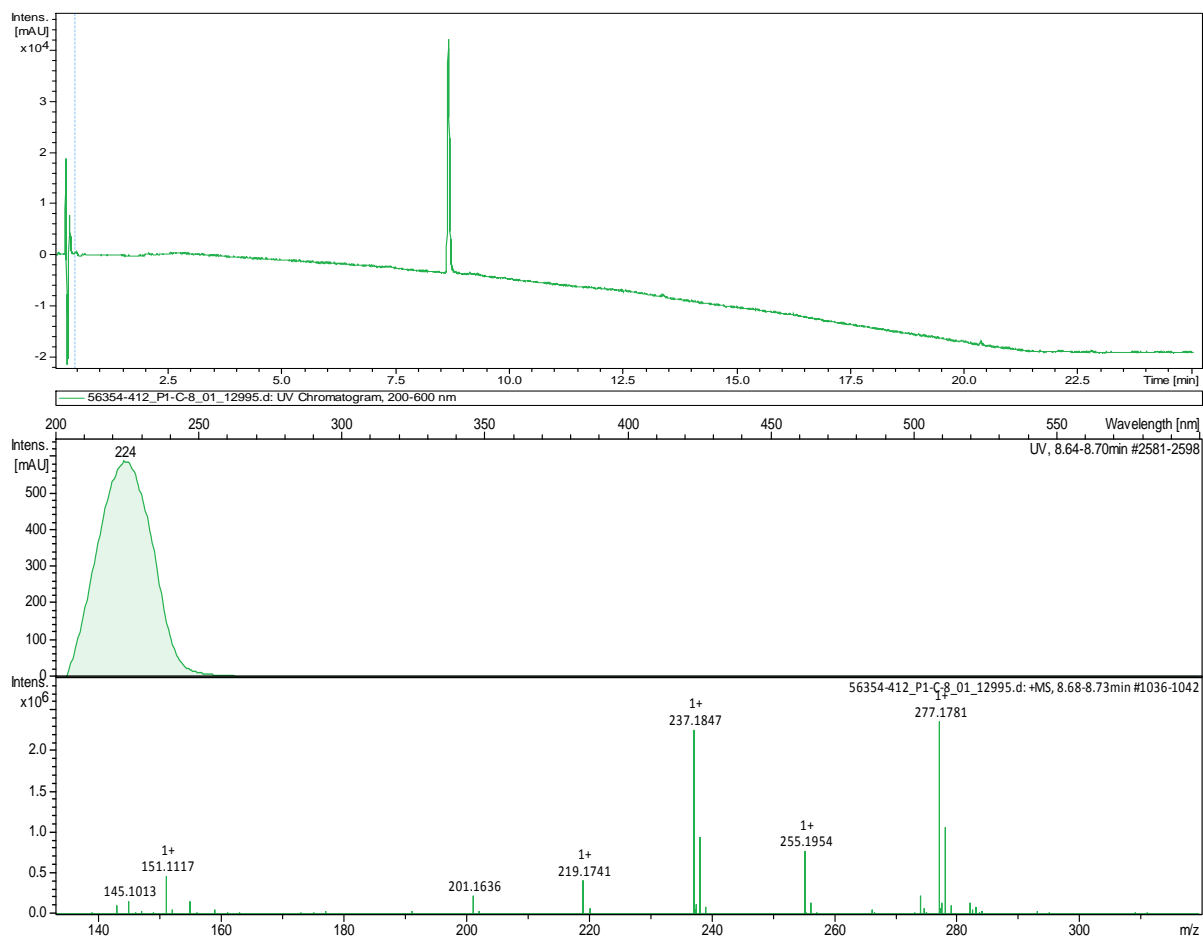


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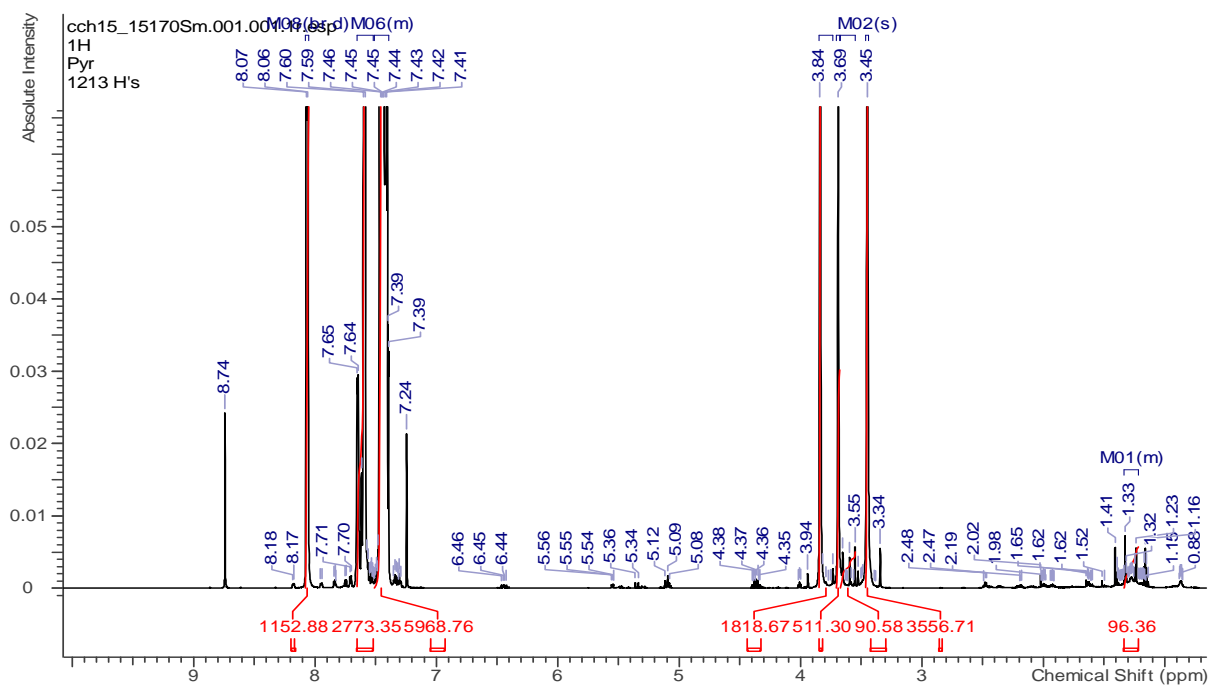


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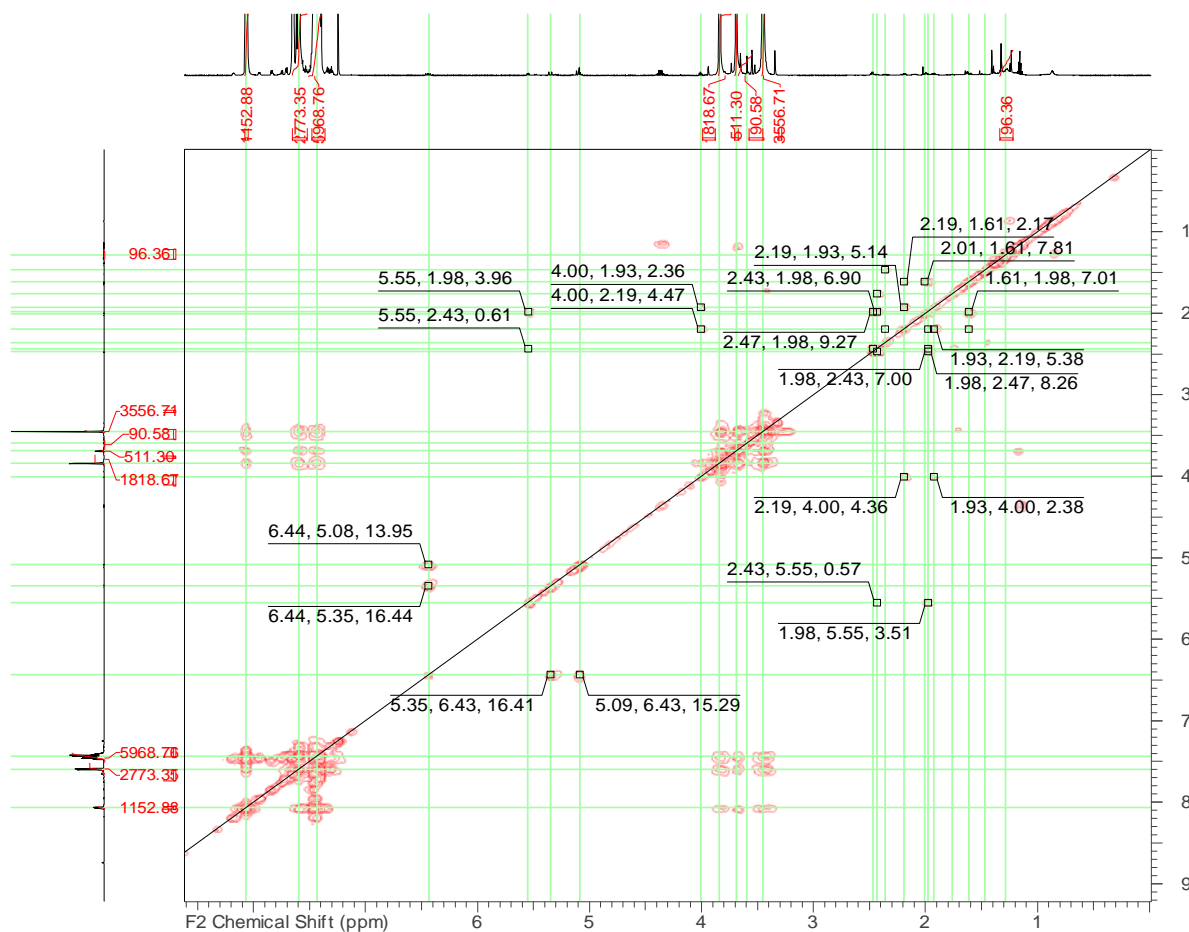


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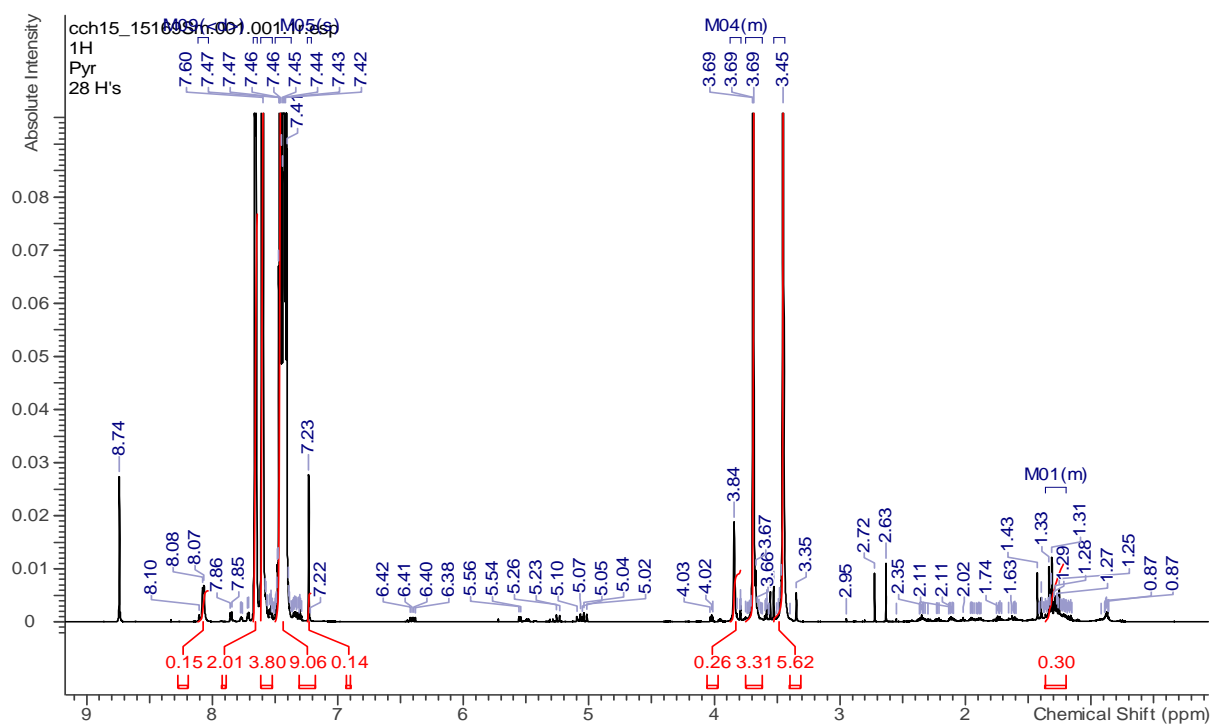
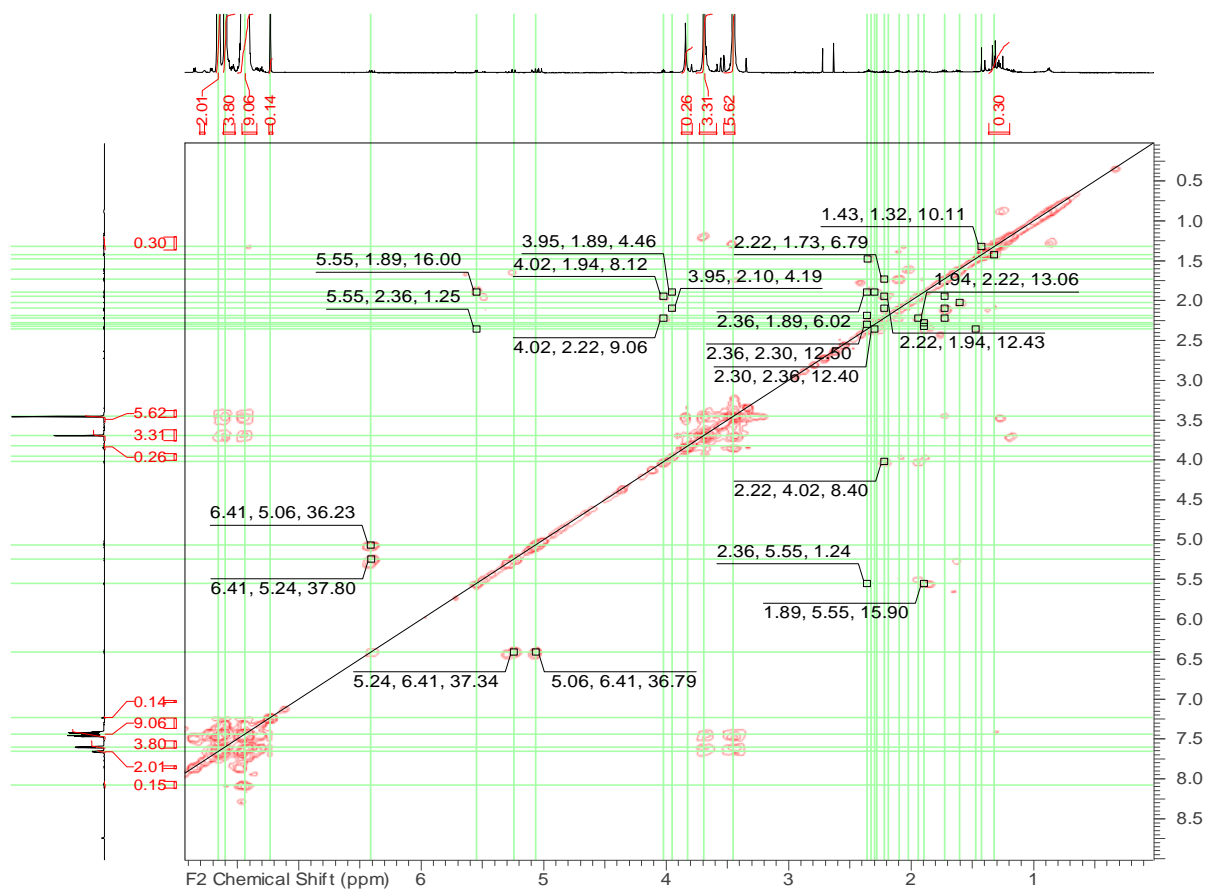


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1 and 2D NMR data for elgonene A (**2**)

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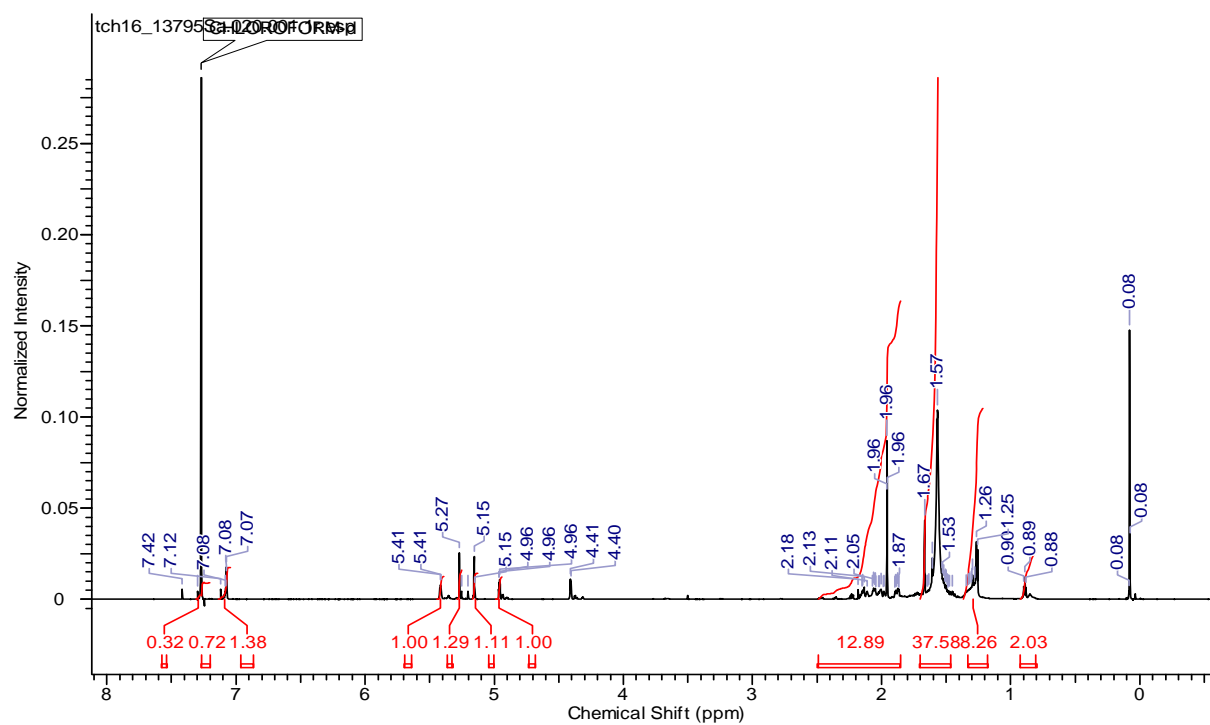


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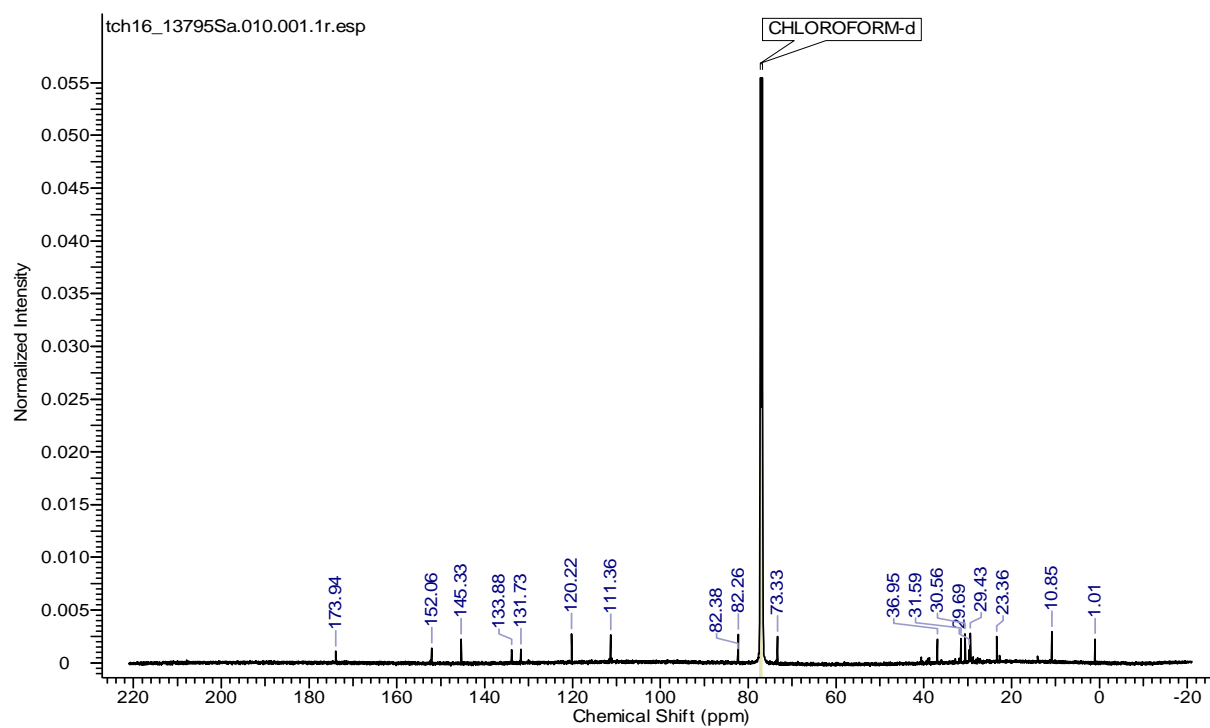


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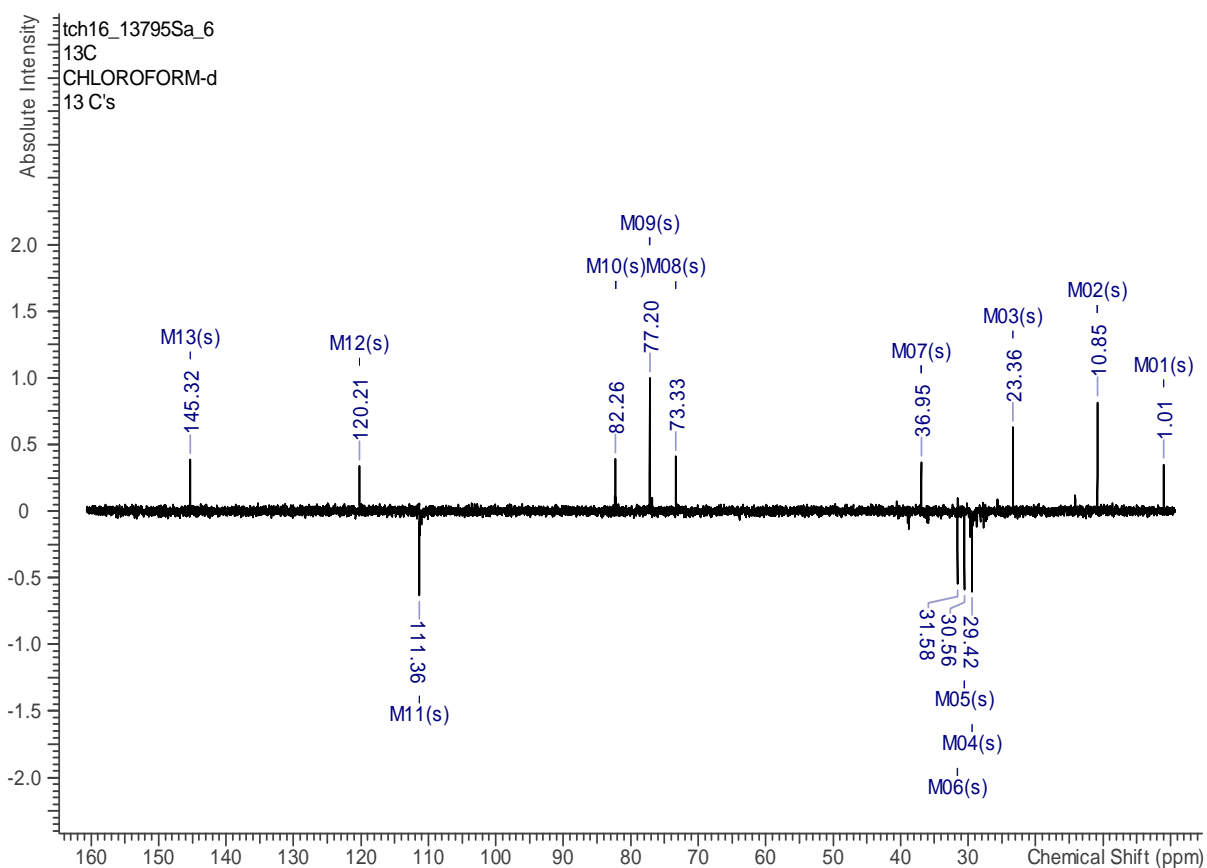


Figure 16: ^1H , ^{13}C HSQC NMR spectrum of elgonene A (**2**) in CDCl_3 (500 MHz, 125 MHz)

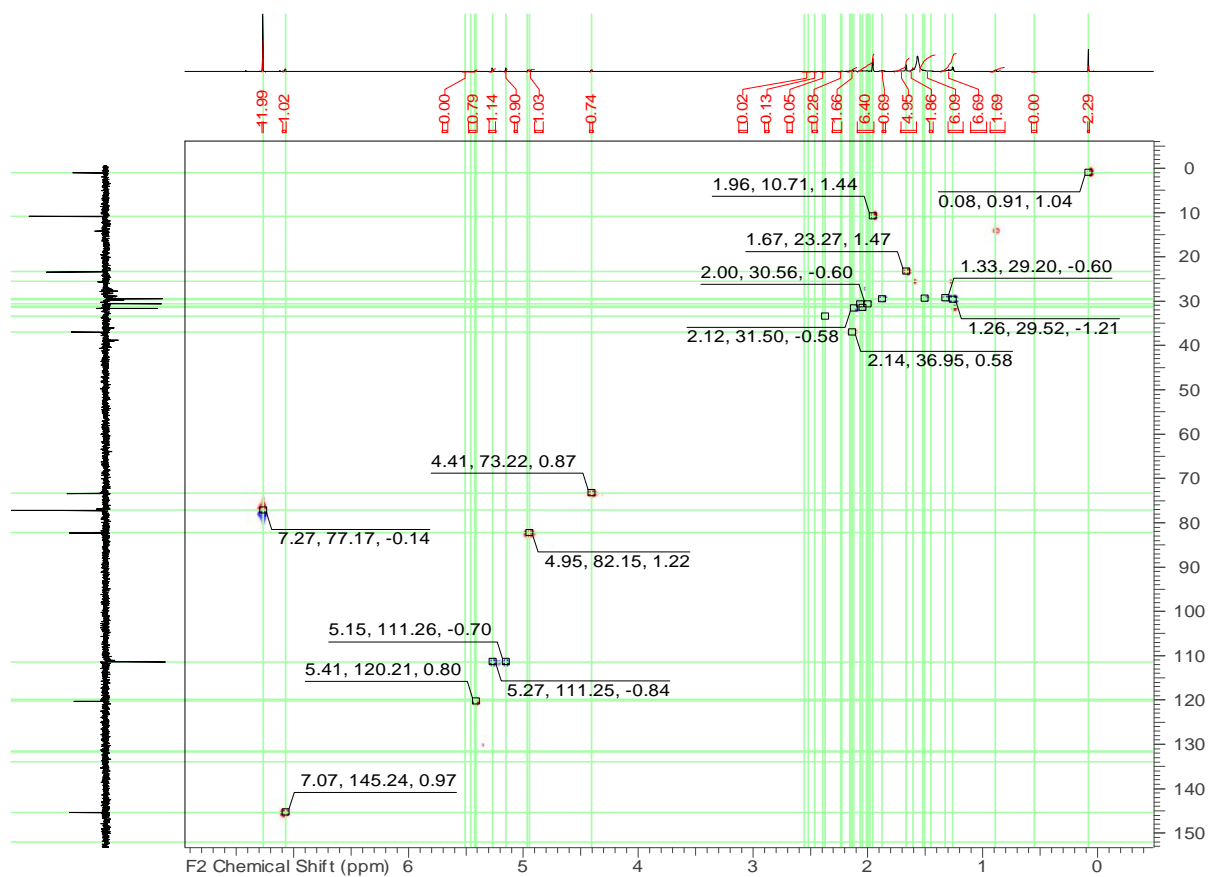


Figure 17: ^1H , ^{13}C HMBC NMR spectrum of elgonene A (**2**) in CDCl_3 (500 MHz, 125 MHz)

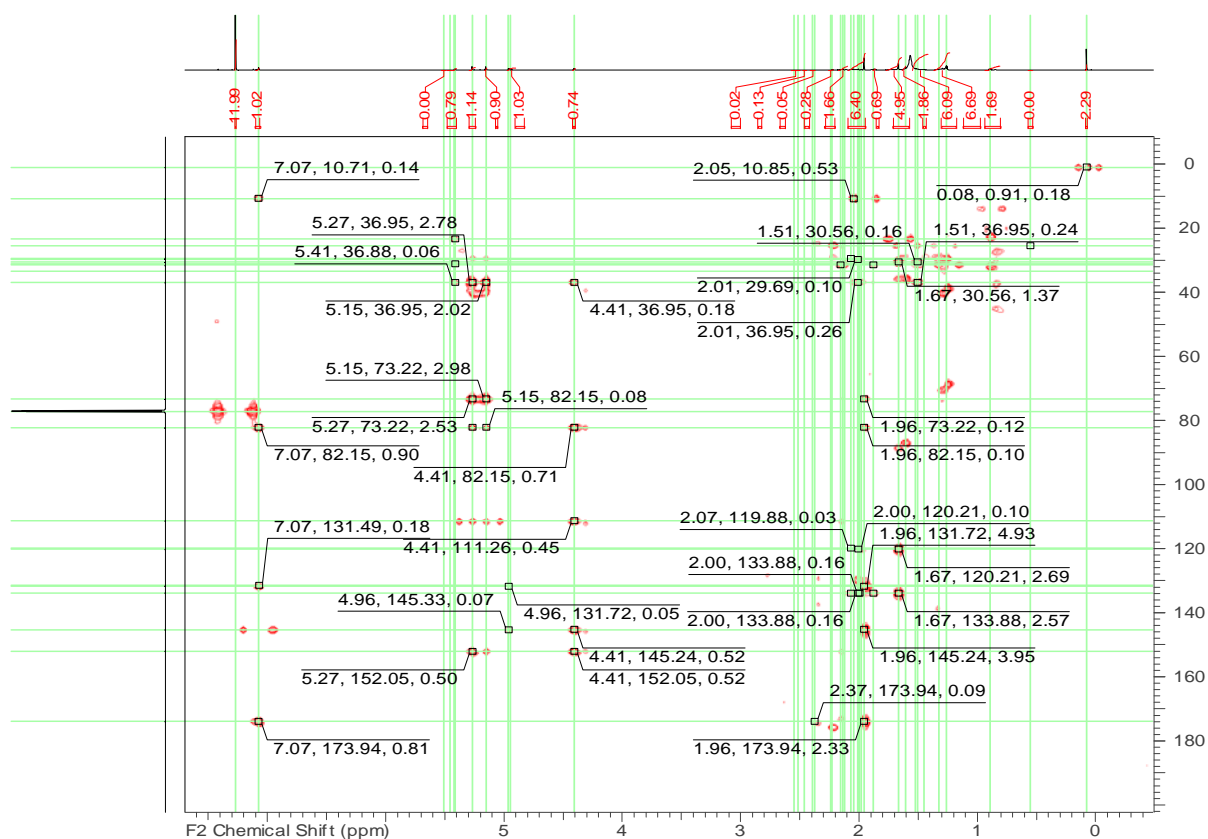


Figure 18: ^1H , ^1H COSY NMR spectrum of elgonene A (**2**) in CDCl_3 (500 MHz)

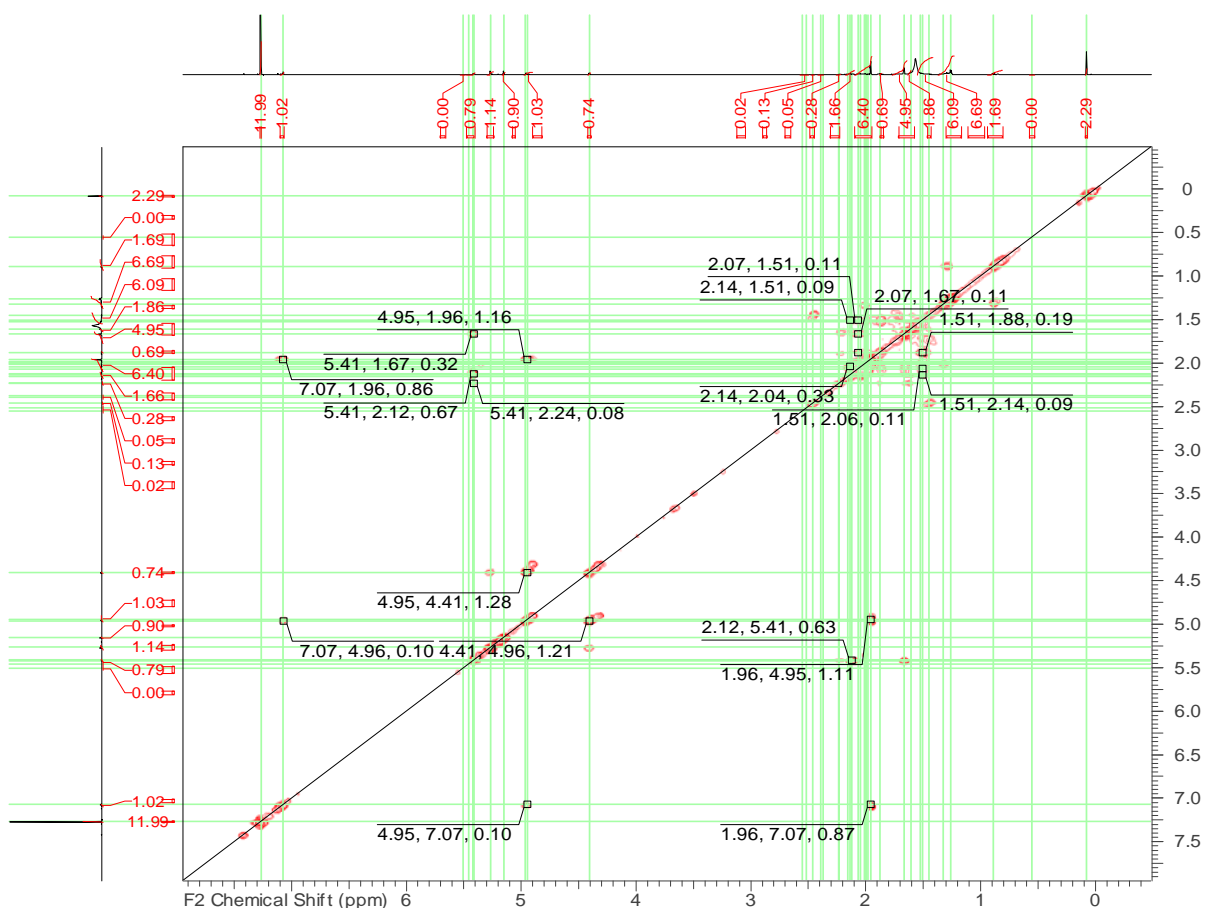


Figure 19: ^1H , ^1H ROESY NMR spectrum of elgonene A (**2**) in CDCl_3 (500 MHz)

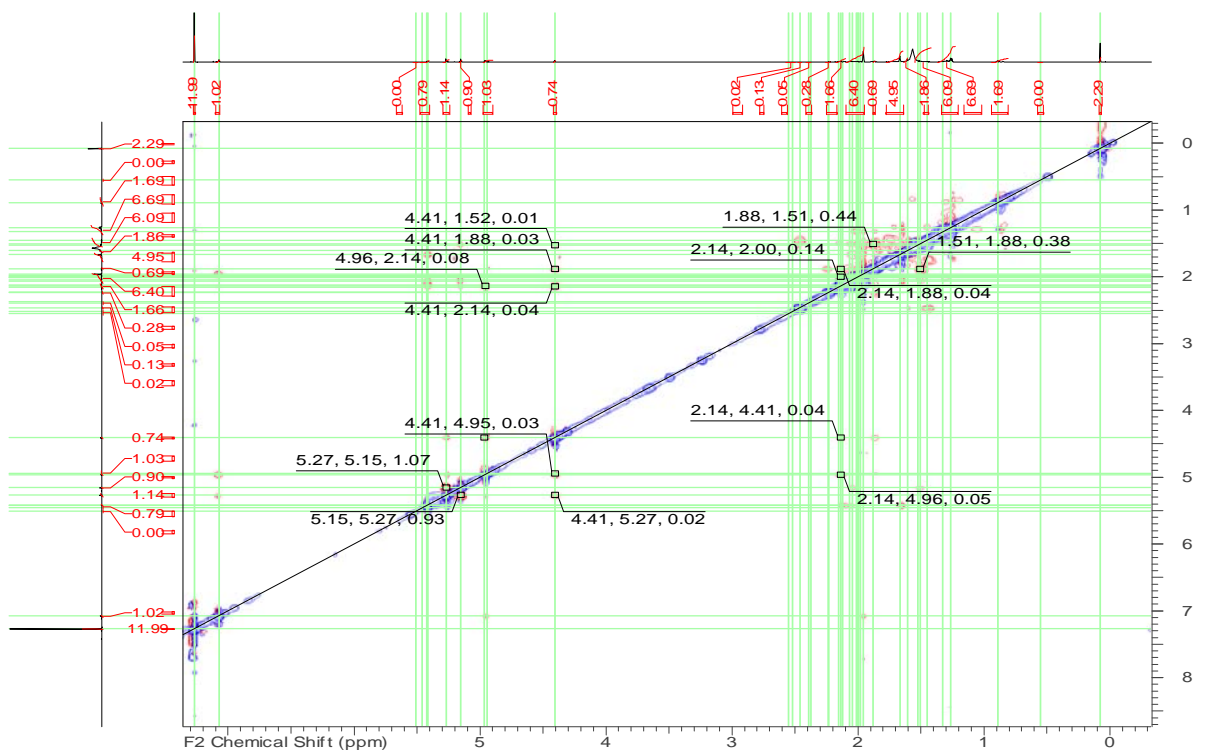


Figure 20: HR-ESIMS spectrum of elgonene A (**2**)

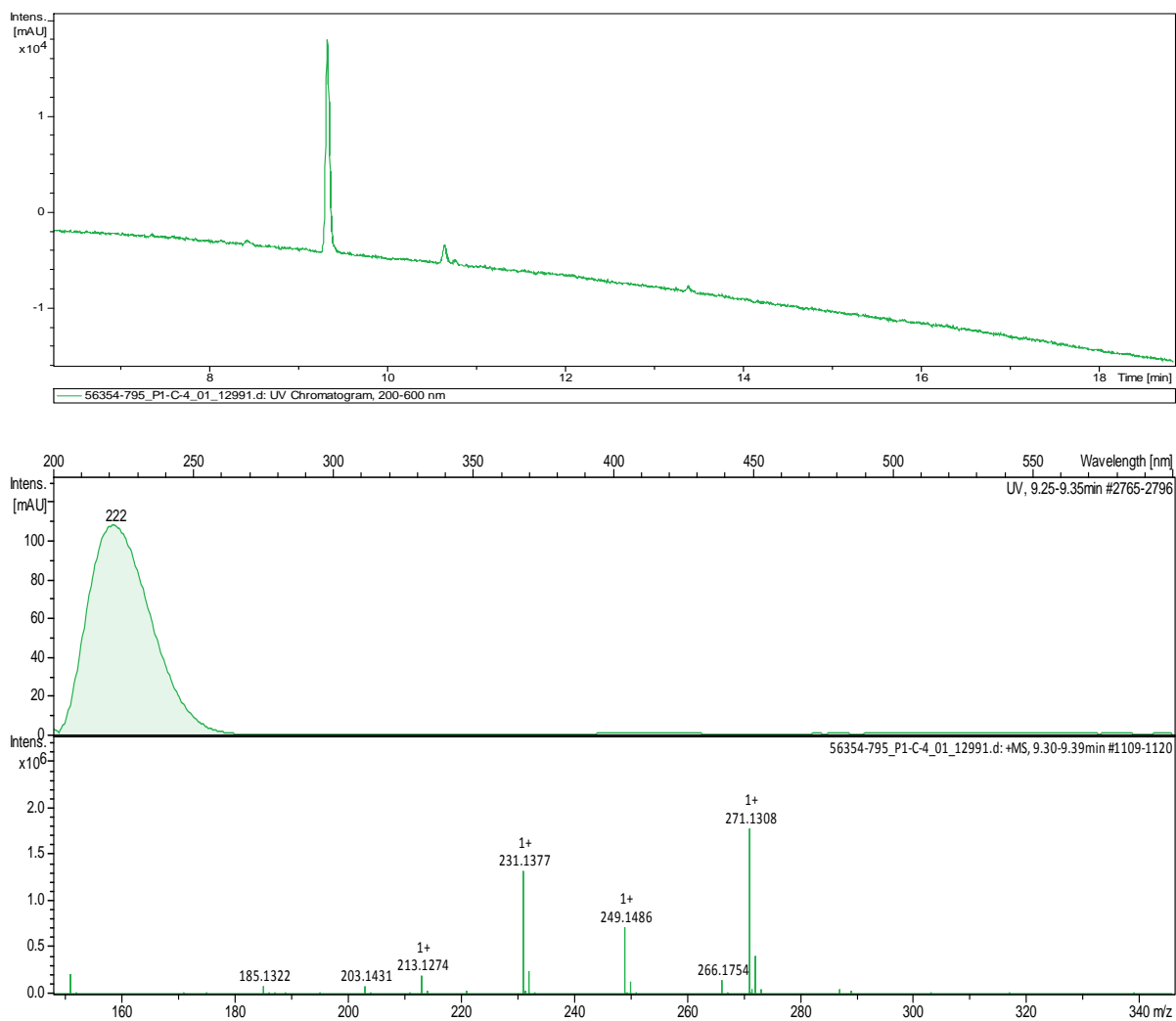


Figure 21: ¹HNMR spectrum of elgonene A (2) *S*- MTPA ester in pyridine d₅ (700 MHz)

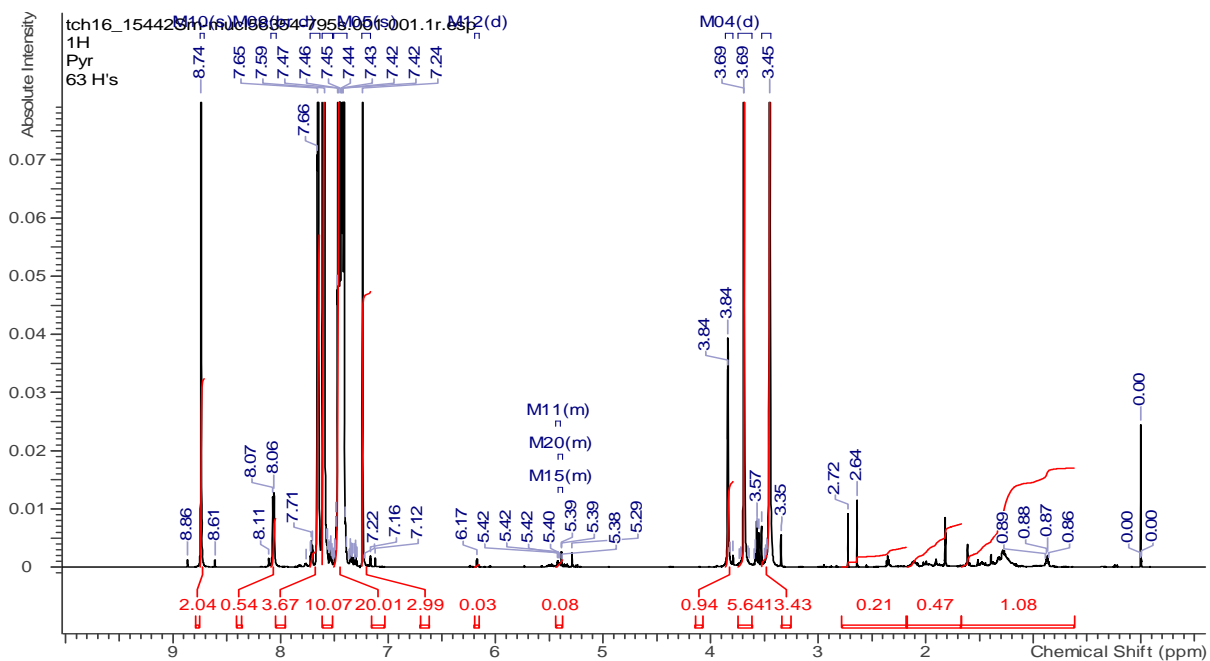


Figure 22: ^1H , ^1H COSY spectrum of elgonene A (2) *S*- MTPA ester in pyridine d_5 (700 MHz)

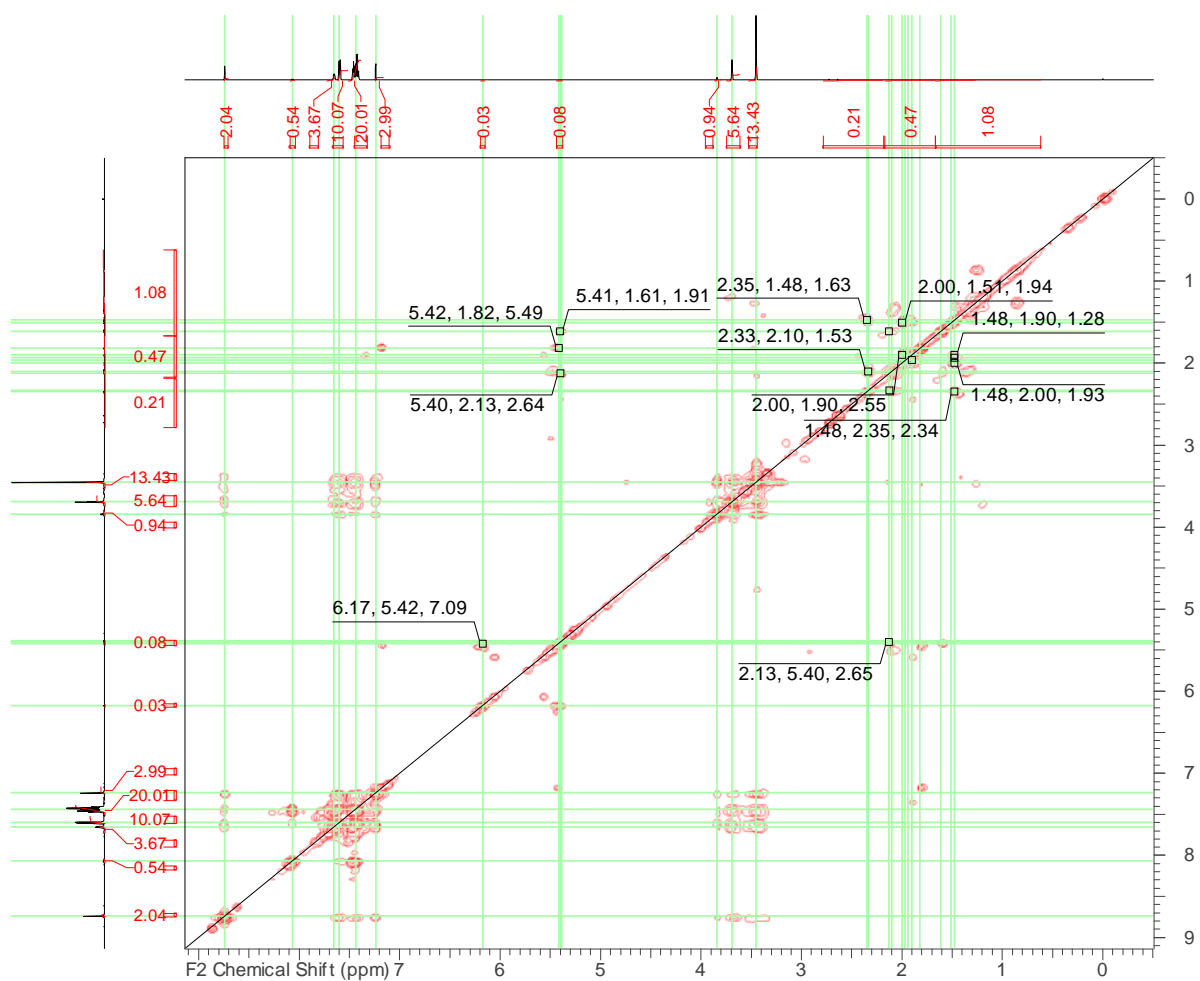


Figure 23: ^1H NMR spectrum of elgonene A (2) *R*- MTPA ester in pyridine d_5 (700 MHz)

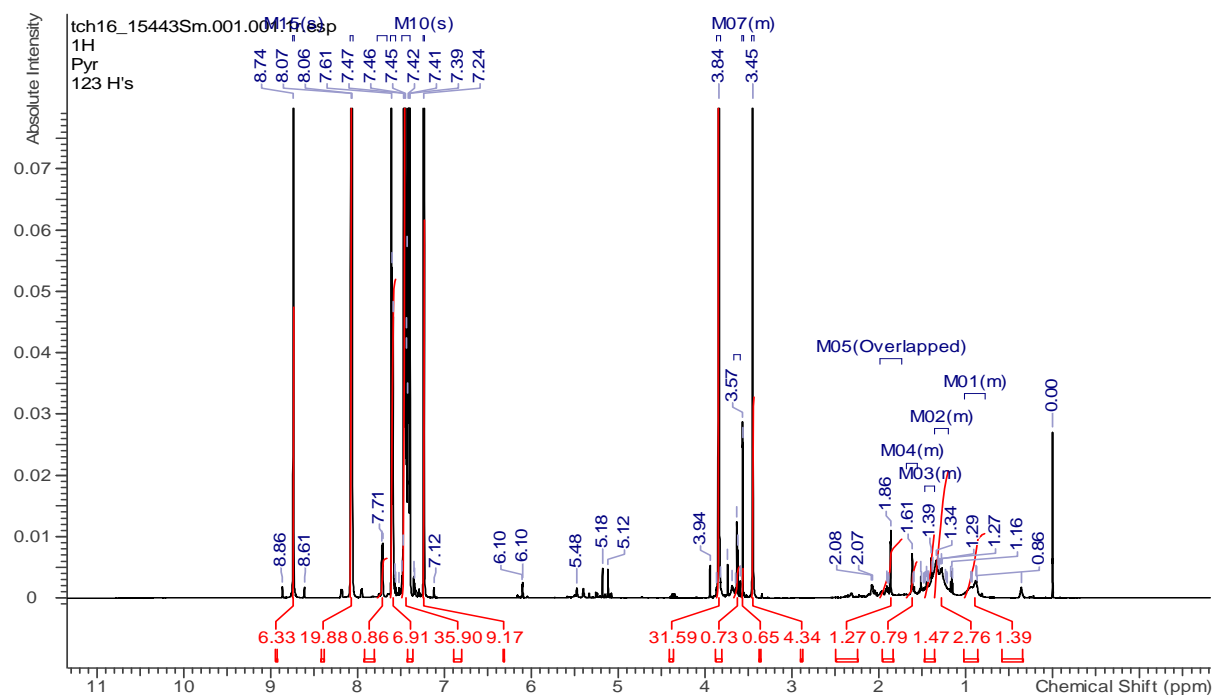
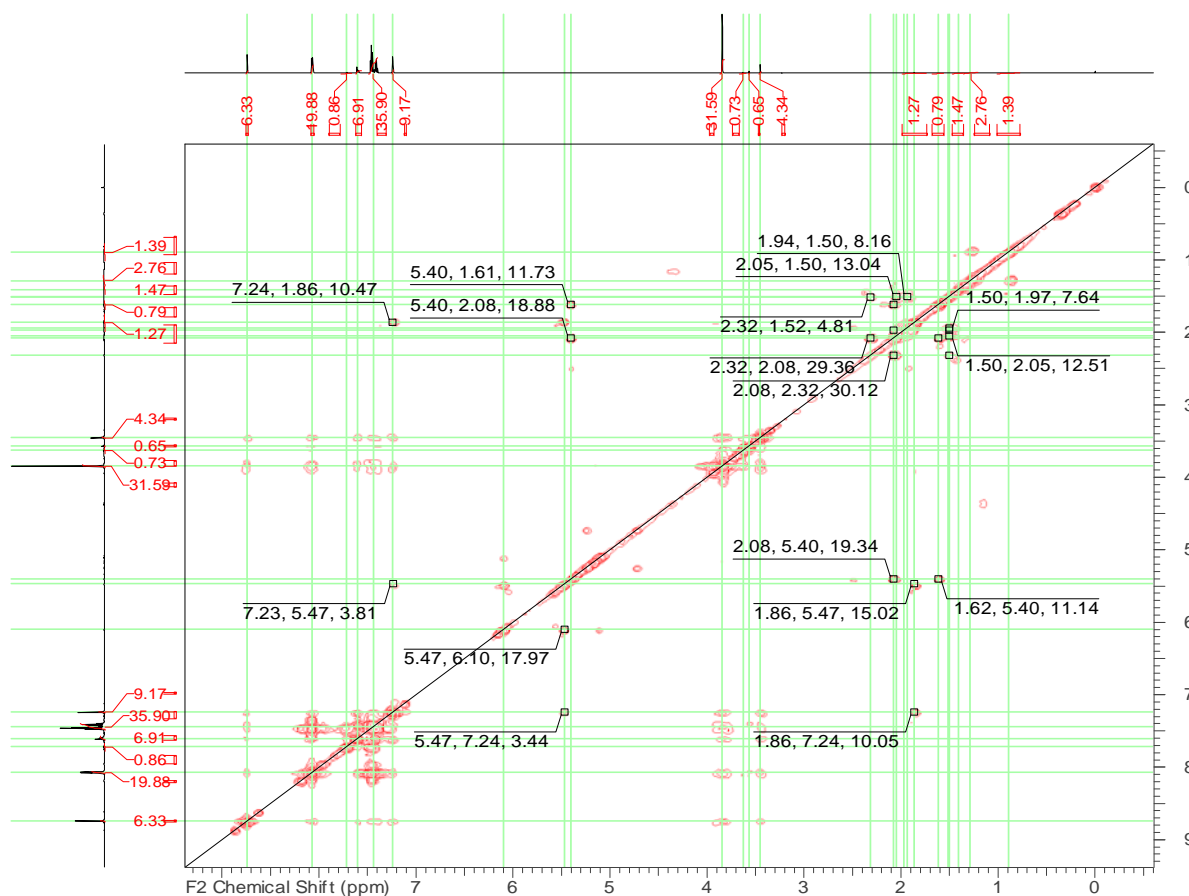


Figure 24: ^1H , ^1H COSY spectrum of elgonene A (2) *R*- MTPA ester in pyridine d_5 (700 MHz)



1 and 2D NMR data for elgonene B (3)

Figure 25: ^1H NMR spectrum of elgonene B (3) in CDCl_3 (500 MHz)

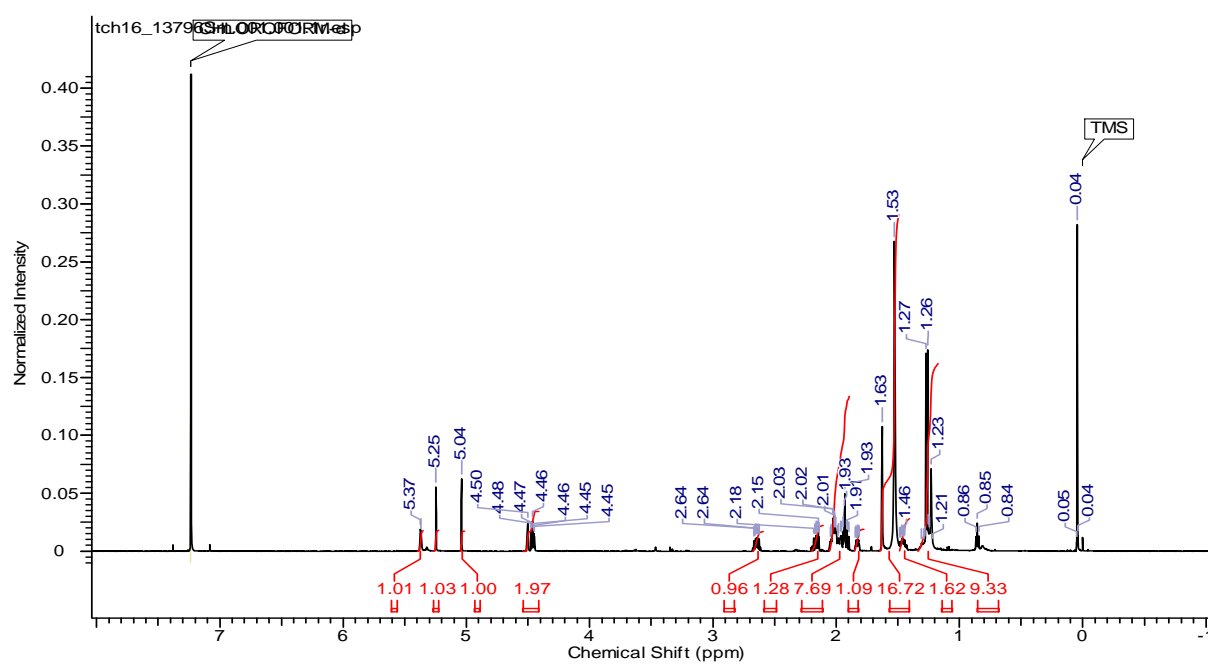


Figure 26: ^{13}C NMR spectrum of elgonene B (**3**) in CDCl_3 (125 MHz)

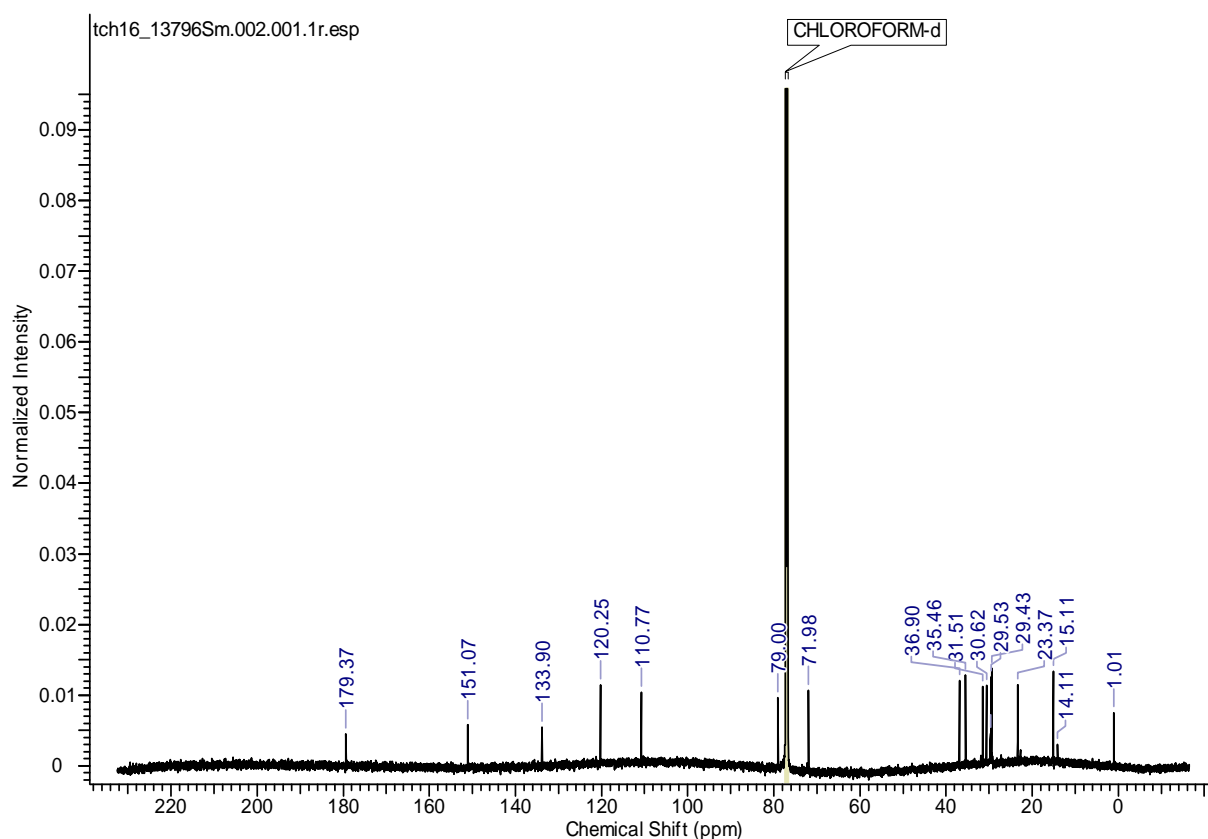


Figure 27: DEPT NMR spectrum of elgonene B (**3**) in CDCl_3 (125 MHz)

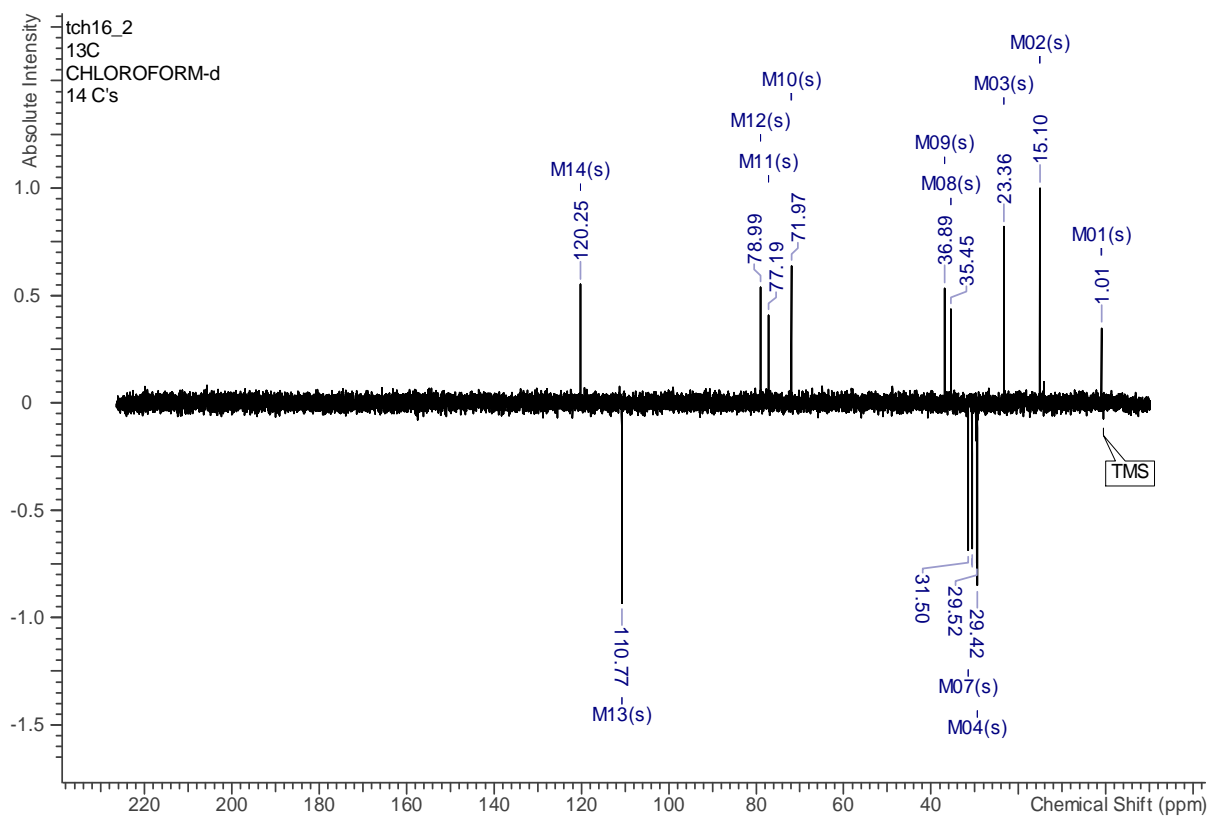


Figure 28: ^1H , ^{13}C HSQC NMR spectrum of elgonene B (**3**) in CDCl_3 (500 MHz, 125 MHz)

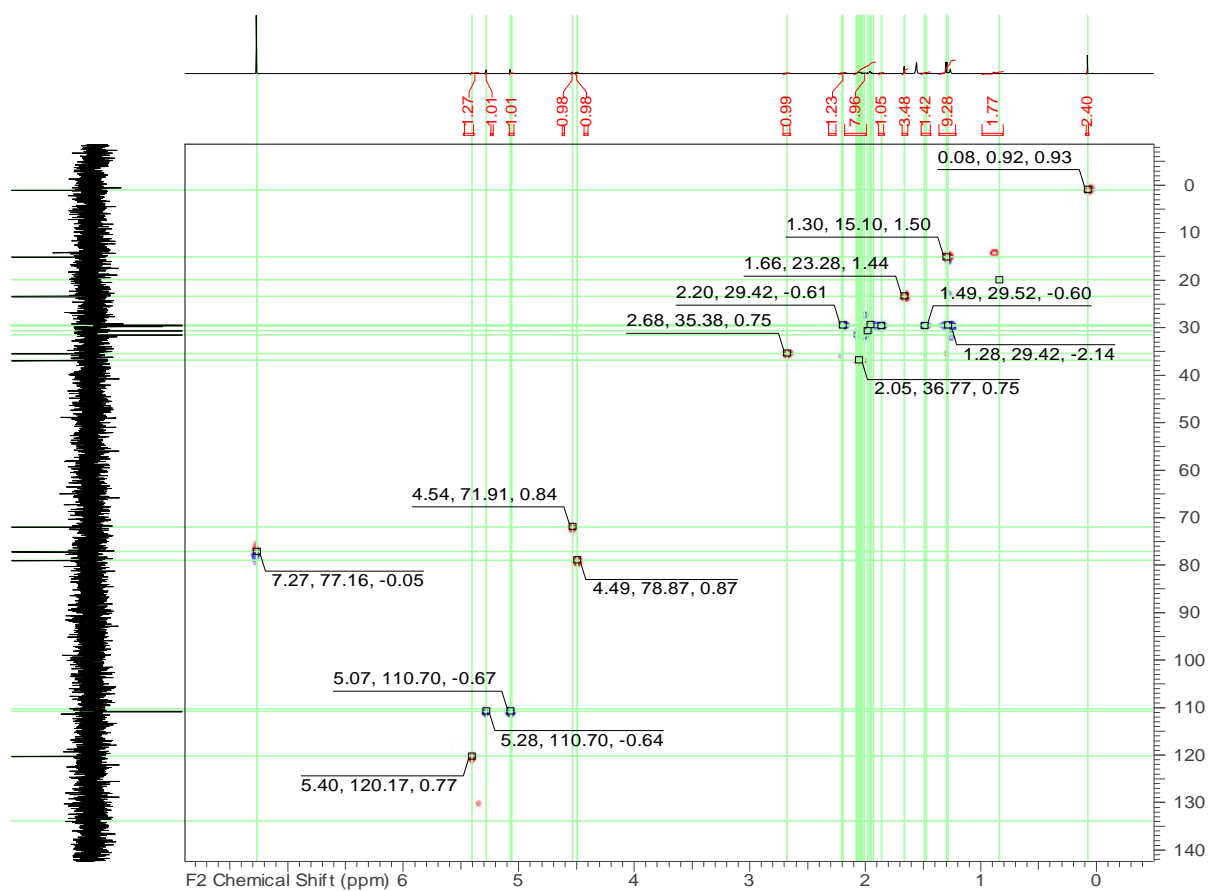


Figure 29: ^1H , ^{13}C HMBC NMR spectrum of elgonene B (**3**) in CDCl_3 (500 MHz, 125 MHz)

Figure 31: ^1H , ^1H ROESY NMR spectrum of elgonene B (**3**) in CDCl_3 (500 MHz)

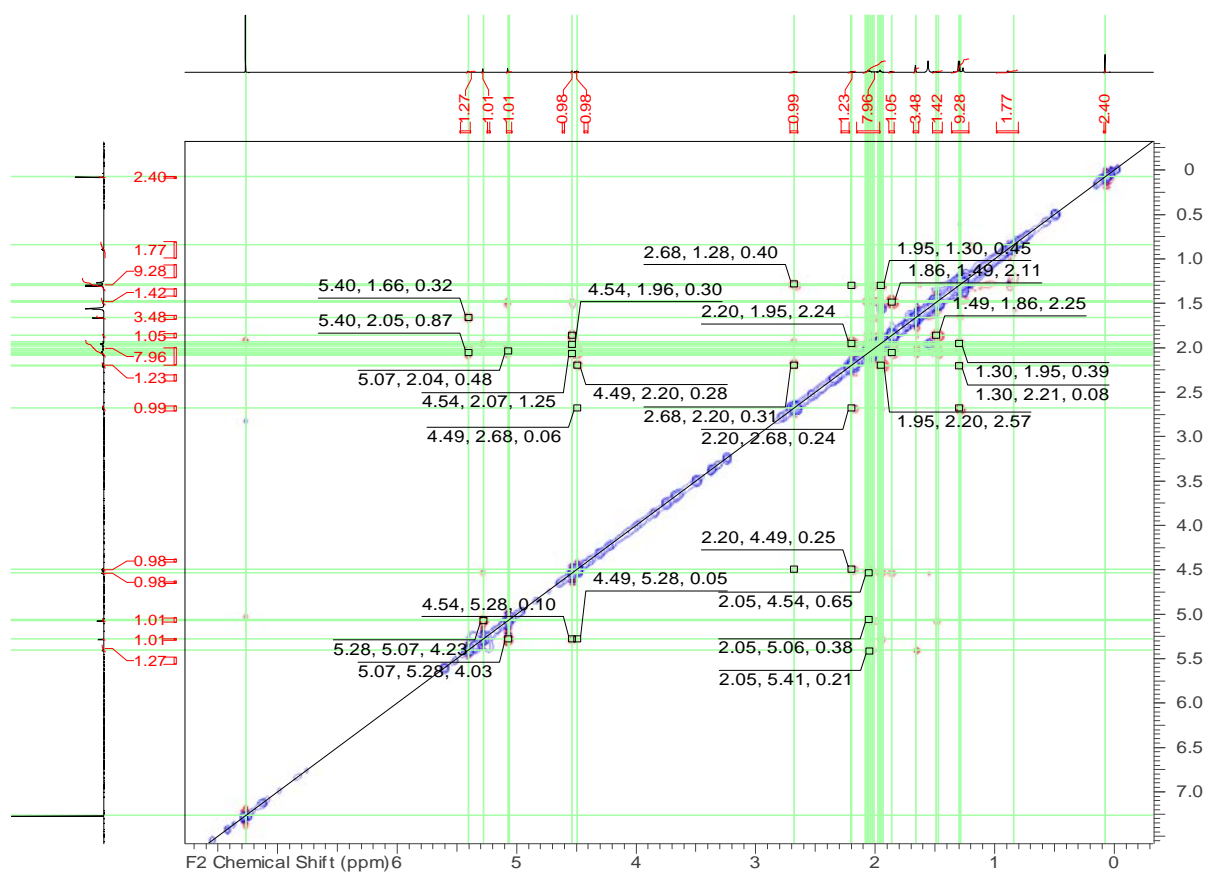
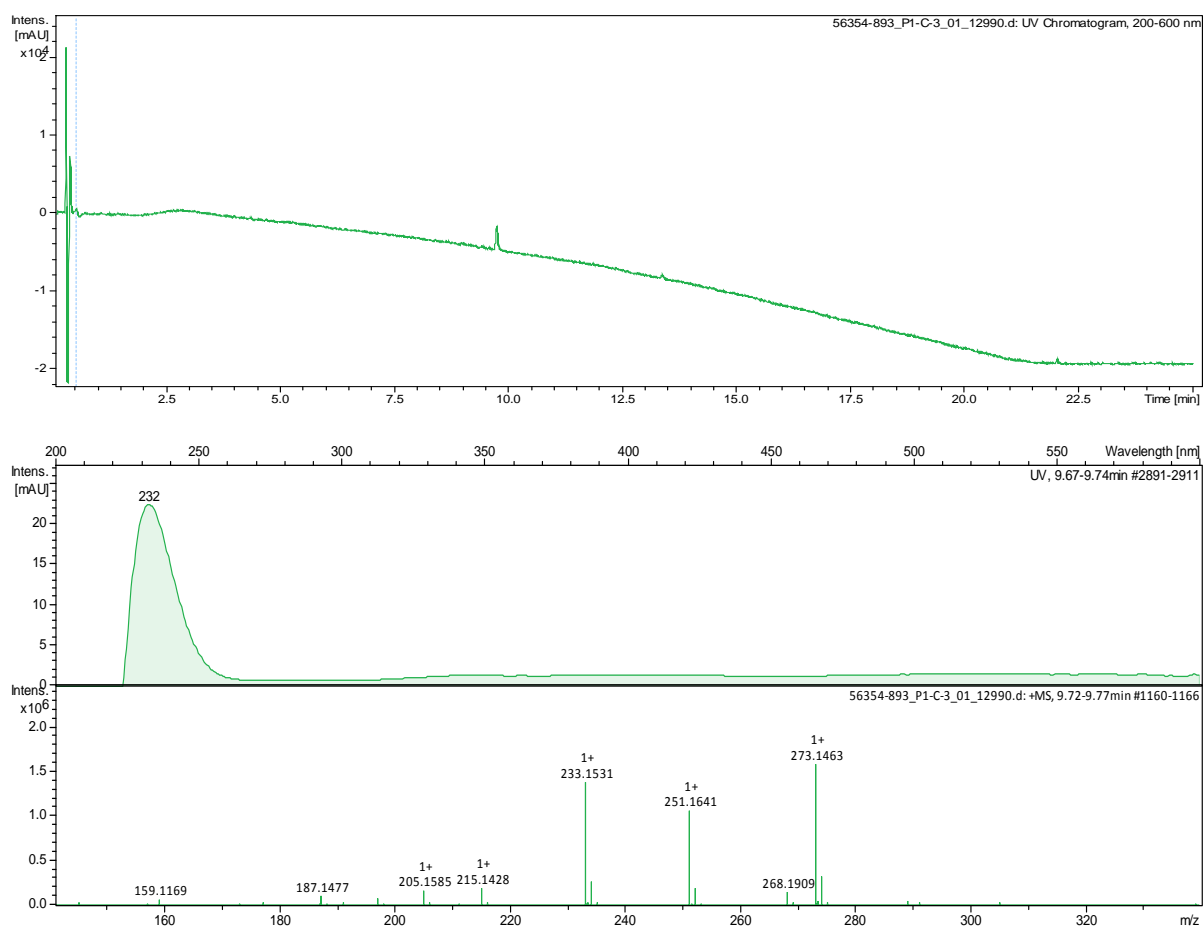


Figure 32: HR-ESIMS spectrum of elgonene B (3)



1 and 2D NMR data for elgonene C (4)

Figure 33: ^1H NMR spectrum of elgonene C (4) in CDCl_3 (500 MHz)

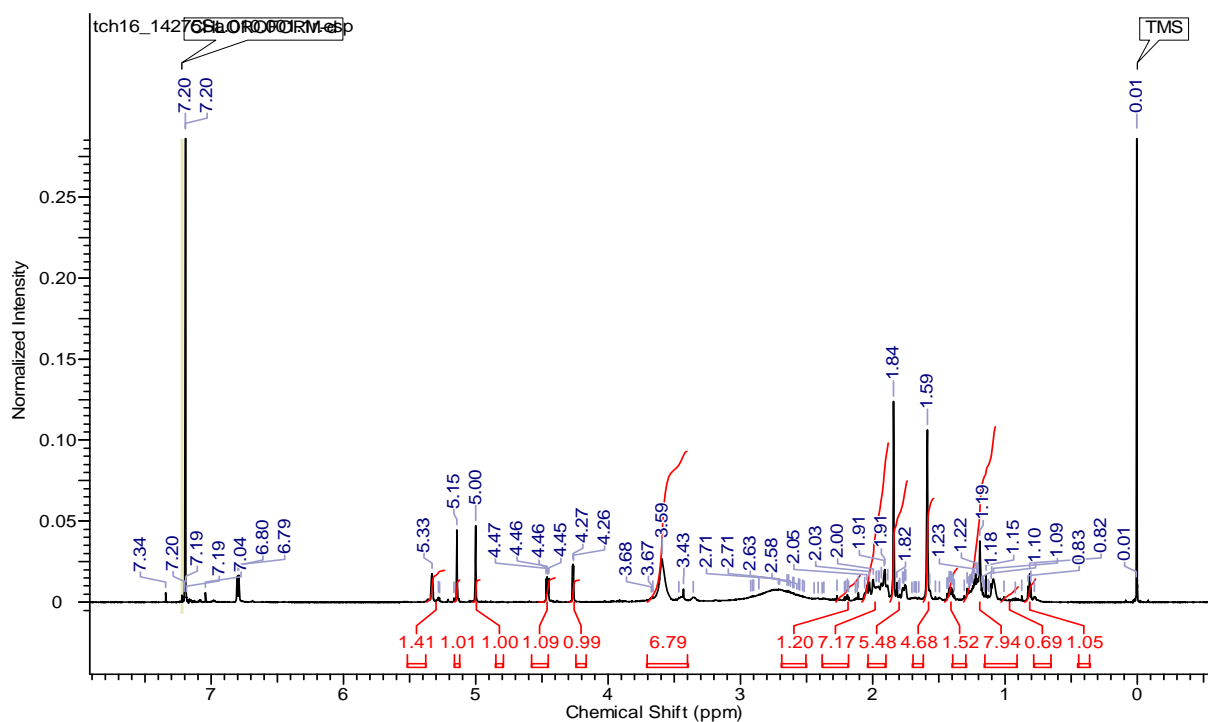


Figure 34: ^{13}C NMR spectrum of elgonene C (**4**) in CDCl_3 (125 MHz)

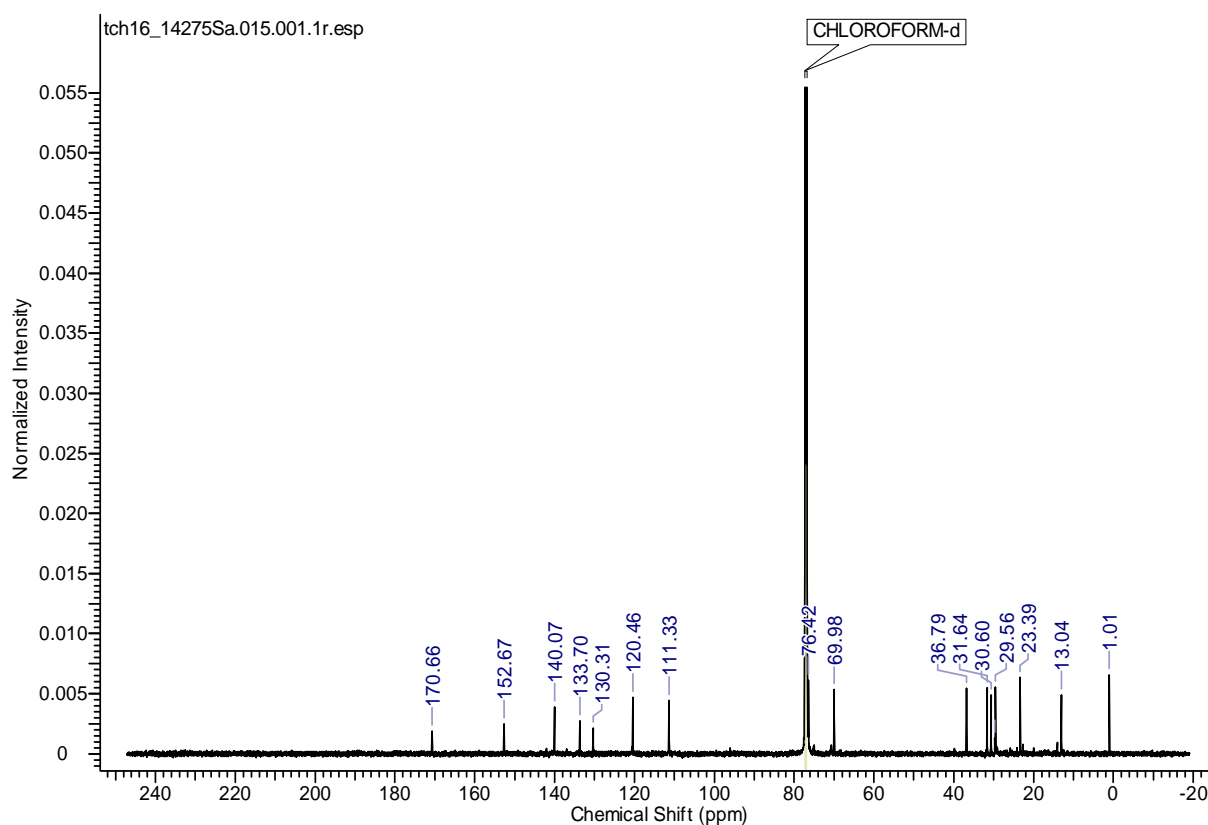


Figure 35: DEPT NMR spectrum of elgonene C (**4**) in CDCl_3 (125 MHz)

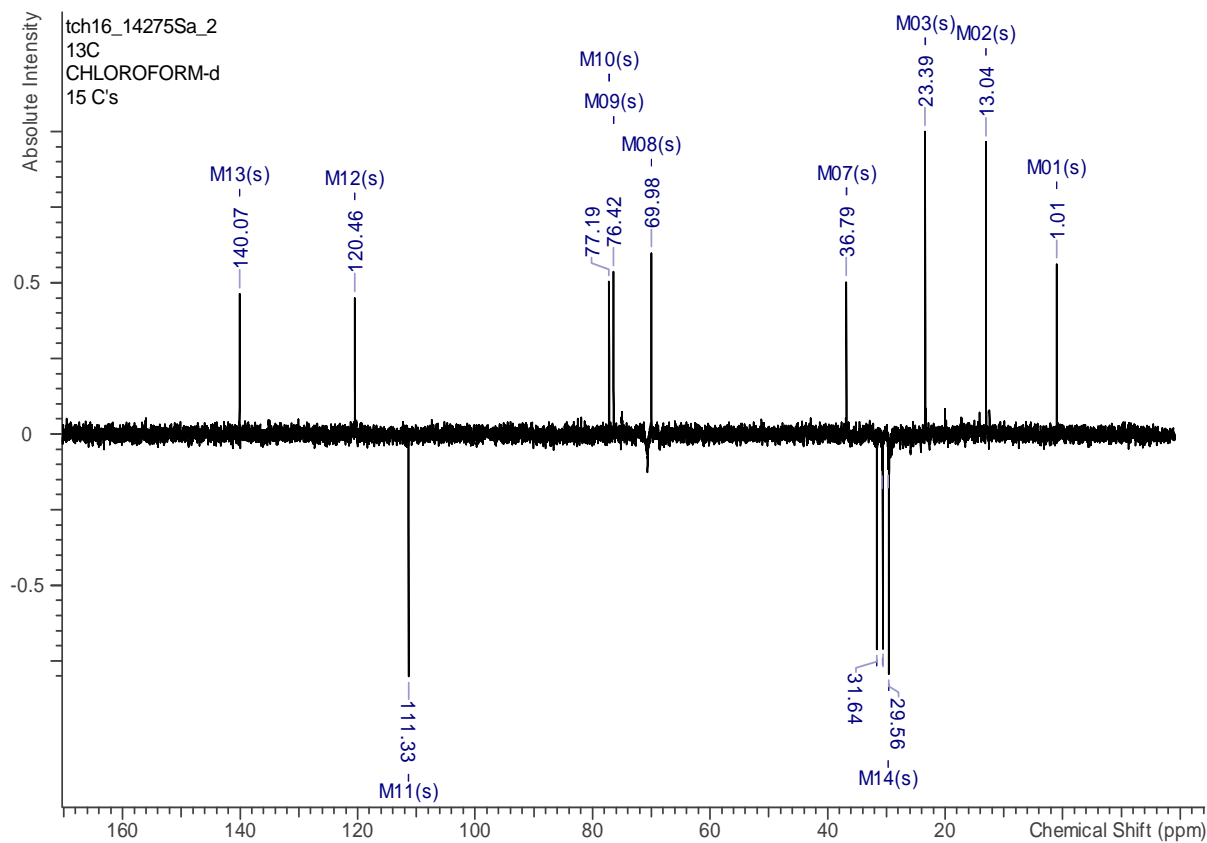


Figure 36: ^1H , ^{13}C HSQC NMR spectrum of elgonene C (**4**) in CDCl_3 (500 MHz, 125 MHz)

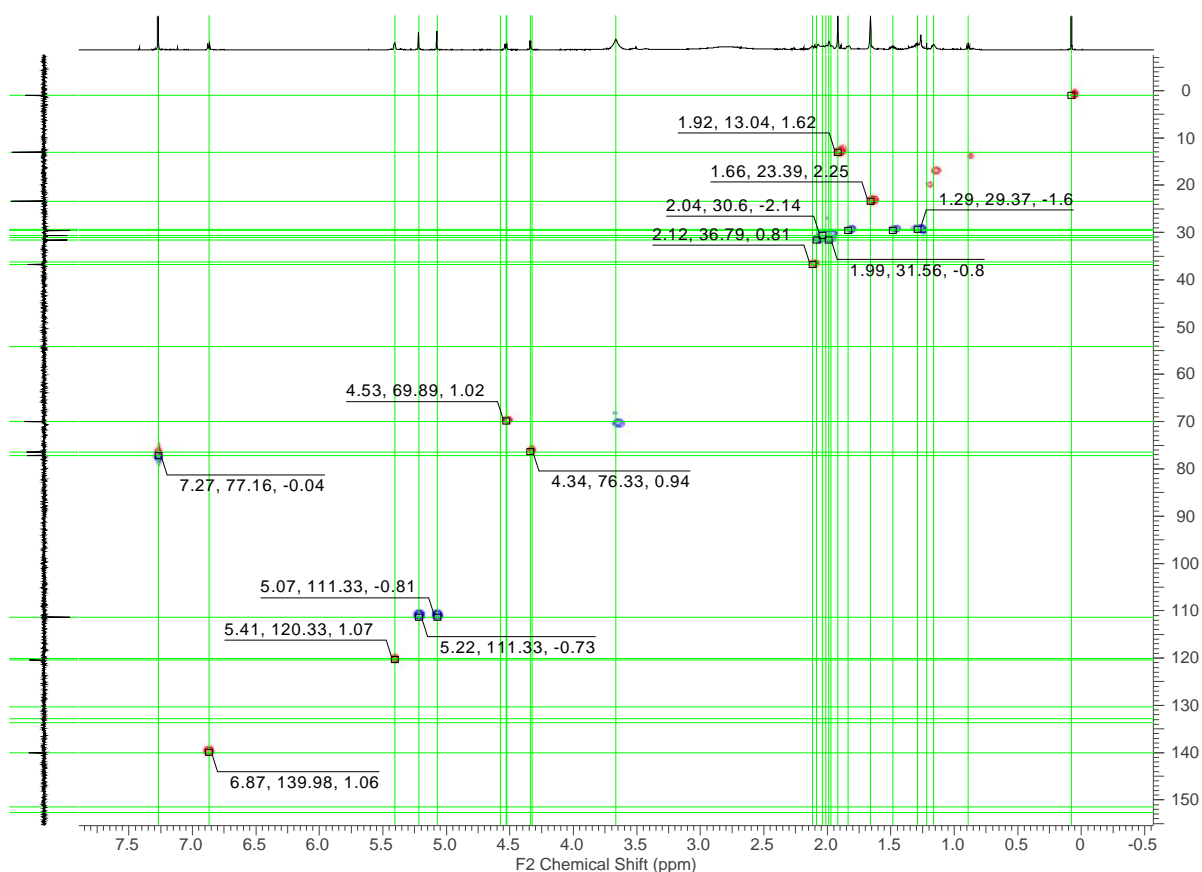


Figure 37: ^1H , ^{13}C HMBC NMR spectrum of elgonene C (**4**) in CDCl_3 (500 MHz, 125 MHz)

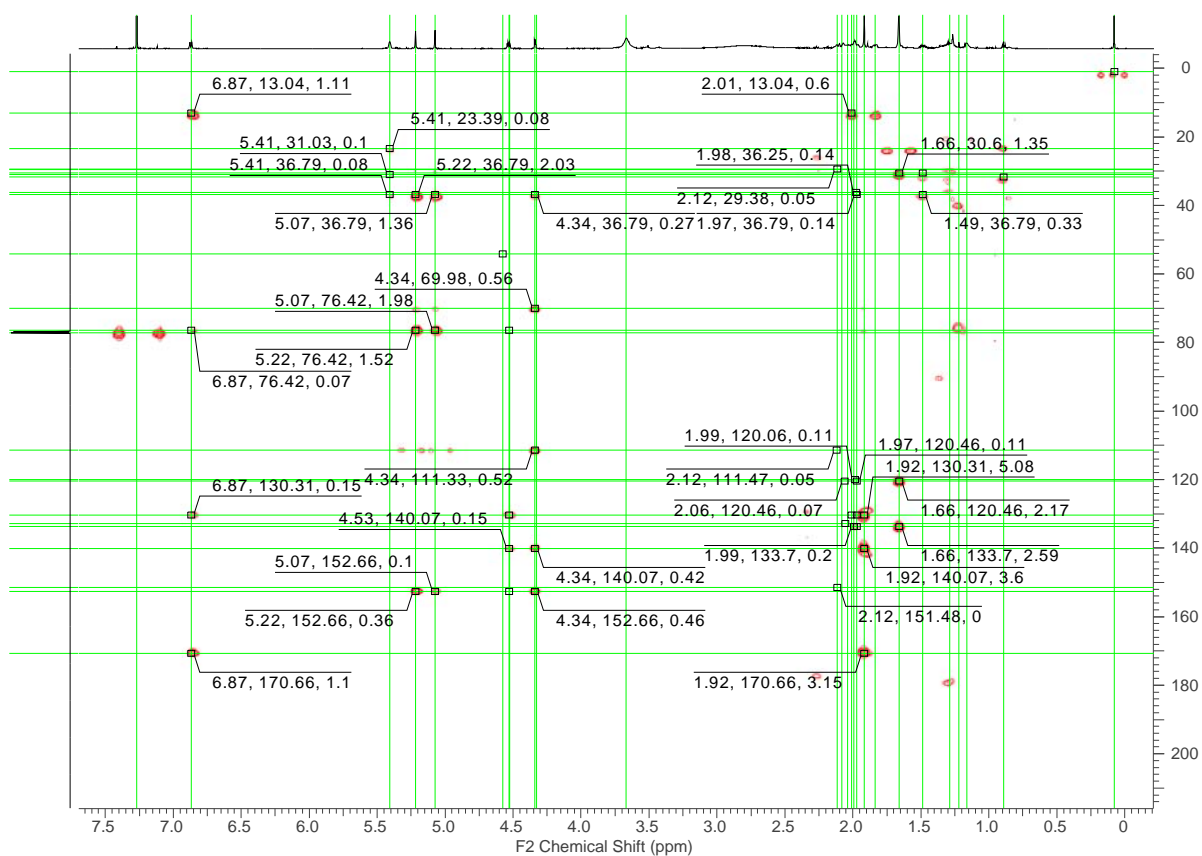


Figure 38: ^1H , ^1H COSY NMR spectrum of elgonene C (**4**) in CDCl_3 (500 MHz)

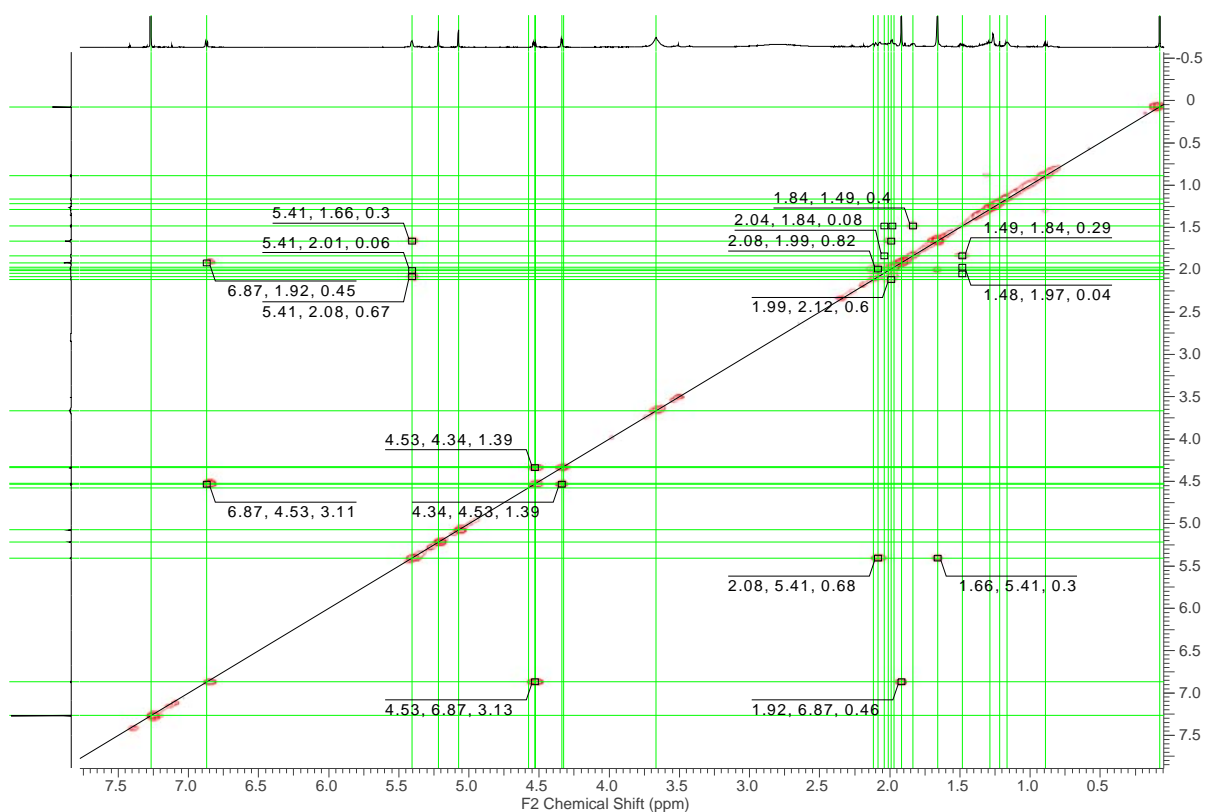


Figure 39: ^1H , ^1H ROESY NMR spectrum of elgonene C (**4**) in CDCl_3 (500 MHz)

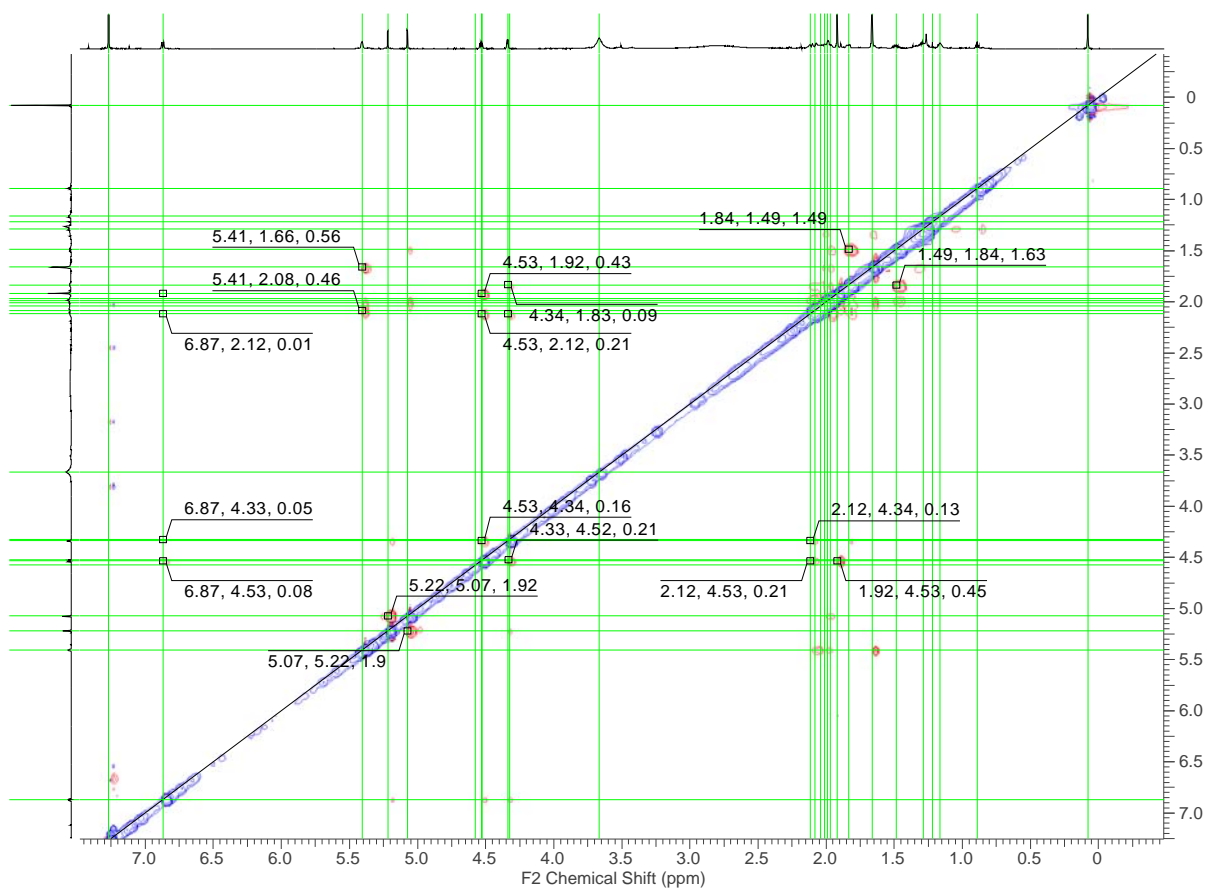
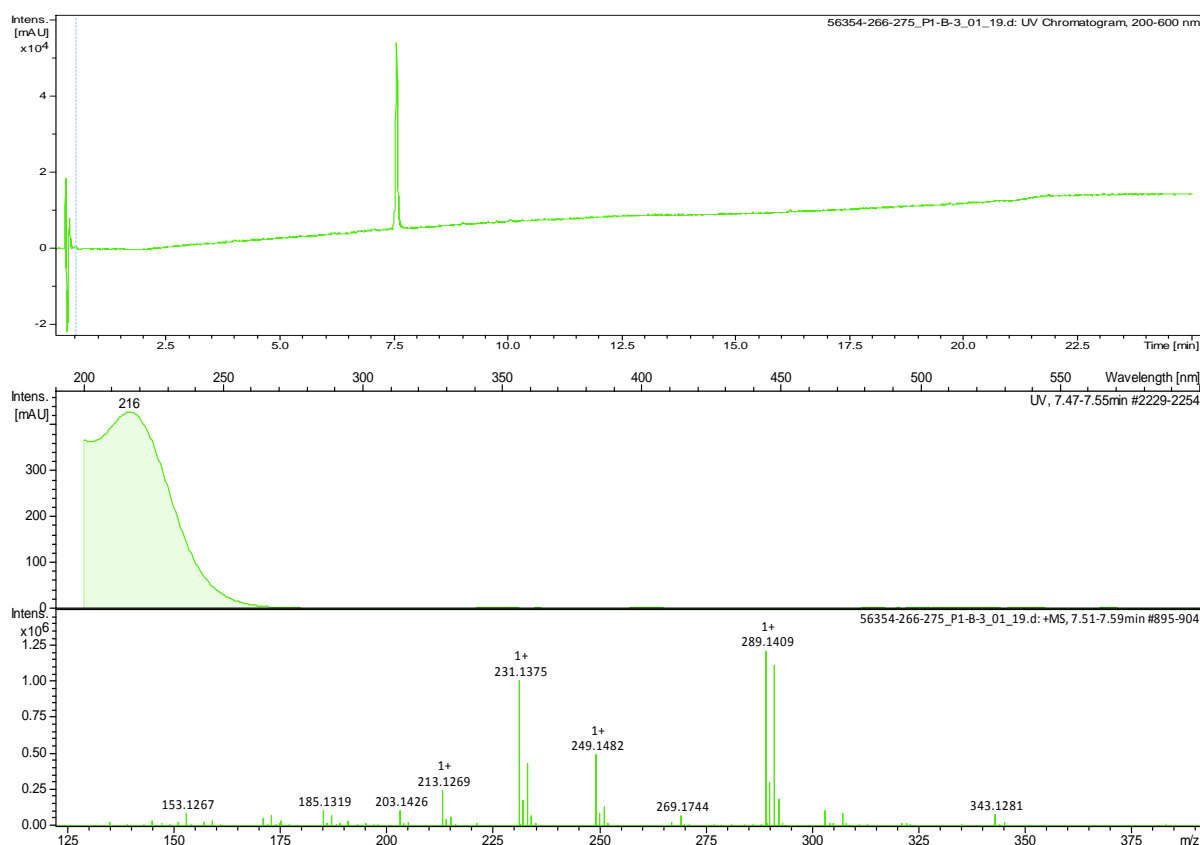


Figure 40: HR-ESIMS spectrum of elgonene C (4)



1 and 2D NMR data for elgonene D (5)

Figure 41: ^1H NMR spectrum of elgonene D (5) in acetone- d_6 (500 MHz)

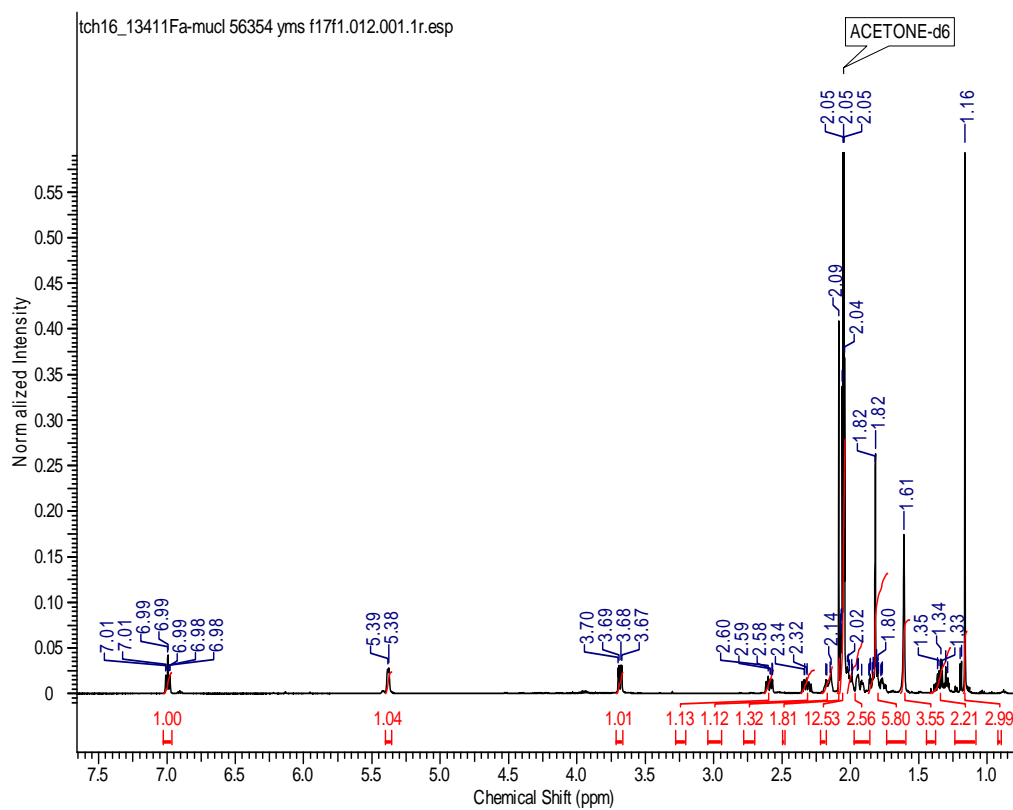


Figure 42: ^{13}C NMR spectrum of elgonene D (**5**) in acetone- d_6 (125 MHz)

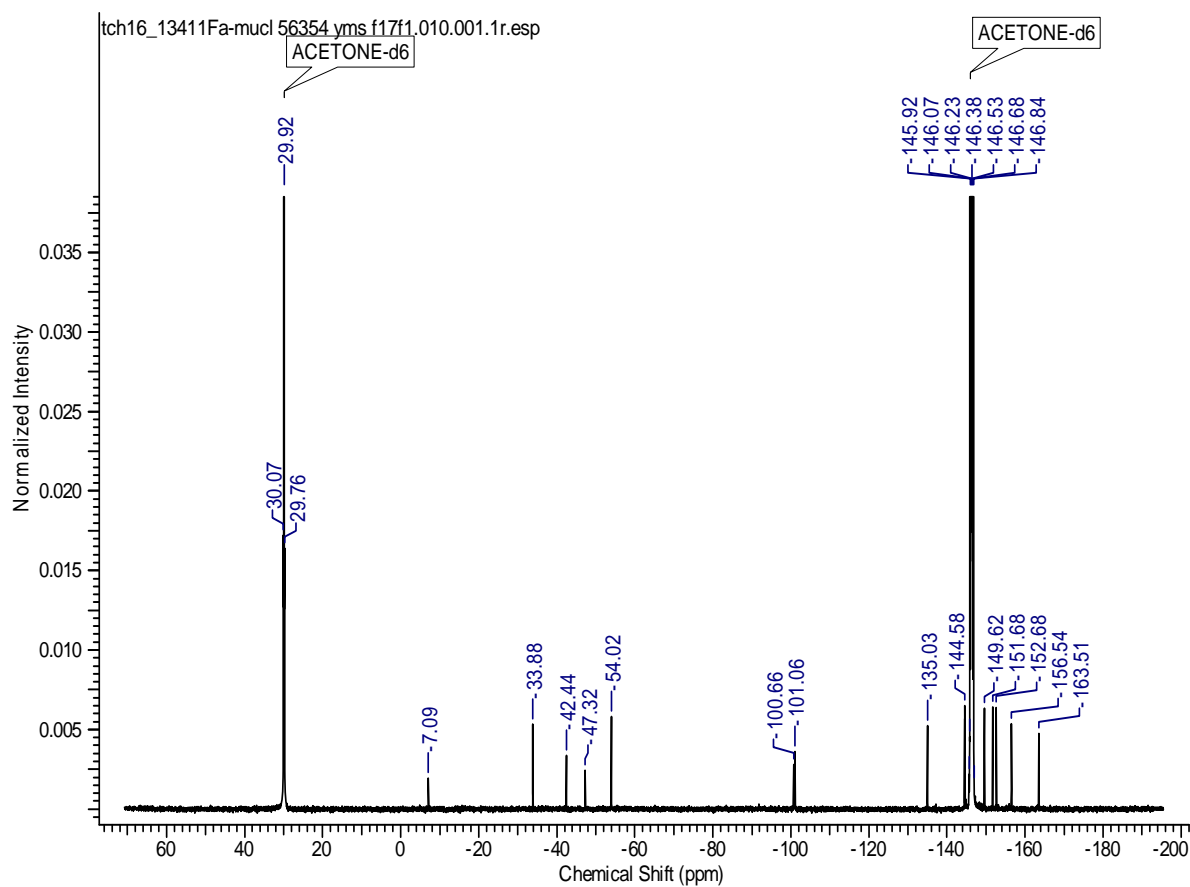


Figure 43: DEPT NMR spectrum of elgonene D (**5**) in acetone- d_6 (125 MHz)

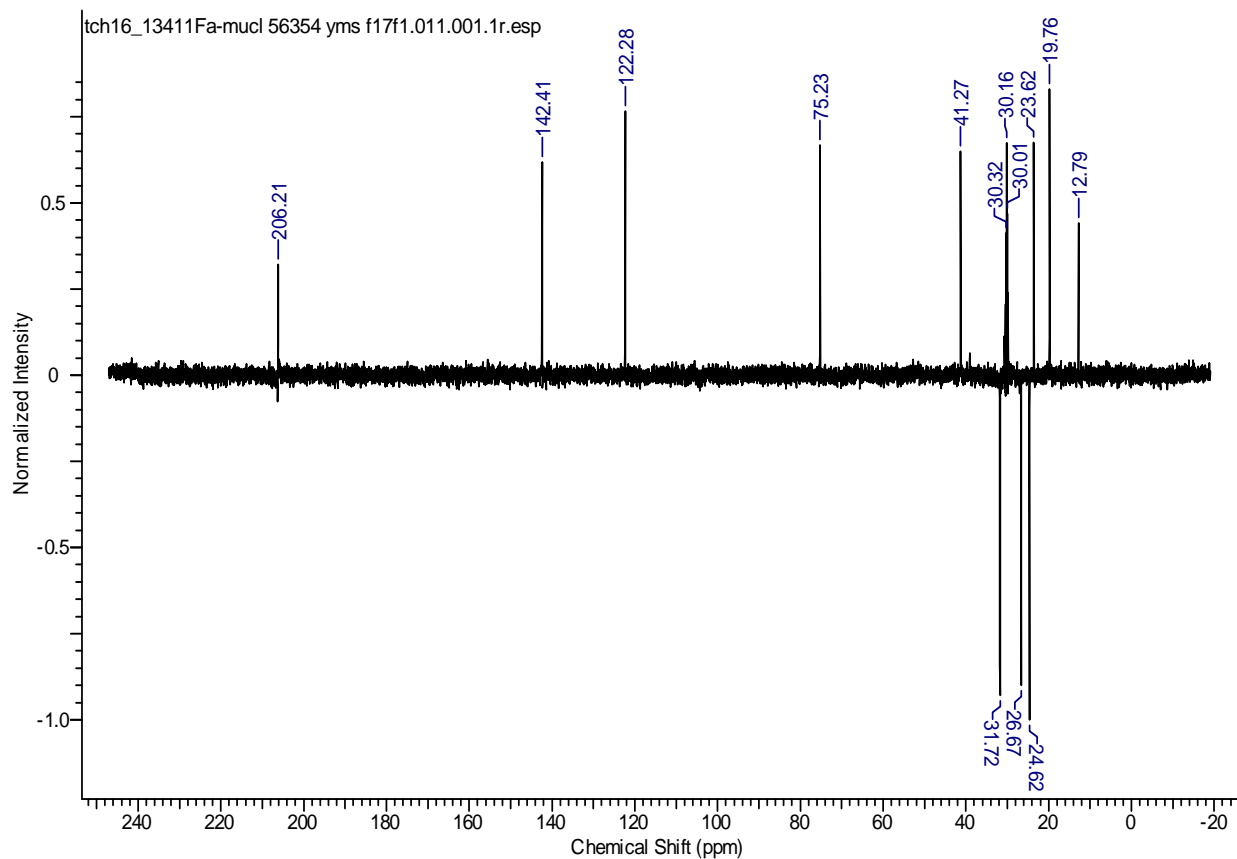


Figure 44: ^1H , ^{13}C HSQC NMR spectrum of elgonene D (**5**) in acetone- d_6 (500 MHz, 125 MHz)

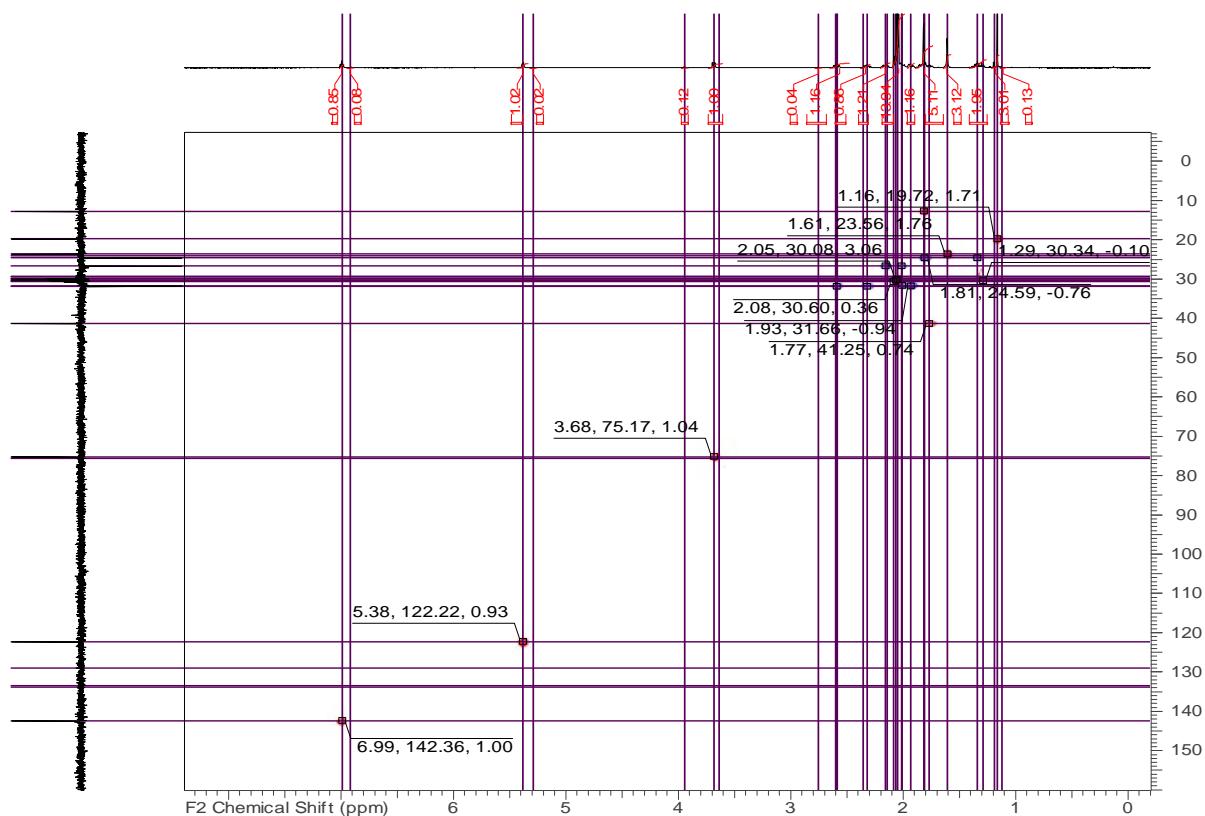


Figure 45: ^1H , ^{13}C HMBC NMR spectrum of elgonene D (**5**) in acetone- d_6 (500 MHz, 125 MHz)

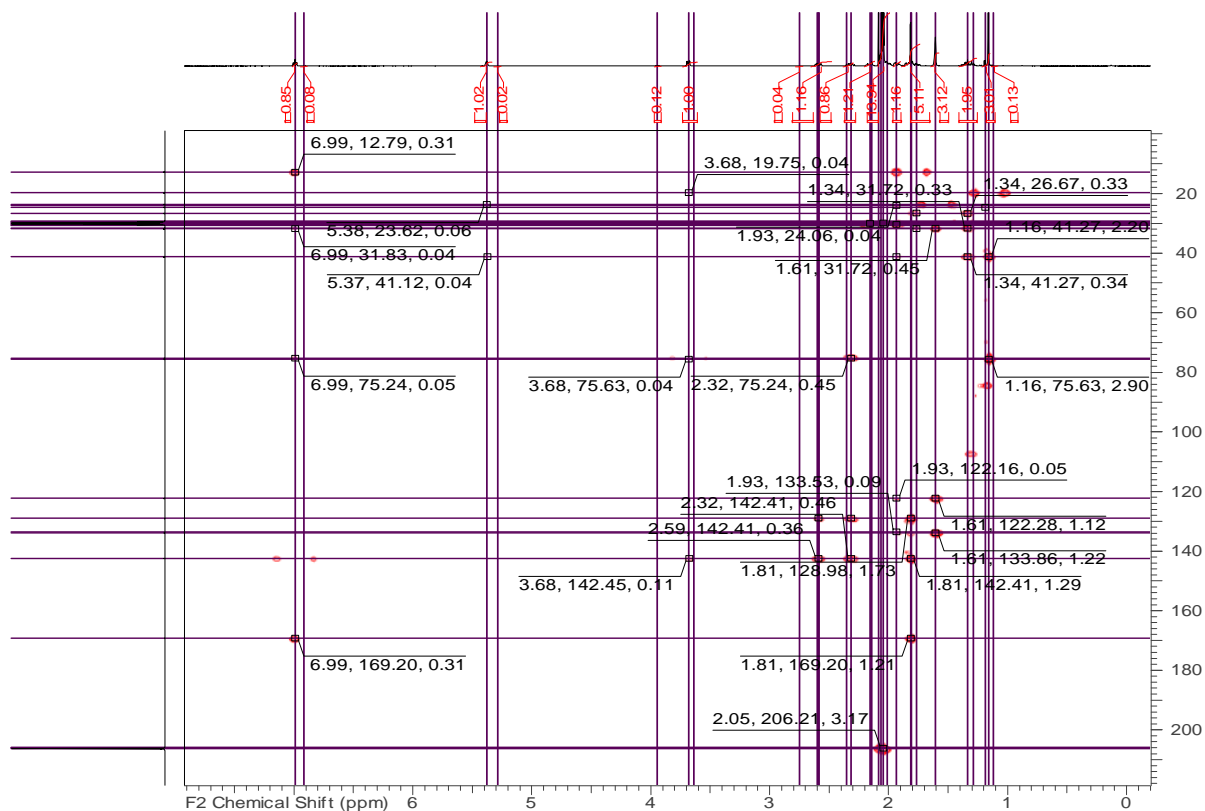


Figure 46: ^1H , ^1H COSY NMR spectrum of elgonene D (**5**) in acetone- d_6 (500 MHz)

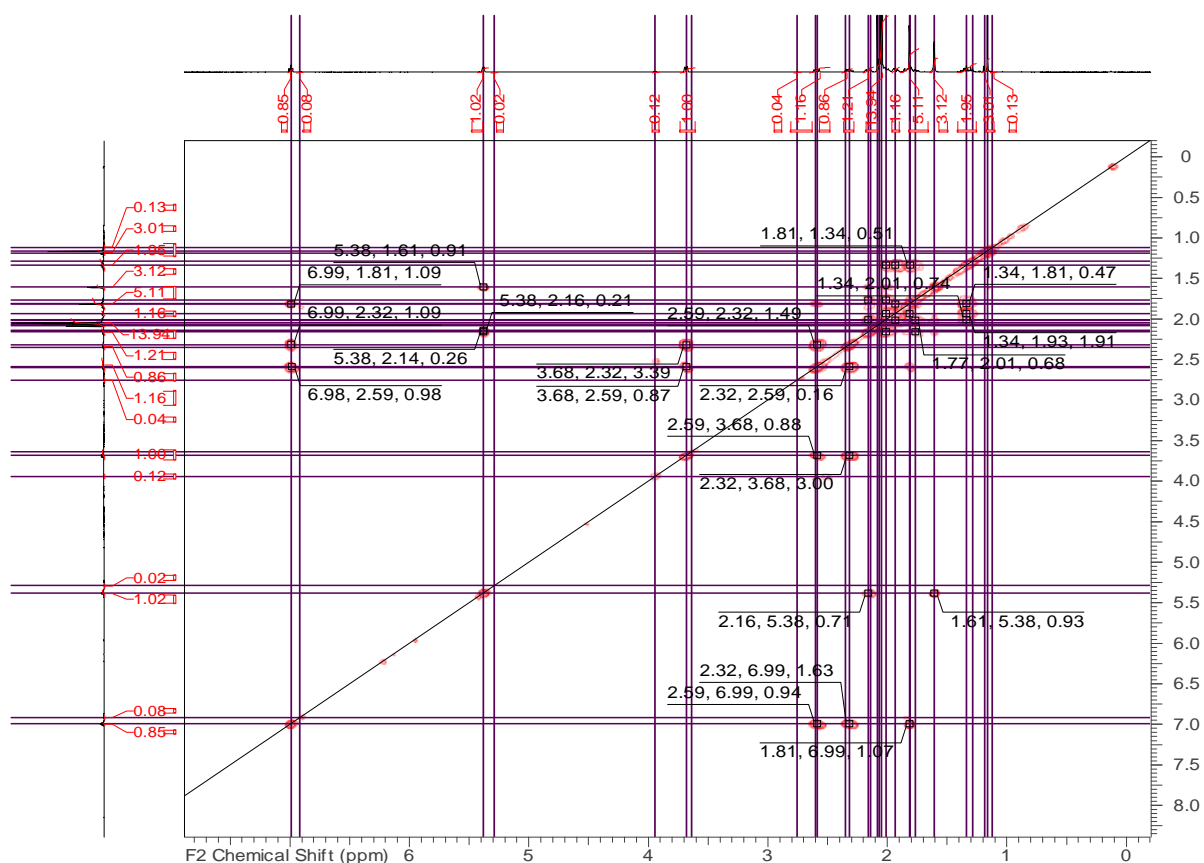


Figure 47: ^1H , ^1H ROESY NMR spectrum of elgonene D (**5**) in acetone- d_6 (500 MHz)

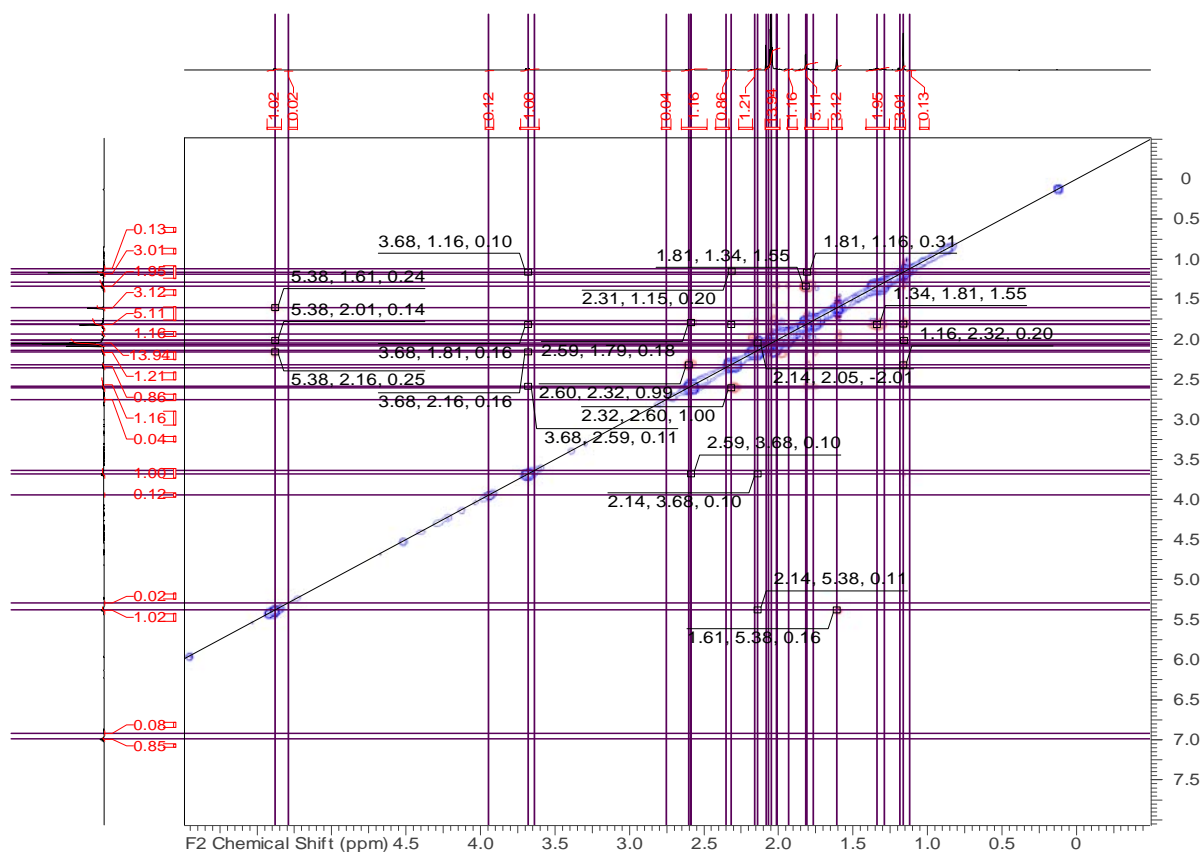


Figure 48: HR-ESIMS spectrum of elgonene D (**5**)

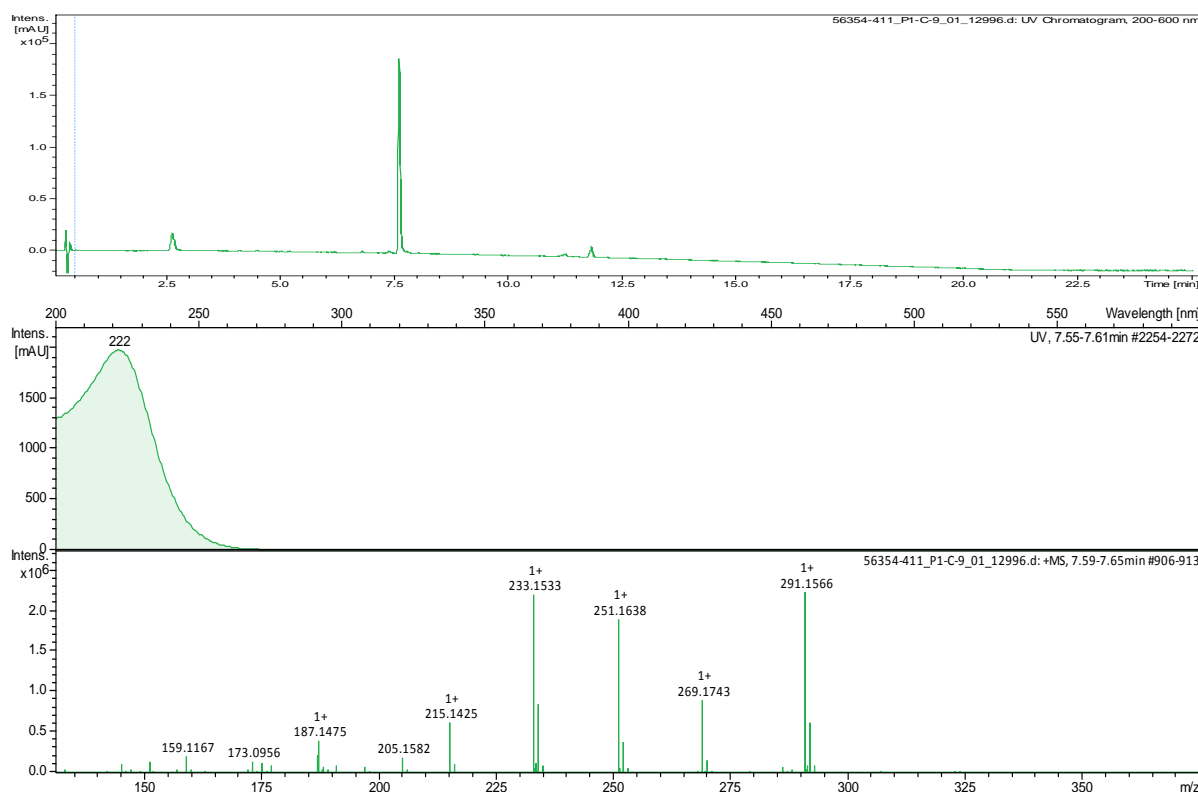


Figure 49: ^1H NMR spectrum of elgonene D (**5**) (*R*)- MTPA ester in pyridine d_5 (700 MHz)

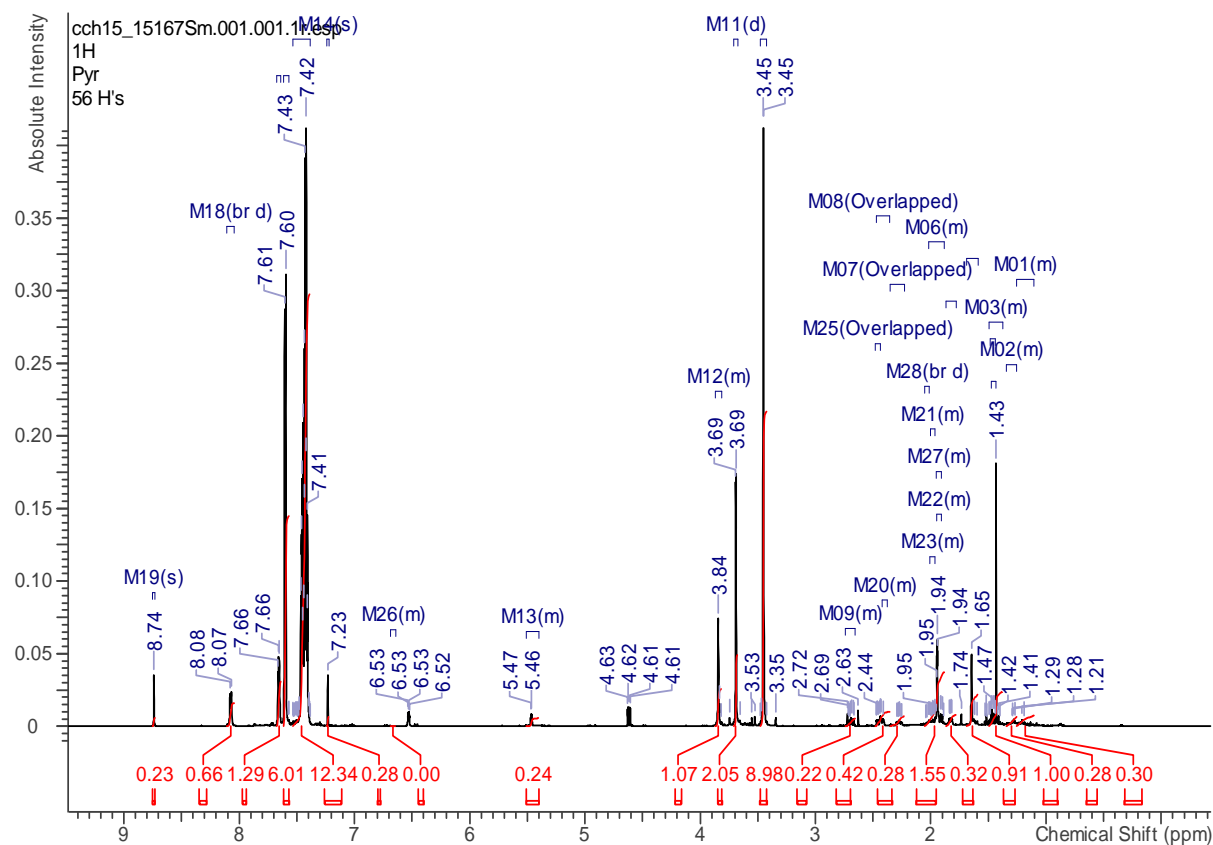


Figure 50: ^1H , ^1H COSY NMR spectrum of elgonene D (**5**) (*R*)- MTPA ester in pyridine d_5 (700 MHz)

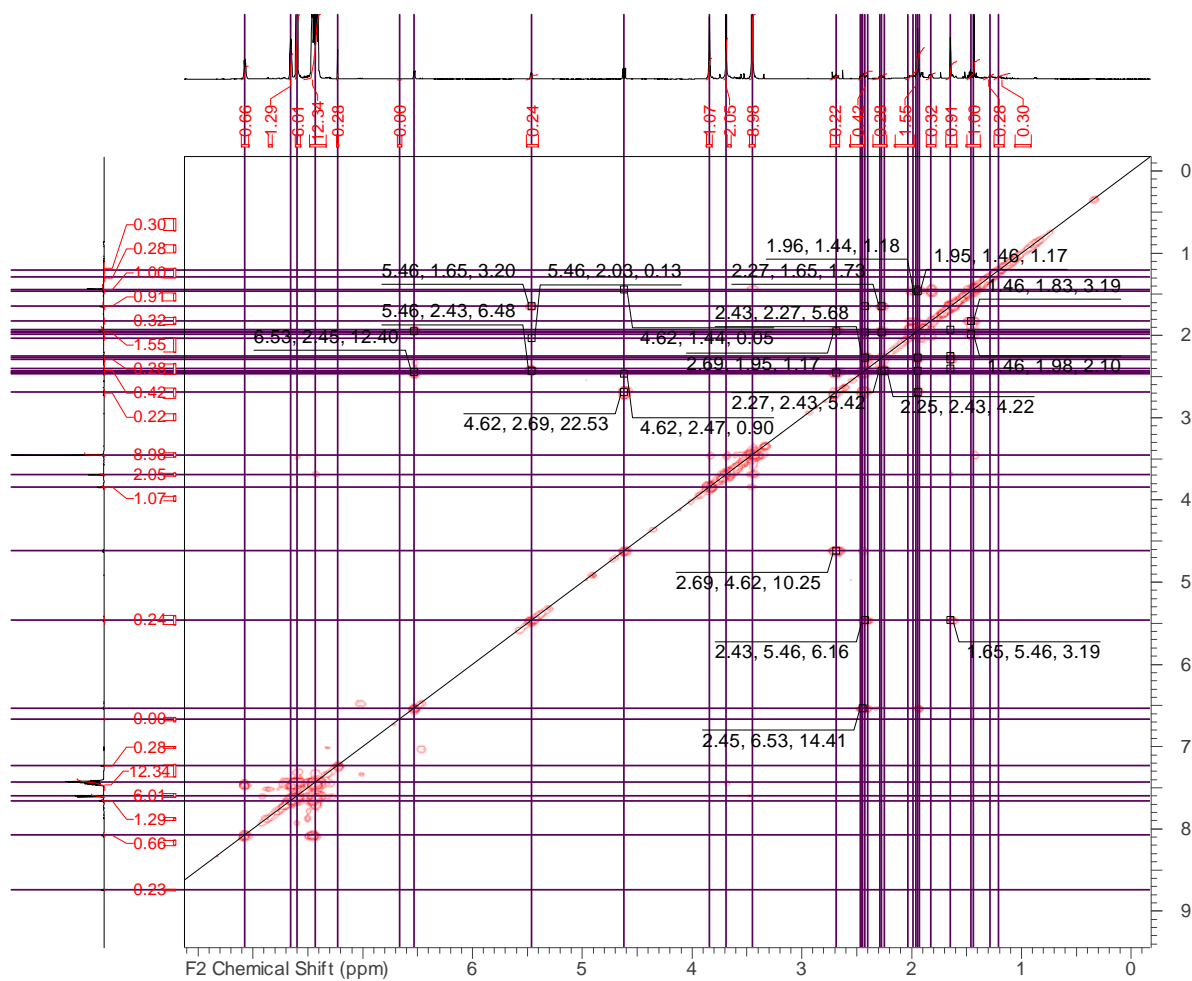


Figure 51: ^1H NMR spectrum of elgonene D (**5**) (*S*)- MTPA ester in pyridine d_5 (700 MHz)

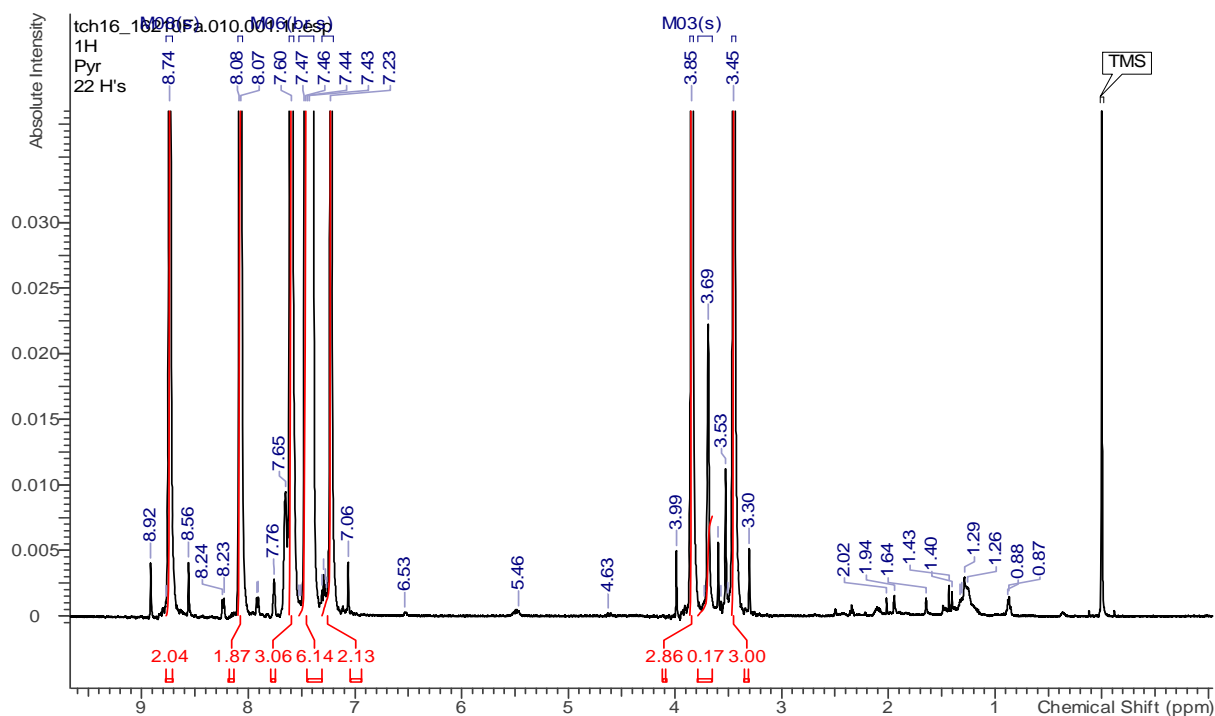
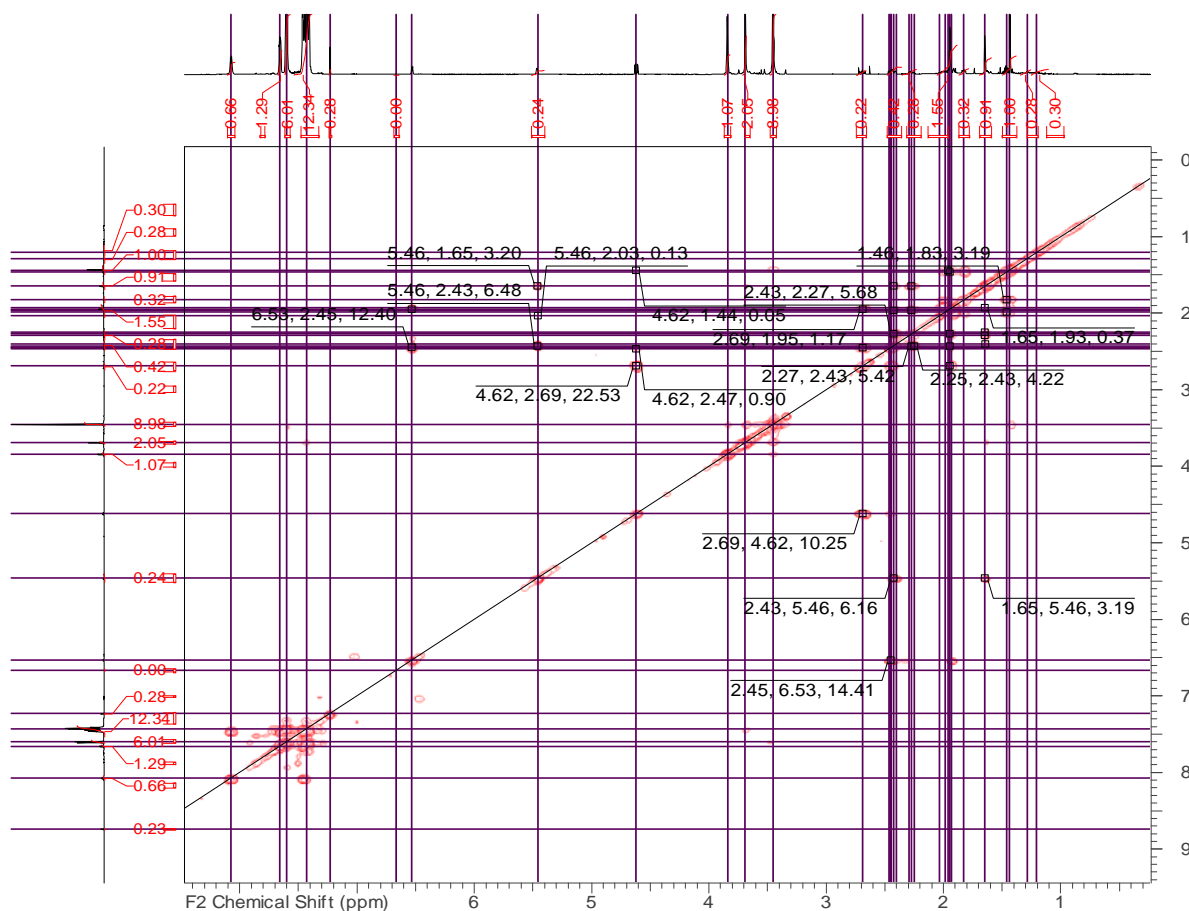


Figure 52: ^1H , ^1H COSY NMR spectrum of elgonene D (**5**) (*S*)- MTPA ester in pyridine d_5 (700 MHz)



1 and 2D NMR data for elgonene E (**6**)

Figure 53: ^1H NMR spectrum of elgonene E (**6**) in methanol d_4 (700 MHz)

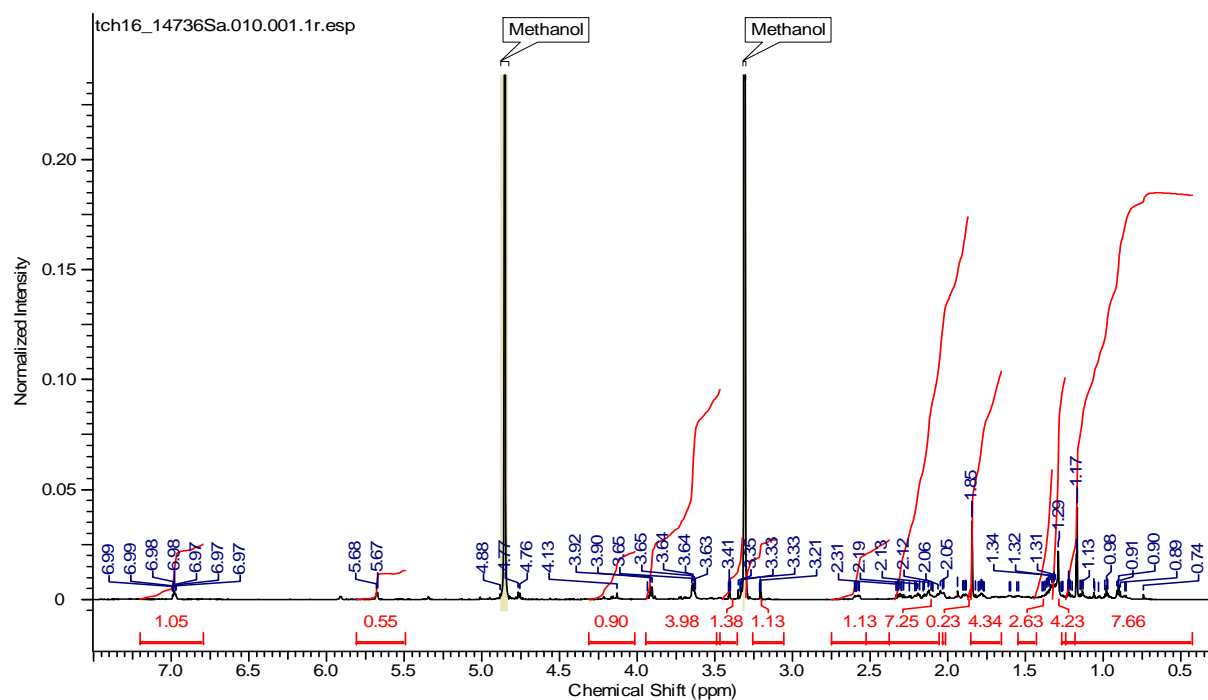


Figure 54: ^{13}C NMR spectrum of elgonene E (**6**) in methanol d_4 (175 MHz)

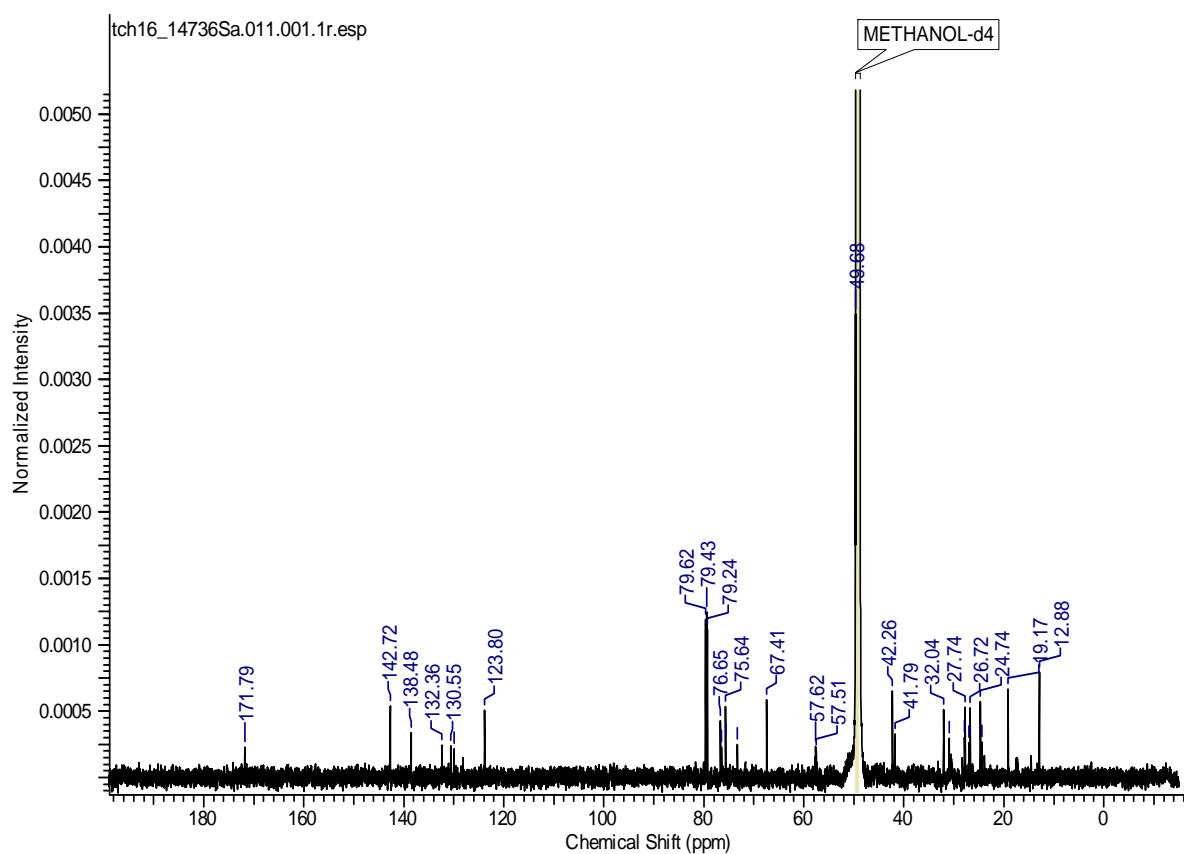


Figure 55: DEPT NMR spectrum of elgonene E (**6**) in methanol d_4 (175 MHz)

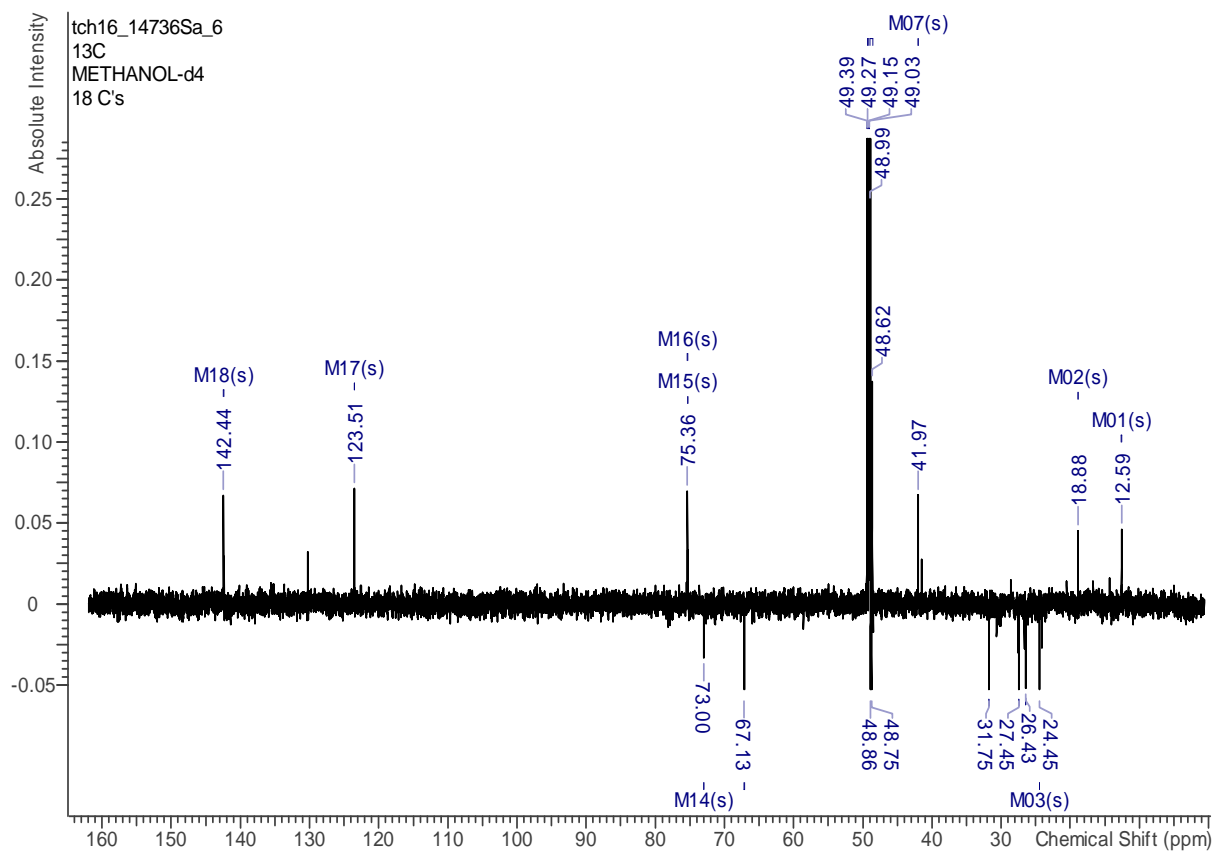


Figure 56: ^1H , ^{13}C HSQC NMR spectrum of elgonene E (**6**) in methanol d_4 (700 MHz, 125 MHz)

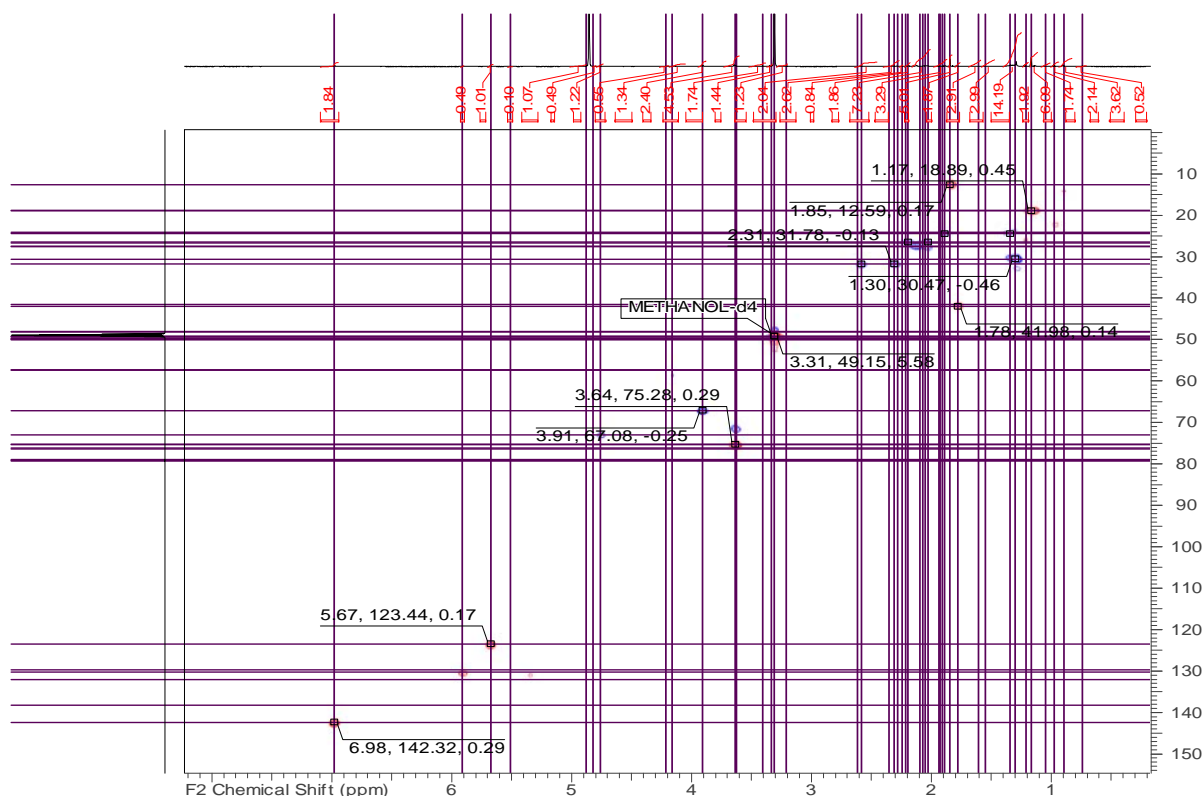


Figure 57: ^1H , ^{13}C HMBC NMR spectrum of elgonene E (**6**) in methanol d_4 (700 MHz, 125 MHz)

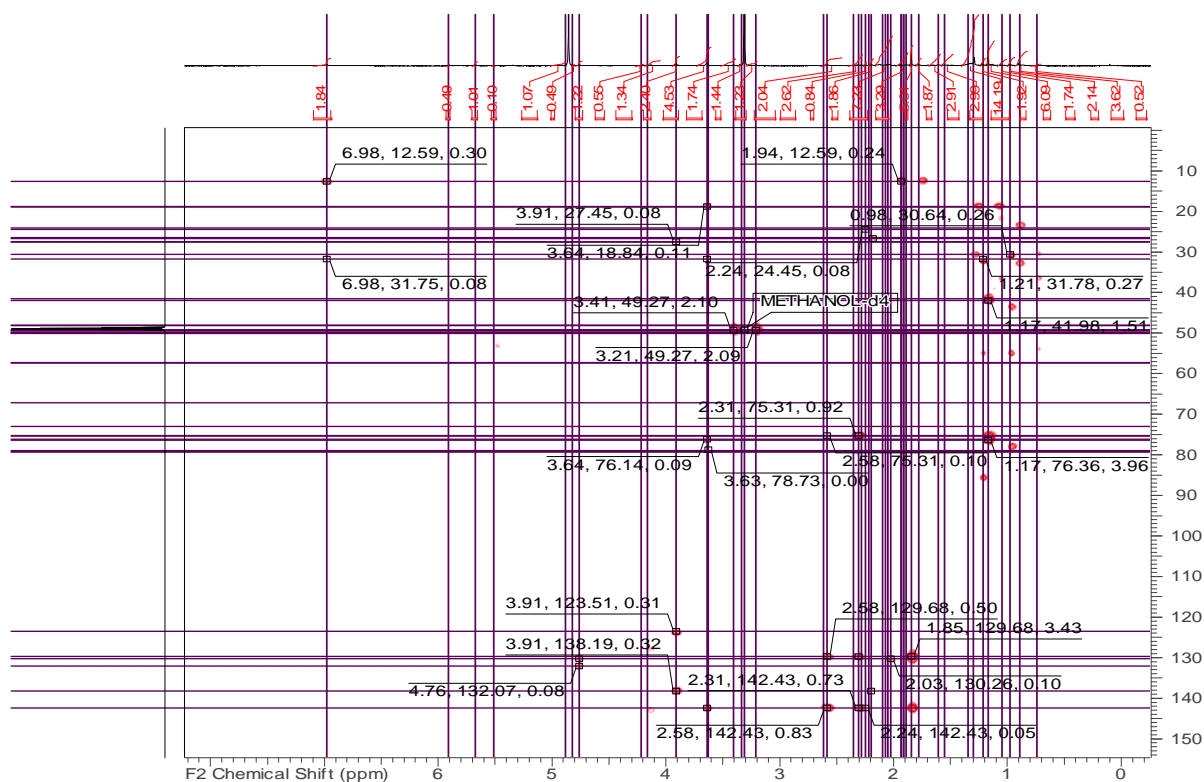


Figure 58: ^1H , ^1H COSY NMR spectrum of elgonene E (**6**) in methanol d_4 (700 MHz)

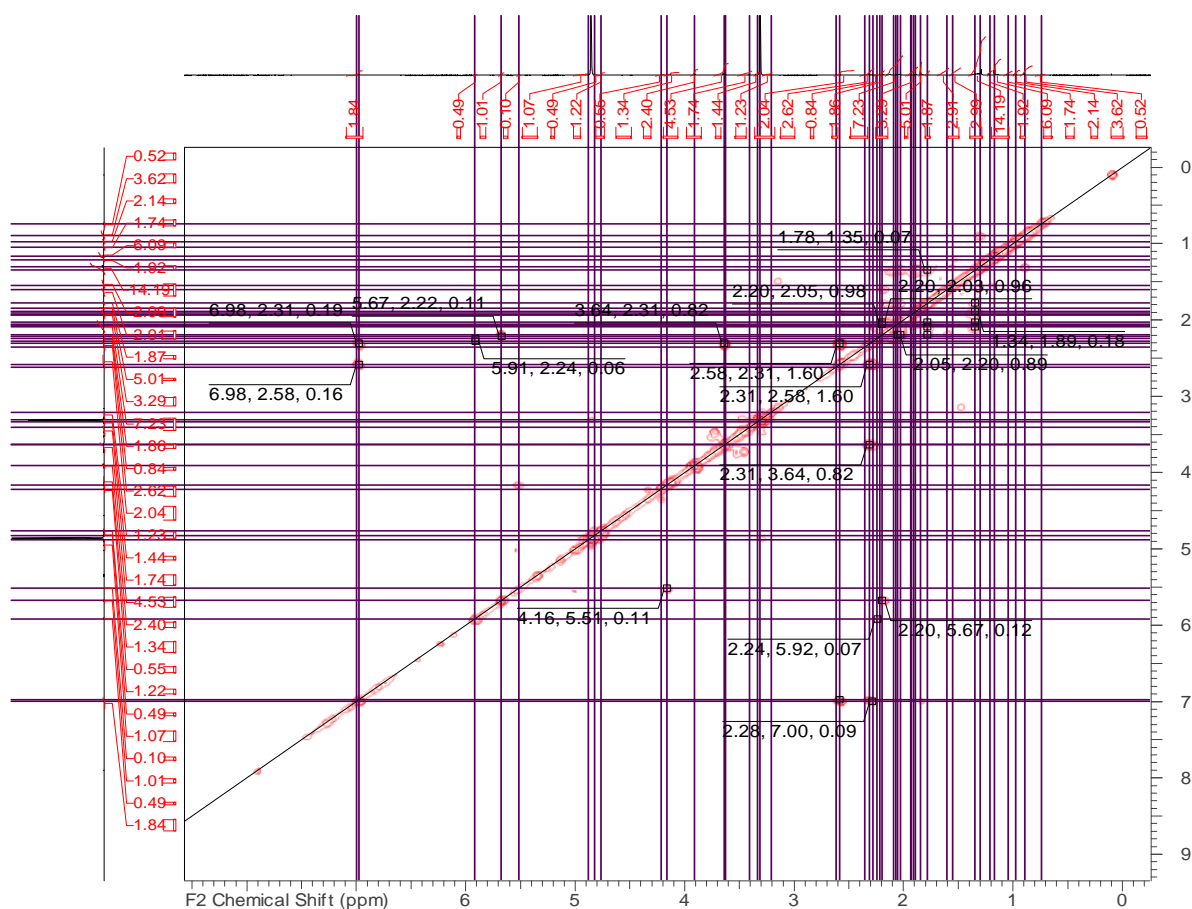


Figure 59: ^1H , ^1H ROESY NMR spectrum of elgonene E (**6**) in methanol d_4 (700 MHz)

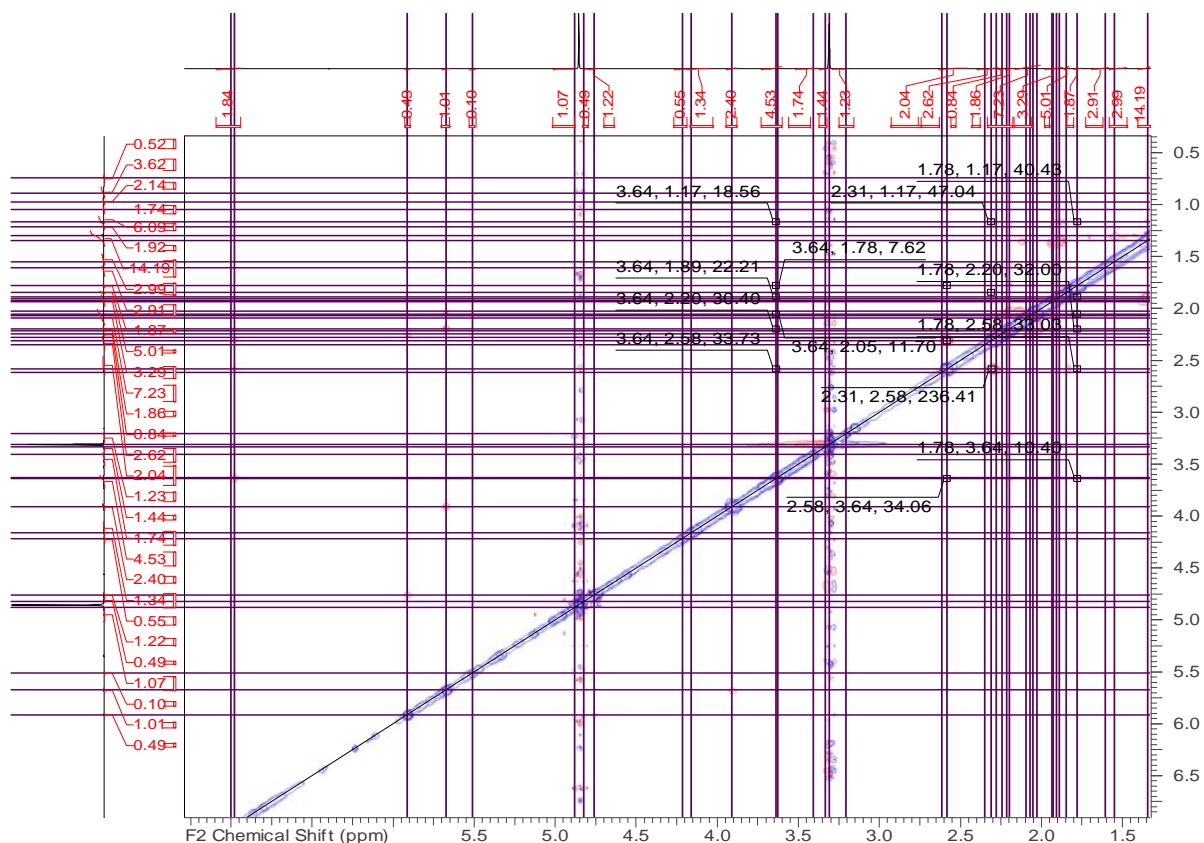
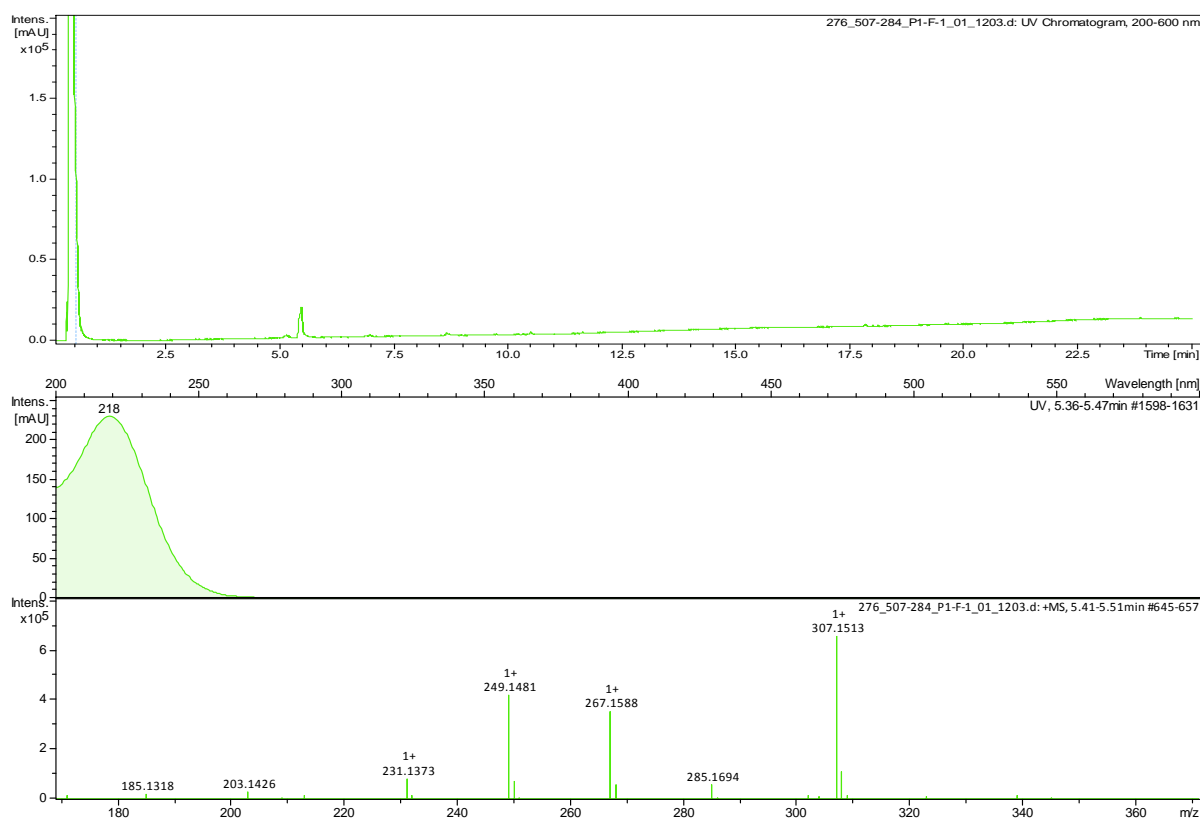


Figure 60: HR-ESIMS spectrum of elgonene E (**6**)



1 and 2D NMR data for elgonene F (**7**)

Figure 61: ^1H NMR spectrum of elgonene F (**7**) in CDCl_3 (700 MHz)

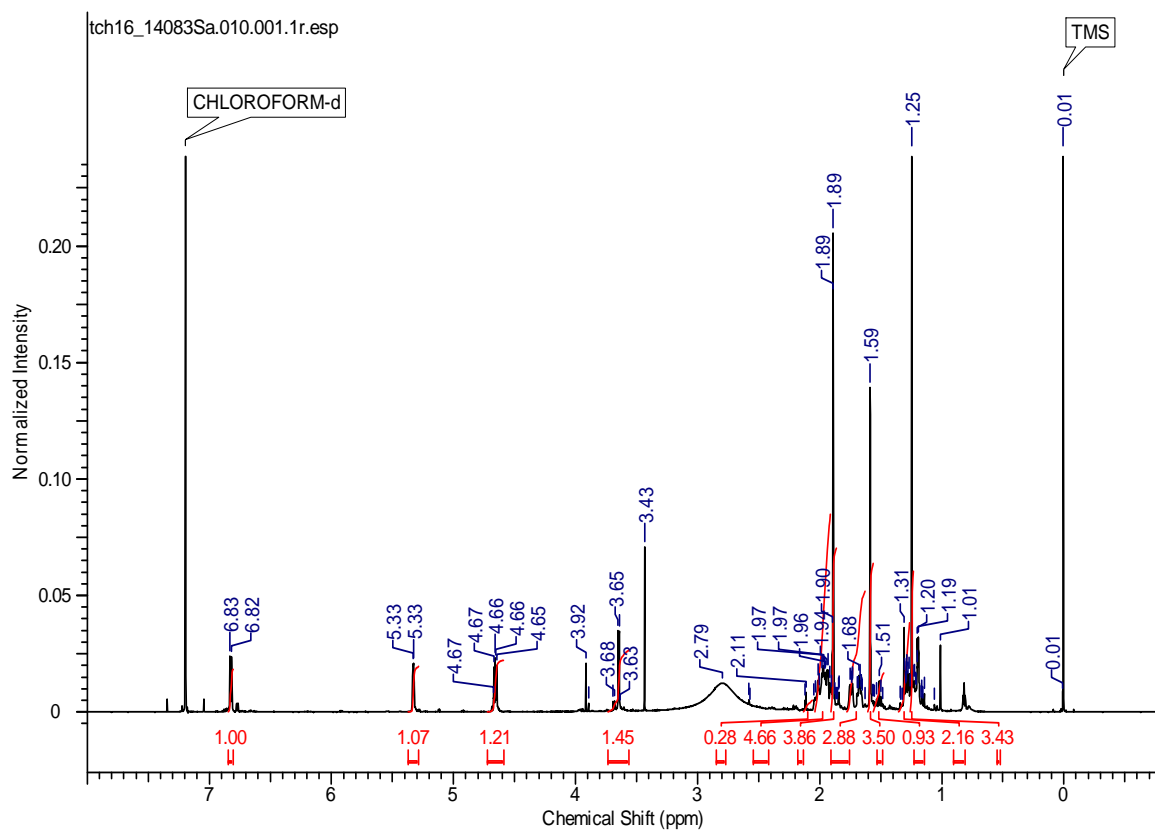


Figure 62: ^{13}C NMR spectrum of elgonene F (**7**) in CDCl_3 (175 MHz)

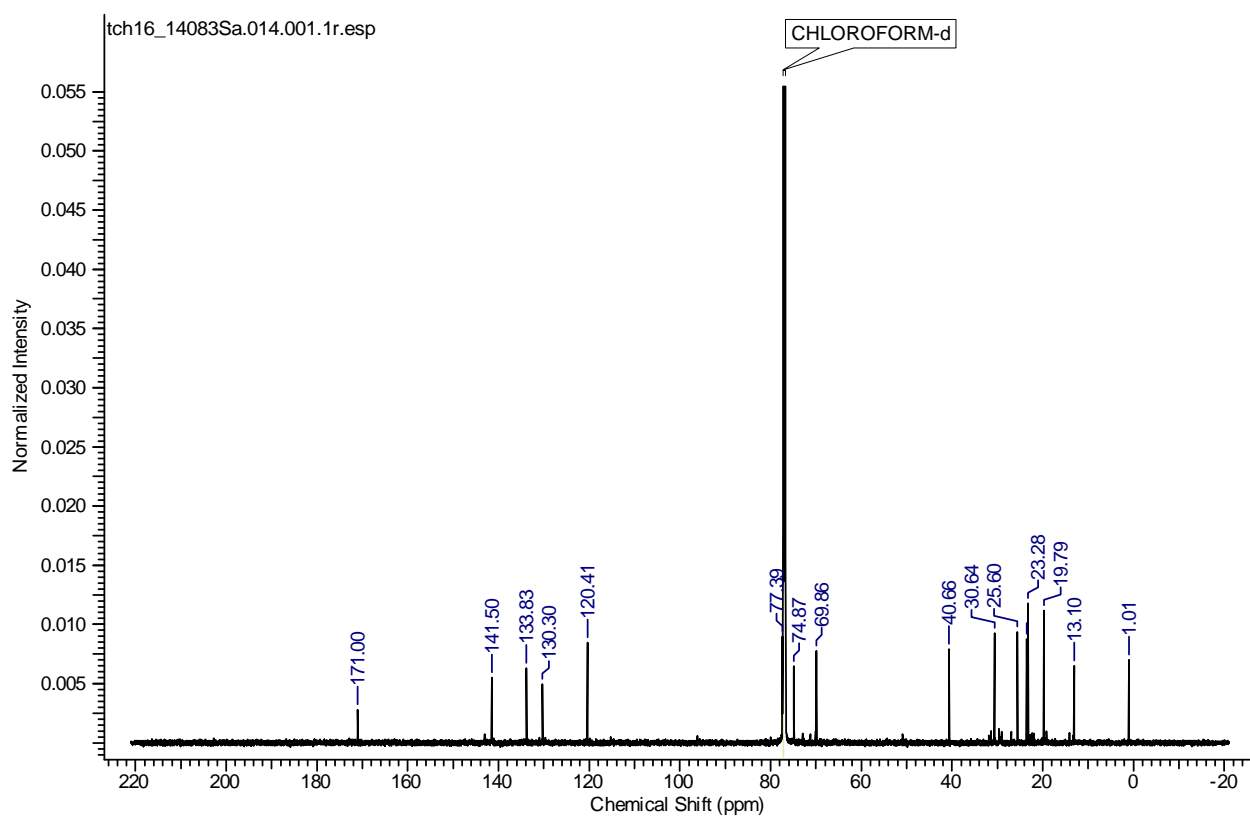


Figure 63: DEPT NMR spectrum of elgonene F (**7**) in CDCl_3 (175 MHz)

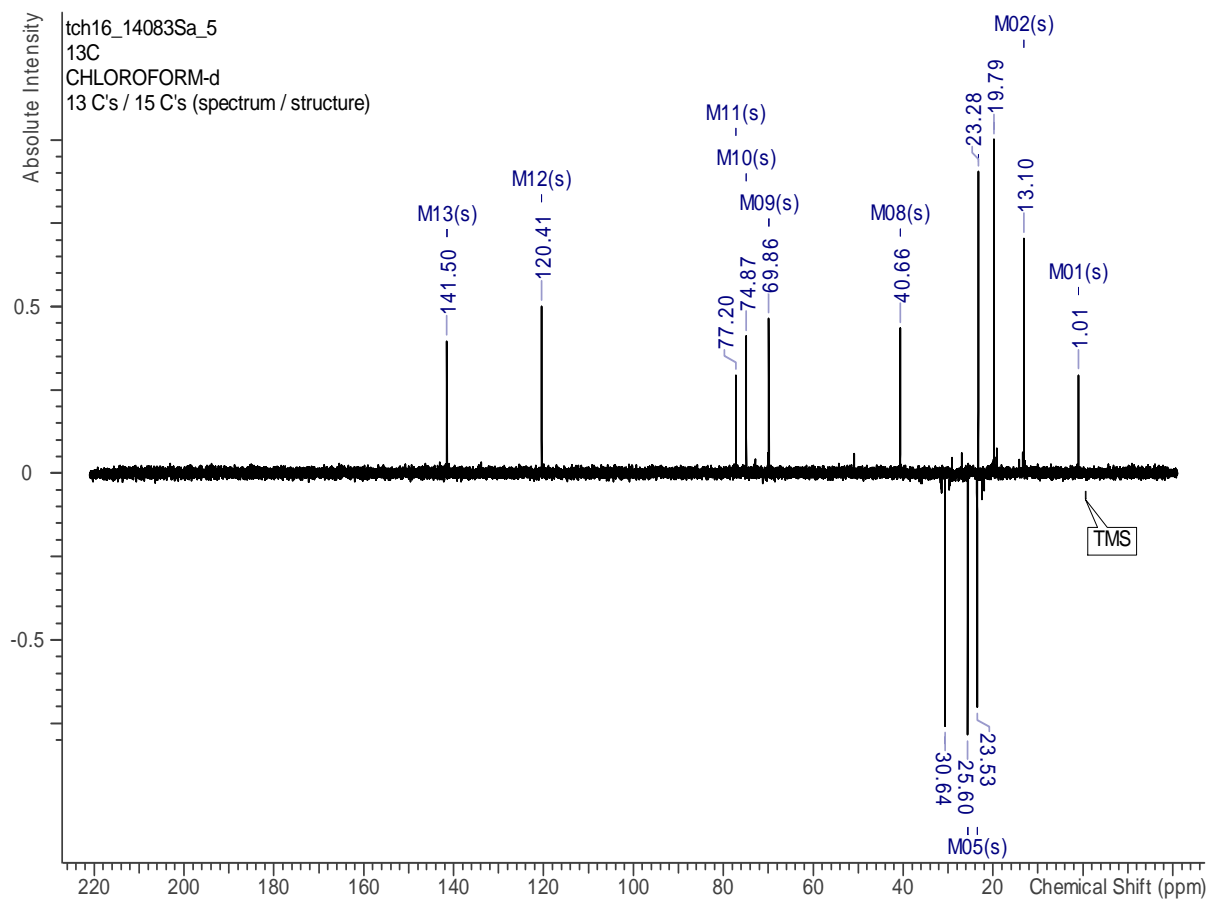


Figure 64: ^1H , ^{13}C HSQC NMR spectrum of elgonene F (**7**) in CDCl_3 (700 MHz, 175 MHz)

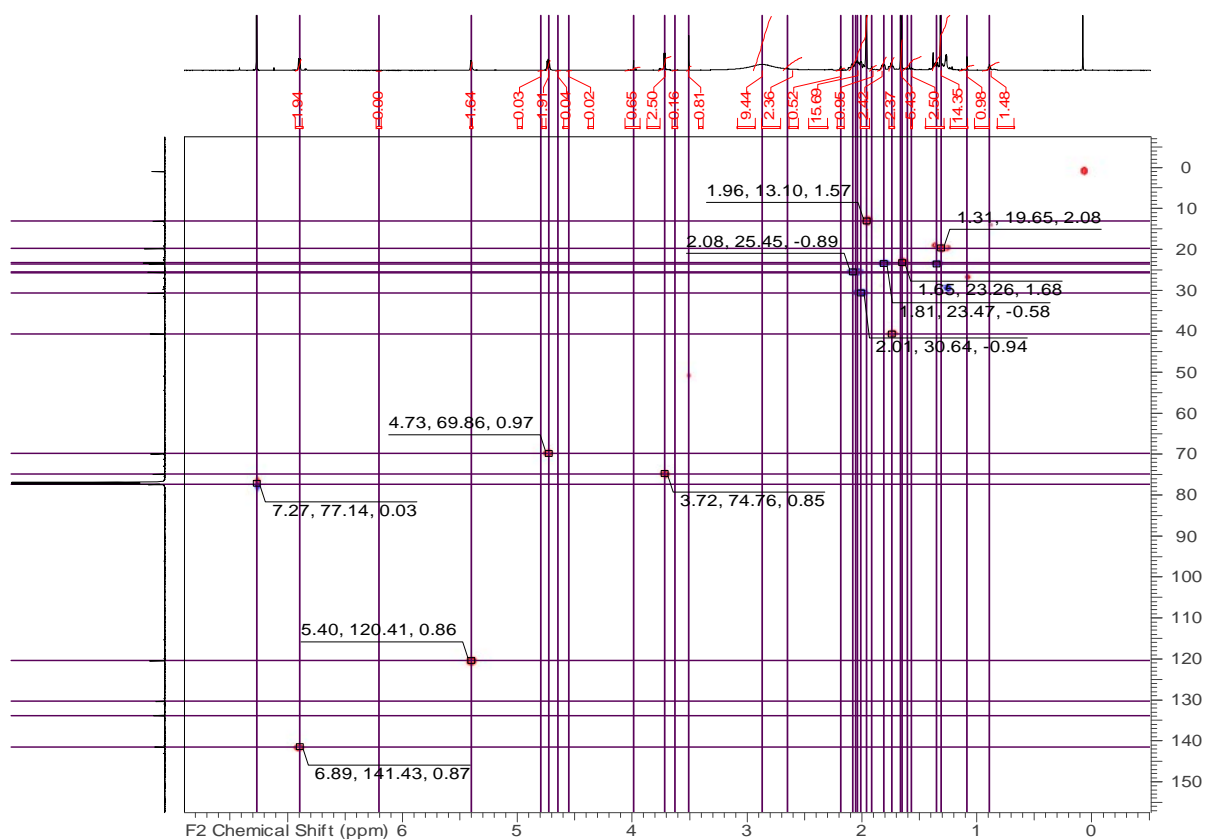


Figure 65: ^1H , ^{13}C HMBC NMR spectrum of elgonene F (**7**) in CDCl_3 (700 MHz, 175 MHz)

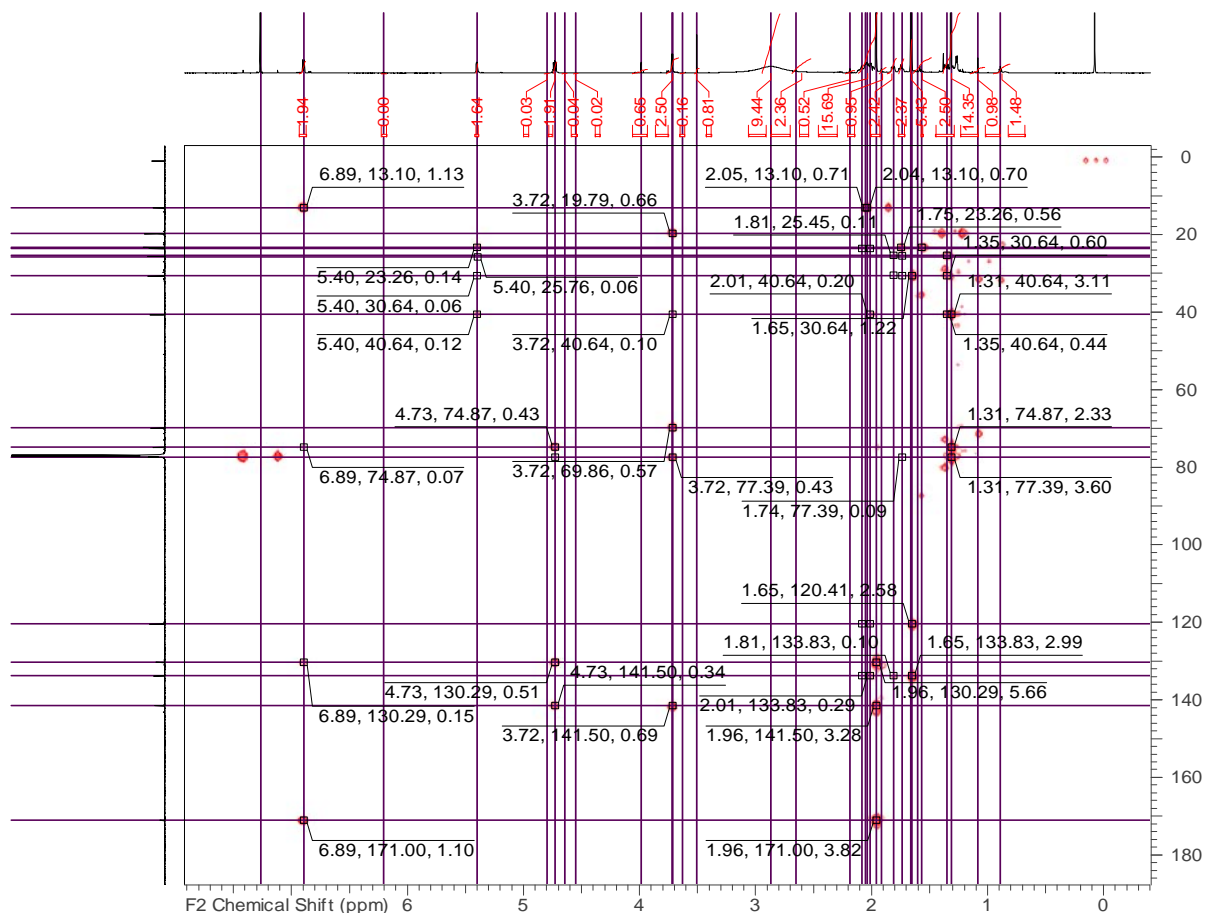


Figure 66: ^1H , ^1H COSY NMR spectrum of elgonene F (**7**) in CDCl_3 (700 MHz)

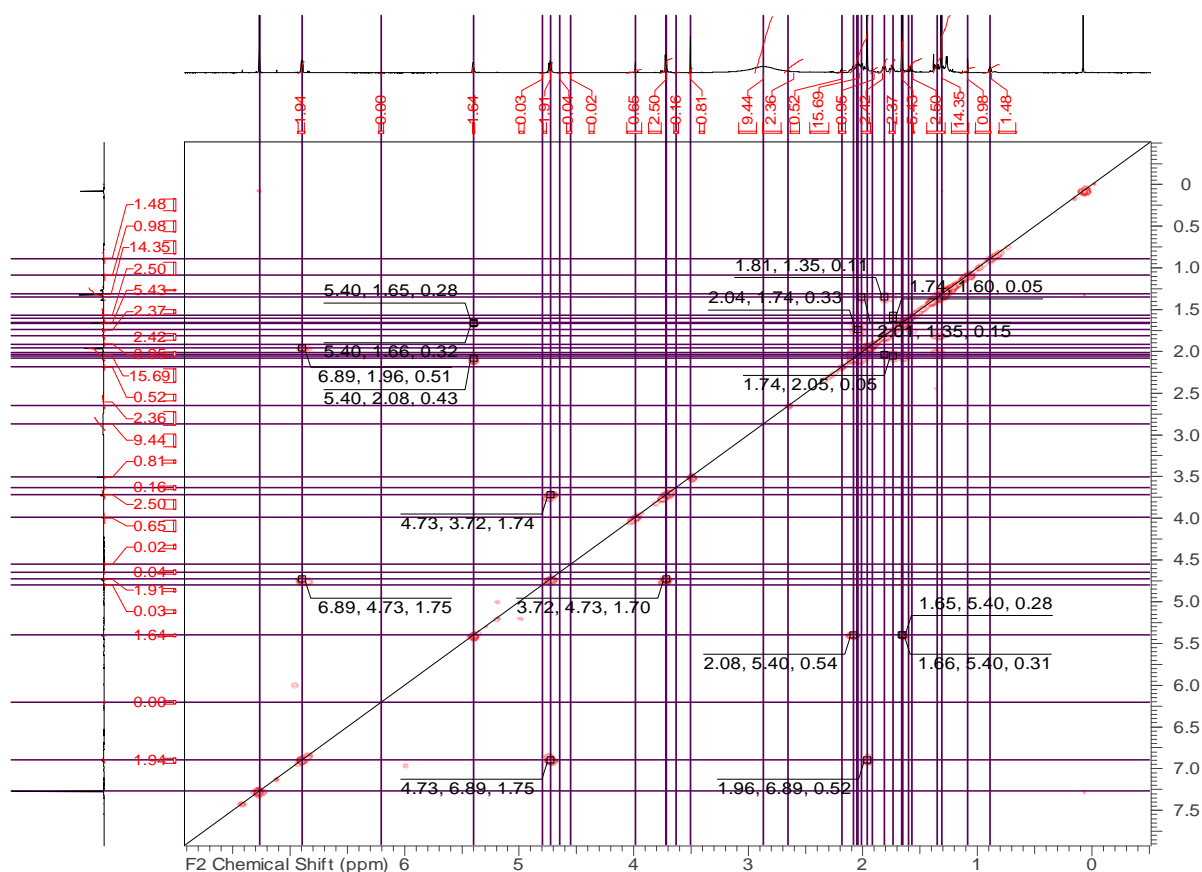


Figure 67: ^1H , ^1H ROESY NMR spectrum of elgonene F (**7**) in CDCl_3 (700 MHz)

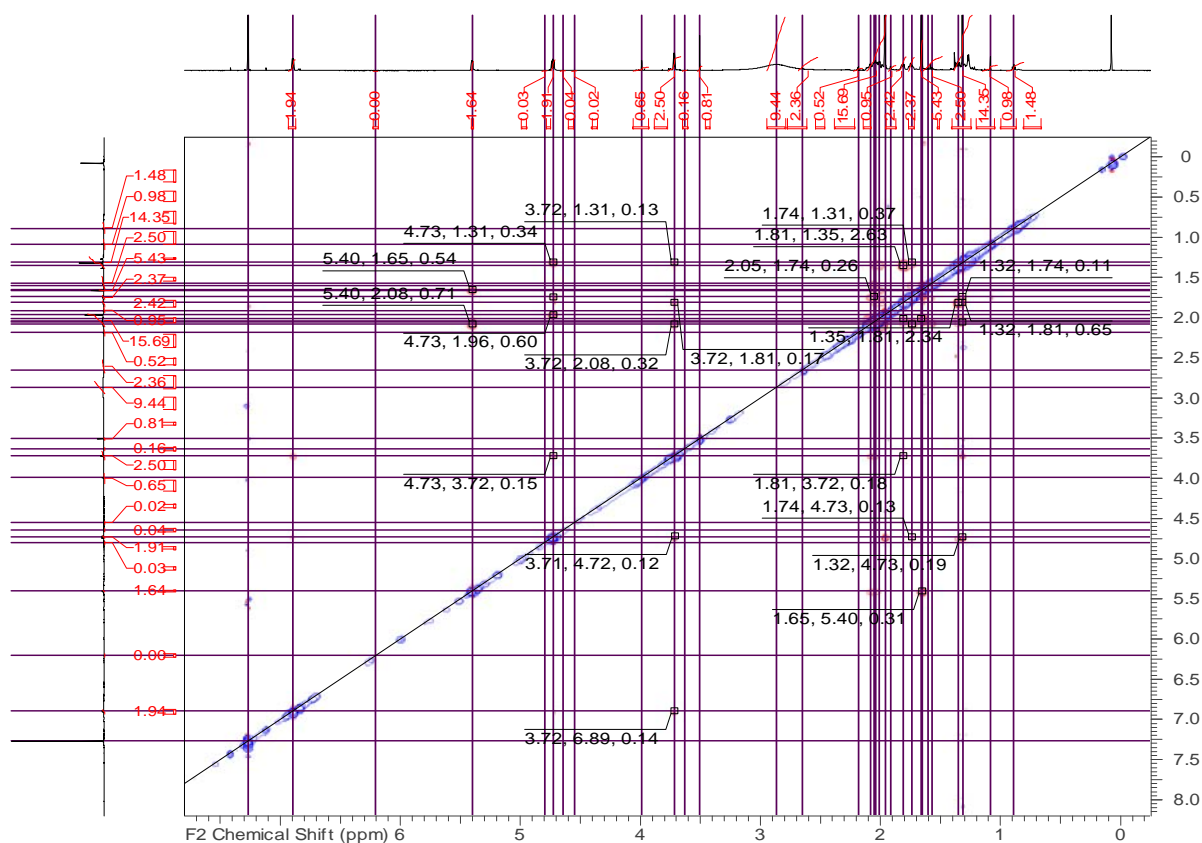
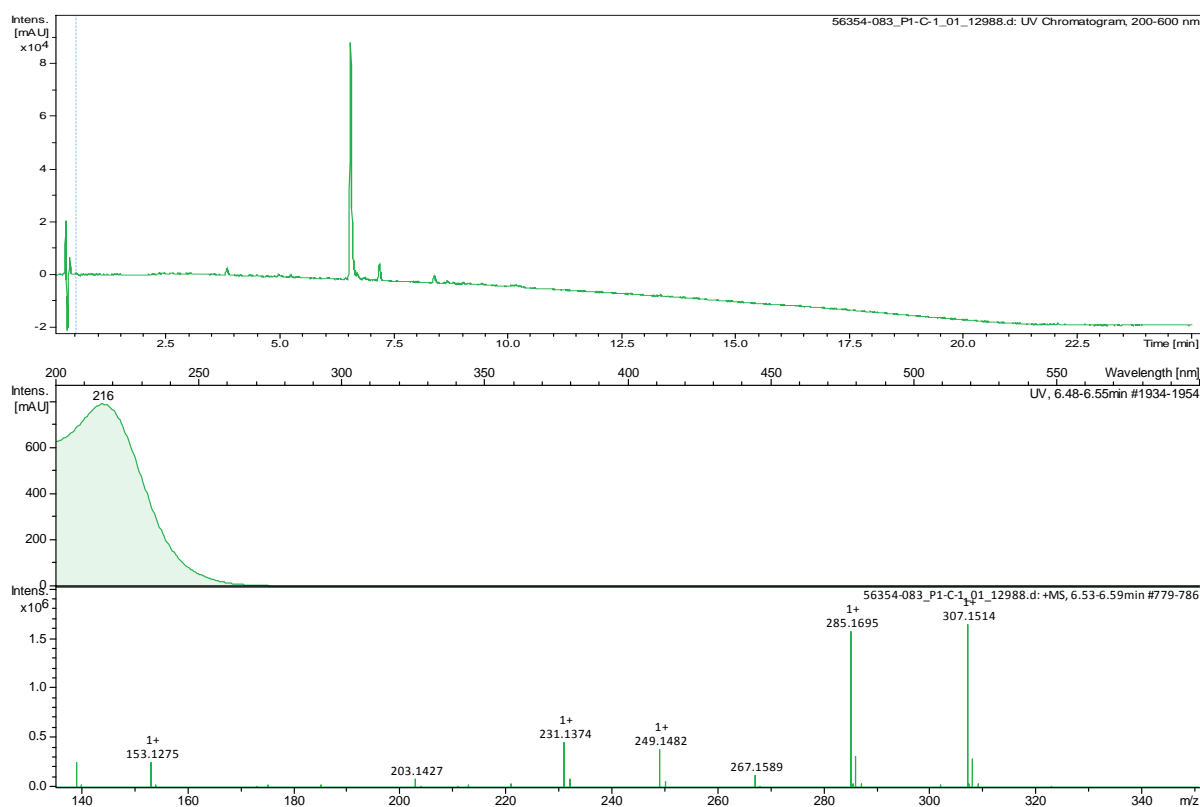


Figure 68: HR-ESIMS spectrum of elgonene F (7)



1 and 2D NMR data for elgonene G (8) and H (9)

Figure 69: ^1H NMR spectrum of elgonene G (8) and H (9) in CDCl_3 (700 MHz)

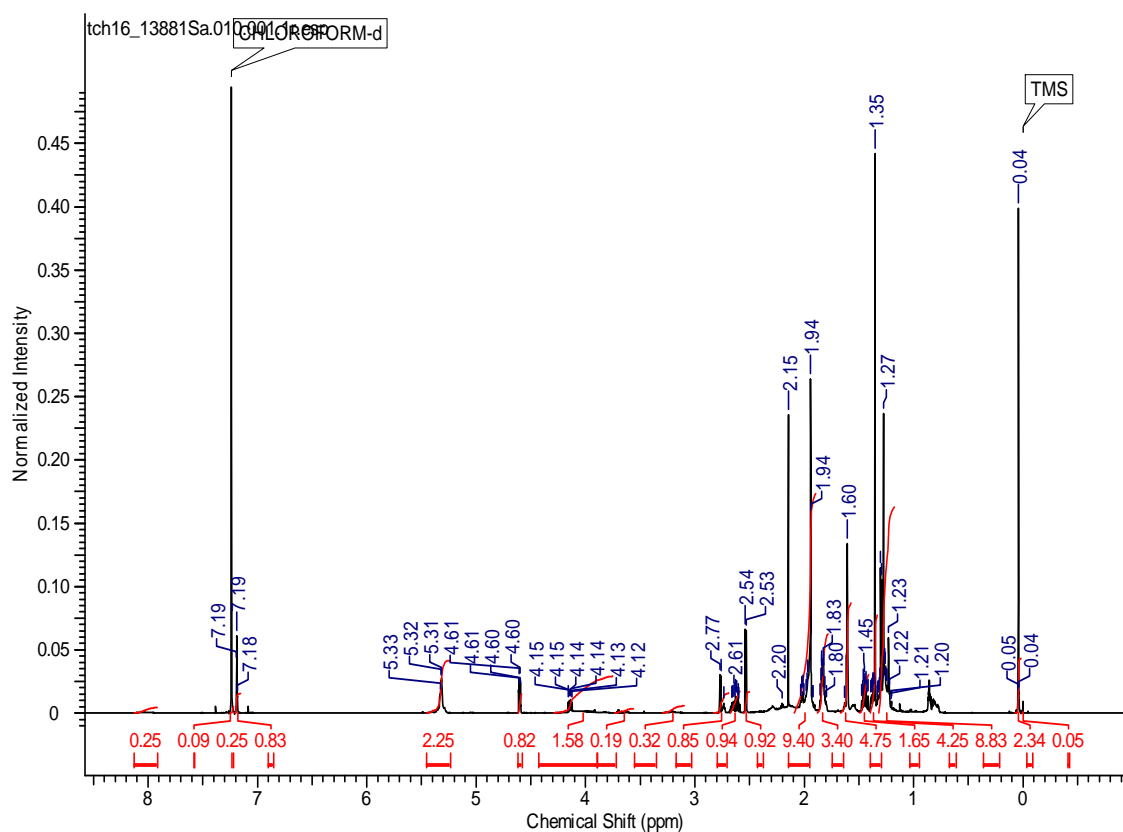


Figure 70: ^{13}C NMR spectrum of elgonene G (**8**) and H (**9**) in CDCl_3 (175 MHz)

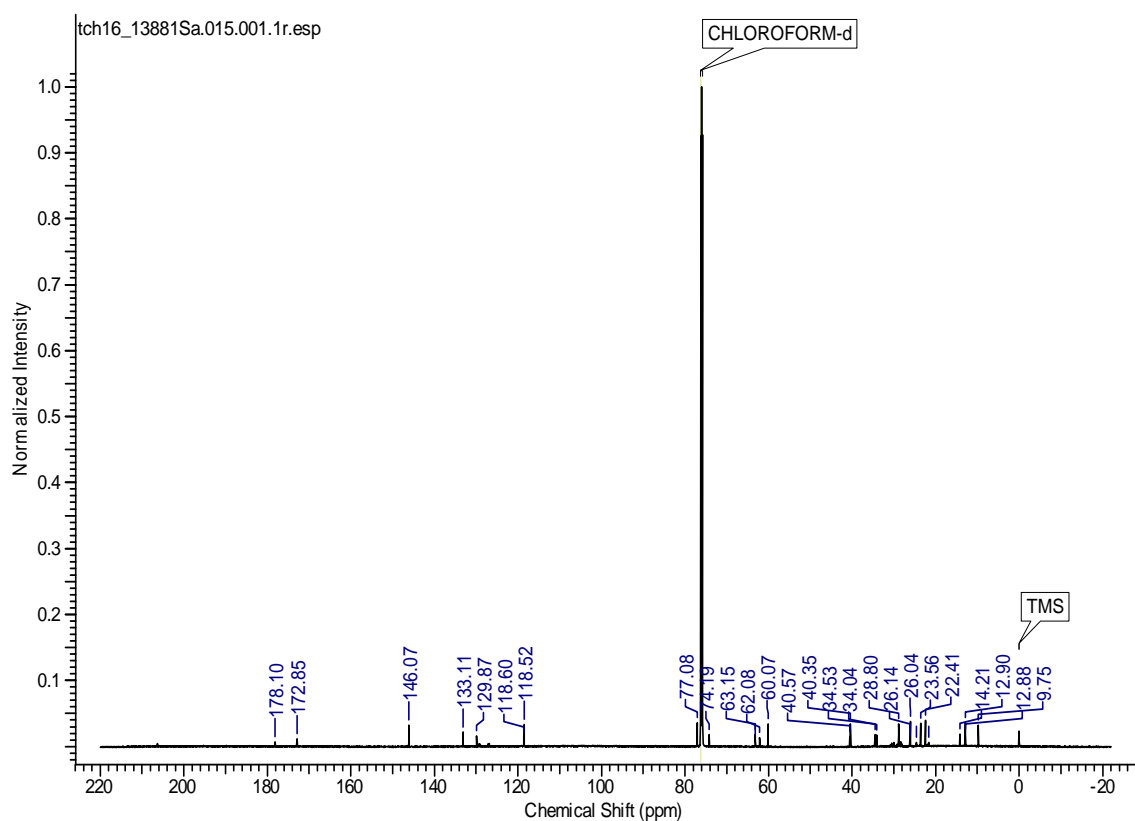


Figure 71: DEPT NMR spectrum of elgonene G (**8**) and H (**9**) in CDCl_3 (175 MHz)

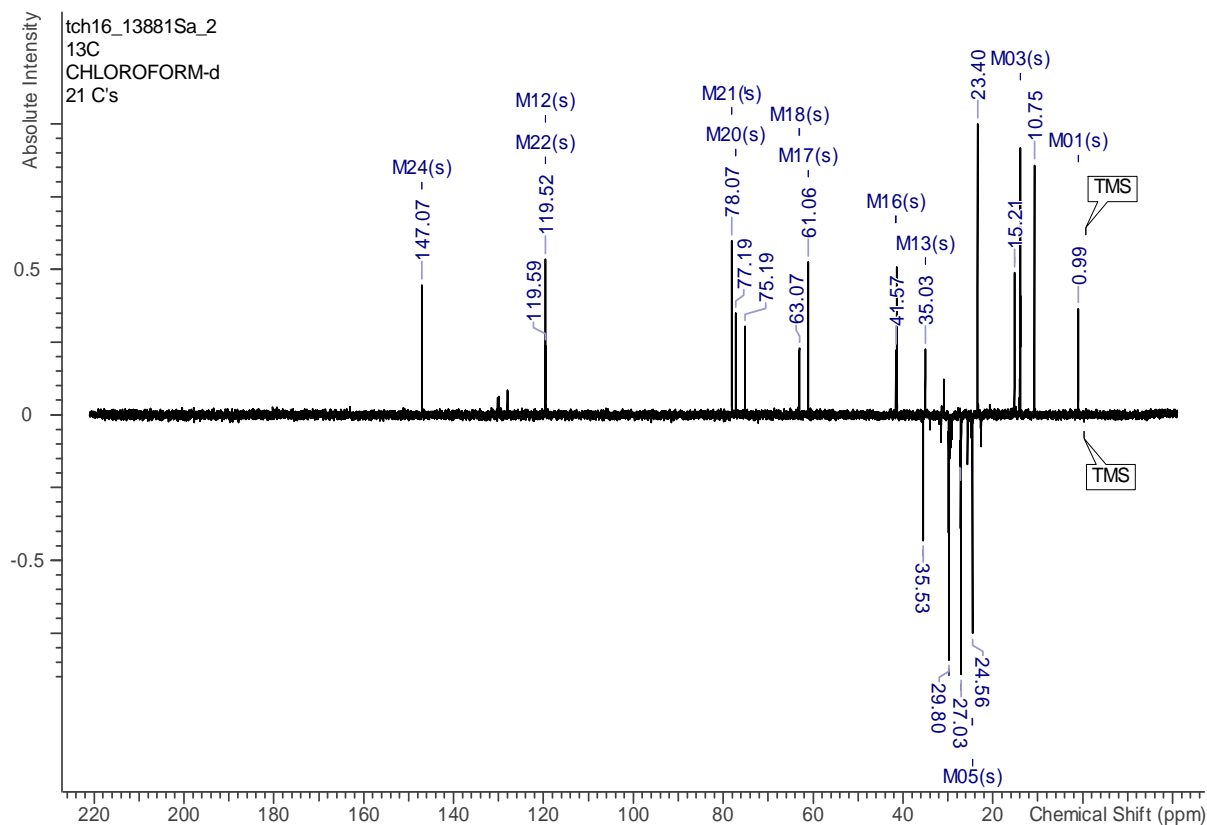


Figure 72: ^1H , ^{13}C HSQC NMR spectrum of elgonene G (**8**) and H (**9**) in CDCl_3 (700 MHz, 175 MHz)

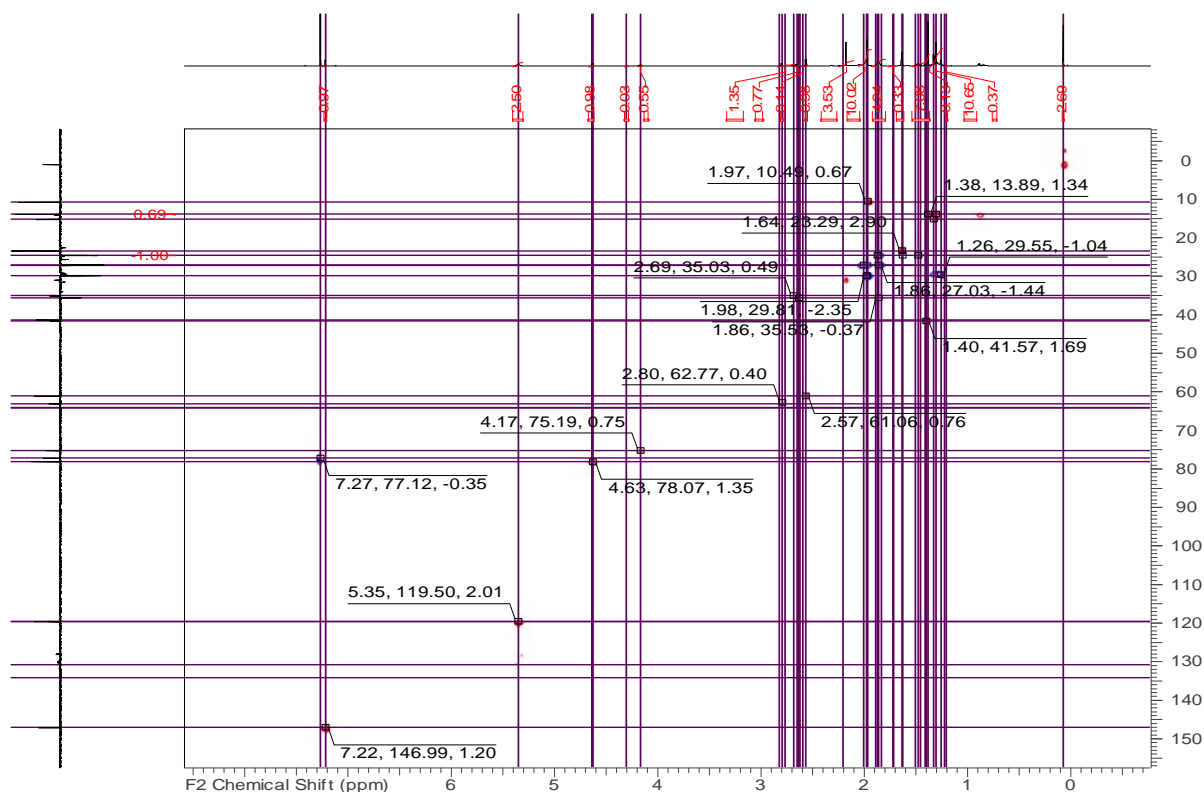


Figure 73: ^1H , ^{13}C HMBC NMR spectrum of elgonene G (**8**) and H (**9**) in CDCl_3 (700 MHz, 175 MHz)

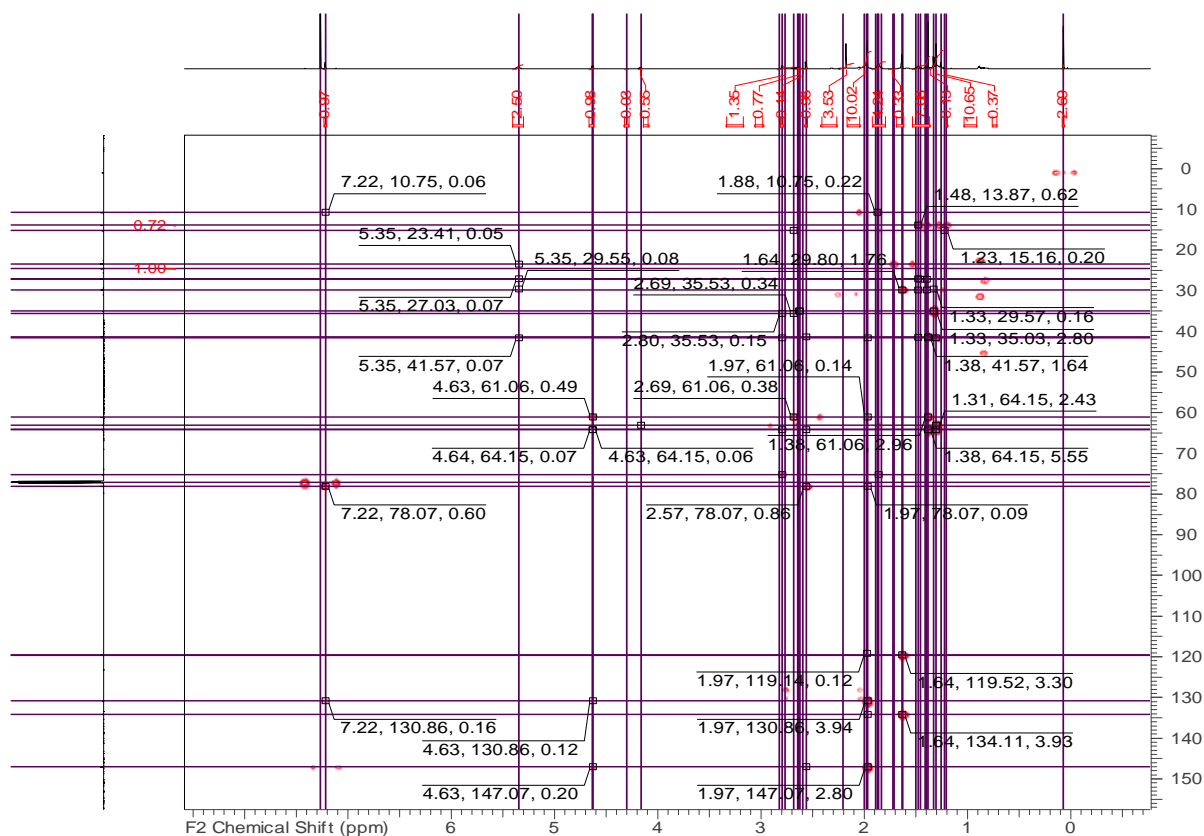


Figure 74: ^1H , ^1H COSY NMR spectrum of elgonene G (**8**) and H (**9**) in CDCl_3 (700 MHz)

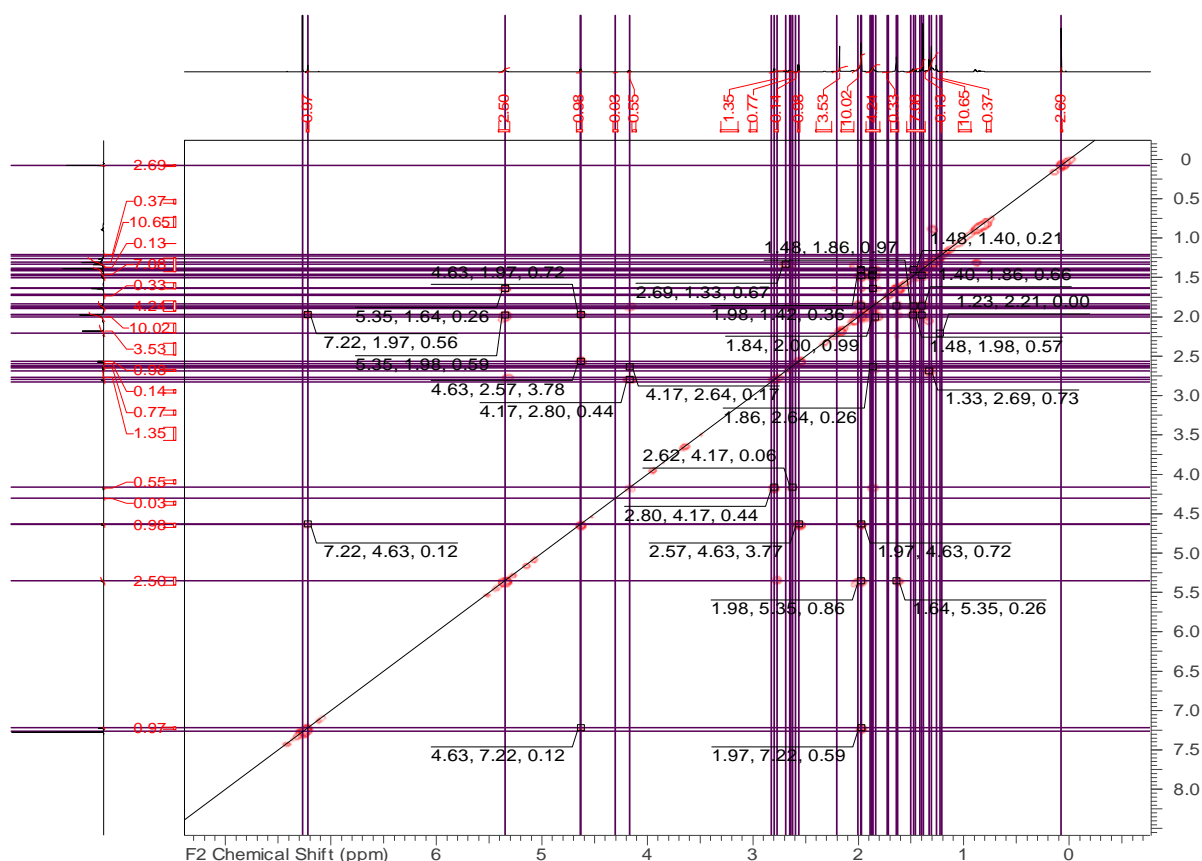


Figure 75: ^1H , ^1H ROESY NMR spectrum of elgonene G (**8**) and H (**9**) in CDCl_3 (700 MHz)

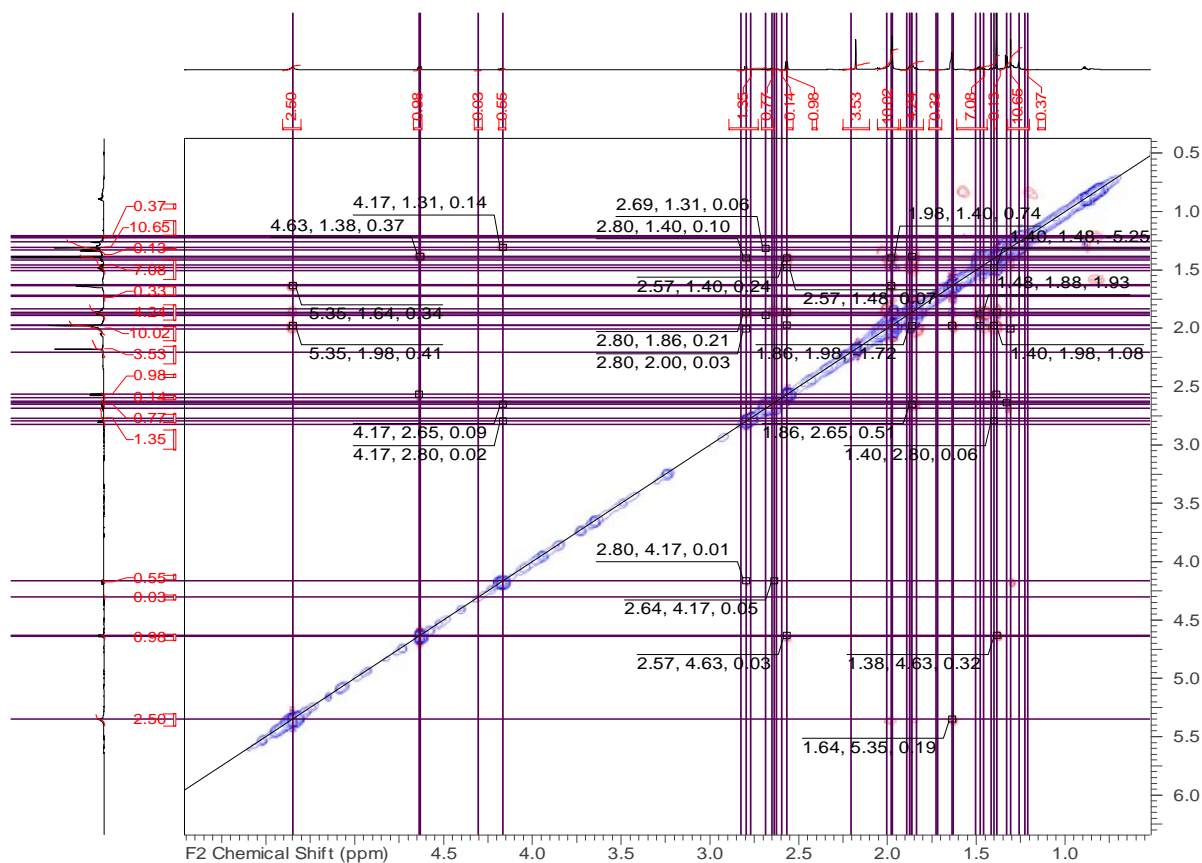
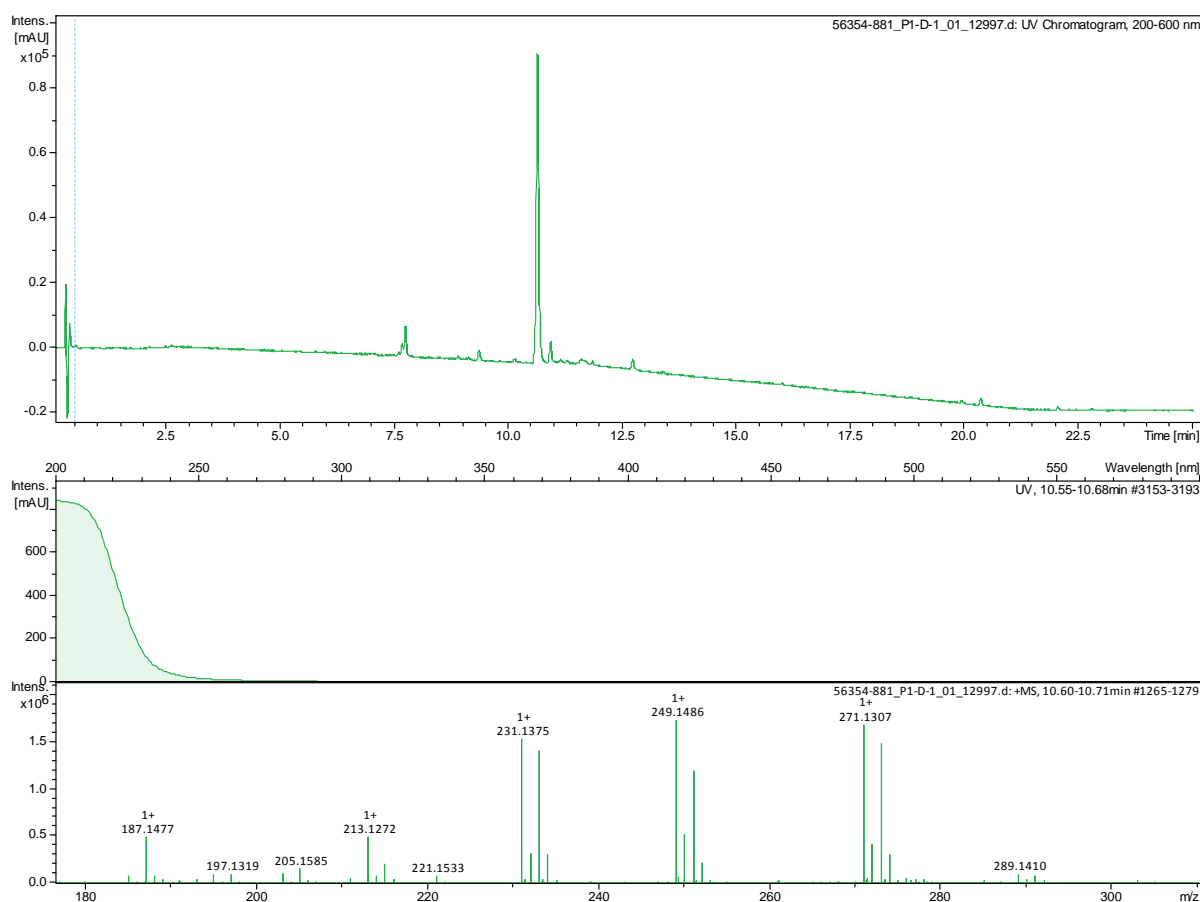


Figure 76: HR-ESIMS spectrum of elgonene G (8) and H (9)



1 and 2D NMR data for elgonene I (10)

Figure 77: ¹H NMR spectrum of elgonene I (10) in acetone-d₆ (500 MHz)

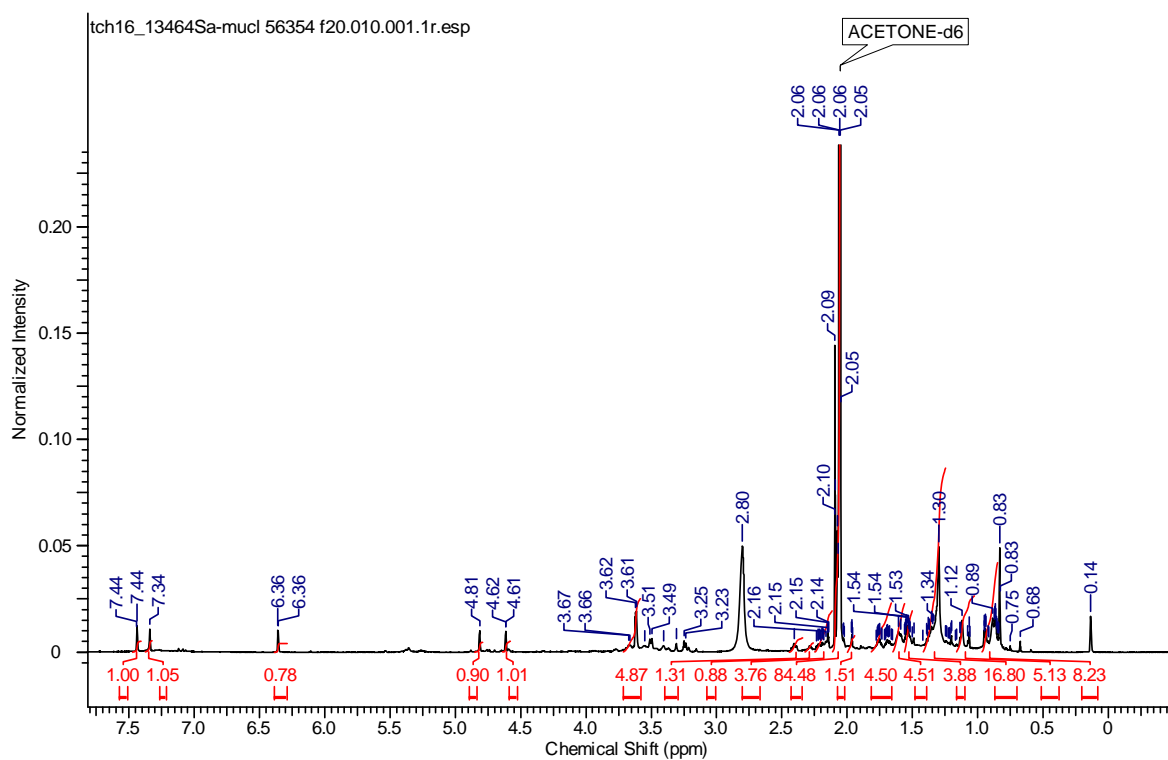


Figure 78: ^{13}C NMR spectrum of elgonene I (**10**) in acetone- d_6 (125 MHz)

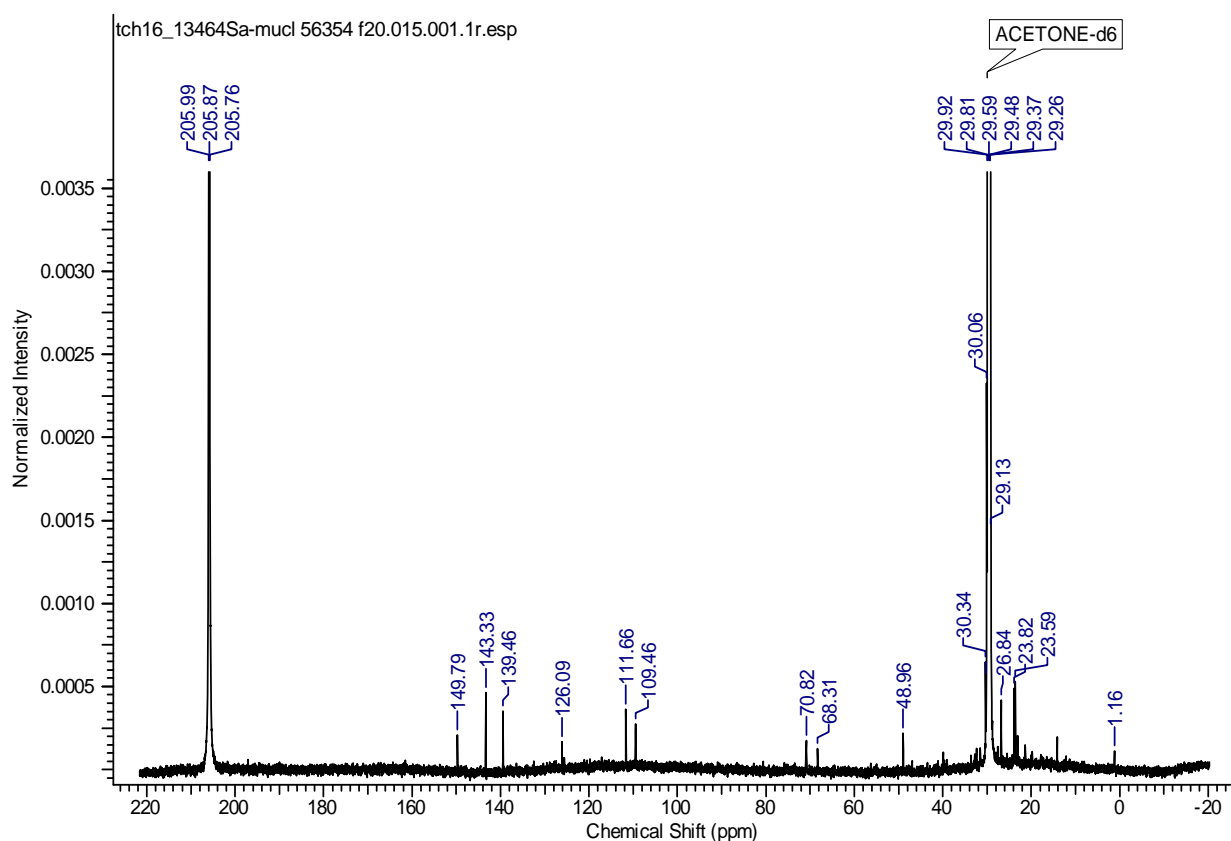


Figure 79: DEPT NMR spectrum of elgonene I (**10**) in acetone- d_6 (125 MHz)

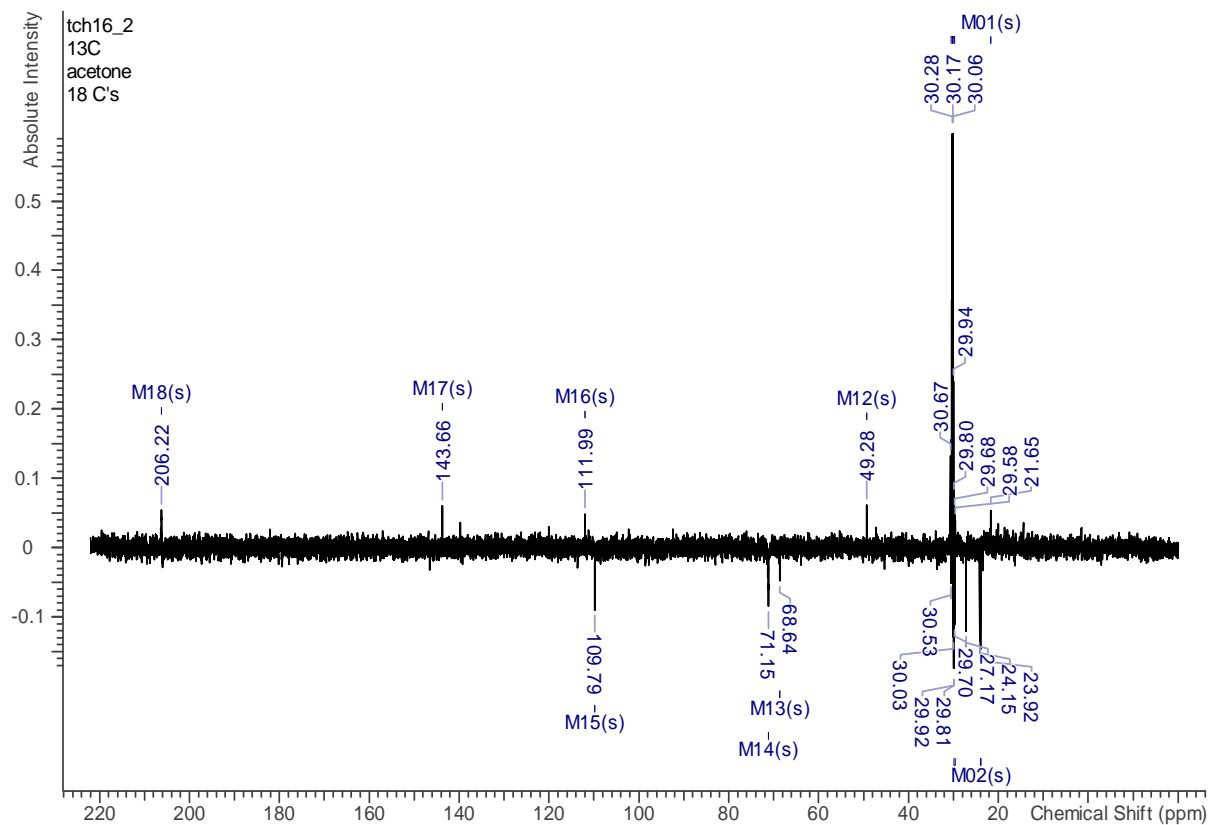


Figure 80: ^1H , ^{13}C HSQC NMR spectrum of elgonene I (**10**) in acetone- d_6 (500 MHz, 125 MHz)

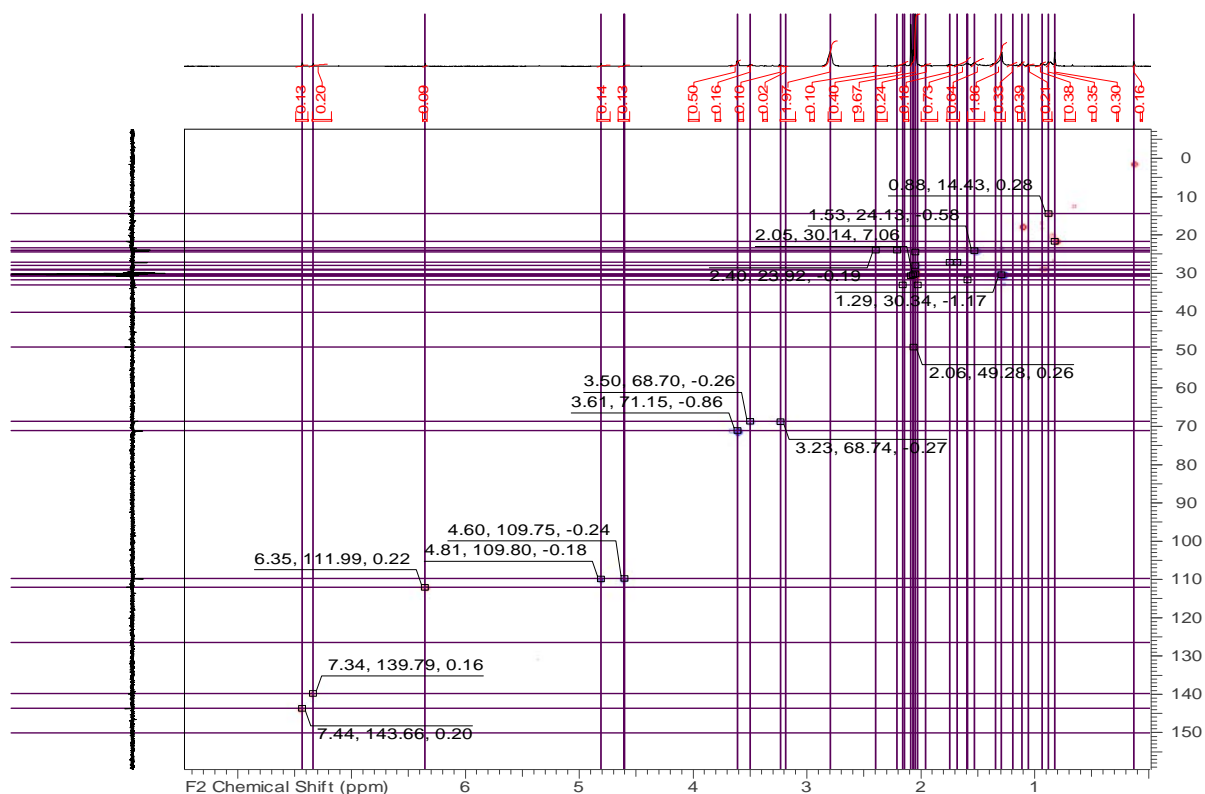


Figure 81: ^1H , ^{13}C HMBC NMR spectrum of elgonene I (**10**) in acetone- d_6 (500 MHz, 125 MHz)

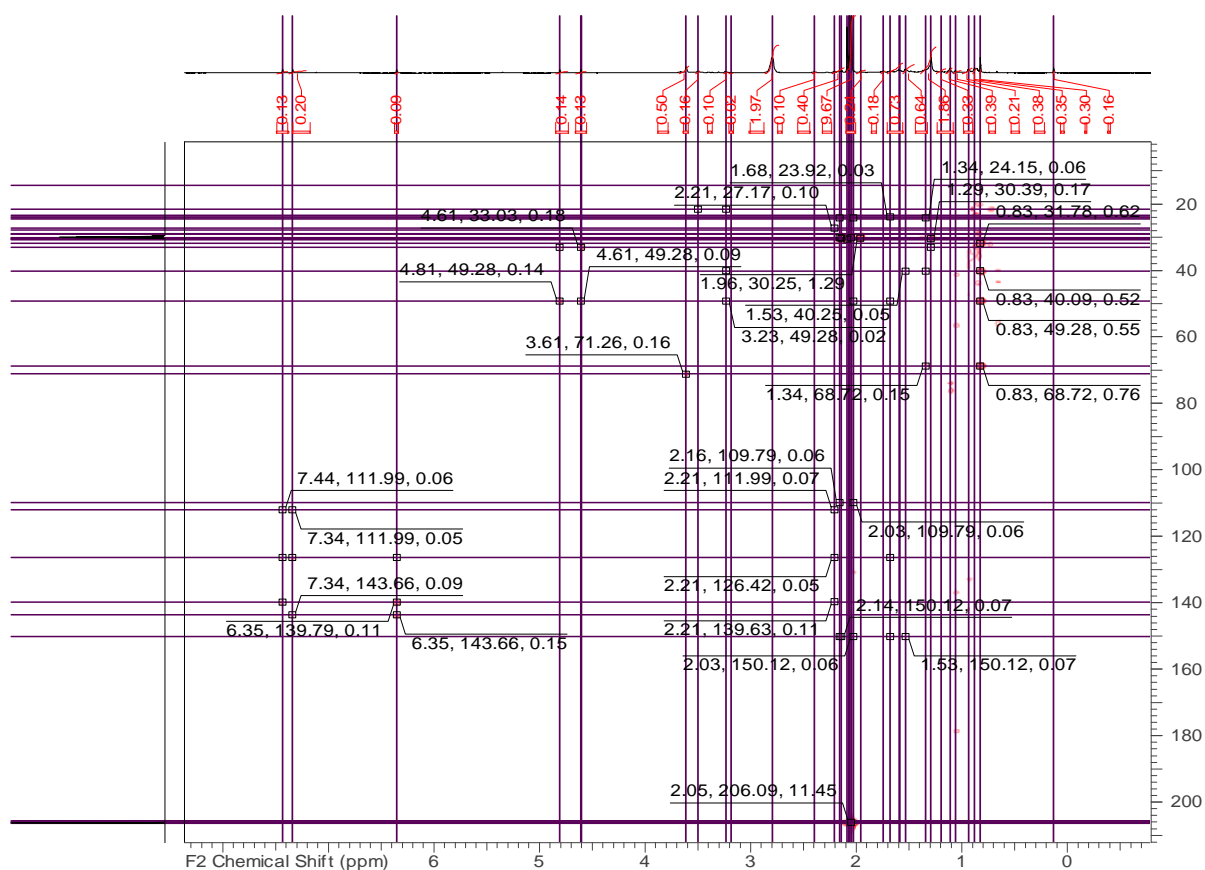


Figure 82: ^1H , ^1H COSY NMR spectrum of elgonene I (**10**) in acetone- d_6 (500 MHz)

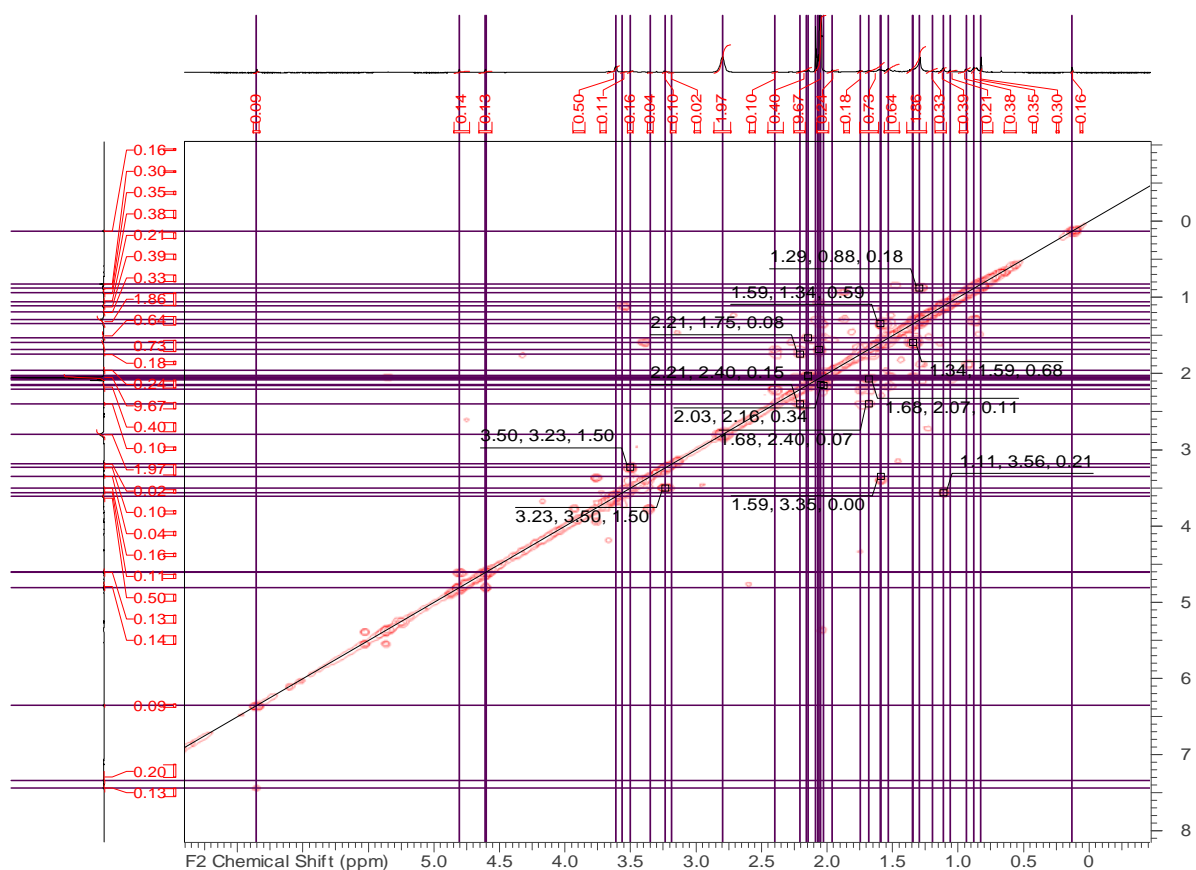


Figure 83: ^1H , ^1H ROESY NMR spectrum of elgonene I (**10**) in acetone- d_6 (500 MHz)

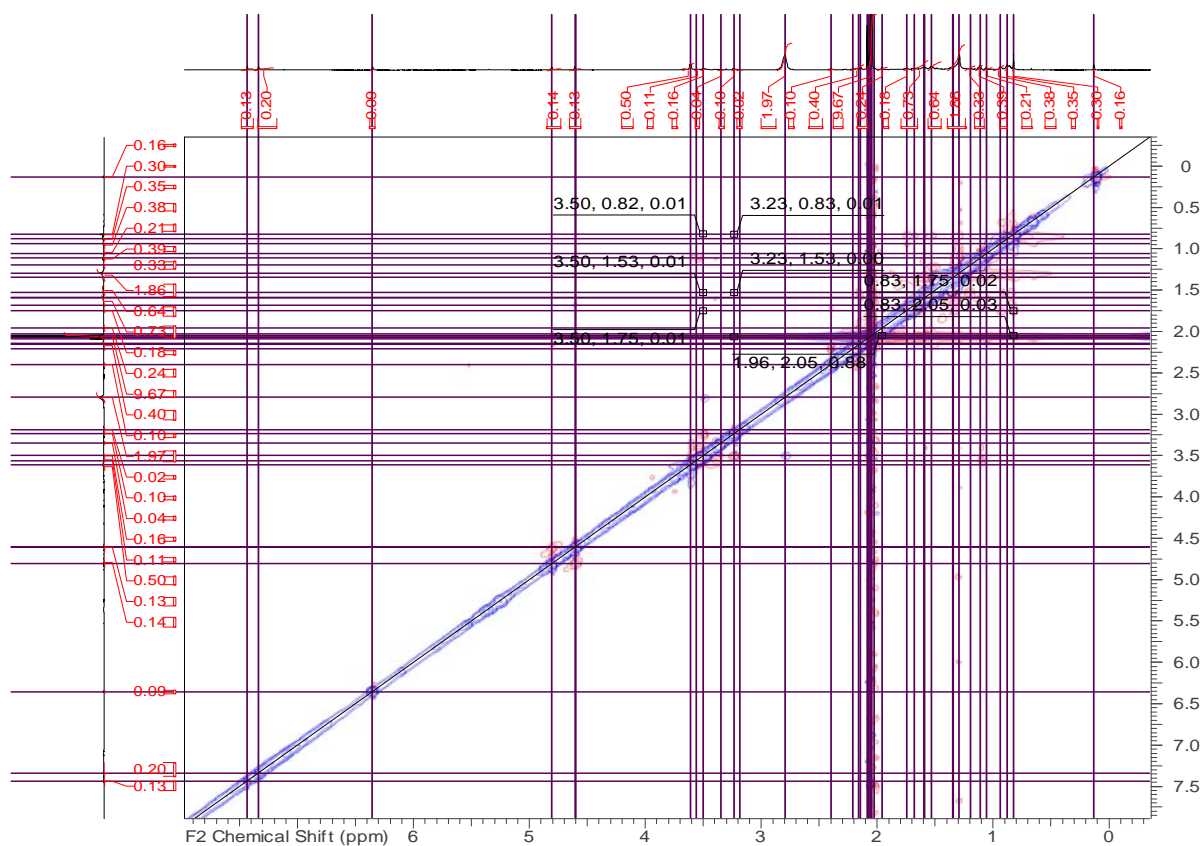
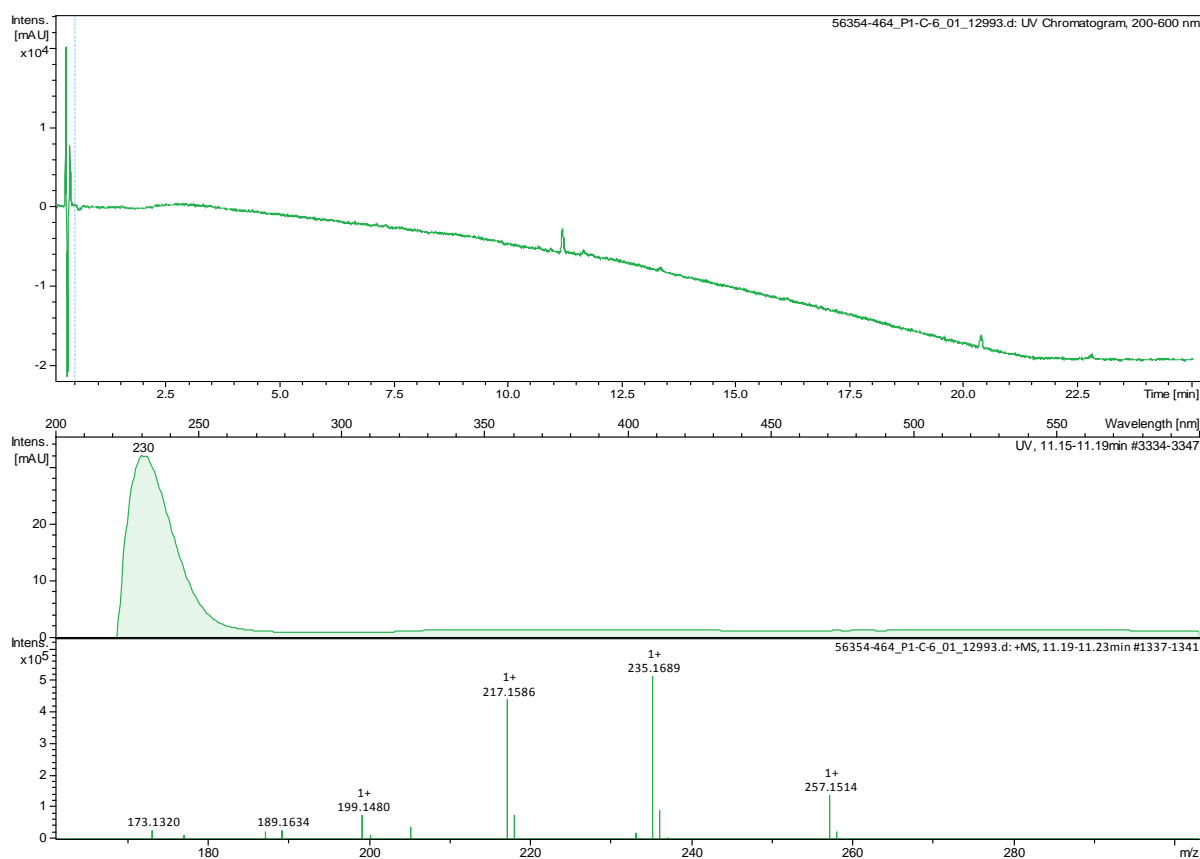


Figure 84: HR-ESIMS spectrum of elgonene I (**10**)



1 and 2D NMR data for elgonene J (**11**)

Figure 85: ¹H NMR spectrum of elgonene J (**11**) in acetone-d₆ (700 MHz)

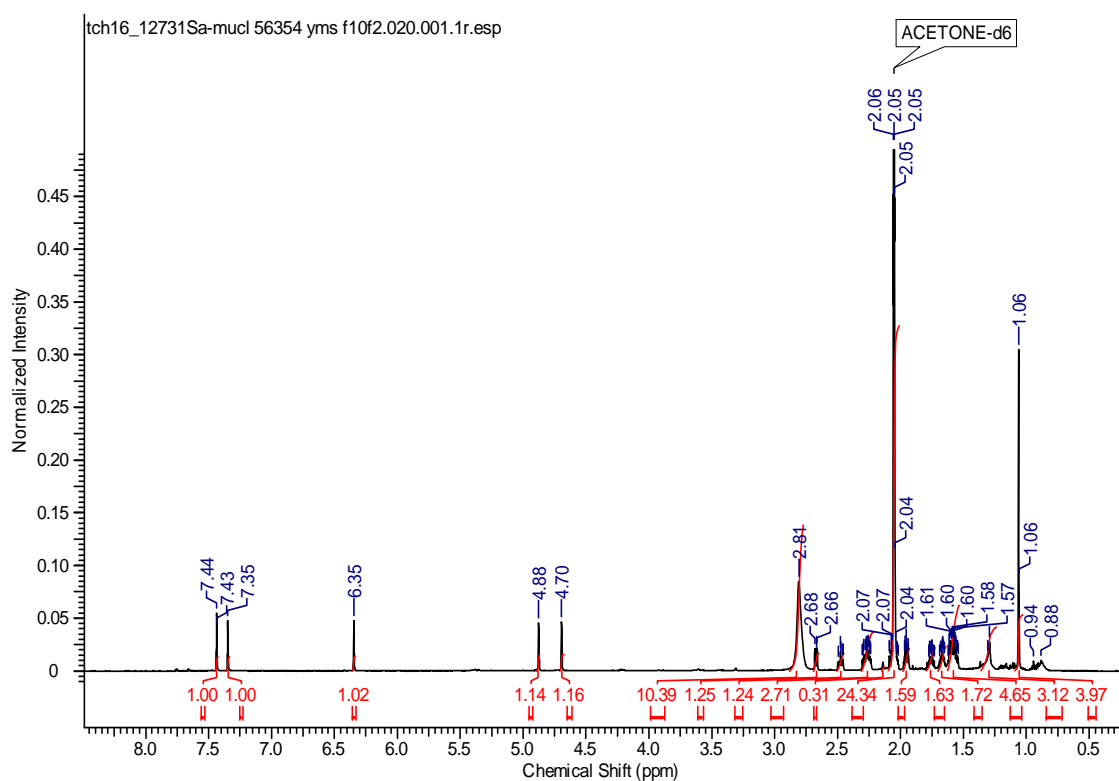


Figure 86: ^{13}C NMR spectrum of elgonene J (**11**) in acetone- d_6 (175 MHz)

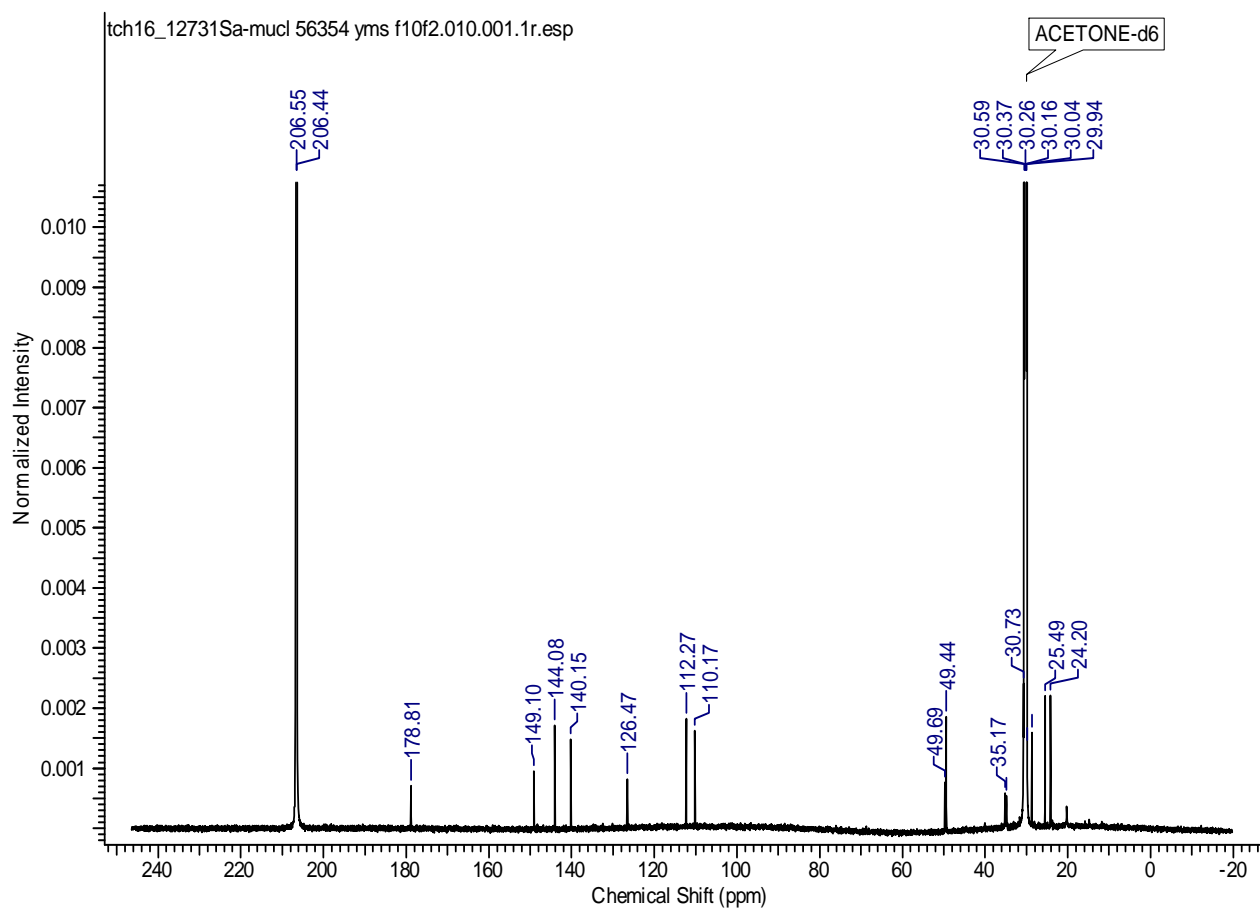


Figure 87: DEPT NMR spectrum of elgonene J (**11**) in acetone- d_6 (175 MHz)

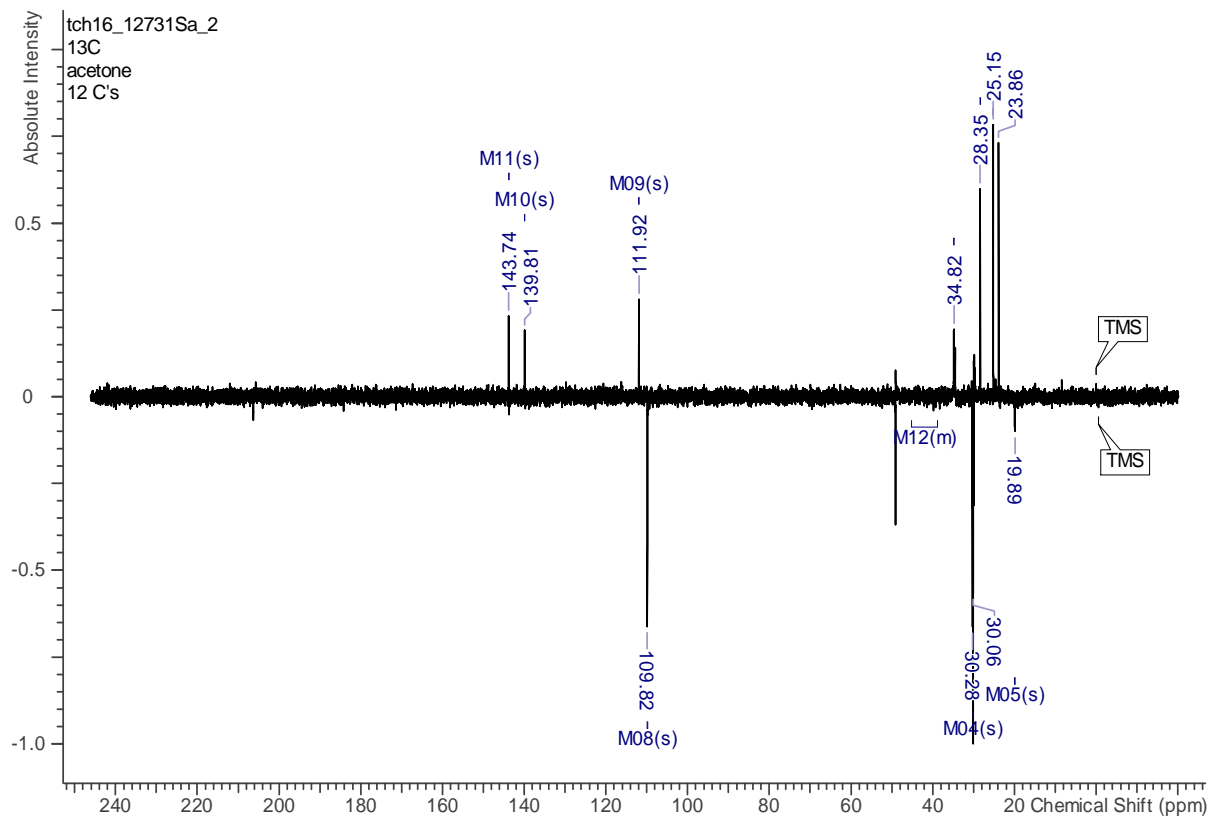


Figure 88: ^1H , ^{13}C HSQC NMR spectrum of elgonene J (**11**) in acetone- d_6 (700 MHz, 175 MHz)

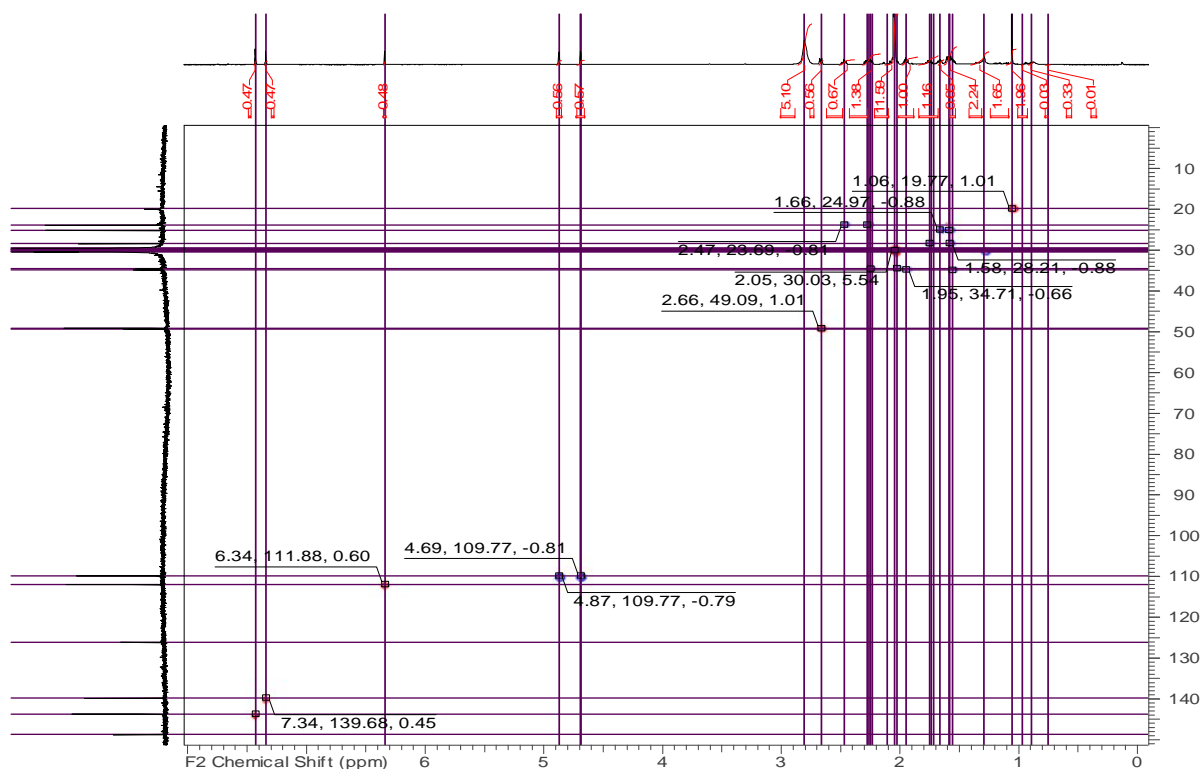


Figure 89: ^1H , ^{13}C HMBC NMR spectrum of elgonene J (**11**) in acetone- d_6 (700 MHz, 175 MHz)

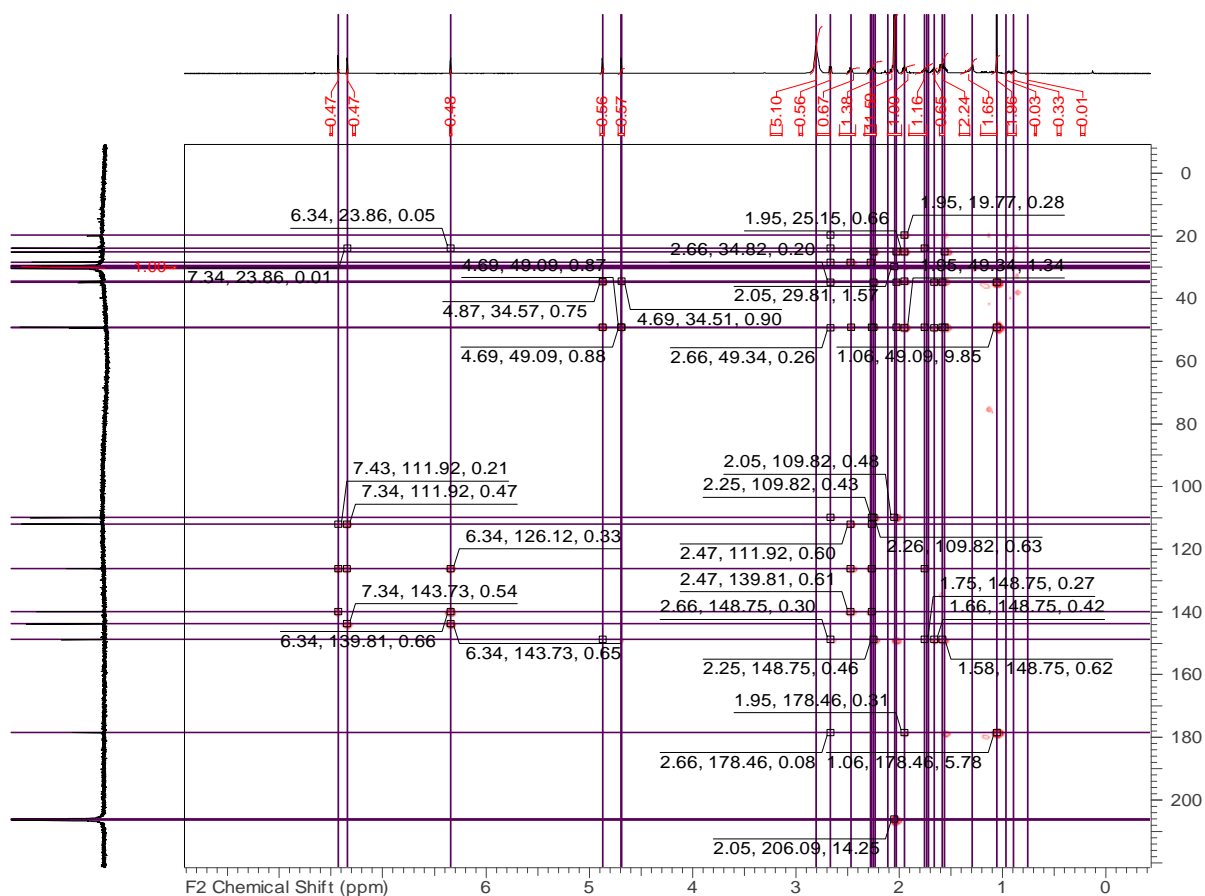


Figure 90: ^1H , ^1H COSY NMR spectrum of elgonene J (**11**) in acetone- d_6 (700 MHz)

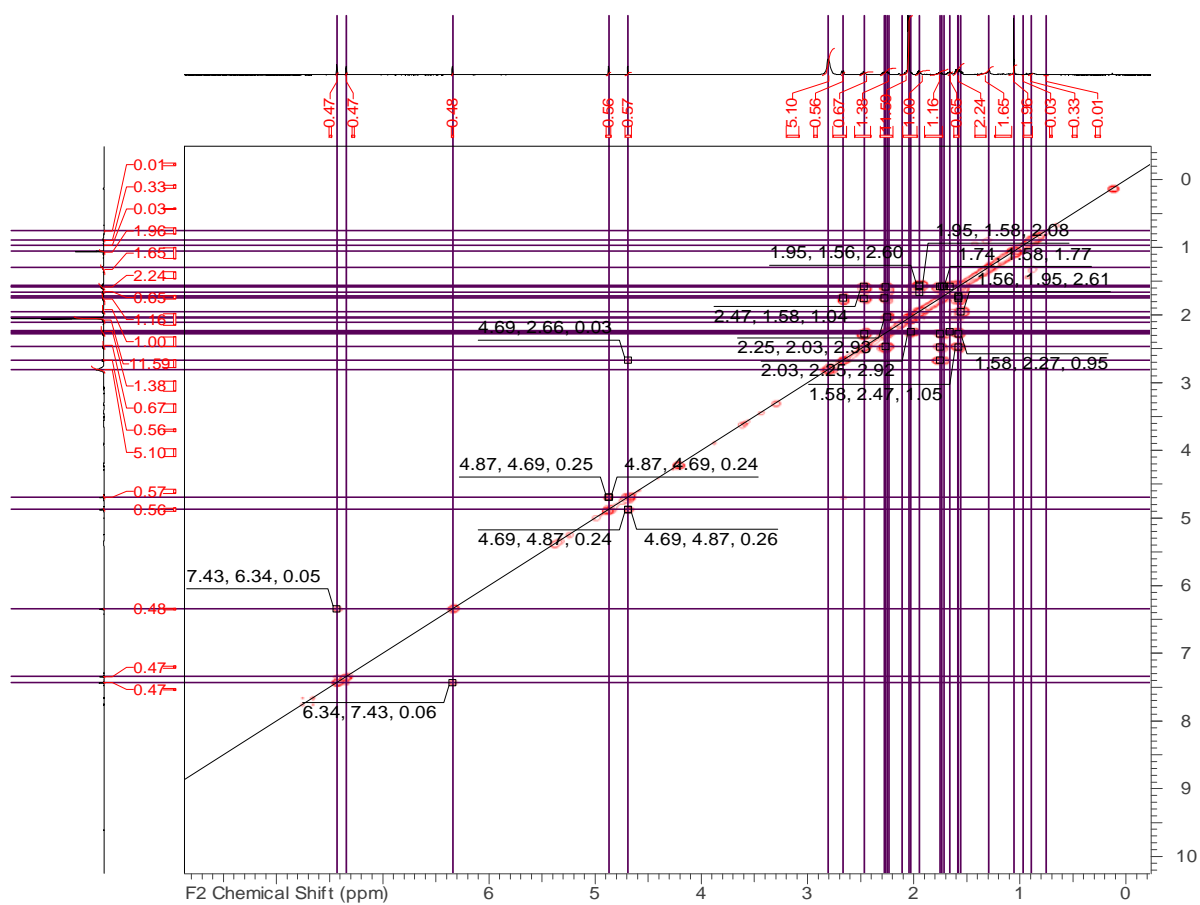


Figure 91: ^1H , ^1H ROESY NMR spectrum of elgonene J (**11**) in acetone- d_6 (700 MHz).

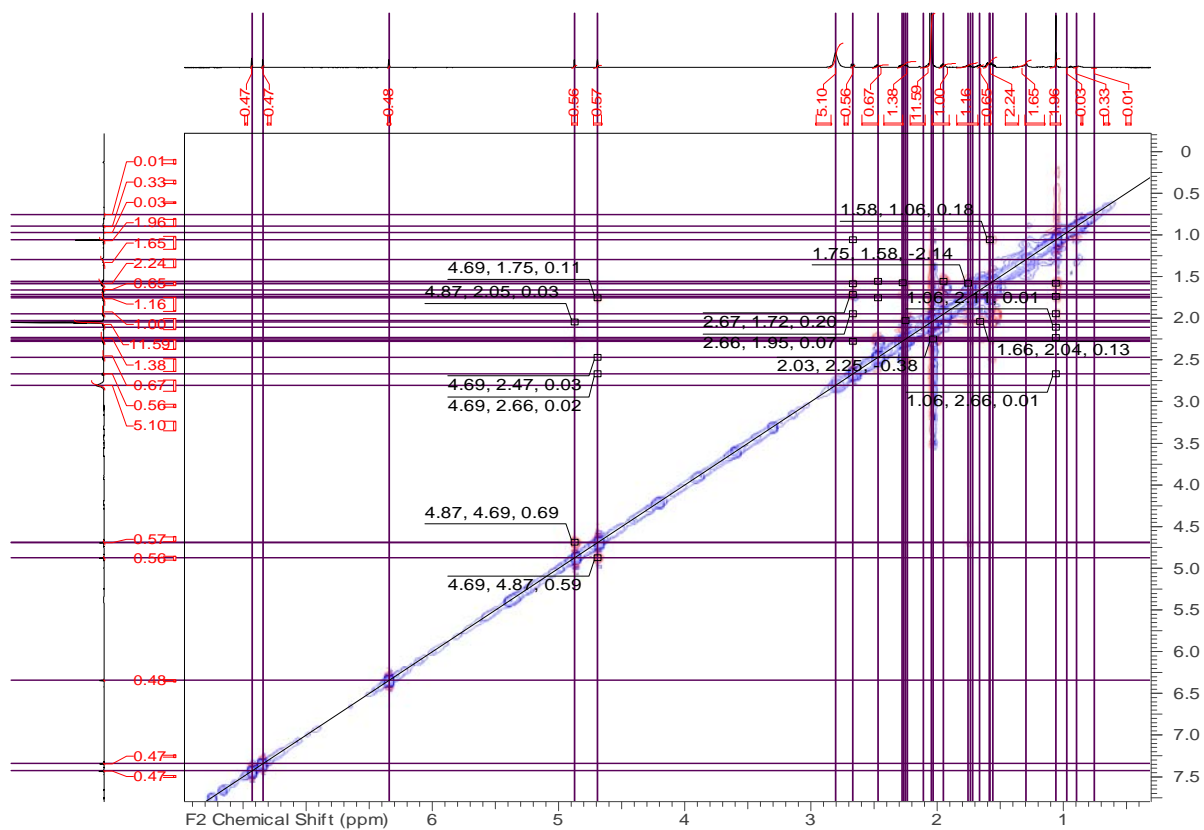
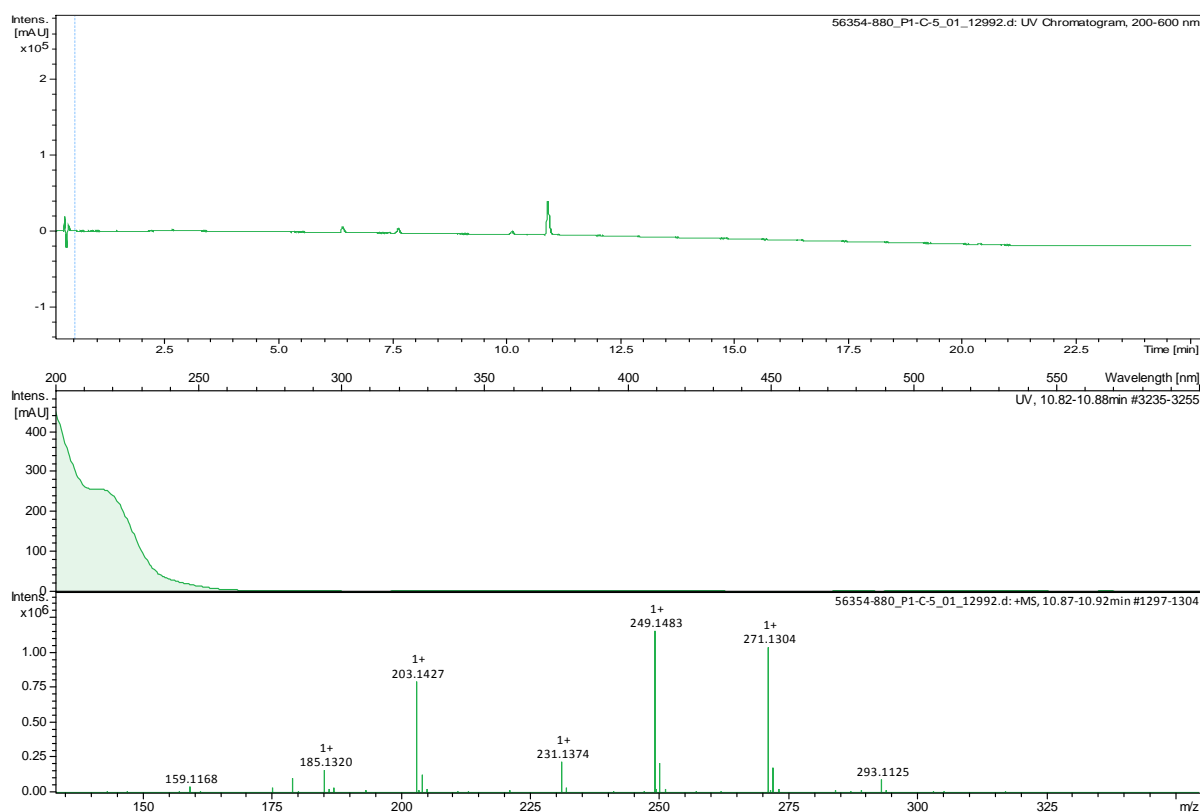


Figure 92: HR-ESIMS spectrum of elgonene J (**11**)



1 and 2D NMR data for elgonene K (**12**)

Figure 93: ^1H NMR spectrum of elgonene K (**12**) in CDCl_3 (500 MHz)

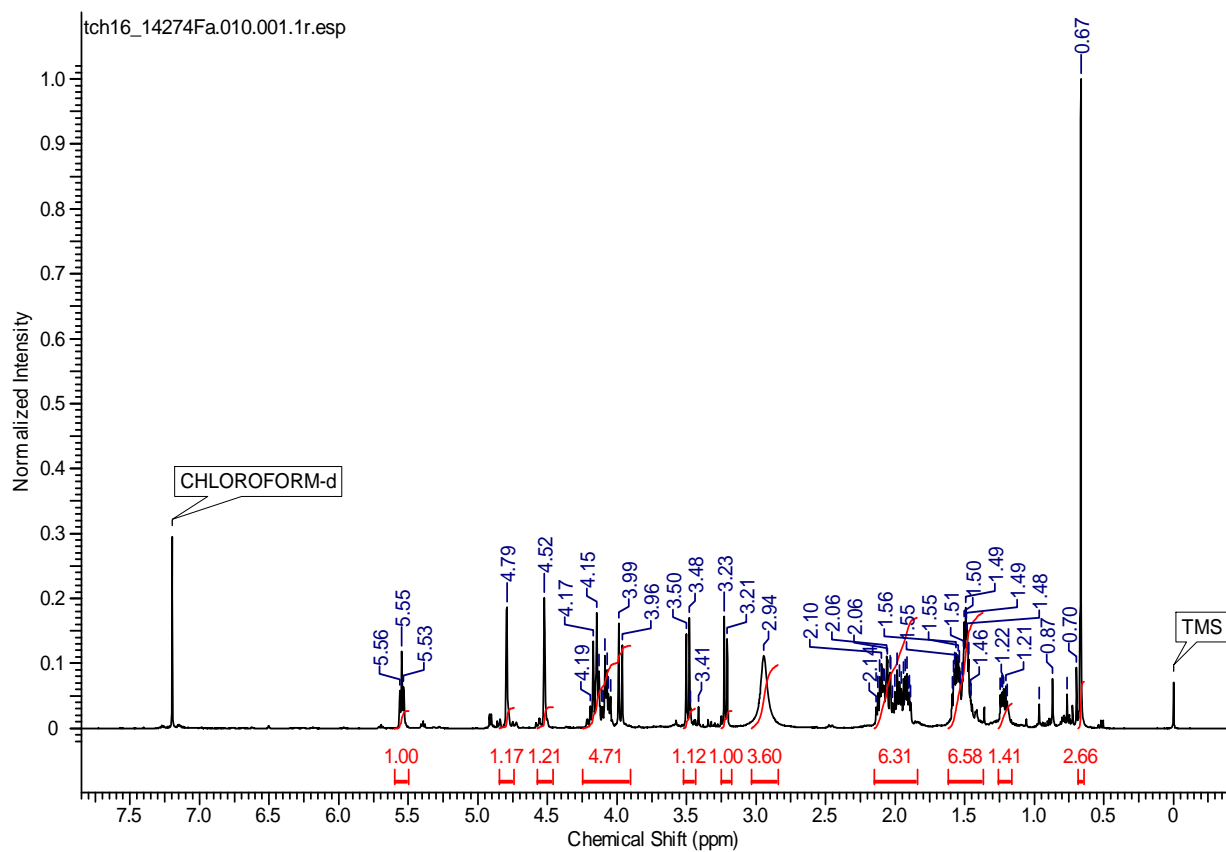


Figure 94: ^{13}C NMR spectrum of elgonene K (**12**) in CDCl_3 (125 MHz)

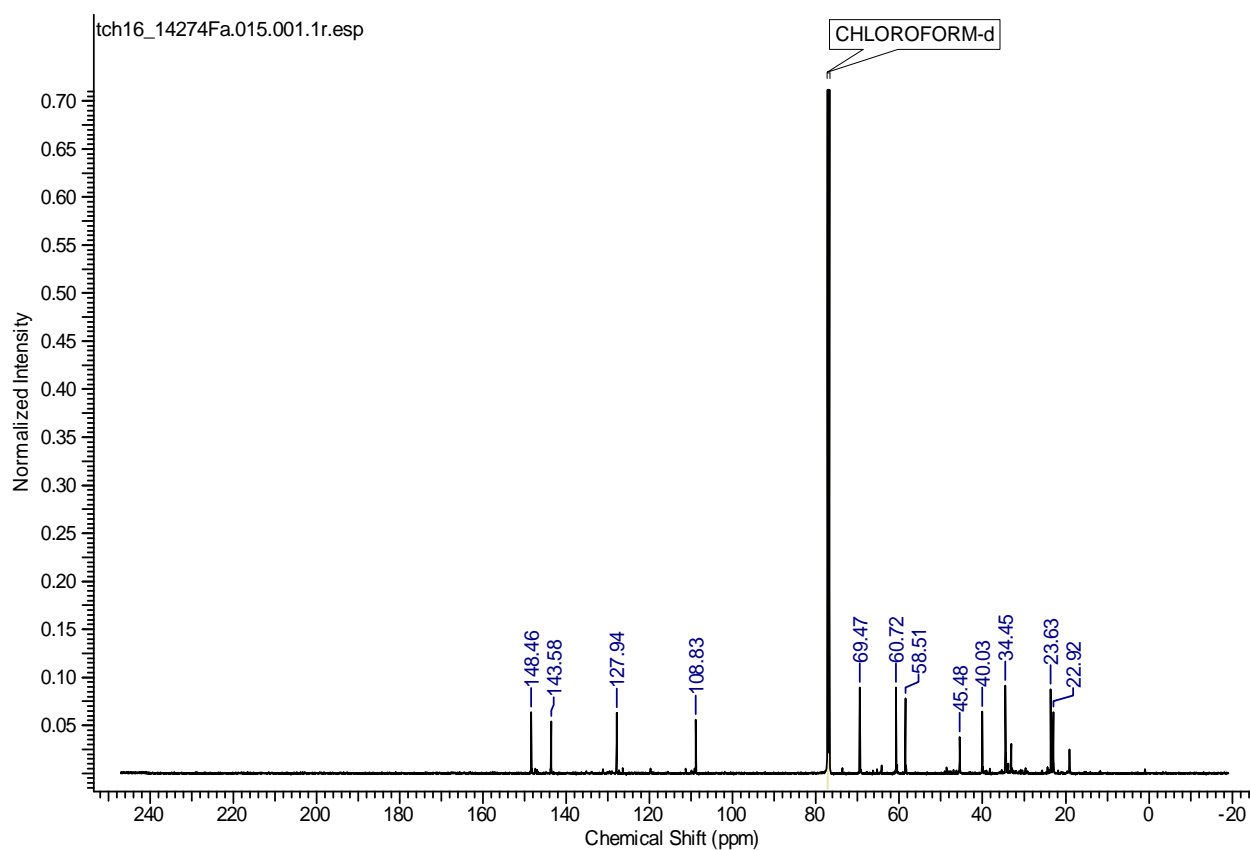


Figure 95: DEPT NMR spectrum of elgonene K (**12**) in CDCl_3 (125 MHz)

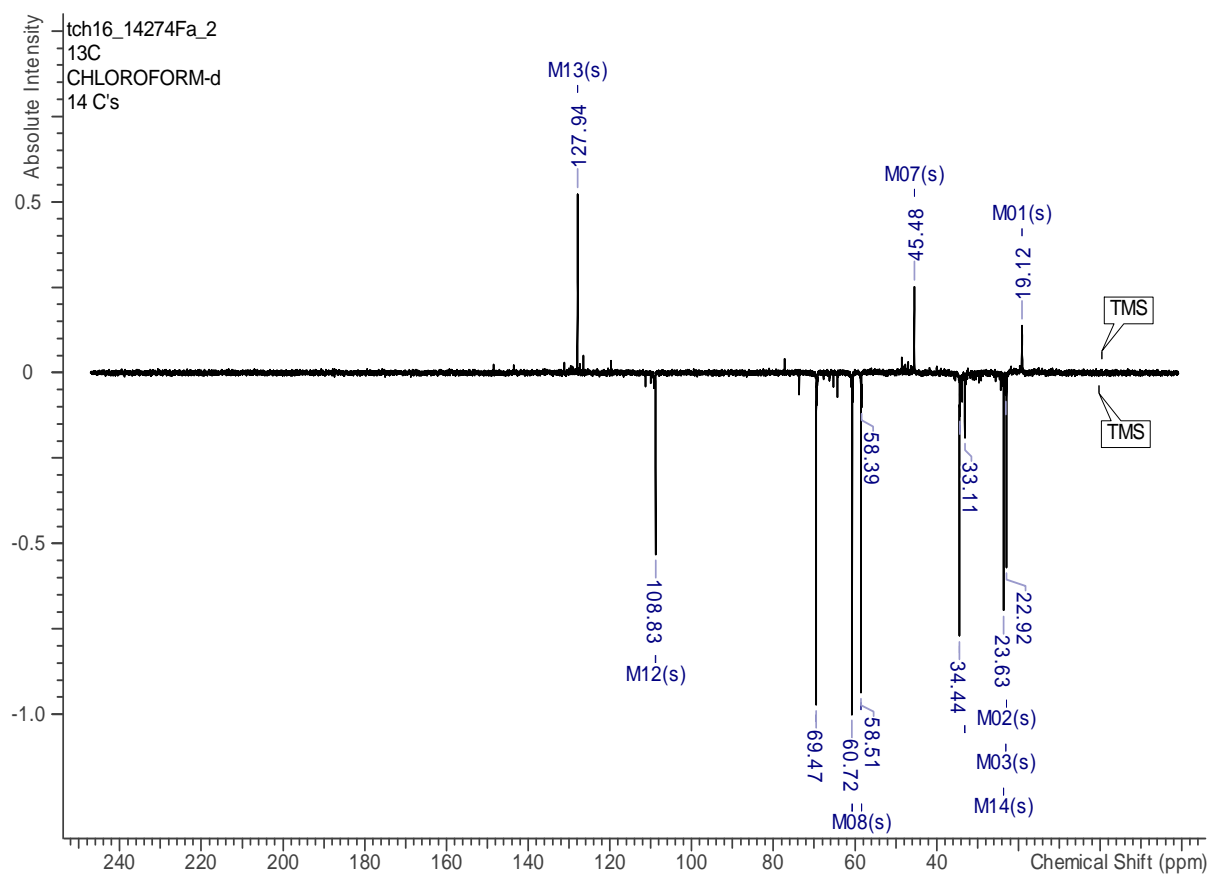


Figure 96: ^1H , ^{13}C HSQC NMR spectrum of elgonene K (**12**) in CDCl_3 (500 MHz, 125 MHz)

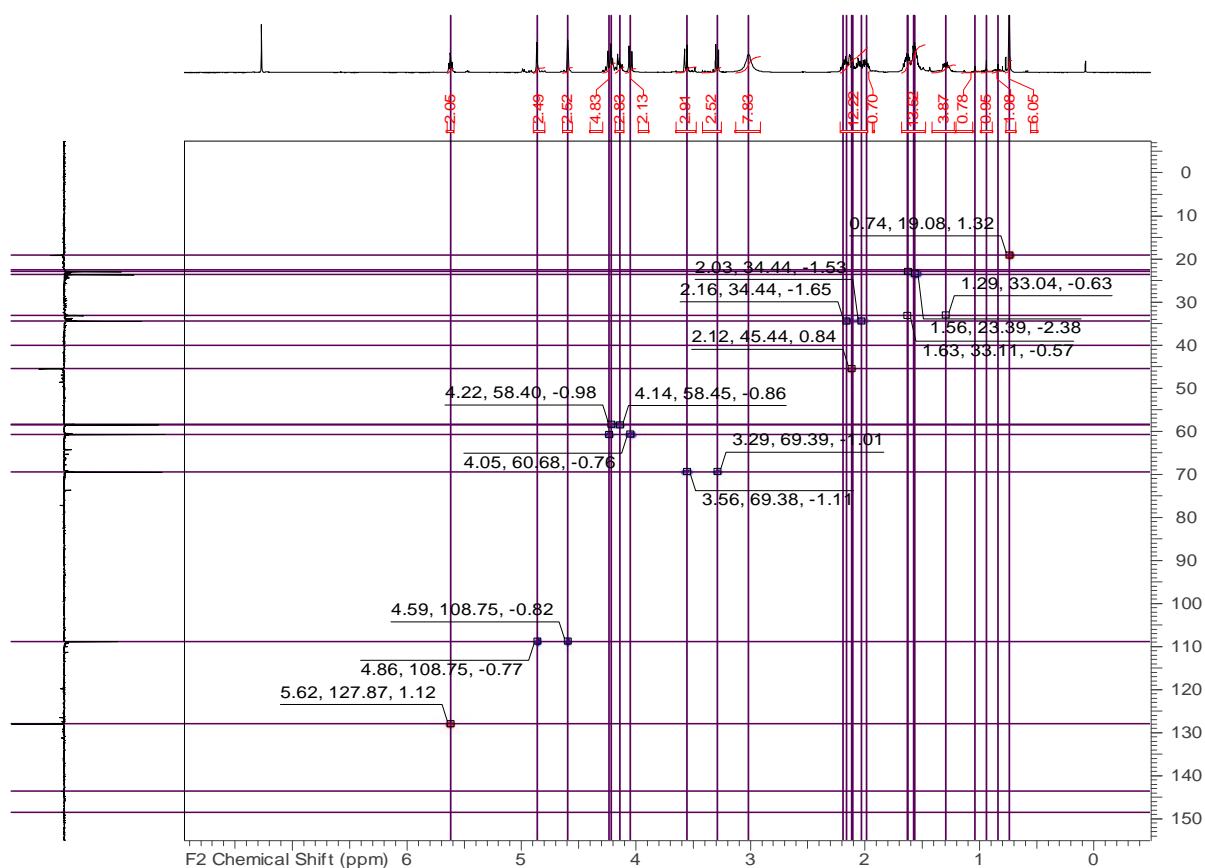


Figure 97: ^1H , ^{13}C HMBC NMR spectrum of elgonene K (**12**) in CDCl_3 (500 MHz, 125 MHz)

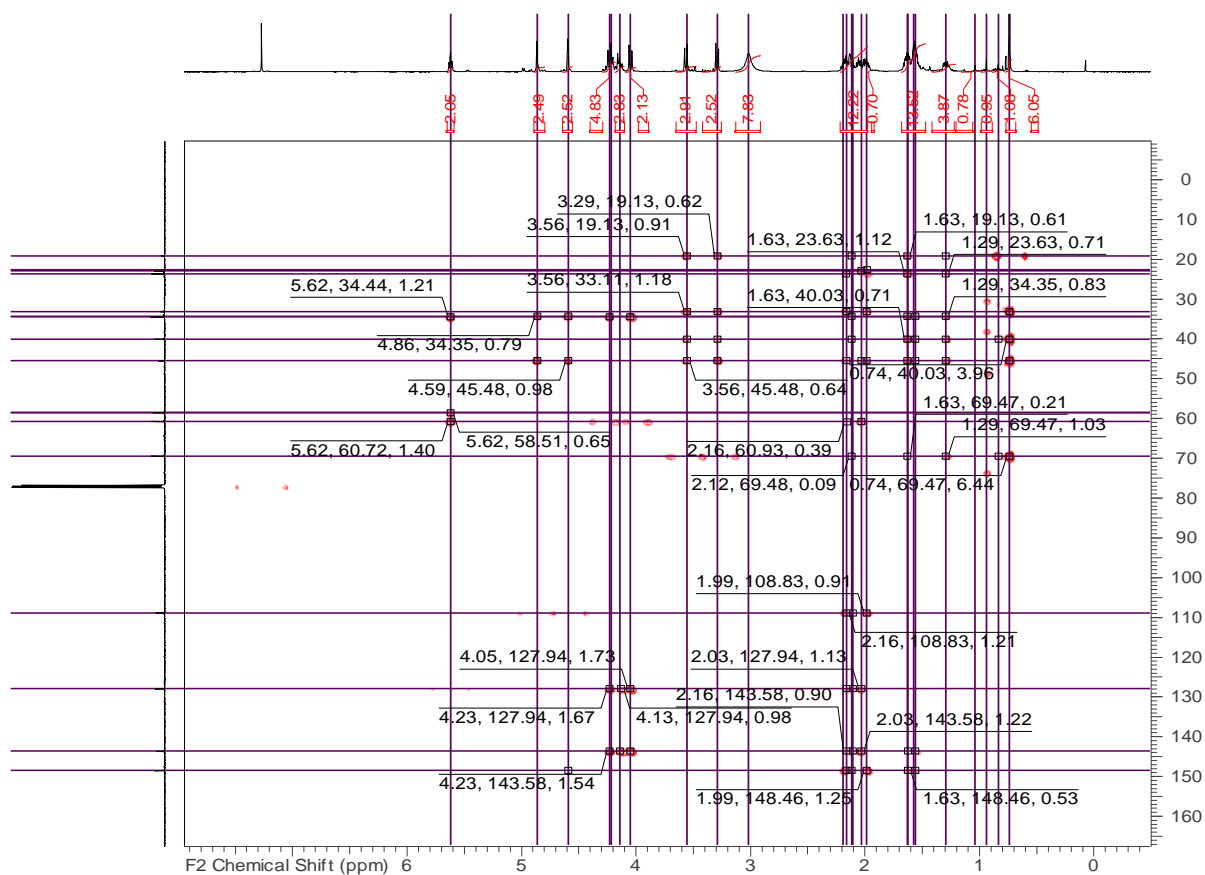


Figure 98: ^1H , ^1H COSY NMR spectrum of elgonene K (**12**) in CDCl_3 (500 MHz)

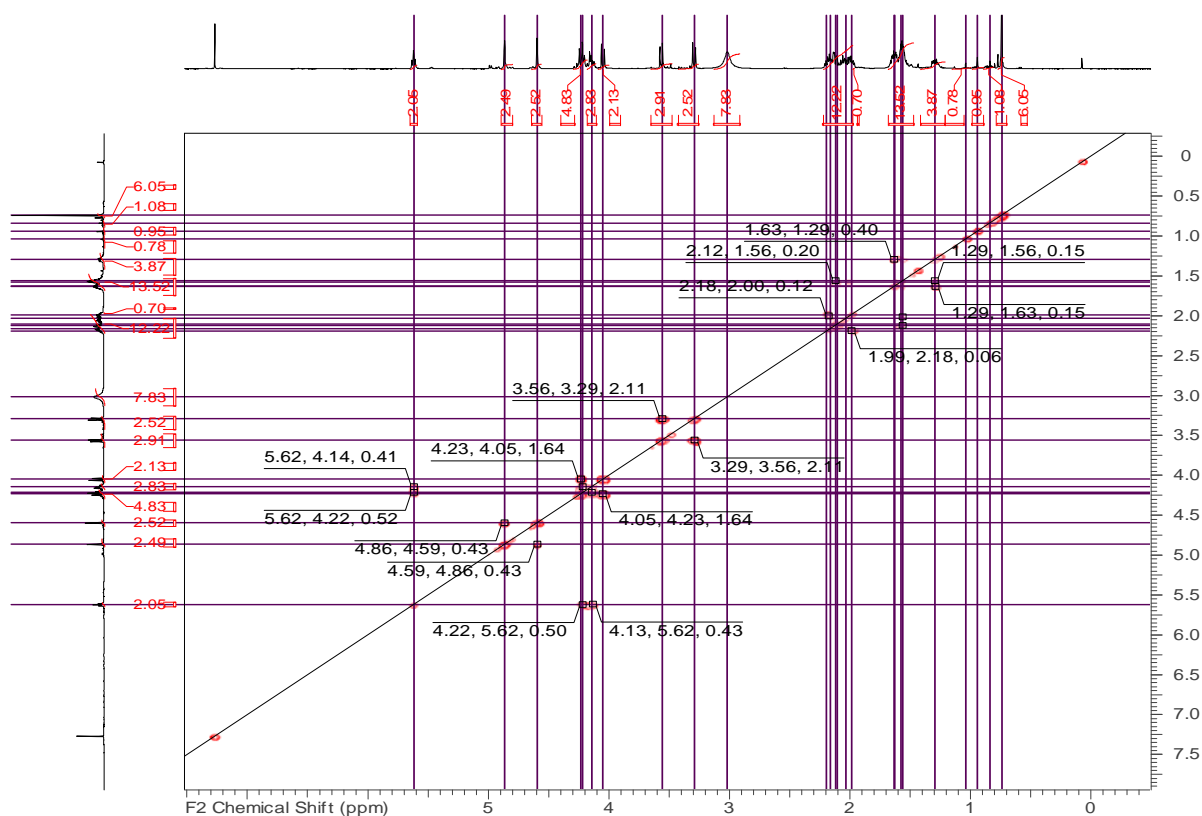


Figure 99: ^1H , ^1H ROESY NMR spectrum of elgonene K (**12**) in CDCl_3 (500 MHz)

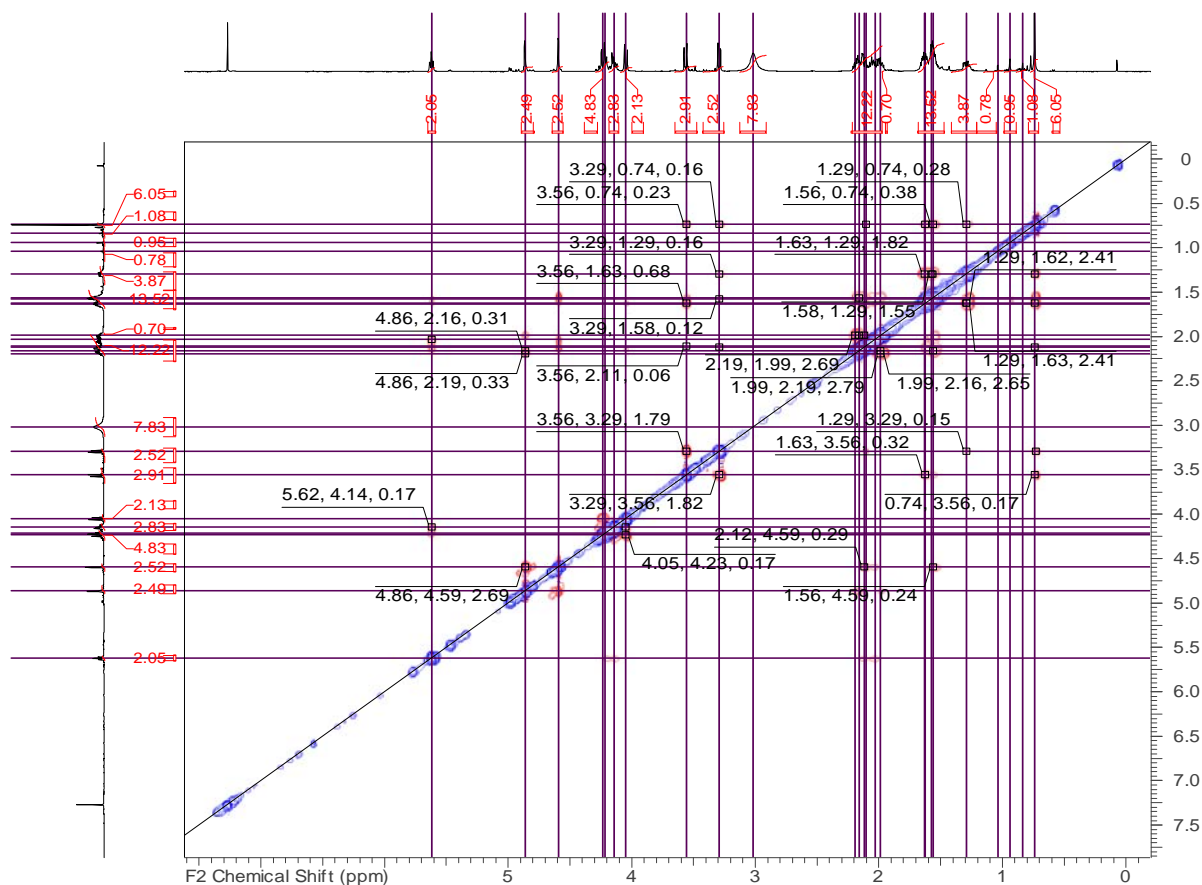
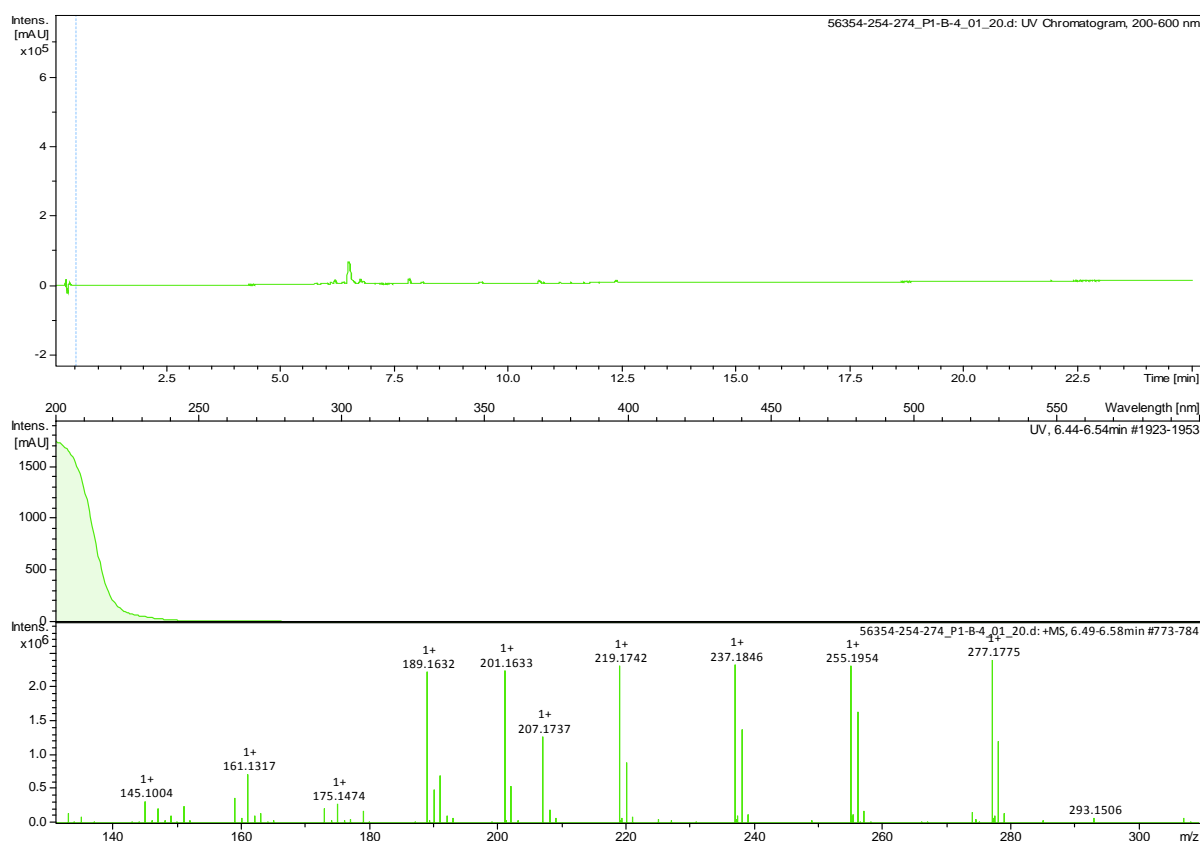


Figure 100: HR-ESIMS spectrum of elgonene K (**12**)



1 and 2D NMR data for elgonene L (**13**)

Figure 101: ^1H NMR spectrum of elgonene L (**13**) in CDCl_3 (700 MHz)

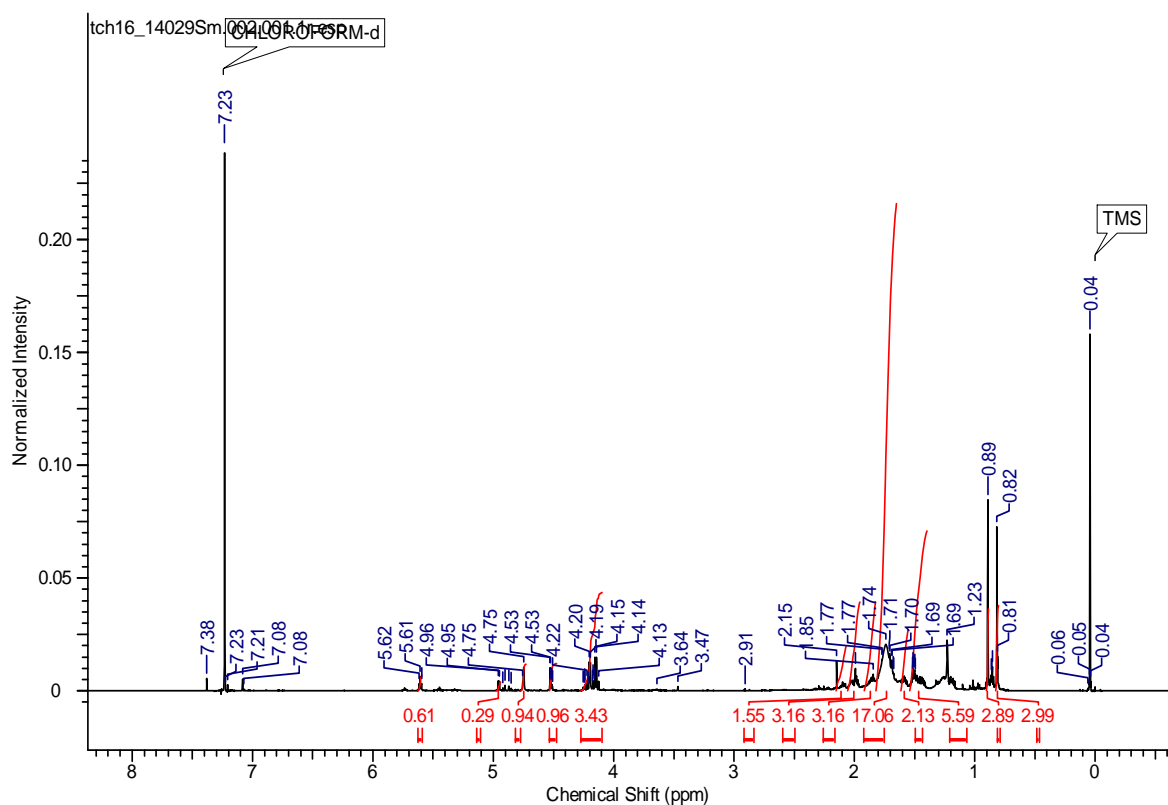


Figure 102: ^{13}C NMR spectrum of elgonene L (**13**) in CDCl_3 (175 MHz)

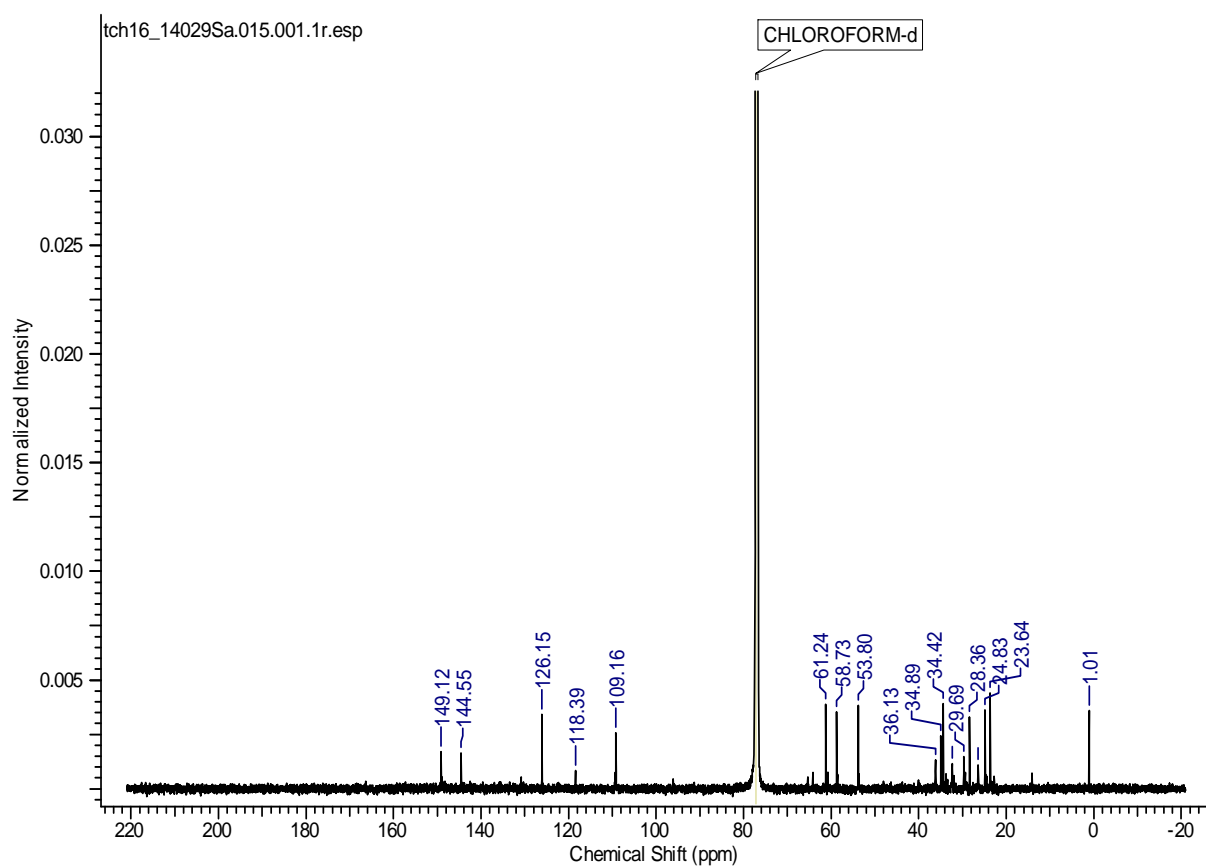


Figure 103: DEPTNMR spectrum of elgonene L (**13**) in CDCl_3 (175 MHz)

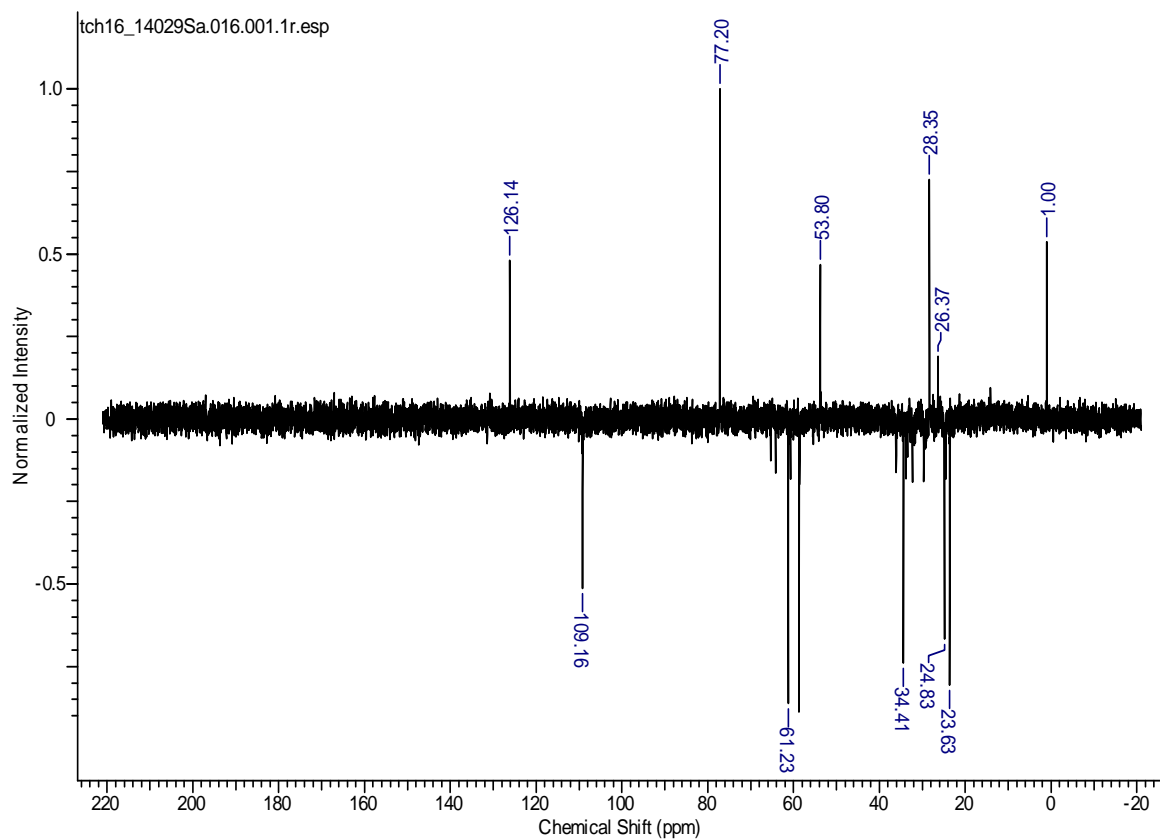


Figure 104: ^1H , ^{13}C HSQC NMR spectrum of elgonene L (**13**) in CDCl_3 (700 MHz, 175 MHz)

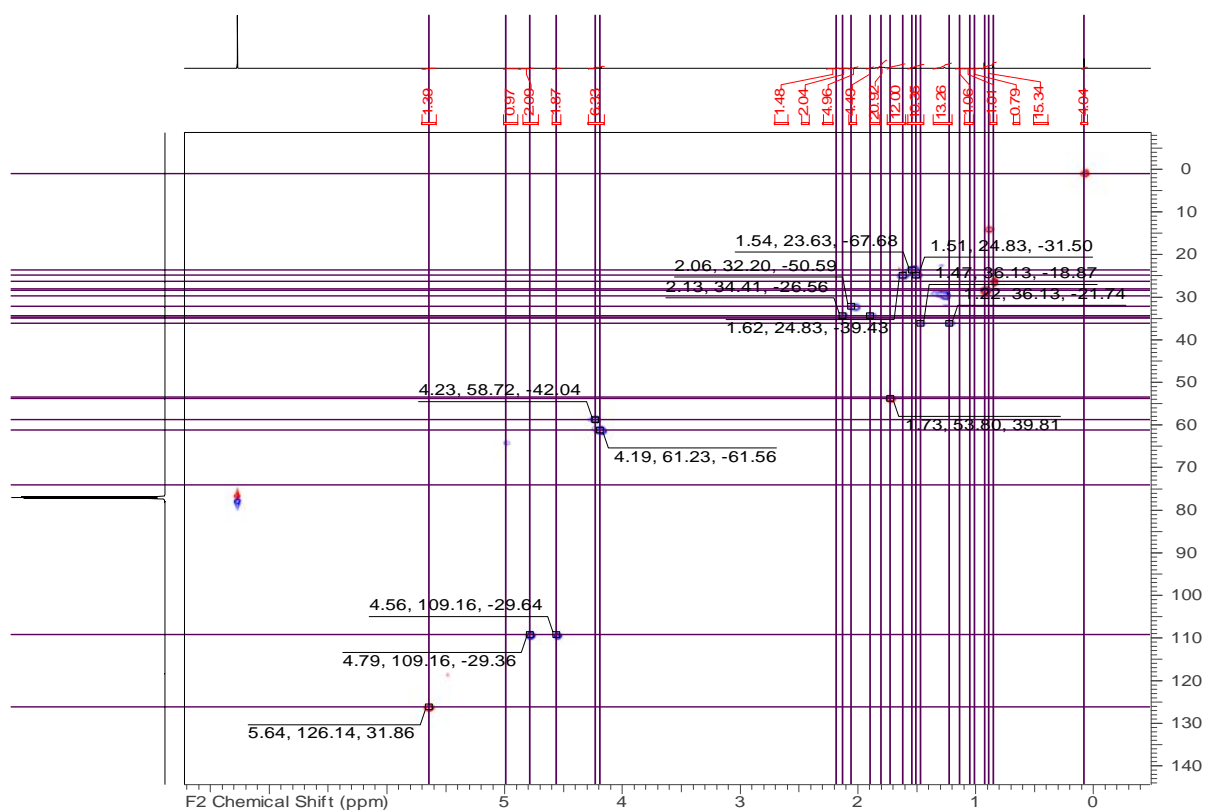


Figure 105: ^1H , ^{13}C HMBC NMR spectrum of elgonene L (**13**) in CDCl_3 (700 MHz, 175 MHz)

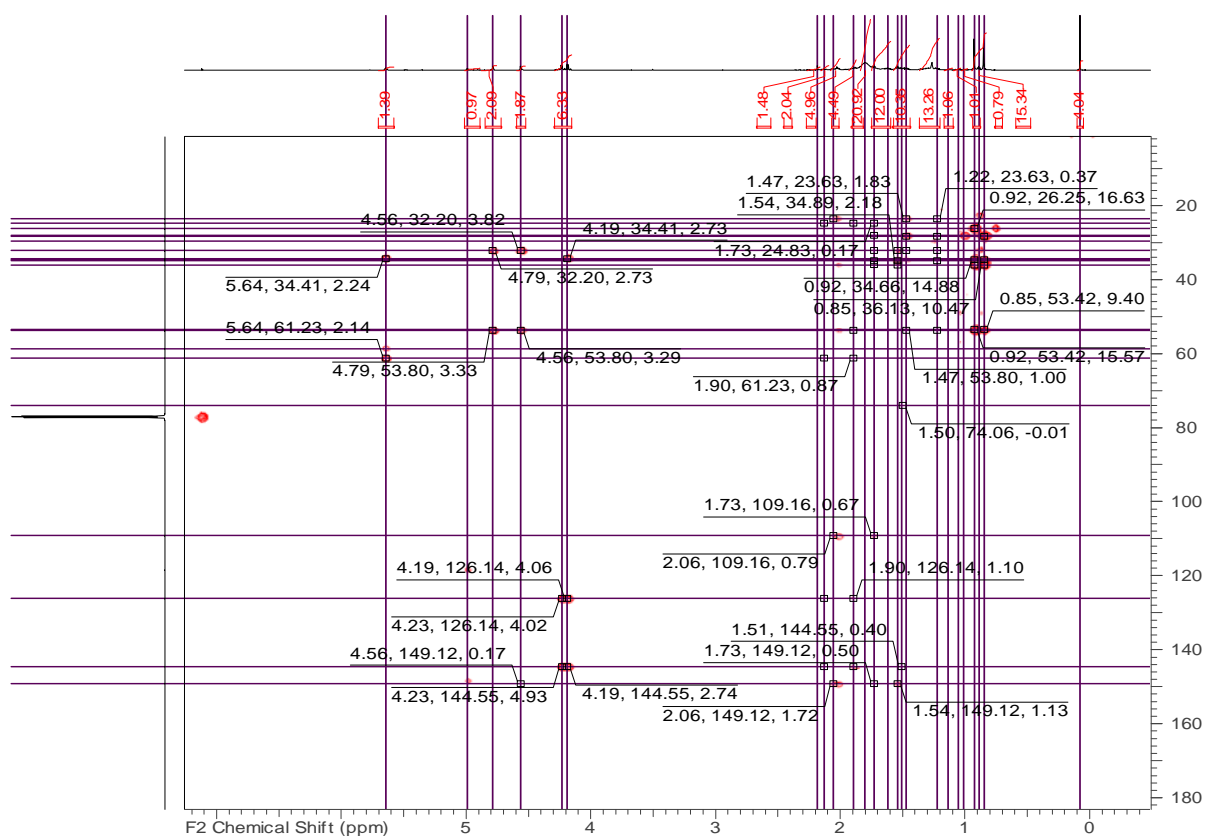


Figure 106: ^1H , ^1H COSY NMR spectrum of elgonene L (**13**) in CDCl_3 (700 MHz)

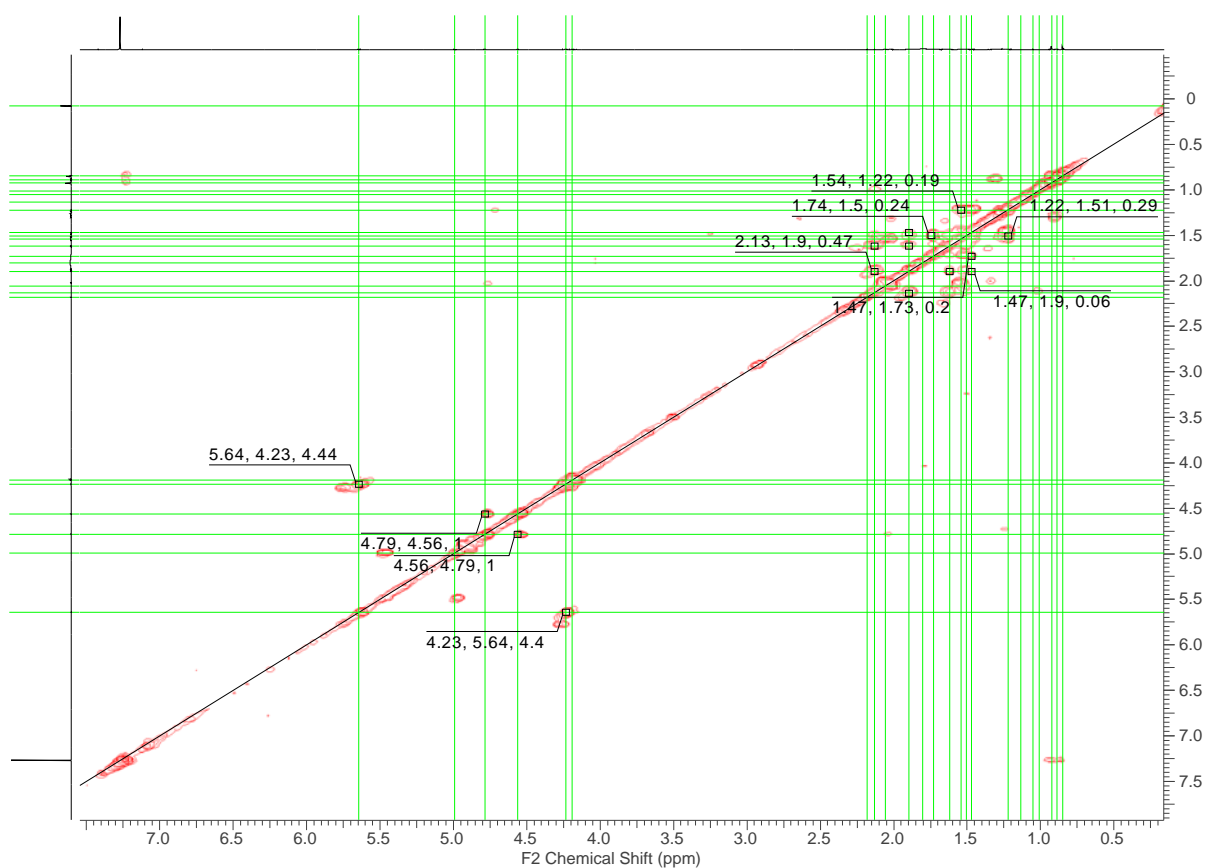


Figure 107: ^1H , ^1H ROESY NMR spectrum of elgonene L (**13**) in CDCl_3 (700 MHz)

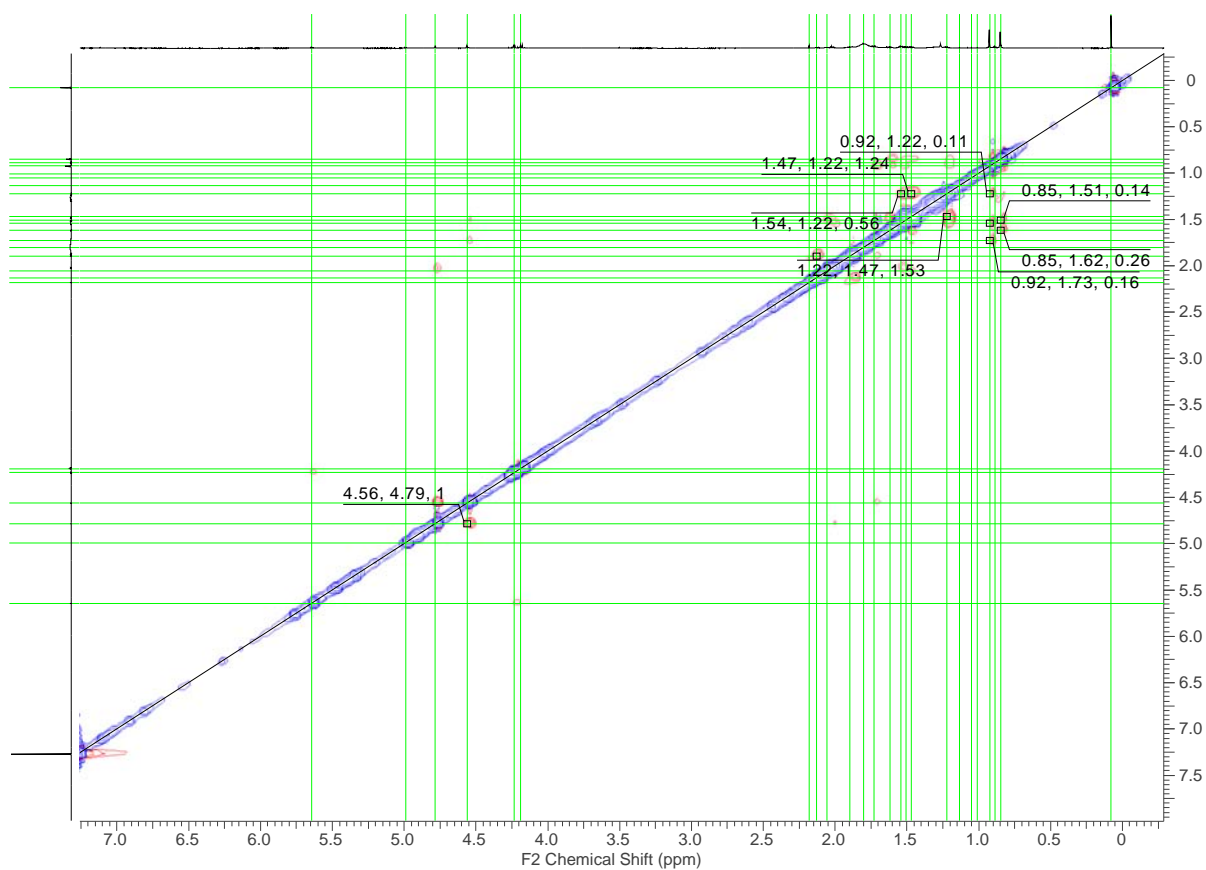
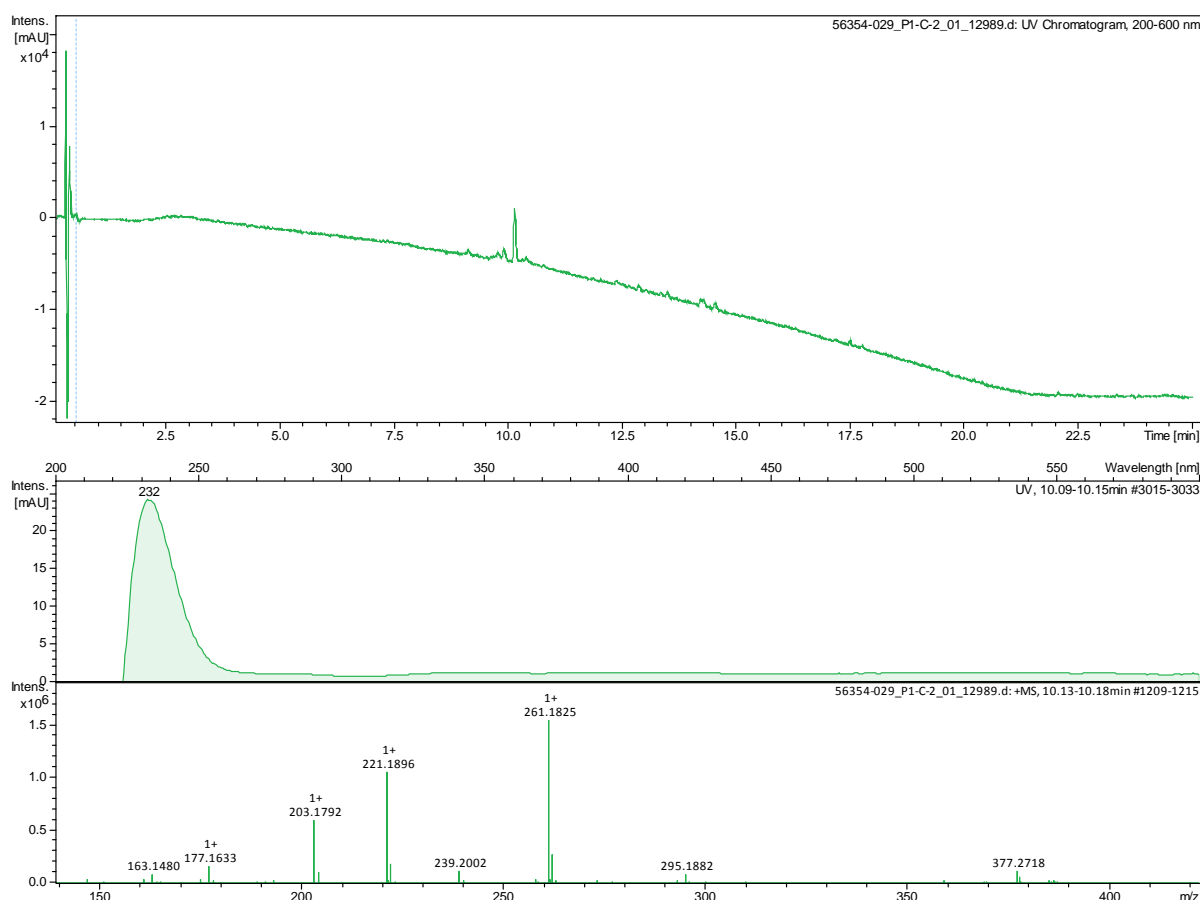


Figure 108: HR-ESIMS spectrum of elgonene L (**13**)



NMR data of (6*R*,7*S*,10*R*)-7,10-epoxy-7,11-dimethyldodec-1-ene-6,11-diol (1**), (S)-MTPA ester**

^1H NMR (700 MHz, Pyridine- d_5), 7.43 (3H, m), 7.59 (2H, m), 6.45 (1H, dd, $J=17.42$, 10.97 Hz), 5.54 (1H, dd, $J=9.46$, 2.15 Hz), 5.36 (1H, d, $J=17.64$), 5.09 (1H, d, $J=10.97$), 4.01 (1H, t, $J=7.10$ Hz), 2.476 (2H, m), 2.43 (1H, m), 2.27 (1H, m), 2.19 (1H, m), 1.99 (1H, m), 1.98 (1H, m), 1.93 (1H, m), 1.62 (1H, m), 1.41 (3H, s), 1.33 (3H, s), 1.23 (3H, s).

NMR data of (6*R*,7*S*,10*R*)-7,10-epoxy-7,11-dimethyldodec-1-ene-6,11-diol (1**), (S)-MTPA ester**

^1H NMR (700 MHz, Pyridine- d_5), 7.43 (3H, m), 7.60 (2H, m), 6.41 (1H, dd, $J=17.42$, 10.97 Hz), 5.54 (1H, dd, $J=9.90$, 2.37 Hz), 5.24 (1H, d, $J=17.42$), 5.08 (1H, d, $J=10.97$), 4.02 (1H, dd, $J=4.04$, 4.02 Hz), 2.36 (2H, m), 2.36 (1H, m), 2.19 (1H, m), 2.22 (1H, m), 2.11 (1H, m), 1.95 (1H, m), 1.89 (1H, m), 1.73 (1H, m), 1.43 (3H, s), 1.33 (3H, s), 1.25 (3H, s).

Table 1: Compound (**1**) (*R*) and (*S*)- MTPA esters data analysis

	<i>S</i> -MTPA ester	<i>R</i> -MTPA	$\Delta\delta_{SR} = S\text{-MTPA} - R\text{-MTPA}$
8a	1.616	1.733	-0.117
8b	1.998	2.108	-0.110
9a	1.932	1.945	-0.013
9b	2.194	2.221	-0.027
10	4.008	4.021	-0.013
12	1.234	1.311	-0.077
13	1.409	1.427	-0.018
14	1.325	1.333	-0.008
2	6.445	6.409	+0.036
1b	5.357	5.241	+0.116
1a	5.094	5.085	+0.009
5b	2.433	2.368	+0.065
5a	1.984	1.894	+0.009
4b	2.476	2.358	+0.118
4a	2.274	2.188	+0.086

NMR data of Elgonene A (**2**) (*S*)- MTPA ester

¹H NMR (700 MHz, Pyridine-d₅), 7.45 (3H, m) , 7.60 (2H, m), 7.24 (1H, m), 6.10 (1H, d, *J*=3.0 Hz), 5.48 (1H, m), 5.40 (1H, m), 5.18 (1H, s), 5.12 (1H, s), 3.84 (3H, OCH₃), 2.32 (1H, m), 2.08 (1H,m), 2.05 (1H, m), 1.97(1H, m), 1.94 (1H, m), 1.86 (3H, s), 1.60 (1H, m), 1.50 (1H, m), 1.61 (3H, s).

NMR data of Elgonene A (**2**) (*R*)- MTPA ester

¹H NMR (700 MHz, Pyridine-d₅), 7.43 (3H, m), 7.60 (2H, m), 7.24 (1H, m), 6.17 (1H, d, *J*=3.23 Hz), 5.40 (1H, m), 5.40 (1H, m), 5.39 (1H, s), 5.30 (1H, s), 3.45 (3H, OCH₃), 2.33 (1H, m), 2.13 (1H,m), 2.09 (1H, m), 1.97(1H, m), 1.94 (1H, m), 1.82 (3H, s), 1.61 (1H, m), 1.51 (1H, m), 1.61 (3H, s).

Table 2: Elgonene A (**2**) (*R*) and (*S*)-MTPA esters data analysis

	<i>S</i> -MTPA ester	<i>R</i> -MTPA ester	$\Delta\delta_{SR}=S\text{-MTPA-}R\text{-MTPA}$
4	5.401	5.404	-0.003
5a	2.077	2.126	-0.049
5b	1.602	1.604	-0.002
6	2.316	2.334	-0.018
14	5.116	5.295	-0.179
	5.180	5.387	-0.207
9	5.476	5.418	+0.058
10	7.239	7.237	+0.002
15	1.862	1.818	+0.044

NMR data of Elgonene D (**5**) (*S*)- MTPA ester

¹H NMR (700 MHz, Pyridine-d₅), 7.43 (3H, m), 7.60 (2H, m), 6.52 (1H, m), 5.47 (1H, m), 4.62 (1H, dd, *J*=5.65, 12.82 Hz), 3.85 (3H, OCH₃), 2.68 (1H, m), 2.46 (1H, m), 2.44 (1H, m), 2.40 (1H, m), 2.29 (1H, m), 2.26 (1H, m), 2.09 (1H, m), 1.96 (1H, m), 1.65 (1H, m), 1.94 (3H, s), 1.64 (3H, s), 1.43 (3H, s).

NMR data of Elgonene D (**5**) (*R*)- MTPA ester

¹H NMR (700 MHz, Pyridine-d₅), 7.43 (3H, m), 7.60 (2H, m), 6.53 (1H, m), 5.47 (1H, m), 4.62 (1H, dd, *J*=3.66, 12.69 Hz), 3.45 (3H, OCH₃), 2.69 (1H, m), 2.50 (1H, m), 2.47 (1H, m), 2.42 (1H, m), 2.29 (1H, m), 2.25 (1H, m), 2.03 (1H, m), 1.95 (1H, m), 1.64 (1H, m), 1.94 (3H, s), 1.65 (3H, s), 1.43 (3H, s).

Table 3: Elgonene D (**5**) (*R*) and (*S*)-MTPA esters data analysis

	<i>S</i> -MTPA ester	<i>R</i> -MTPA ester	$\Delta\delta_{SR}=S\text{-MTPA-}R\text{-MTPA}$
4	2.461	2.466	-0.005
	2.682	2.690	-0.008
3	6.524	6.530	-0.006
14	1.435	1.432	+0.003
7	2.262	2.250	+0.012
8	1.645	1.643	+0.002
	1.955	1.950	+0.005
11	5.467	5.465	+0.002
12	2.093	2.034	+0.059
	2.440	2.420	+0.02

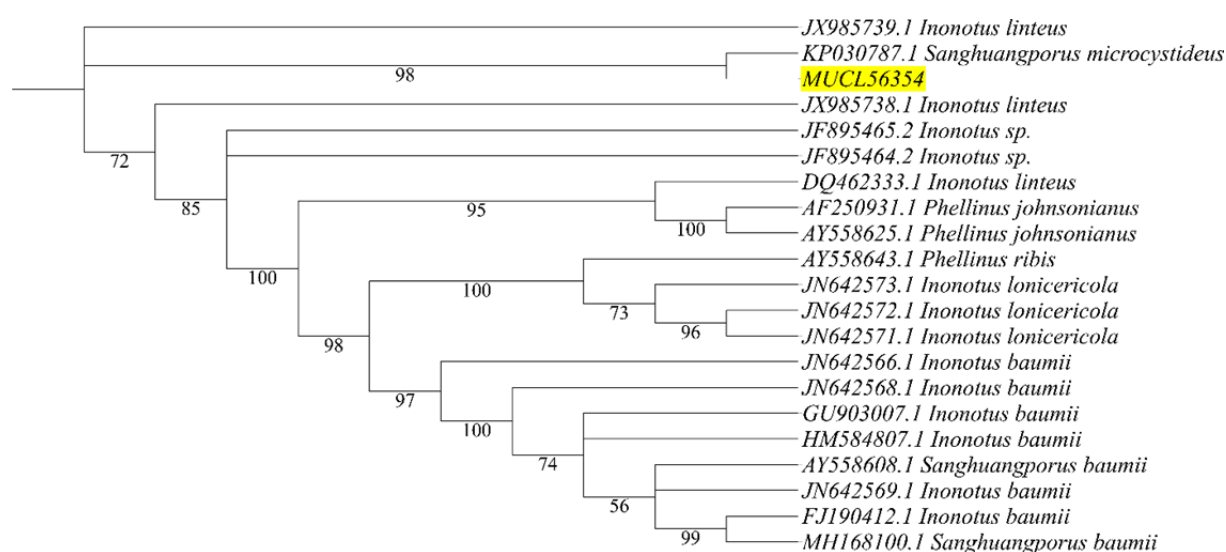
ITS nrDNA sequence of MUCL56354

>MUCL56354

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TCGGACAAGGAGCTGTTGTTGCTCCTTCTTGACCCCTTTGACTCAAATCAGGTAGG
ACTACCCGCTGAACCTTAAGCT
```

An initial BLAST search of ITS nucleotide sequences from the NCBI database (<http://www.ncbi.nlm.nih.gov/>) gave KP030787.1 (*Sanghuangporus microcystideus*), the closest hit with identity 96%, the next closest hit (JF895464.2 with 93%) belongs to *Inonotus* species, The comparison of the 20 closest ITS BLAST results showed the relationship of MUCL56354, *Sanghuangporus* species, *Inonotus* species and *Phellinus* species (Figure 109). Based on molecular data we have addressed the strain as *Sanghuangporus* sp. MUCL56354.

Figure 109: RAXML phylogenetic tree of the 20 closest ITS BLAST results



Media

YM 6.3: 10 g/L malt extract, 4 g/L yeast extract, 4 g/L D-glucose and PH=6.3; Q6 _{1/2}: 10 g/L glycerol, 2.5 g/L D-glucose, 5 g/L cotton seed flour and PH=7.2; ZM _{1/2}: 5 g/L molasses, 5 g/L oatmeal, 1.5 g/L D-glucose, 4 g/L sucrose, 4 g/L mannitol, 0.5 g/L edamine, ammonium sulphate 0.5 g/L, 1.5 g/L calcium carbonate and PH=7.2