Supporting Information

Microwave-assisted synthesis of novel hetero[5]helicene-like molecules and coumarin derivatives

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.

1. Crystal data of compounds 3a and 4a

A. Crystal data of compound 3a

Table 1. Crystal data and structure refinement for **3a** CCDC 1561314

Empirical formula	C27H21N3O2
Formula weight	419.47
Temperature	298(2) K
Wavelength	0.71073 A
Crystal system, space group	Monoclinic, P2(1)/c
Unit cell dimensions	a = 10.0070(9) A alpha = 90 deg.
	b = 11.0039(11) A beta = 105.024(2) deg.
	c = 18.1201(16) A gamma = 90 deg.
Volume	1927.1(3) A^3
Z, Calculated density	4, 1.446 Mg/m^3
Absorption coefficient	0.093 mm^{-1}
F(000)	880
Crystal size	0.18 x 0.14 x 0.13 mm
T heta range for data collection	2.70 to 25.02 deg.
Limiting indices	-11<=h<=11, -13<=k<=11, -20<=l<=21
Reflections collected / unique	9567 / 3374 [R(int) = 0.1236]
Completeness to theta = 25.02	99.5 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.9880 and 0.9835
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	3374 / 0 / 321
Goodness-of-fit on F^2	1.053
Final R indices [I>2sigma(I)]	R1 = 0.0752, wR2 = 0.1788
R indices (all data)	R1 = 0.4187, wR2 = 0.2666
Extinction coefficient	0.013(3)
Largest diff. peak and hole	0.270 and -0.246 $e.A^{-3}$

Table 2. Selected bond lengths (Å) of compound **3a**

Bond	Bond Lengths	Bond	Bond Lengths	Bond	Bond Lengths
N(1)-C(18)	1.335(6)	C(9)-C(10)	1.368(7)	C(16')-H(16C)	0.9700
N(1)-N(2)	1.337(5)	C(10)-C(11)	1.346(7)	C(16')-H(16D)	0.9700
N(1)-C(22)	1.375(6)	C(10)-H(10)	0.9300	C(17')-H(17D)	0.9600
N(2)-C(20)	1.294(6)	C(11)-C(12)	1.360(8)	C(17')-H(17E)	0.9600
N(3)-C(14)	1.309(7)	C(11)-H(11)	0.9300	C(17')-H(17F)	0.9600
N(3)-C(18)	1.313(6)	C(12)-C(13)	1.315(9)	C(18)-C(19)	1.356(7)
O(1)-C(5)	1.337(6)	C(12)-H(12)	0.9300	C(19)-C(20)	1.402(6)
O(1)-C(1)	1.340(7)	C(13)-H(13)	0.9300	C(20)-C(21)	1.452(6)
O(2)-C(1)	1.175(6)	C(14)-C(15)	1.501(17)	C(21)-H(21A)	0.9600
C(1)-C(2)	1.429(8)	C(14)-C(15')	1.53(5)	C(21)-H(21B)	0.9600
C(2)-C(3)	1.371(7)	C(15)-C(16)	1.50(2)	C(21)-H(21C)	0.9600

C(2)-C(14)	1.370(7)	C(15)-H(15A)	0.9700	C(22)-C(27)	1.362(8)
C(3)-C(19)	1.380(7)	C(15)-H(15B)	0.9700	C(22)-C(23)	1.363(8)
C(3)-C(4)	1.418(7)	C(16)-C(17)	1.52(3)	C(23)-C(24)	1.369(8)
C(4)-C(5)	1.352(7)	C(16)-H(16A)	0.9700	C(23)-H(23)	0.9300
C(4)-C(9)	1.400(7)	C(16)-H(16B)	0.9700	C(24)-C(25)	1.362(9)
C(5)-C(6)	1.358(7)	C(17)-H(17A)	0.9600	C(24)-H(24)	0.9300
C(6)-C(7)	1.315(8)	C(17)-H(17B)	0.9600	C(25)-C(26)	1.364(8)
C(6)-H(6)	0.9300	C(17)-H(17C)	0.9600	C(25)-H(25)	0.9300
C(7)-C(8)	1.380(8)	C(15')-C(16')	1.53(7)	C(26)-C(27)	1.363(8)
C(7)-H(7)	0.9300	C(15')-H(15C)	0.9700	C(26)-H(26)	0.9300
C(8)-C(13)	1.386(8)	C(15')-H(15D)	0.9700	C(27)-H(27)	0.9300
C(8)-C(9)	1.390(7)	C(16')-C(17')	1.51(7)		

Table 3. Selected bond angles (°) of compound **3a**

Angles	(°)	Angles	(°)
C(18)-N(1)-N(2)	110.0(4)	C(10)-C(9)-C(4)	122.7(5)
C(18)-N(1)-C(22)	131.4(4)	C(8)-C(9)-C(4)	118.7(5)
N(2)-N(1)-C(22)	118.7(4)	C(11)-C(10)-C(9)	120.8(6)
C(20)-N(2)-N(1)	107.4(4)	C(10)-C(11)-C(12)	120.4(7)
C(14)-N(3)-C(18)	113.6(5)	C(13)-C(12)-C(11)	120.3(6)
C(5)-O(1)-C(1)	121.4(5)	C(12)-C(13)-C(8)	121.1(6)
C(18)-N(1)-N(2)	109.8(4)	N(3)-C(14)-C(2)	123.6(5)
O(2)-C(1)-O(1)	115.9(6)	N(3)-C(14)-C(15)	113.4(6)
O(2)-C(1)-C(2)	127.2(6)	C(2)-C(14)-C(15)	122.3(6)
O(1)-C(1)-C(2)	116.6(5)	N(3)-C(14)-C(15')	106.5(12)
C(3)-C(2)-C(14)	120.6(5)	C(2)-C(14)-C(15')	122.8(12)
C(3)-C(2)-C(1)	118.5(5)	C(15)-C(14)-C(15')	37.4(13)
C(14)-C(2)-C(1)	120.7(5)	C(16)-C(15)-C(14)	107.8(12)
C(2)-C(3)-C(19)	115.1(5)	C(15)-C(16)-C(17)	109.4(15)
C(2)-C(3)-C(4)	118.2(5)	C(14)-C(15')-C(16')	107(4)
C(19)-C(3)-C(4)	126.6(5)	C(17')-C(16')-C(15')	115(4)
C(5)-C(4)-C(9)	117.2(5)	N(3)-C(18)-N(1)	124.2(5)
C(5)-C(4)-C(3)	116.5(5)	N(3)-C(18)-C(19)	127.8(5)
C(9)-C(4)-C(3)	126.1(5)	N(1)-C(18)-C(19)	107.9(4)
O(1)-C(5)-C(4)	121.2(5)	C(18)-C(19)-C(3)	117.3(5)
O(1)-C(5)-C(6)	115.7(5)	C(18)-C(19)-C(20)	104.4(5)
C(4)-C(5)-C(6)	123.1(6)	C(3)-C(19)-C(20)	137.9(5)
C(7)-C(6)-C(5)	118.87(6)	N(2)-C(20)-C(19)	110.1(5)
C(7)-C(6)-H(6)	120.6	N(2)-C(20)-C(21)	117.5(5)
C(5)-C(6)-H(6)	120.6	C(19)-C(20)-C(21)	131.9(5)
C(6)-C(7)-C(8)	121.8(6)	C(27)-C(22)-C(23)	120.9(5)
C(6)-C(7)-H(7)	119.1	C(27)-C(22)-N(1)	119.0(5)
C(8)-C(7)-H(7)	119.1	C(23)-C(22)-N(1)	120.4(5)
C(7)-C(8)-C(13)	122.2(6)	C(22)-C(23)-C(24)	119.1(6)

C(7)-C(8)-C(9)	119.0(6)	C(25)-C(24)-C(23)	120.6(7)
C(13)-C(8)-C(9)	118.7(6)	C(24)-C(25)-C(26)	119.5(6)
C(10)-C(9)-C(8)	118.2(6)	C(25)-C(26)-C(27)	120.6(6)
		C(22)-C(27)-C(26)	119.3(6)

B. Crystal data of compound 4a

Table 4. Crystal data and structure refinement for **4a** CCDC 1561315

Empirical formula	C27 H23 N3 O
Formula weight	405.48
Temperature	298(2) K
Wavelength	0.71073 A
Crystal system, space group	Triclinic, P-1
Unit cell dimensions	a = 10.8840(9) A alpha = 104.061(2)deg.
	b = 14.4830(13) A beta = 106.620(2) deg.
	c = 14.9970(12) A gamma = 100.8970(10) deg.
Volume	2110.7(3)A^3
Z, Calculated density	4, 1.276 Mg/m^3
Absorption coefficient	0.079 mm^{-1}
F(000)	856
Crystal size	0.38 x 0.21 x 0.11 mm
Theta range for data collection	2.85 to 25.02 deg.
Limiting indices	-12<=h<=8, -17<=k<=17, -17<=l<=17
Reflections collected / unique	10773 / 7310 [R(int) = 0.0271]
Completeness to theta = 25.02	98.1 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	0.9914 and 0.9706
Refinement method	Full-matrix least-squares on F^2
Data / restraints / parameters	7310 / 0 / 563
Goodness-of-fit on F^2	1.052
Final R indices [I>2sigma(I)]	R1 = 0.0527, wR2 = 0.0931
R indices (all data)	R1 = 0.1150, wR2 = 0.1069
Largest diff. peak and hole	0.172 and -0.280 $e.A^{-3}$

Table 5. Selected bond lengths (Å) of compound **4a**

Bond	Bond Lengths	Bond	Bond Lengths	Bond	Bond Lengths
N(1)-C(5)	1.331(3)	C(6)-C(7)	1.396(3)	C(29)-C(30)	1.496(3)
N(1)-C(6)	1.345(2)	C(7)-C(8)	1.433(3)	C(30)-C(31)	1.504(3)
N(2)-C(6)	1.378(3)	C(8)-C(9)	1.499(3)	C(31)-C(37)	1.392(3)
N(2)-N(3)	1.387(2)	C(10)-C(11)	1.507(3)	C(31)-C(32)	1.405(3)
N(2)-C(22)	1.423(3)	C(11)-C(12)	1.526(3)	C(33)-C(34)	1.401(3)
N(3)-C(8)	1.320(3)	C(12)-C(13)	1.519(3)	C(34)-C(37)	1.403(3)

N(4)-C(32)	1.335(3)	C(14)-C(15)	1.361(3)	C(34)-C(35)	1.433(3)
N(4)-C(33)	1.343(3)	C(15)-C(16)	1.413(3)	C(35)-C(36)	1.502(3)
N(5)-C(33)	1.375(3)	C(16)-C(21)	1.413(3)	C(37)-C(38)	1.508(3)
N(5)-N(6)	1.392(3)	C(16)-C(17)	1.424(3)	C(38)-C(39)	1.539(3)
N(5)-C(49)	1.417(3)	C(17)-C(18)	1.409(3)	C(39)-C(40)	1.500(3)
N(6)-C(35)	1.323(3)	C(18)-C(19)	1.366(3)	C(41)-C(42)	1.363(3)
O(1)-C(5)	1.383(2)	C(19)-C(20)	1.403(3)	C(42)-C(43)	1.409(3)
O(1)-C(1)	1.399(2)	C(20)-C(21)	1.358(3)	C(43)-C(48)	1.414(3)
O(2)-C(32)	1.377(3)	C(22)-C(27)	1.380(3)	C(43)-C(44)	1.420(3)
O(2)-C(28)	1.399(2)	C(22)-C(23)	1.383(3)	C(44)-C(45)	1.416(3)
C(1)-C(2)	1.358(3)	C(23)-C(24)	1.384(3)	C(45)-C(46)	1.369(3)
C(1)-C(14)	1.411(3)	C(24)-C(25)	1.372(3)	C(46)-C(47)	1.400(4)
C(2)-C(17)	1.425(3)	C(25)-C(26)	1.376(3)	C(47)-C(48)	1.368(4)
C(2)-C(3)	1.508(3)	C(26)-C(27)	1.377(3)	C(49)-C(50)	1.377(3)
C(3)-C(4)	1.513(3)	C(27)-H(27)	0.9300	C(49)-C(54)	1.384(3)
C(4)-C(10)	1.393(3)	C(28)-C(29)	1.352(3)	C(50)-C(51)	1.383(3)
C(4)-C(5)	1.400(3)	C(28)-C(41)	1.411(3)	C(51)-C(52)	1.373(3)
				C(52)-C(53)	1.378(4)

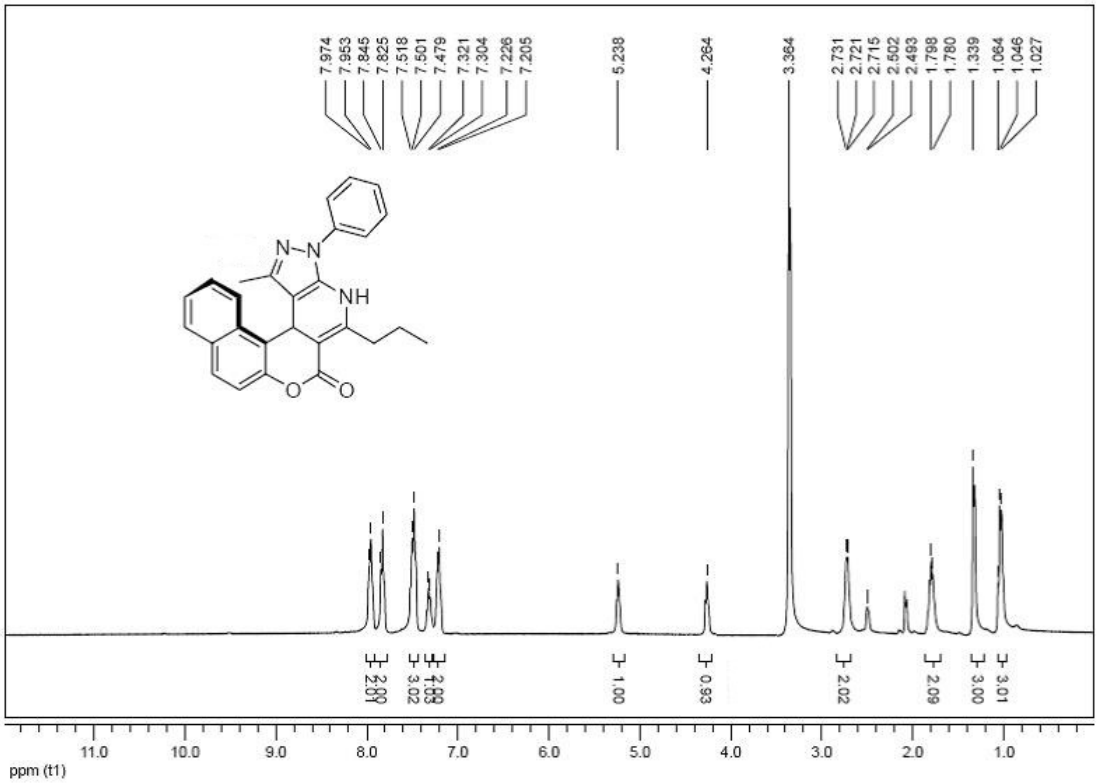
Table 6. Selected bond angles (°) of compound **4a**

Angles	(°)	Angles	(°)
C(5)-N(1)-C(6)	112.44(19)	C(24)-C(25)-C(26)	118.4(3)
C(6)-N(2)-N(3)	109.67(19)	C(25)-C(26)-C(27)	121.4(3)
C(6)-N(2)-C(22)	131.94(19)	C(26)-C(27)-C(22)	119.7(2)
N(3)-N(2)-C(22)	118.37(19)	C(29)-C(28)-O(2)	123.5(2)
C(8)-N(3)-N(2)	106.80(19)	C(29)-C(28)-C(41)	123.4(2)
C(5)-O(1)-C(1)	119.14(18)	O(2)-C(28)-C(41)	113.1(2)
C(32)-O(2)-C(28)	119.10(19)	C(28)-C(29)-C(44)	118.2(2)
C(2)-C(1)-O(1)	123.6(2)	C(28)-C(29)-C(30)	121.1(2)
C(2)-C(1)-C(14)	123.3(2)	C(44)-C(29)-C(30)	120.7(2)
O(1)-C(1)-C(14)	113.2(2)	C(29)-C(30)-C(31)	113.8(2)
C(1)-C(2)-C(17)	118.0(2)	C(37)-C(31)-C(32)	118.3(2)
C(1)-C(2)-C(3)	121.1(2)	C(37)-C(31)-C(30)	121.7(2)
C(17)-C(2)-C(3)	120.8(2)	C(32)-C(31)-C(30)	120.0(2)
C(2)-C(3)-C(4)	113.11(19)	N(4)-C(32)-O(2)	110.7(2)
C(10)-C(4)-C(5)	118.0(2)	N(4)-C(32)-C(31)	126.8(2)
C(10)-C(4)-C(3)	121.3(2)	O(2)-C(32)-C(31)	122.4(2)
C(5)-C(4)-C(3)	120.66(19)	N(4)-C(33)-N(5)	125.5(2)
N(1)-C(5)-O(1)	110.19(19)	N(4)-C(33)-C(34)	126.8(2)
N(1)-C(5)-C(4)	127.5(2)	N(5)-C(33)-C(34)	107.7(2)
O(1)-C(5)-C(4)	122.3(2)	C(33)-C(34)-C(37)	118.0(2)
N(1)-C(6)-N(2)	125.3(2)	C(33)-C(34)-C(35)	104.7(2)
N(1)-C(6)-C(7)	126.7(2)	C(37)-C(34)-C(35)	137.2(2)
N(2)-C(6)-C(7)	107.93(19)	N(6)-C(35)-C(34)	110.9(2)

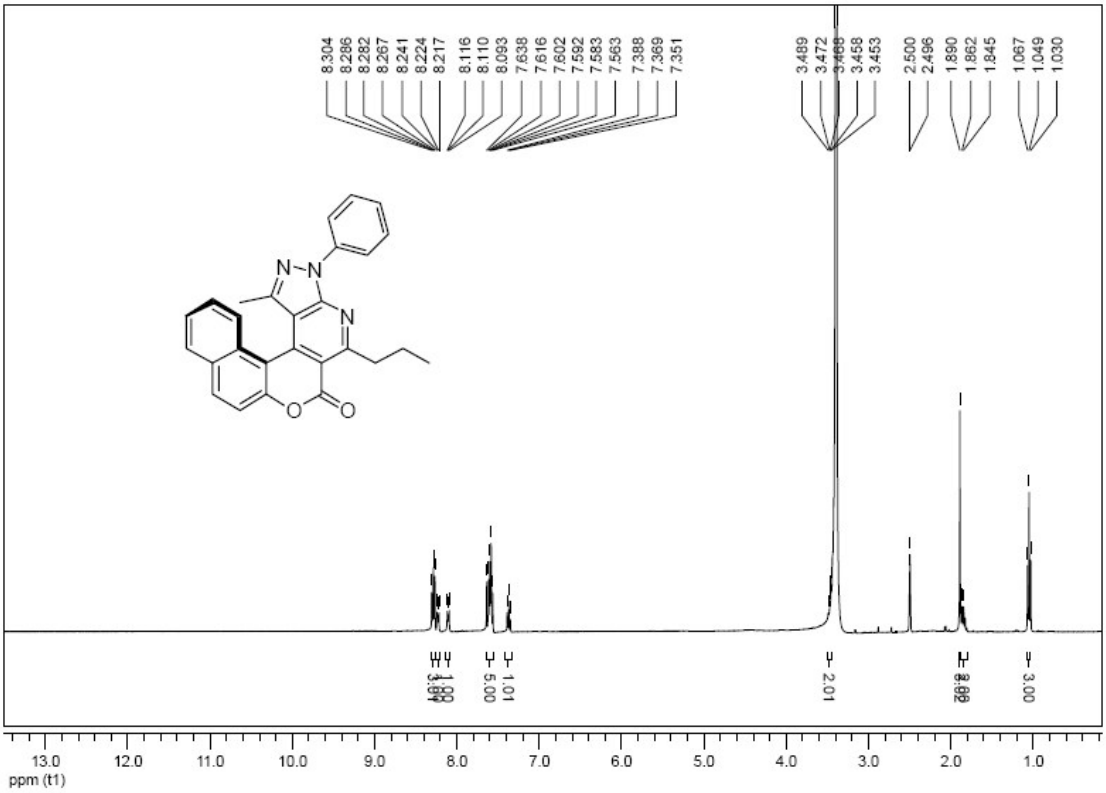
C(6)-C(7)-C(10)	118.2(2)	N(6)-C(35)-C(36)	118.4(2)
C(6)-C(7)-C(8)	104.2(2)	C(34)-C(35)-C(36)	130.8(2)
C(10)-C(7)-C(8)	137.6(2)	C(31)-C(37)-C(34)	117.2(2)
N(3)-C(8)-C(7)	111.4(2)	C(31)-C(37)-C(38)	120.3(2)
N(3)-C(8)-C(9)	118.8(2)	C(34)-C(37)-C(38)	122.4(2)
C(7)-C(8)-C(9)	129.8(2)	C(37)-C(38)-C(39)	112.1(2)
C(4)-C(10)-C(7)	117.1(2)	C(40)-C(39)-C(38)	113.2(2)
C(4)-C(10)-C(11)	122.0(2)	C(42)-C(41)-C(28)	118.5(3)
C(7)-C(10)-C(11)	120.87(19)	C(41)-C(42)-C(43)	121.2(3)
C(10)-C(11)-C(12)	114.34(19)	C(42)-C(43)-C(48)	121.8(3)
C(13)-C(12)-C(11)	111.9(2)	C(42)-C(43)-C(44)	119.1(2)
C(15)-C(14)-C(1)	118.9(2)	C(48)-C(43)-C(44)	119.1(3)
C(14)-C(15)-C(16)	121.1(2)	C(45)-C(44)-C(43)	118.4(2)
C(15)-C(16)-C(21)	122.2(2)	C(45)-C(44)-C(29)	122.1(2)
C(15)-C(16)-C(17)	118.8(2)	C(43)-C(44)-C(29)	119.5(2)
C(21)-C(16)-C(17)	118.9(3)	C(46)-C(45)-C(44)	121.2(3)
C(18)-C(17)-C(16)	117.8(2)	C(45)-C(46)-C(47)	120.1(3)
C(18)-C(17)-C(2)	122.3(2)	C(48)-C(47)-C(46)	120.6(3)
C(16)-C(17)-C(2)	119.8(2)	C(47)-C(48)-C(43)	120.7(3)
C(19)-C(18)-C(17)	121.9(2)	C(50)-C(49)-C(54)	119.5(3)
C(18)-C(19)-C(20)	119.8(3)	C(50)-C(49)-N(5)	121.5(2)
C(21)-C(20)-C(19)	120.2(3)	C(54)-C(49)-N(5)	119.0(3)
C(20)-C(21)-C(16)	121.3(3)	C(49)-C(50)-C(51)	120.3(2)
C(27)-C(22)-C(23)	119.7(2)	C(52)-C(51)-C(50)	120.5(3)
C(27)-C(22)-N(2)	119.4(2)	C(51)-C(52)-C(53)	119.0(3)
C(23)-C(22)-N(2)	120.9(2)	C(54)-C(53)-C(52)	121.1(3)
C(22)-C(23)-C(24)	119.4(2)	C(53)-C(54)-C(49)	119.6(3)
C(25)-C(24)-C(23)	121.4(2)		

2. ^{1}H NMR and ^{13}C NMR Spectra

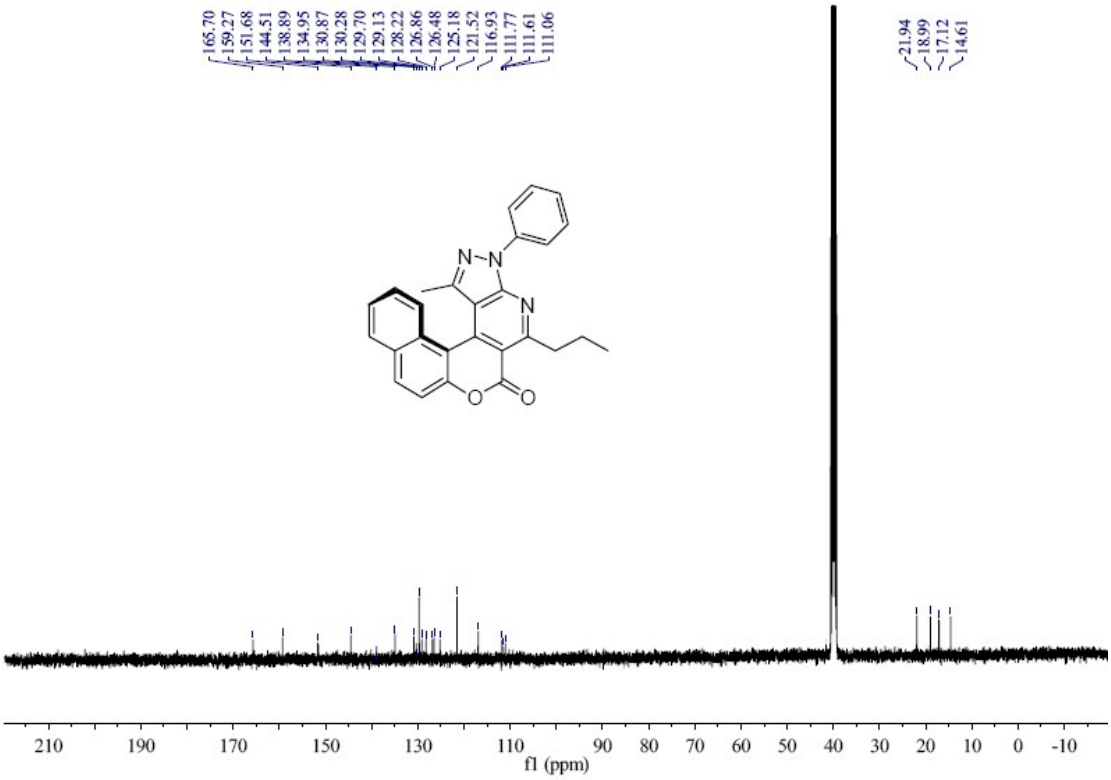
^{1}H NMR of 11-methyl-13-phenyl-2-propyl-1,2-dihydrobenzo[5,6]chromeno [4,3-*d*]pyrazolo[3, 4-*b*]pyridin-3(13*H*)-one **(5)**



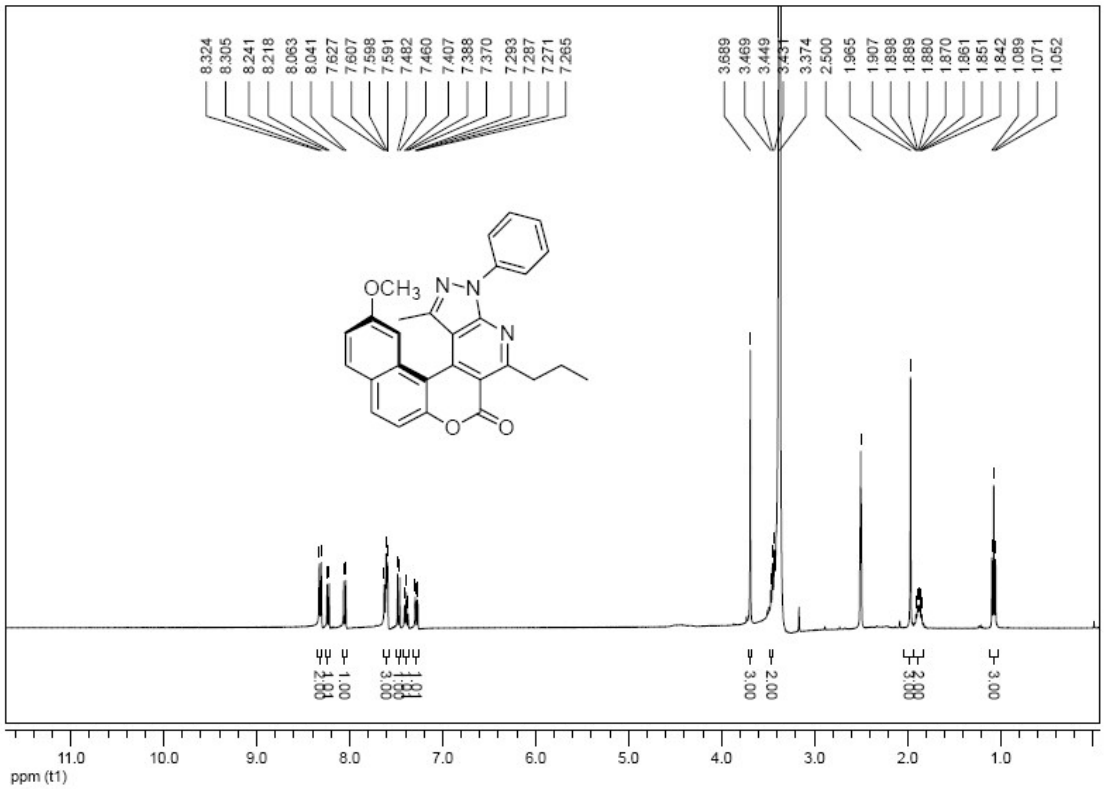
^{1}H NMR of 11-methyl-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one (**3a**)



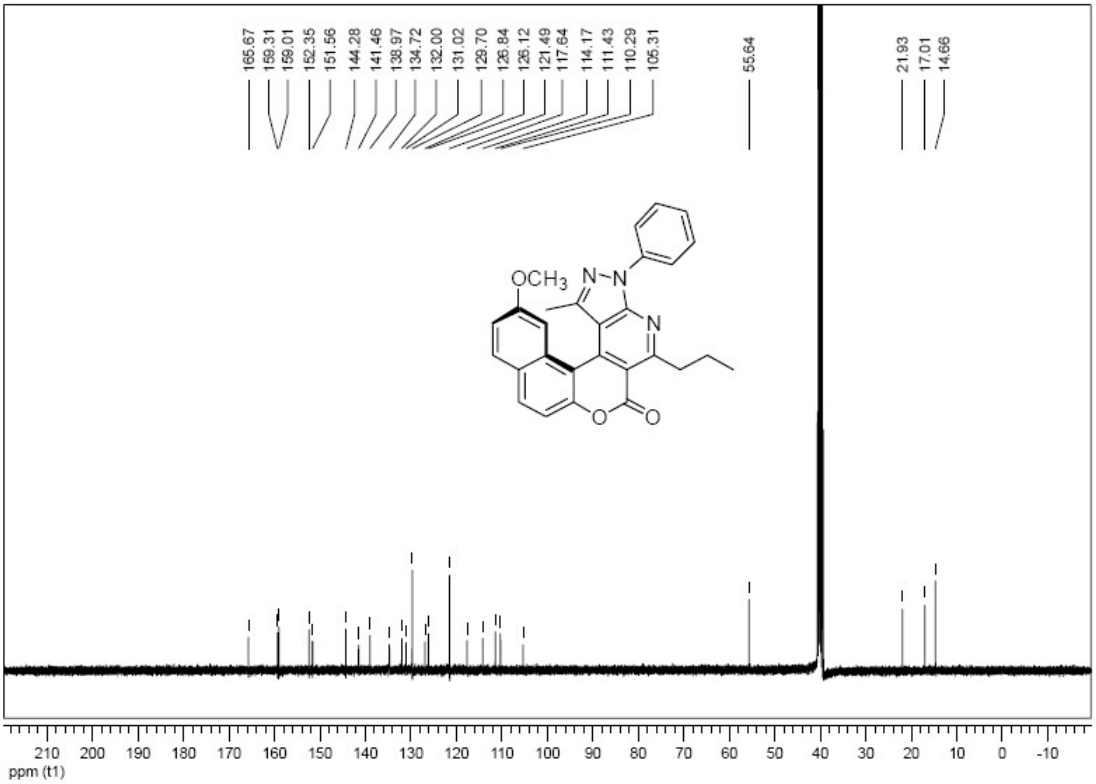
^{13}C NMR of 11-methyl-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*] pyridin-3(13*H*)-one (**3a**)



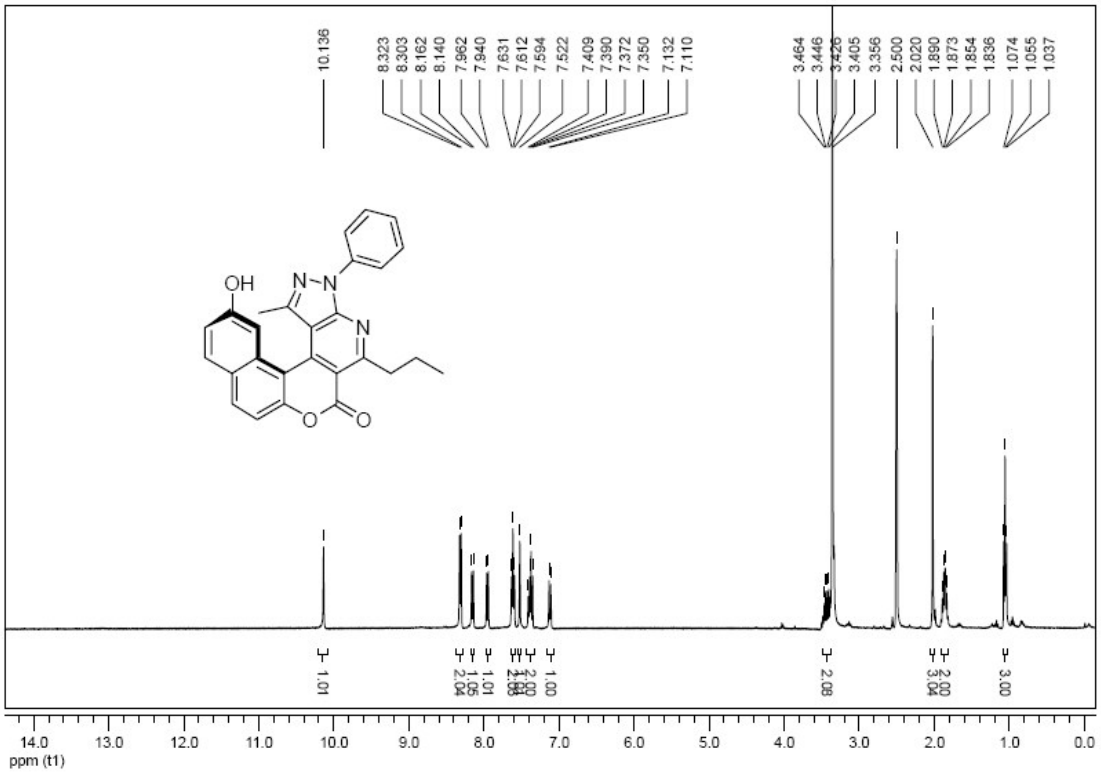
^{1}H NMR of 9-methoxy-11-methyl-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*] pyridin-3(13*H*)-one **(3b)**



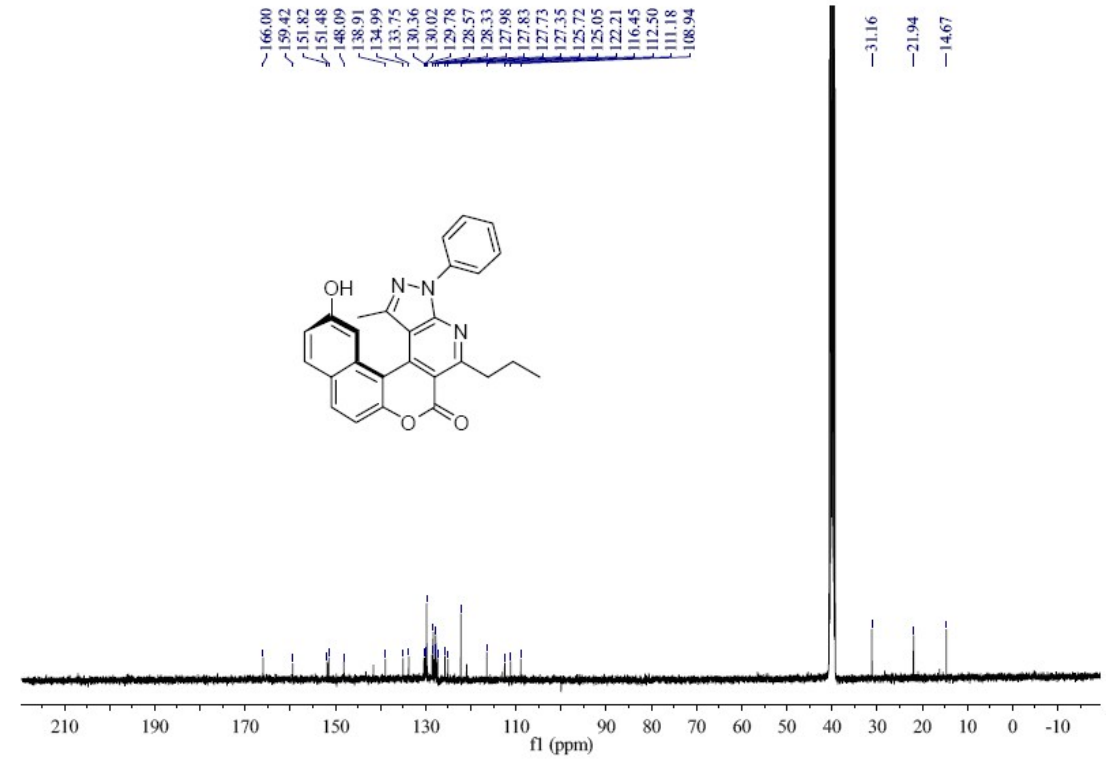
^{13}C NMR of 9-methoxy-11-methyl-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*] pyridin-3(13*H*)-one **(3b)**



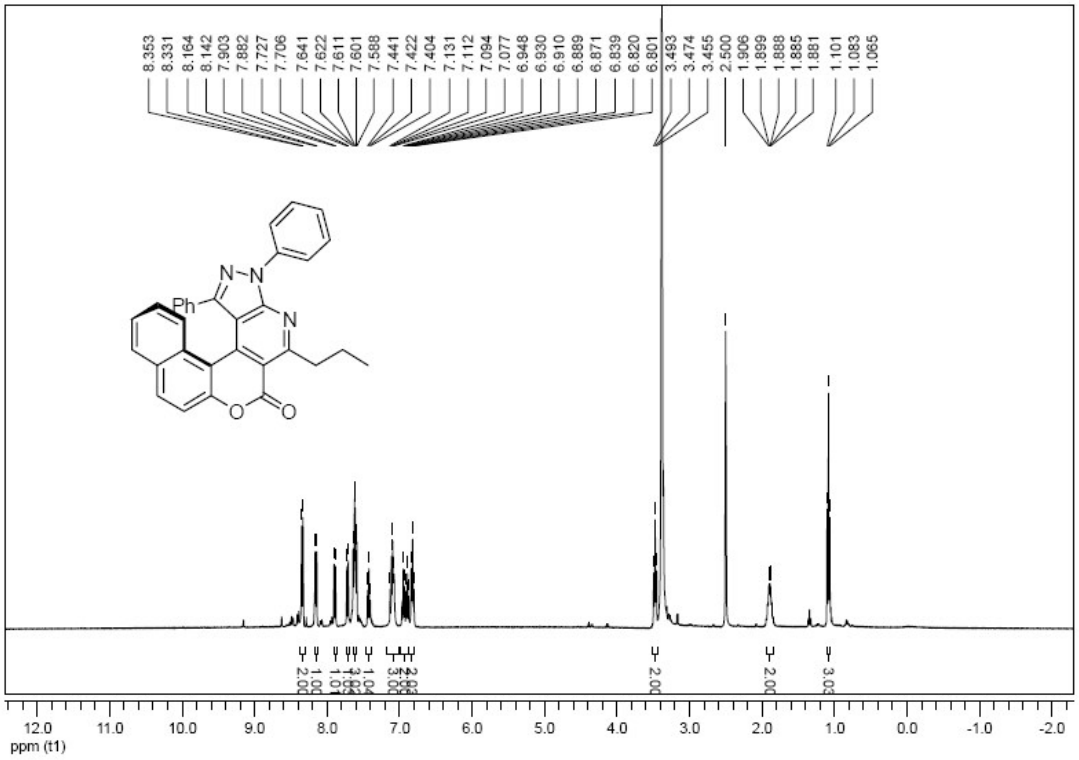
^{1}H NMR of 9-hydroxy-11-methyl-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*] pyridin-3(13*H*)-one **(3c)**



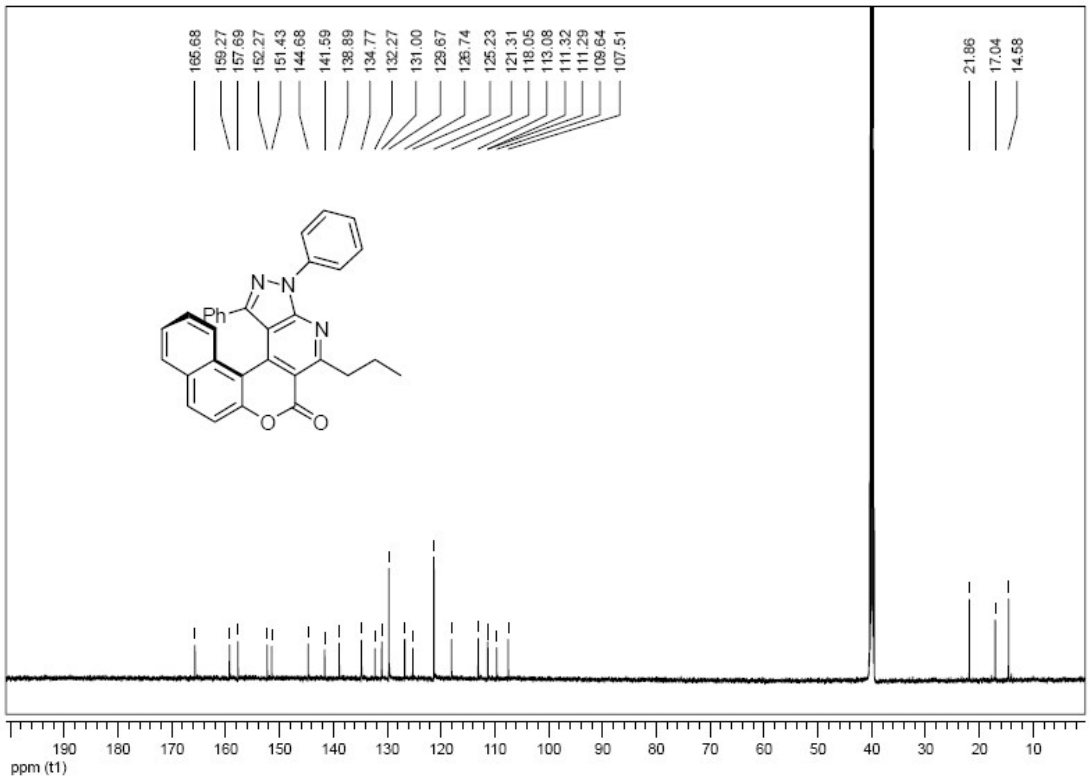
^{13}C NMR of 9-hydroxy-11-methyl-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*] pyridin-3(13*H*)-one **(3c)**



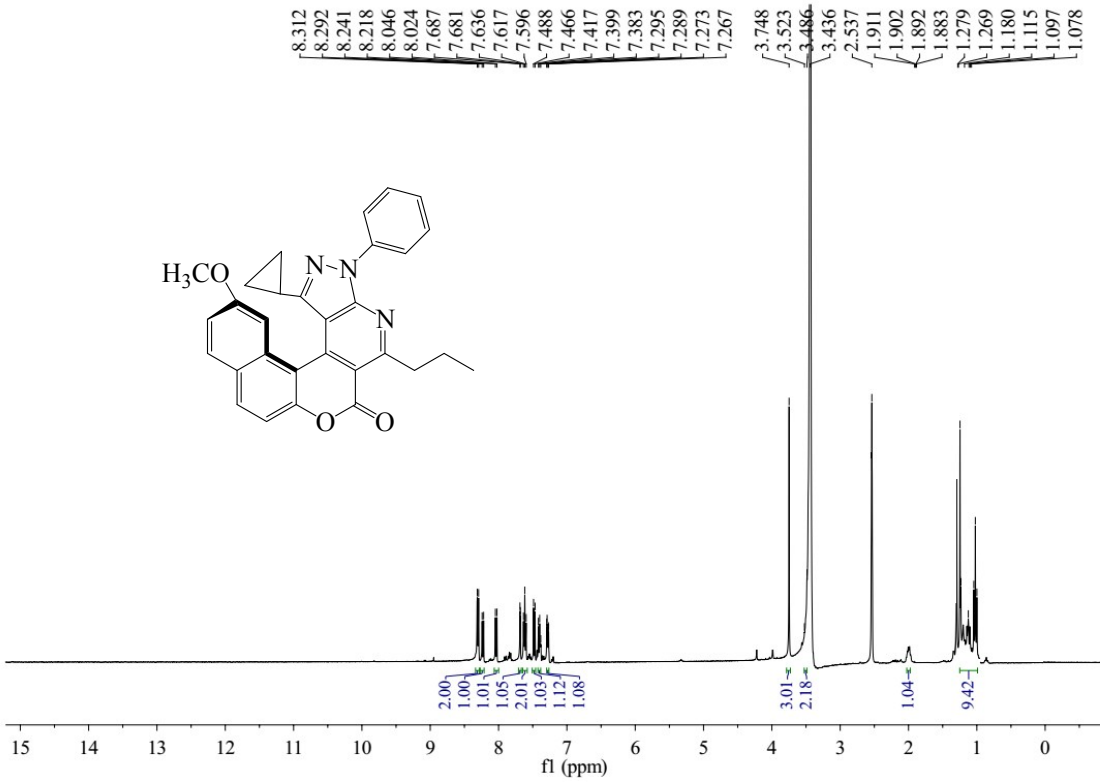
^{1}H NMR of 11,13-diphenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one **(3d)**



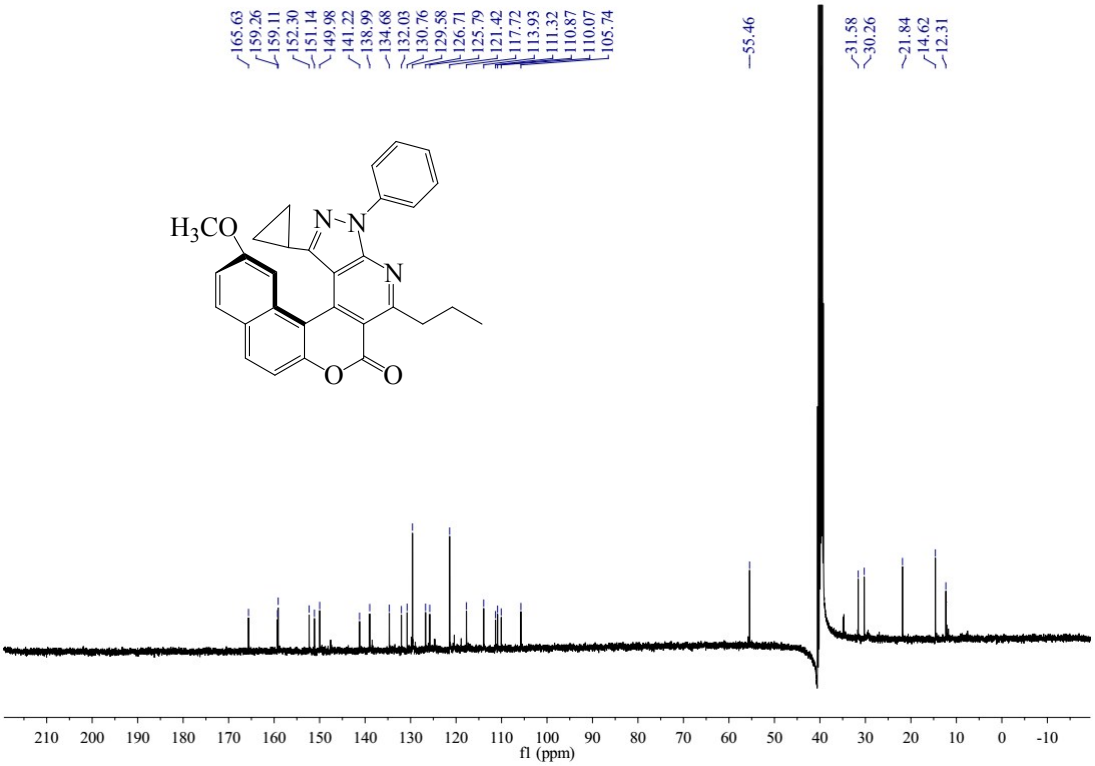
^{13}C NMR of 11,13-diphenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one **(3d)**



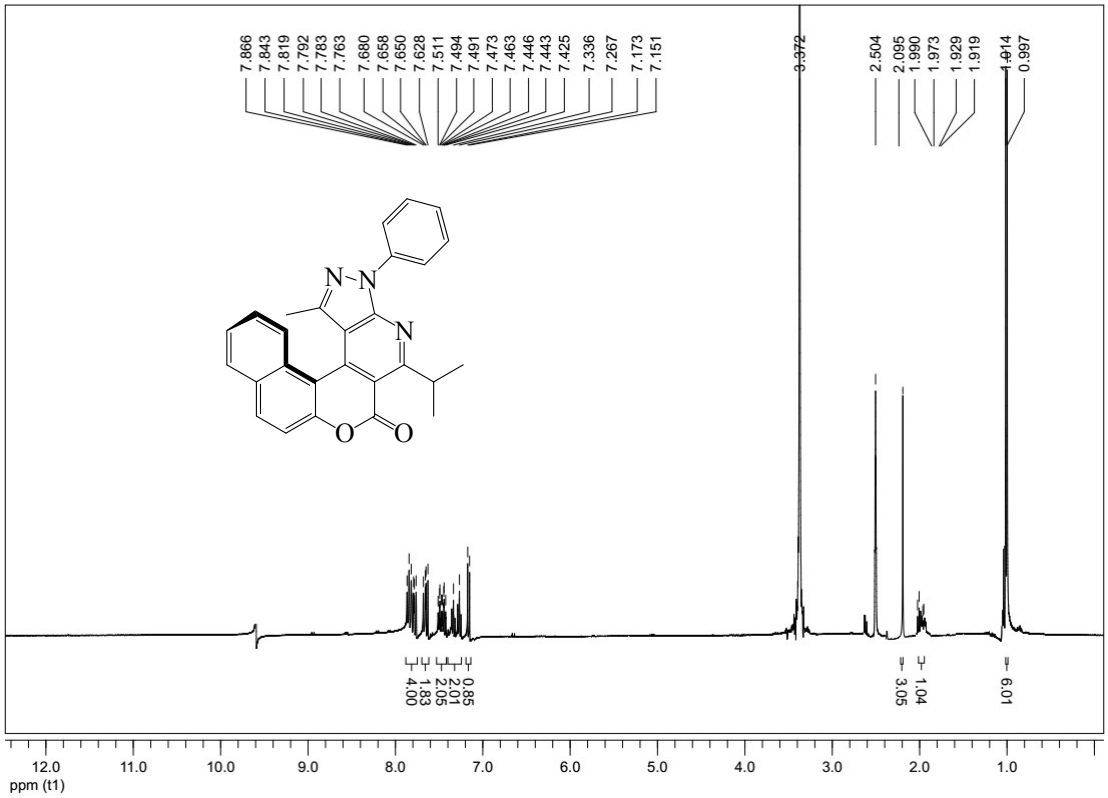
^{1}H NMR of 11-cyclopropyl-9-methoxy-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-on **(3e)**



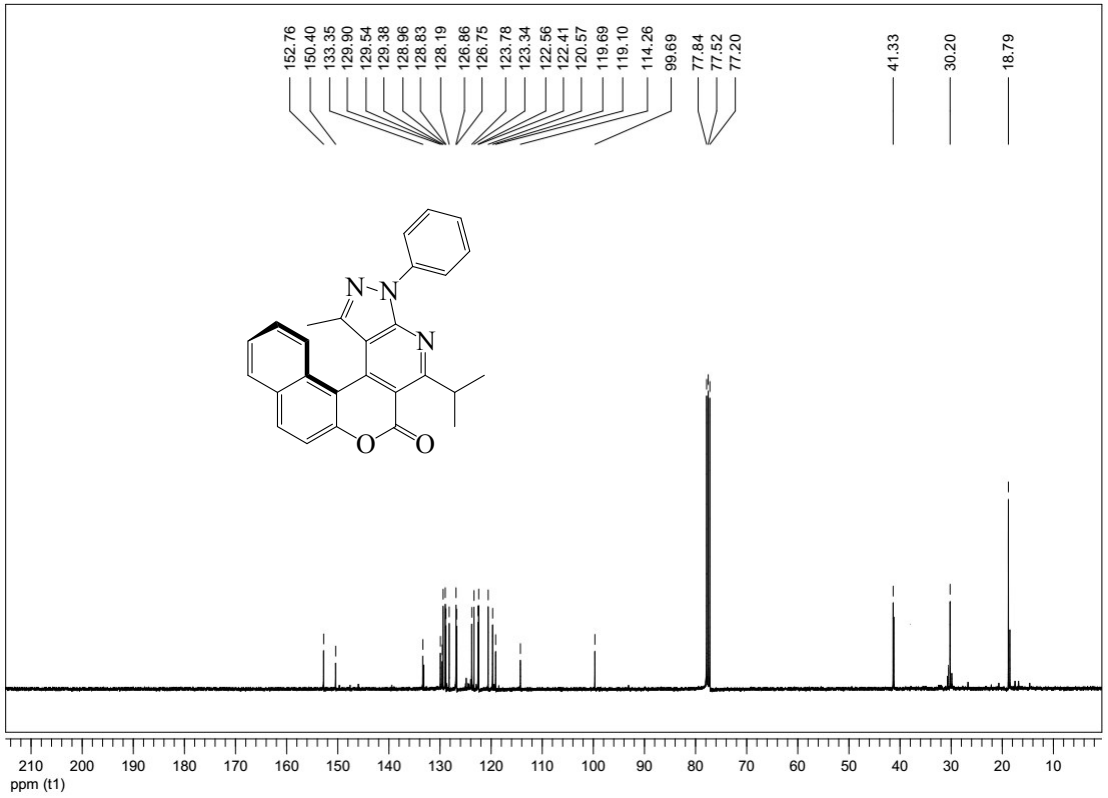
^{13}C NMR of 11-cyclopropyl-9-methoxy-13-phenyl-2-propylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-on **(3e)**



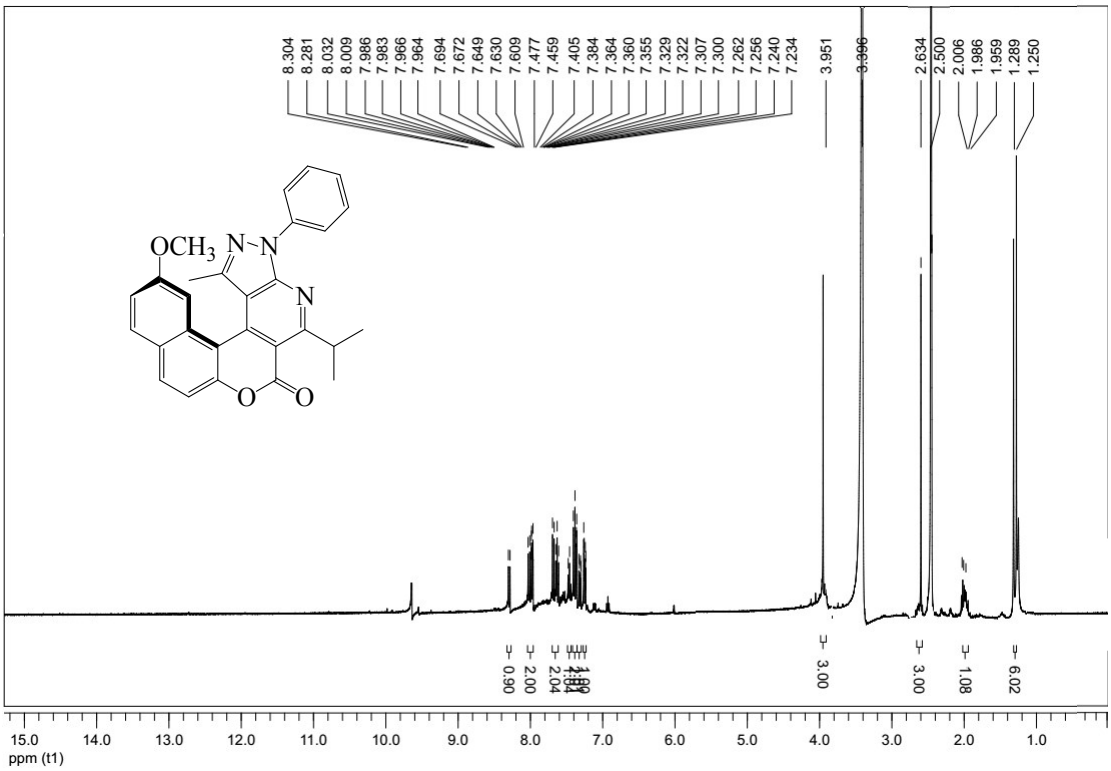
^{1}H NMR of 2-isopropyl-11-methyl-13-phenylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one **(3f)**



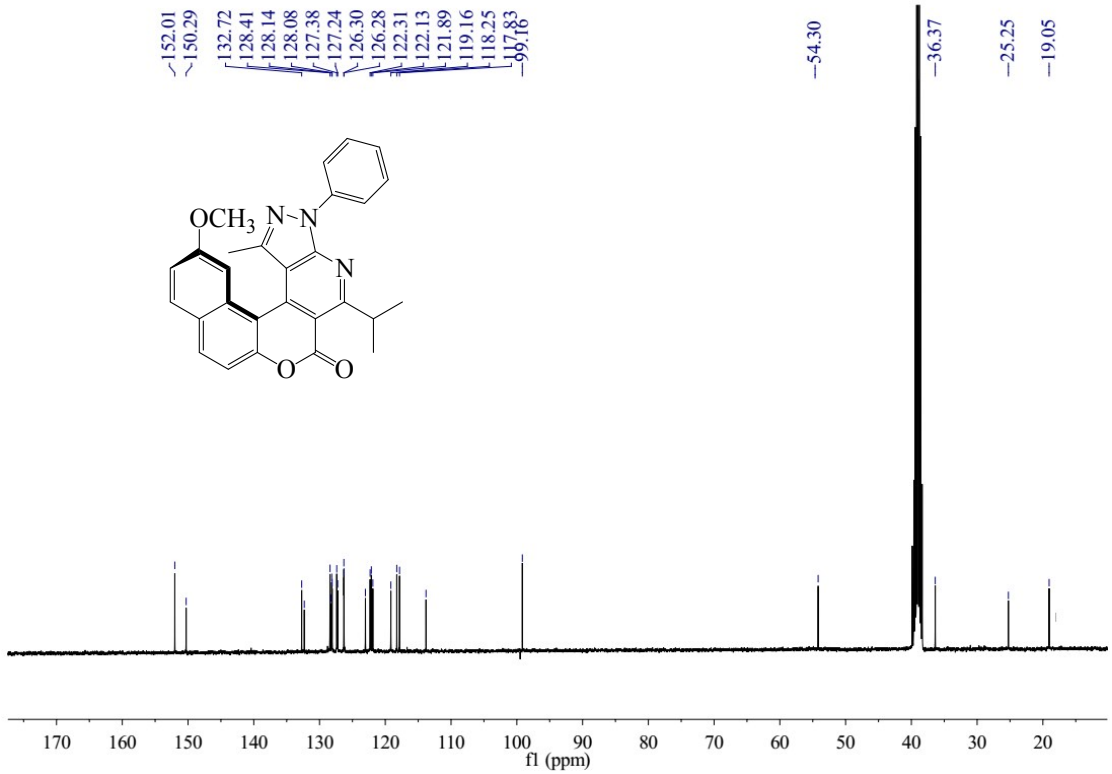
^{13}C NMR of 2-isopropyl-11-methyl-13-phenylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one **(3f)**



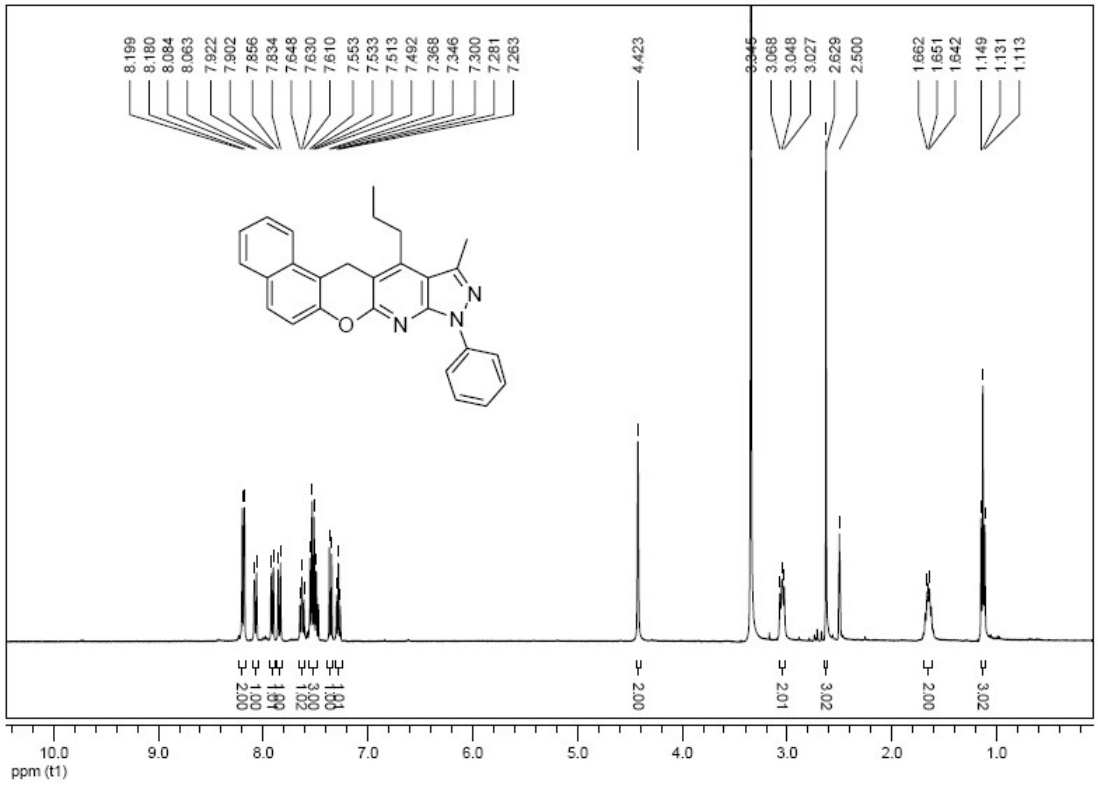
^{1}H NMR of 2-isopropyl-9-methoxy-11-methyl-13-phenylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one **(3g)**



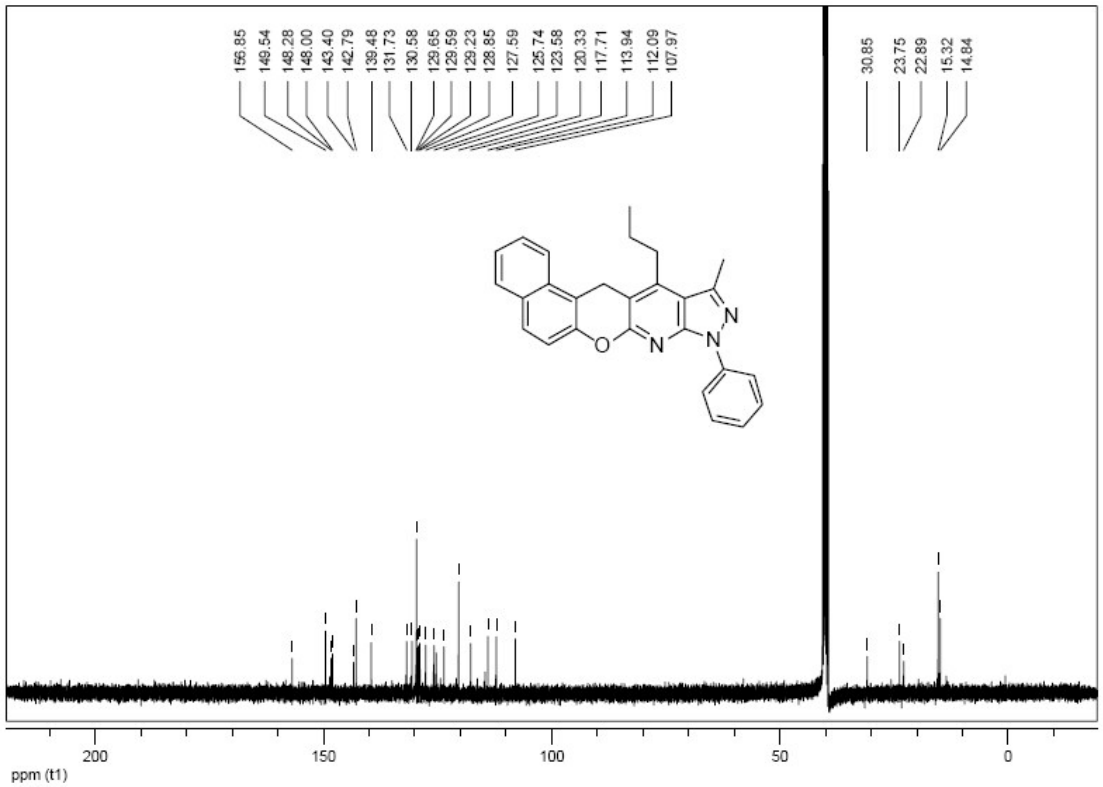
^{13}C NMR of 2-isopropyl-9-methoxy-11-methyl-13-phenylbenzo[5,6]chromeno[4,3-*d*]pyrazolo[3,4-*b*]pyridin-3(13*H*)-one **(3g)**



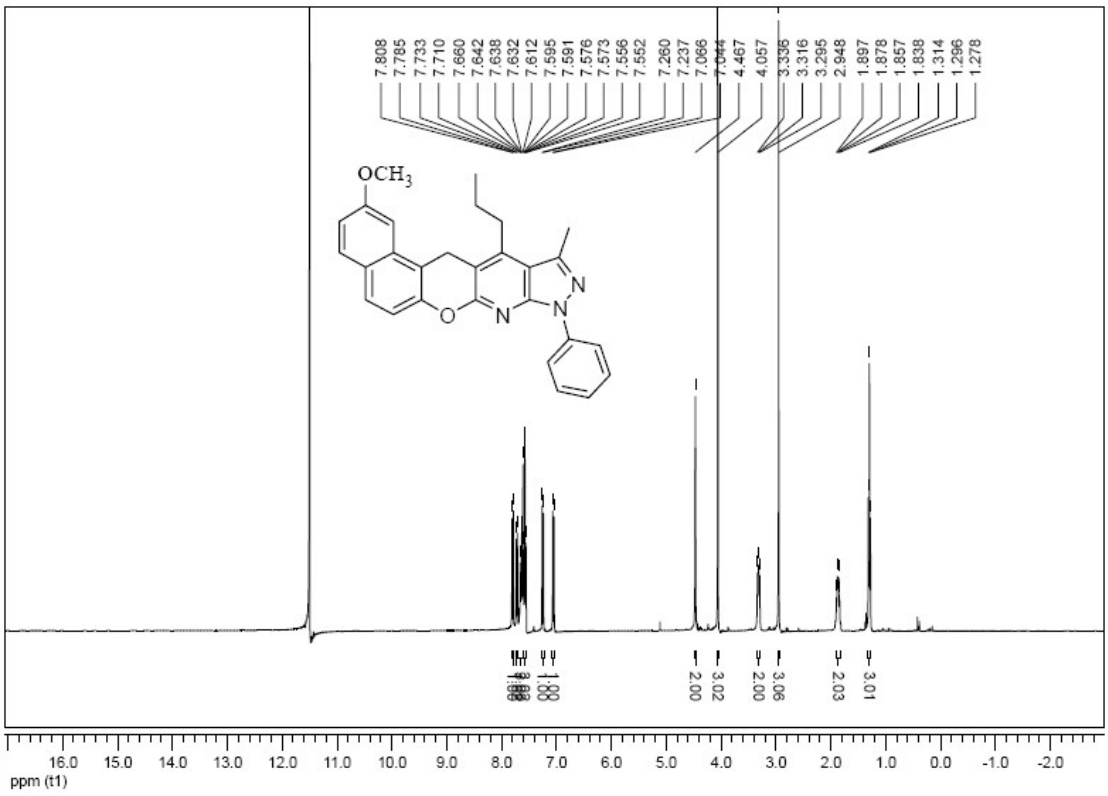
^{1}H NMR of 11-methyl-9-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine (**4a**)



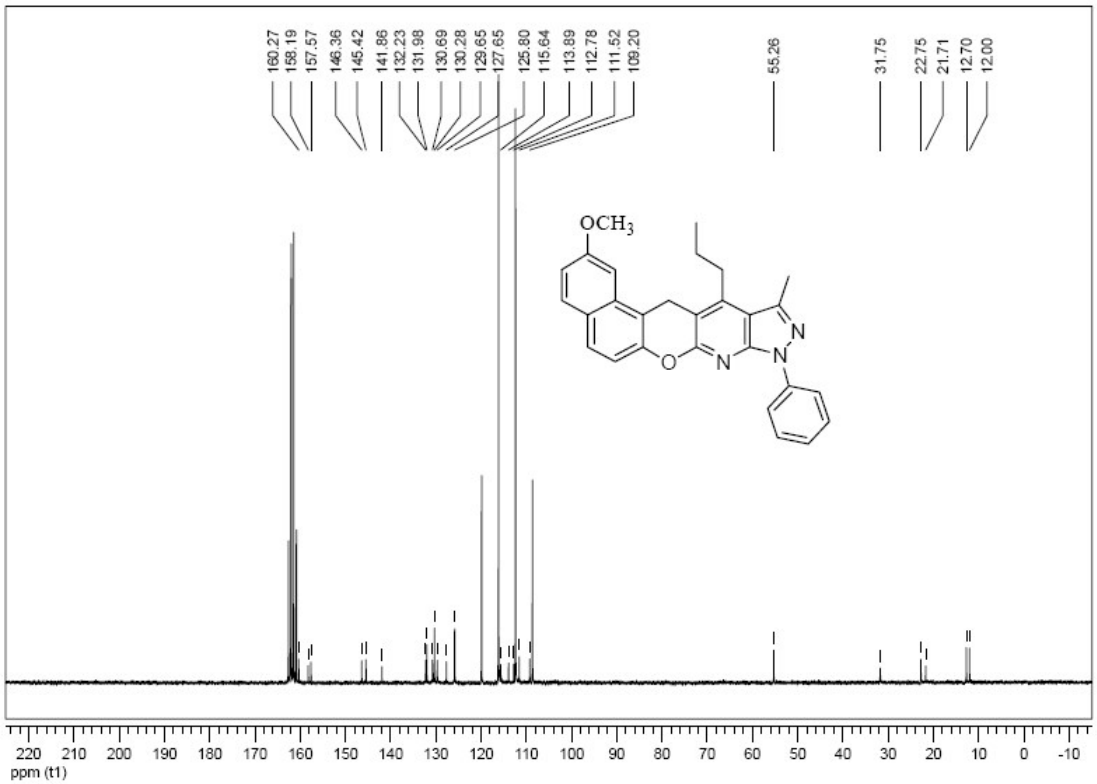
^{13}C NMR of 11-methyl-9-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine (**4a**)



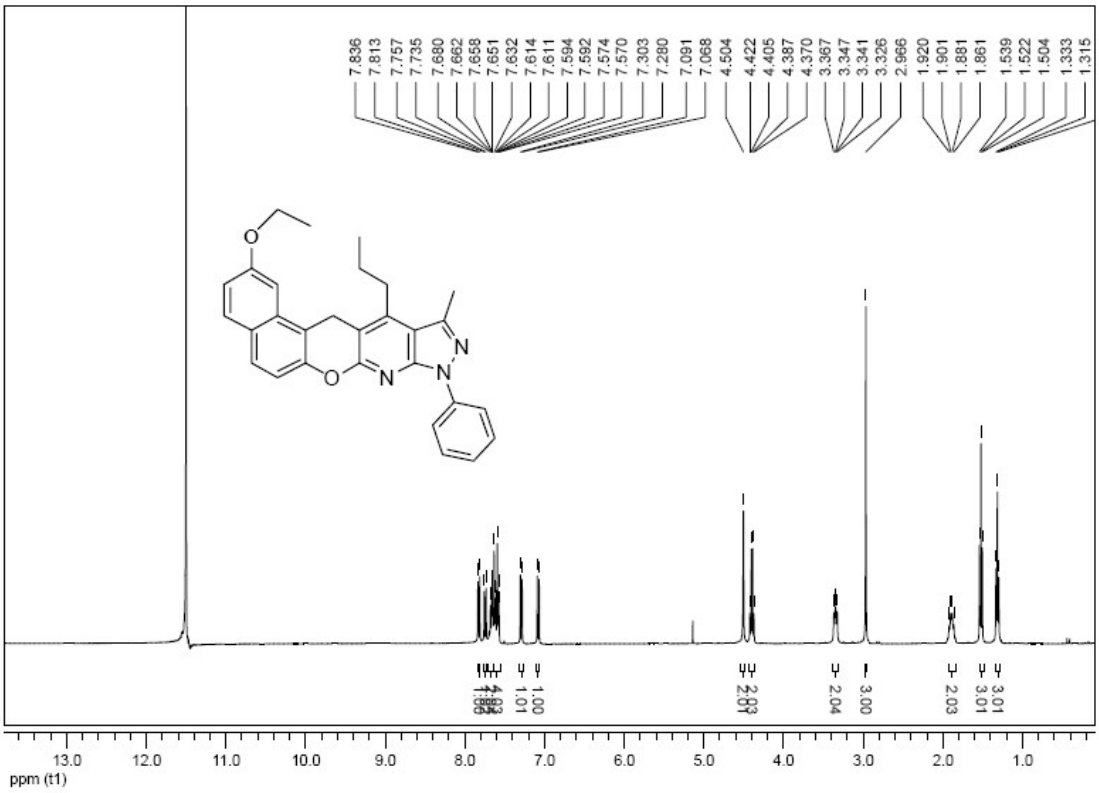
^{1}H NMR of 2-methoxy-11-methyl-9-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*] pyrazolo [4,3-*e*]pyridine **(4b)**



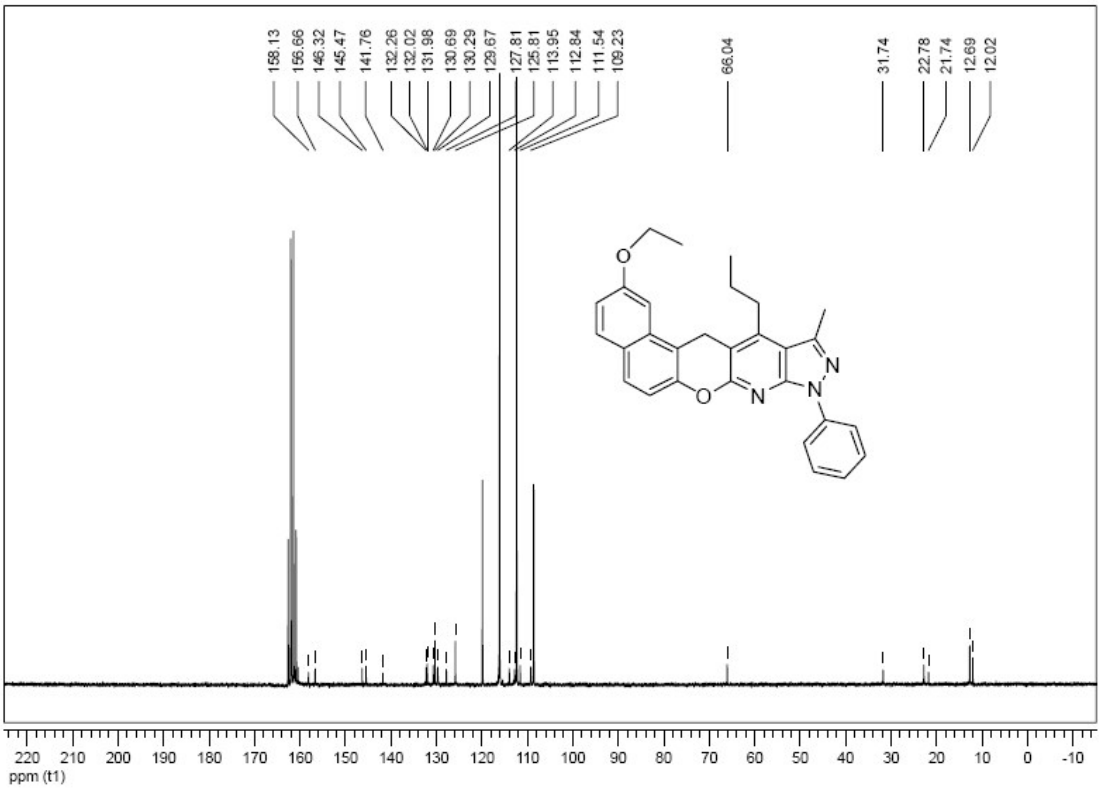
^{13}C NMR of 2-methoxy-11-methyl-9-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*] pyrazolo [4,3-*e*]pyridine **(4b)**



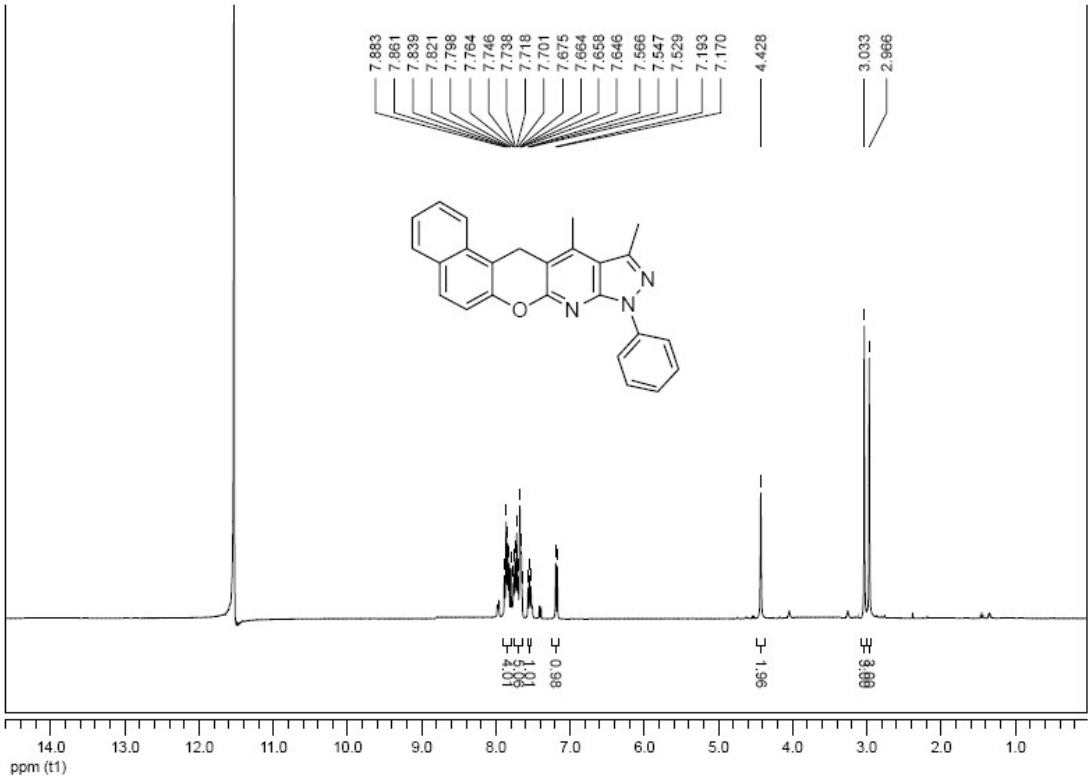
^{1}H NMR of 2-Ethoxy-11-methyl-9-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*] pyrazolo[4,3-*e*]pyridine **(4c)**



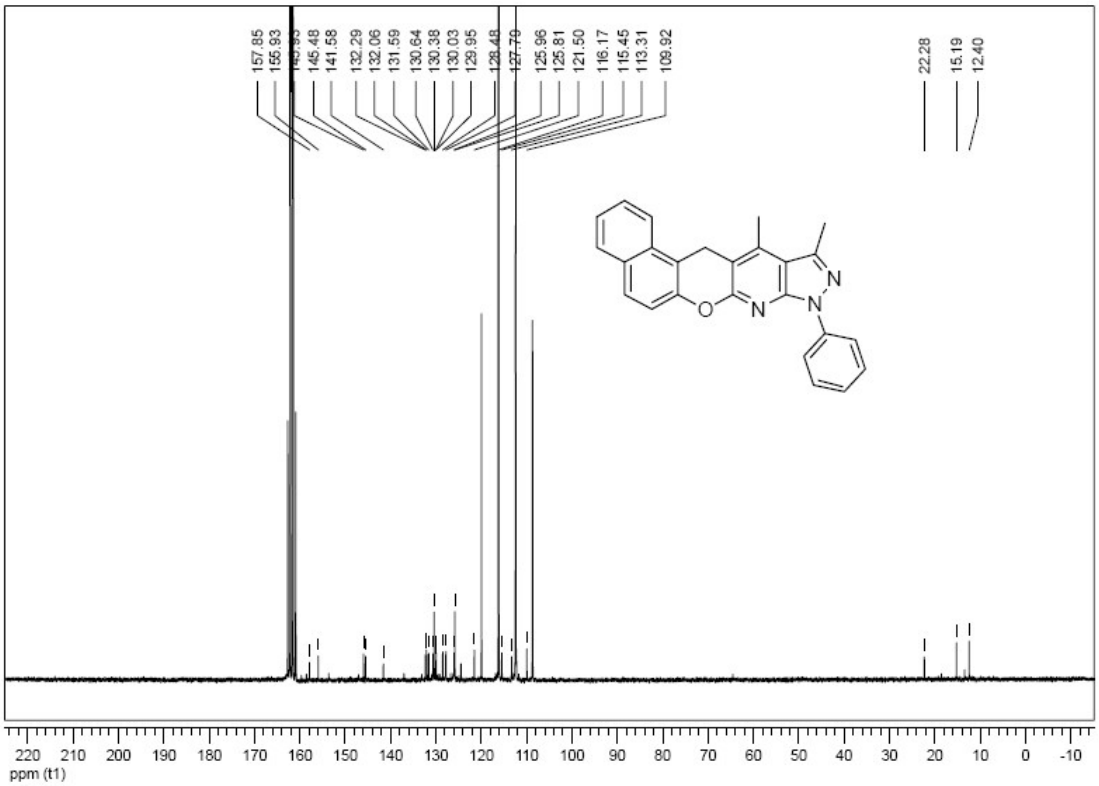
^{13}C NMR of 2-Ethoxy-11-methyl-9-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*] pyrazolo[4,3-*e*]pyridine **(4c)**



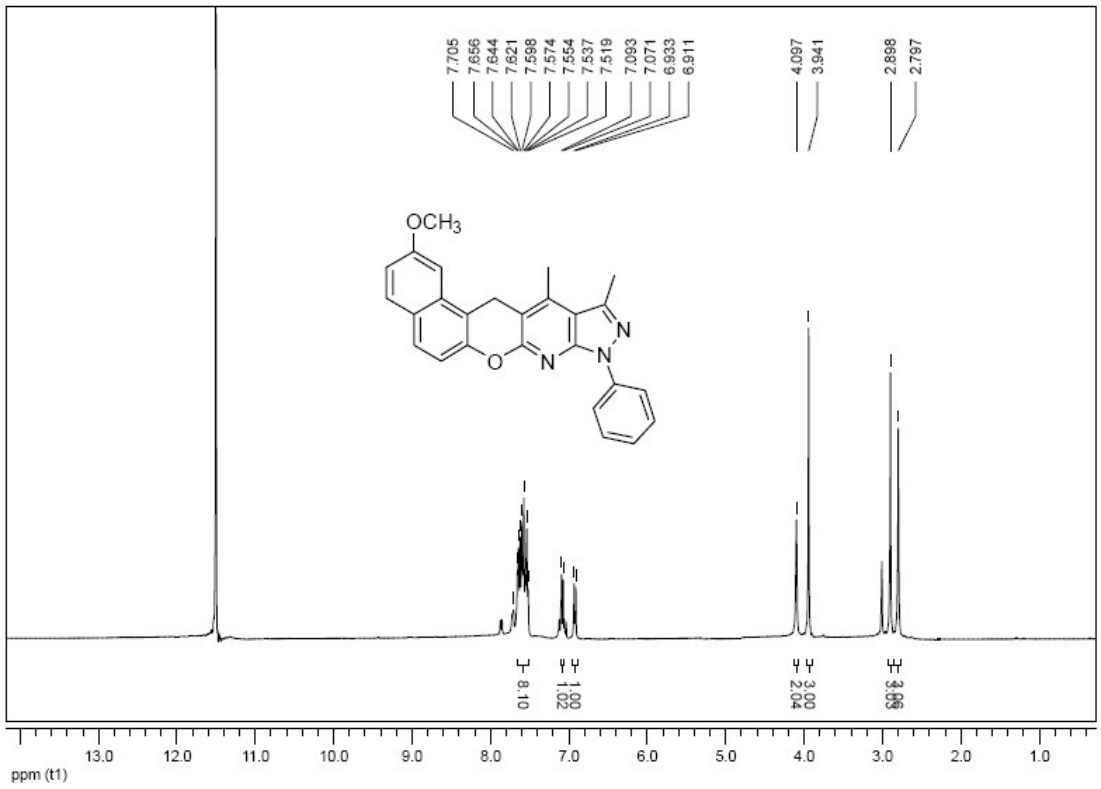
^{1}H NMR of 11,12-dimethyl-9-phenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4d)**



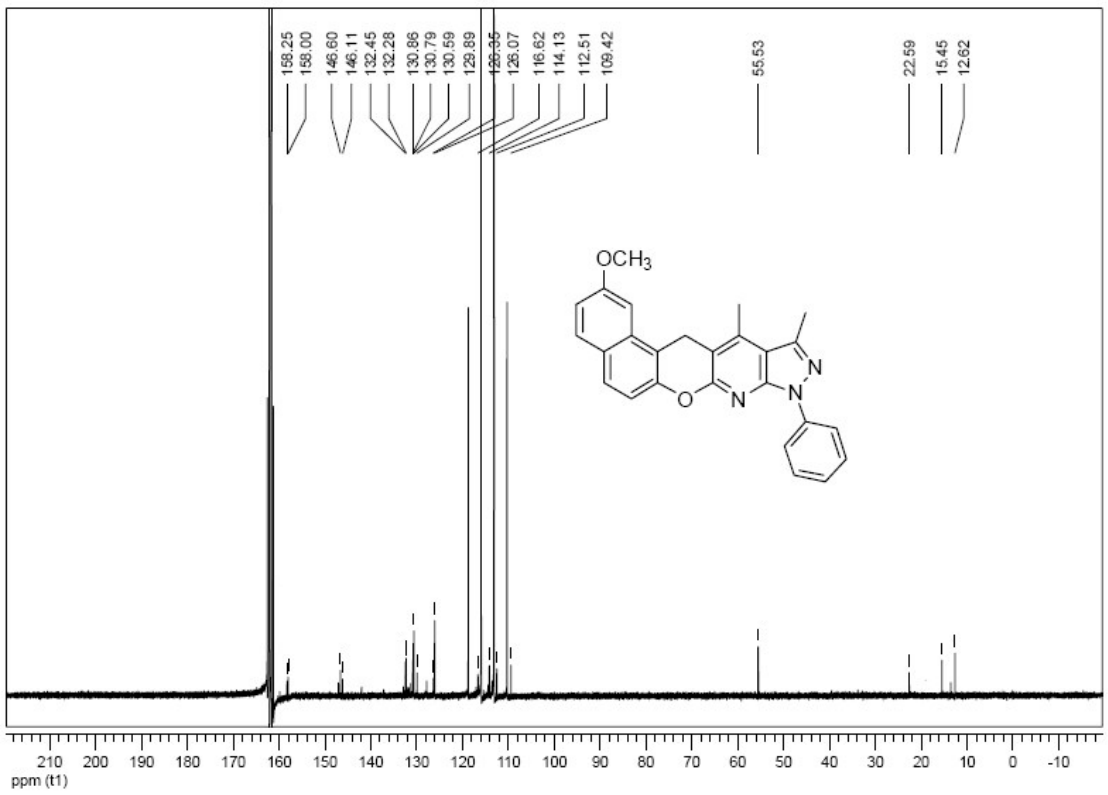
^{13}C NMR of 11,12-dimethyl-9-phenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4d)**



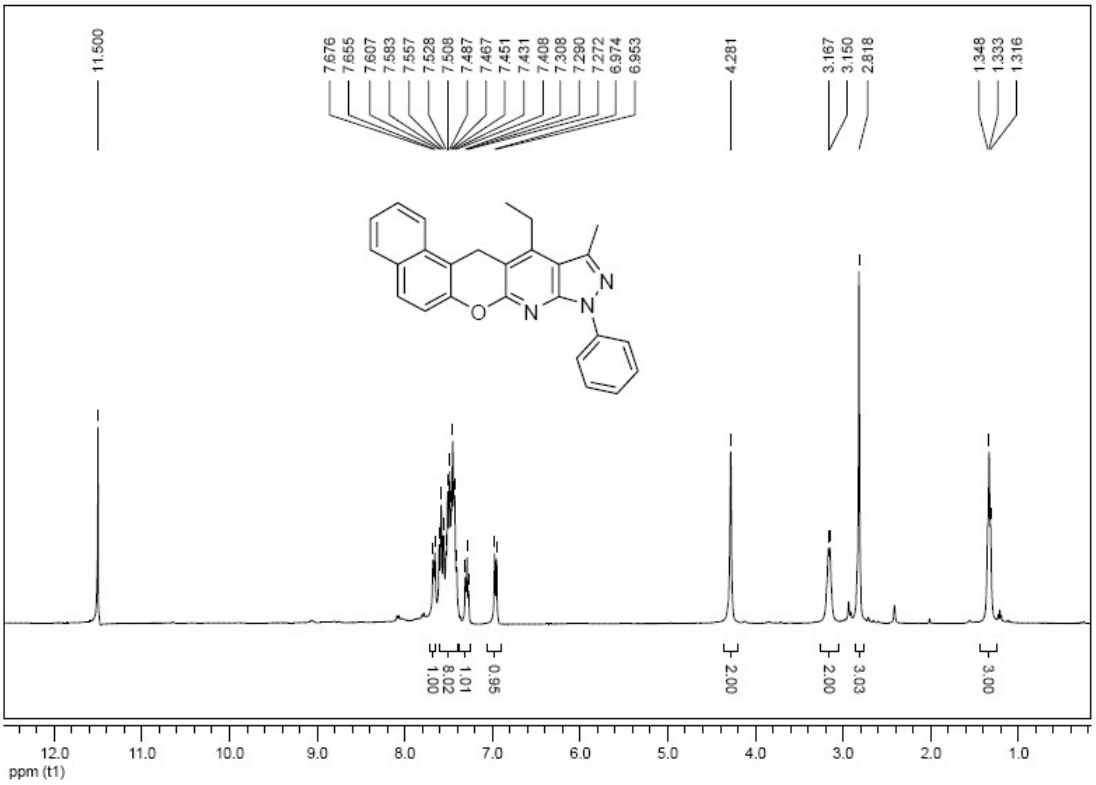
^{1}H NMR of 2-methoxy-11,12-dimethyl-9-phenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo [4,3-*e*]pyridine **(4e)**



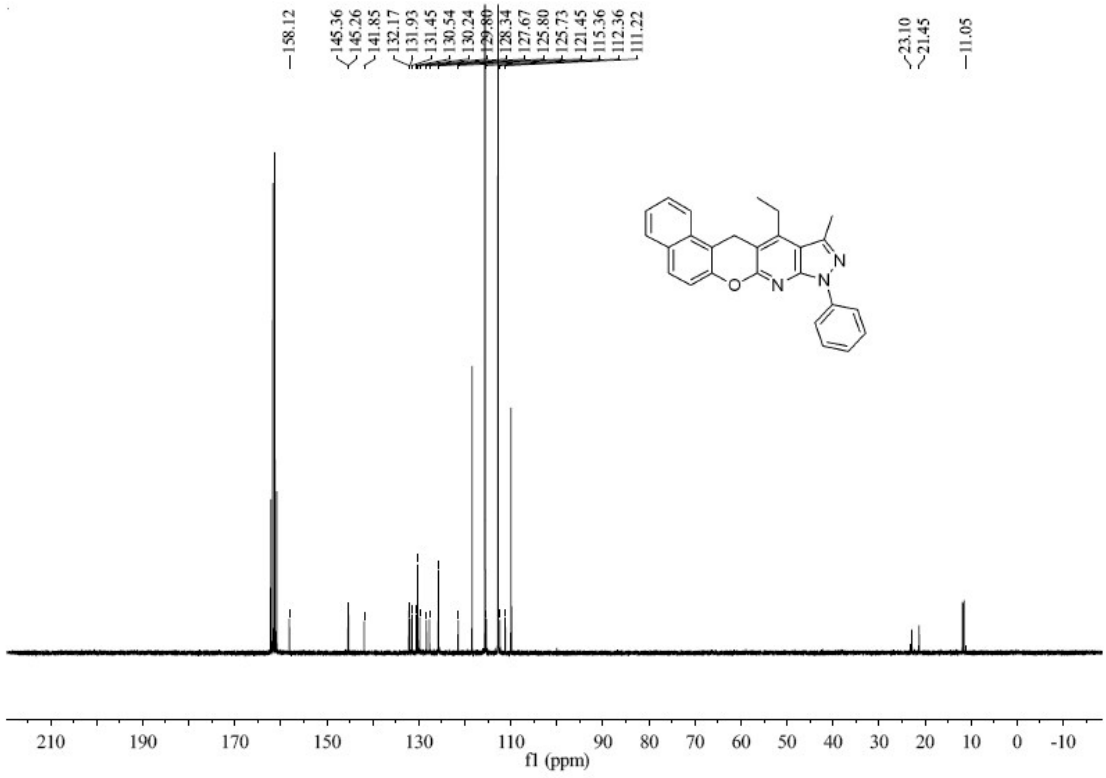
^{13}C NMR of 2-methoxy-11,12-dimethyl-9-phenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo [4,3-*e*]pyridine **(4e)**



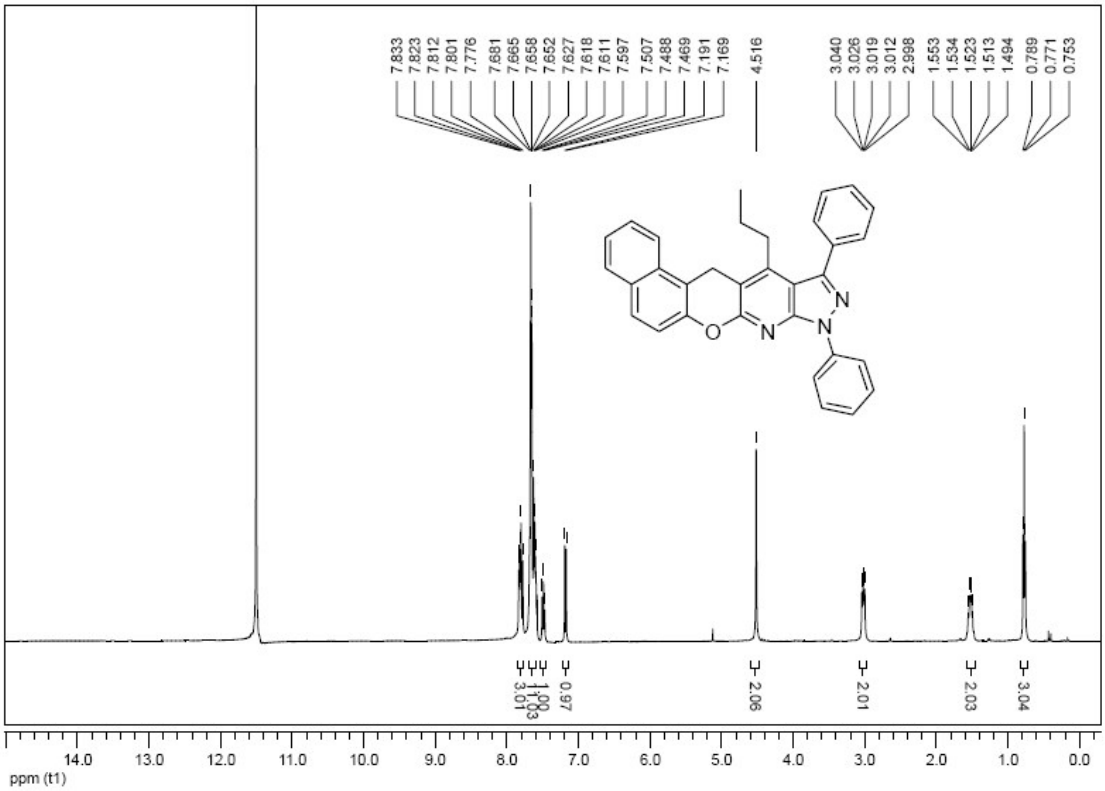
^{1}H NMR of 12-ethyl-11-methyl-9-phenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine(**4f)**



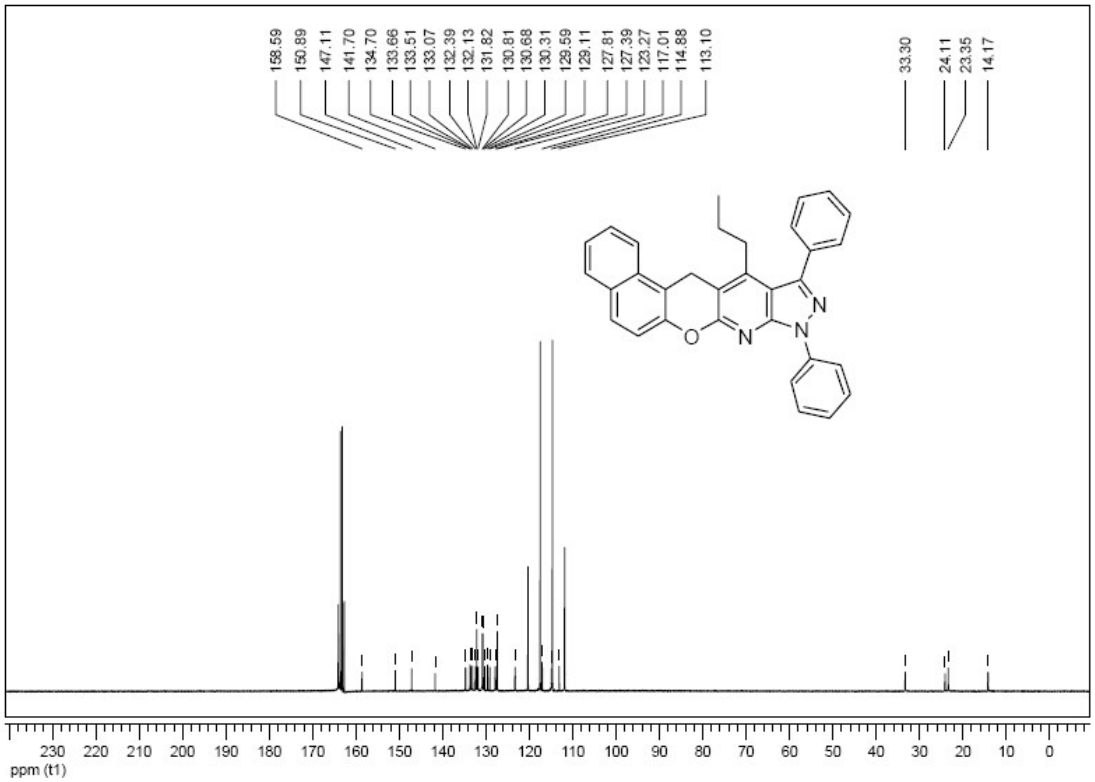
^{13}C NMR of 12-ethyl-11-methyl-9-phenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine(**4f)**



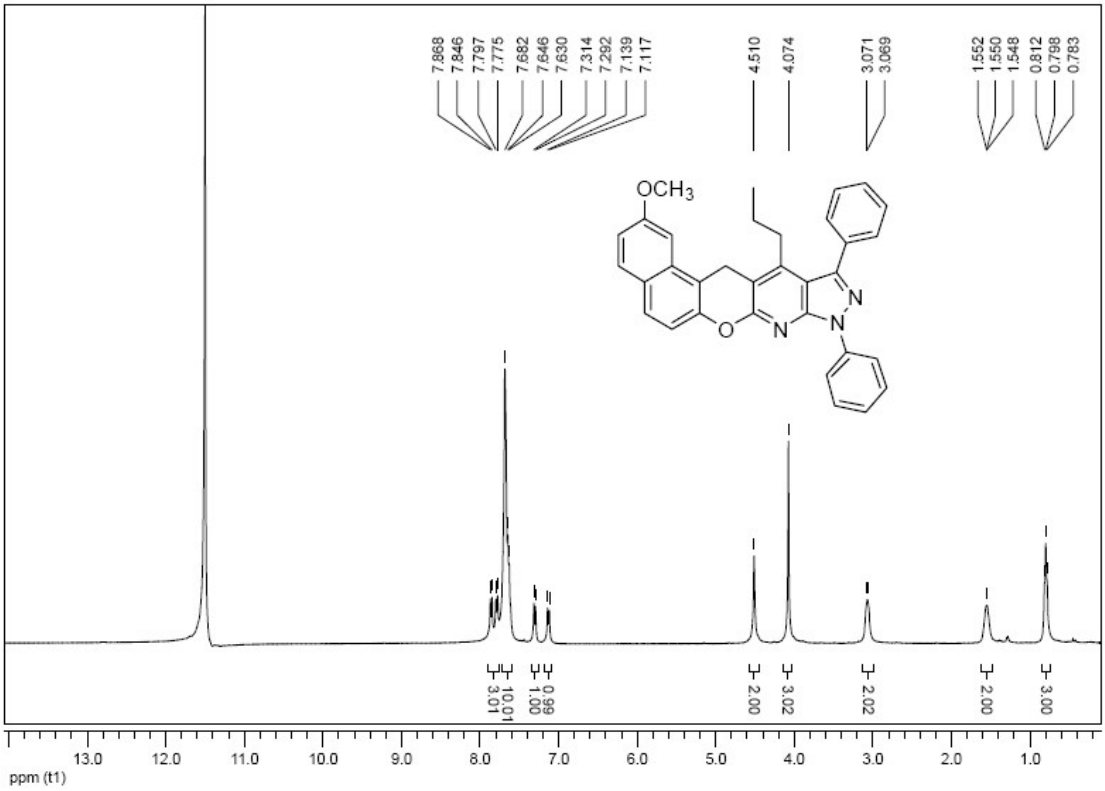
^{1}H NMR of 9,11-Diphenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4g)**



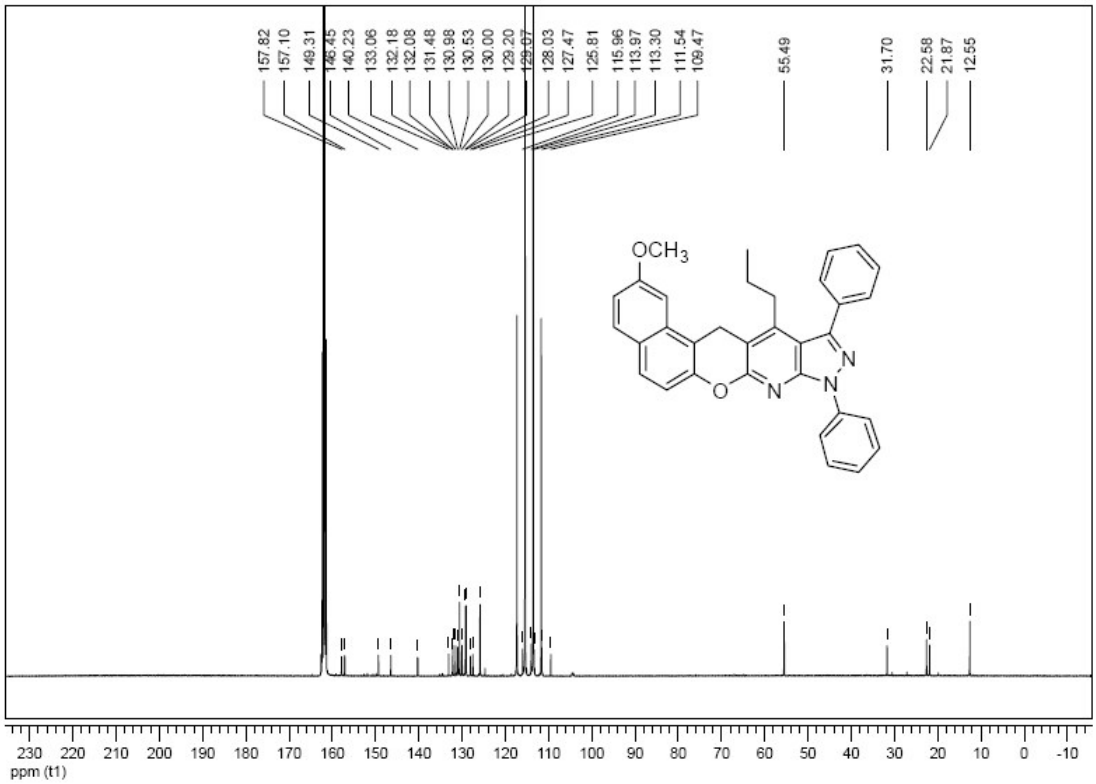
^{13}C NMR of 9,11-Diphenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4g)**



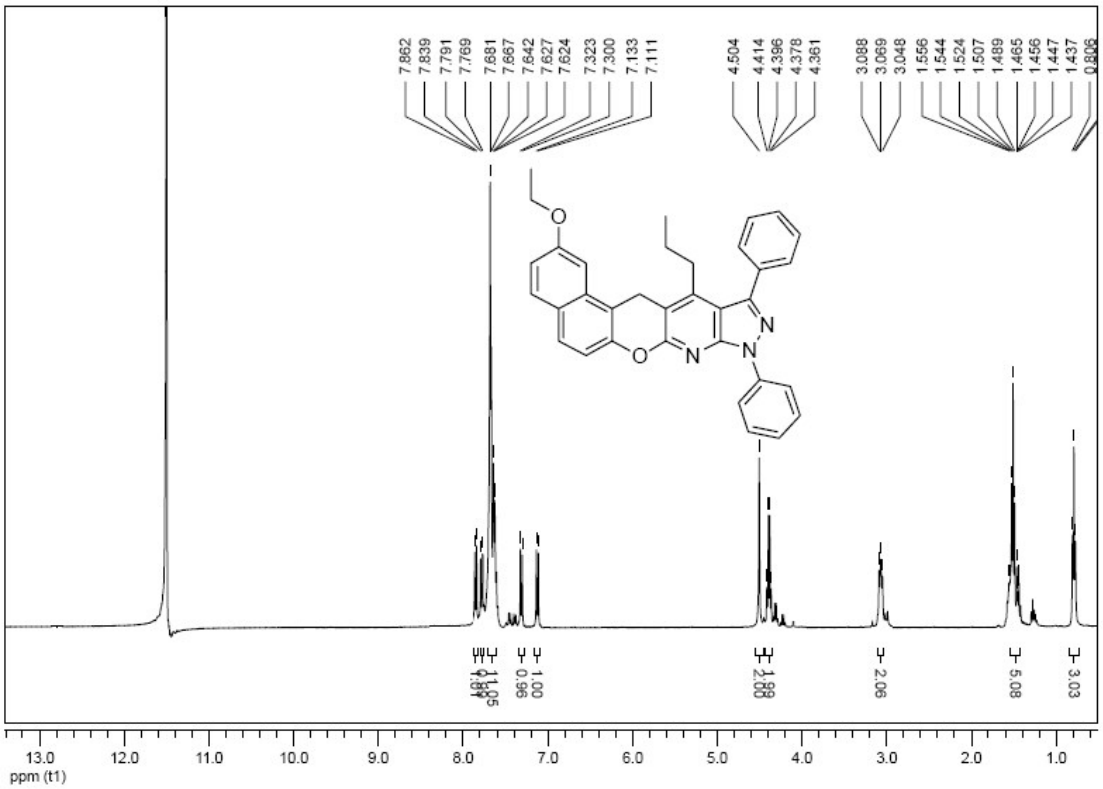
^{1}H NMR of 2-methoxy-9,11-diphenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo [4,3-*e*]pyridine **(4h)**



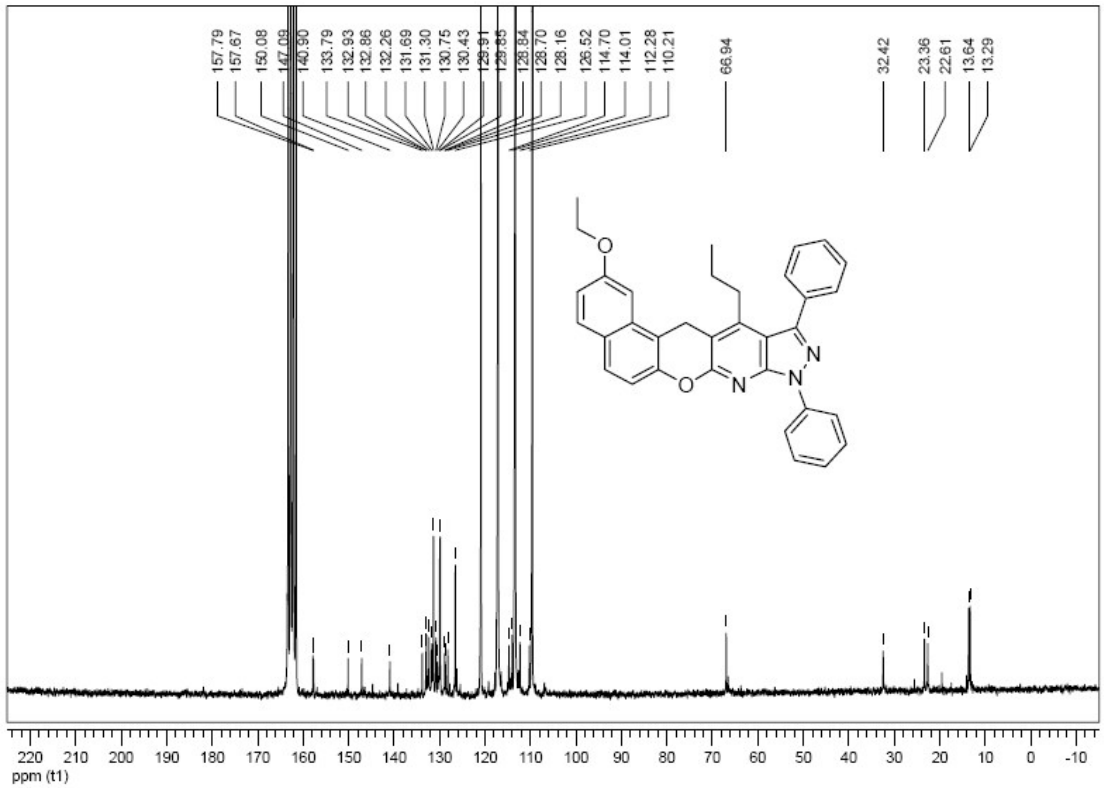
^{13}C NMR of 2-methoxy-9,11-diphenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo [4,3-*e*]pyridine **(4h)**



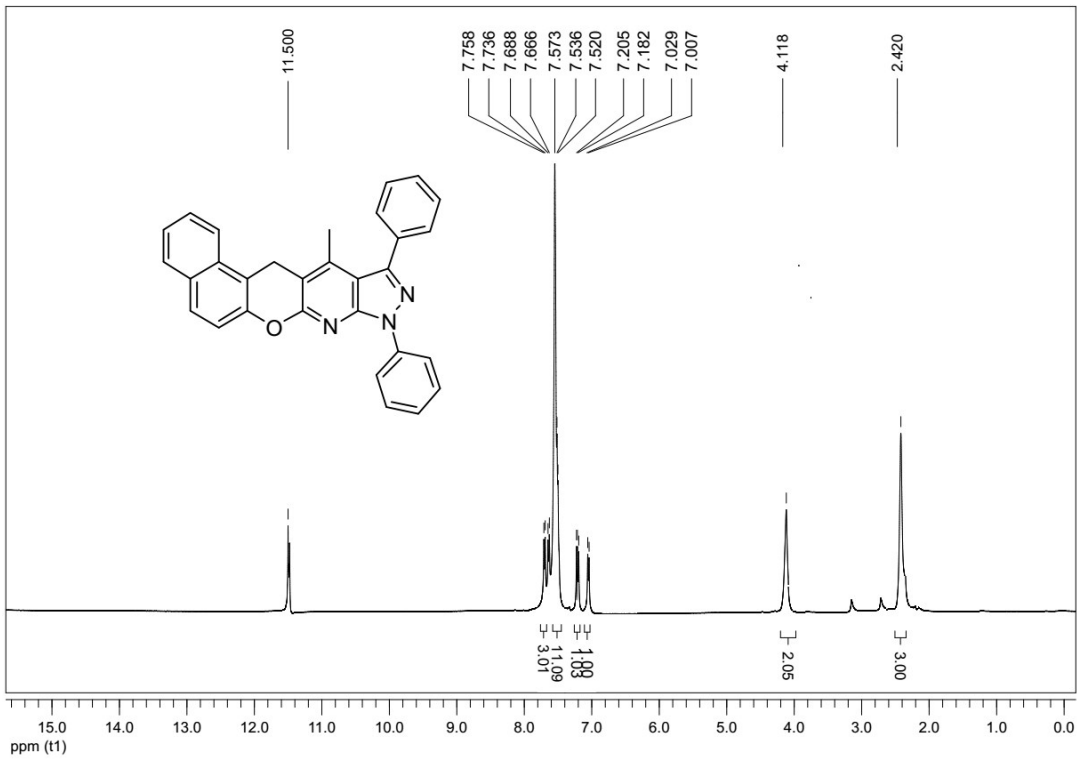
^{1}H NMR of 2-ethoxy-9,11-diphenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-b]pyrazolo [4,3-e]pyridine **(4i)**



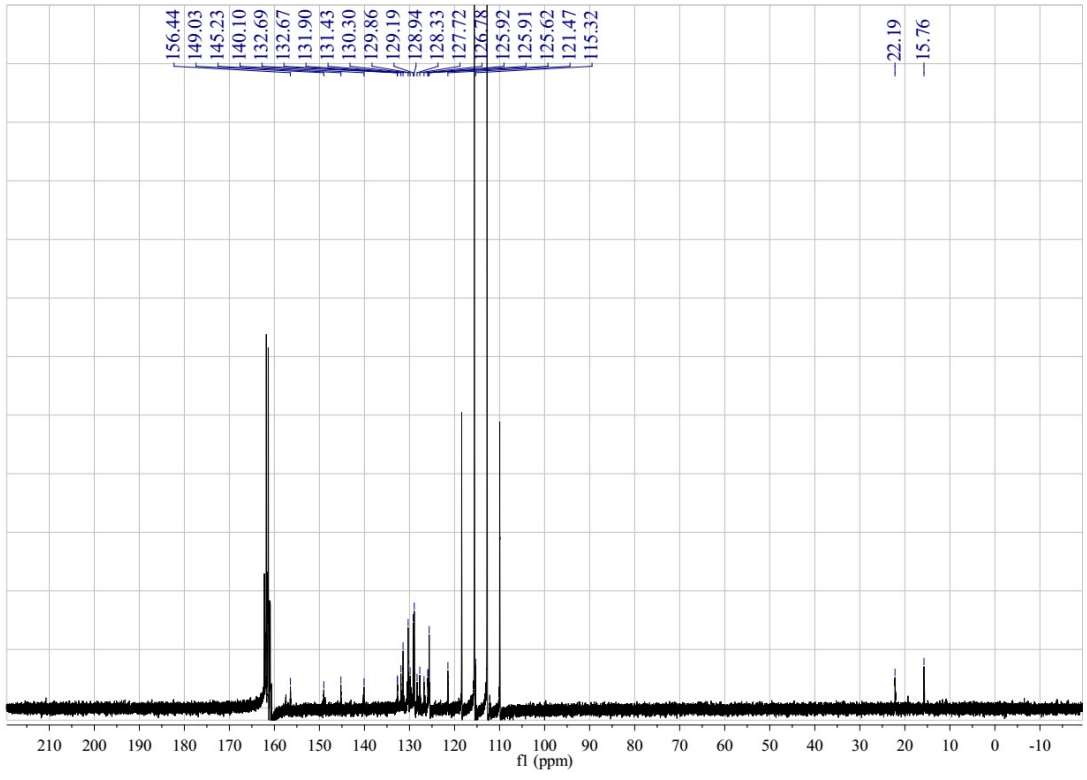
^{13}C NMR of 2-ethoxy-9,11-diphenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-b]pyrazolo [4,3-e]pyridine **(4i)**



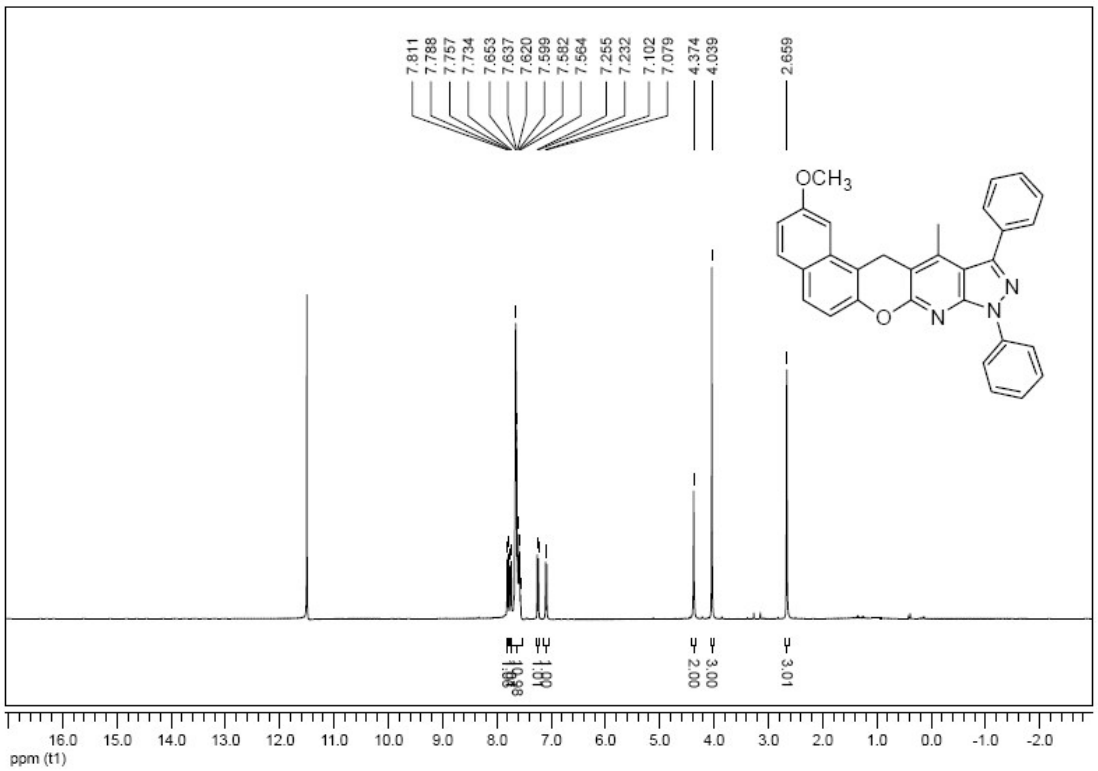
^{1}H NMR of 12-methyl-9,11-diphenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4j)**



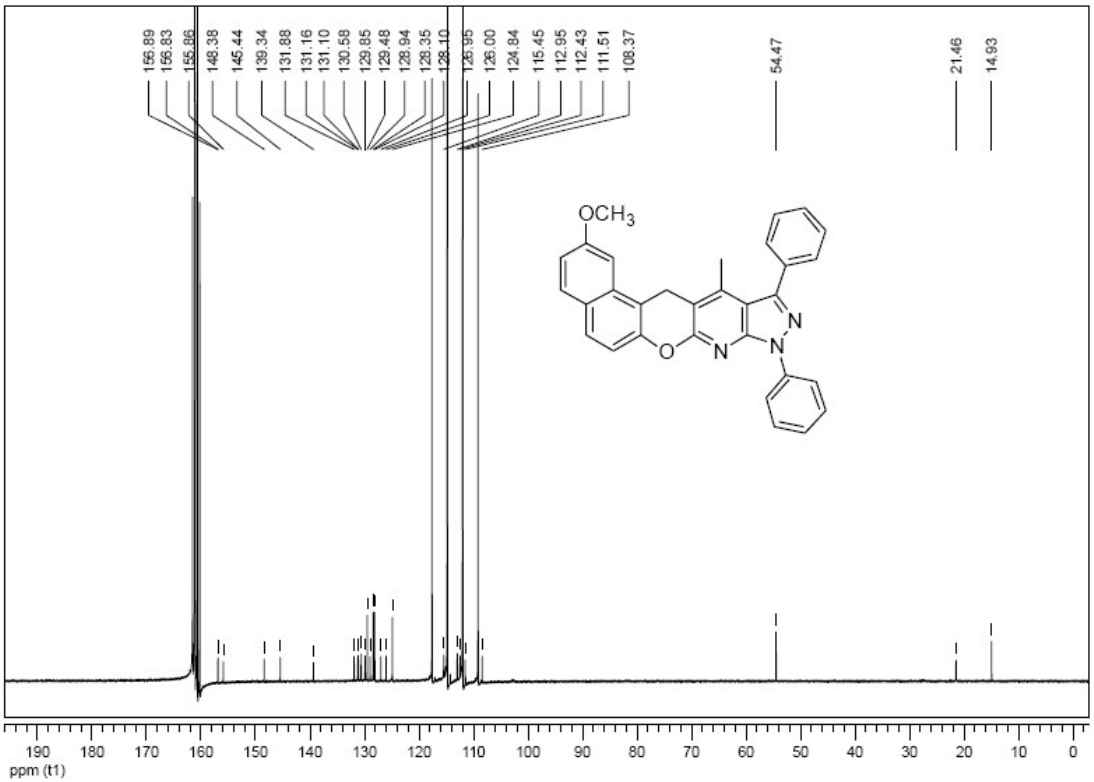
^{13}C NMR of 12-methyl-9,11-diphenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4j)**



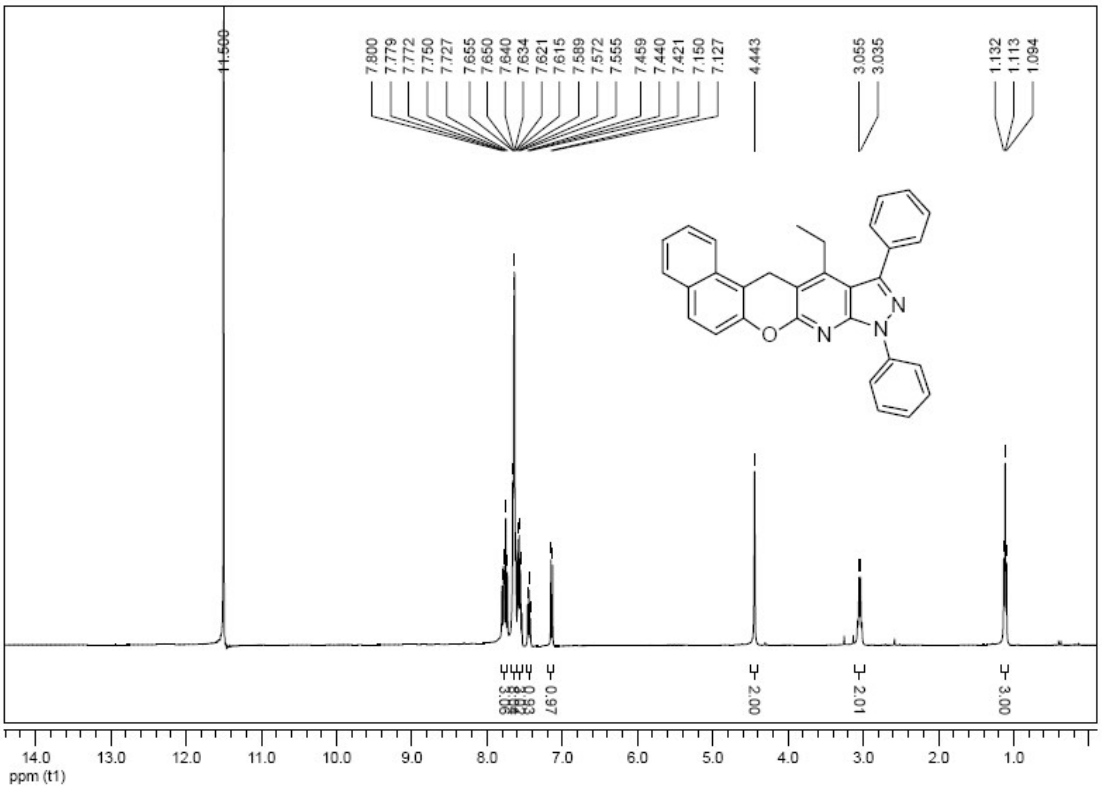
^{1}H NMR of 2-methoxy-12-methyl-9,11-diphenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo [4,3-*e*]pyridine **(4k)**



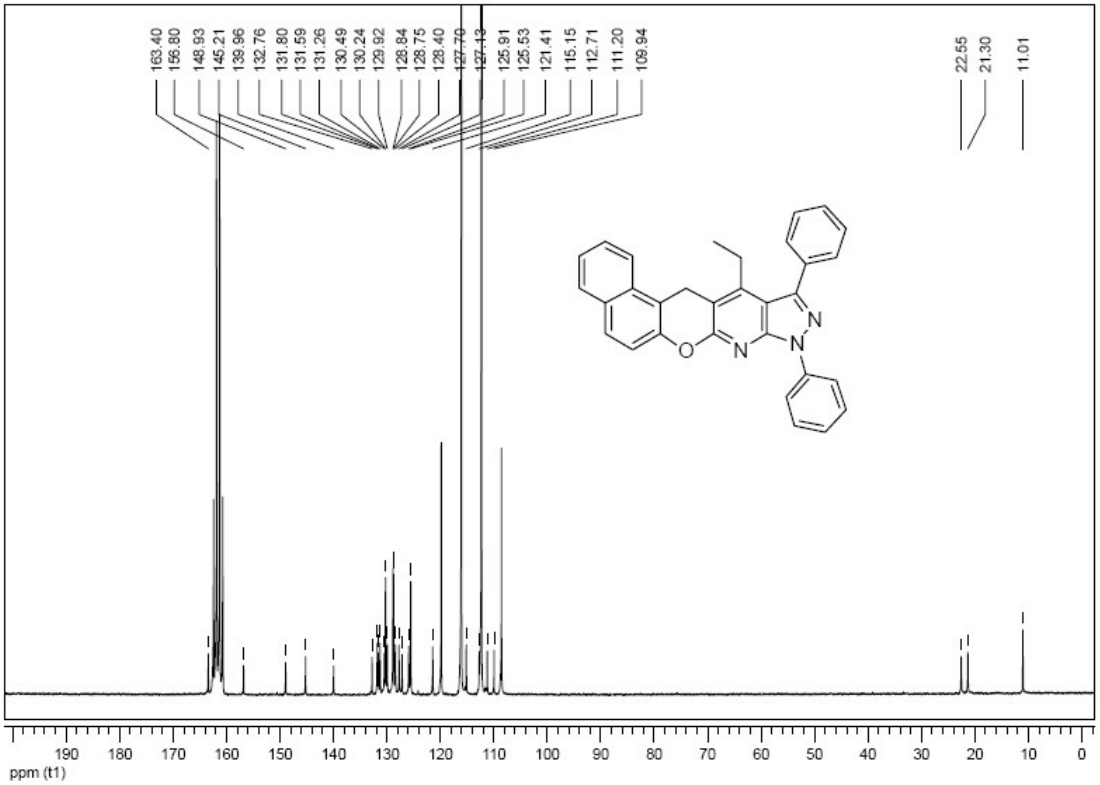
^{13}C NMR of 2-methoxy-12-methyl-9,11-diphenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo [4,3-*e*]pyridine **(4k)**



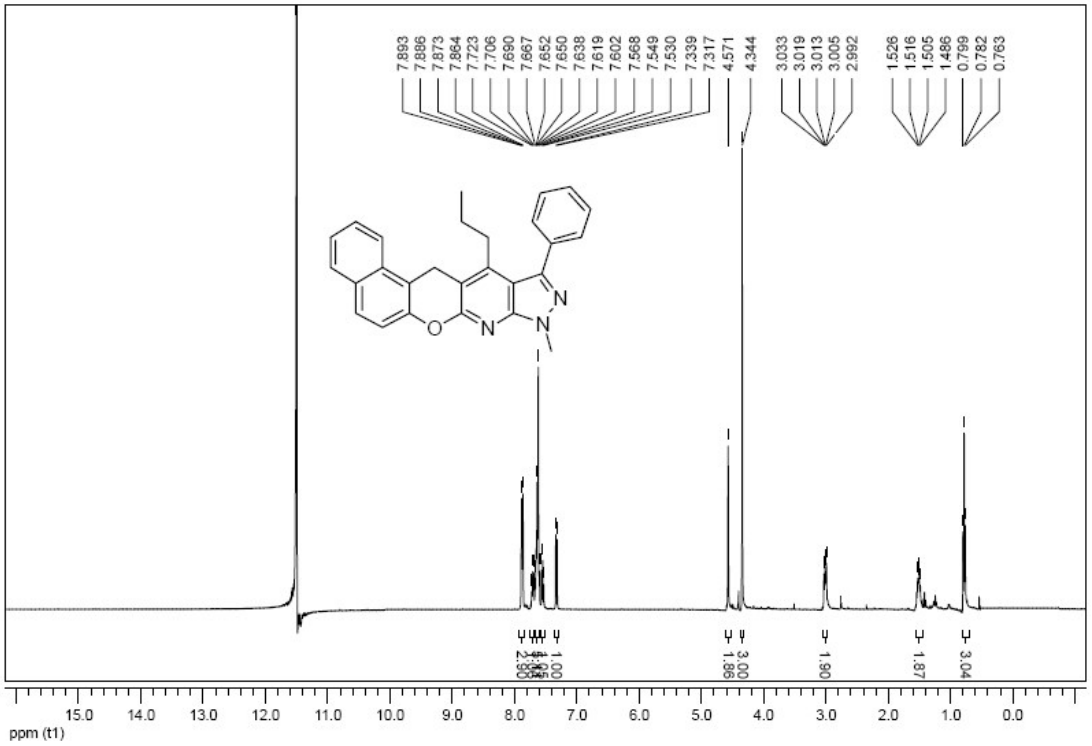
^{1}H NMR of 12-ethyl-9,11-diphenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine (**4l)**



^{13}C NMR of 12-ethyl-9,11-diphenyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine (**4l)**



^{1}H NMR of 9-methyl-11-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4m)**



^{13}C NMR of 9-methyl-11-phenyl-12-propyl-9,13-dihydrobenzo[5,6]chromeno[2,3-*b*]pyrazolo[4,3-*e*] pyridine **(4m)**