Supporting information for

Ruthenium (II)–Catalyzed Regioselective C8–H Acyloxylation of Indolizines with Carboxylic Acids

Karthikeyan Rajkumar,[a] Shikha Dhiman,[a] Veena Vijayan,[a,] Vinita Jagtap, [c] Ashutosh Singh,[c] Akshay Kamble,[b] Amit Kumar Pandey [c,*] and Satyasheel Sharma,[a,b*]

[a]*Department of Natural Products, National Institute of Pharmaceutical Education and Research - Ahmedabad, Gandhinagar, Gujarat, 382355, INDIA*
[b]*Department of Medicinal Chemistry, National Institute of Pharmaceutical Education and Research - Ahmedabad, Gandhinagar, Gujarat, 382355, INDIA*
[c]*Department of Biotechnology, National Institute of Pharmaceutical Education and Research - Ahmedabad, Gandhinagar, Gujarat, 382355, INDIA*

**Corresponding Author:* Dr. Satyasheel Sharma: *Email:* sharma.satyasheel@gmail.com; satyasheel.sharma@niperahm.res.in
Dr. Amit Kumar Pandey: amit.pandey@niperahm.res.in

1. General Information

All the reactions were carried out in an oven-dried glass ware. Purified compounds were further dried under vacuum. Yields mentioned refer to purified and spectroscopically pure compounds, unless otherwise stated.

Unless otherwise mentioned, all the reagents like catalysts, starting materials, bases, additives, oxidants were received from commercial vendors like Alfa Aesar®, Sigma-Aldrich®, BLDpharm™, TCI®, Qualigens® and used without further purification. Solvents like Ethyl acetate, Hexane, Dichloromethane, Chloroform, Methanol were purchased from Qualigens® or Sigma-Aldrich® and used as received without further purification or distillation. All deuterated solvents were purchased from Sigma-Aldrich®, Cambridge Isotope Laboratories, Inc., TCI® and used as received.

Reaction progress was monitored by thin layer chromatography, TLC (Merck silica gel 60 F-254, 0.25 nm, precoated plates on alumina) and visualized by fluorescence quenching under UV light. Whenever required, the developed TLCs were visualized by Wagner's staining reagent. Column chromatography was performed on Merck silica gel (230-400 mesh) using ethyl acetate and hexane as mobile phase.

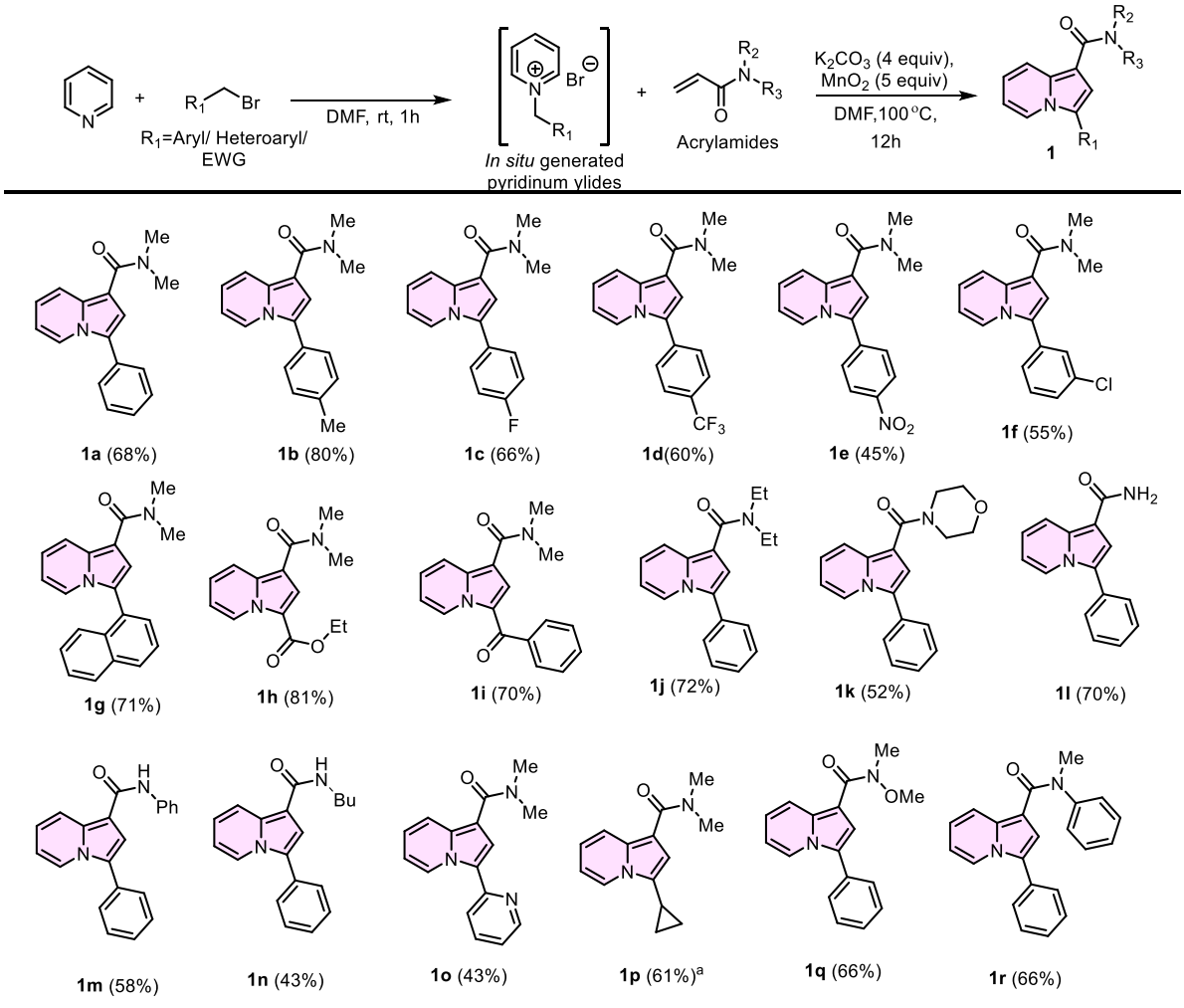
Spectroscopic characterizations were carried at the Central Instrumentation Facility (CIF), National Institute of Pharmaceutical Education and Research-Ahmedabad (NIPER-A). All ^{1}H-NMR spectra were recorded on Bruker 500 (500 MHz) and ^{13}C{^{1}H}-NMR spectra were recorded on a Bruker 500 (125 MHz) in $CDCl_3$ (99.8 atom % D, contains 1 % (v/v)) or solvent as mentioned per spectra.^{19}F NMR was recorded on Bruker 500 (470 MHz). Both ^{1}H-NMR and ^{13}C{^{1}H} NMR chemical shifts were reported in parts per million downfield from tetramethylsilane (δ 0.0ppm) with the solvent residual peak ($CDCl_3$, δ 7.26 ppm, s). Data were reported as δ (chemical shift as ppm), J (coupling constant in Hz) and the carbon spectra were reported only in δ (chemical shift). Multiplicities were indicated by (s = singlet, d = doublet, t = triplet, q = quartet, p = pentet, h = heptet, m = multiplet, dd = doublet of doublets, tt = triplet of triplets, ddd = doublet of doublets of doublets, td = triplet of doublets, dt = doublet of triplets, qd = quartet of doublets).

High-resolution Mass Spectrometry (HRMS) was done on HRMS Thermo Orbitrap-Fusion™ in positive (ESI^+ ion) mode. Single crystal X-Ray analysis was performed on SuperNova, Single source at offset/far, HyPix3000 diffractometer.

2. Experimental details

2.1 General experimental procedure for Synthesis of Indolizine-1-carboxamides[1] (1a-1r):

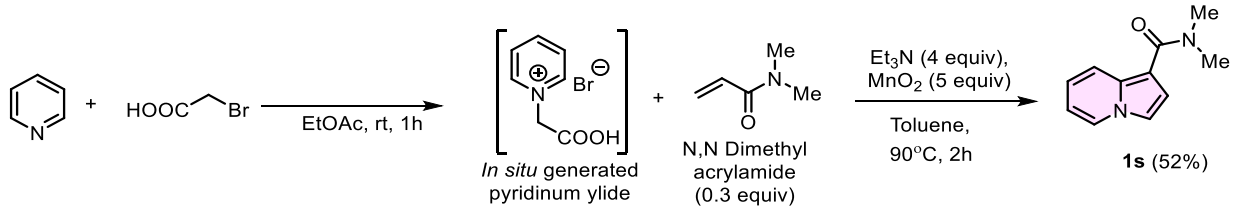
The synthesis of 3-substitituted indolizine-1-carboxamides were performed in a one-pot reaction as reported by Wang and co-workers[1], with slight modifications in base and oxidants. Pyridine (10 mmol) and halogenated hydrocarbons (10 mmol) were reacted at room temperature in an oven dried round bottom flask with a stopper for 1h in 0.5 mL of DMF to form *in situ* generated pyridinium salt. Then K_2CO_3 (40 mmol), was added to the reaction mixture and stirred for 10 minutes, followed by the addition of corresponding acrylamides (10 mmol). MnO_2 (5 equiv.) was added as an oxidant to the mixture along with and 10-15 mL of DMF. Then the mixture was heated at 100 °C for another 12 h (the reaction course was monitored by TLC). After the reaction was complete, the mixture was filtered under vacuum. The crude filtrate was poured into water and extracted by ethyl acetate (10 mL × 3). The organic layers were combined, washed with brine, dried over anhydrous sodium sulphate and filtered. The organic solvent was removed under vacuum and the residue was purified by column chromatography (230-400 mesh, 1.5:1 EtOAc/Hexane), to yield the indolizines.



[a] The reaction time for *in situ* generation of Pyridinium ylide is 12h, in the case of **1p**

Scheme-S1: Synthesis of Indolizine-1-carboxamides **(1a-1r)**.

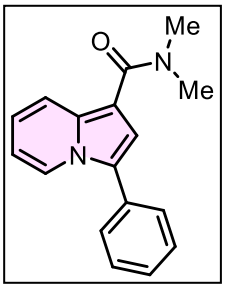
2.2 General experimental procedure for Synthesis of N,N-dimethylindolizine-1-carboxamide[2] (1s):



Pyridine (10 mmol) and Bromoacetic acid (10 mmol) were reacted at 60°C in an oven dried round bottom flask with a stopper for 4h in 0.5 mL of Ethyl acetate to form *in situ* generated pyridinium salt. Then triethylamine (40 mmol) was added to the reaction mixture and stirred for 10 minutes, followed by the addition of N,N dimethyl acrylamide (3 mmol) and MnO_2 (5 equiv.) The mixture was heated at 90°C for 12 h with toluene (the reaction course was monitored by TLC). After the reaction was complete, the mixture was filtered under vacuum and washed off with acetone. The crude filtrate was concentrated under vacuum and the residue was purified by column chromatography (230-400 mesh, 1.5:1 EtOAc/Hexane), to yield the indolizine **(1s).**

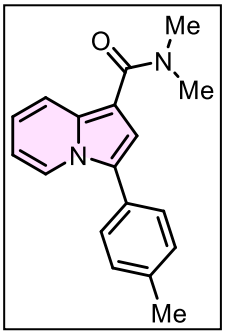
The spectral characterization of synthesised indolizines **(1a-1s)** were concurrent with the literature[1-3] and the characterization of the new compounds are also discussed here.

N,N-Dimethyl-3-phenylindolizine-1-carboxamide (1a).



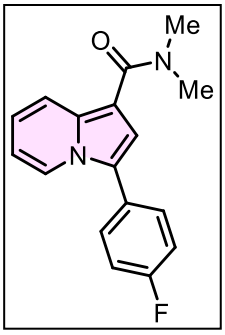
Dark brown oil; 1.8g, (68%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.26 (d, J = 7.2 Hz, 1H), 7.99 (d, J = 9.1 Hz, 1H), 7.56 (d, J = 7.7 Hz, 2H), 7.51 (t, J = 7.0 Hz, 2H), 7.41 (t, J = 7.3 Hz, 1H), 7.00 (d, J = 2.0 Hz, 1H), 6.94 (t, J = 7.8 Hz, 1H), 6.63 (t, J = 6.9 Hz, 1H), 3.23 (s, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.7, 135.1, 131.6, 129.1, 128.5, 127.8, 125.1, 122.6, 120.3, 120.2, 114.6, 112.1, 107.5, 37.2. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{17}H_{17}N_2O^+$ $[M+H]^+$ 265.1335, found 265.1347.

N,N-Dimethyl-3-(p-tolyl)indolizine-1-carboxamide (1b).



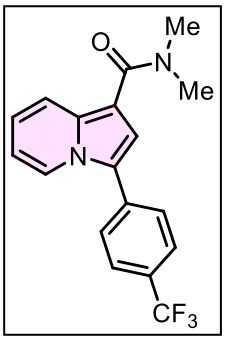
Light green solid, 2.2g, (80%). M.P: 167-168°C. **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.2 (d, J = 7.1 Hz, 1H), 8.0 (d, J = 9.1 Hz, 1H), 7.4 (d, J = 8.2 Hz, 2H), 7.3 (d, J = 7.8 Hz, 2H), 6.9 (s, 1H), 6.9 (ddd, J = 9.1, 6.5, 1.1 Hz, 1H), 6.6 (td, J = 6.8, 1.4 Hz, 1H), 3.2 (s, 6H), 2.4 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.8, 137.7, 134.9, 129.8, 128.6, 128.5, 125.1, 122.7, 120.2, 120.1, 114.4, 112.0, 107.3, 37.6, 21.3. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{18}H_{19}N_2O^+$ $[M+H]^+$ 279.1492, found 279.1510

3-(4-Fluorophenyl)-N,N-dimethylindolizine-1-carboxamide (1c).



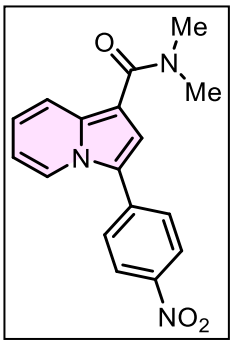
Dark brown sticky solid; 1.8g, (66%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.14 (d, J = 7.1 Hz, 1H), 7.97 (d, J = 9.1 Hz, 1H), 7.51 (dd, J = 8.3, 5.4 Hz, 2H), 7.20 (t, J = 8.4 Hz, 2H), 6.95 (s, 1H), 6.96 – 6.90 (m, 1H), 6.64 (t, J = 6.8 Hz, 1H), 3.22 (s, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.7, 163.3, 161.3, 135.0, 130.5, 130.4, 127.7, 127.6, 124.0, 122.4, 120.3, 120.2, 116.2, 116.1, 114.6, 112.2, 107.4, 37.2. **^{19}F NMR (470 MHz, $CDCl_3$)** δ -113.4. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{17}H_{16}FN_2O^+$ $[M+H]^+$ 283.1241, found 283.1252.

N,N-Dimethyl-3-(4-(trifluoromethyl)phenyl)indolizine-1-carboxamide (1d).



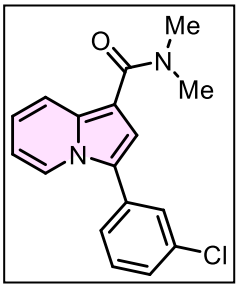
Brown sticky solid; 1.9g, (60%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.28 (d, J = 7.1 Hz, 1H), 7.98 (d, J = 9.1 Hz, 1H), 7.76 (d, J = 8.0 Hz, 2H), 7.69 (d, J = 8.0 Hz, 2H), 7.06 (s, 1H), 6.99 (t, J = 7.9 Hz, 1H), 6.70 (t, J = 7.6 Hz, 1H), 3.23 (s, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.5, 135.6, 135.2, 129.6, 129.3, 129.0, 128.3, 126.2, 126.1, 126.1, 126.1, 125.2, 123.5, 123.0, 122.4, 120.9, 120.4, 115.5, 112.7, 108.1, 37.4. **^{19}F NMR (471 MHz, $CDCl_3$)** δ -62.6. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{18}H_{16}F_3N_2O^+$ $[M+H]^+$ 333.1209, found 333.1211.

N,N-Dimethyl-3-(4-nitrophenyl)indolizine-1-carboxamide (1e).



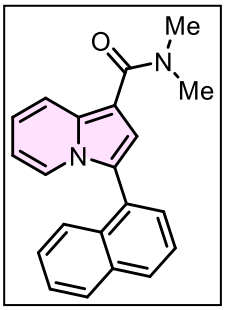
Red solid; 1.4g, (45%). M.P:170-172^{o}C. **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.36 (d, J = 8.0 Hz, 3H), 7.99 (d, J = 9.1 Hz, 1H), 7.75 (d, J = 8.4 Hz, 2H), 7.14 (s, 1H), 7.04 (dd, J = 9.1, 6.6 Hz, 1H), 6.76 (t, J = 6.8 Hz, 1H), 3.23 (s, 6H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.1, 146.3, 138.1, 136.4, 127.8, 124.6, 122.8, 122.5, 121.6, 120.5, 116.5, 113.2, 109.0, 38.6. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{17}H_{16}N_3O_3^+$ $[M+H]^+$ 310.1186, found 310.1209.

3-(3-Chlorophenyl)-N,N-dimethylindolizine-1-carboxamide (1f).



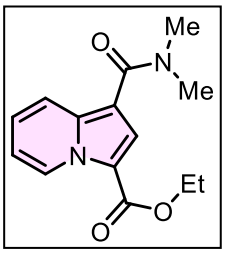
Dark green semi solid; 1.6g (55%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.24 (d, J = 7.1 Hz, 1H), 7.98 (d, J = 9.1 Hz, 1H), 7.55 (s, 1H), 7.47 – 7.42 (m, 2H), 7.40 – 7.35 (m, 1H), 7.01 (s, 1H), 6.96 (dd, J = 9.2, 6.5 Hz, 1H), 6.68 (t, J = 6.8 Hz, 1H), 3.23 (s, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.5, 135.4, 135.0, 133.4, 130.4, 128.3, 127.7, 126.4, 123.5, 122.5, 120.7, 120.3, 115.1, 112.5, 107.7, 38.0. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{17}H_{16}ClN_2O^+$ $[M+H]^+$ 299.0946, found 299.0948

N,N-Dimethyl-3-(naphthalen-1-yl)indolizine-1-carboxamide (1g).



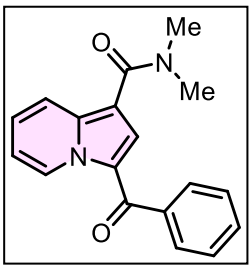
Reddish solid; 2.2g (71%). M.P: 165-167°C. **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.09 (d, J = 9.1 Hz, 1H), 7.99 (t, J = 8.2 Hz, 2H), 7.63 – 7.60 (m, 2H), 7.60 – 7.55 (m, 2H), 7.53 (d, J = 9.0 Hz, 1H), 7.45 (d, J = 7.5 Hz, 1H), 7.11 (s, 1H), 6.97 (t, J = 8.8, 7.3 Hz, 1H), 6.54 (t, J = 6.8 Hz, 1H), 3.27 (s, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.9, 135.0, 133.9, 132.3, 129.3, 129.3, 128.8, 128.7, 126.9, 126.3, 125.6, 125.6, 123.4, 122.8, 120.3, 120.1, 116.0, 111.8, 107.0, 37.5. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{21}H_{19}N_2O^+$ $[M+H]^+$ 315.1492, found 315.1501.

Ethyl 1-(dimethyl carbamoyl) indolizine-3-carboxylate (1h).



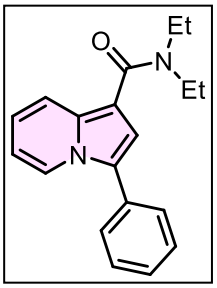
Light brown solid; 2.1g (81%). M.P: 183-184°C. **^{1}H NMR (500 MHz, $CDCl_3$)** δ 9.5 (dt, J = 7.1, 1.1 Hz, 1H), 8.1 (dt, J = 9.0, 1.3 Hz, 1H), 7.6 (s, 1H), 7.2 (ddd, J = 9.0, 6.7, 1.1 Hz, 1H), 6.9 (td, J = 6.9, 1.4 Hz, 1H), 4.4 (q, J = 7.1 Hz, 2H), 3.2 (s, 6H), 1.4 (t, J = 7.1 Hz, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 166.6, 161.3, 138.6, 127.3, 124.0, 121.8, 119.7, 114.0, 113.4, 108.4, 60.1, 14.6. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{14}H_{17}N_2O_3^+$ $[M+H]^+$ 261.1234, found 261.1235

3-Benzoyl-N,N-dimethylindolizine-1-carboxamide (1i).



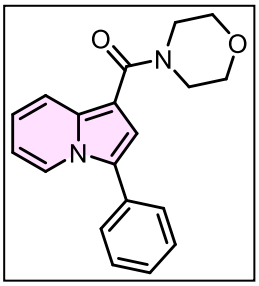
Dark brown oil; 2g, (70%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 9.93 (d, J = 7.0 Hz, 1H), 8.05 (d, J = 9.0 Hz, 1H), 7.78 (d, J = 7.1 Hz, 2H), 7.58 – 7.51 (m, 1H), 7.48 (t, J = 7.4 Hz, 2H), 7.44 (s, 1H), 7.34 (t, J = 8.3, 7.3 Hz, 1H), 7.03 (td, J = 6.9, 1.4 Hz, 1H), 3.13 (s, 6H).**^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 185.1, 166.4, 140.2, 139.3, 131.3, 128.9, 128.6, 128.3, 126.4, 126.3, 121.5, 119.4, 115.0, 109.7, 37.7. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{18}H_{17}N_2O_2^+$ $[M+H]^+$ 293.1285, found 293.1311

N,N-Diethyl-3-phenylindolizine-1-carboxamide (1j).



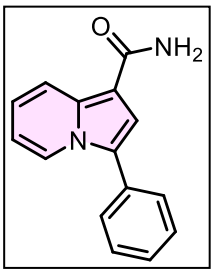
Dark green sticky solid; 2.1g (72%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.25 (d, J = 7.1 Hz, 1H), 7.98 (d, J = 9.1 Hz, 1H), 7.56 (d, J = 7.6 Hz, 2H), 7.51 (t, J = 7.5 Hz, 2H), 7.41 (t, J = 7.3 Hz, 1H), 6.95 (s, 1H), 6.91 (t, J = 7.8 Hz, 1H), 6.62 (t, J = 6.9 Hz, 1H), 3.64 (q, J = 7.1 Hz, 4H), 1.30 (t, J = 8.3, 6.5 Hz, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.0, 135.0, 131.7, 129.1, 128.5, 127.7, 125.0, 122.5, 120.2, 120.0, 113.5, 112.0, 108.2, 41.6, 13.9. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{19}H_{21}N_2O^+$ $[M+H]^+$ 293.1648, found 293.1659.

Morpholino(3-phenylindolizin-1-yl)methanone (1k).



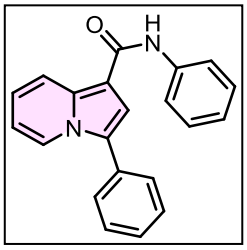
Dark green solid; 1.6g (52%). M.P: 161-163°C. **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.27 (d, J = 7.1 Hz, 1H), 7.92 (d, J = 9.1 Hz, 1H), 7.56 (d, J = 7.7 Hz, 2H), 7.52 (t, J = 6.9 Hz, 2H), 7.42 (t, J = 7.3, 6.7 Hz, 1H), 6.97 (t, J = 7.9 Hz, 1H), 6.94 (d, J = 1.6 Hz, 1H), 6.66 (t, J = 6.9 Hz, 1H), 3.87 – 3.82 (m, 4H), 3.80 – 3.75 (m, 4H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 166.9, 135.0, 131.4, 129.1, 128.5, 128.0, 125.5, 122.8, 120.6, 119.8, 114.3, 112.2, 106.6, 67.2, 45.7. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{19}H_{19}N_2O_2^+$ $[M+H]^+$ 307.1441, found 307.1460.

3-Phenylindolizine-1-carboxamide (1l).



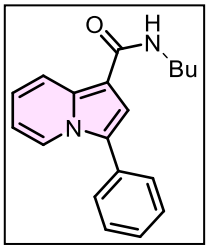
Yellow powder; 1.65g, (70%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.44 (d, J = 9.1 Hz, 1H), 8.28 (d, J = 7.1 Hz, 1H), 7.55 (t, J = 7.6, 6.2 Hz, 3H), 7.52 (d, J = 7.5 Hz, 1H), 7.43 (t, J = 8.1, 6.8 Hz, 1H), 7.06 (t, J = 7.9 Hz, 1H), 7.01 (s, 1H), 6.71 (t, J = 6.9 Hz, 1H), 5.69 (s, 2H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.1, 135.9, 131.2, 129.2, 128.6, 128.1, 126.0, 123.0, 121.9, 120.6, 113.1, 112.7, 105.9. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{15}H_{13}N_2O^+$ $[M+H]^+$ 237.1022, found 237.1028.

N,3-diphenylindolizine-1-carboxamide (1m)



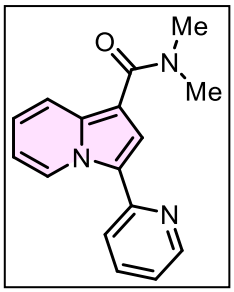
Dark green sticky solid; 1.25g, (43%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.50 (d, J = 9.1 Hz, 1H), 8.29 (d, J = 7.1 Hz, 1H), 7.73 – 7.66 (m, 3H), 7.57 (d, J = 7.6 Hz, 2H), 7.53 (t, J = 7.5 Hz, 2H), 7.44 (t, J = 7.3 Hz, 1H), 7.37 (t, J = 7.7 Hz, 2H), 7.15 – 7.09 (m, 2H), 7.07 (t, J = 8.5, 6.9 Hz, 1H), 6.73 (t, J = 6.8 Hz, 1H). **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{21}H_{17}N_2O^+$ $[M+H]^+$ 313.1335, found 313.1371.

N-butyl-3-phenylindolizine-1-carboxamide (1n)



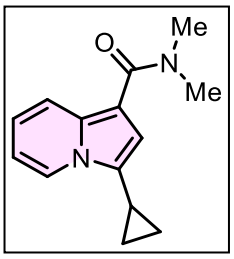
Dark yellow semi solid; 1.25g, (43%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.44 (dt, J = 9.1, 1.3 Hz, 1H), 8.26 (dt, J = 7.0, 1.1 Hz, 1H), 7.58 – 7.52 (m, 2H), 7.55 – 7.48 (m, 2H), 7.42 (tt, J = 7.4, 1.0 Hz, 1H), 7.01 (ddd, J = 9.1, 6.5, 1.1 Hz, 1H), 6.96 (s, 1H), 6.67 (td, J = 6.8, 1.4 Hz, 1H), 5.92 (s, 1H), 3.50 (q, J = 7.5, 7.0, 6.0 Hz, 2H), 1.64 (p, J = 7.4 Hz, 2H), 1.46 (hept, J = 8.0, 8.0, 7.5, 7.4, 7.4 Hz, 2H), 0.99 (t, J = 7.4 Hz, 3H). **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{19}H_{21}N_2O^+$ $[M+H]^+$ 293.1648, found 293.1641.

N,N-dimethyl-3-(pyridin-2-yl)indolizine-1-carboxamide (1o).



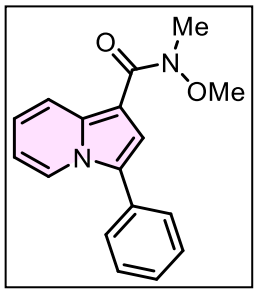
Dark Brown sticky solid; 1.1g, (43%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 9.94 (dt, J = 7.2, 0.9 Hz, 1H), 8.62 (dq, J = 4.1, 0.8 Hz, 1H), 7.93 (dt, J = 9.0, 1.3 Hz, 1H), 7.68 (td, J = 7.7, 7.3, 1.8 Hz, 1H), 7.63 (dt, J = 8.1, 1.2 Hz, 1H), 7.42 (s, 1H), 7.10 (ddd, J = 7.3, 4.9, 1.2 Hz, 1H), 7.03 (ddd, J = 9.0, 6.5, 1.1 Hz, 1H), 6.77 (td, J = 6.9, 1.4 Hz, 1H), 3.19 (s, 6H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.6, 152.0, 148.4, 136.5, 136.4, 127.0, 122.4, 121.8, 120.9, 120.4, 119.3, 116.1, 112.5, 108.0, 37.7. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{16}H_{16}N_3O^+$ $[M+H]^+$ 266.1288, found 266.1291.

3-Cyclopropyl-N,N-dimethylindolizine-1-carboxamide (1p).



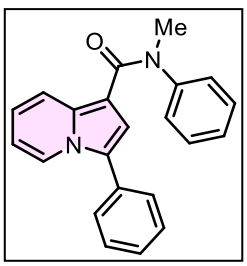
Dark yellow oil; 1.34g, (61%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.11 (dt, J = 7.1, 1.1 Hz, 1H), 7.89 (dt, J = 9.1, 1.0 Hz, 1H), 6.91 (ddd, J = 9.0, 6.6, 1.1 Hz, 1H), 6.71 – 6.65 (m, 2H), 3.16 (s, 6H), 1.83 (hept, J = 5.2, 5.2, 4.9, 4.6, 3.5, 3.2 Hz, 1H), 1.03 – 0.96 (m, 2H), 0.68 – 0.65 (m, 2H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 168.1, 134.3, 125.9, 122.7, 119.8, 112.5, 111.5, 105.3, 38.0, 22.3, 6.0, 5.4. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{14}H_{17}N_2O^+$ $[M+H]^+$ 229.1335, found 229.1329.

N-methoxy-N-methyl-3-phenylindolizine-1-carboxamide (1q).



Dark green sticky solid; 1.8g, (66%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.5 (dt, J = 9.2, 1.2 Hz, 1H), 8.3 (dt, J = 7.0, 1.2 Hz, 1H), 7.6 (dd, J = 7.1, 1.7 Hz, 2H), 7.5 (td, J = 7.6, 2.2 Hz, 2H), 7.4 (tt, J = 7.3, 1.3 Hz, 1H), 7.4 (s, 1H), 7.1 (ddd, J = 9.2, 6.6, 1.1 Hz, 1H), 6.7 (td, J = 6.9, 1.4 Hz, 1H), 3.8 (s, 3H), 3.4 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 166.2, 137.6, 131.6, 129.1, 128.7, 127.9, 125.9, 122.8, 121.8, 121.0, 115.7, 112.7, 104.7, 60.9, 33.5. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{17}H_{17}N_2O_2^+$ $[M+H]^+$ 281.1285, found 281.1301.

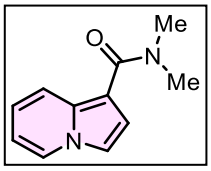
N-methyl-N,3-diphenylindolizine-1-carboxamide (1r)



Dark brown sticky solid; 2.2g, (69%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.44 (dt, J = 9.1, 1.2 Hz, 1H), 8.18 (dt, J = 7.0, 1.1 Hz, 1H), 7.42 – 7.31 (m, 5H), 7.32 – 7.21 (m, 5H), 7.00 (ddd, J = 9.2, 6.6, 1.1 Hz, 1H), 6.64 (td, J = 6.8, 1.4 Hz, 1H), 5.83 (s, 1H), 3.54 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 166.3, 146.0, 137.1, 131.4, 129.3, 128.9, 128.4, 127.6, 127.6, 126.7, 124.8, 122.6, 121.2, 121.0, 115.8, 112.4, 107.0, 38.4.

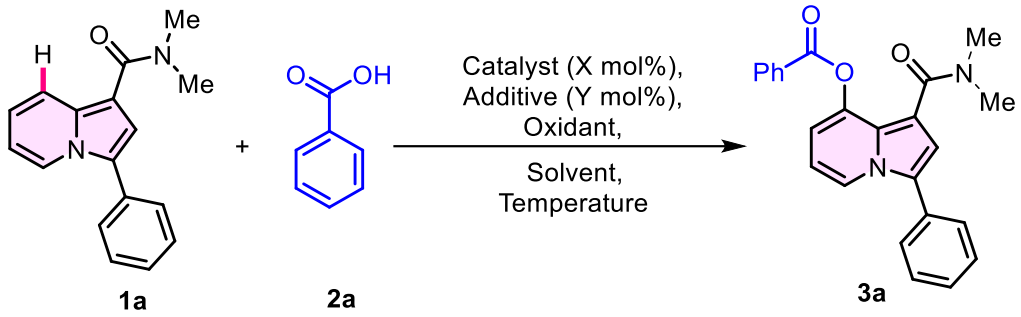
HRMS (ESI-Orbitrap) m/z: calcd for Chemical Formula: $C_{22}H_{19}N_2O^+$ $[M+H]^+$ 327.1492, found 327.1491.

N,N-dimethylindolizine-1-carboxamide (1s)



Dark Brown semi-solid; 0.9g, (52%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 7.95 – 7.88 (m, 2H), 7.23 (d, J = 2.9 Hz, 1H), 6.93 (d, J = 3.0 Hz, 1H), 6.92 – 6.85 (m, 1H), 6.60 (t, J = 6.7 Hz, 1H), 3.18 (s, 6H). **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{11}H_{13}N_2O^+$ $[M+H]^+$ 189.1022, found 189.1031.

2.2 Optimization of reaction conditions for C-8 Acyloxylation of Indolizines.



Scheme-S2: Optimization of reaction conditions for C-8 Acyloxylation of Indolizines.

The oven dried reaction tube equipped with magnetic stir bar was loaded with X mol% of catalyst and Y mol% of additive as mentioned in the table below. Further, *N,N*-dimethyl-3-phenylindolizine-1-carboxamide (**1a**) (0.2 mmol) and benzoic acid (**2a**) (**1a:2a** as mentioned in the table below) were added to the reaction tube. Next, the oxidant (appropriate equivalents as mentioned in the table below) and solvent (1 mL) were added to the reaction tube and stirred at mentioned temperatures (below table) for 24 hours. After completion, the reaction was cooled to ambient temperature, diluted with ethyl acetate and passed through celite pad. The organic compounds were collected completely, concentrated under reduced pressure and purified by column chromatography on silica gel (230-400 mesh, 1:1 EtOAc/Hexane) to obtain the product **3a.**

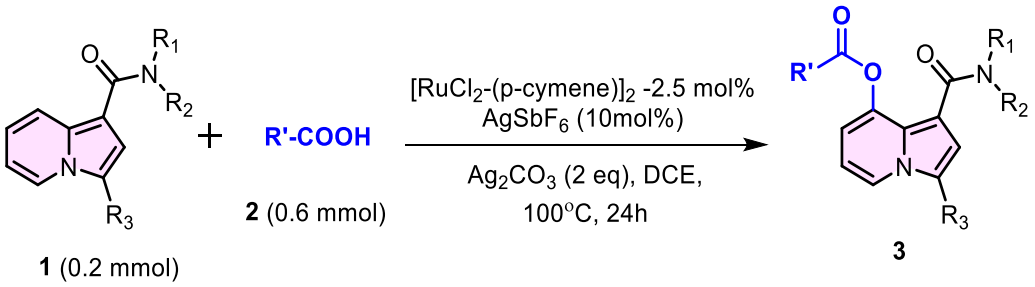
Table S1. Results for the optimisation of reaction conditons:

Entry	Ratio between 1a and 2a	Catalyst (X Mol%)	Additive (Y Mol%)	Oxidant (equiv)	Temp. (°C)	Solvent (1ml)	Isolated Yield 3aa (%)
1	1:2	$[RhCp^*Cl_2]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	THF	52%
2	1:2	$[Cp^*IrCl_2]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	THF	Traces
3	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	THF	48%
4	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	DCE	63%
5	1:2	--	--	Ag_2CO_3 (3)	100	DCE	NR
6	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	Toluene	46%
7	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	1,4-Dioxane	Traces
8	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	DMF	Traces
9	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	NMP	NR
10	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	t-AmOH	17%
11[a]	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	TFE	-
12	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	MeOH	NR
13	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	EtOAc	53%
14	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	HFIP	NR
15	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	K_2CO_3 (3)	100	DCE	NR
16	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	$(NH_4)_2S_2O_8$ (3)	100	DCE	18%
17	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Oxone (3)	100	DCE	NR
18	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2O (3)	100	DCE	23%
19	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	$PhI(OAc)_2$ (3)	100	DCE	Traces
20	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	AgF (3)	100	DCE	61%
21	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	$Cu(OAc)_2$ (3)	100	DCE	NR
22	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	MnO_2 (3)	100	DCE	NR
23	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	AgOTf (10)	Ag_2CO_3 (3)	100	DCE	37%
24	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	KPF_6 (10)	Ag_2CO_3 (3)	100	DCE	25%
25	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgBF_4$ (10)	Ag_2CO_3 (3)	100	DCE	7%

26	1:2	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	AgOAc (10)	Ag_2CO_3 (3)	100	DCE	24%
27	1:2	$[RuCl_2$-(p-cymene)$]_2$ (1)	$AgSbF_6$ (4)	Ag_2CO_3 (3)	100	DCE	33%
28	1:3	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	100	DCE	86%
29	1:3	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (2)	100	DCE	82%
30	1:3	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (1)	100	DCE	27%
31	1:3	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	25	DCE	NR
32	1:3	$[RuCl_2$-(p-cymene)$]_2$ (2.5)	$AgSbF_6$ (10)	Ag_2CO_3 (3)	70	DCE	21%

NR= No Reaction,
[a]Neither product nor **1a** was observed.

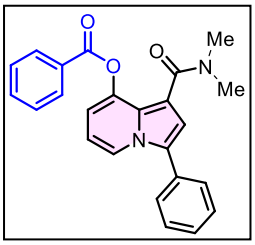
2.3 General Procedure for the synthesis of C-8 Acyloxylated Products of Indolizines and their spectral characterization data.



Scheme-S3: Synthetic scheme for regioselective C-8 acyloxylation of Indolizines

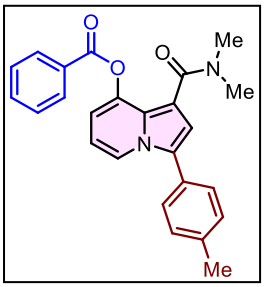
The oven dried reaction tube equipped with magnetic stir bar was loaded with Ru[(*p*-cymene)Cl_2]$_2$ (3 mg, 2.5 mol%), $AgSbF_6$ (7 mg, 10 mol%), corresponding indolizines (**1**) (0.2 mmol) and carboxylic acid (**2**) (0.6 mmol). Further, Ag_2CO_3 (110 mg, 2 equiv) and DCE (1 mL) were added to the reaction tube. The reaction mixture was stirred 100 °C for 24 hours. After completion, the reaction was cooled to ambient temperature, diluted with ethyl acetate and passed through celite pad. The organic compounds were collected completely, concentrated under reduced pressure and purified by column chromatography on silica gel (230-400 mesh, 1:1 EtOAc/Hexane) to obtain the corresponding acyloxylated product **3.**

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl benzoate (3aa).



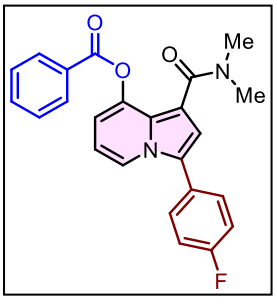
Dark green semi-solid; 63mg, (84%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.27 (d, J = 7.8 Hz, 2H), 8.17 (d, J = 7.1 Hz, 1H), 7.69 (t, J = 7.4 Hz, 1H), 7.58 (dt, J = 8.1, 3.7 Hz, 4H), 7.52 (t, J = 7.5 Hz, 2H), 7.42 (t, J = 7.3 Hz, 1H), 6.85 (s, 1H), 6.76 (d, J = 7.2 Hz, 1H), 6.61 (t, J = 7.1 Hz, 1H), 2.88 (s, 3H), 2.57 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.8, 164.6, 142.2, 133.9, 131.5, 130.4, 129.1, 128.8, 128.7, 128.6, 128.0, 126.7, 125.1, 120.6, 113.5, 110.9, 110.5, 108.8, 39.3, 34.5. **IR (ATR-FTIR)** υ **cm^{-1}** 2930, 2870, 2421, 2417, 1790, 1673, 1622, 1504, 1486, 1433, 1292, 1288, 1170, 1064, 1045, 1015. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{21}N_2O_3^+$ $[M+H]^+$ 385.1547, found 385.1585.

1-(dimethylcarbamoyl)-3-(p-tolyl) indolizin-8-yl benzoate (3ba).



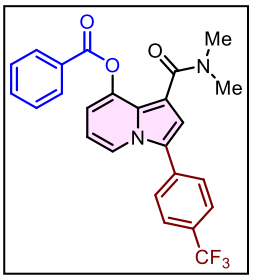
Light brown semi-solid; 42mg, (53%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ δ 8.26 (d, J = 7.3 Hz, 2H), 8.12 (d, J = 7.1 Hz, 1H), 7.67 (t, J = 7.4 Hz, 1H), 7.56 (t, J = 7.6 Hz, 2H), 7.45 (d, J = 7.8 Hz, 2H), 7.32 (d, J = 7.8 Hz, 2H), 6.82 (s, 1H), 6.74 (d, J = 7.2 Hz, 1H), 6.59 (t, J = 7.2 Hz, 1H), 2.88 (s, 3H), 2.56 (s, 3H), 2.44 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.8, 164.6, 142.1, 138.0, 133.9, 130.4, 129.8, 128.7, 128.5, 128.4, 126.8, 124.9, 120.7, 113.3, 110.7, 110.4, 39.3, 34.6, 21.3. **IR (ATR-FTIR)** υ **cm^{-1}** 2921, 2876, 2852, 2411, 2348, 1740, 1596, 1555, 1451, 1406, 1254, 1225, 1169, 1112, 1053, 1015. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{25}H_{23}N_2O_3^+$ $[M+H]^+$ 399.1703, found 399.1727.

1-(Dimethylcarbamoyl)-3-(4-fluorophenyl) indolizin-8-yl benzoate (3ca).



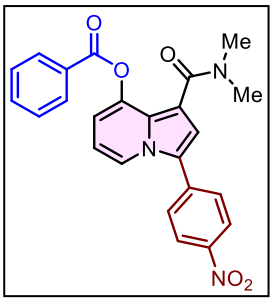
Dark green sticky solid; 48mg, (60%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.27 (d, J = 7.8 Hz, 1H), 8.10 (d, J = 7.8 Hz, 1H), 8.04 (d, J = 7.1 Hz, 1H), 7.68 (t, J = 7.4 Hz, 1H), 7.61 – 7.55 (m, 2H), 7.55 – 7.50 (m, 2H), 7.47 (t, J = 7.7 Hz, 1H), 7.21 (t, J = 8.4 Hz, 2H), 6.83 (s, 1H), 6.76 (d, J = 7.2 Hz, 1H), 6.61 (t, J = 7.1 Hz, 1H), 2.88 (s, 3H), 2.57 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 168.0, 164.6, 162.4 (d, $^1J_{C\text{-}F}$ = 248.2 Hz), 142.1, 134.0, 133.4, 130.5 (d, $^3J_{C\text{-}F}$ = 8.3 Hz) 130.4, 130.1, 128.7, 128.4, 127.4 (d, $^4J_{C\text{-}F}$ = 3.5 Hz), 125.6, 125.0, 120.4, 116.2 (d, $^2J_{C\text{-}F}$ = 21.6 Hz), 113.6, 111.0, 110.7, 39.4, 34.6. **^{19}F NMR (471 MHz, $CDCl_3$)** δ -113.1. **IR (ATR-FTIR)** υ **cm^{-1}** 2931, 2873, 2422, 2420, 1791, 1671, 1623, 1501, 1487, 1430, 1293, 1285, 1171, 1060, 1045. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}FN_2O_3^+$ $[M+H]^+$ 403.1452, found 403.1463.

1-(Dimethylcarbamoyl)-3-(4-(trifluoromethyl)phenyl) indolizin-8-yl benzoate (3da).



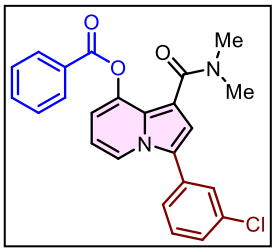
Light green sticky solid; 43mg, (49%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.26 (d, J = 7.8 Hz, 2H), 8.17 (d, J = 7.2 Hz, 1H), 7.77 (d, J = 8.1 Hz, 2H), 7.69 (t, J = 7.9, 7.5 Hz, 3H), 7.58 (t, J = 7.9, 7.5 Hz, 2H), 6.92 (s, 1H), 6.81 (d, J = 7.2 Hz, 1H), 6.67 (t, J = 7.2 Hz, 1H), 2.88 (s, 3H), 2.56 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, CDCl3)** δ 167.5, 164.5, 142.3, 135.0, 134.0, 130.4, 129.5, 128.7, 128.6, 128.4, 126.2, 126.2, 126.2, 126.1(q, $^3J_{C-F}$ = 4.0 Hz), 125.9, 125.1, 120.3, 114.3, 111.6, 111.2, 109.3, 39.3, 34.5. **^{19}F NMR (470 MHz, $CDCl_3$)** δ -62.6. **IR (ATR-FTIR)** υ **cm^{-1}** 2943, 2873, 2436, 1667, 1654, 1531, 1449, 1427, 1263, 1198, 1174, 1062, 1045, 971. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{25}H_{20}F_3N_2O_3^+$ $[M+H]^+$ 453.1421, found 453.1463.

1-(Dimethylcarbamoyl)-3-(4-nitrophenyl)indolizin-8-yl benzoate (3ea).



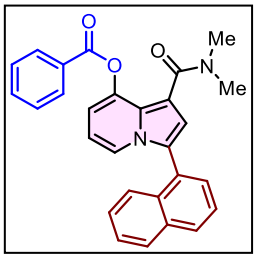
Reddish solid; 46mg, (53%). M.P: 127-129^{o}C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.38 (d, J = 8.3 Hz, 2H), 8.26 (d, J = 8.4 Hz, 3H), 7.76 (d, J = 8.4 Hz, 2H), 7.70 (t, J = 7.4 Hz, 1H), 7.58 (t, J = 7.6 Hz, 2H), 6.99 (s, 1H), 6.86 (d, J = 7.3 Hz, 1H), 6.75 (t, J = 7.2 Hz, 1H), 2.87 (s, 3H), 2.56 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.1, 164.5, 146.5, 142.4, 137.9, 134.1, 130.4, 128.8, 128.5, 128.0, 126.8, 124.7, 124.4, 120.4, 115.2, 112.4, 111.9, 110.2, 39.3, 34.5. **IR (ATR-FTIR)** υ **cm^{-1}** 2962, 2923, 2855, 2348, 2312, 1741, 1633, 1590, 1553, 1515, 1454, 1379, 1342, 1254, 1229, 1173, 1082, 1011. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}N_3O_5^+$ $[M+H]^+$ 430.1397, found 430.1402.

3-(3-Chlorophenyl)-1-(dimethylcarbamoyl) indolizin-8-yl benzoate (3fa).



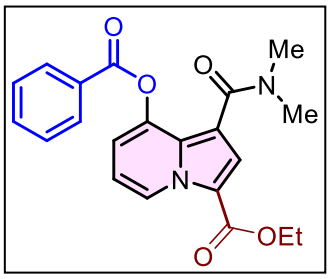
Light green sticky solid; 50mg, (60%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.25 (dd, J = 7.1, 0.9 Hz, 2H), 8.13 (d, J = 7.0 Hz, 1H), 7.67 (t, J = 7.5 Hz, 1H), 7.59 – 7.54 (m, 3H), 7.46 – 7.41 (m, 2H), 7.40 – 7.36 (m, 1H), 6.85 (s, 1H), 6.77 (d, J = 7.2 Hz, 1H), 6.64 (t, J = 7.2 Hz, 1H), 2.86 (s, 3H), 2.56 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.5, 164.5, 142.3, 135.0, 133.9, 133.2, 130.4, 128.7, 128.7, 128.3, 128.0, 126.5, 125.5, 125.1, 120.4, 113.9, 111.3, 111.0, 109.2, 39.2, 34.5. **IR (ATR-FTIR)** υ **cm^{-1}** 2926, 2855, 2313, 2168, 2117, 1740, 1713, 1595, 1554, 1510, 1455, 1412, 1259, 1228, 1168, 1109, 1058, 1018. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}ClN_2O_3^+$ $[M+H]^+$ 419.1157, found 419.1195.

1-(Dimethylcarbamoyl)-3-(naphthalen-1-yl)indolizin-8-yl benzoate (3ga).



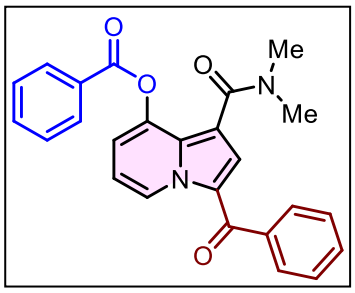
Light green semi-solid; 23mg, (27%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.31 (d, J = 7.7 Hz, 2H), 7.98 (t, J = 8.4 Hz, 2H), 7.69 (t, J = 7.4 Hz, 1H), 7.66 – 7.52 (m, 6H), 7.51 – 7.43 (m, 2H), 6.96 (s, 1H), 6.78 (d, J = 7.2 Hz, 1H), 6.50 (t, J = 7.2 Hz, 1H), 2.96 (s, 3H), 2.62 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.9, 164.6, 142.1, 133.9, 133.9, 132.2, 130.5, 129.4, 129.2, 128.9, 128.7, 128.6, 126.9, 126.4, 125.6, 125.6, 124.9, 124.4, 121.4, 114.9, 110.9, 110.2, 108.5, 39.4, 34.6. **IR (ATR-FTIR)** υ **cm^{-1}** 2801, 2379, 2311, 1737, 1684, 1598, 1550, 1513, 1488, 1449, 1396, 1368, 1252, 1226, 1166, 1133, 1109, 1050, 1017. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{28}H_{23}N_2O_3^+$ $[M+H]^+$ 435.1703, found 435.1711.

Ethyl 8-(benzoyloxy)-1-(dimethylcarbamoyl) indolizine-3-carboxylate (3ha).



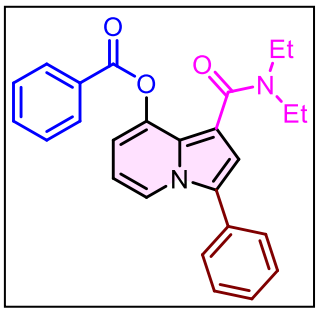
Light green solid; 54mg, (72%). M.P: 118-120^{o}C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 9.41 (d, J = 7.1 Hz, 1H), 8.24 (d, J = 7.8 Hz, 2H), 7.69 (t, J = 7.5 Hz, 1H), 7.57 (t, J = 7.7 Hz, 2H), 7.51 (s, 1H), 7.05 (d, J = 7.4 Hz, 1H), 6.93 (t, J = 7.2 Hz, 1H), 4.40 (q, J = 7.1 Hz, 2H), 2.82 (s, 3H), 2.55 (s, 3H), 1.42 (t, J = 7.1 Hz, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 166.6, 164.4, 161.1, 141.5, 134.1, 130.5, 130.5, 129.5, 129.3, 128.7, 128.4, 125.2, 120.5, 115.2, 115.0, 112.7, 109.7, 60.3, 39.2, 34.5, 14.5. **IR (ATR-FTIR)** υ **cm^{-1}** 2902, 2810, 2435, 2240, 1734, 1637, 1611, 1540, 1453, 1390, 1142, 1129, 1046, 1010. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{21}H_{21}N_2O_5^+$ $[M+H]^+$ 381.1445, found 3381.1469.

3-benzoyl-1-(dimethylcarbamoyl)indolizin-8-yl benzoate (3ia).



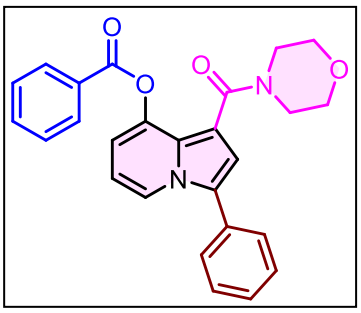
Light brown powder; 46mg(56%). M.P: 149-150^{o}C; **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 9.89 (dd, J = 7.0, 0.9 Hz, 1H), 8.25 (dd, J = 7.2, 0.9 Hz, 2H), 7.85 – 7.81 (m, 2H), 7.70 (tt, J = 7.4, 1.4 Hz, 1H), 7.58 (t, J = 7.7 Hz, 3H), 7.51 (t, J = 7.5 Hz, 2H), 7.34 (s, 1H), 7.22 (dd, J = 7.5, 0.9 Hz, 1H), 7.06 (t, J = 7.3 Hz, 1H), 2.80 (s, 3H), 2.53 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 185.2, 166.3, 164.4, 141.4, 140.0, 134.2, 131.5, 130.6, 130.4, 129.0, 128.8, 128.4, 128.3, 126.5, 125.0, 122.9, 117.7, 113.9, 110.7, 39.2, 34.5. **IR (ATR-FTIR)** υ **cm^{-1}** 2942, 2866, 2834, 2420, 2333, 1735, 1591, 1565, 1432, 1401, 1221, 1180, 1112, 1073, 1015. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{25}H_{21}N_2O_4^+$ $[M+H]^+$ 413.1496, found 413.1520.

1-(Diethylcarbamoyl)-3-phenylindolizin-8-yl benzoate (3ja).



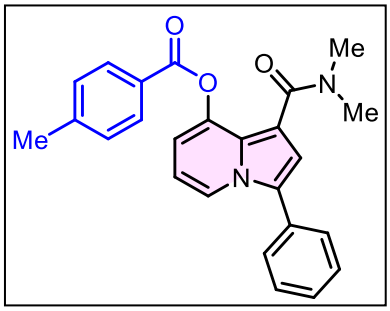
Dark green sticky solid; 62mg, (76%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.28 (d, J = 7.8 Hz, 2H), 8.16 (d, J = 7.0 Hz, 1H), 7.66 (t, J = 7.4 Hz, 1H), 7.57 (d, J = 8.1 Hz, 3H), 7.56 – 7.49 (m, 3H), 7.42 (t, J = 7.3 Hz, 1H), 6.83 (s, 1H), 6.73 (d, J = 7.2 Hz, 1H), 6.60 (t, J = 7.1 Hz, 1H), 3.35 – 3.29 (m, 2H), 3.26 – 3.16 (m, 2H), 1.04 (t, J = 7.5 Hz, 3H), 0.87 (t, J = 11.6 Hz, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 167.2, 164.8, 142.3, 133.8, 131.5, 130.6, 129.1, 129.0, 128.6, 127.9, 126.4, 125.5, 120.5, 113.3, 110.8, 110.6, 110.5, 109.4, 46.5, 43.6, 14.3, 12.8. **IR (ATR-FTIR)** υ **cm^{-1}** 2970, 2820, 2461, 1750, 1576, 1463, 1282, 1276, 1235, 1093, 1045. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{26}H_{25}N_2O_3^+$ $[M+H]^+$ 413.1860, found 413.1901.

1-(Morpholine-4-carbonyl)-3-phenylindolizin-8-yl benzoate (3ka).



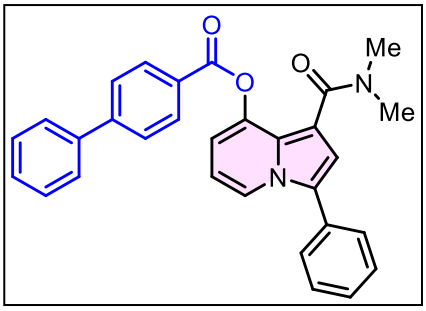
Dark green semi-solid; 49mg, (58%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.33 – 8.27 (m, 2H), 8.17 (d, J = 7.1 Hz, 1H), 7.69 (t, J = 7.5 Hz, 1H), 7.57 (dd, J = 13.3, 5.5 Hz, 4H), 7.53 (t, J = 7.5 Hz, 2H), 7.43 (t, J = 7.2 Hz, 1H), 6.82 (s, 1H), 6.77 (d, J = 7.1 Hz, 1H), 6.64 (d, J = 7.2 Hz, 1H), 3.51 – 3.28 (m, 8H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 166.4, 164.7, 142.2, 134.0, 131.3, 130.6, 129.2, 128.9, 128.7, 128.6, 128.1, 126.8, 125.9, 121.4, 120.8, 113.4, 111.4, 110.8, 107.8, 66.6, 48.2, 42.1. **IR (ATR-FTIR)** υ **cm^{-1}** 2957, 2857, 2379, 2311, 1739, 1599, 1553, 1514, 1445, 1372, 1341, 1298, 1255, 1228, 1171, 1055, 1013. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{26}H_{23}N_2O_4^+$ $[M+H]^+$ 427.1652, found 427.1696.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-methyl benzoate (3ab).



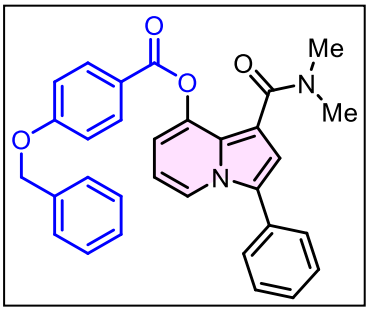
Light green solid; 62mg, (78%). M.P: 128-129^{o}C; **1H NMR (500 MHz, $CDCl_3$)** δ 8.15 (d, J = 7.6 Hz, 3H), 7.57 (d, J = 7.6 Hz, 2H), 7.52 (t, J = 7.6 Hz, 2H), 7.42 (t, J = 7.4 Hz, 1H), 7.36 (d, J = 7.9 Hz, 2H), 6.85 (s, 1H), 6.76 (d, J = 7.2 Hz, 1H), 6.61 (t, J = 7.2 Hz, 1H), 2.75 (s, 6H), 2.48 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 168.0, 164.6, 144.8, 142.3, 131.5, 130.5, 129.4, 129.1, 128.6, 128.0, 126.7, 126.1, 120.5, 113.6, 111.0, 110.6, 21.8. **IR (ATR-FTIR)** υ **cm^{-1}** 2961, 2922, 2856, 2348, 2314, 2219, 1738, 1622, 1557, 1516, 1453, 1376, 1344, 1254, 1227, 1179, 1078, 1014. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{25}H_{23}N_2O_3^+$ $[M+H]^+$ 399.1703, found 399.1740.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl [1,1'-biphenyl]-4-carboxylate (3ac).



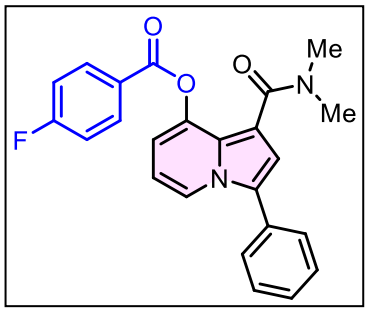
Light green solid; 71mg, (77%). M.P: 117-119°C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.34 (d, J = 8.0 Hz, 2H), 8.18 (d, J = 7.1 Hz, 1H), 7.81 (d, J = 7.9 Hz, 2H), 7.71 (d, J = 7.6 Hz, 2H), 7.58 (d, J = 7.7 Hz, 2H), 7.53 (t, J = 7.5 Hz, 4H), 7.45 (dd, J = 13.6, 7.1 Hz, 2H), 6.87 (s, 1H), 6.79 (d, J = 7.1 Hz, 1H), 6.62 (t, J = 7.1 Hz, 1H), 2.92 (s, 3H), 2.64 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.9, 164.5, 146.5, 142.2, 139.8, 131.5, 131.0, 129.2, 129.1, 128.6, 128.4, 128.0, 127.5, 127.4, 127.3, 126.7, 125.1, 120.6, 113.5, 110.9, 110.6, 108.8, 39.4, 34.7. **IR (ATR-FTIR)** υ **cm^{-1}** 2800, 2360, 2315, 1550, 1513, 1498, 1452, 1400, 1379, 1255, 1276, 1165, 1132, 1100, 1051, 1016. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{30}H_{25}N_2O_3^+$ $[M+H]^+$ 461.1860, found 461.1902.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(benzyloxy) benzoate (3ad).



Light green solid; 53mg, (53%). M.P: 141-143°C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.22 (d, J = 8.5 Hz, 2H), 8.15 (d, J = 7.1 Hz, 1H), 7.57 (d, J = 7.6 Hz, 2H), 7.52 (t, J = 7.6 Hz, 2H), 7.48 (d, J = 7.5 Hz, 2H), 7.46 – 7.41 (m, 3H), 7.41 – 7.36 (m, 1H), 7.12 (d, J = 8.5 Hz, 2H), 6.85 (s, 1H), 6.74 (d, J = 7.2 Hz, 1H), 6.60 (t, J = 7.2 Hz, 1H), 5.20 (s, 2H), 2.86 (s, 3H), 2.59 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.9, 164.2, 163.2, 142.2, 136.1, 132.6, 131.5, 129.1, 128.7, 128.5, 128.3, 127.9, 127.6, 126.7, 125.2, 121.3, 120.4, 114.8, 113.4, 110.8, 110.6, 108.8, 70.2, 39.3, 34.6. **IR (ATR-FTIR)** υ **cm^{-1}** 3062, 2961, 2924, 2854, 2348, 2312, 2221, 1740, 1624, 1553, 1515, 1453, 1378, 1342, 1256, 1227, 1173, 1079, 1014. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{31}H_{27}N_2O_4^+$ $[M+H]^+$ 491.1965, found 491.2003.

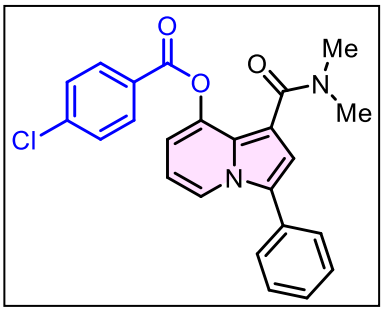
1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-fluoro benzoate (3ae).



Reddish brown sticky solid; 52mg, (65%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.30 (tq, J = 5.6, 5.4, 3.4, 2.6, 2.1 Hz, 2H), 8.16 (d, J = 7.0 Hz, 1H), 7.57 (dd, J = 7.0, 1.3 Hz, 2H), 7.52 (t, J = 7.7 Hz, 2H), 7.42 (t, J = 7.3 Hz, 1H), 7.24 (tt, J = 8.6, 2.8, 2.0 Hz, 2H), 6.84 (s, 1H), 6.75 (d, J = 7.1 Hz, 1H), 6.60 (t, J = 7.2 Hz, 1H), 2.89 (s, 3H), 2.62 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, CDCl3)** δ 167.7, 166.32 (d, $^1J_{C\text{-}F}$ = 255.4 Hz), 163.6, 142.1, 133.11 (d, $^3J_{C\text{-}F}$ = 9.6 Hz), 131.4, 129.1, 128.6, 128.0, 126.7, 125.18 (d, $^4J_{C\text{-}F}$ = 2.9 Hz) 125.1, 120.6, 115.88 (d, $^2J_{C\text{-}F}$ = 22.1 Hz), 113.5, 110.9, 110.5, 108.8, 39.3, 34.6. **^{19}F NMR (470 MHz, $CDCl_3$)**

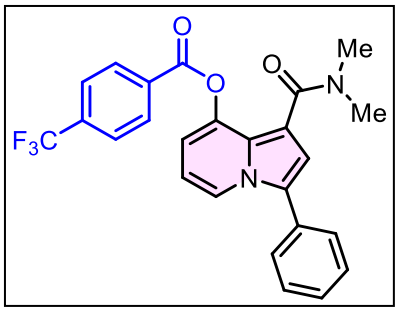
δ -103.8. **IR (ATR-FTIR) υ cm^{-1}** 2940, 2925, 1875, 1587, 1493, 1365, 1350, 1112. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}FN_2O_3^+$ $[M+H]^+$ 403.1452, found 403.1453.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-chloro benzoate (3af).



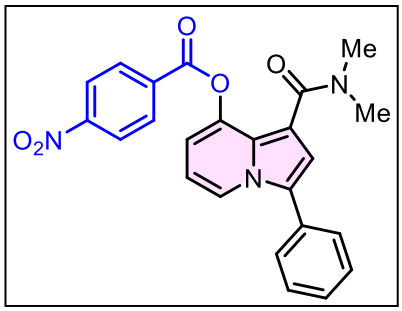
Light green semi-solid; 64mg, (77%). **^{1}H NMR (500 MHz, CDCl$_3$)** δ 8.21 (d, J = 8.2 Hz, 2H), 8.17 (d, J = 7.1 Hz, 1H), 7.56 (t, J = 8.7 Hz, 5H), 7.52 (d, J = 7.5 Hz, 1H), 7.43 (t, J = 7.2 Hz, 1H), 6.85 (s, 1H), 6.75 (d, J = 7.1 Hz, 1H), 6.61 (t, J = 7.2 Hz, 1H), 2.90 (s, 3H), 2.64 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, CDCl$_3$)** δ 167.7, 163.8, 142.0, 140.4, 131.8, 131.4, 129.2, 129.0, 128.6, 128.1, 127.4, 126.7, 125.1, 120.7, 113.5, 110.9, 110.5, 108.7, 39.4, 34.7. **IR (ATR-FTIR) υ cm^{-1}** 2961, 2954, 2356, 2333, 1746, 1645, 1550, 1521, 1446, 1377, 1341, 1259, 1220, 1177, 1059, 1015. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}ClN_2O_3^+$ $[M+H]^+$ 419.1157, found 419.1192.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(trifluoromethyl) benzoate (3ag).



Brown semi-solid; 61mg, (68%). **^{1}H NMR (500 MHz, CDCl$_3$)** δ 8.40 (d, J = 8.1 Hz, 2H), 8.18 (d, J = 7.1 Hz, 1H), 7.84 (d, J = 8.1 Hz, 2H), 7.57 (d, J = 7.6 Hz, 2H), 7.53 (t, J = 7.5 Hz, 2H), 7.43 (t, J = 7.3 Hz, 1H), 6.85 (s, 1H), 6.77 (d, J = 7.2 Hz, 1H), 6.62 (t, J = 7.2 Hz, 1H), 2.94 (s, 3H), 2.63 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, CDCl3)** δ 167.6, 163.4, 142.0, 132.3, 131.3, 130.8, 129.2, 128.6, 128.1, 126.8, 125.7 (q, $^3J_{C\text{-}F}$ = 3.7 Hz), 125.2, 122.5, 120.9, 113.6, 111.0, 110.5, 108.7, 39.4, 34.7. **^{19}F NMR (470 MHz, CDCl$_3$)** δ -75.6. **IR (ATR-FTIR) υ cm^{-1}** 2930, 2870, 2421, 2417, 1790, 1673, 1622, 1504, 1486, 1433, 1292, 1288, 1170, 1064, 1045, 975. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{25}H_{20}F_3N_2O_3^+$ $[M+H]^+$ 453.1421, found 453.1463.

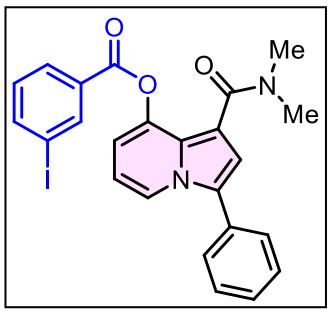
1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-nitro benzoate (3ah).



Yellow solid**;** 21mg, (24%). **^{1}H NMR (500 MHz, CDCl$_3$)** δ 8.46 (d, J = 7.9 Hz, 2H), 8.42 (d, J = 9.2 Hz, 2H), 8.19 (d, J = 7.1 Hz, 1H), 7.56 (t, J = 7.5,6.0 Hz, 3H), 7.53 (d, J = 7.6 Hz, 1H), 7.44 (t, J = 7.3 Hz, 1H), 6.86 (s, 1H), 6.79 (d, J = 7.2 Hz, 1H), 6.64 (t, J = 7.1 Hz, 1H), 2.98 (s, 3H), 2.68 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, CDCl$_3$)** δ 167.5, 162.8, 150.9, 141.9, 134.6, 131.6, 131.2, 129.2, 128.6, 128.2, 126.8, 125.3, 123.7, 121.1, 113.8, 111.2, 110.5, 108.7, 39.5, 34.8. **IR (ATR-FTIR) υ cm^{-1}** 2969, 2914, 2855, 2356, 2304, 1741, 1640, 1553, 1553, 1521, 1448, 1379, 1347, 1259, 1229, 1177, 1059, 1011,

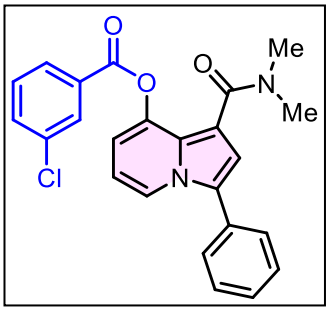
985. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}N_3O_5^+$ $[M+H]^+$ 430.1397, found 430.1421.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-iodo benzoate (3ai).



Brown sticky solid; 73mg, (72%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.56 (s, 1H), 8.25 (d, J = 7.3 Hz, 1H), 8.17 (d, J = 7.3 Hz, 1H), 8.00 (d, J = 7.8 Hz, 1H), 7.57 (d, J = 7.5 Hz, 2H), 7.53 (d, J = 7.5 Hz, 2H), 7.43 (d, J = 7.5 Hz, 1H), 7.32 (t, J = 7.9 Hz, 1H), 6.85 (s, 1H), 6.74 (d, J = 7.2 Hz, 1H), 6.61 (t, J = 7.2 Hz, 1H), 2.95 (s, 3H), 2.69 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.6, 163.1, 142.6, 142.0, 139.0, 131.3, 130.9, 130.4, 129.7, 129.2, 128.6, 128.1, 126.7, 125.1, 120.8, 113.7, 111.0, 110.5, 108.8, 93.9, 39.4, 34.8. **IR (ATR-FTIR)** υ **cm^{-1}** 2930, 2855, 1794, 1561, 1468, 1411, 1286, 1171, 1072, 1015. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}IN_2O_3^+$ $[M+H]^+$ 511.0513, found 511.0559.

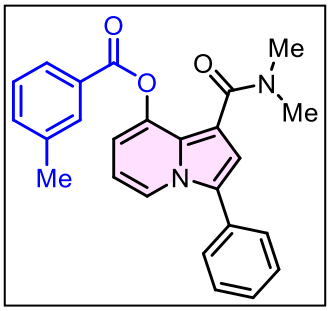
1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-chloro benzoate (3aj).



Light green sticky solid; 44mg, (53%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.22 (s, 1H), 8.17 (d, J = 7.1 Hz, 2H), 7.65 (dt, J = 8.0, 1.6 Hz, 1H), 7.59 – 7.56 (m, 2H), 7.56 – 7.50 (m, 3H), 7.43 (t, J = 7.3 Hz, 1H), 6.85 (s, 1H), 6.76 (d, J = 7.2 Hz, 1H), 6.61 (t, J = 7.2 Hz, 1H), 2.94 (s, 3H), 2.68 (s, 3H).**^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.6, 163.4, 142.0, 134.7, 133.8, 131.4, 130.8, 130.3, 130.0, 129.1, 128.6, 128.6, 128.1, 126.7, 125.1, 120.8, 113.6, 110.9, 110.5, 108.9, 39.4, 34.7.**IR (ATR-FTIR)** υ **cm^{-1}** 2923, 2853, 1793, 1698, 1600, 1572, 1468, 1411, 1285, 1171, 1072, 1019, 971. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{24}H_{20}ClN_2O_3^+$ $[M+H]^+$ 419.1157, found 419.1235.

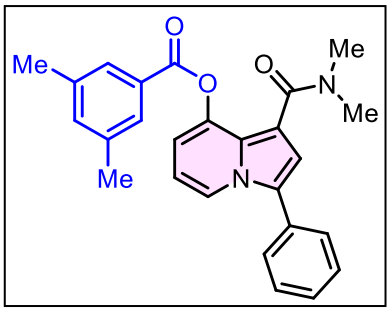
1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-methylbenzoate (3ak).

Dark green sticky solid; 34mg, (43%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.16 (d, J = 7.1 Hz, 1H), 8.09 – 8.05 (m, 1H), 7.57 (d, J = 7.5 Hz, 2H), 7.52 (d, J = 7.5 Hz, 2H), 7.48 (dd, J = 15.0, 9.5 Hz, 2H), 7.44



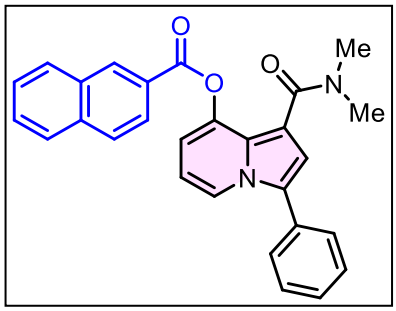
– 7.36 (m, 2H), 6.86 (s, 1H), 6.75 (d, J = 7.2 Hz, 1H), 6.60 (t, J = 7.1 Hz, 1H), 2.89 (s, 3H), 2.59 (s, 3H), 2.49 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.9, 164.7, 142.2, 138.5, 134.7, 131.4, 130.9, 129.1, 128.7, 128.6, 128.5, 128.0, 127.6, 126.7, 125.1, 120.5, 113.6, 110.9, 110.6, 108.7, 39.3, 34.6, 21.4. **IR (ATR-FTIR)** υ **cm^{-1}** 2927, 2856, 2380, 2310, 1742, 1682, 1600, 1552, 1512, 1457, 1371, 1264, 1231, 1171, 1130, 1018. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{25}H_{23}N_2O_3^+$ $[M+H]^+$ 399.1703, found 399.1737.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3,5-dimethyl benzoate (3al).



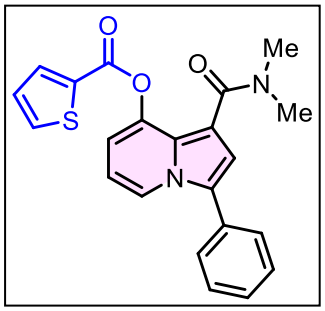
Light green semi-solid**;** 60mg, (73%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.17 – 8.12 (m, 1H), 7.88 (s, 2H), 7.58 (d, J = 7.0 Hz, 2H), 7.52 (t, J = 7.6 Hz, 2H), 7.42 (t, J = 7.4 Hz, 1H), 7.30 (s, 1H), 6.86 (s, 1H), 6.74 (d, J = 7.2 Hz, 1H), 6.59 (t, J = 7.2 Hz, 1H), 2.89 (s, 3H), 2.62 (s, 3H), 2.45 (s, 6H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.8, 164.8, 142.3, 138.3, 135.5, 131.5, 129.7, 129.1, 128.8, 128.6, 128.1, 127.9, 126.6, 125.1, 120.4, 113.6, 110.7, 110.5, 109.0, 62.7, 39.3, 34.5, 21.2. **IR (ATR-FTIR) υ cm^{-1}** 2926, 2857, 2379, 2311, 2170, 2111, 1799, 1730, 1684, 1632, 1601, 1552, 1484, 1452, 1370, 1298, 1235, 1188, 1161, 1095, 1018. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{26}H_{25}N_2O_3^+$ $[M+H]^+$ 413.1860, found 413.1901.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 2-naphthoate (3am).



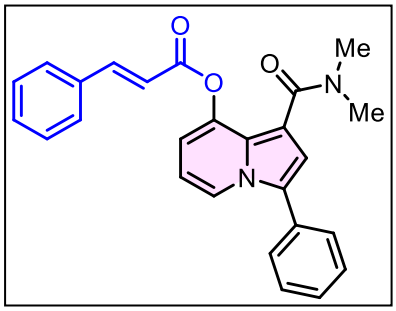
Dark green sticky solid; 36mg, (42%). **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.27 (d, *J* = 7.7 Hz, 2H), 8.13 (dd, *J* = 13.2, 7.5 Hz, 2H), 7.69 (t, *J* = 7.4 Hz, 1H), 7.62 (t, *J* = 7.6 Hz, 1H), 7.60 – 7.55 (m, 3H), 7.49 (t, *J* = 8.0 Hz, 2H), 7.45 (d, *J* = 4.9 Hz, 2H), 7.41 – 7.38 (m, 1H), 6.87 (s, 1H), 6.79 (d, *J* = 7.2 Hz, 1H), 6.66 (t, *J* = 7.2 Hz, 1H), 2.88 (s, 3H), 2.57 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.7, 164.5, 142.2, 135.0, 134.0, 133.6, 133.2, 130.4, 130.2, 128.7, 128.7, 128.5, 128.3, 128.0, 126.5, 125.5, 125.2, 120.4, 114.0, 111.4, 111.0, 109.0, 39.3, 34.6. **IR (ATR-FTIR) *υ* cm^{-1}** 2861, 2388, 2331, 1736, 1689, 1594, 1550, 1517, 1486, 1449, 1400, 1364, 1252, 1231, 1161, 1133, 1110, 1049, 1017. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{28}H_{23}N_2O_3^+$ $[M+H]^+$ 435.1703, found 435.1745

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl thiophene-2-carboxylate (3an).



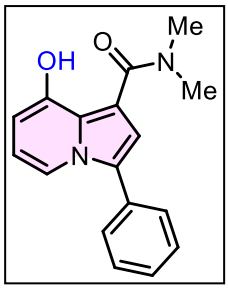
Dark green solid; 42mg, (53%). M.P: 142-144^{o}C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.15 (d, *J* = 7.1 Hz, 1H), 8.09 (d, *J* = 3.7 Hz, 1H), 7.72 (d, *J* = 4.9 Hz, 1H), 7.57 (d, *J* = 7.6 Hz, 2H), 7.52 (t, *J* = 7.5 Hz, 2H), 7.42 (t, *J* = 7.3 Hz, 1H), 7.23 (t, *J* = 4.4 Hz, 1H), 6.86 (s, 1H), 6.75 (d, *J* = 7.2 Hz, 1H), 6.59 (t, *J* = 7.2 Hz, 1H), 2.93 (s, 3H), 2.69 (s, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 167.7, 160.0, 141.8, 135.3, 133.9, 132.1, 131.4, 129.1, 128.6, 128.2, 128.0, 126.7, 125.0, 120.7, 113.6, 110.9, 110.5, 108.8, 39.4, 34.6. **IR (ATR-FTIR) *υ* cm^{-1}** 2925, 2855, 2593, 2408, 2311, 2169, 1734, 1619, 1551, 1514, 1408, 1364, 1296, 1254, 1224, 1206, 1161, 1127, 1043, 1013. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{22}H_{19}N_2O_3S^+$ $[M+H]^+$ 391.1111, found 391.1150.

1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl (E)-3-phenylacrylate (3ao).



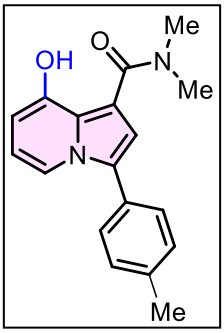
Dark brown sticky solid; 48mg, (56%). M.P: 137-138°C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 8.15 (d, J = 7.2 Hz, 1H), 7.95 (d, J = 15.9 Hz, 1H), 7.68 – 7.63 (m, 2H), 7.57 (d, J = 7.7 Hz, 2H), 7.52 (t, J = 7.5 Hz, 2H), 7.49 – 7.44 (m, 3H), 7.42 (t, J = 6.8 Hz, 1H), 6.86 (s, 1H), 6.74 (d, J = 7.2 Hz, 1H), 6.69 (d, J = 16.0 Hz, 1H), 6.59 (t, J = 7.3 Hz, 1H), 2.99 (s, 6H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 168.0, 164.7, 147.2, 142.1, 134.0, 131.4, 130.9, 129.2, 129.1, 128.6, 128.5, 128.0, 126.6, 125.2, 120.5, 116.6, 113.6, 110.8, 110.6, 108.7, 39.5, 35.2. **IR (ATR-FTIR)** υ **cm^{-1}** 2921, 2852, 2311, 1732, 1628, 1552, 1516, 1454, 1407, 1372, 1332, 1303, 1261, 1199, 1164, 1120, 1021, 976. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{26}H_{23}N_2O_3^+$ $[M+H]^+$ 411.1703, found 411.1743.

8-Hydroxy-N,N-dimethyl-3-phenylindolizine-1-carboxamide (4a).



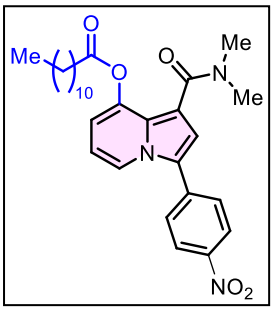
Light brown solid; 32mg, (88%). M.P: 120-121°C; **^{1}H NMR (500 MHz, $CDCl_3$)** δ 12.49 (s, 1H), 7.84 (d, J = 6.9 Hz, 1H), 7.56 – 7.52 (m, 3H), 7.51 (d, J = 7.7 Hz, 1H), 7.45 – 7.41 (m, 1H), 6.95 (s, 1H), 6.66 (t, J = 7.1 Hz, 1H), 6.49 (d, J = 7.4 Hz, 1H), 3.33 (s, 6H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 169.3, 150.2, 131.4, 131.1, 129.1, 128.9, 128.2, 126.2, 114.8, 114.6, 114.2, 105.7, 10;4.2, 39.3. **IR (ATR-FTIR)** υ **cm^{-1}** 3521, 2922, 2890, 1751, 1601, 1479, 1320, 1099, 1080. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{17}H_{17}N_2O_2^+$ $[M+H]^+$ 281.1285, found 281.1310.

8-Hydroxy-N,N-dimethyl-3-(p-tolyl)indolizine-1-carboxamide (4b).



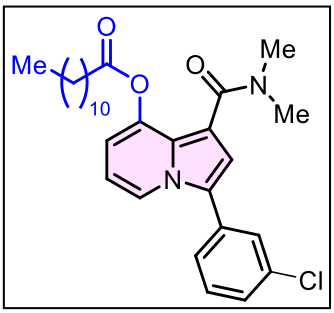
Light green solid; 36 mg (62%); M.P: 134-135°C; **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 12.48 (s, 1H), 7.81 (d, J = 6.8 Hz, 1H), 7.43 (d, J = 7.8 Hz, 2H), 7.32 (d, J = 7.8 Hz, 2H), 6.92 (s, 1H), 6.65 (t, J = 7.2 Hz, 1H), 6.47 (d, J = 7.4 Hz, 1H), 3.33 (s, 6H), 2.45 (s, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 169.3, 150.2, 138.2, 130.9, 129.8, 128.8, 128.4, 126.3, 114.9, 114.3, 114.1, 105.6, 104.0, 39.3, 21.3. **IR (ATR-FTIR)** υ **cm^{-1}** 3577, 2892, 2890, 1741, 1752, 1612, 1610, 1479, 1421, 1320, 1099, 1080, 1016. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{18}H_{19}N_2O_2^+$ $[M+H]^+$ 295.1441, found 295.1468

1-(Dimethylcarbamoyl)-3-(4-nitrophenyl)indolizin-8-yl dodecanoate (3eq).



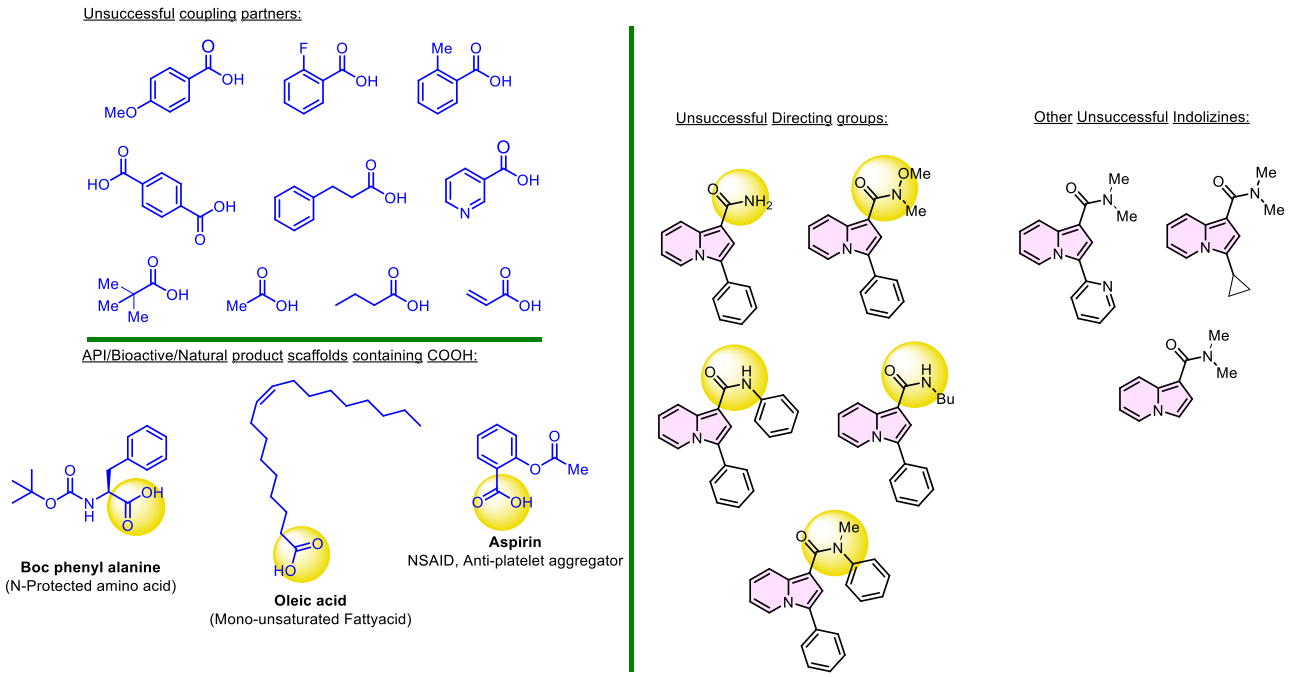
Dark brown sticky solid; 26mg, (52%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.37 (d, J = 8.5 Hz, 2H), 8.19 (d, J = 7.0 Hz, 1H), 7.74 (d, J = 8.6 Hz, 2H), 7.00 (s, 1H), 6.74 (d, J = 7.2 Hz, 1H), 6.69 (t, J = 7.1 Hz, 1H), 3.17 (s, 3H), 3.04 (s, 3H), 2.62 (t, J = 7.6 Hz, 2H), 1.75 (p, J = 7.5 Hz, 2H), 1.35 – 1.26 (m, 16H), 0.90 (t, J = 6.8 Hz, 3H). **^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$)** δ 171.6, 167.5, 146.6, 142.3, 137.8, 128.1, 127.5, 124.6, 124.6, 124.1, 120.2, 115.6, 112.5, 111.9, 33.9, 31.9, 29.6, 29.5, 29.4, 29.3, 29.2, 24.6, 22.7, 14.1. **IR (ATR-FTIR) υ cm^{-1}** 2951, 2843, 2301, 1614, 1595, 1546, 1461, 1413, 1372, 1362, 1308, 1264, 1187, 1164, 1123, 1020. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{29}H_{38}N_3O_5^+$ $[M+H]^+$ 508.2806, found 508.2853.

1-(Dimethylcarbamoyl)-3-(3-chlorophenyl)indolizin-8-yl dodecanoate (3fq).



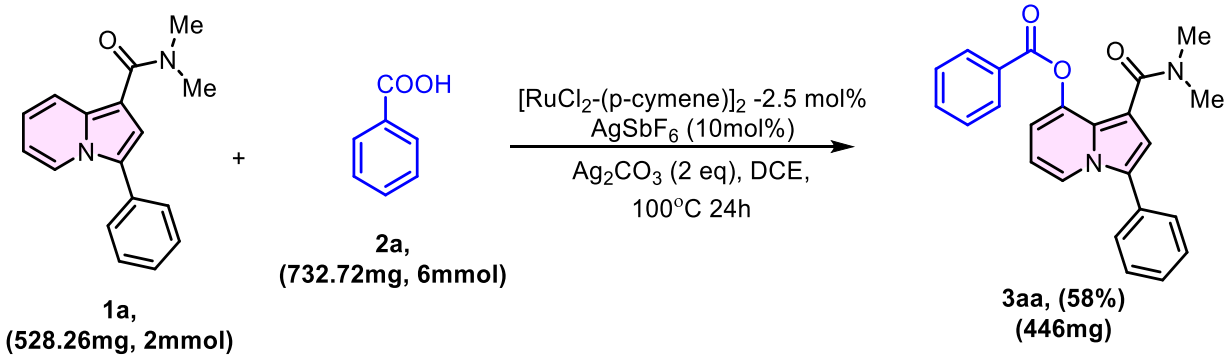
Light brown oil; 41mg, (41%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.09 (d, J = 7.0 Hz, 1H), 7.55 – 7.51 (m, 1H), 7.46 – 7.40 (m, 2H), 7.41 – 7.34 (m, 1H), 6.85 (s, 1H), 6.66 (d, J = 7.2 Hz, 1H), 6.60 (t, J = 7.1 Hz, 1H), 3.09 (d, J = 53.5 Hz, 6H), 2.62 (t, J = 7.6 Hz, 2H), 2.35 (t, J = 7.6 Hz, 2H), 1.75 (p, J = 7.6 Hz, 2H), 1.30 – 1.28 (m, 14H), 0.90 (t, J = 6.7 Hz, 3H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 178.9, 171.7, 167.7, 142.3, 139.3, 135.0, 133.1, 130.4, 128.4, 128.0, 126.8, 126.5, 126.3, 125.0, 124.8, 120.3, 114.3, 114.1, 111.5, 111.0, 108.7, 34.0, 33.9, 31.9, 29.7, 29.6, 29.6, 29.3, 29.3, 29.2, 29.1, 24.7, 24.6, 22.7, 14.1. **IR (ATR-FTIR) υ cm^{-1}** 2851, 2312, 1611, 1585, 1551, 1476, 1413, 1391, 1382, 1306, 1262, 1188, 1162, 1160, 1135, 1123, 1120, 1020. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{29}H_{38}ClN_2O_3^+$ $[M+H]^+$ 497.2565, found 497.2581.

2.4. Unsuccessful substrates:



3. Scale-up & Post Synthetic Diversification

3.1 Scale up experiment of C-8 Acyloxylation of Indolizine:

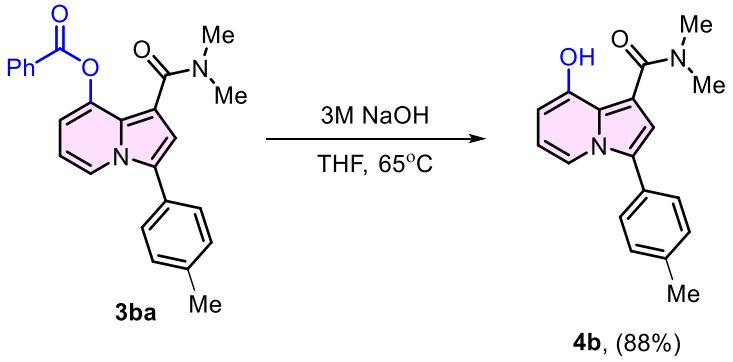


Scheme-S4: Scale-up synthesis of **3aa**.

The oven dried reaction tube equipped with magnetic stir bar was loaded with Ru[(*p*-cymene)Cl_2]$_2$ (30.6 mg, 2.5 mol%), $AgSbF_6$ (68.7 mg, 10 mol%), N,N-dimethyl-3-phenylindolizine-1-carboxamide (**1a**) (528.2 mg, 2 mmol) and benzoic acid (**2a**) (732.72 mg, 6 mmol). Further, Ag_2CO_3 (1.10 g, 2 equiv) and DCE (10 mL) were added to the reaction tube. The reaction mixture was stirred 100 °C for 24 hours. After completion, the reaction was cooled to ambient temperature, diluted with ethyl acetate and passed through celite pad. The organic compounds were collected completely, concentrated under reduced pressure and purified by column chromatography on silica gel (230-400

mesh, 1:1 EtOAc/Hexane) to obtain the corresponding acyloxylated product **3aa** in 53% yield (407.2 mg).

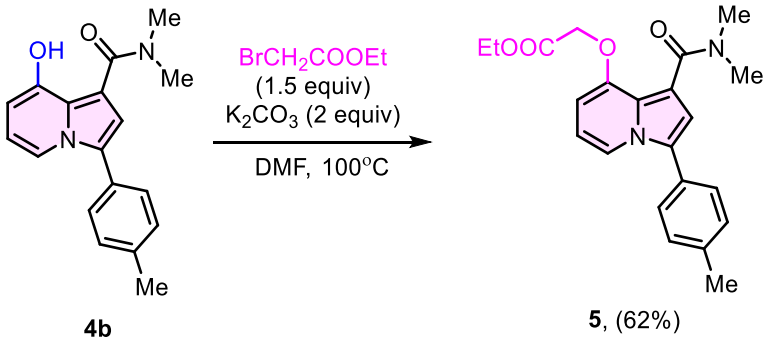
3.2 Ester hydrolysis reaction of 3ba:



Scheme-S5- Ester hydrolysis of **3ba**.

A 3M NaOH solution (3mL) was added to a 50ml oven dried round bottom flask, containing a solution of 1-(dimethylcarbamoyl)-3-(p-tolyl) indolizin-8-yl benzoate **(3ba)** (50 mg, 0.125 mmol) in 4mL THF. The reaction mixture was heated at 60 °C for overnight. The reaction was monitored for complete conversion by TLC, and upon completion of the reaction, the mixture was allowed to cool. Then the pH of the solution was adjusted to acidic range (pH 1-2) with 1N HCl. The mixture was extracted with ethyl acetate (30mL x 3) and washed with brine solution, organic layers were combined and concentrated under reduced pressure. The crude residue was then purified by silica gel column chromatography to provide 31 mg (88%) of **4b.**

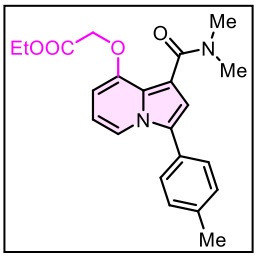
3.3 Functionalisation of hydroxyl group:



Scheme-S6 Functionalization of Hydroxyl group.

0.2 mmol (59 mg) of **4b** in DMF (5 mL) was mixed in an oven dried reaction tube with 2 equivalents (55 mg) of Potassium carbonate and 1.5 equivalents (50 mg) of Ethyl bromoacetate at 100 °C for 5 hours. The reaction was monitored by TLC and upon completion, the contents were cooled to ambient temperature. The reaction was poured to water (10 mL) and extracted with ethyl acetate (15 mL x 3) and washed with brine solution. The organic phases were combined, concentrated under reduced pressure and purified by silica gel column chromatography (Hexane: Ethyl aceteate- 1:1) to yield **5**.

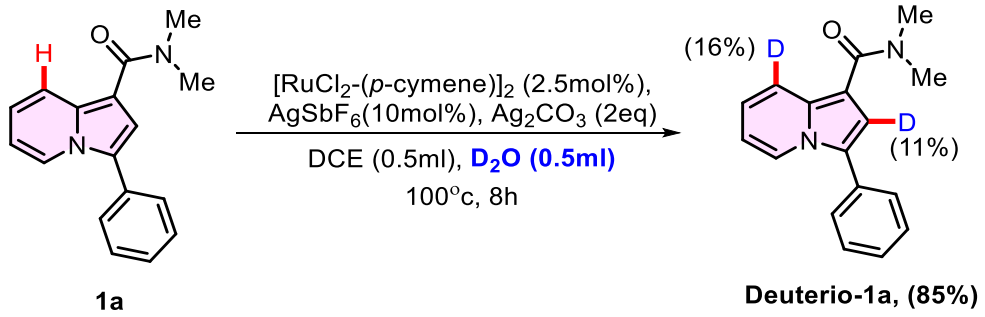
Ethyl 2-((1-(dimethylcarbamoyl)-3-(p-tolyl)indolizin-8-yl)oxy)acetate (5).



Reddish brown stickly solid; 47mg (62%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 7.44 (d, J = 8.1 Hz, 2H), 7.29 (d, J = 9.2 Hz, 2H), 6.81 (s, 1H), 6.40 (t, J = 7.2 Hz, 1H), 5.99 (d, J = 7.3 Hz, 1H), 4.68 (s, 2H), 4.29 (q, J = 7.1 Hz, 2H), 3.20 (s, 3H), 3.03 (s, 3H), 2.43 (s, 3H), 1.33 (t, J = 7.2 Hz, 4H). **^{13}C{^{1}H} NMR (126 MHz, $CDCl_3$)** δ 168.8, 168.1, 149.9, 137.6, 129.7, 128.8, 128.4, 126.9, 123.4, 117.1, 112.9, 110.4, 109.7, 96.4, 65.6, 61.4, 39.3, 35.1, 34.1, 14.1. **IR (ATR-FTIR)** υ **cm^{-1}** 2905, 2811, 2438, 2240, 1732, 1640, 1611, 1543, 1457, 1390, 1141, 1132, 1049, 1011. **HRMS (ESI-Orbitrap) m/z:** calcd for Chemical Formula: $C_{22}H_{25}N_2O_4^+$ $[M+H]^+$ 381.1809, found 381.1843

4. Mechanistic investigation

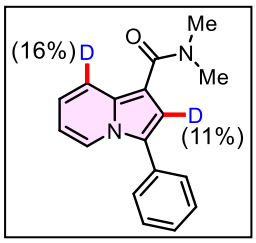
4.1 Deuterium labelling experiment:



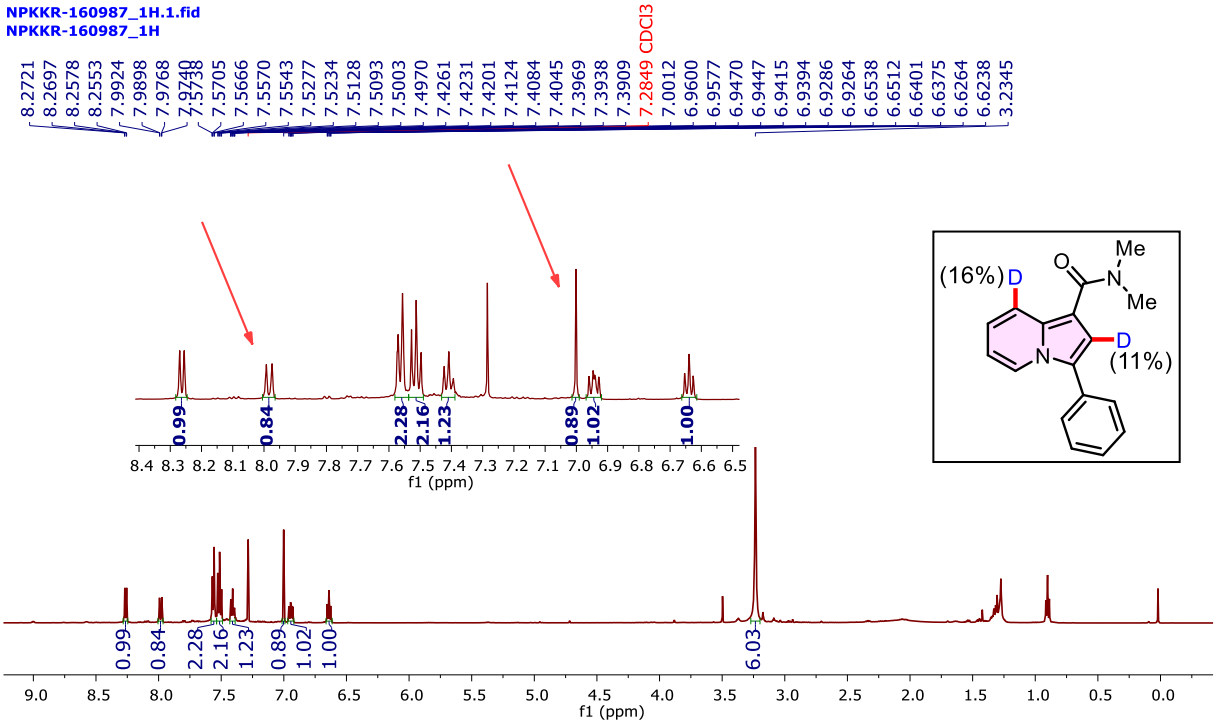
Scheme-S7 Deuterium labelling of **1a.**

The oven dried reaction tube with magnetic stir bar was loaded with $[RuCl_2$-(*p*-cymene)$]_2$ (2.3 mg, 2.5 mol%), $AgSbF_6$ (5 mg, 10 mol%), N,N-dimethyl-3-phenylindolizine-1-carboxamide **(1a) (** 40 mg, 0.15 mmol) and 2 equivalents (83mg) of silver carbonate. Next, D_2O (0.5mL) and 0.5 mL of DCE was added and the reaction was stirred under reflux at 100°C for 8 hours. After completion, the reaction was cooled to ambient temperature, diluted with ethyl acetate and passed through celite pad. The organic compounds were collected completely, concentrated under reduced pressure and purified by column chromatography on silica gel (230-400 mesh, 1:1 EtOAc/Hexane) to obtain the product.

N,N-dimethyl-3-phenylindolizine-1-carboxamide-2,8-d$_2$: (Deuterio-1a)

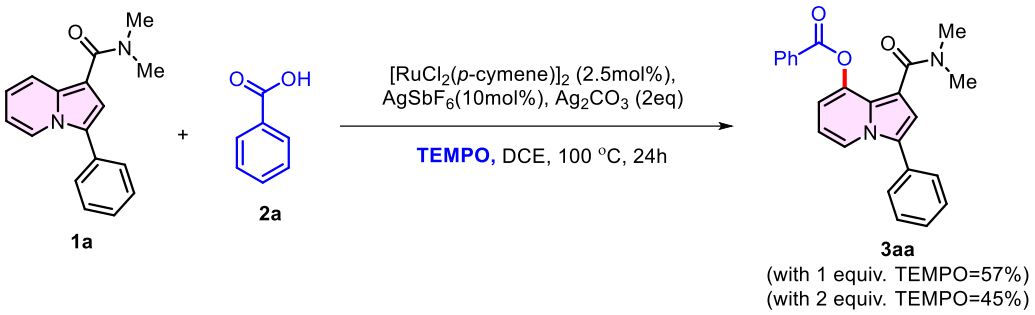


Dark green oil; 34mg, (85%). **^{1}H NMR (500 MHz, Chloroform-*d*)** δ 8.26 (dd, J = 7.2, 1.2 Hz, 1H), 7.98 (dt, J = 9.7, 0.7 Hz, 0.84H), 7.58 – 7.54 (m, 2H), 7.51 (q, J = 7.9, 7.4, 6.5 Hz, 2H), 7.41 (tt, J = 7.4, 1.4, 0.9 Hz, 1H), 7.00 (s, 0.89H), 6.94 (ddd, J = 9.2, 6.5, 1.1 Hz, 1H), 6.64 (td, J = 6.8, 1.3 Hz, 1H), 3.23 (s, 6H).



4.2 Radical quenching experiment:

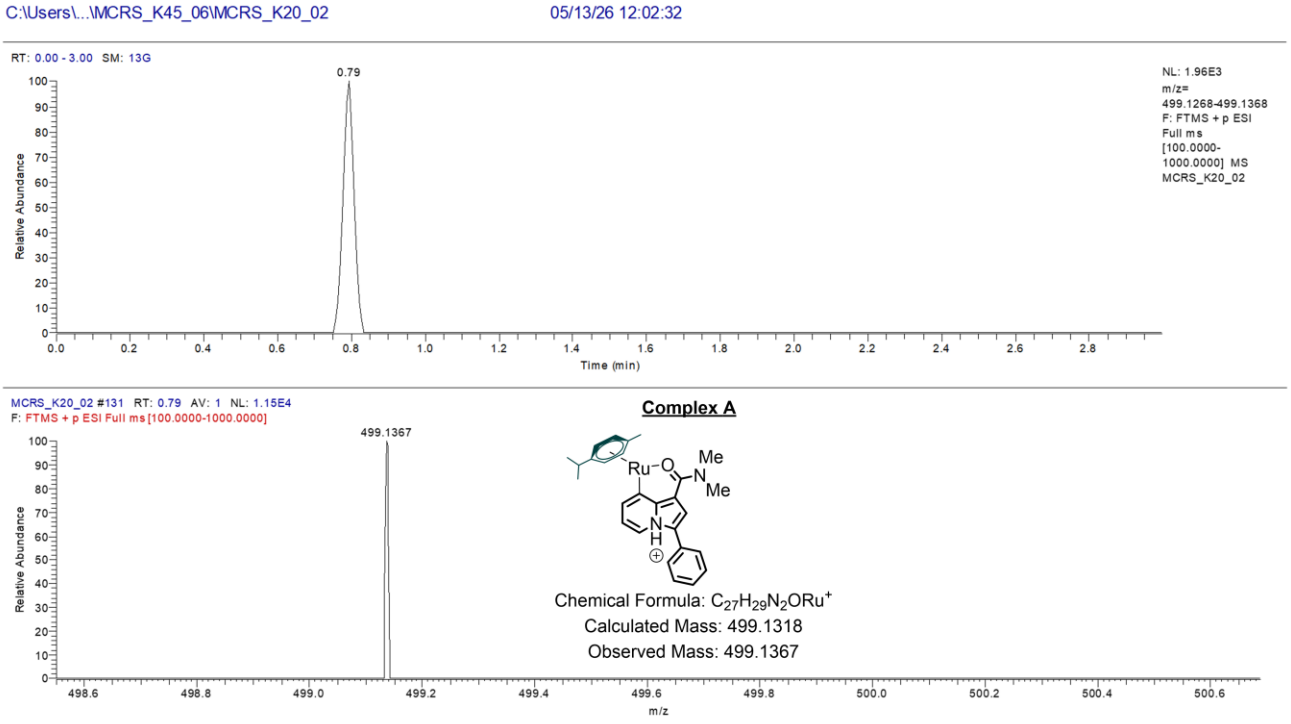
Oven dried reaction tubes were loaded with 0.2 mmol (50mg) of N,N-dimethyl-3-phenyl indolizine-1-carboxamide **(1a)**, 3 equivalents (73mg) of benzoic acid. 2.5 mol% of [RuCl$_2$-(*p*-cymene)]$_2$ (3mg), 10 mol% of Silver hexafluoro antimonate (7mg) and 2 equivalents of silver carbonate (110mg) were added to the tubes. The tubes were respectively loaded with 1 equivalent (31mg) and 2 equivalents (62mg) of TEMPO and 1 mL of DCE and stirred under reflux for 24 hours. After completion of the reaction, the tubes were cooled to room temperature, diluted with ethyl acetate and passed through celite pad. The organic compounds were collected completely, concentrated under reduced pressure and purified by column chromatography on silica gel (230-400 mesh, 1:1 EtOAc/Hexane).

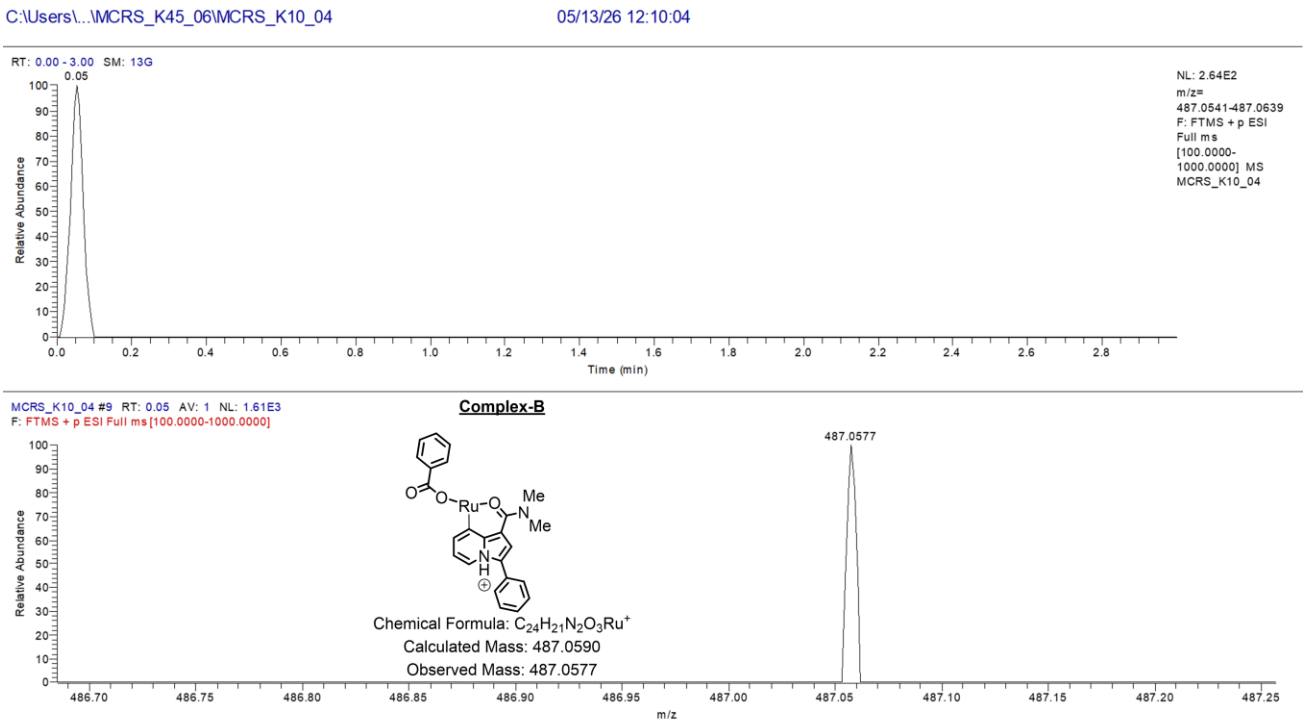


Scheme-S8 Radical quenching experiment.

4.3 High resolution mass analysis:

In order to ascertain the possible intermediate formation, aliquots were collected at shorter time interval from the reaction **(Scheme-S3)** and analysed by High resolution mass spectrometry under ESI condition (Positive mode). The following figure represents the corresponding chromatogram and mass spectrum of the detected Ruthenium chelation intermediate.

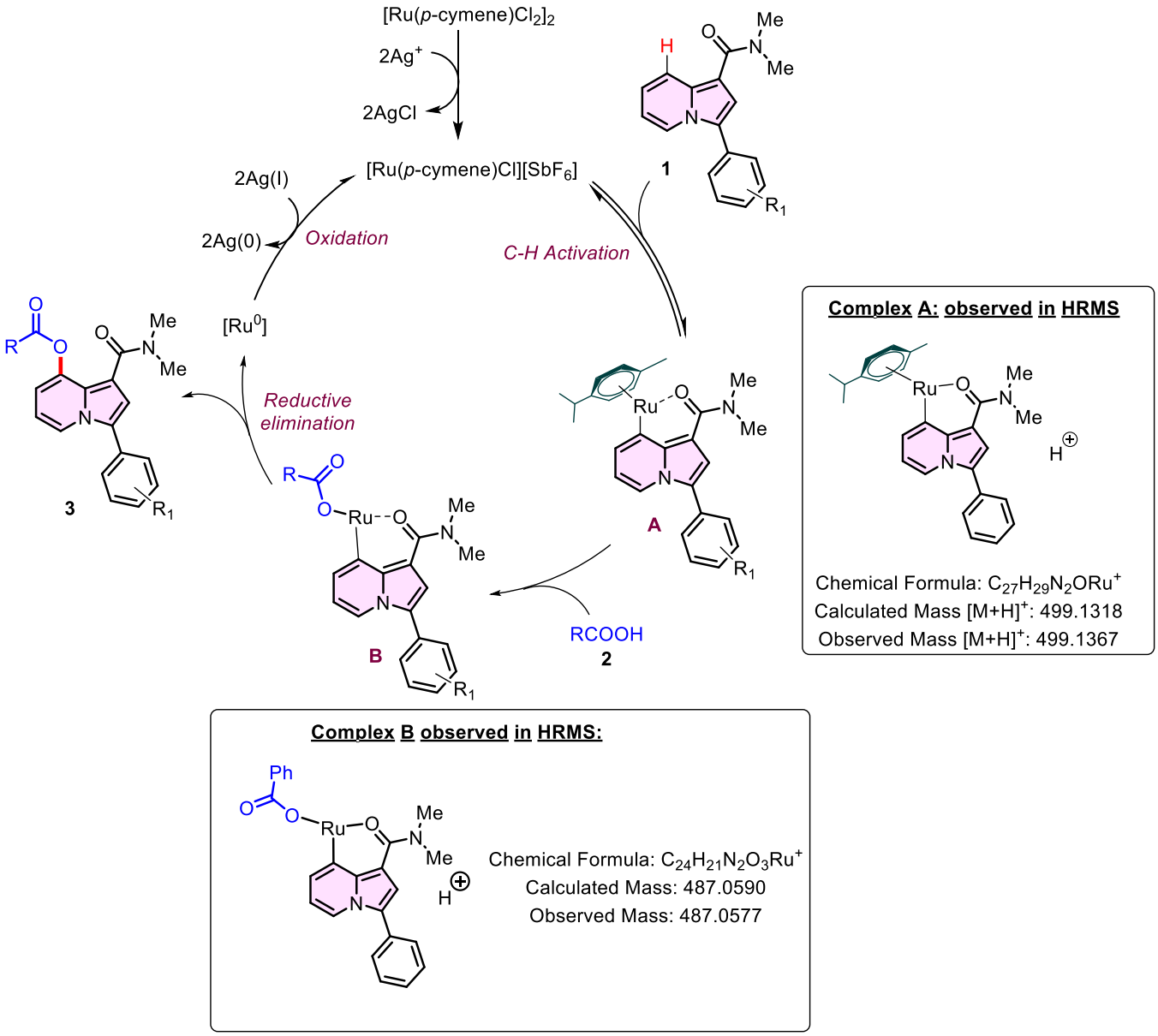




FigureS1. HRMS analysis of detected Ruthenium chelation intermediates (**Complex A** and **Complex B**).

4.4. Plausible Mechanistic Cycle

We propose a plausible mechanistic cycle, where the Ru(II) catalyst is activated into an active cationic Ru(II) complex, by the $AgSbF_6$. This active Ru(II) complex, reversibly and weakly co-ordinates with the carbonyl oxygen of the amide directing group on indolizine (**1**) and undergoes a preferential C–H activation at C-8 position to form a six membered ruthenacyle (**Complex A)** (**Scheme S9**). Further, **complex A** coordinates with the carboxylic acid (2) to generate **complex B**. On reductive elimination, the acyloxyated product (**3**) is produced with the generation of Ru(0) species, which is further oxidized by silver (II) oxidant, in the presence of carboxylic acid to regenerate Ru(II) catalyst



Scheme S9-Plausble Mechanistic cycle

5. Single crystal X-Ray analysis (3ac; CCDC2487967)

Crystals of **3ac** ($C_{30}H_{24}N_2O_3$) were grown in a dual solvent phase (Pentane:Chloroform). A suitable crystal was selected and analysed on a SuperNova, Single source at offset/far, HyPix3000 diffractometer. The crystal was kept at 293(2) K during data collection. Using Olex2 [4], the structure was solved with the SHELXT[5] structure solution program using Intrinsic Phasing and refined with the SHELXL[6] refinement package using Least Squares minimisation.

No syntax errors found. CIF dictionary
Please wait while processing .... Interpreting this report

Datablock: ex-nikkre236_auto

Bond precision:	C-C = 0.0031 A		Wavelength=0.71073
Cell:	a=12.8704(5)	b=6.3555(2)	c=29.2525(13)
	alpha=90	beta=97.402(4)	gamma=90
Temperature: 293 K			

	Calculated	Reported
Volume	2372.85(16)	2372.84(17)
Space group	P 21/c	P 1 21/c 1
Hall group	-P 2ybc	-P 2ybc
Moiety formula	C30 H24 N2 O3	C30 H24 N2 O3
Sum formula	C30 H24 N2 O3	C30 H24 N2 O3
Mr	460.51	460.51
Dx,g cm-3	1.289	1.289
Z	4	4
Mu (mm-1)	0.084	0.084
F000	968.0	968.0
F000'	968.42	
h,k,lmax	16,8,37	16,8,37
Nref	5262	4864
Tmin,Tmax		0.801,1.000
Tmin'		

Correction method= # Reported T Limits: Tmin=0.801 Tmax=1.000 AbsCorr = MULTI-SCAN

Data completeness= 0.924 Theta(max)= 27.140

R(reflections)= 0.0518(3098) wR2(reflections)= 0.1538(4864)

S = 1.056 Npar= 319

The following ALERTS were generated. Each ALERT has the format
test-name_ALERT_alert-type_alert-level.
Click on the hyperlinks for more details of the test.

Alert level C

PLAT031_ALERT_4_C Refined Extinction Parameter Within Range of ... 2.750 Sigma
PLAT053_ALERT_1_C Minimum Crystal Dimension Missing (or Error) ... Please Check
PLAT054_ALERT_1_C Medium Crystal Dimension Missing (or Error) ... Please Check
PLAT055_ALERT_1_C Maximum Crystal Dimension Missing (or Error) ... Please Check
PLAT910_ALERT_3_C Missing FCF Reflection(s) Below Theta(Min)[Deg]= 3.28 Note
1 0 0, 2 0 0, -1 0 2, 0 0 2, 1 0 2, -1 0 4,

0 0 4,

PLAT911_ALERT_3_C Missing FCF Refl Between Thmin & STh/L= 0.600 39 Report

-2 0 2, -3 0 4, -2 0 4, -3 0 6, -4 0 8, 10 1 9,
10 0 10, -7 0 12, 7 0 20, 8 1 21, -11 3 22, 7 0 22,
7 1 22, 8 0 22, 8 1 22, 9 0 22, 9 1 22, 10 1 22,
7 1 23, 8 1 23, 9 1 23, 10 1 23, 7 0 24, 7 1 24,
8 0 24, 8 1 24, 9 0 24, 9 1 24, 7 1 25, 8 1 25,
(9 More Missing: see the .ckf listing file)

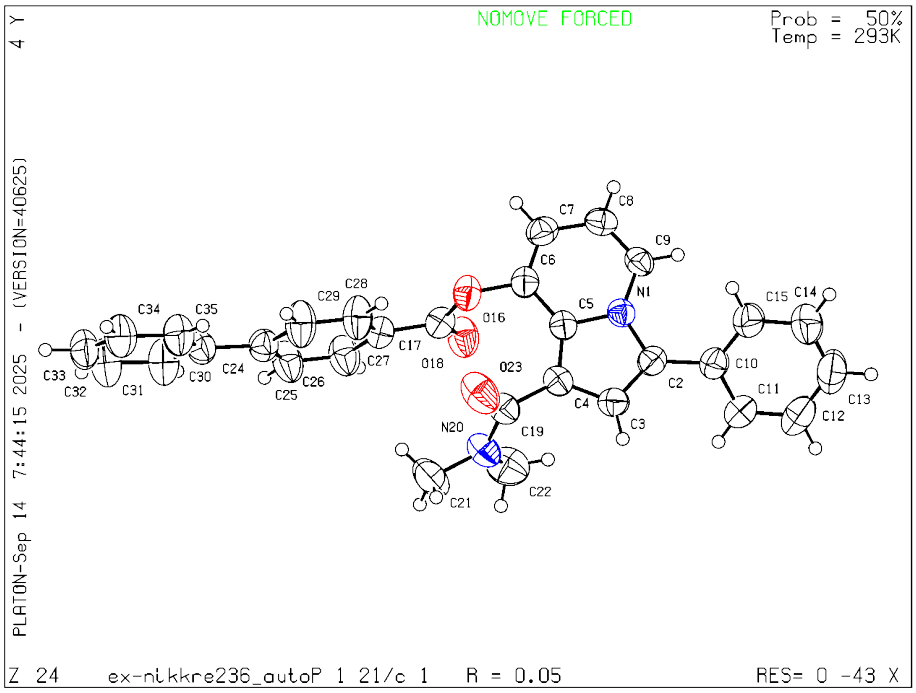
Alert level G

PLAT199_ALERT_1_G Reported _cell_measurement_temperature ..... (K) 293 Check
PLAT200_ALERT_1_G Reported _diffrn_ambient_temperature ..... (K) 293 Check
PLAT432_ALERT_2_G Short Inter X...Y Contact C8 ..C9 . 3.19 Ang.
1-x,1-y,1-z = 3_666 Check
PLAT912_ALERT_4_G Missing # of FCF Reflections Above STh/L= 0.600 348 Note
PLAT941_ALERT_3_G Average HKL Measurement Multiplicity ..... 4.7 Low
PLAT955_ALERT_1_G Reported (CIF) and Actual (FCF) Lmax Differ by . 1 Units
PLAT969_ALERT_5_G The 'Henn et al.' R-Factor-gap value ..... 2.774 Note
Predicted wR2: Based on Sigl**2 5.54 or SHELX Weight 14.56
PLAT978_ALERT_2_G Number C-C Bonds with Positive Residual Density. 3 Info

---

0 **ALERT level A** = Most likely a serious problem - resolve or explain
0 **ALERT level B** = A potentially serious problem, consider carefully
6 **ALERT level C** = Check. Ensure it is not caused by an omission or oversight
8 **ALERT level G** = General information/check it is not something unexpected

PLATON version of 04/06/2025; check.def file version of 30/05/2025
Datablock ex-nikkre236_auto - ellipsoid plot

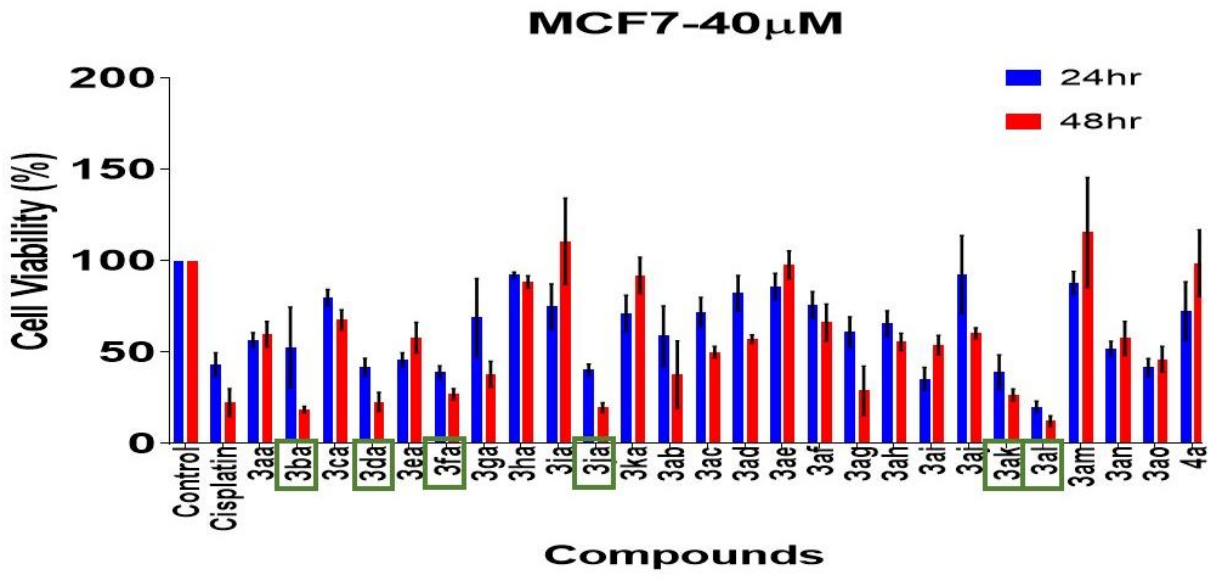


6. In vitro Anti-cancer evaluation

6.1. Preliminary Cytotoxicity assay

The cytotoxic activity of the Indolizine derivatives was evaluated using the Alamar Blue assay[7]. The cells in this study were maintained at standard culture conditions in 37°C incubator and 5% CO_2. MCF-7 and MDA-MB-231 were cultured in DMEM Medium (GIBCO). A280 cell line was maintained in RPMI 1640 (GIBCO). MCF-10A was grown in DMEM/F12 (GIBCO) supplemented in 5% Horse Serum , EGF (20ng/ul),Hydrocortisone(0.5mg/ml), Cholera Toxin(100ng/ml), Insulin(10ug/ml) . All the cell lines except MCF-10A were supplemented with 10% FBS (GIBCO) and Antibiotic Antimycotic solution (HiMedia).

The MCF-7, MDA-MB-231, and A2780 cell lines were seeded in 96-well plates at a density of 5,000 cells per well and maintained at 5% CO_2 incubator. Once the cells have attached, medium was removed and replaced with serum-free medium, and the plates were incubated overnight. Following 12–16 hours of serum starvation, the incomplete medium was replaced with treatment medium supplemented with a single dose of the novel indolizine derivatives, and cells were incubated for 24 and 48 hours, respectively. Cell viability was assessed using the Alamar Blue fluorometric assay at each time point. The reagent was added to each well and incubated for 3–4 hours, fluorescence was measured at an excitation/emission wavelength of 560/590 nm using a Varioskan Lux Multimode Microplate Reader. Percentage cell viability was subsequently calculated using Microsoft Excel, and dose–response graphs were plotted using GraphPad Prism (version 8.0).



FigureS2-Cytotoxicity screening of synthesised indolizine derivatives **(3aa-3ka, 3ab-3ao, 4a)** against MCF-7 cells.

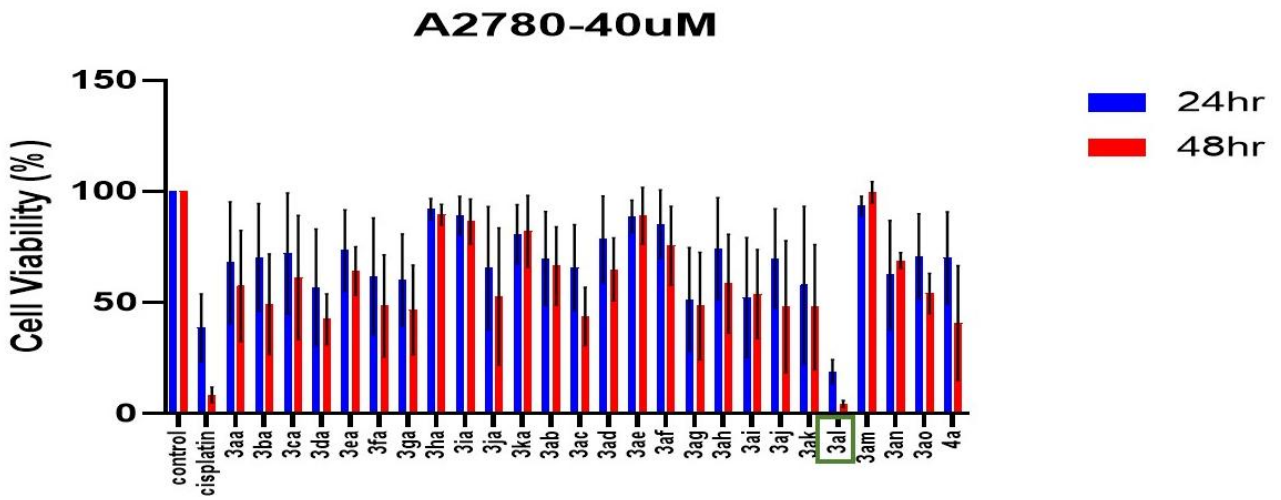


Figure S3-Cytotoxicity screening of synthesised indolizine derivatives **(3aa-3ka, 3ab-3ao, 4a)** against A2780 cells.

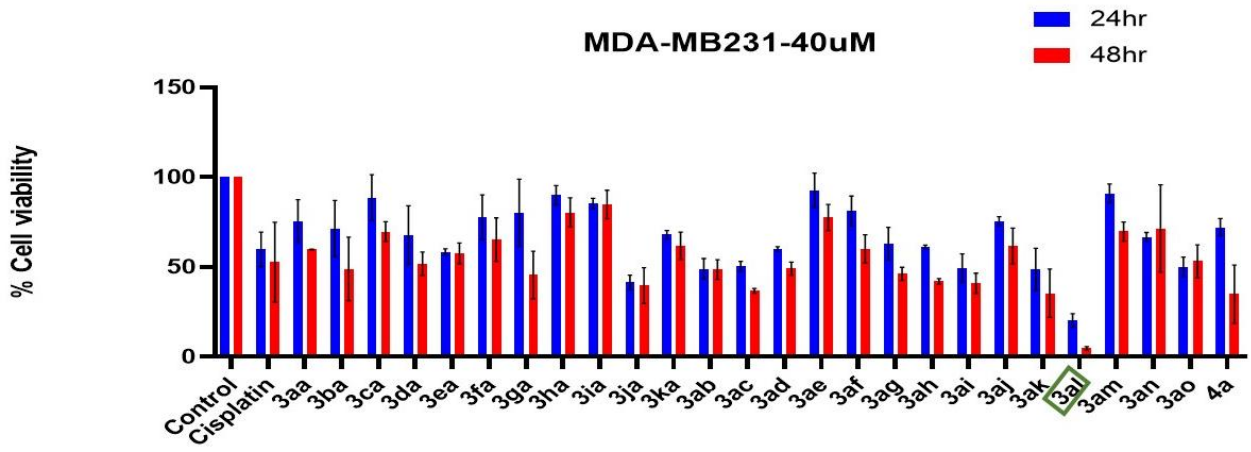


Figure S4-Cytotoxicity screening of synthesised indolizine derivatives **(3aa-3ka, 3ab-3ao, 4a)** against MDA-MB-231 cells.

6.2 IC_{50} Determination

The Identified hit compounds from the preliminary screening were tested for IC_{50} against the selected cancer and non-cancerous cell lines. MCF-7, MDA-MB-231, and A2780, MCF-10A cells were seeded in 96-well plates at a density of 5,000 cells per well and cultured in a 5% CO_2 incubator. Once the cells have attached to the plate the medium was replaced with serum-free medium and cells were subjected to serum starvation overnight. After 12–16 hours, the serum-free medium was replaced with treatment medium with a series of graded concentrations of each identified hit compound, and cells were incubated for 24 and 48 hours under standard culture conditions. At the designated time points, cell viability was evaluated using the Alamar Blue fluorometric assay. The reagent was incubated for 3–4 hours and fluorescence intensity was recorded at an excitation/emission wavelength

of 560/590 nm using the Varioskan Lux Multimode Microplate Reader. IC50 was determined using GraphPad Prism (version 8.0).

(The IC_{50} values of hit compounds against MCF-7 cells at 48h incubation were represented in figure-1(A) of main article. The remaining data has been presented here).

IC_{50} on MCF7 cells (for 3al, 24h incubation)

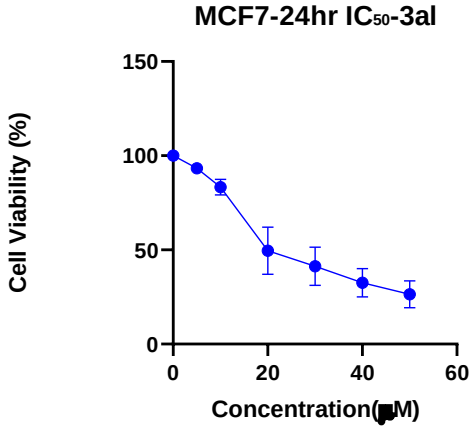
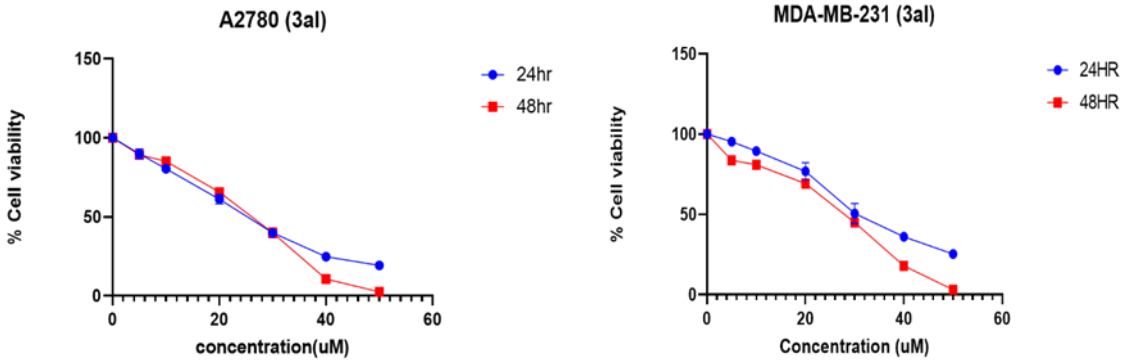


Figure S5- Dose dependent inhibition curve of **3al** against MCF-7 cells. IC50 of 3al on MCF7 Cell line at 24 h [IC_{50} (µM) : 15.44±1.68].

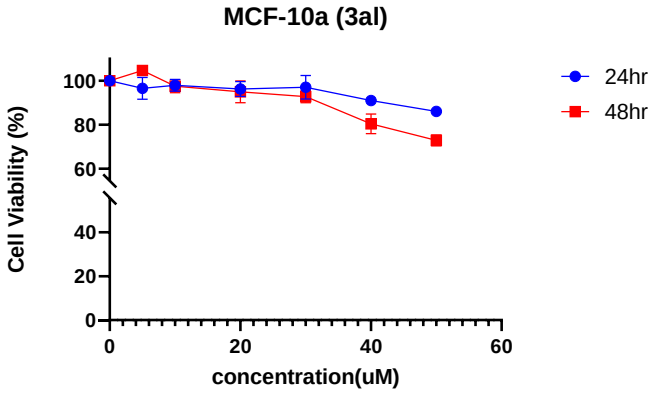
IC_{50} on A2780 and MDA MB-231



Cell Line	IC_{50} (µM±SEM) 24 h	IC_{50} (µM±SEM) 48 h
A2780	17.98±1.69	23.55±0.43
MDA-MB-231	24.26±2.36	24.30±1.26

Figure S6- Dose dependent inhibition curve of **3al** against A2780 and MDA-MB-231 cells.

Effect of compound 3al on MCF10a (non-cancerous cell line)



Cell Line	IC_{50} (µM±SEM) 24 h	IC_{50} (µM±SEM) 48 h
MCF-10a	122.6±4.84	73.32±3.72

Figure S7- Cytotoxicity evaluation (at 40µM) and dose dependent inhibition curve of **3al** against MCF-10a cells.

6.3 Cell Migration Assay (Scratch Assay)

MCF-7 cells were seeded at a density of 0.25 × 10^6 cells per well in 12-well plates and incubated overnight under standard culture conditions to allow complete cell adhesion and monolayer formation. The following day, the culture medium was removed cell monolayer was gently washed with 1X PBS . A uniform linear wound was made across each well using a 10 µL pipette tip, followed by an additional wash with 1X PBS to remove detached cells. Further, cells were subsequently treated with the respective compound at its IC_{50} concentration and incubated for up to 72 hours. Images of the scratch wounds were captured at same positions at 0, 24, 48, and 72 hours using a fluorescence inverted microscope . The acquired images were analyzed using ImageJ software to quantify the cell-free area at each time point, and the resulting data were analyzed and represented using GraphPad Prism (version 8.0).

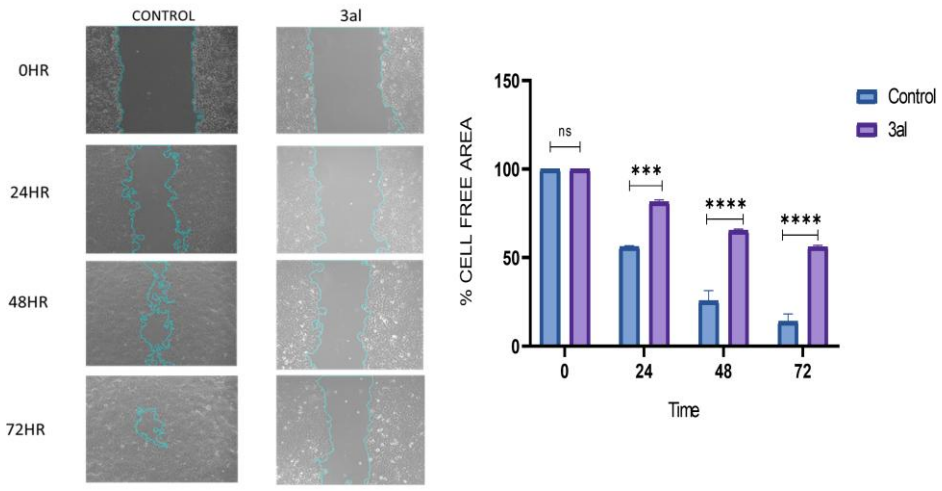


Figure S8- Effect of **3al** on MCF-7 cells migration. Compound **3al** significantly inhibited the migration of MCF-7 cells, demonstrating anti migratory potential.

6.4 Colony Forming Assay

MCF-7 cells were seeded at a density of 1,000 cells per well in 6-well plates and incubated for 24 hours under standard culture conditions to allow adequate cell adhesion. Following the initial incubation period, the culture medium was replaced with the treatment of compounds 3al at its IC_{50} concentration, and incubated for 24 hours. After completion of the treatment period, the medium was removed and the wells were washed with 1X PBS, followed by the addition of fresh complete medium.Cells were allowed to proliferate for 10–12 days, The media was changed every 2 days . After the incubation period, the medium was removed, and the wells were washed with 1X PBS. Colonies were fixed with absolute methanol for 15 minutes, followed by 1X PBS wash. The fixed colonies were stained with 0.5% crystal violet solution for 30 minutes followed by removal of stain the wells were thoroughly rinsed with Milli-Q water. The plates were air dried at room temperature, and colony counts were determined using ImageJ software.

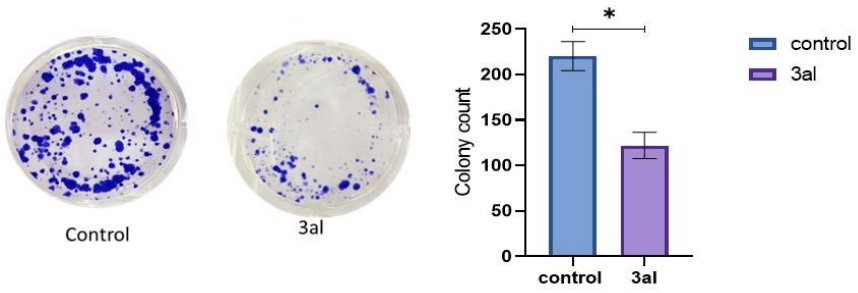


Figure S9- Effect of **3al** on MCF-7 Colony formation. Treatment with **3al** suppressed colony formation as compared to untreated controls indicating strong anti-proliferative effects.

6.5 Cell Cycle Assay

MCF-7 cells were seeded at a density of 0.5×10^6 cells per well in 6-well plates and incubated overnight at 5 % CO_2 and 37°C. Next day, cells were treated with compound **3al** at IC_{50} concentration and incubated for 24 hours. Then cells were trypsinized and collected by centrifugation at 200 × g for 7 minutes. The resulting cell pellet was washed with ice-cold 1X PBS, after which 70% ethanol was added dropwise with gentle vortexing to facilitate fixation, and the cells were kept on ice for 30 minutes to ensure complete fixation. Following fixation, cells were centrifuged at 800 × g for 5 minutes, washed with ice-cold 1X PBS, and centrifuged again at 200 × g for 7 minutes. The cell pellet was then resuspended in 50 µL of RNase A (100µg/ml) and incubated at 37°C for 30 minutes to eliminate RNA interference. Further, cells were stained with 200 µL of propidium iodide at a concentration of 50 µg/mL, transferred to FACS tubes, and analyzed using a flow cytometer. The percentage of cells in the G_0/G_1, S, and G_2/M phases of the cell cycle was determined by analyzing the acquired data using FACS Express software.

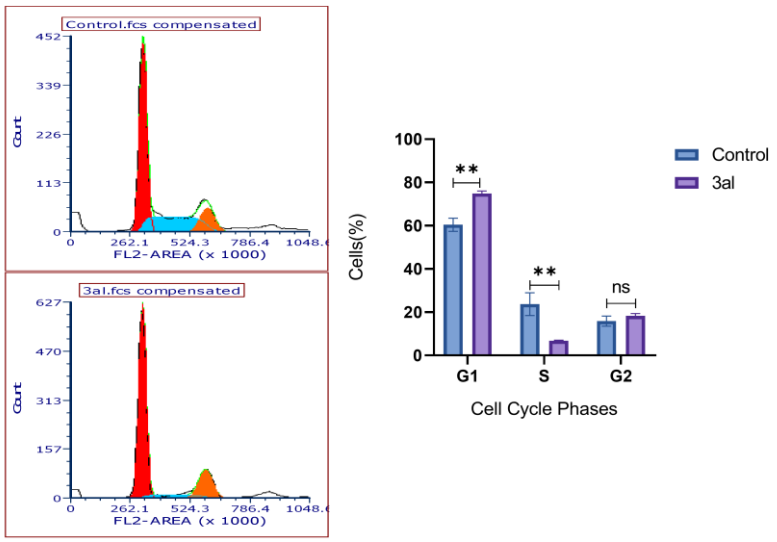


Figure S10- Cell cycle analysis in MCF-7 cells following treatment with compound **3al**.

6.6 Apoptosis Assay

MCF-7 cells were seeded at a density of 0.5 × 10^6 cells per well in 6-well plates and incubated overnight under standard culture conditions. Next day cells were treated with compound **3al** at IC_{50} concentration and incubated for 24 hours. Then cells were trypsinized and collected by centrifugation at 200 × g for 7 minutes, followed 1X PBS washes with centrifugation at 200 × g for 7 minutes. Then the resulting cell pellet was resuspended in 195 µL of 1X binding buffer. Annexin V (5 µL) was added to the cell suspensions and incubated for 15 minutes at room temperature in the dark conditions. After incubation cells were centrifuged at 200 × g for 5 minutes, the supernatant was discarded, and the pellet was carefully resuspended in 195 µL of 1X binding buffer. Before acquisition, 5 µL of propidium iodide (PI) was added to the treated samples, and all samples were immediately analysed using a flow cytometer to distinguish between viable, early apoptotic, late apoptotic, and necrotic cell populations.

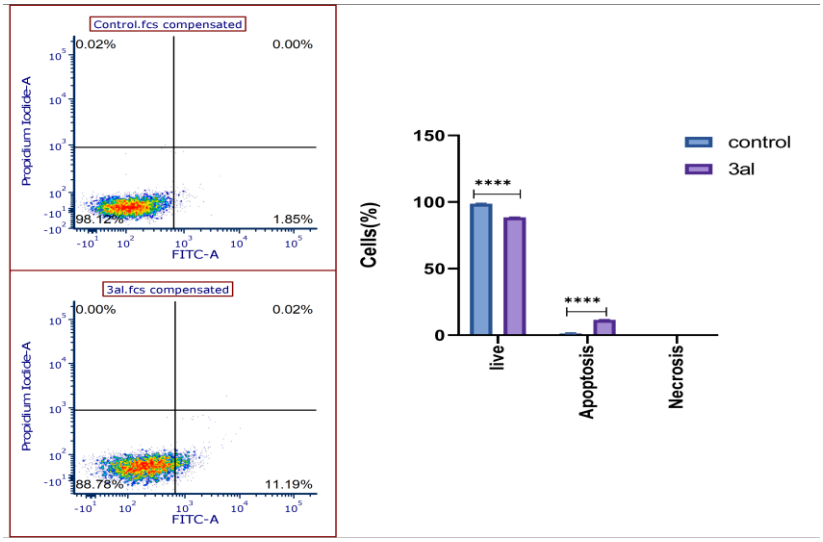


Figure S11- Annexin V-based flow cytometric detection of apoptosis induction by compound **3al.**

7. References

(1) Y. Liu, H. Hu, J. Zhou, W. Wang, Y. He and C. Wang, *Org. Biomol. Chem*., 2017, **15**, 5016.

(2) L. Zhang, F. Liang, L. Sun, Y. Hu and H. Hu, *Synth.*, 2000, **2000**, 1733.

(3) (a) X. Feng, J. Tian, Y. Sun, H. Hu, M. Lu, Y. Kan, D. Fang and C. Wang, *Chin. Chem. Lett.*, 2021, **32**, 470. (b) H. Hu, Y. Liu, J. Xu, Y. Kan, C. Wang and M. Ji, *RSC Adv.*, 2014, **4**, 24389. (c) F. Shi, Y. Zhang, Z. Lu, X. Zhu, W. Kan, X. Wang and H. Hu, *Synth.*, 2016, **48**, 413.

(4 O. V. Dolomanov, L. J. Bourhis, R. J. Gildea, J. A. K. Howard and H. Puschmann, *J. Appl. Cryst.*, 2009, **42**, 339.

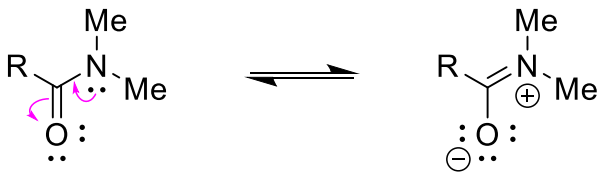
(5) G. M. Sheldrick, *Acta Crystallogr. A*, 2015, **71**, 3.

(6) G. Sheldrick, *Acta Crystallogr. C*, 2015, **71**, 3.

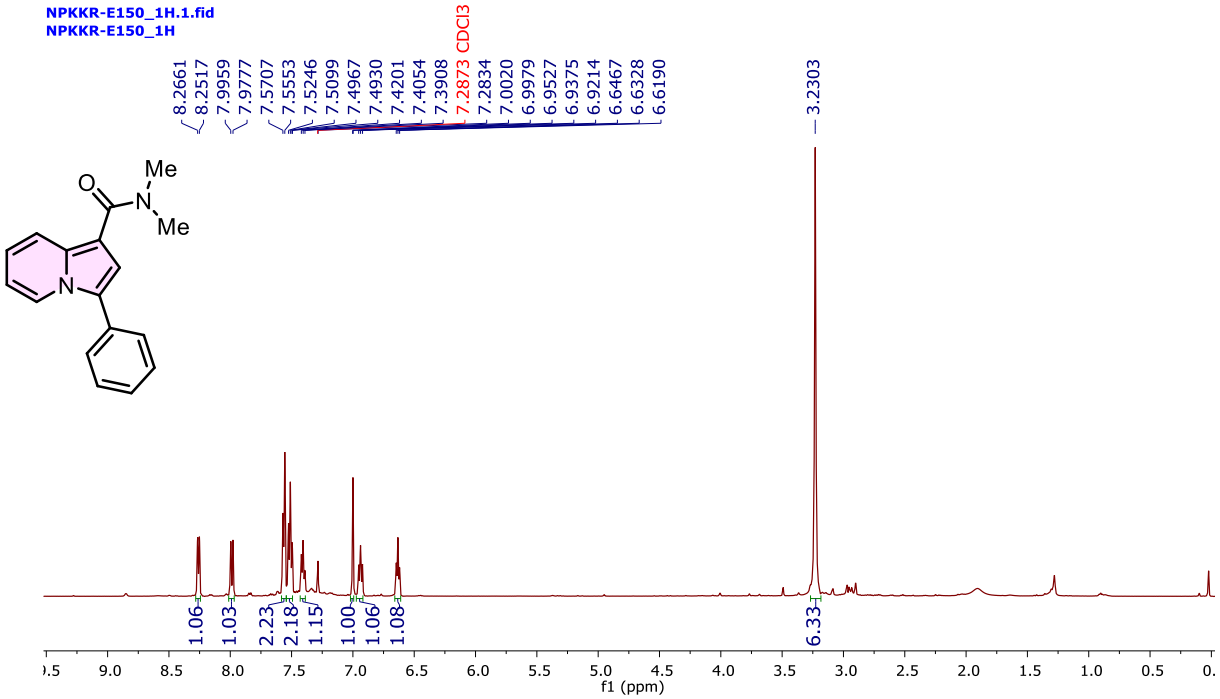
(7) R. Hamid, Y. Rotshteyn, L. Rabadi, R. Parikh and P. Bullock, *Toxicology in Vitro*, 2004, **18**, 703.

NMR Spectra Notes:

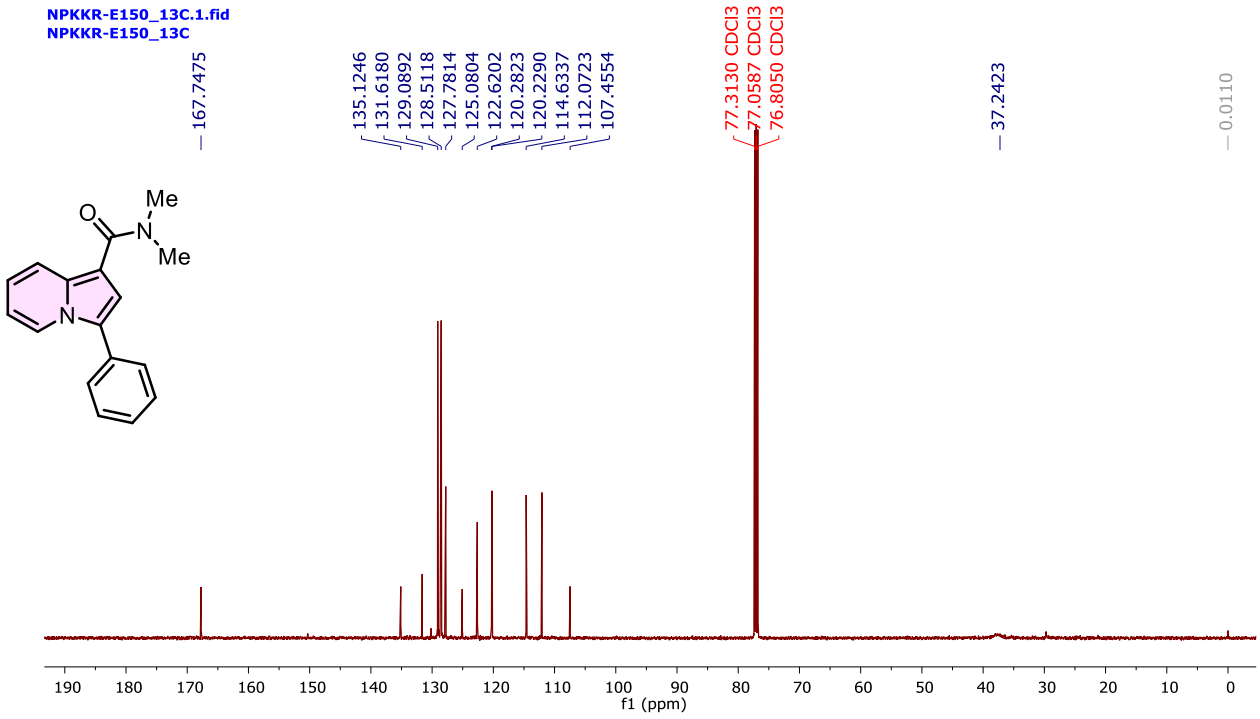
In $^{13}C\{^{1}H\}$ spectra of compounds, the methyl peaks of N,N dimethyl carbamoyl group, is either diminished or missing. This could be be attributed due to amides inherent transient fluxional character, i.e the double bond character arises from the resonance structure of amides as shown below (W. E. Stewart, T. H. Siddall, Nuclear magnetic resonance studies of amides, *Chem. Rev.* 1970, **70**, 5, 517–551) and probably due to T_2 shortening and exchange broadening (H. S. Gutowsky, and C. H. Holm, Rate Processes and Nuclear Magnetic Resonance Spectra. II. Hindered Internal Rotation of Amides *J. Chem. Phys*. 1956, **25**, 1228–1234).



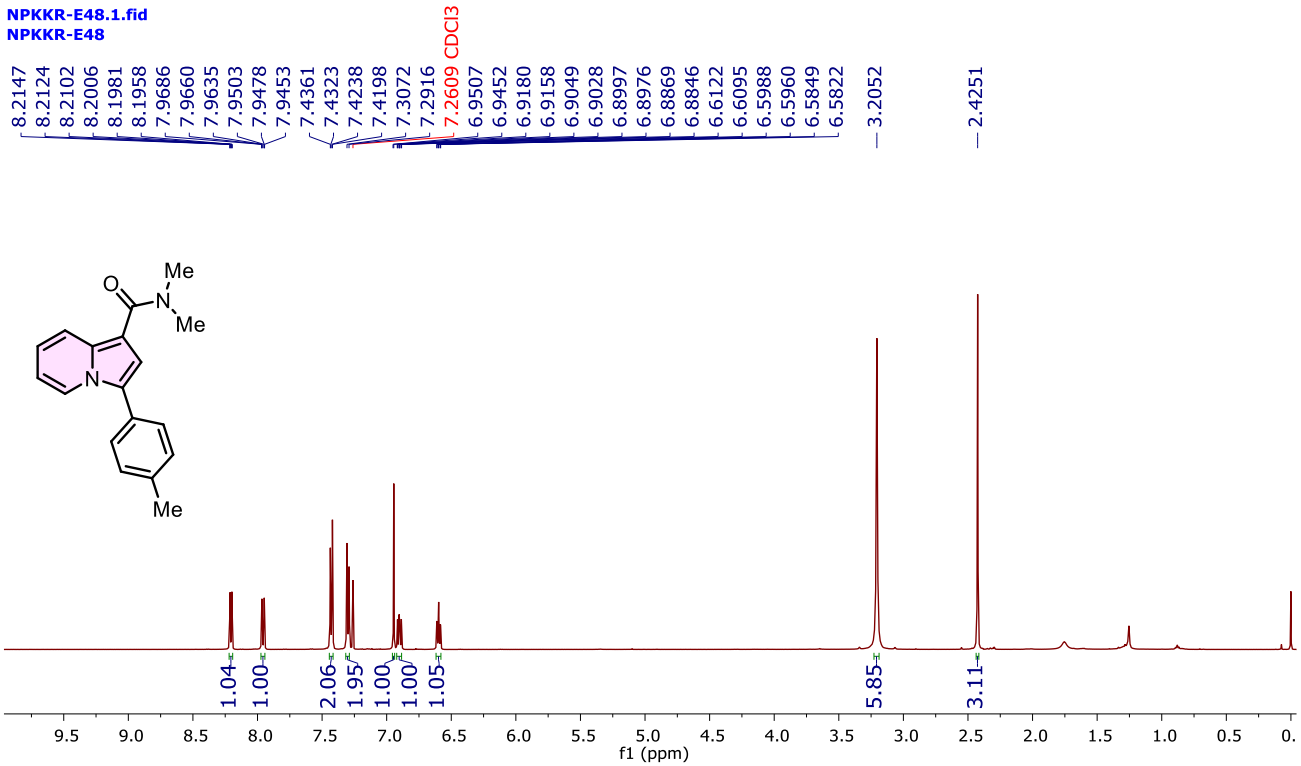
8. ^{1}H and $^{13}C\{^{1}H\}$ & ^{19}F NMR Spectra of synthesised starting materials.



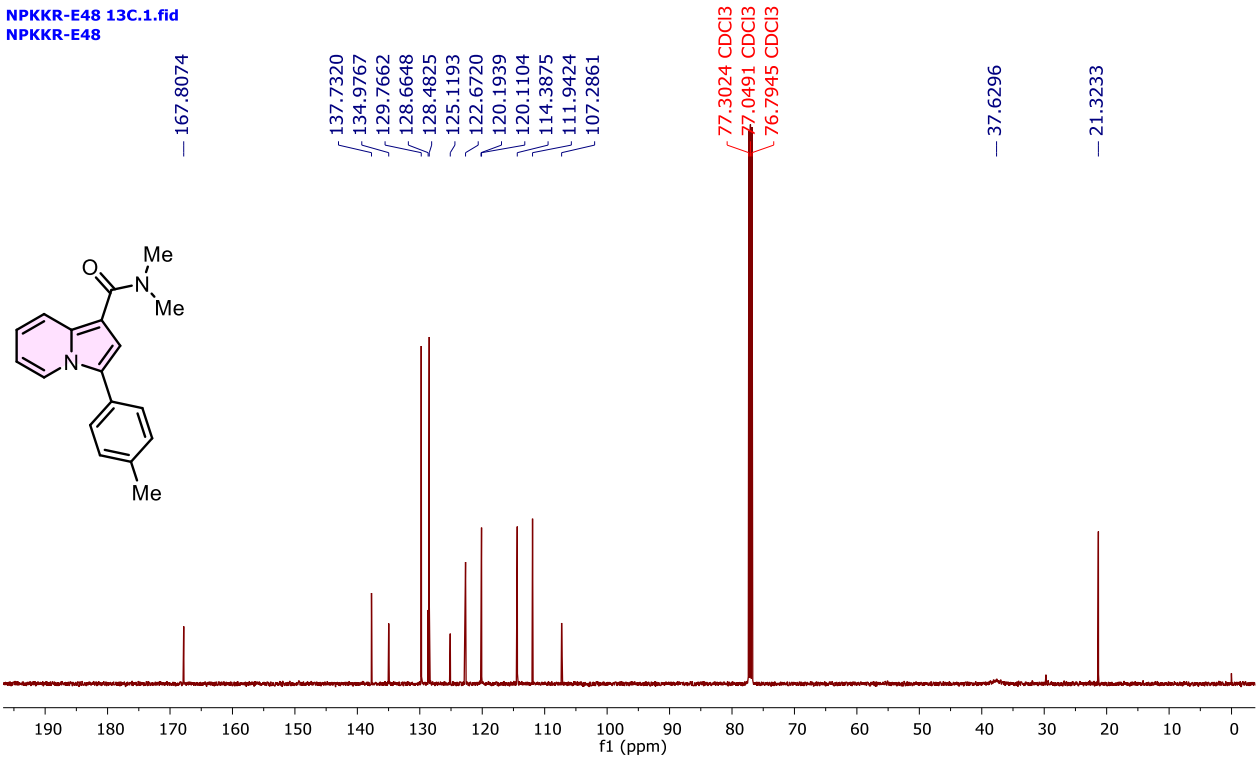
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-Dimethyl-3-phenylindolizine-1-carboxamide **(1a)**



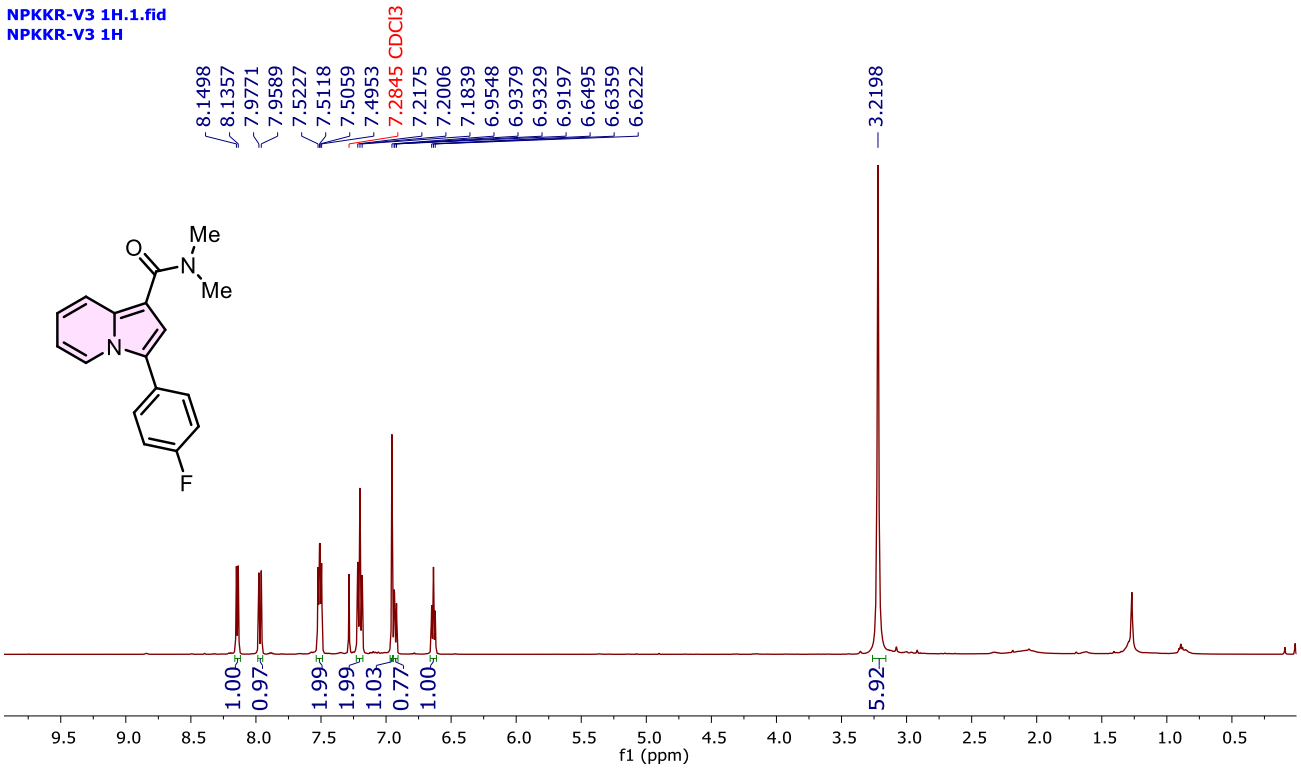
$^{13}C\{^{1}H\}$-NMR (125 MHz, $CDCl_3$) of N,N-Dimethyl-3-phenylindolizine-1-carboxamide **(1a)**



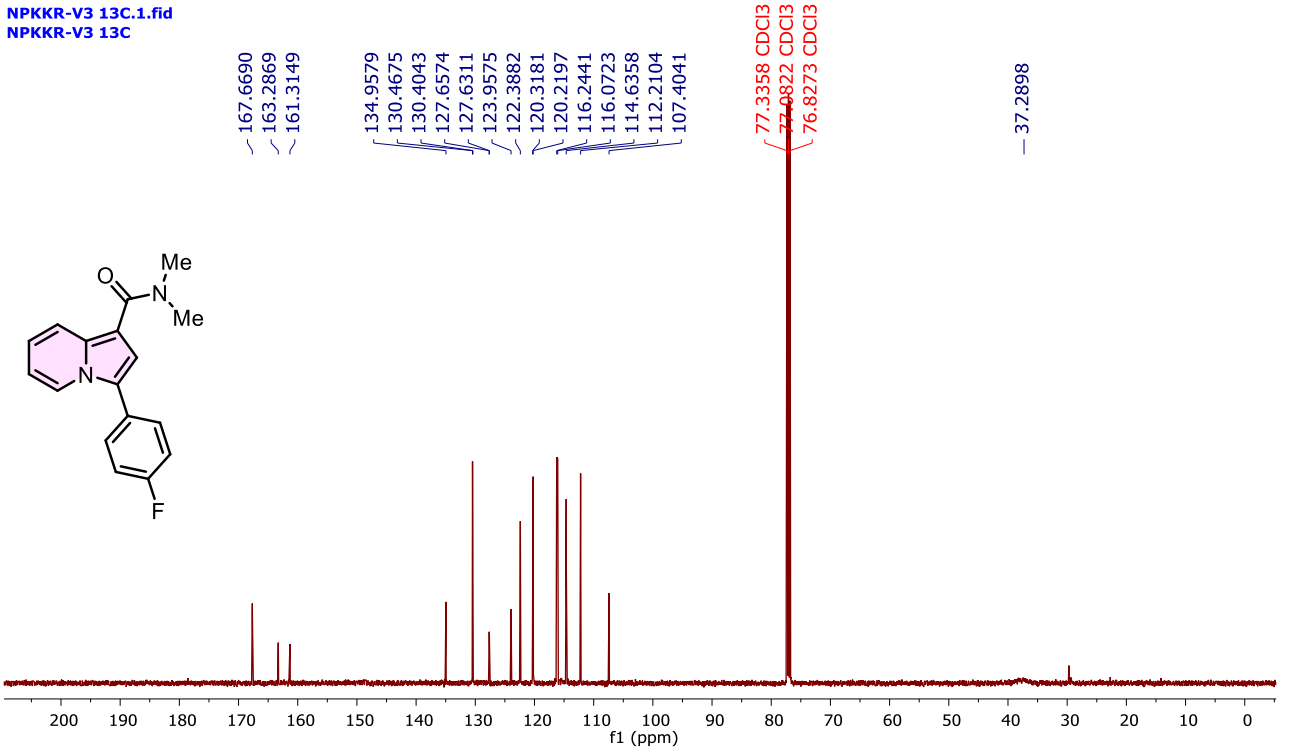
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-Dimethyl-3-(p-tolyl)indolizine-1-carboxamide (**1b**)



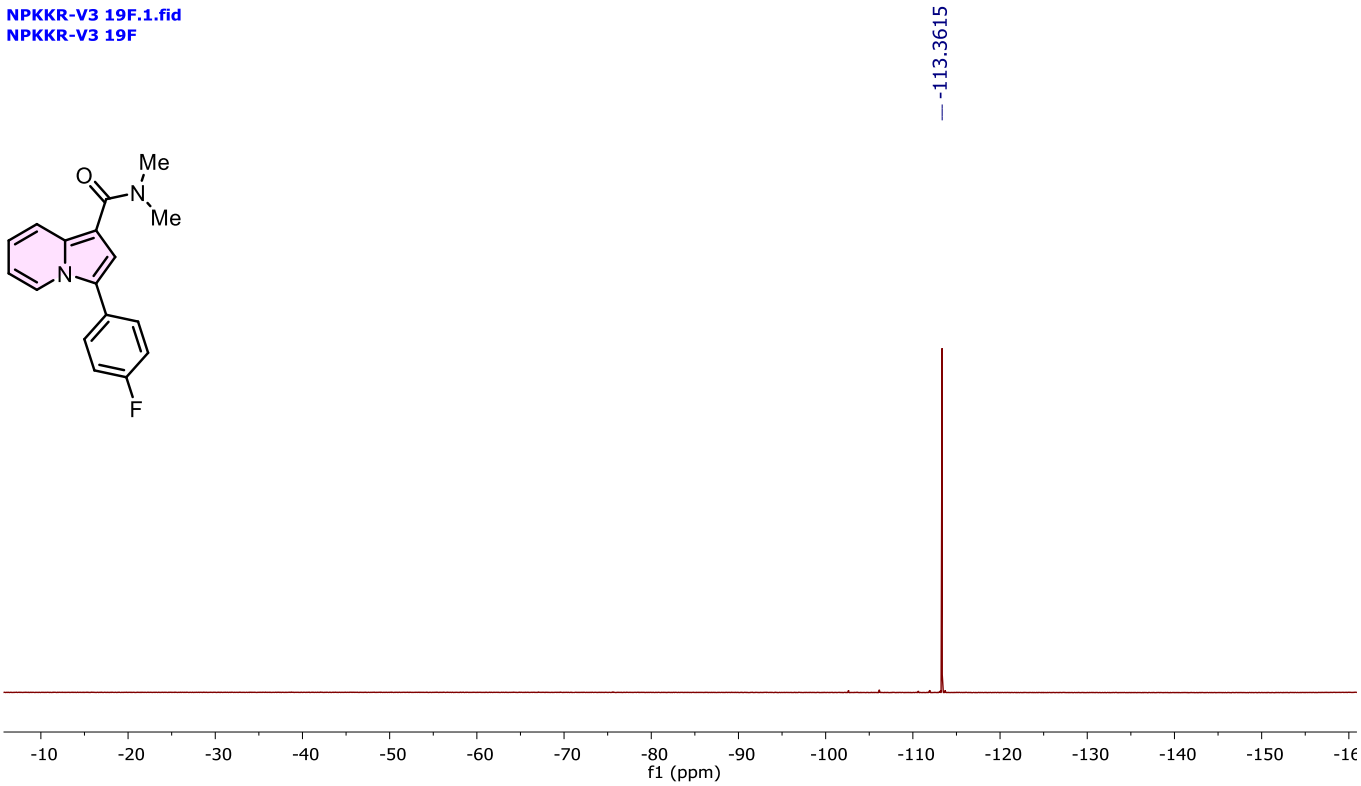
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of N,N-Dimethyl-3-(p-tolyl)indolizine-1-carboxamide (**1b**)



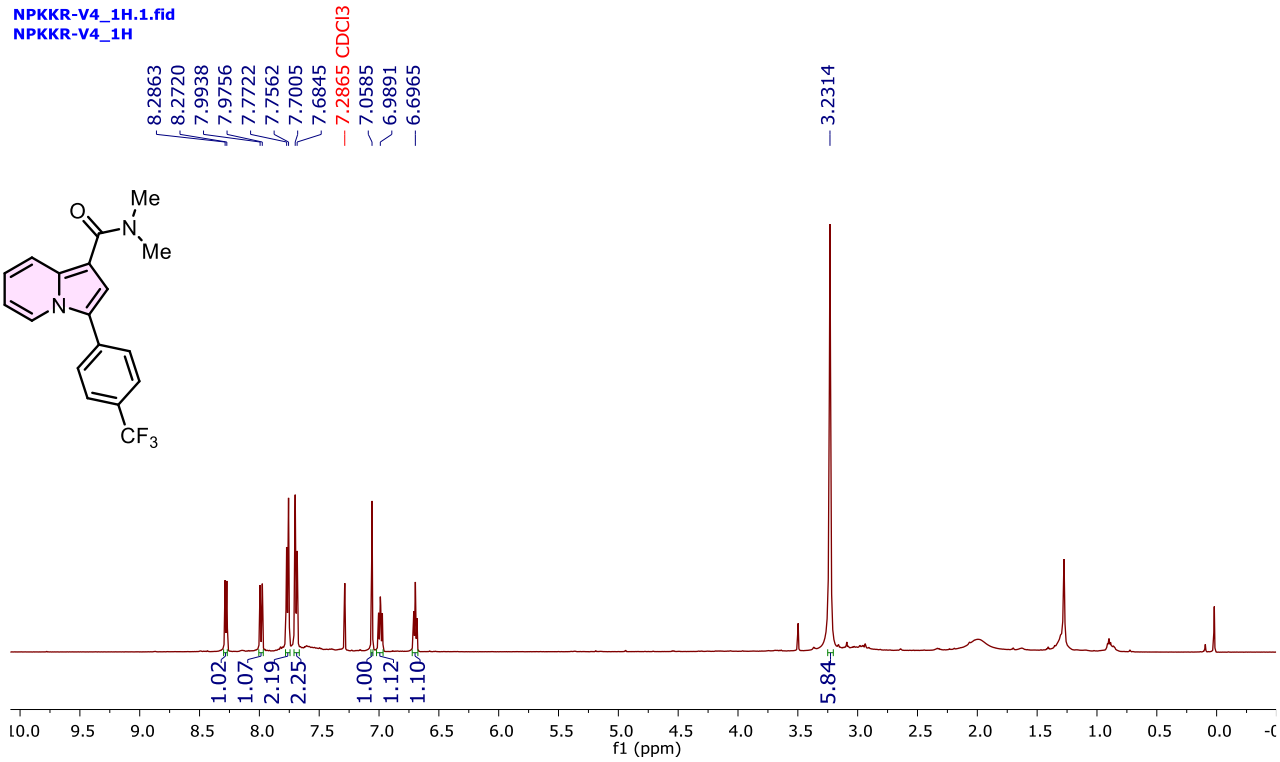
^{1}H-NMR (500 MHz, $CDCl_3$) 3-(4-Fluorophenyl)-N,N-dimethylindolizine-1-carboxamide. **(1c)**



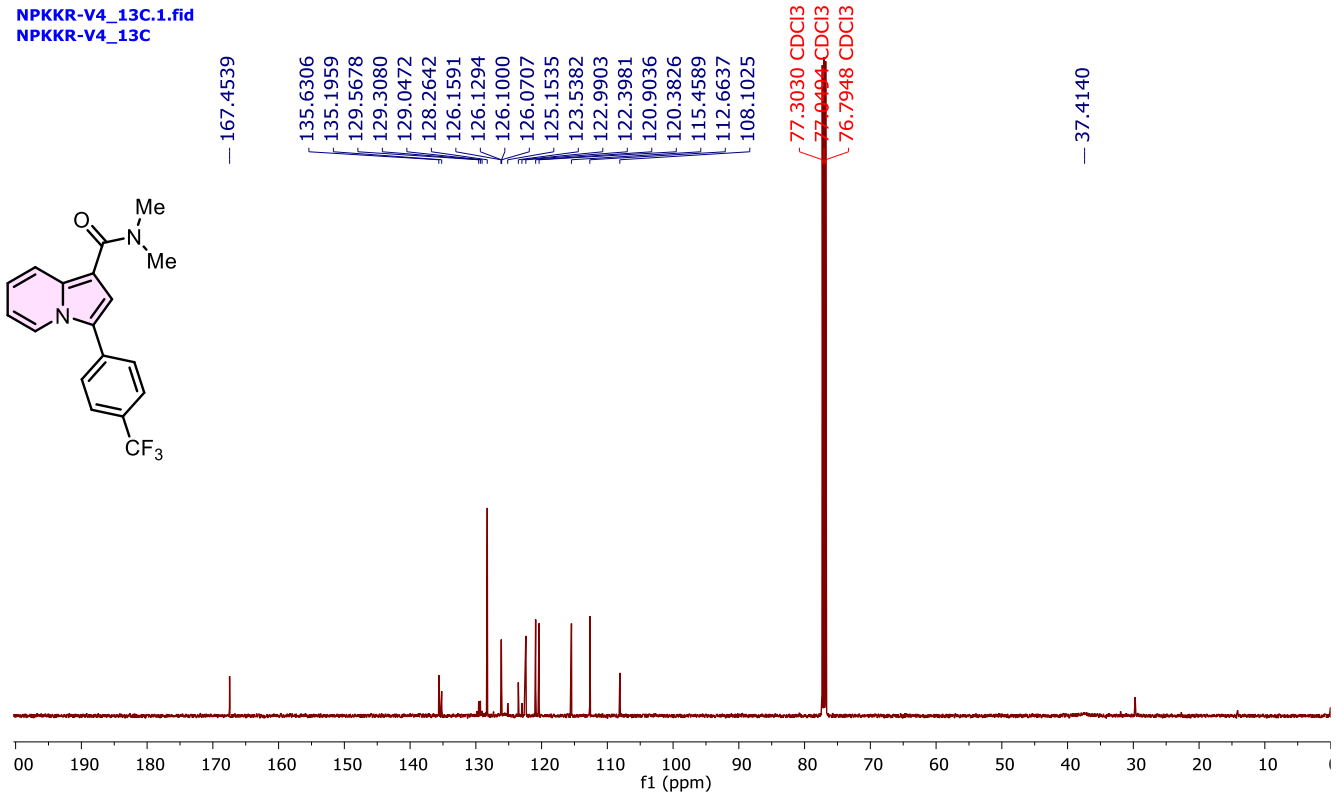
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) 3-(4-Fluorophenyl)-N,N-dimethylindolizine-1-carboxamide. **(1c)**



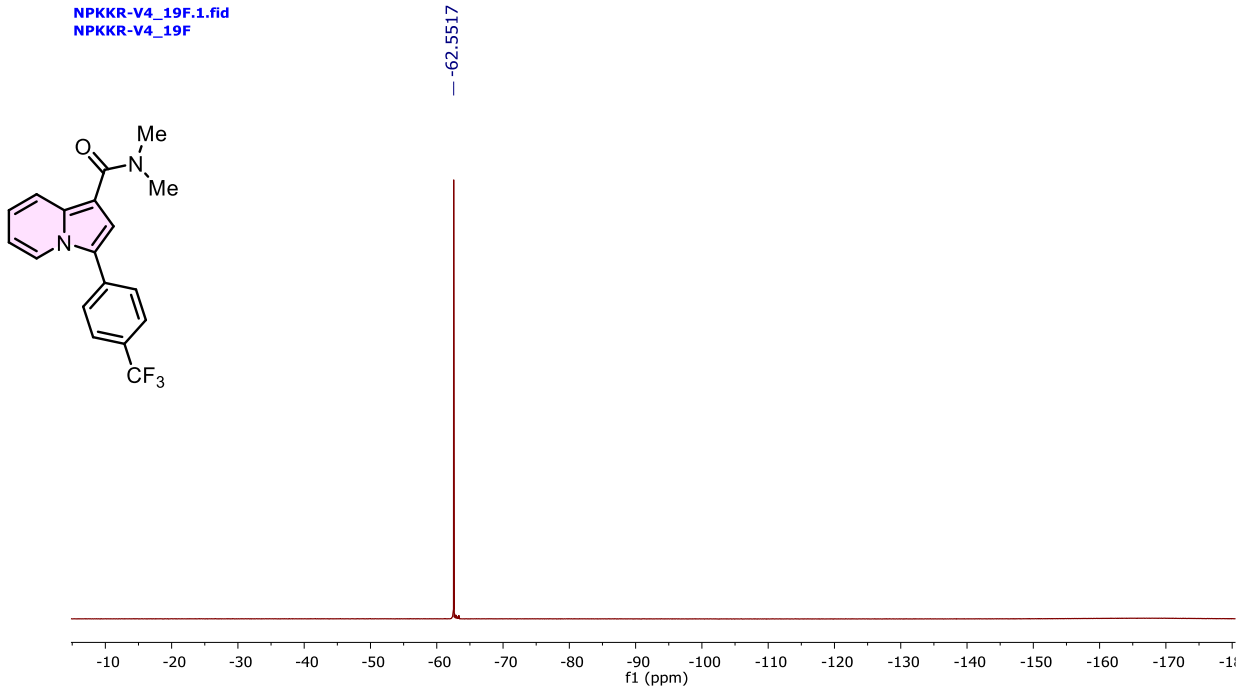
^{19}F-NMR (470 MHz, $CDCl_3$) of 3-(4-Fluorophenyl)-N,N-dimethylindolizine-1-carboxamide. **(1c)**



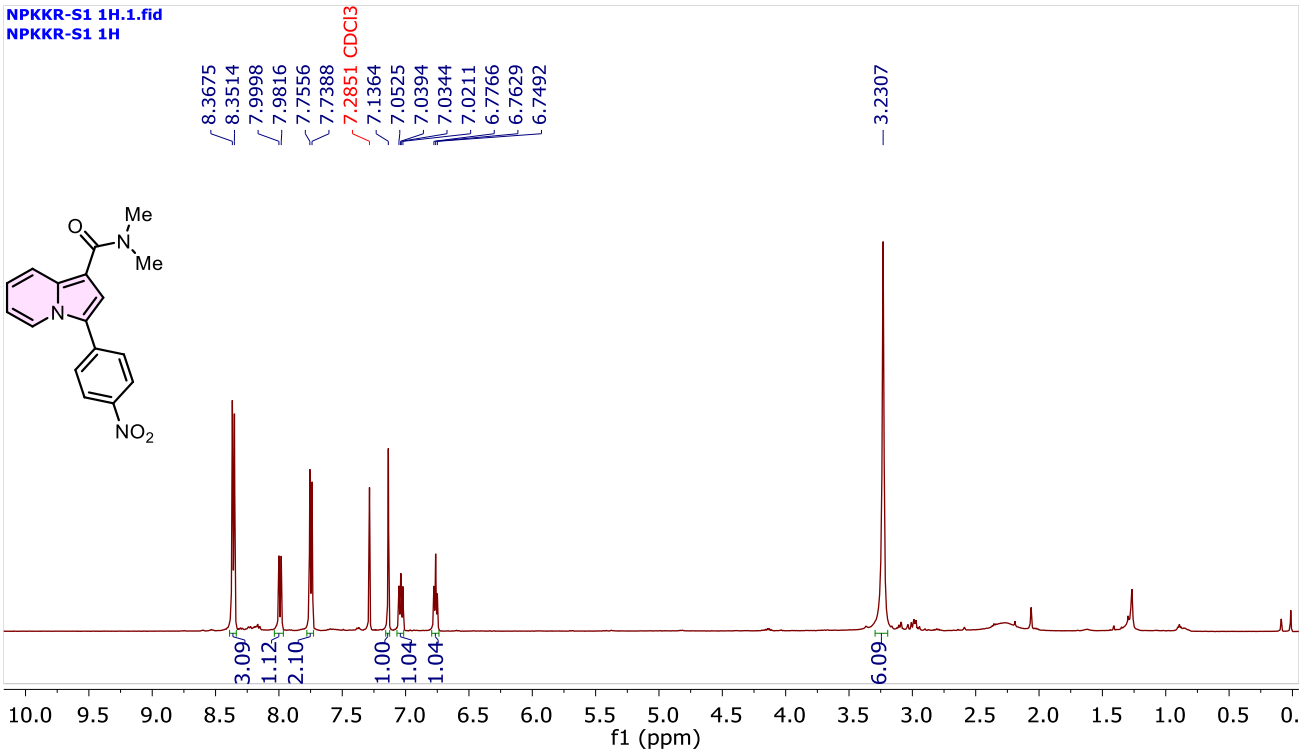
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-Dimethyl-3-(4-(trifluoromethyl)phenyl)indolizine-1-carboxamide **(1d).**



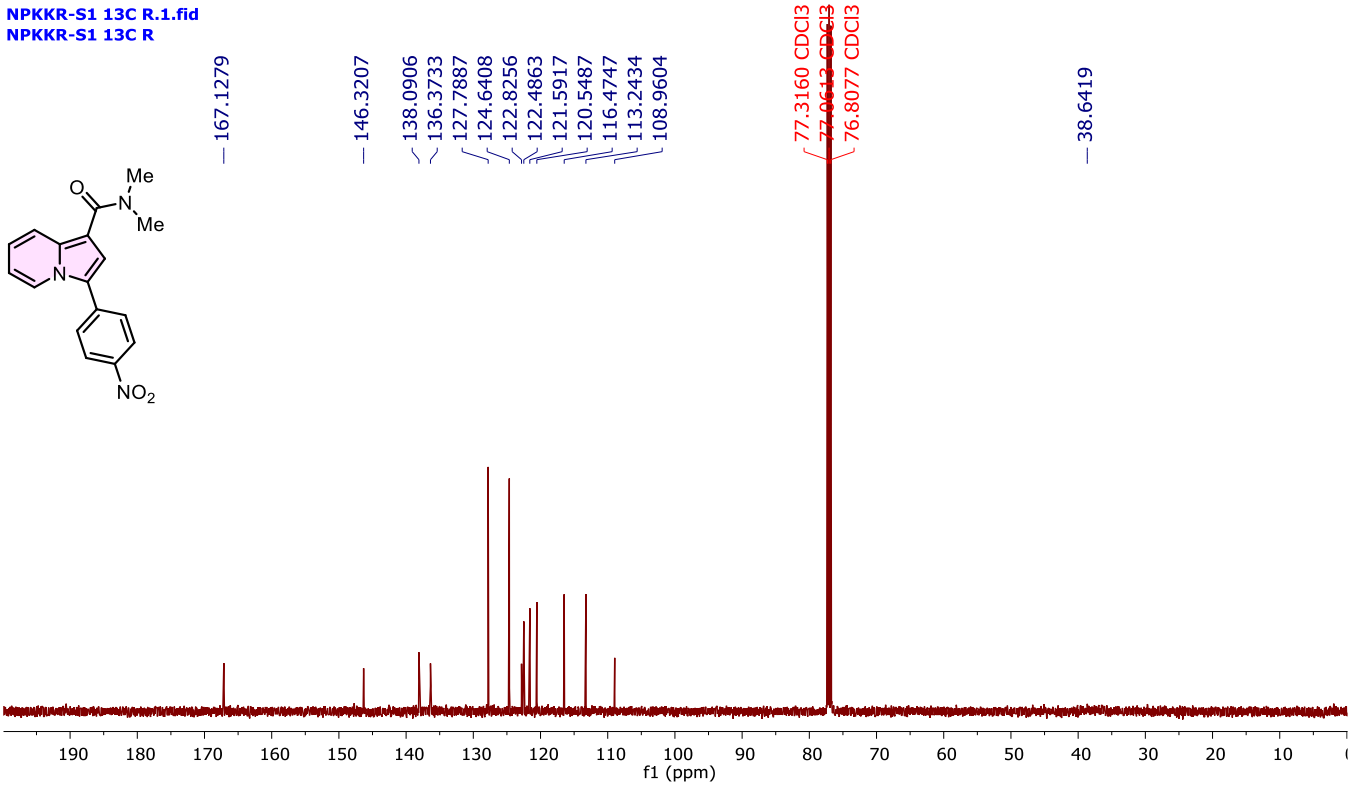
$^{13}C\{^{1}H\}$-NMR (125 MHz, $CDCl_3$) of N,N-Dimethyl-3-(4-(trifluoromethyl)phenyl)indolizine-1-carboxamide **(1d).**



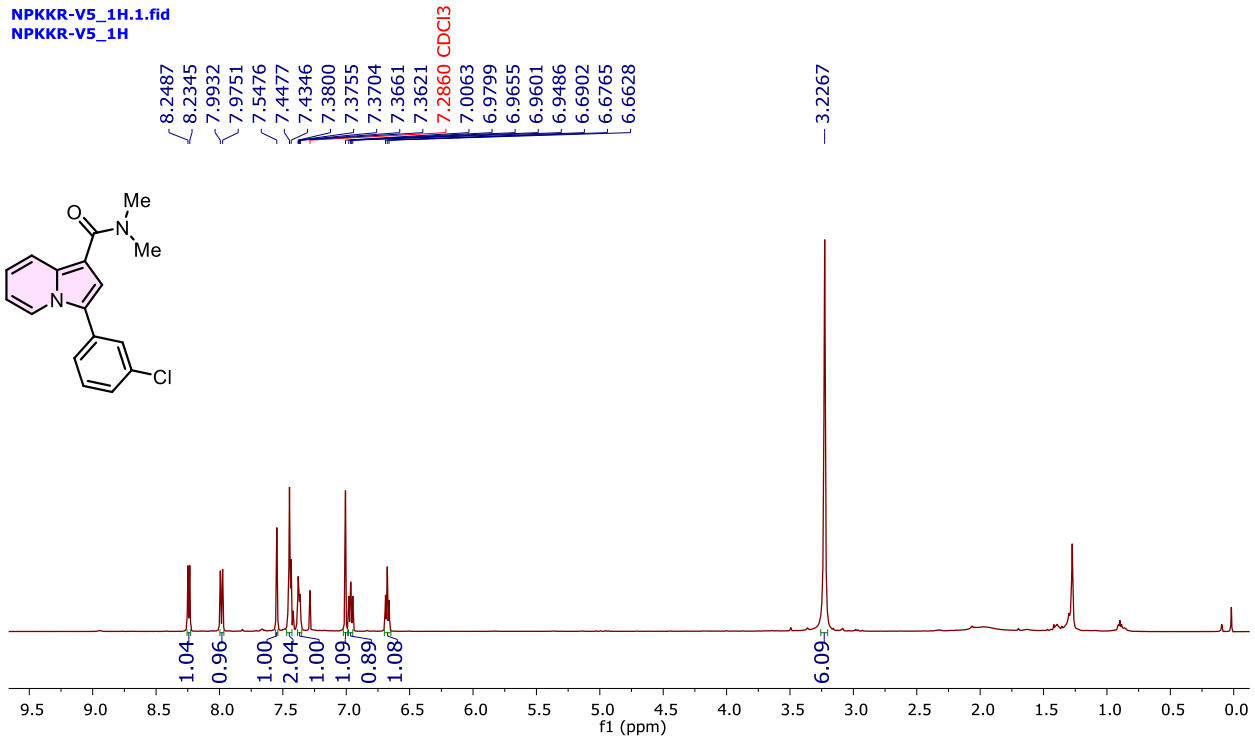
^{19}F-NMR (470 MHz, $CDCl_3$) of N,N-Dimethyl-3-(4-(trifluoromethyl)phenyl)indolizine-1-carboxamide **(1d).**



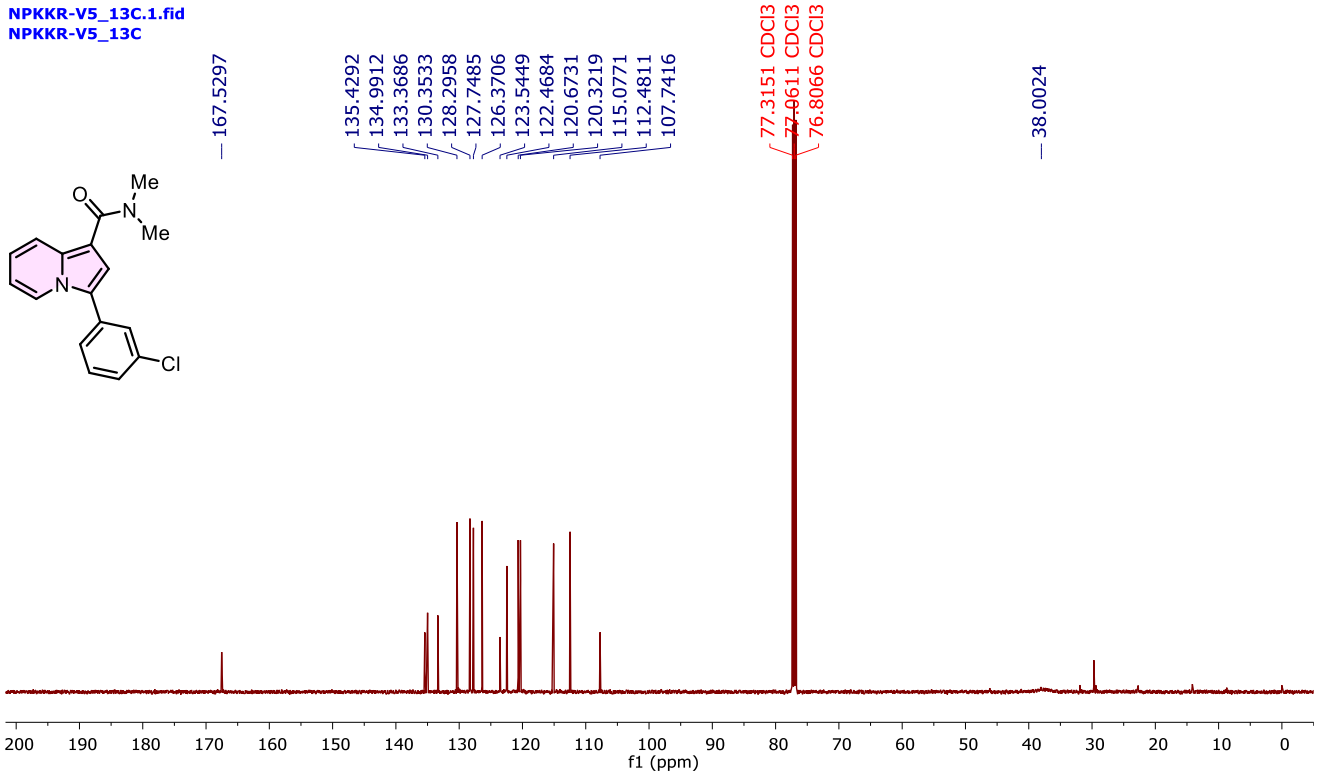
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-Dimethyl-3-(4-nitrophenyl)indolizine-1-carboxamide. **(1e)**



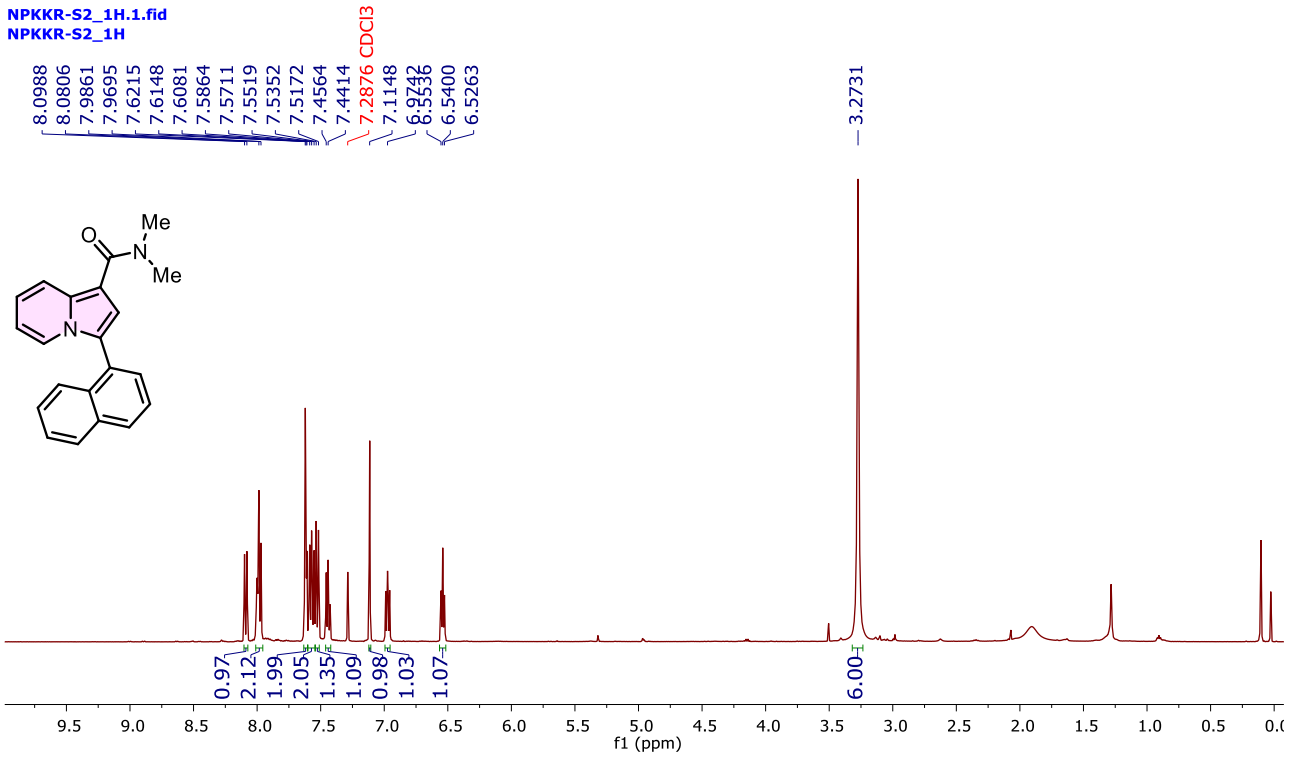
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of N,N-Dimethyl-3-(4-nitrophenyl)indolizine-1-carboxamide. **(1e)**



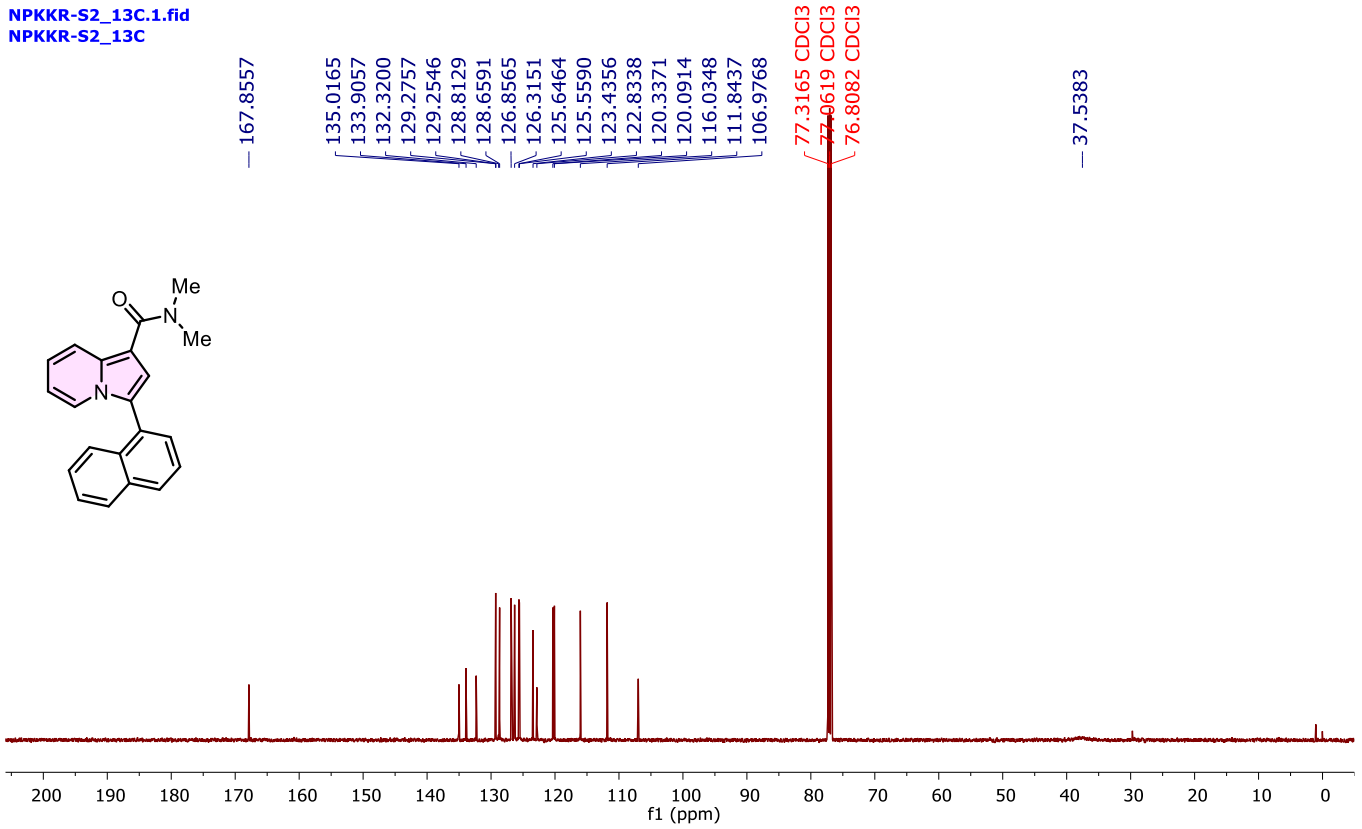
^{1}H-NMR (500 MHz, $CDCl_3$) of 3-(3-Chlorophenyl)-N,N-dimethylindolizine-1-carboxamide **(1f)**.



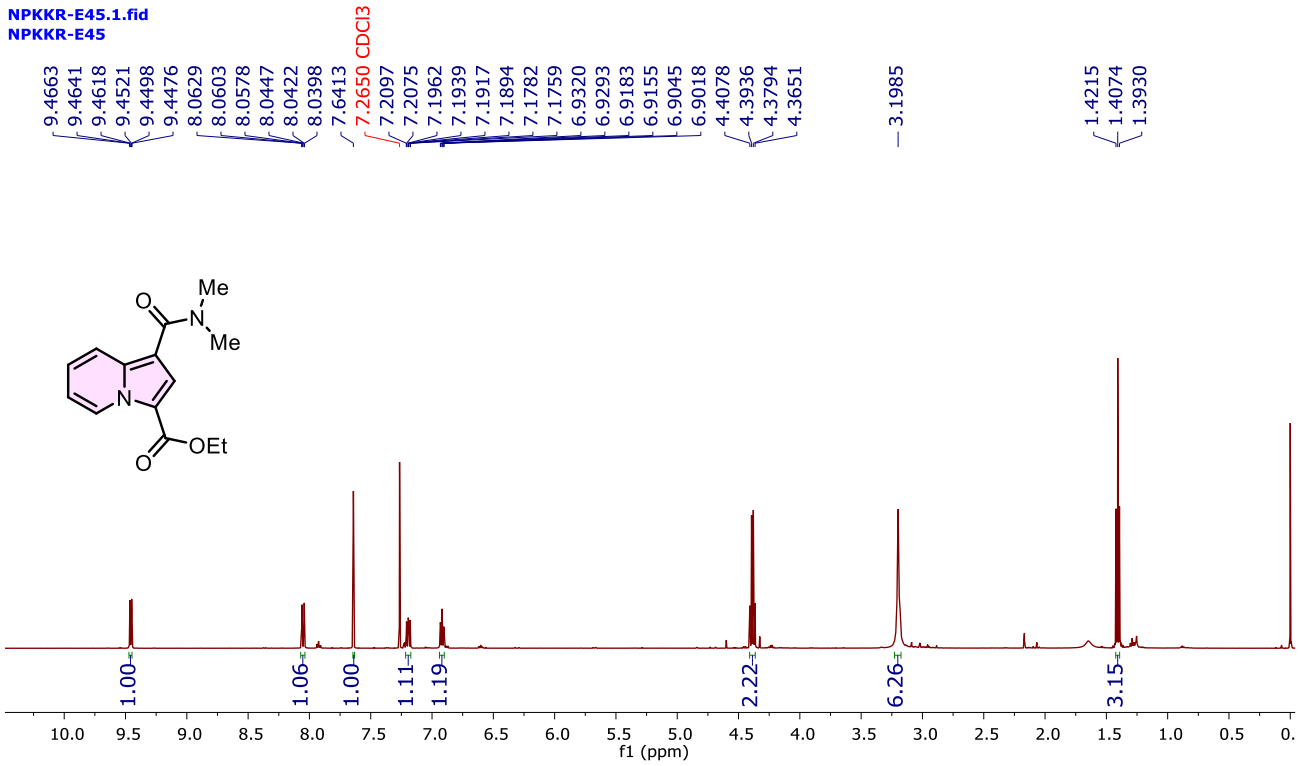
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of 3-(3-Chlorophenyl)-N,N-dimethylindolizine-1-carboxamide **(1f)**.



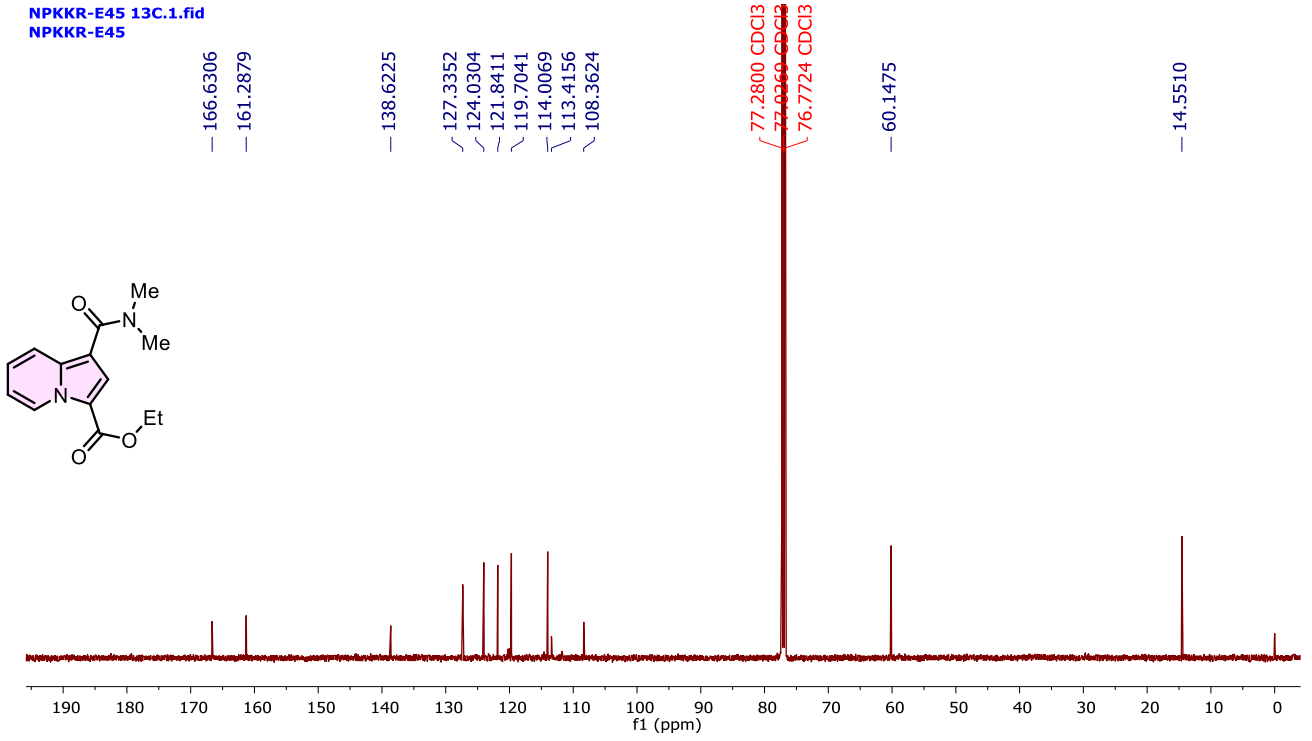
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-Dimethyl-3-(naphthalen-1-yl)indolizine-1-carboxamide **(1g).**



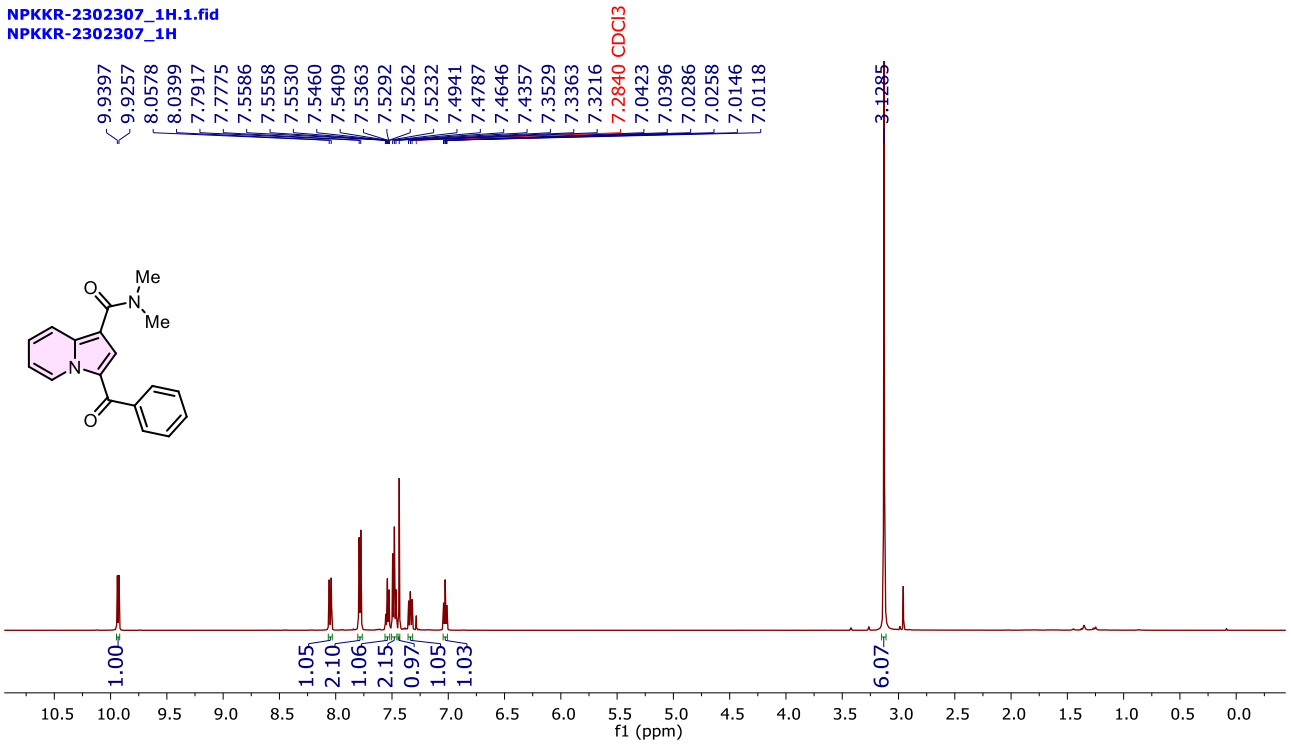
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of N,N-Dimethyl-3-(naphthalen-1-yl)indolizine-1-carboxamide **(1g).**



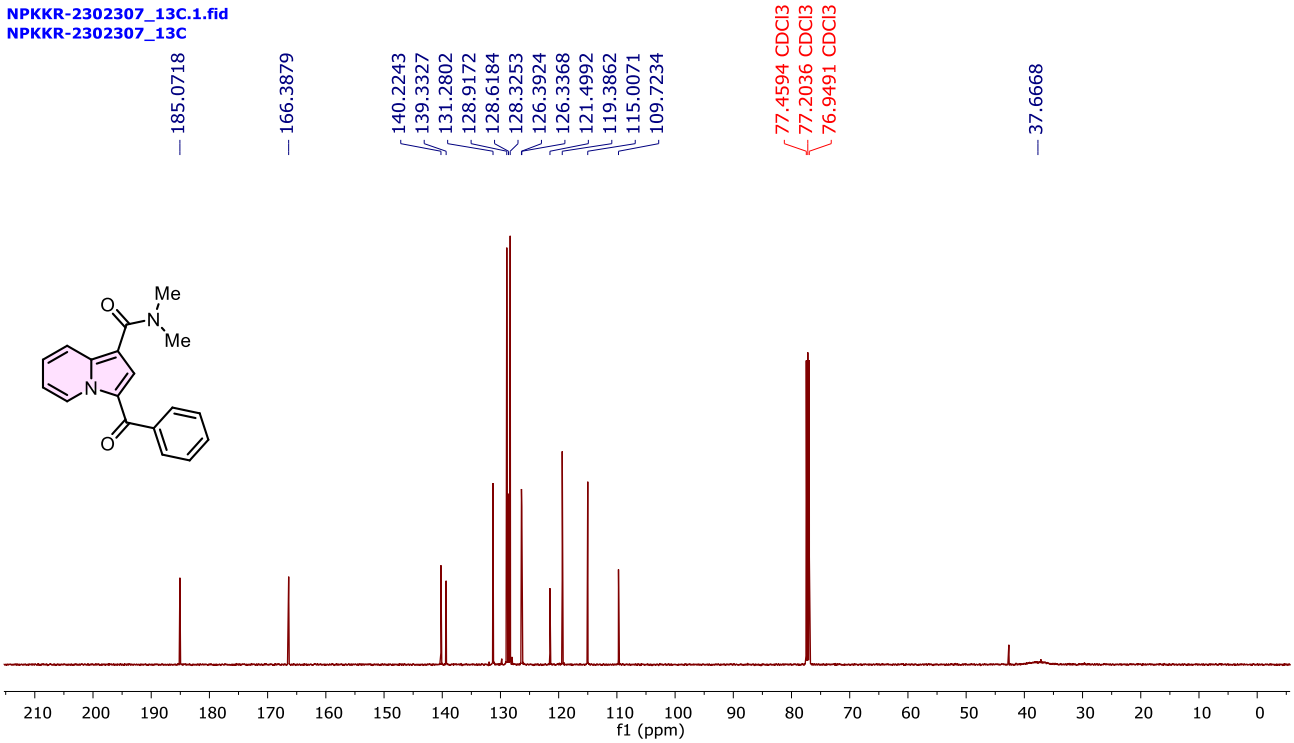
^{1}H-NMR (500 MHz, $CDCl_3$) of Ethyl 1-(dimethyl carbamoyl)indolizine-3-carboxylate. **(1h)**



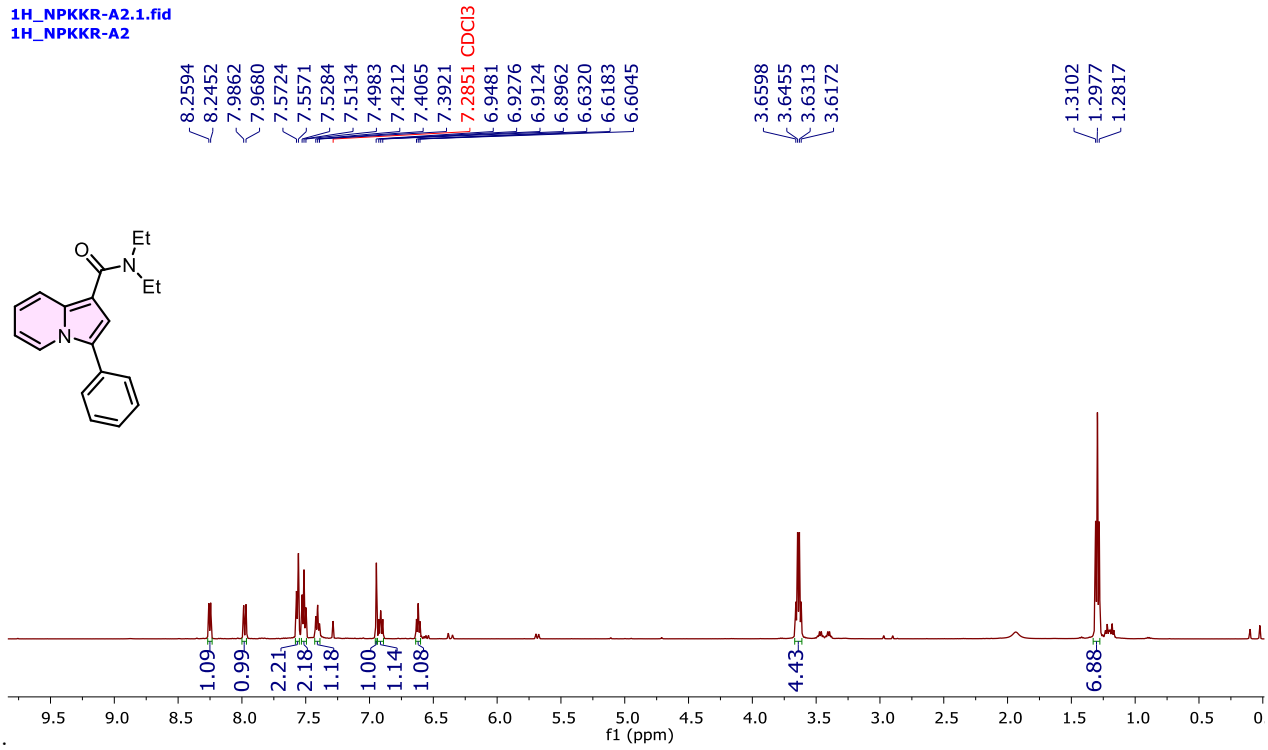
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of Ethyl 1-(dimethyl carbamoyl)indolizine-3-carboxylate. **(1h)**



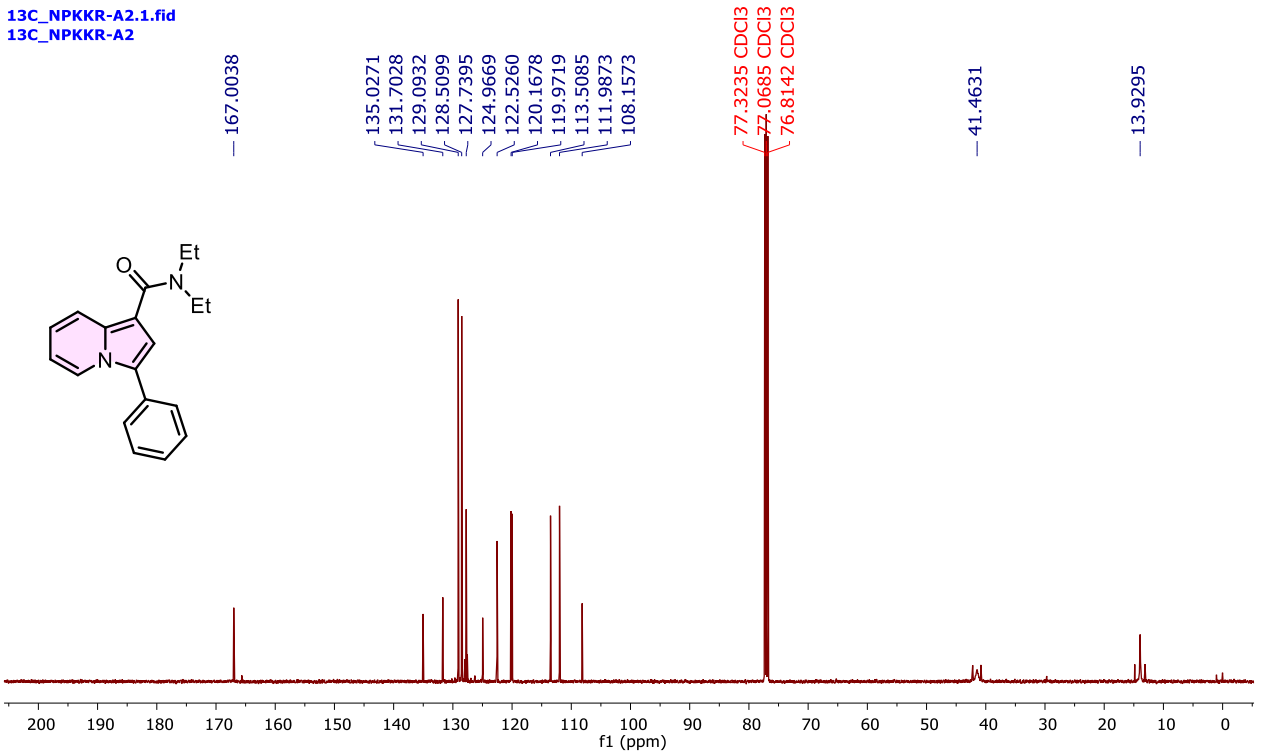
^{1}H-NMR (500 MHz, $CDCl_3$) of 3-Benzoyl-N,N-dimethylindolizine-1-carboxamide **(1i).**



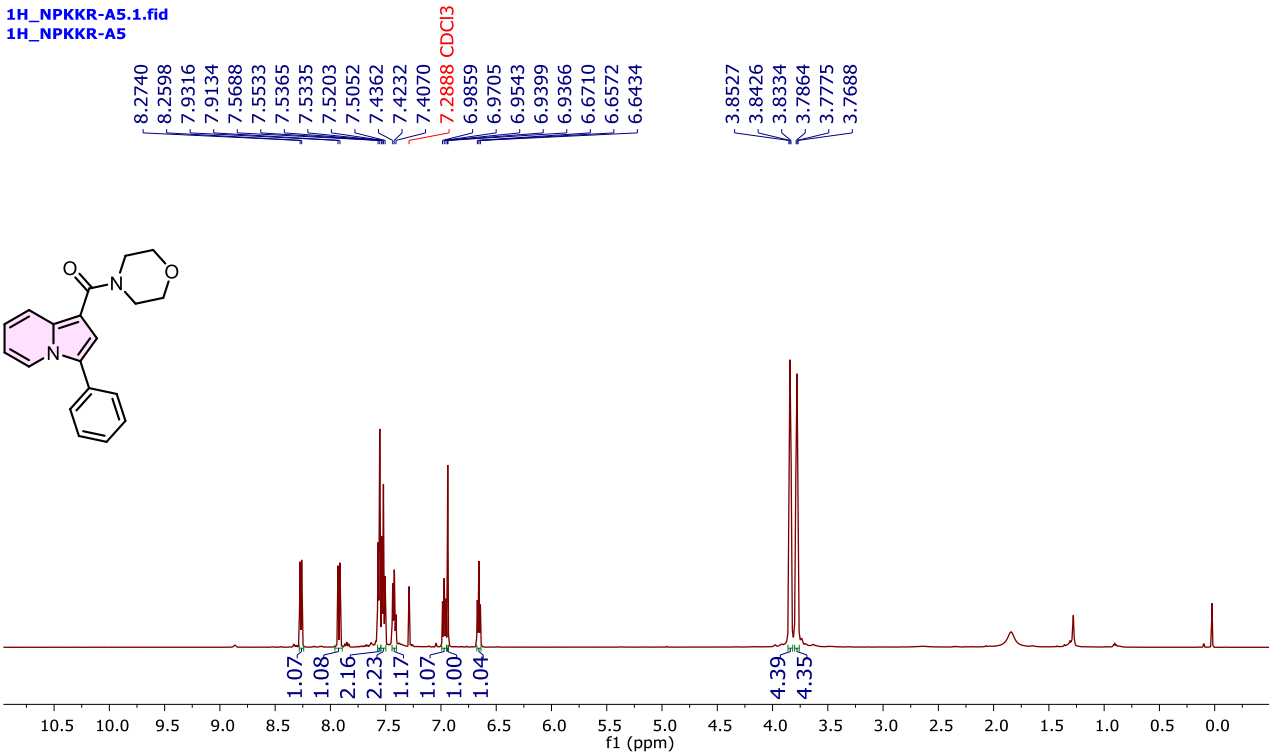
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of 3-Benzoyl-N,N-dimethylindolizine-1-carboxamide **(1i).**



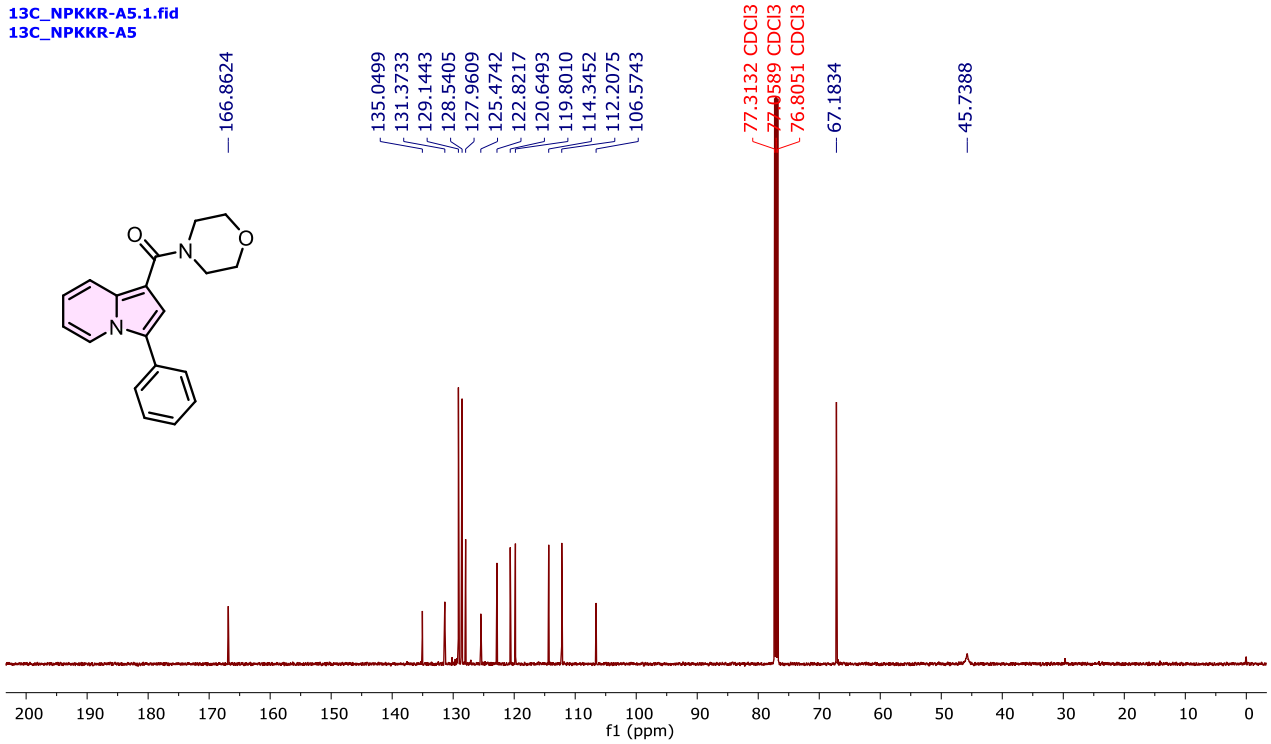
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-Diethyl-3-phenylindolizine-1-carboxamide **(1j)**.



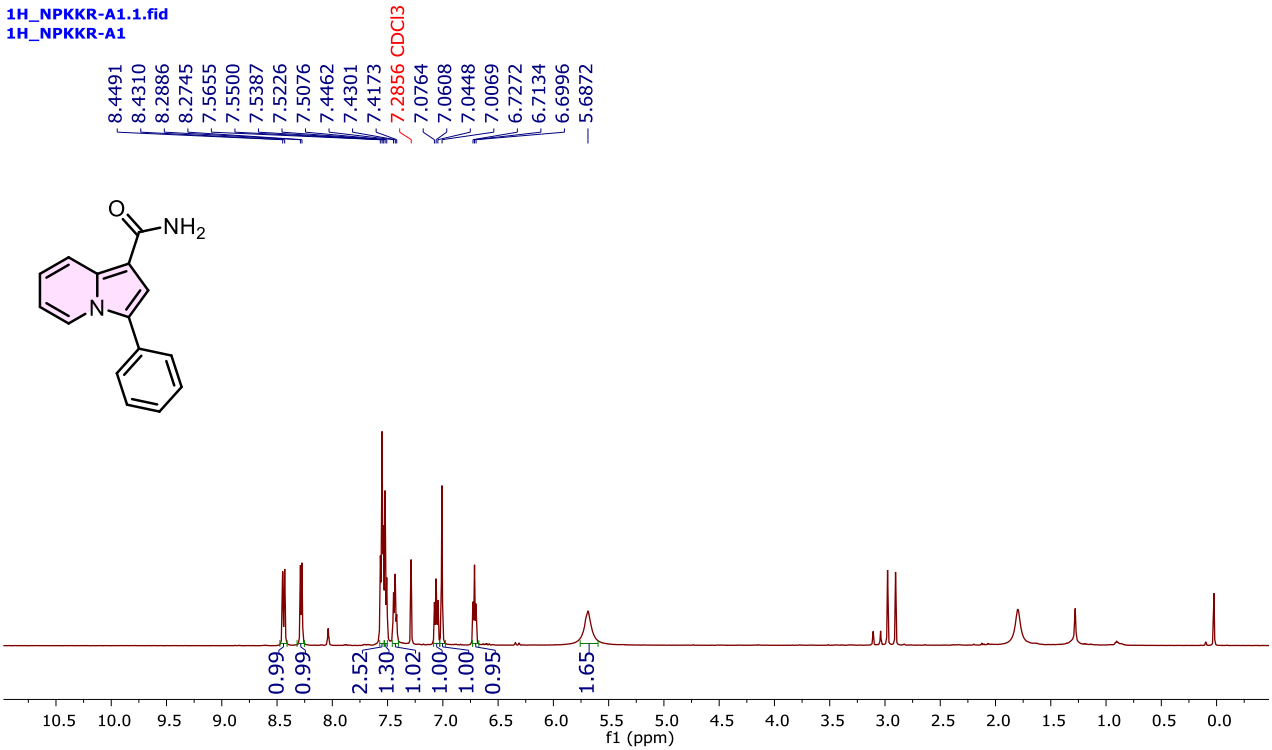
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of N,N-Diethyl-3-phenylindolizine-1-carboxamide **(1j)**.



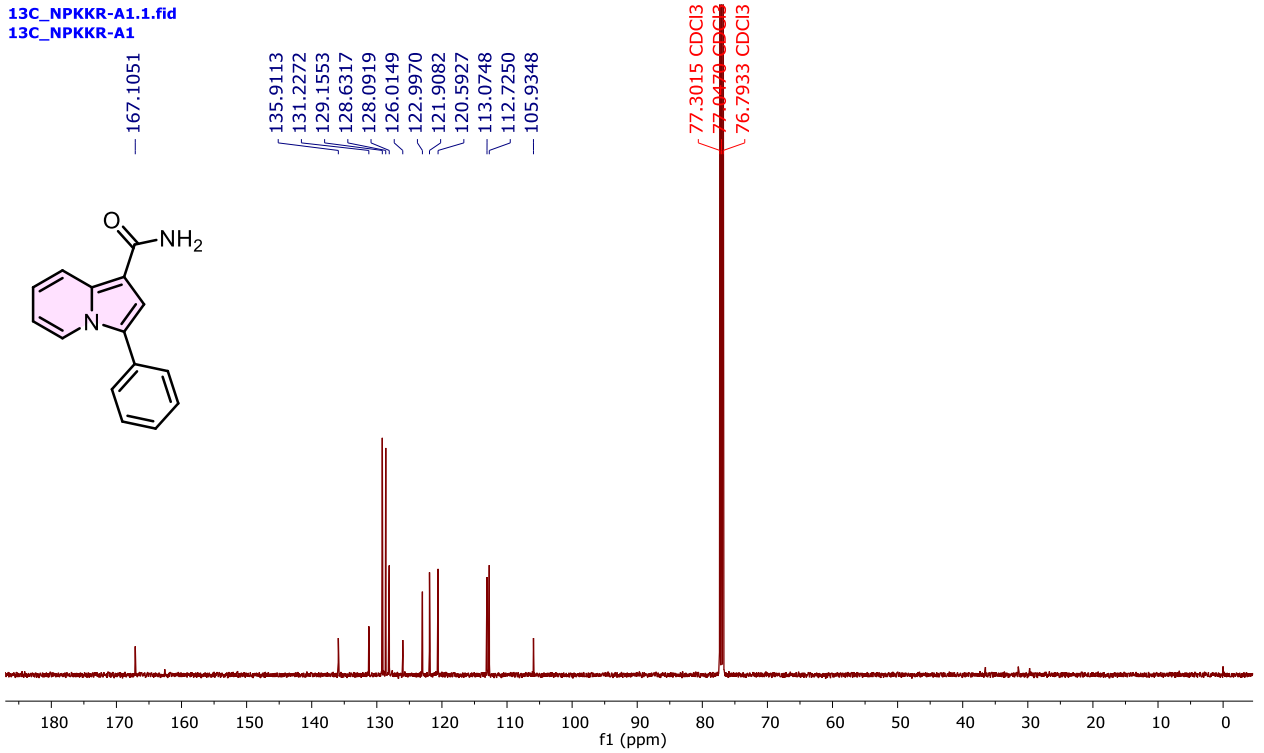
^{1}H-NMR (500 MHz, $CDCl_3$) of Morpholino(3-phenylindolizin-1-yl)methanone. **(1k)**



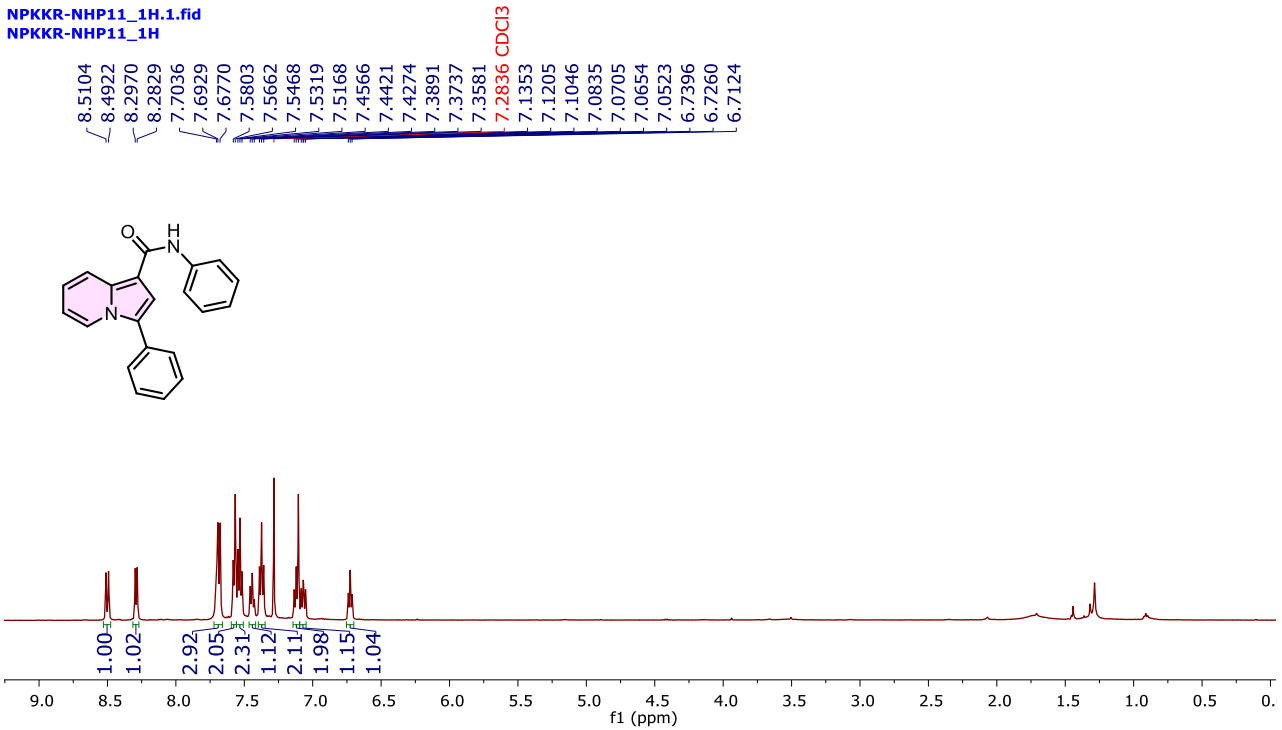
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of Morpholino(3-phenylindolizin-1-yl)methanone. **(1k)**



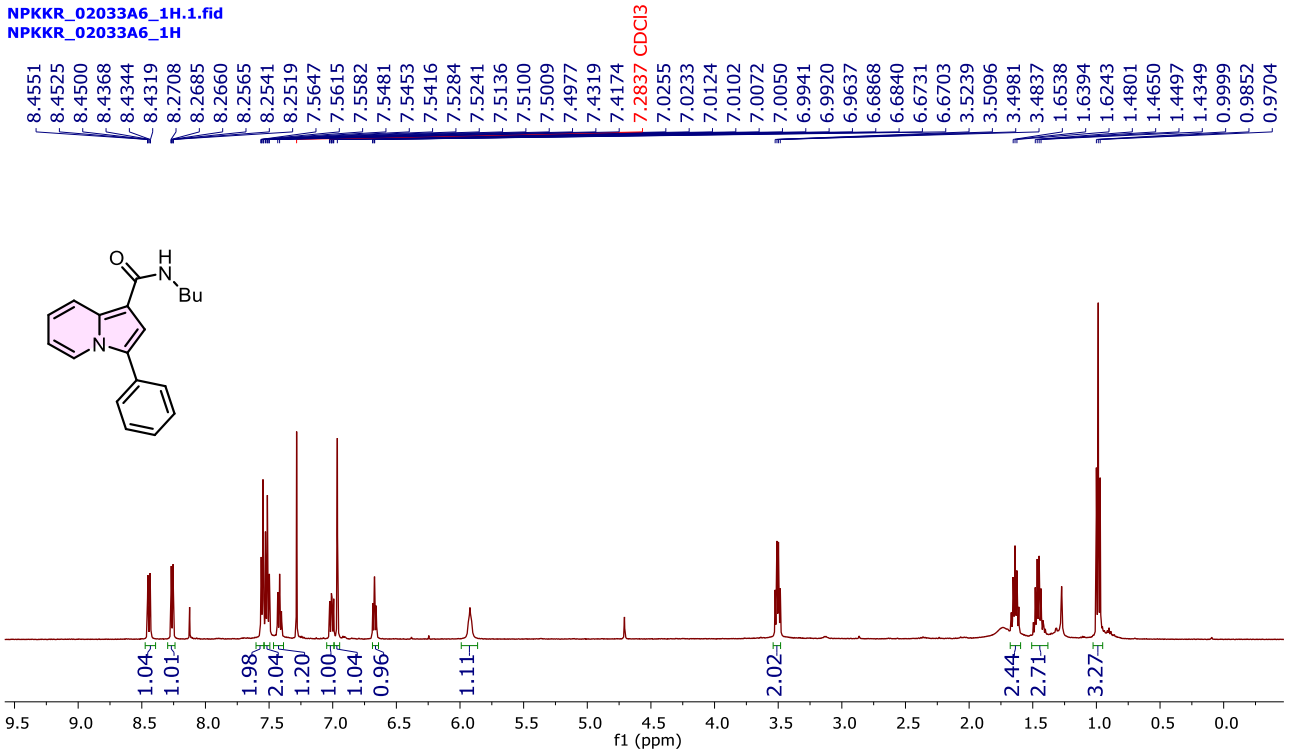
^{1}H-NMR (500 MHz, $CDCl_3$) of 3-Phenylindolizine-1-carboxamide. **(1l)**



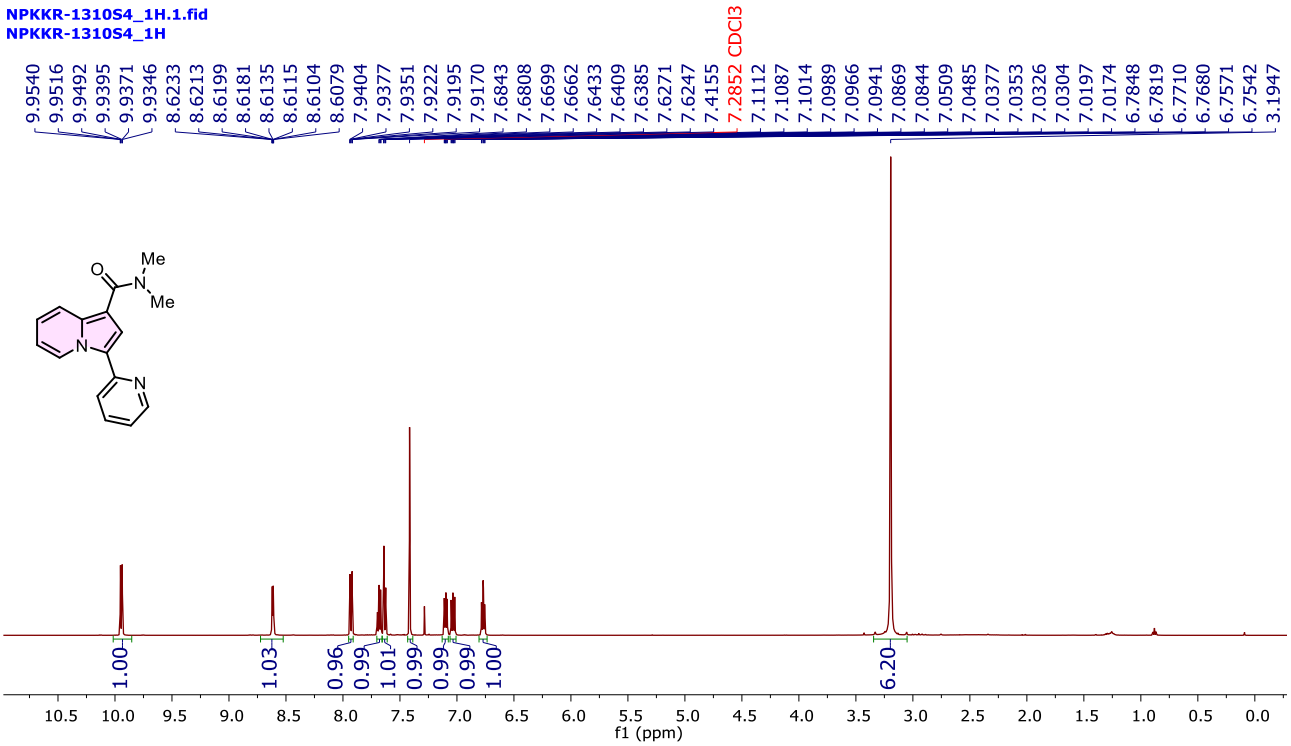
^{13}C{^{1}H}-NMR (500 MHz, $CDCl_3$) of 3-Phenylindolizine-1-carboxamide. **(1l)**



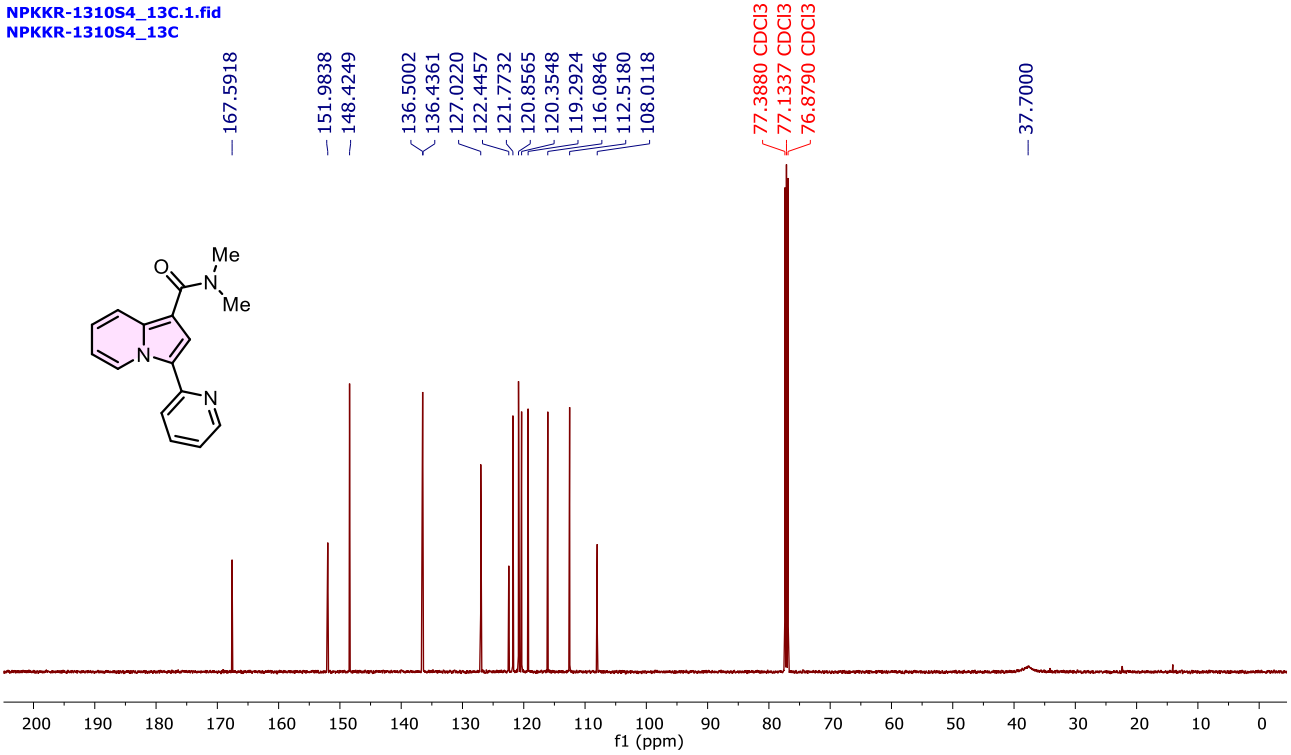
^{1}H-NMR (500 MHz, $CDCl_3$) of N,3-diphenylindolizine-1-carboxamide **(1m).**



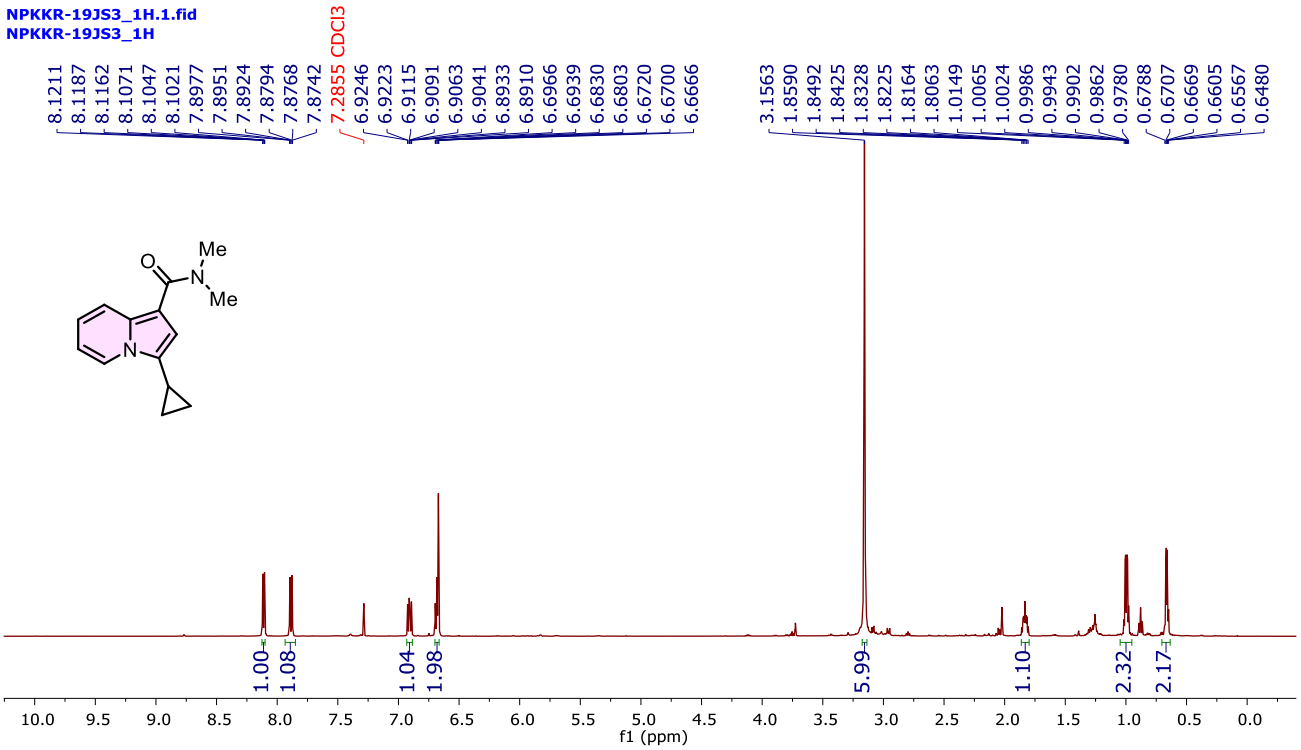
^{1}H-NMR (500 MHz, $CDCl_3$) of N-butyl-3-phenylindolizine-1-carboxamide **(1n)**



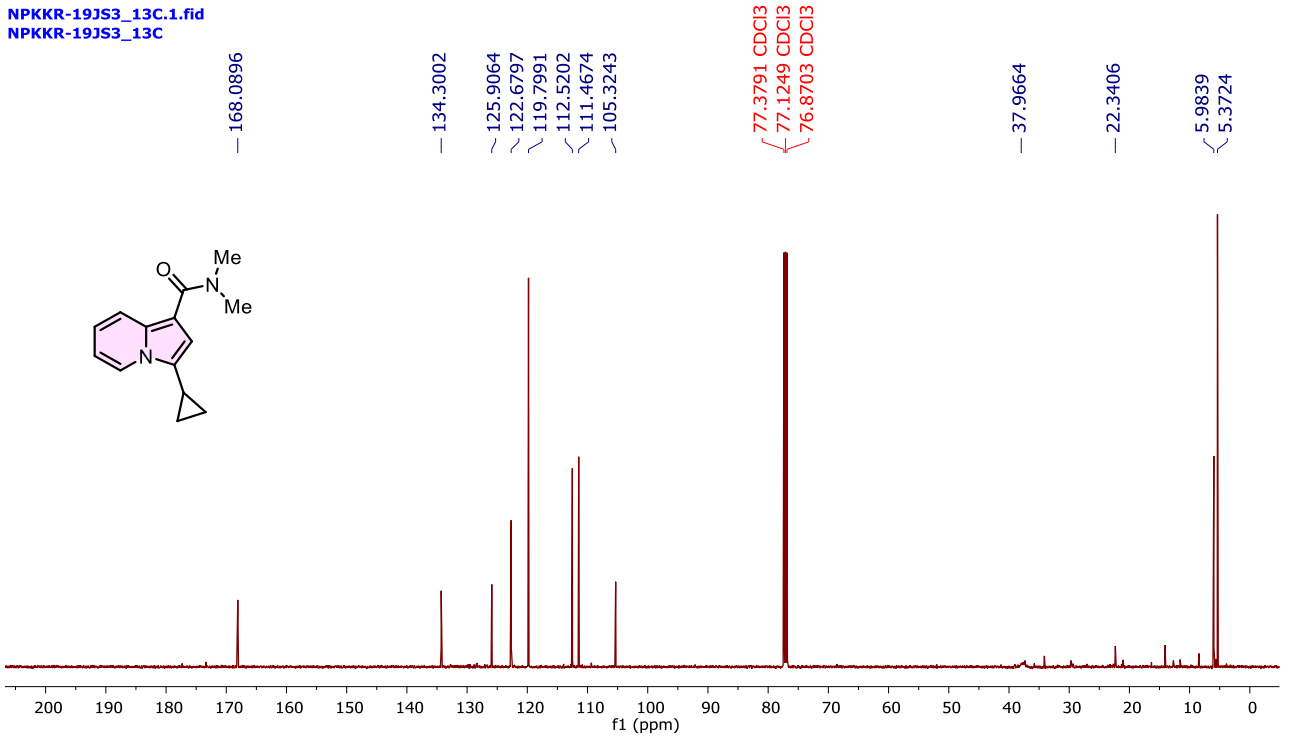
^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-dimethyl-3-(pyridin-2-yl)indolizine-1-carboxamide **(1o)**.



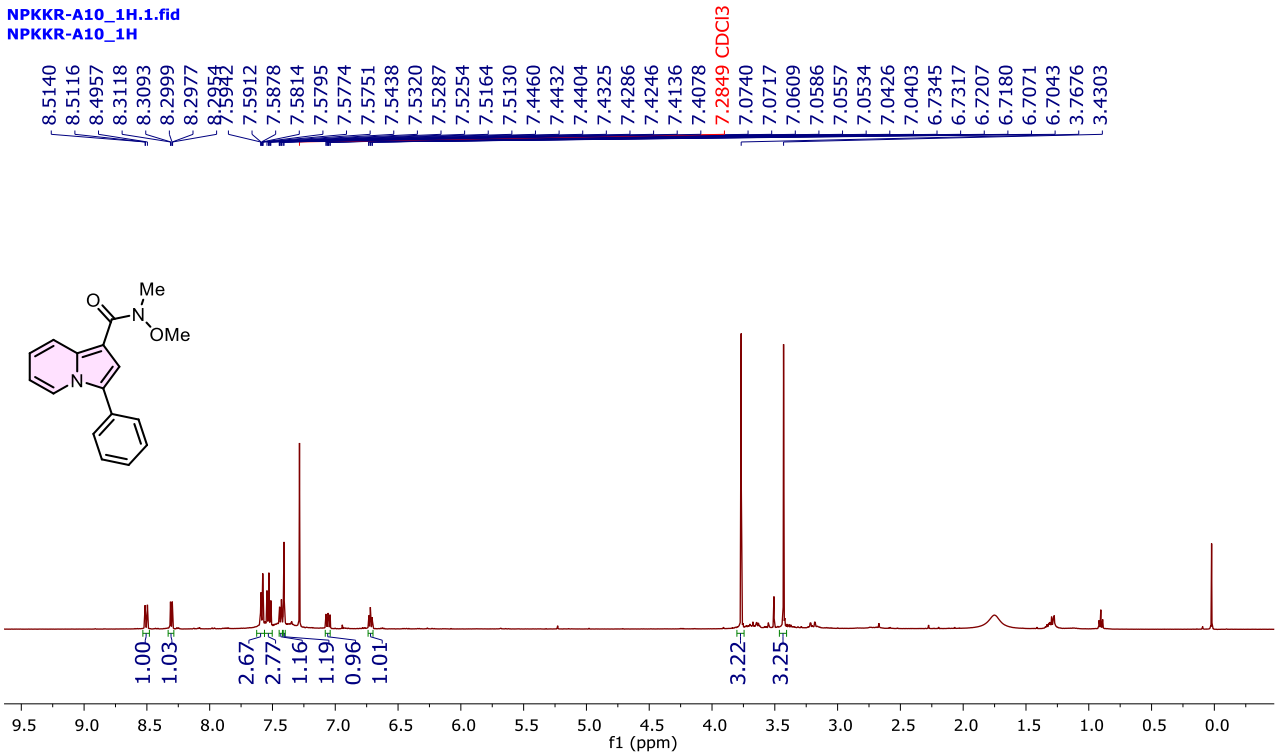
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of N,N-dimethyl-3-(pyridin-2-yl)indolizine-1-carboxamide **(1o)**.



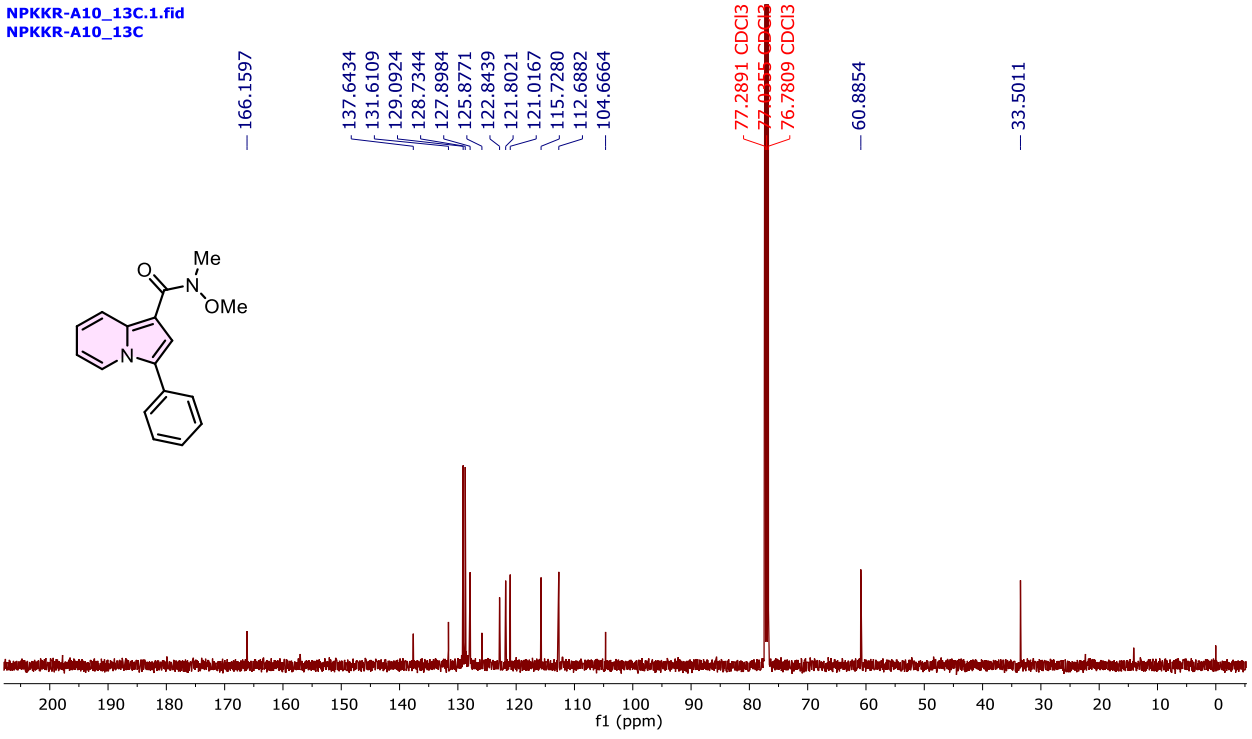
^{1}H-NMR (500 MHz, $CDCl_3$) of 3-Cyclopropyl-N,N-dimethylindolizine-1-carboxamide **(1p)**.



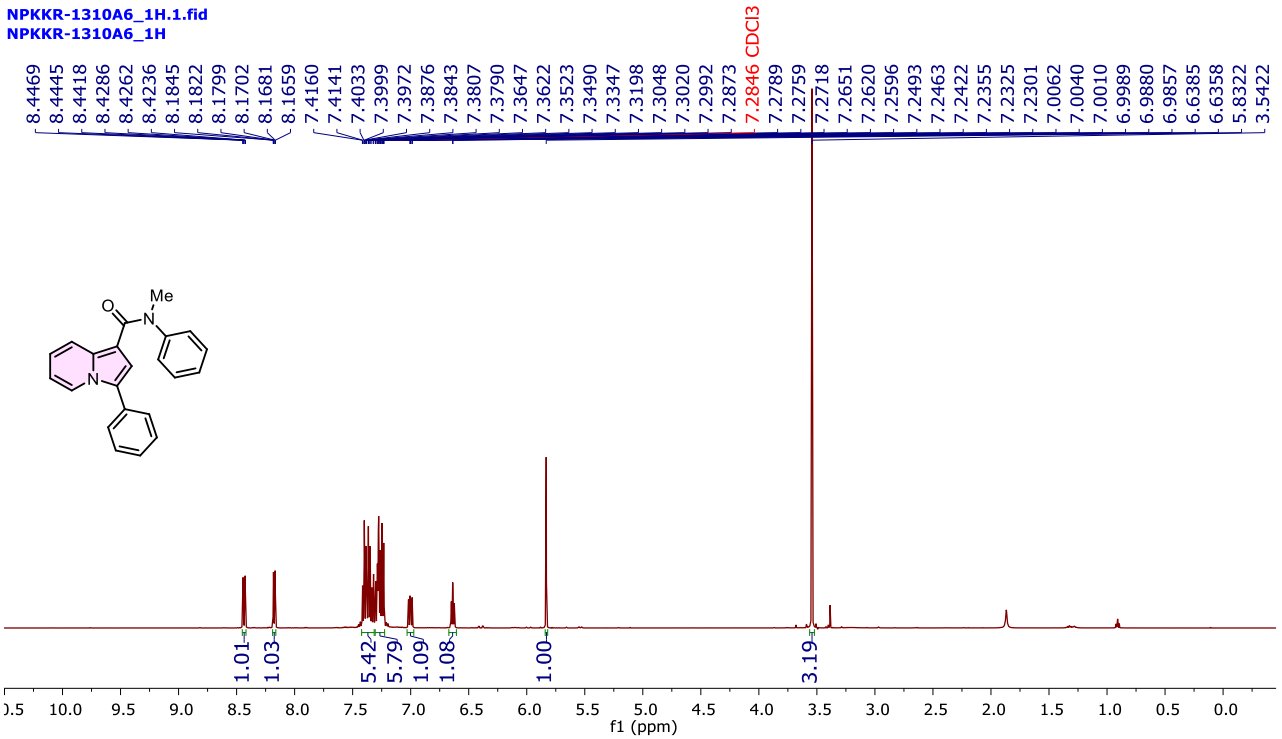
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of 3-Cyclopropyl-N,N-dimethylindolizine-1-carboxamide **(1p)**.



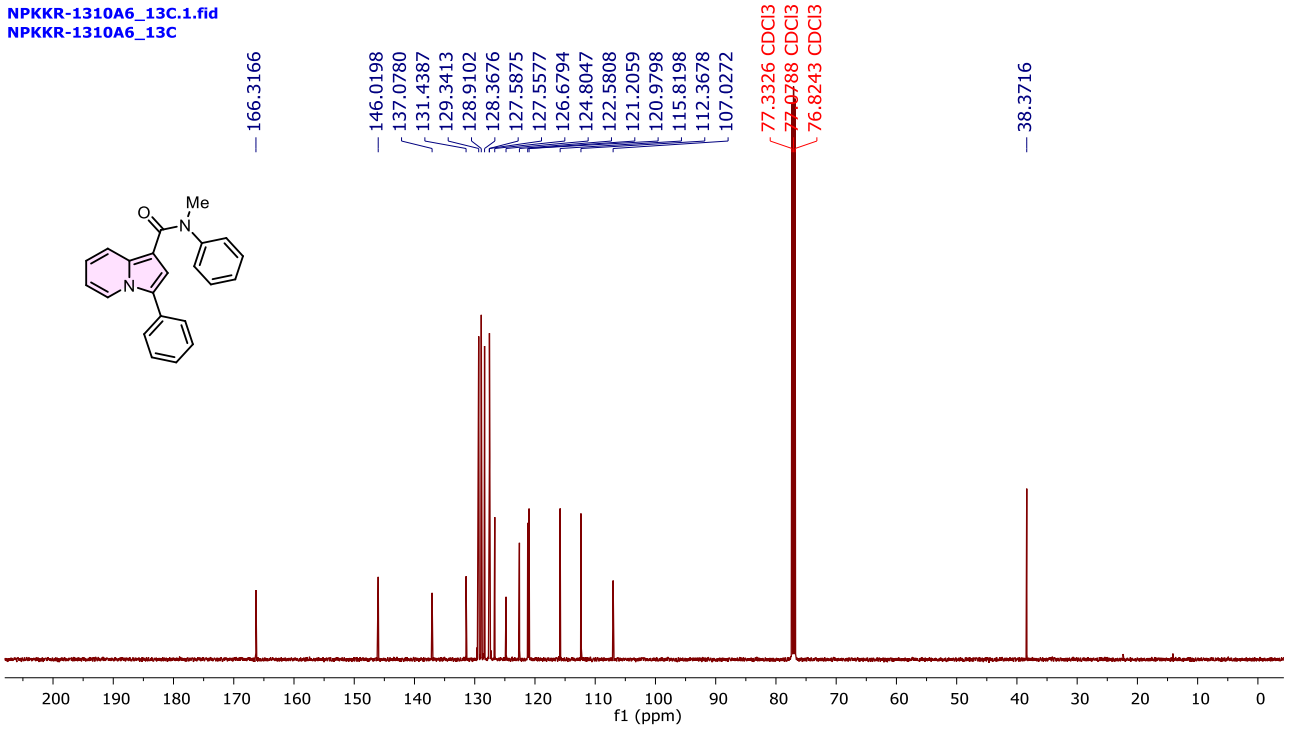
^{1}H-NMR (500 MHz, $CDCl_3$) of N-methoxy-N-methyl-3-phenylindolizine-1-carboxamide **(1q).**



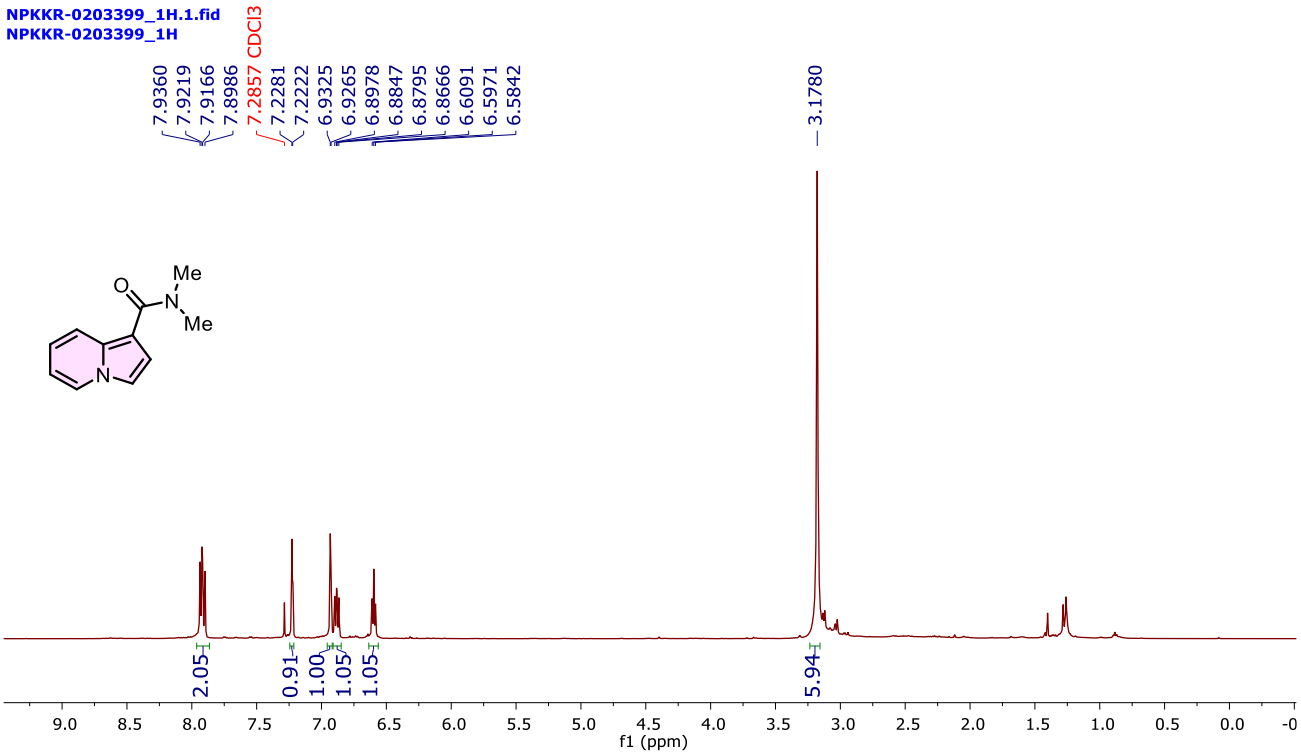
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of N-methoxy-N-methyl-3-phenylindolizine-1-carboxamide **(1q).**



^{1}H-NMR (500 MHz, $CDCl_3$) of N-methyl-N,3-diphenylindolizine-1-carboxamide **(1r).**

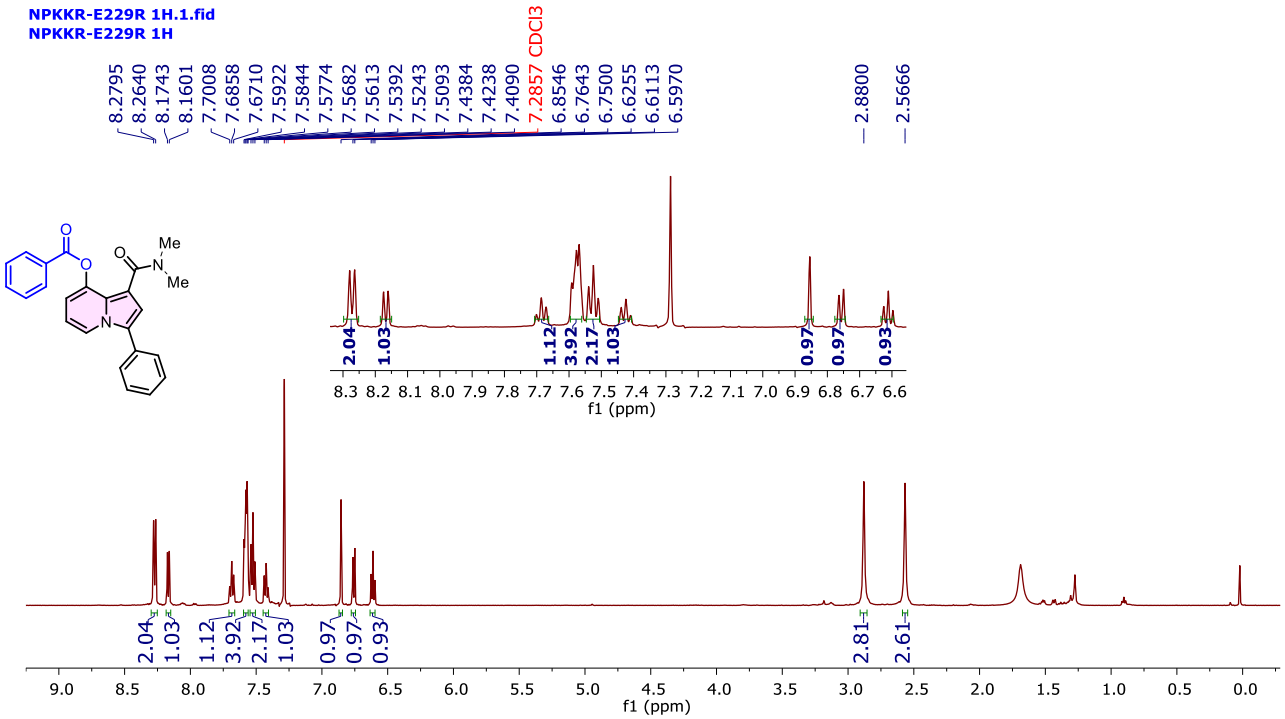


^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of N-methyl-N,3-diphenylindolizine-1-carboxamide **(1r).**

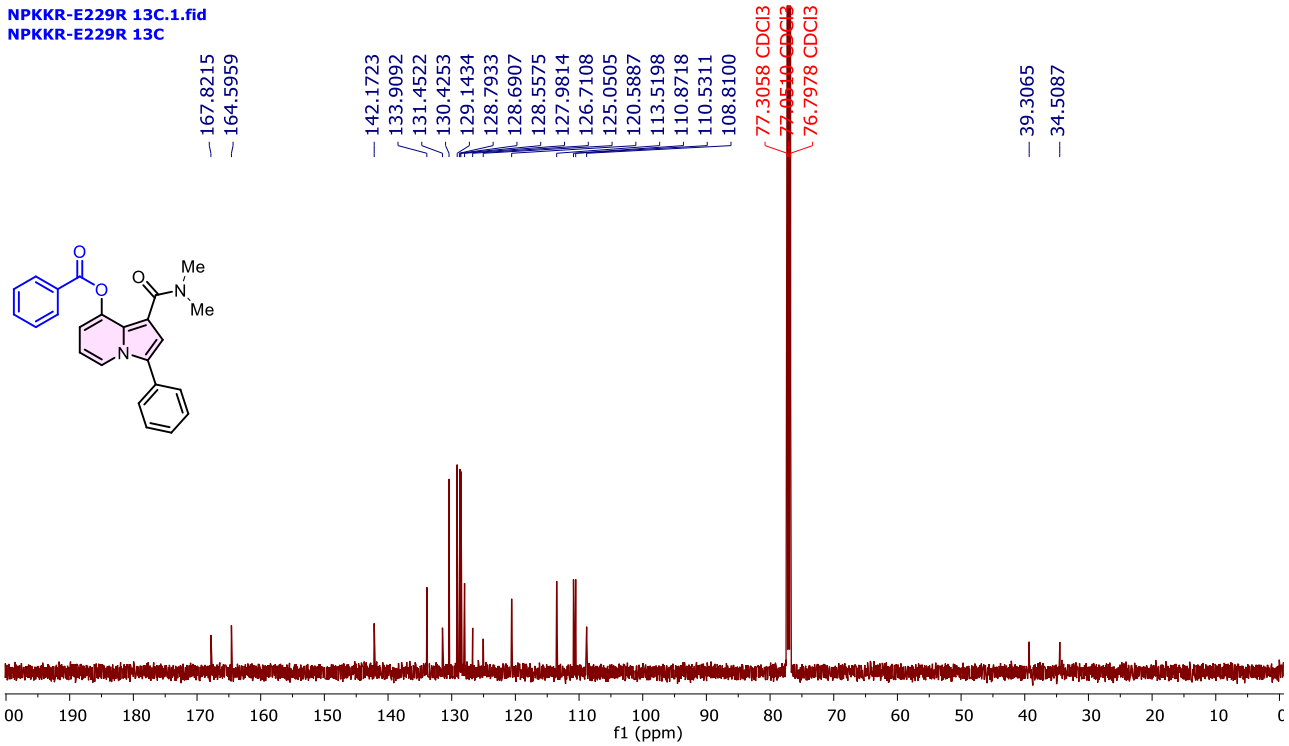


^{1}H-NMR (500 MHz, $CDCl_3$) of N,N-dimethylindolizine-1-carboxamide **(1s)**

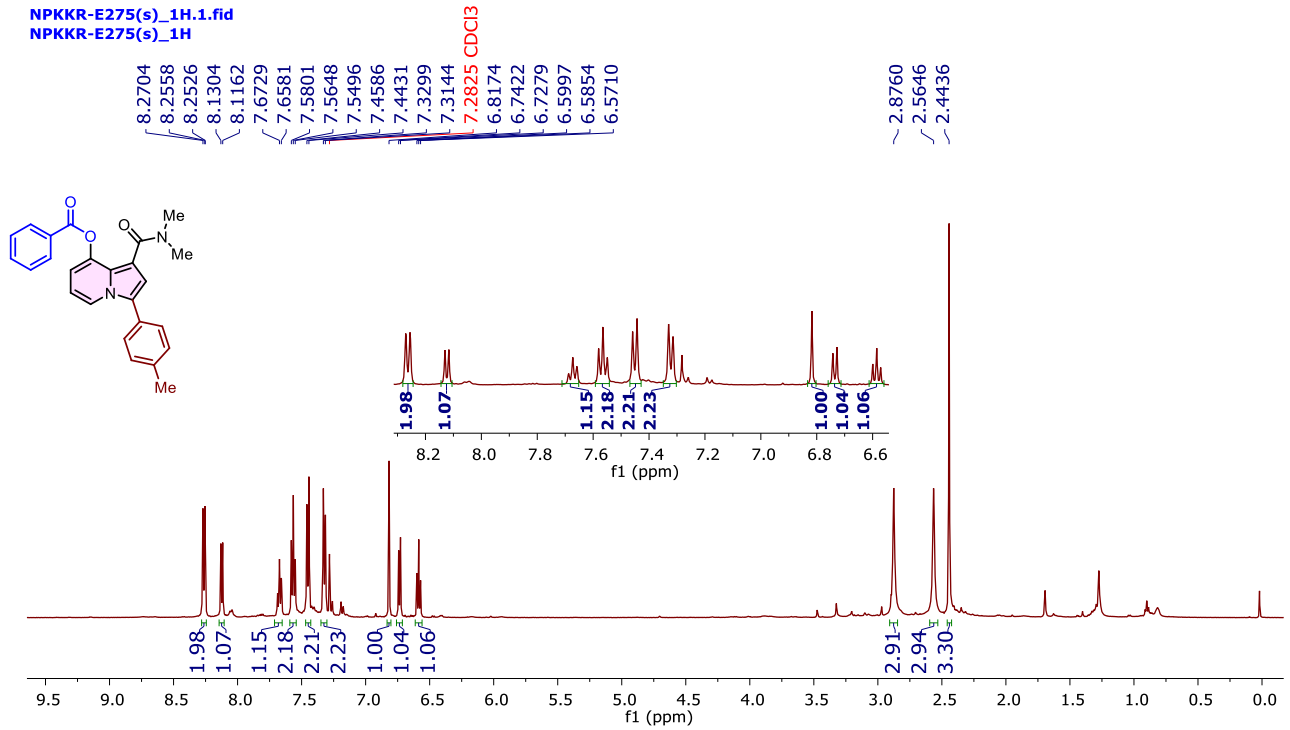
9. ^{1}H, $^{13}C\{^{1}H\}$, and ^{19}F NMR Spectra of C-8 Acyloxylated indolizines:



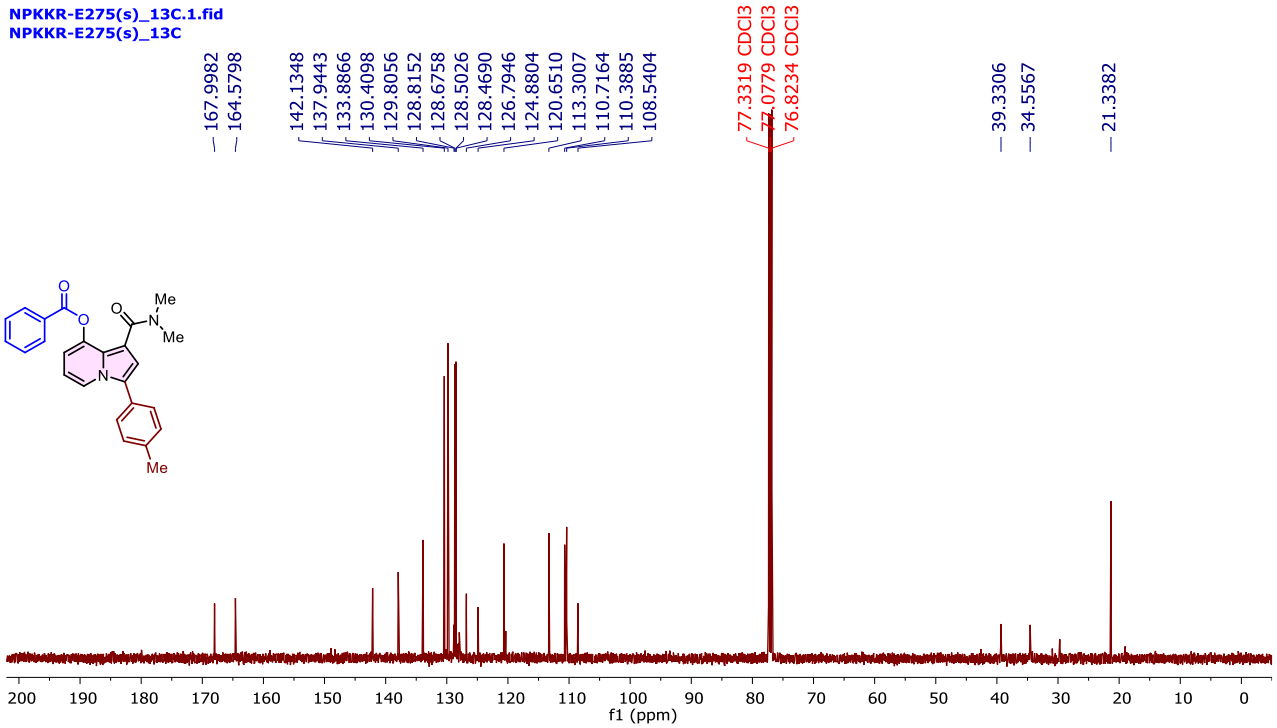
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl benzoate. **(3aa)**



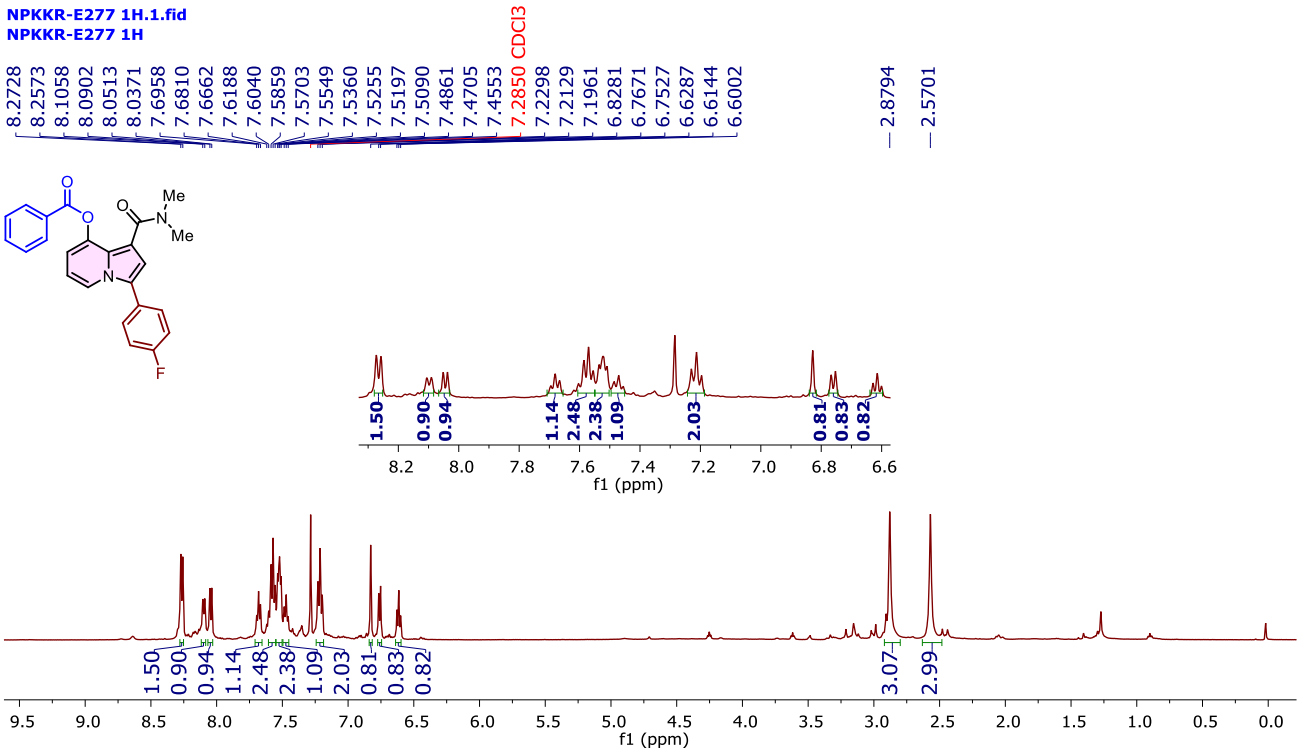
$^{13}C\{^{1}H\}$-NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl benzoate. **(3aa)**



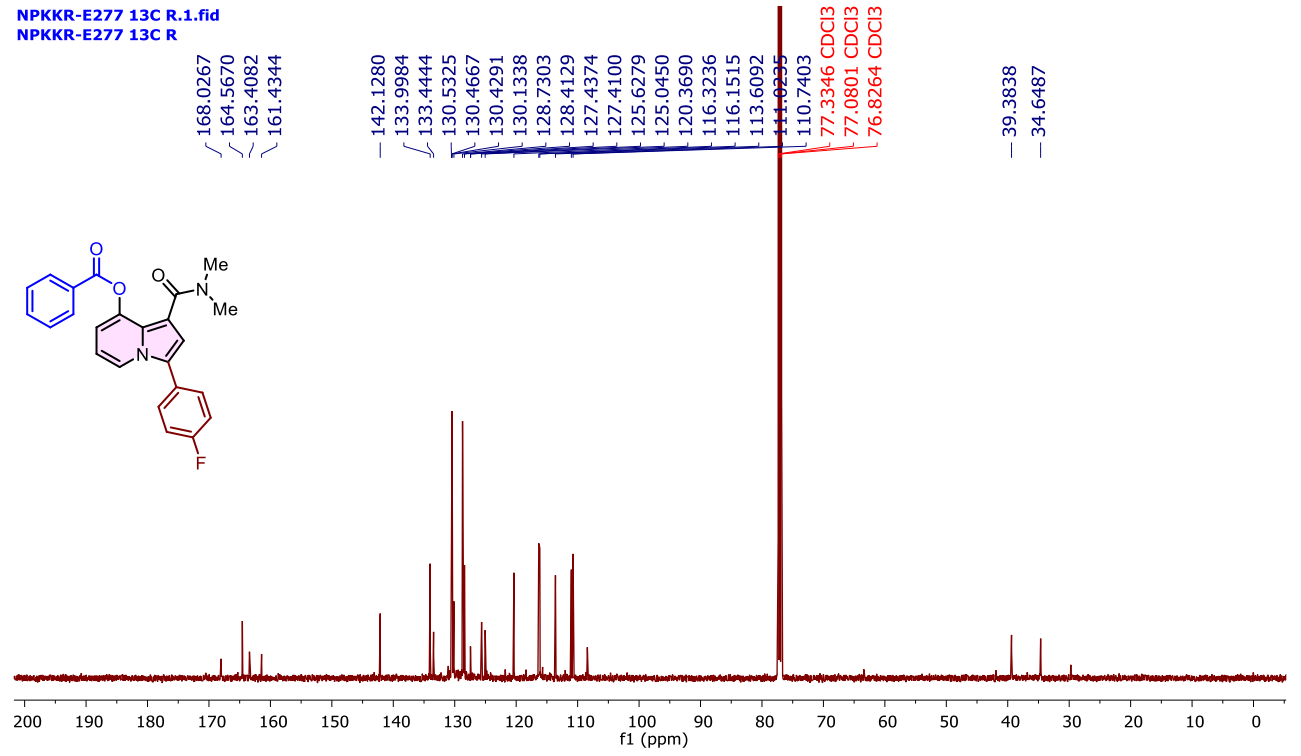
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(dimethylcarbamoyl)-3-(p-tolyl) indolizin-8-yl benzoate **(3ba)**



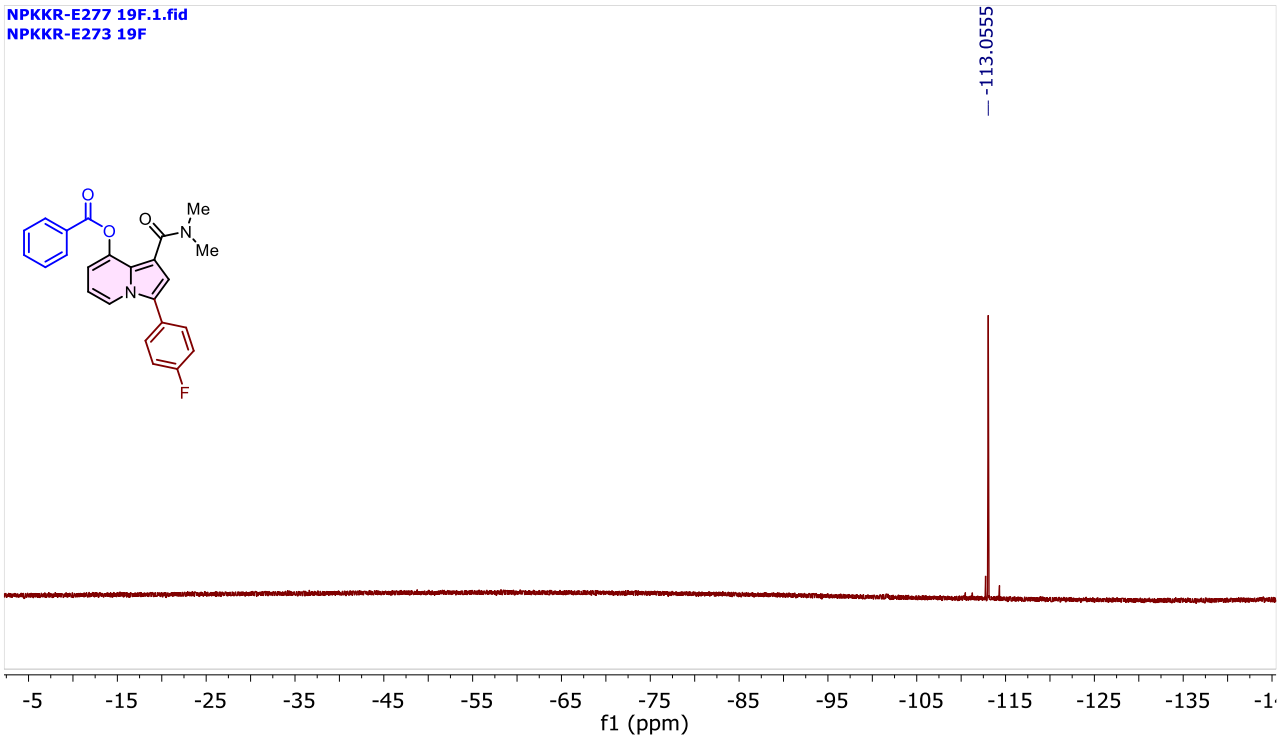
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(dimethylcarbamoyl)-3-(p-tolyl) indolizin-8-yl benzoate **(3ba)**



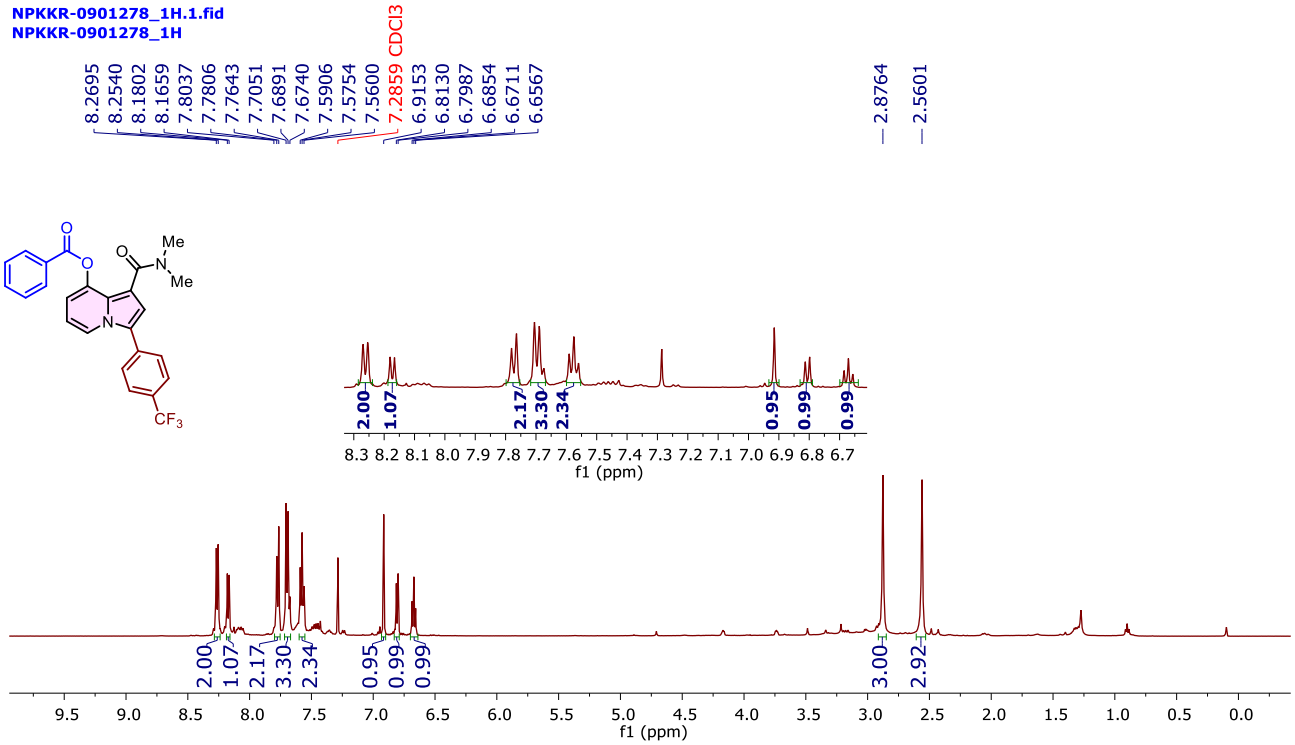
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-fluorophenyl) indolizin-8-yl benzoate **(3ca).**



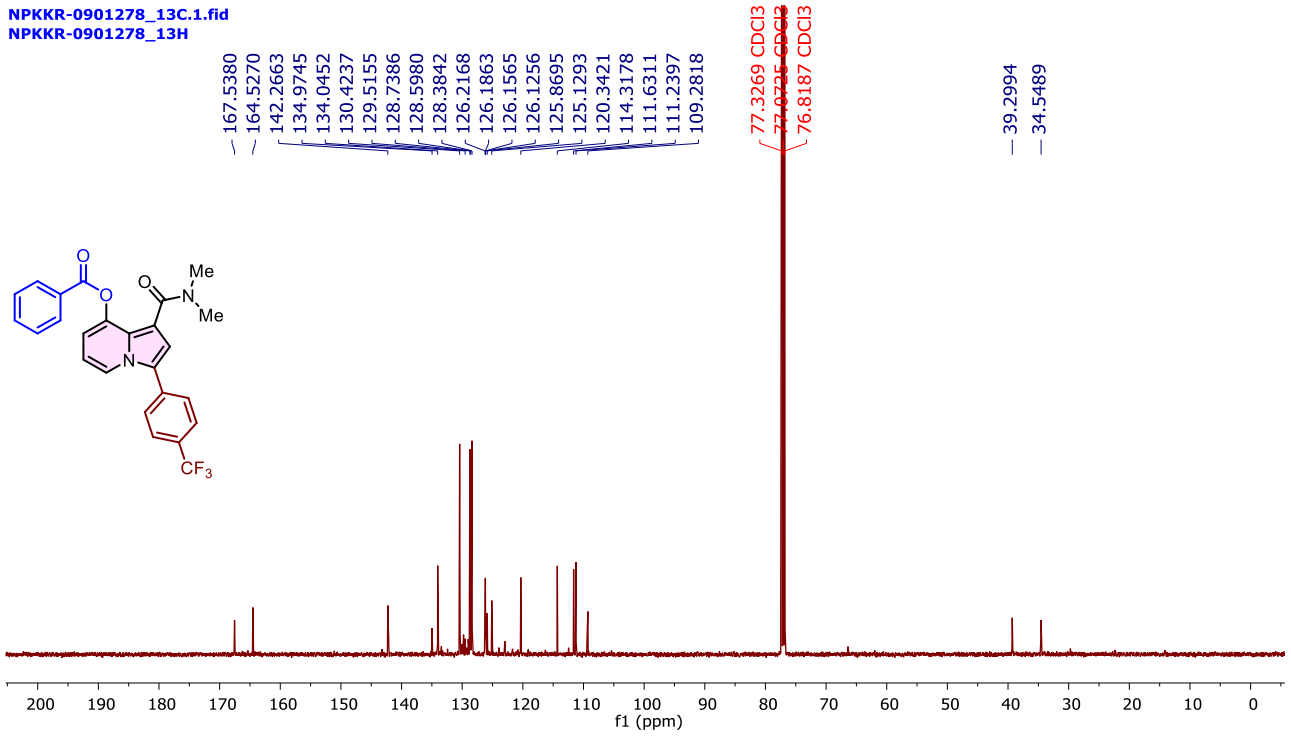
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-fluorophenyl) indolizin-8-yl benzoate **(3ca).**



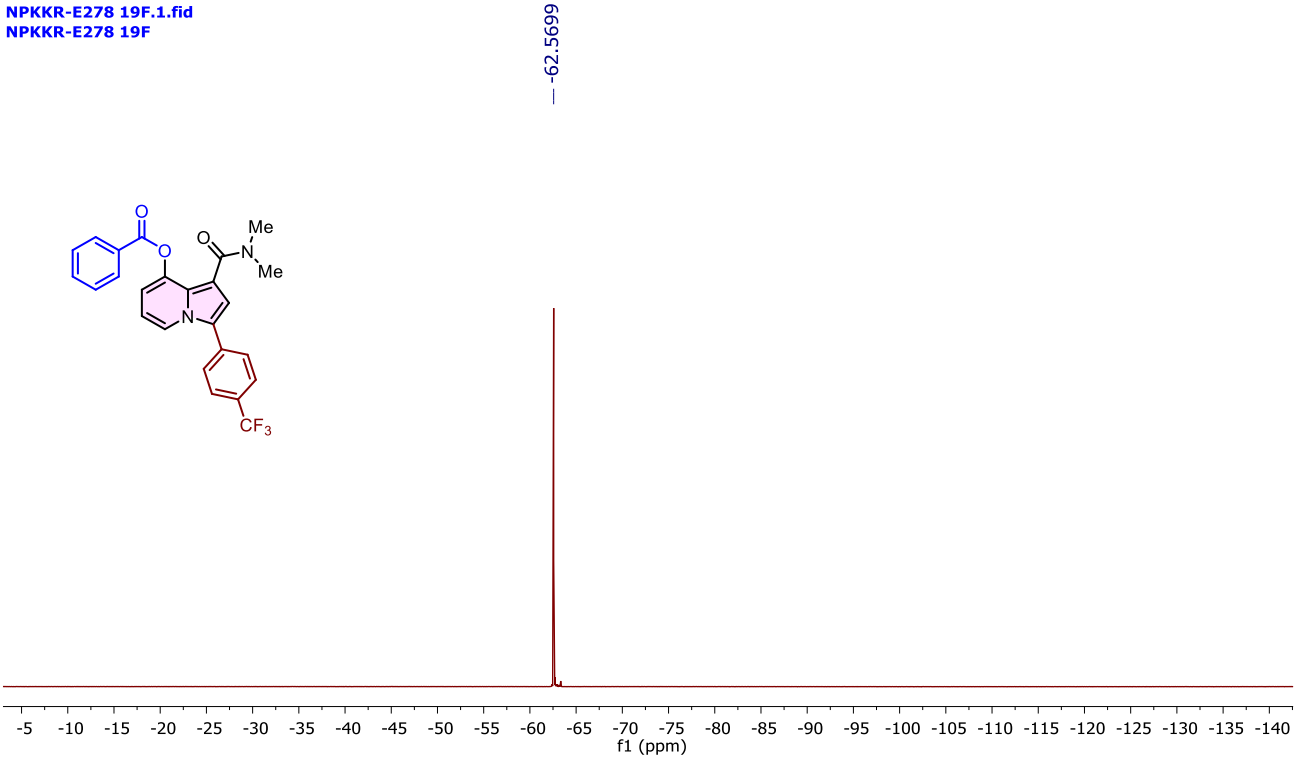
^{19}F NMR (470 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-fluorophenyl) indolizin-8-yl benzoate **(3ca).**



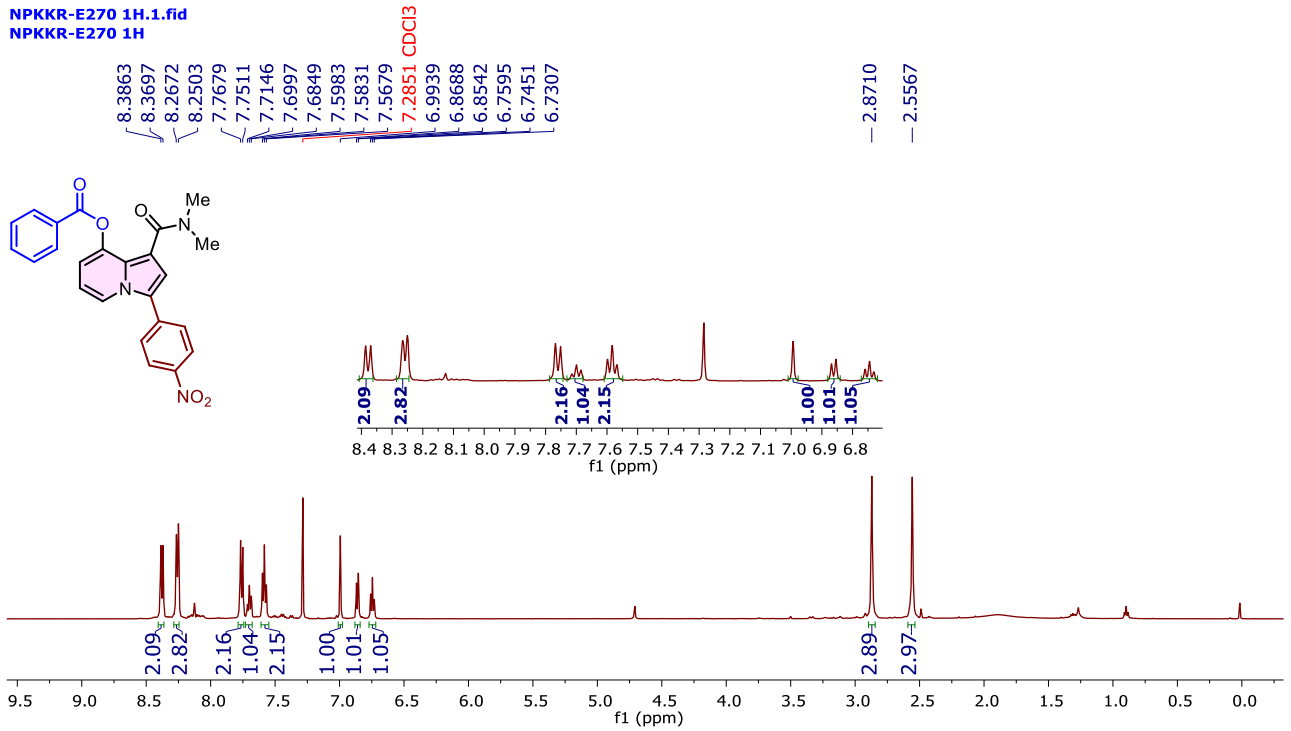
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-(trifluoromethyl)phenyl) indolizin-8-yl benzoate. **(3da).**



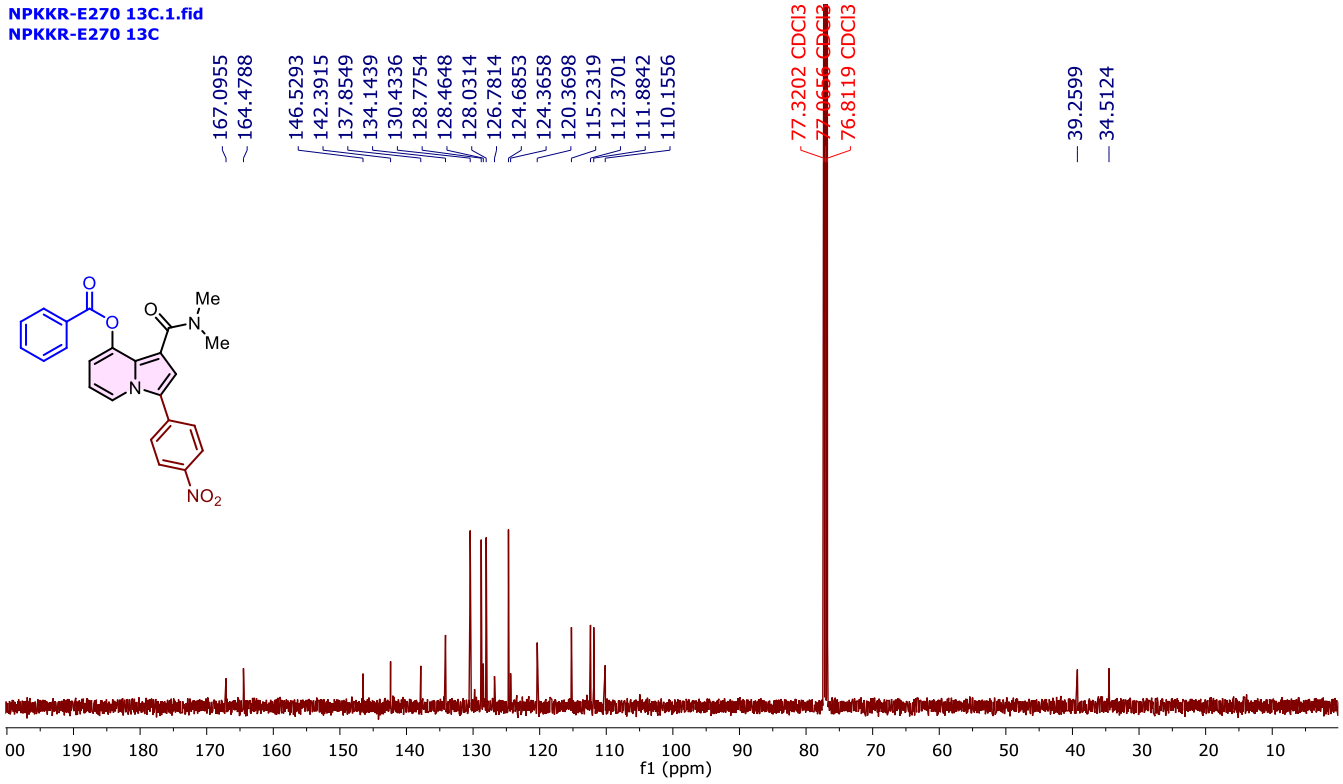
$^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-(trifluoromethyl)phenyl) indolizin-8-yl benzoate **(3da).**



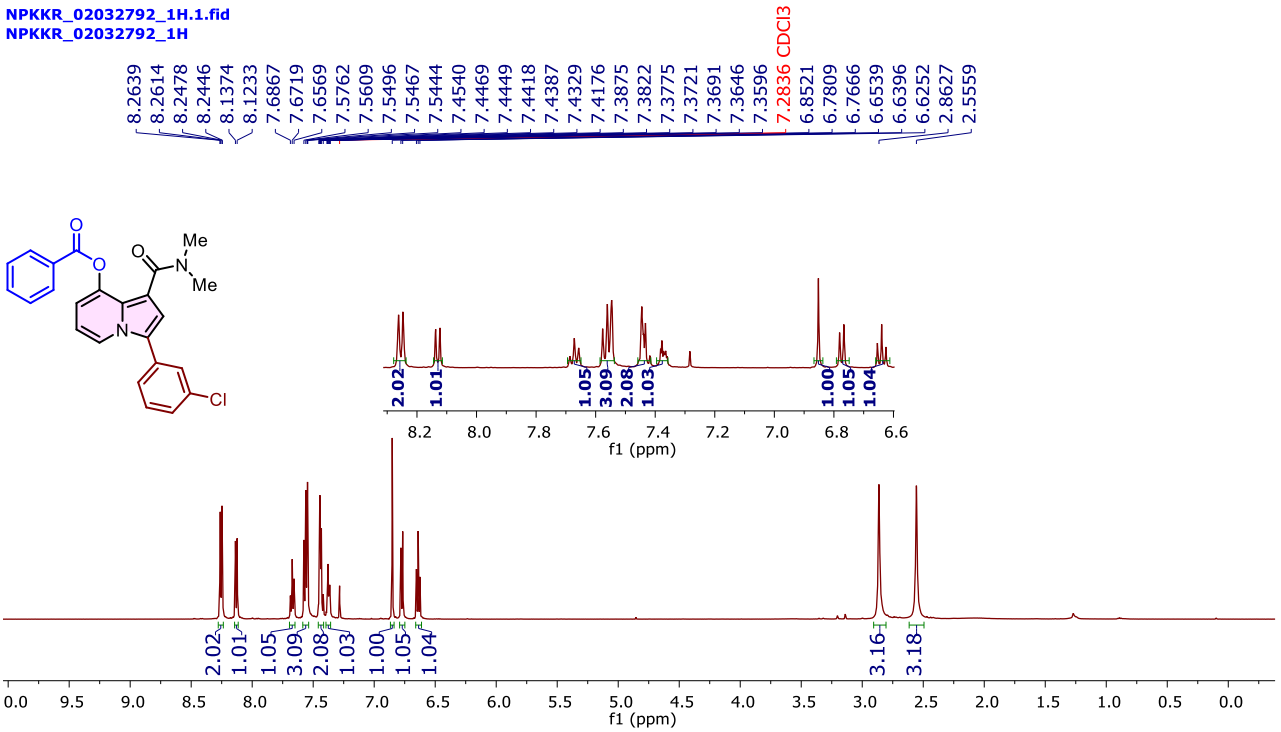
^{19}F NMR (470 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-(trifluoromethyl)phenyl) indolizin-8-yl benzoate. **(3da).**



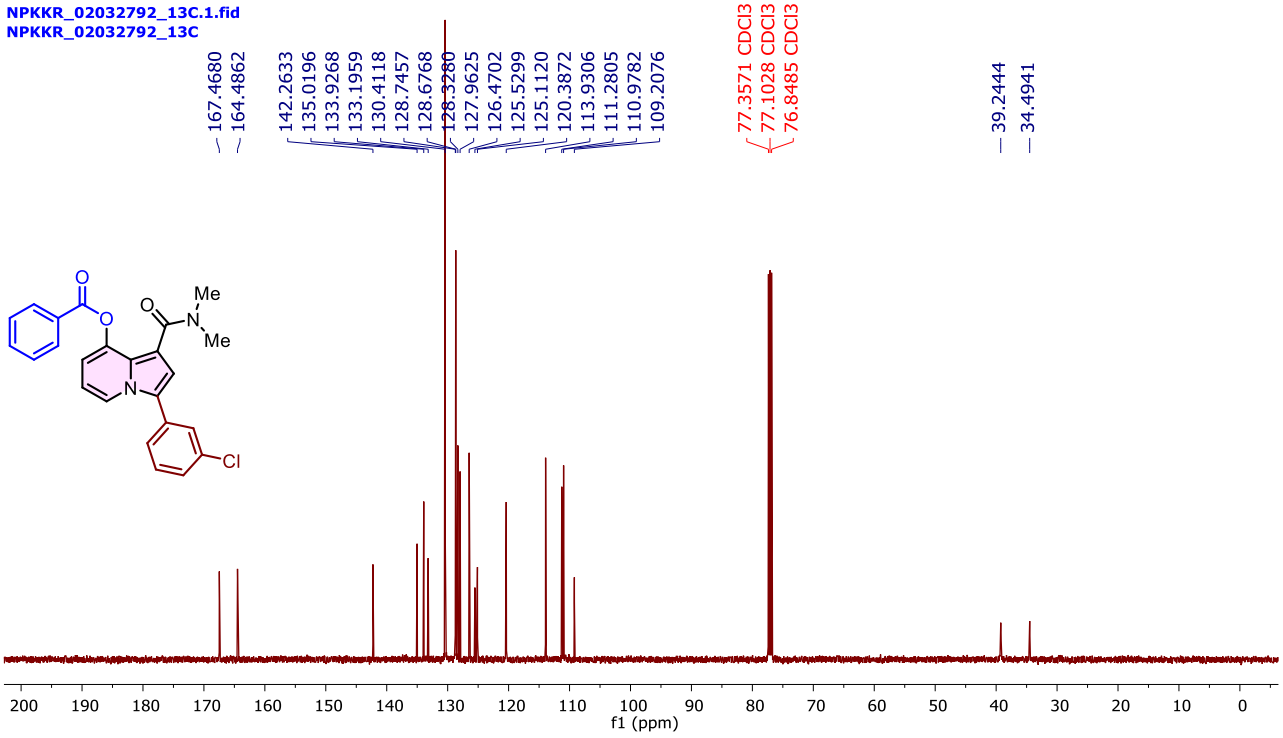
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-nitrophenyl)indolizin-8-yl benzoate. (**3ea**)



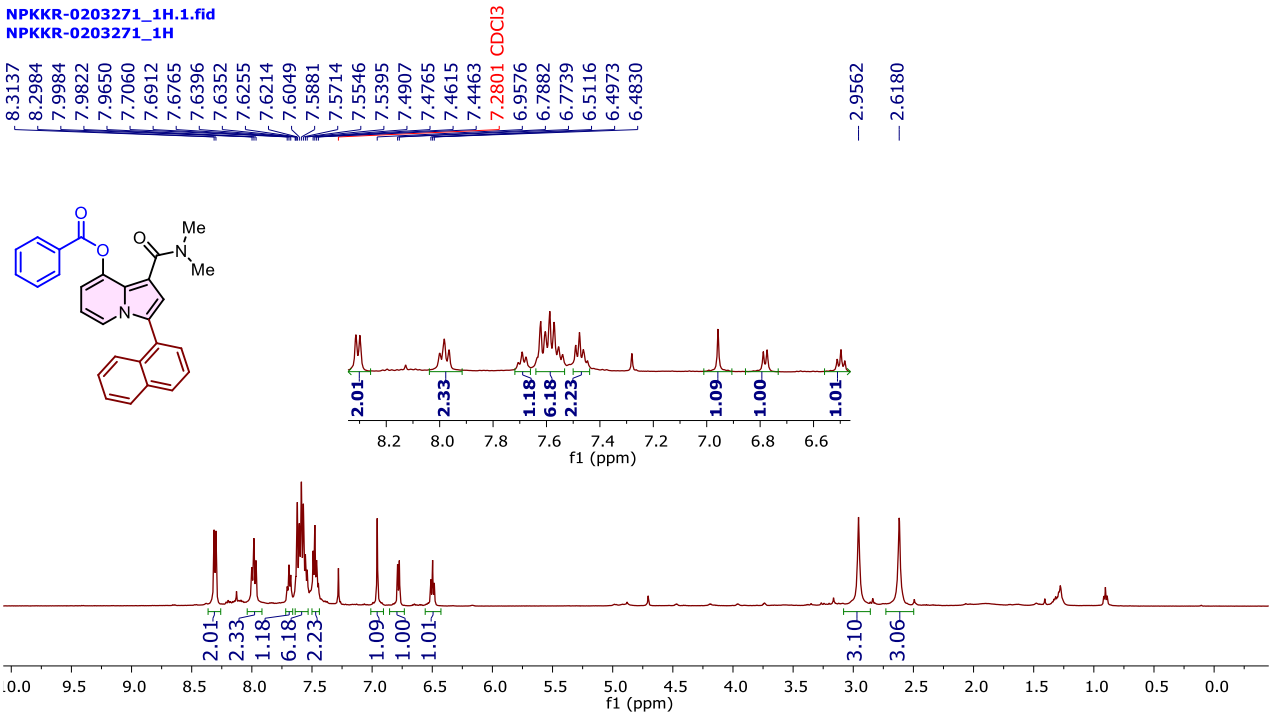
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-nitrophenyl)indolizin-8-yl benzoate. (**3ea**)



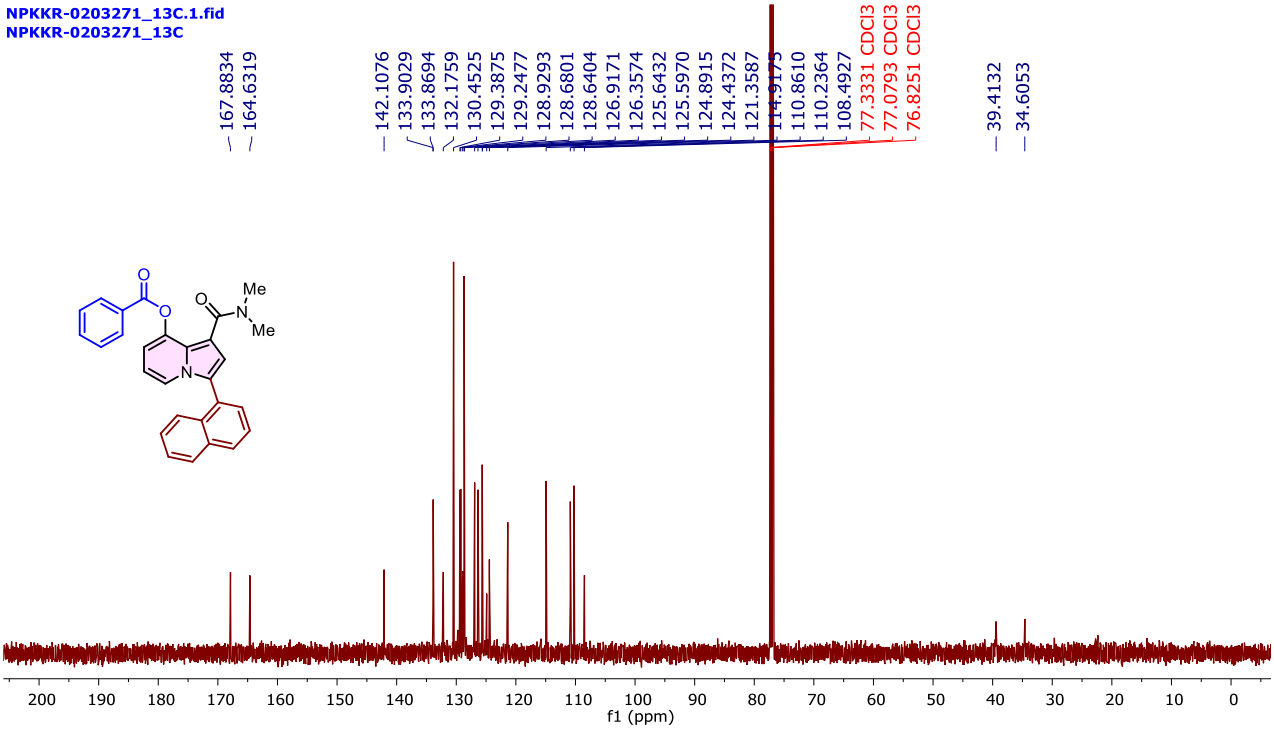
^{1}H NMR (500 MHz, $CDCl_3$) of 3-(3-Chlorophenyl)-1-(Dimethylcarbamoyl) indolizin-8-yl benzoate. **(3fa).**



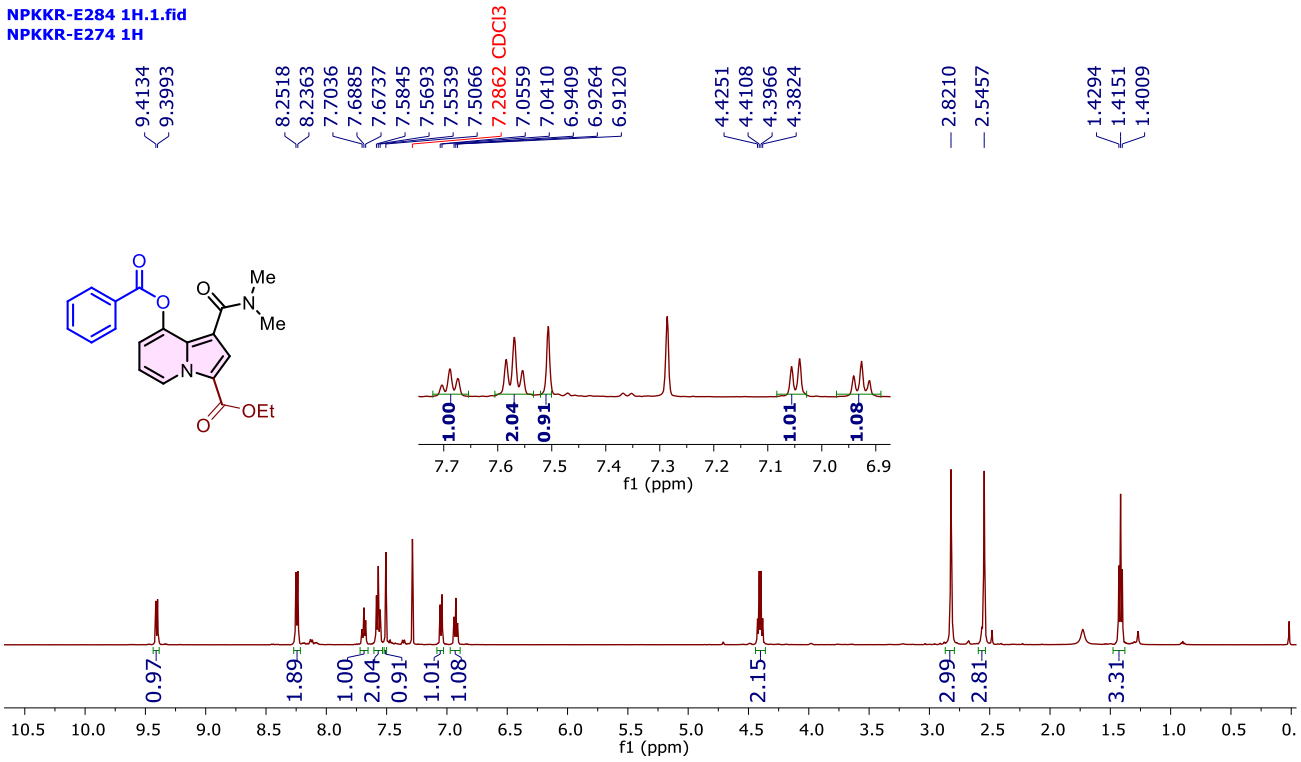
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 3-(3-Chlorophenyl)-1-(Dimethylcarbamoyl) indolizin-8-yl benzoate. **(3fa).**



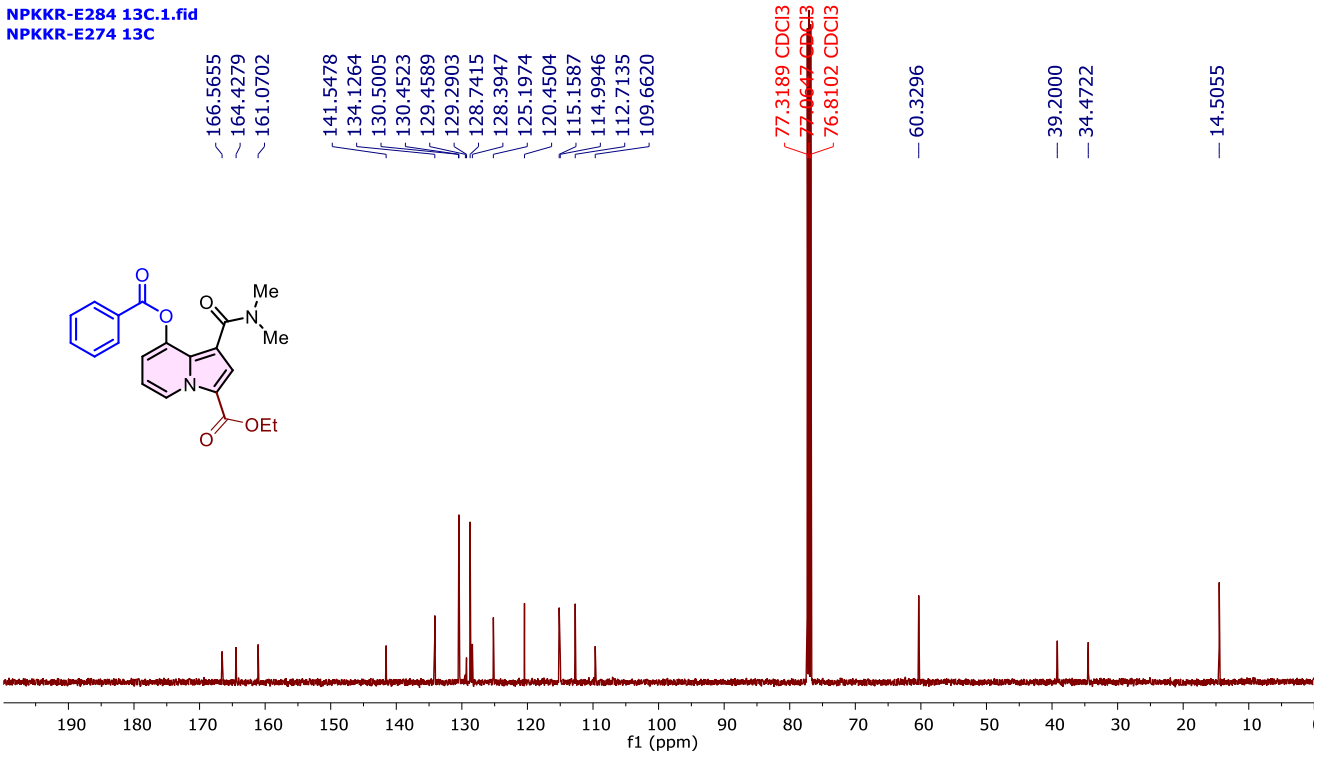
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(naphthalen-1-yl)indolizin-8-yl benzoate. (**3ga)**



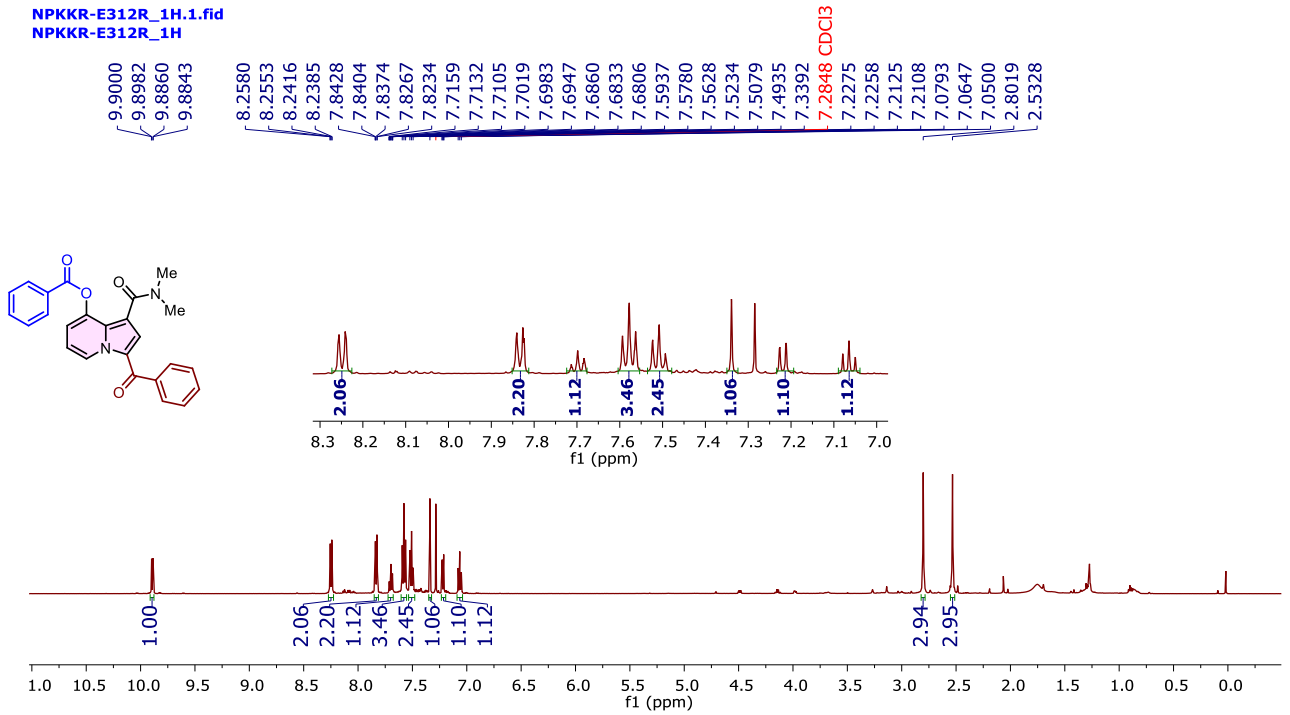
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(naphthalen-1-yl)indolizin-8-yl benzoate. **(3ga)**



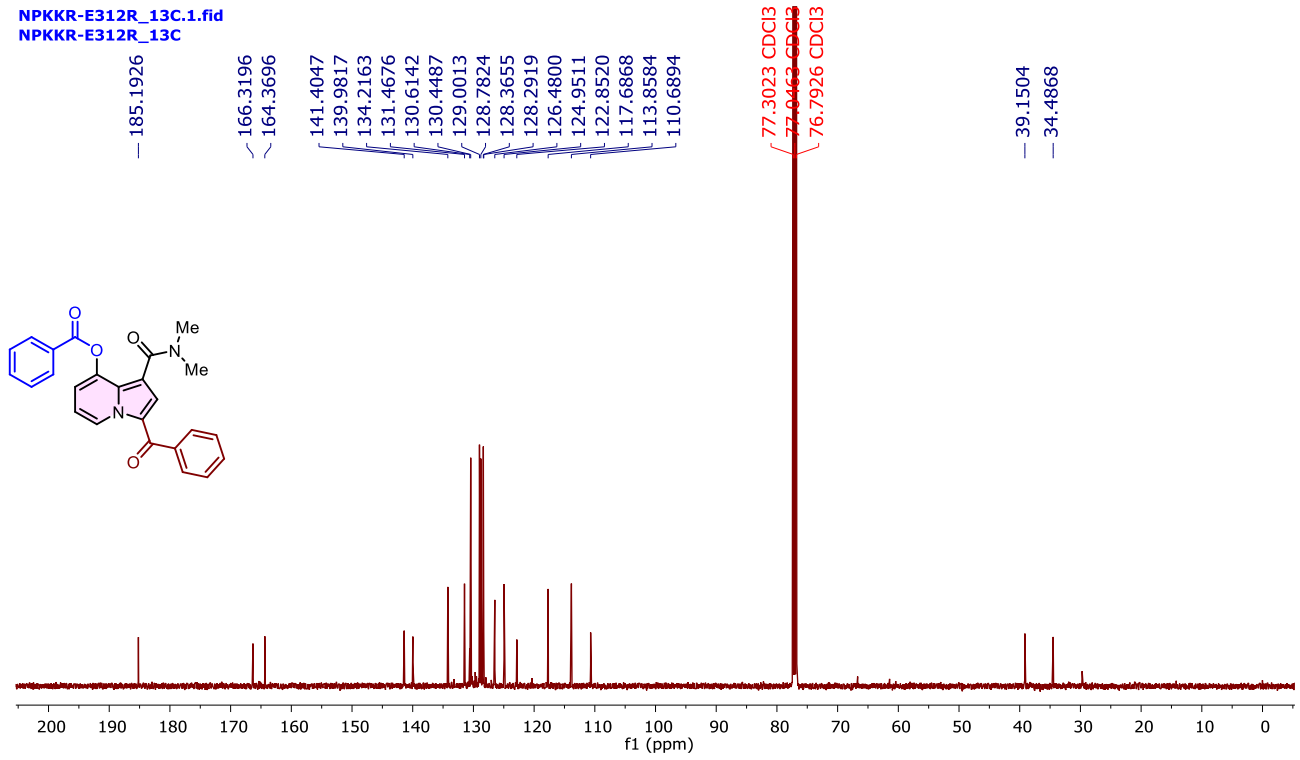
^{1}H NMR (500 MHz, $CDCl_3$) of Ethyl 8-(benzoyloxy)-1-(dimethylcarbamoyl) indolizine-3-carboxylate. (**3ha**)



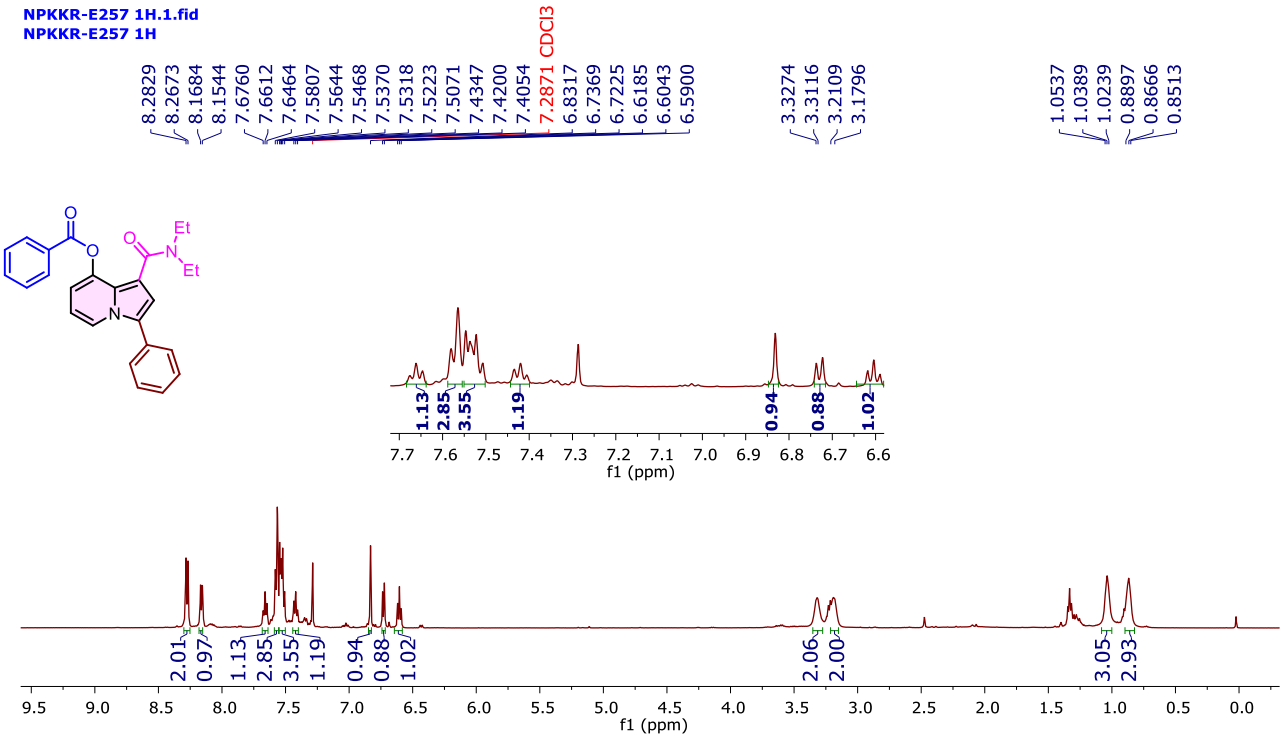
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of Ethyl 8-(benzoyloxy)-1-(dimethylcarbamoyl) indolizine-3-carboxylate. (**3ha**)



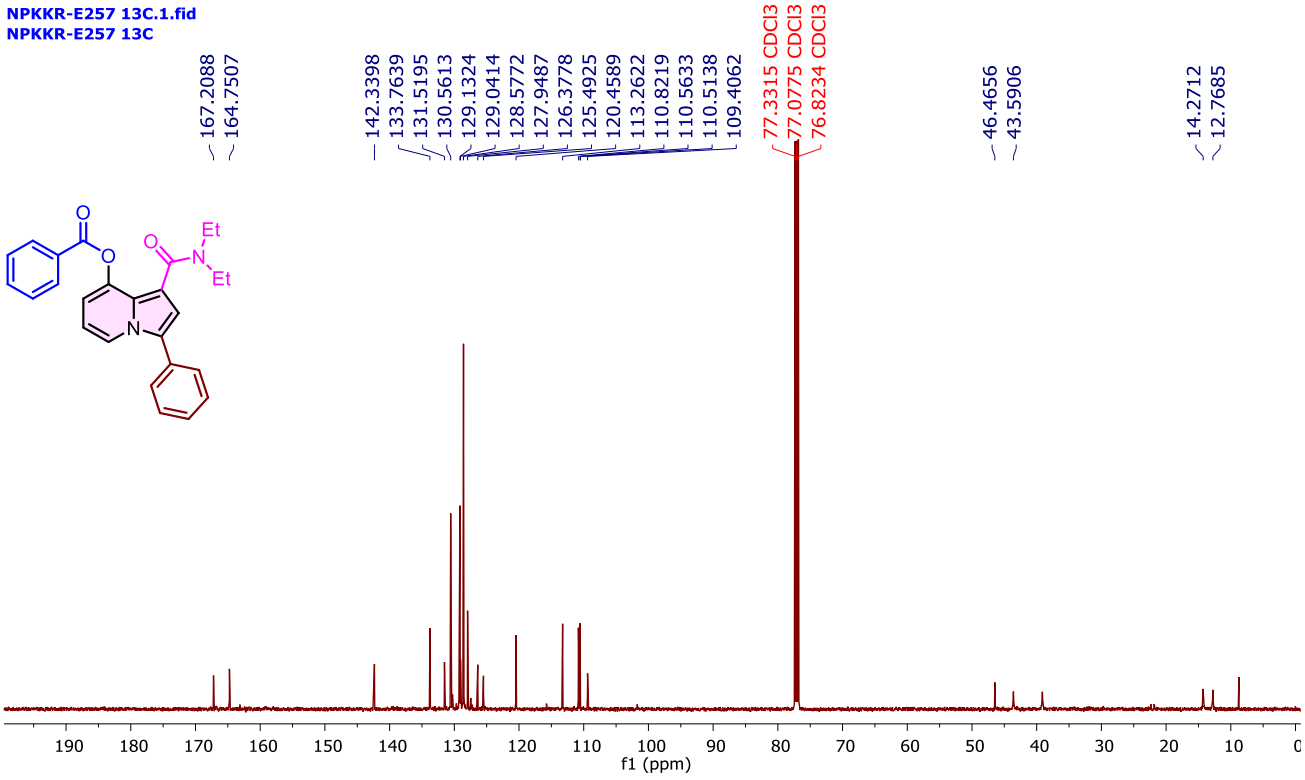
^{1}H NMR (500 MHz, $CDCl_3$) of 3-benzoyl-1-(dimethylcarbamoyl)indolizin-8-yl benzoate **(3ia)**



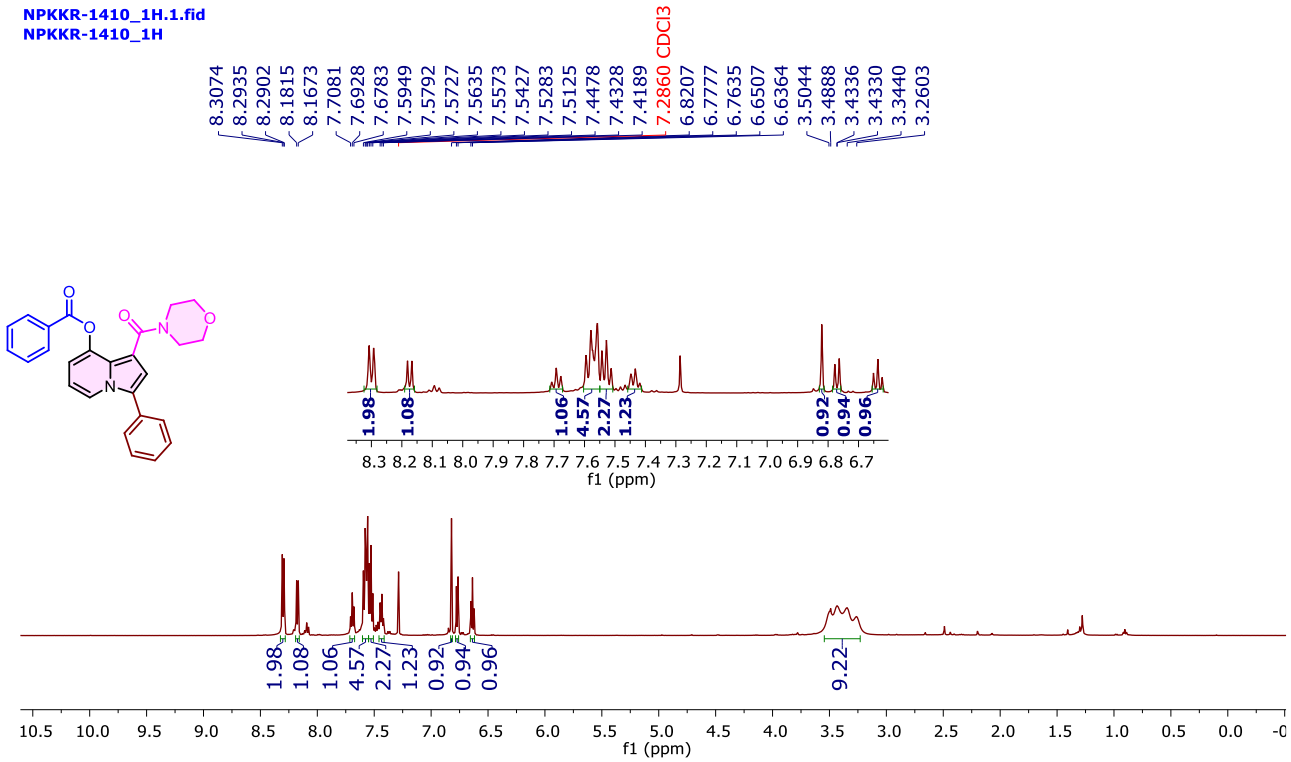
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 3-benzoyl-1-(dimethylcarbamoyl)indolizin-8-yl benzoate **(3ia)**



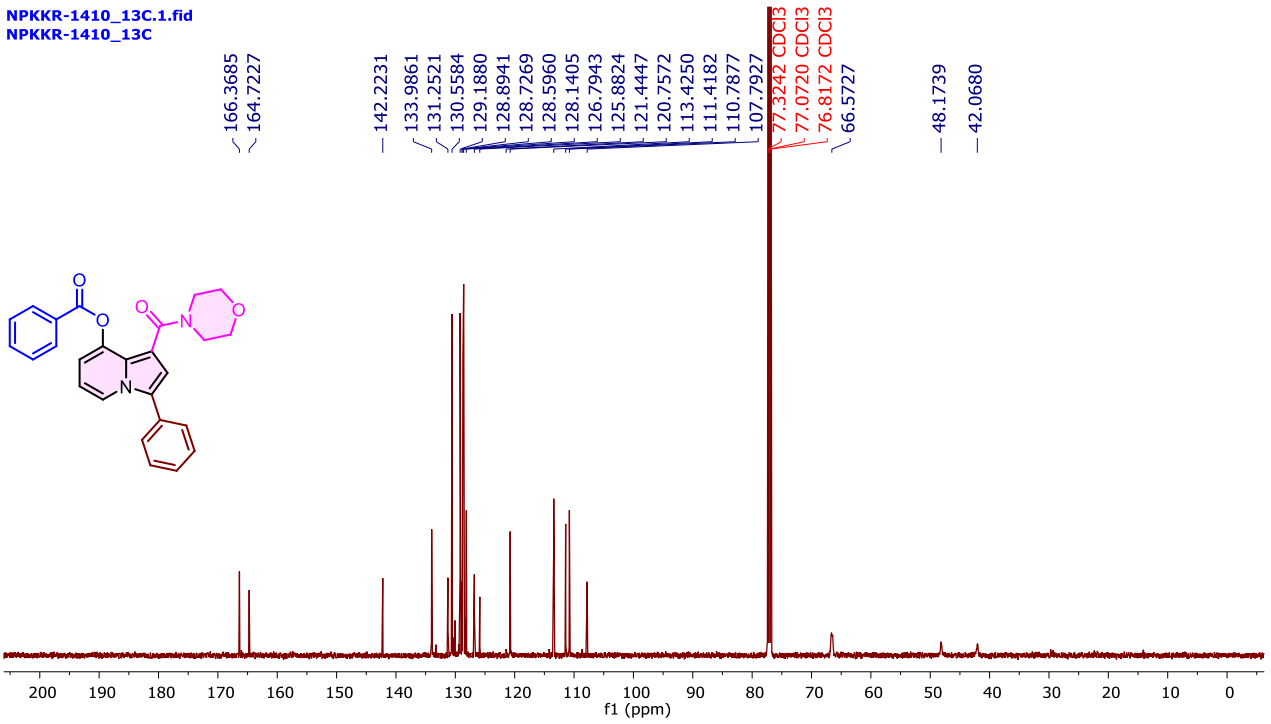
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Diethylcarbamoyl)-3-phenylindolizin-8-yl benzoate. **(3ja).**



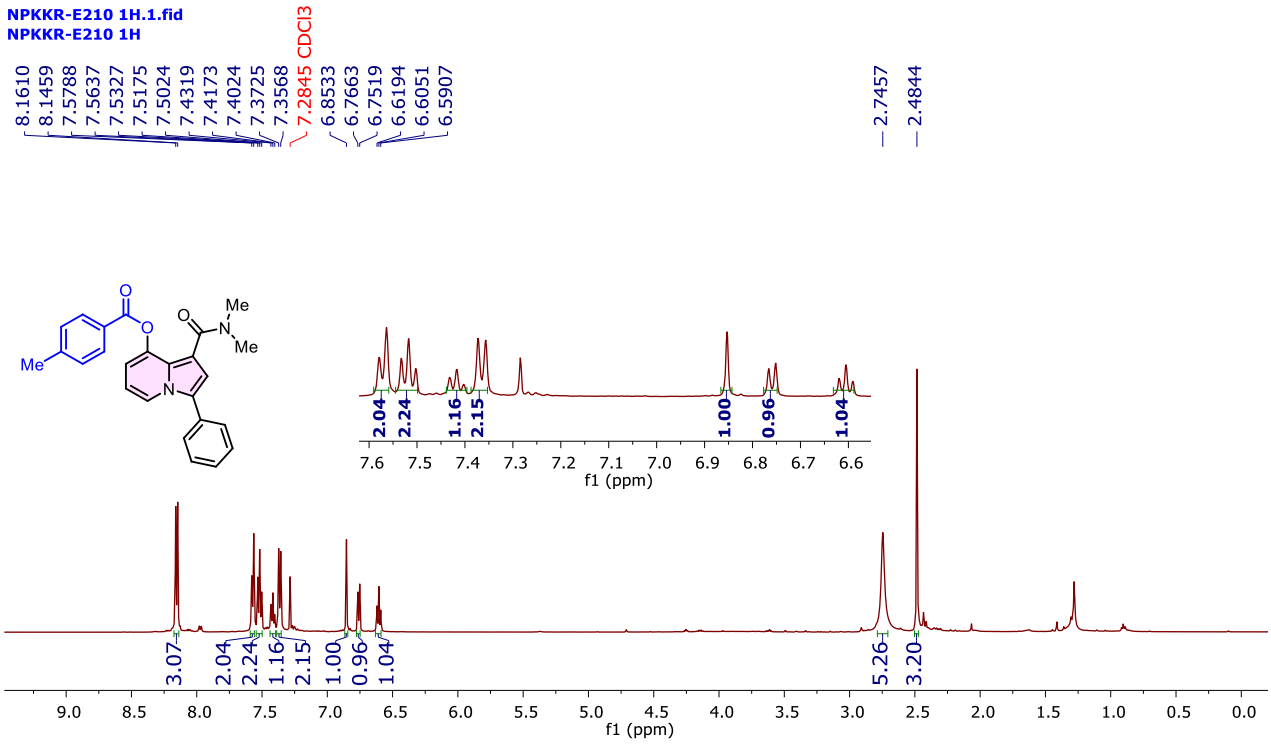
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Diethylcarbamoyl)-3-phenylindolizin-8-yl benzoate. **(3ja).**



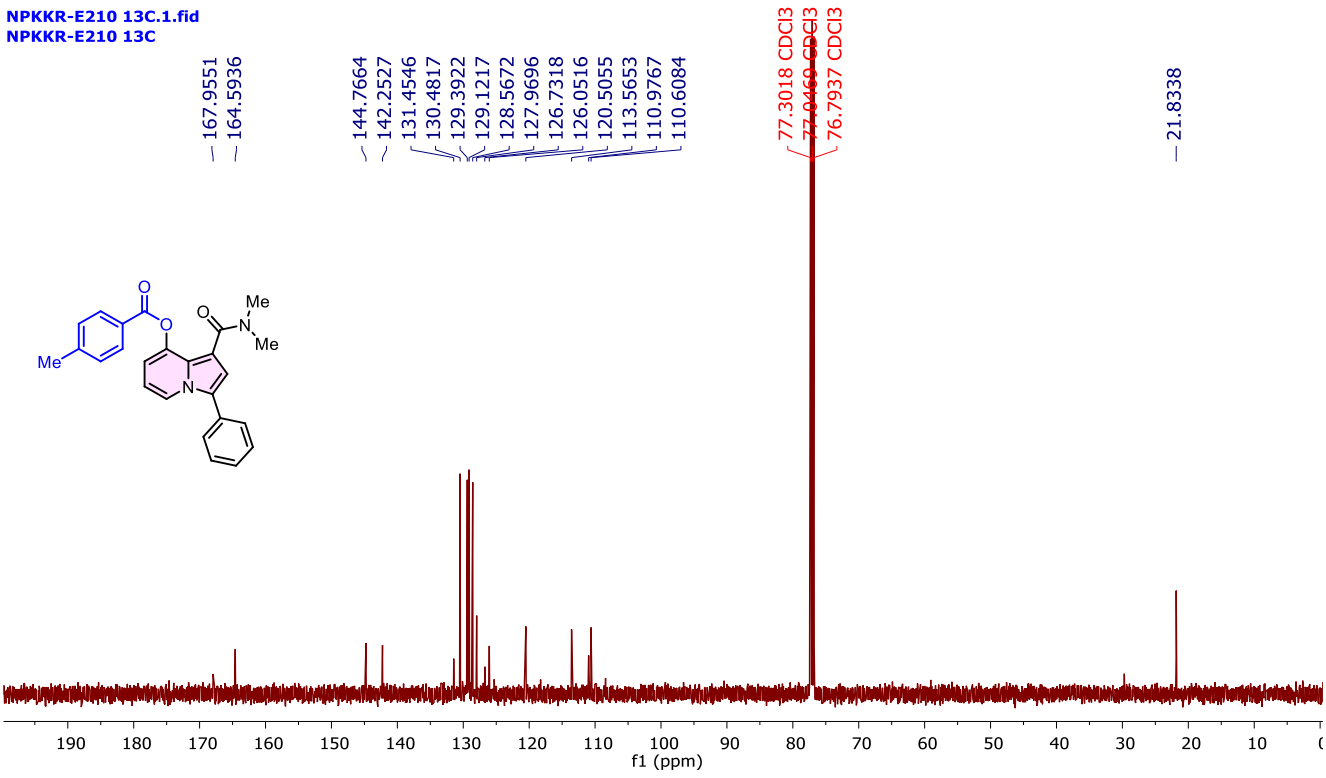
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Morpholine-4-carbonyl)-3-phenylindolizin-8-yl benzoate. **(3ka)**



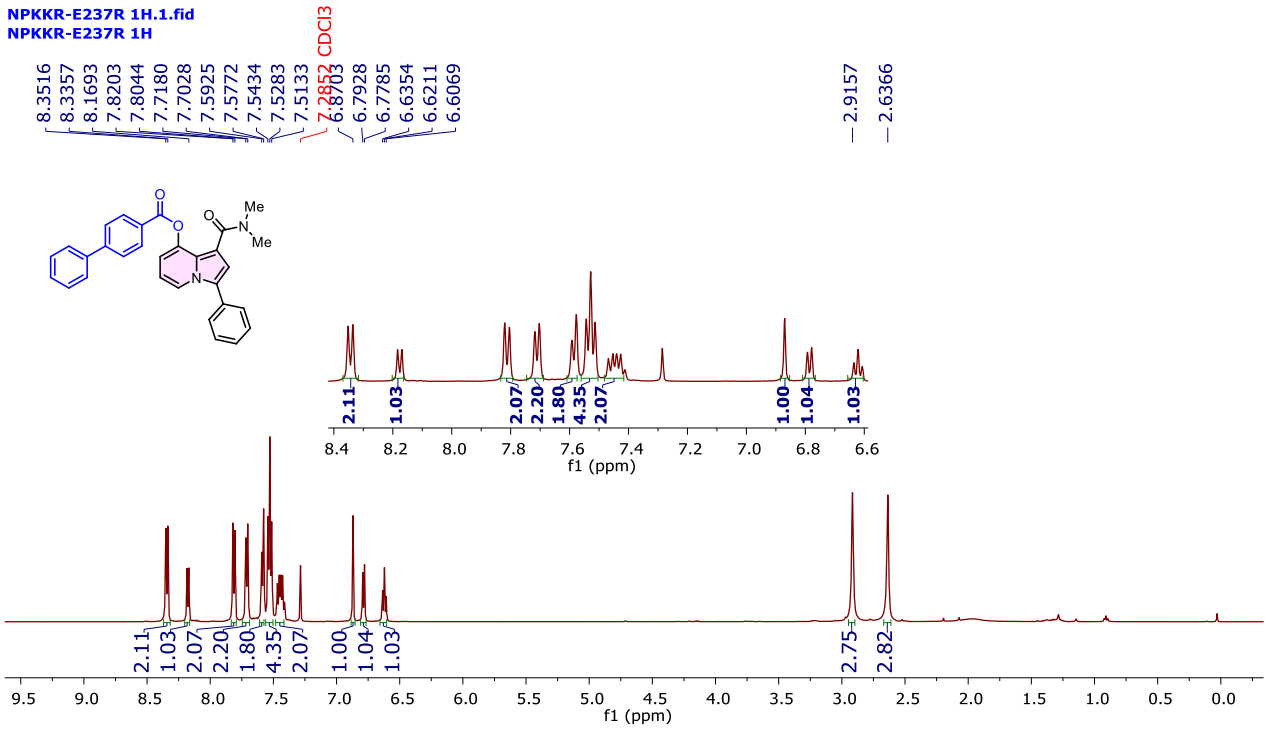
^{13}C{^{1}H} NMR (500 MHz, $CDCl_3$) of 1-(Morpholine-4-carbonyl)-3-phenylindolizin-8-yl benzoate. **(3ka)**



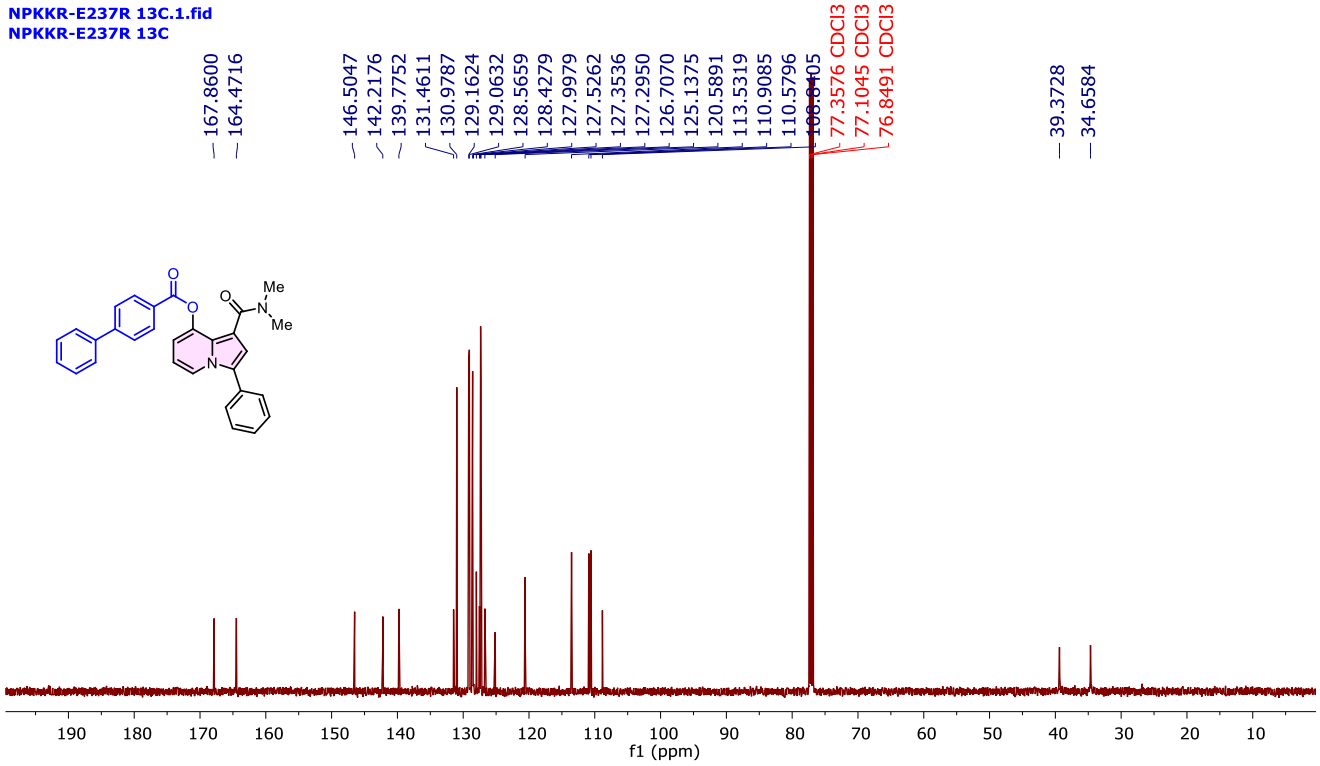
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4 methyl benzoate (**3ab)**



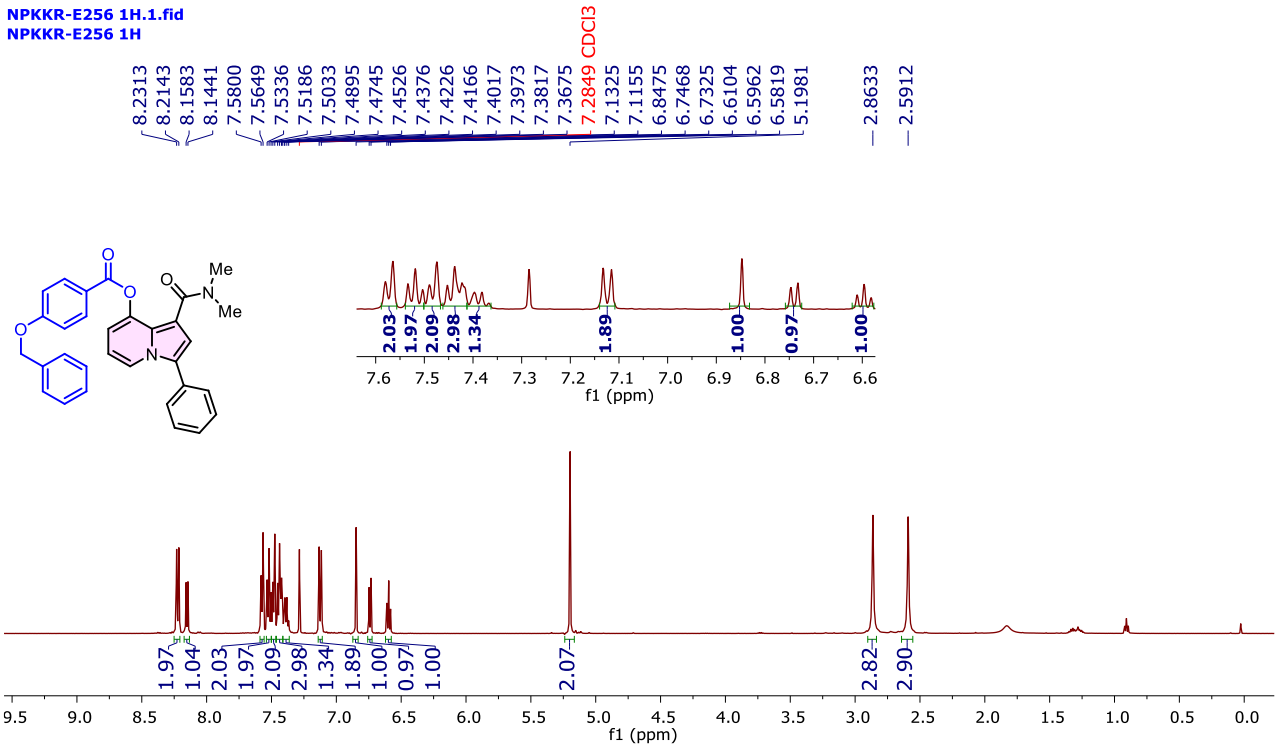
^{13}C{^{1}H}-NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4 methyl benzoate (**3ab)**



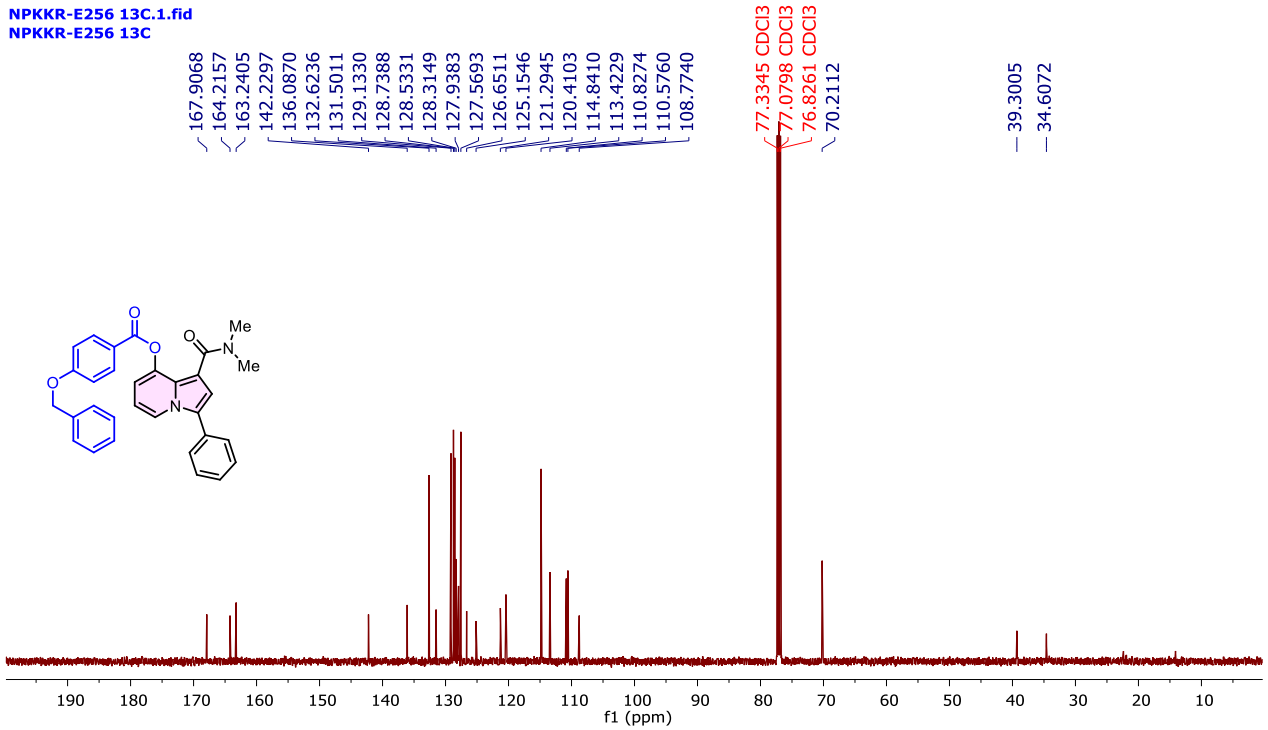
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl [1,1'-biphenyl]-4-carboxylate. (**3ac**)



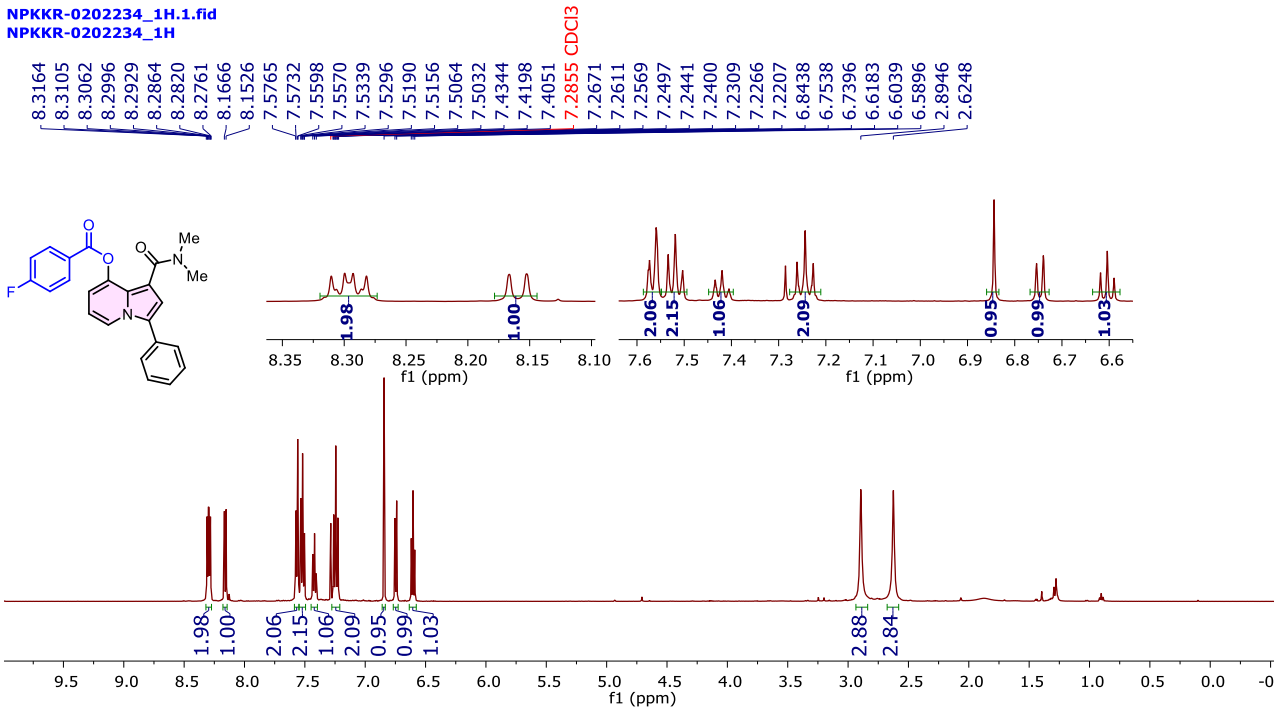
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl [1,1'-biphenyl]-4-carboxylate. (**3ac**)



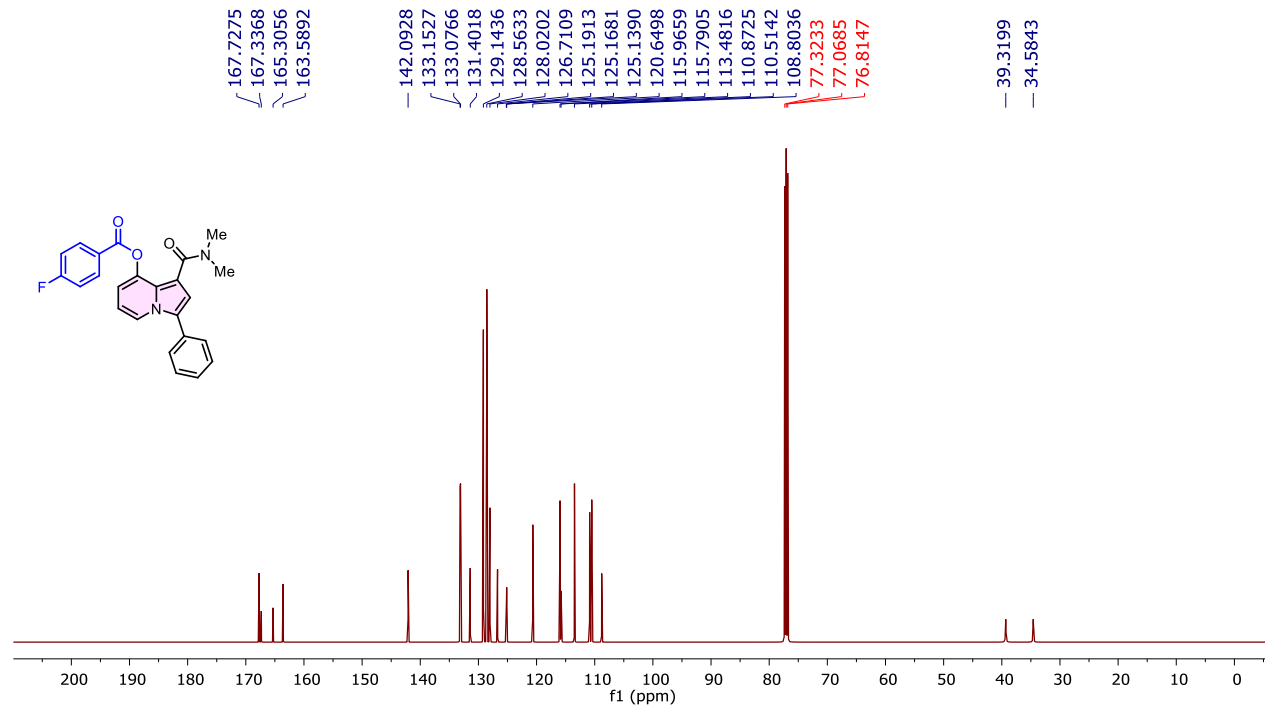
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(benzyloxy) benzoate. (**3ad)**



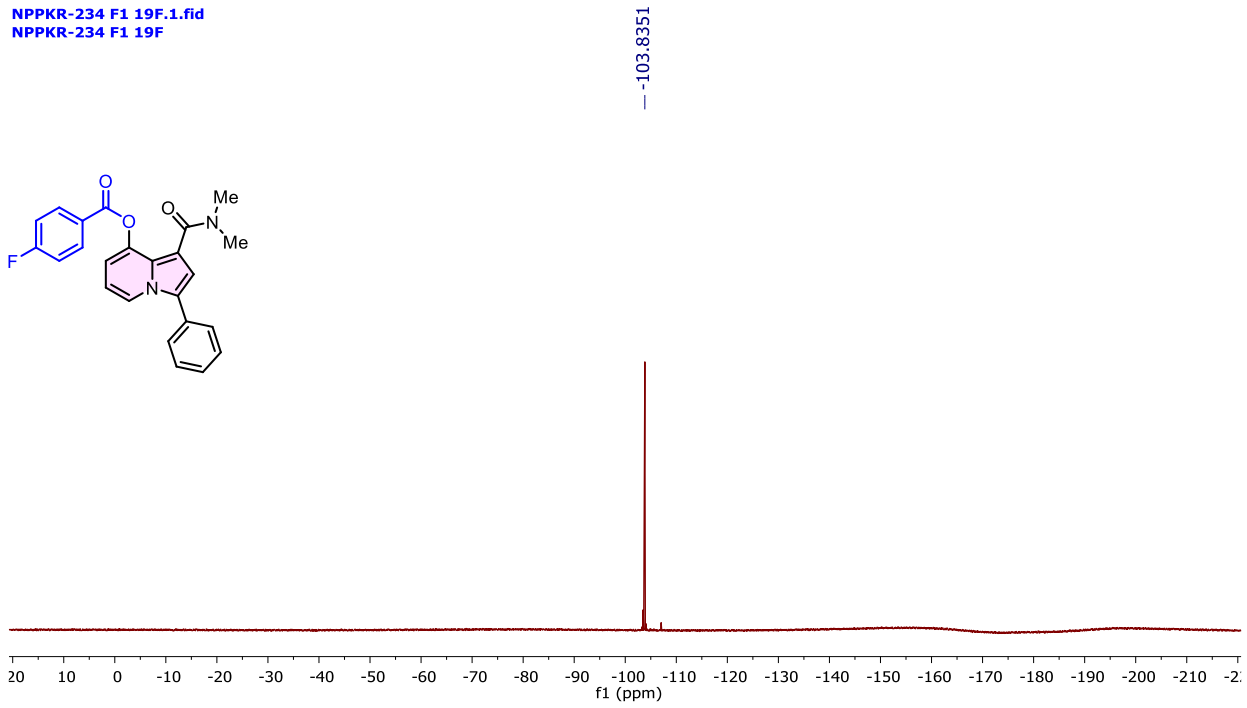
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(benzyloxy) benzoate. (**3ad)**



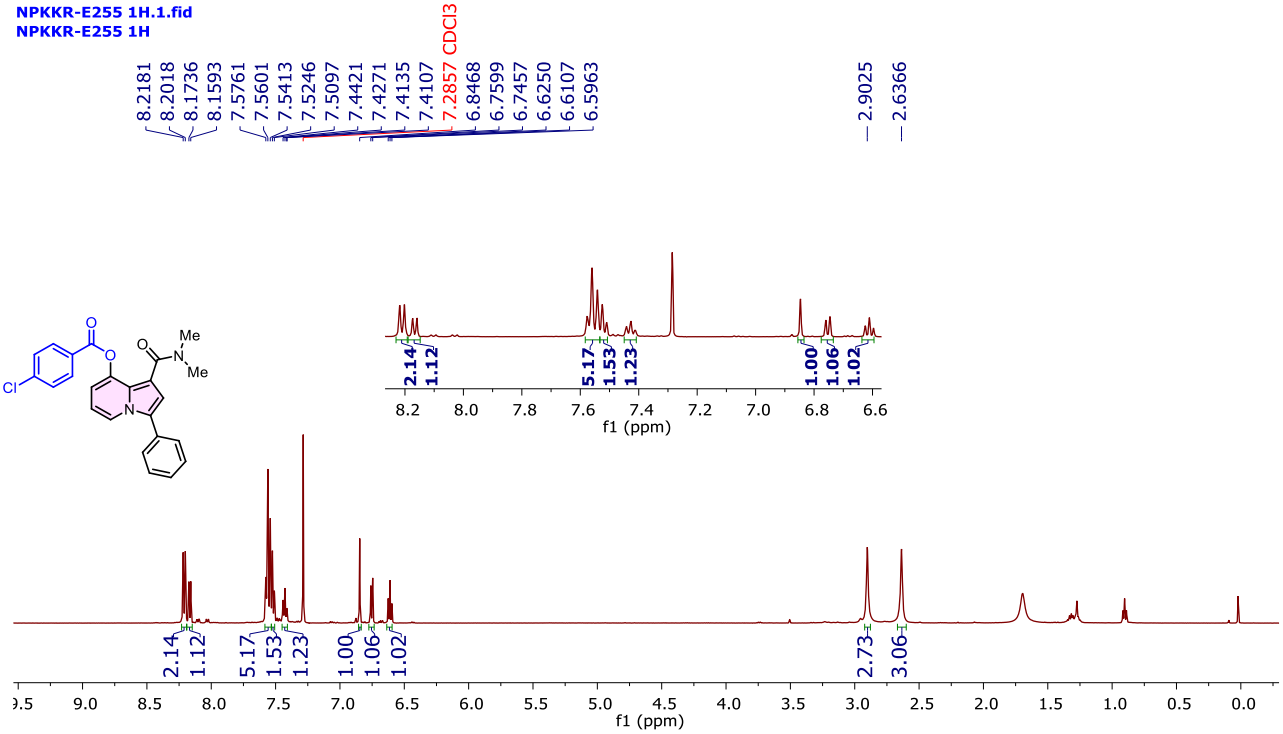
^{1}H NMR (500 MHz, $CDCl_3$) 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-fluoro benzoate (**3ae**)



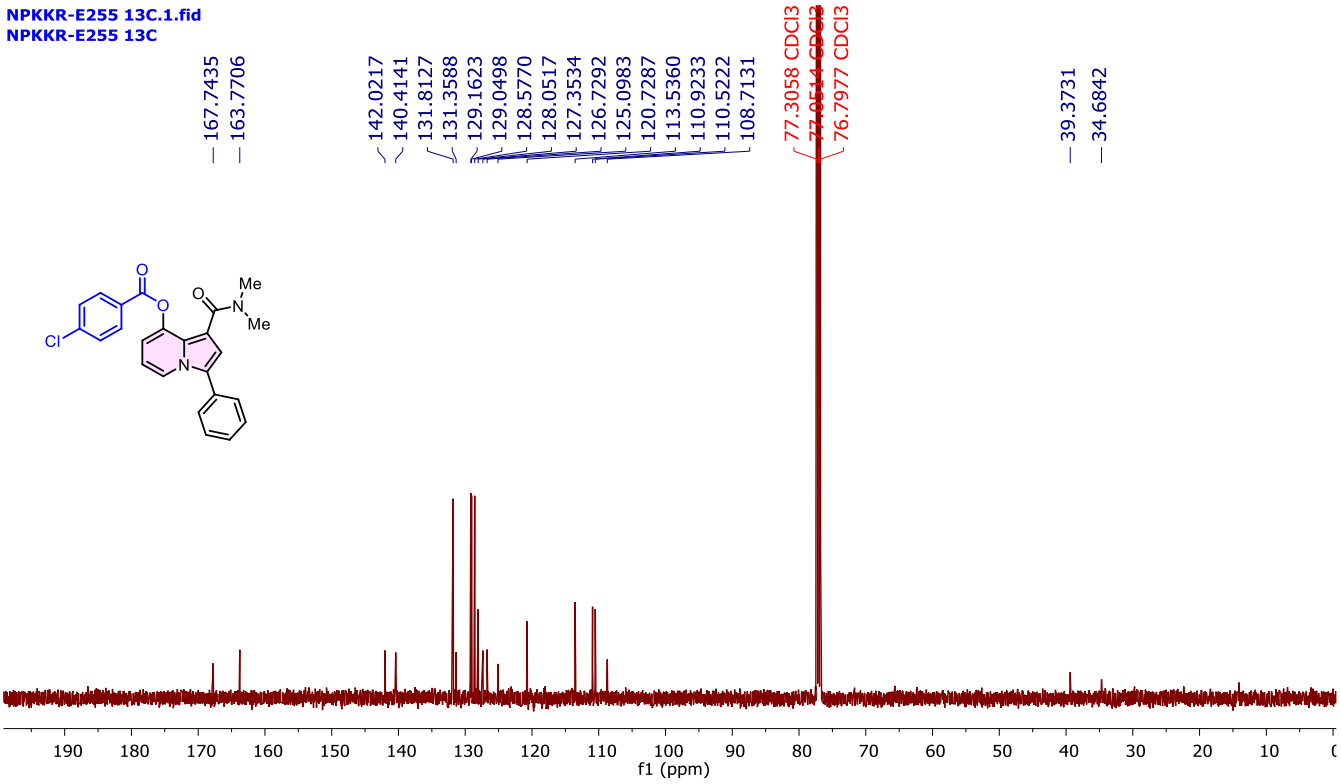
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-fluoro benzoate (**3ae**)



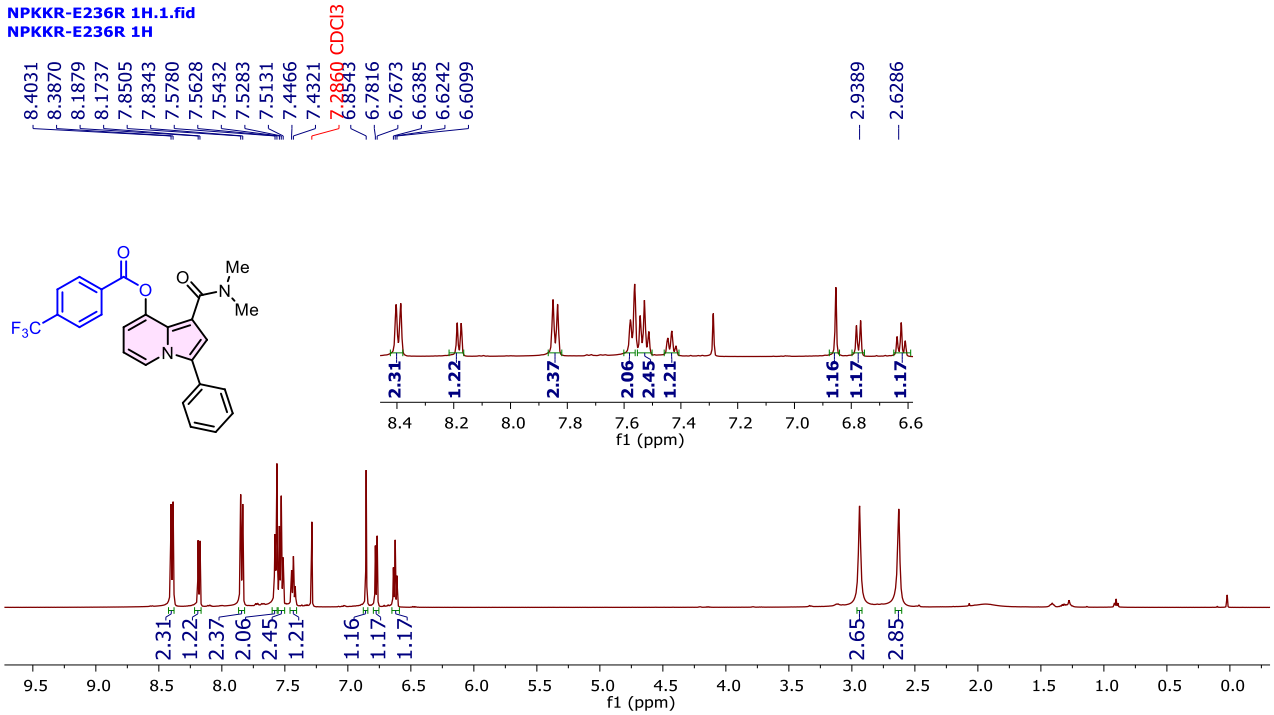
^{19}F NMR (470 MHz, $CDCl_3$) 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-fluoro benzoate (**3ae)**



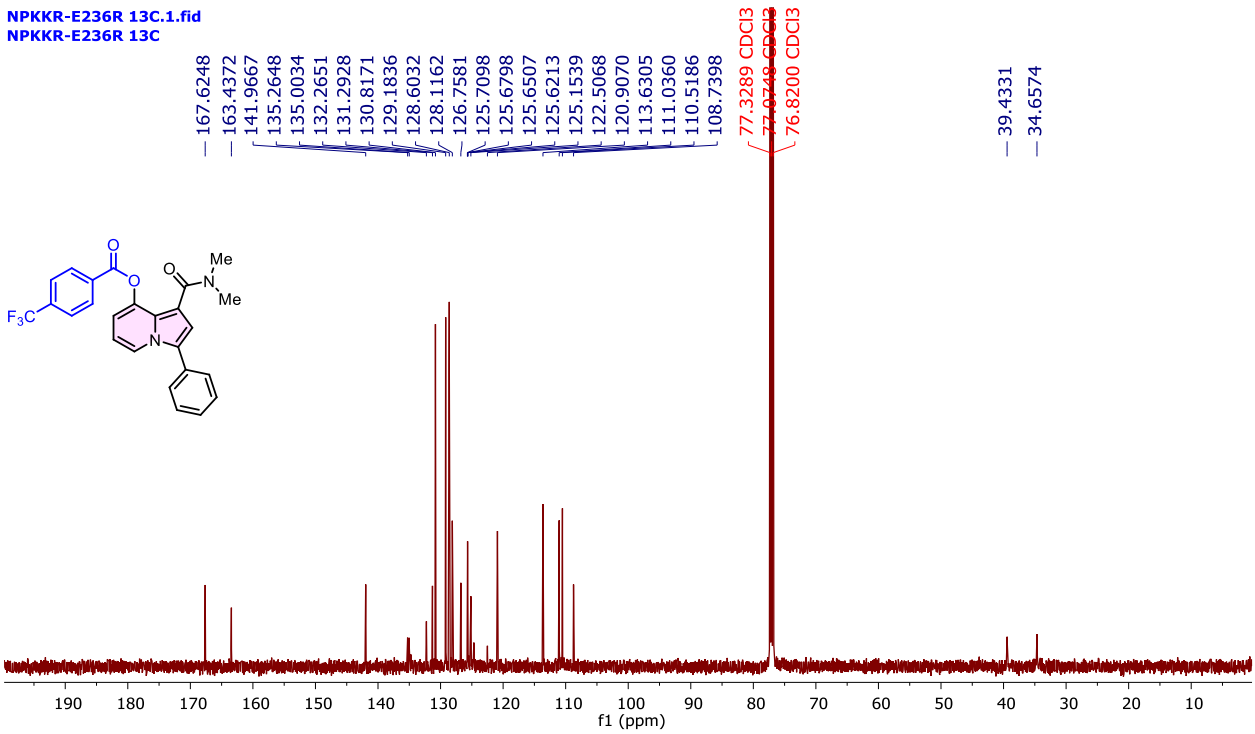
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-chloro benzoate. (**3af)**



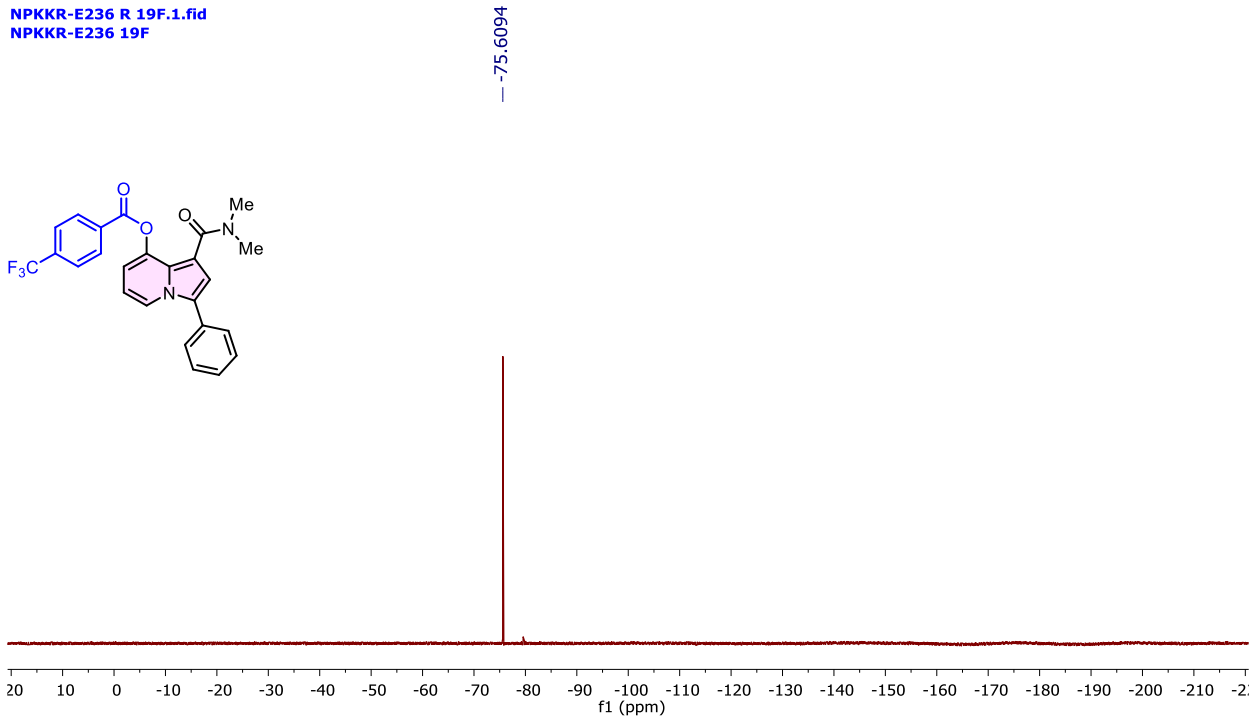
^{13} C NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-chloro benzoate. (**3af)**



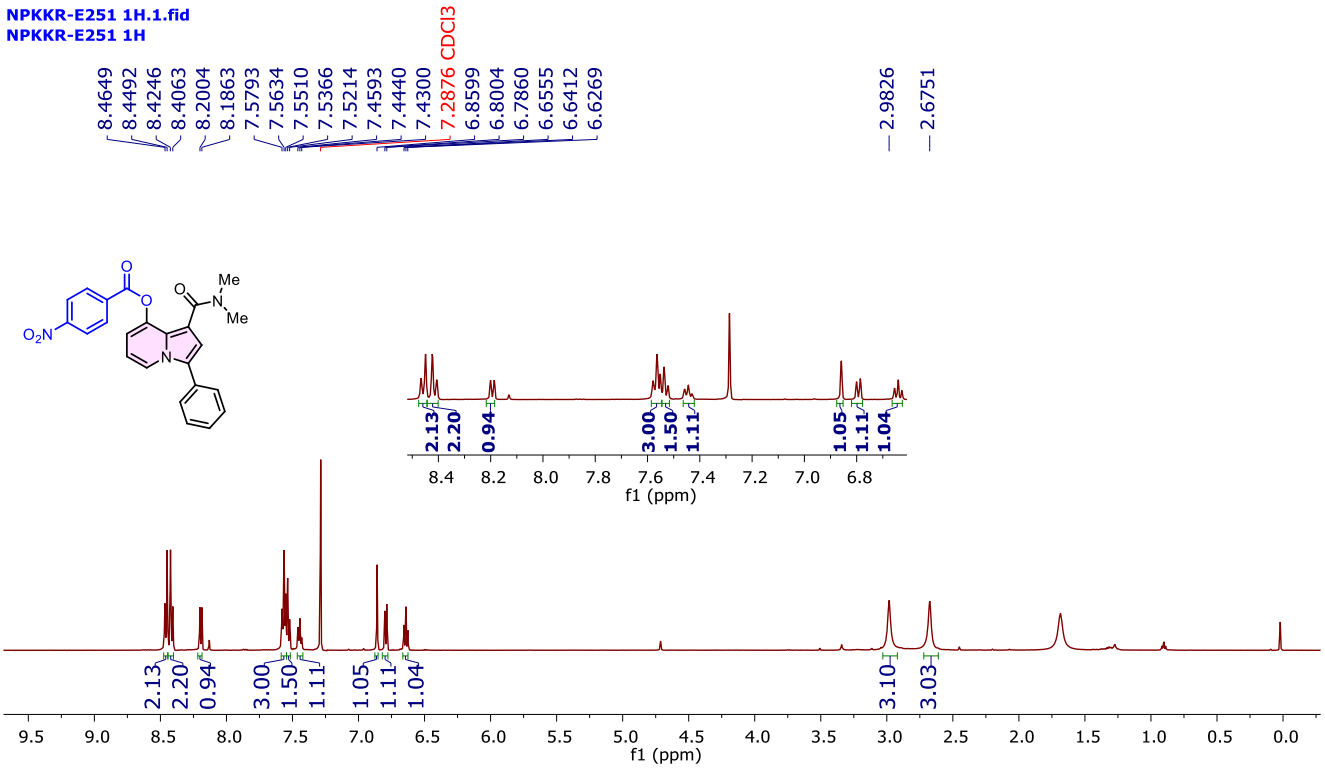
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(trifluoromethyl) benzoate. (**3ag)**



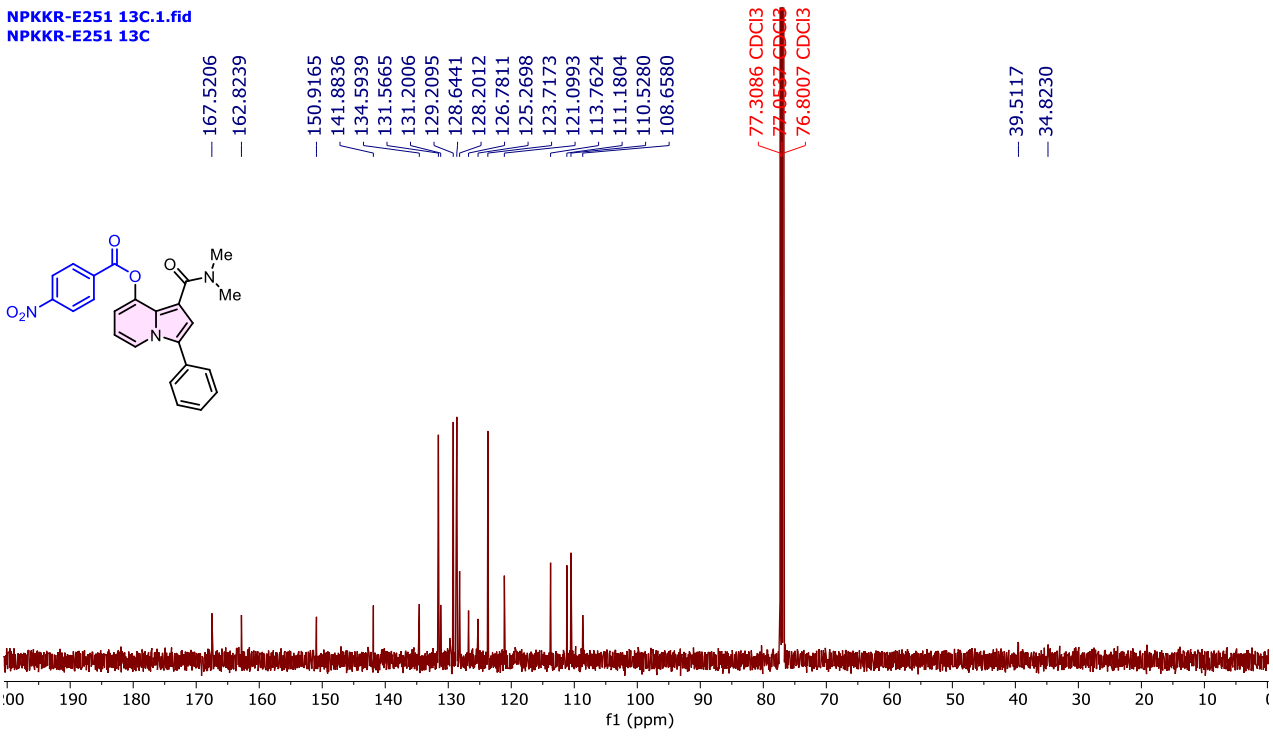
$^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(trifluoromethyl) benzoate. (**3ag)**



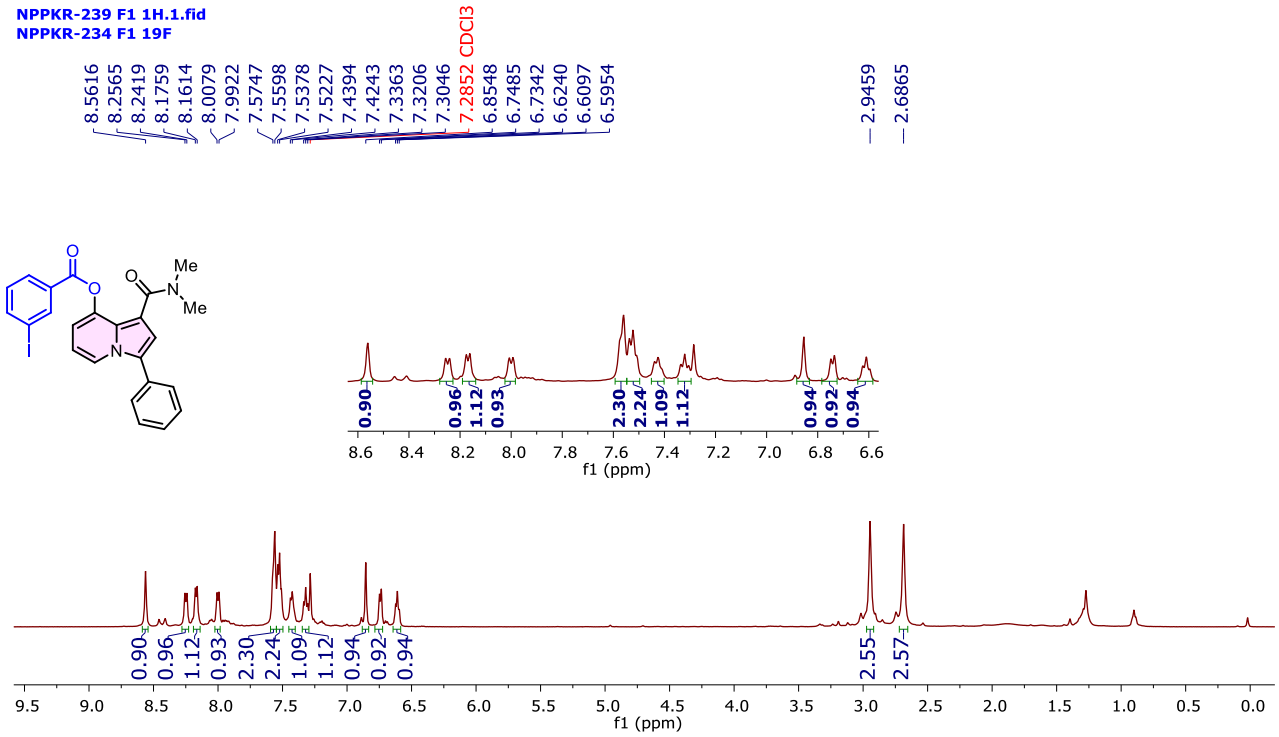
^{19}F NMR (470 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-(trifluoromethyl) benzoate. (**3ag)**



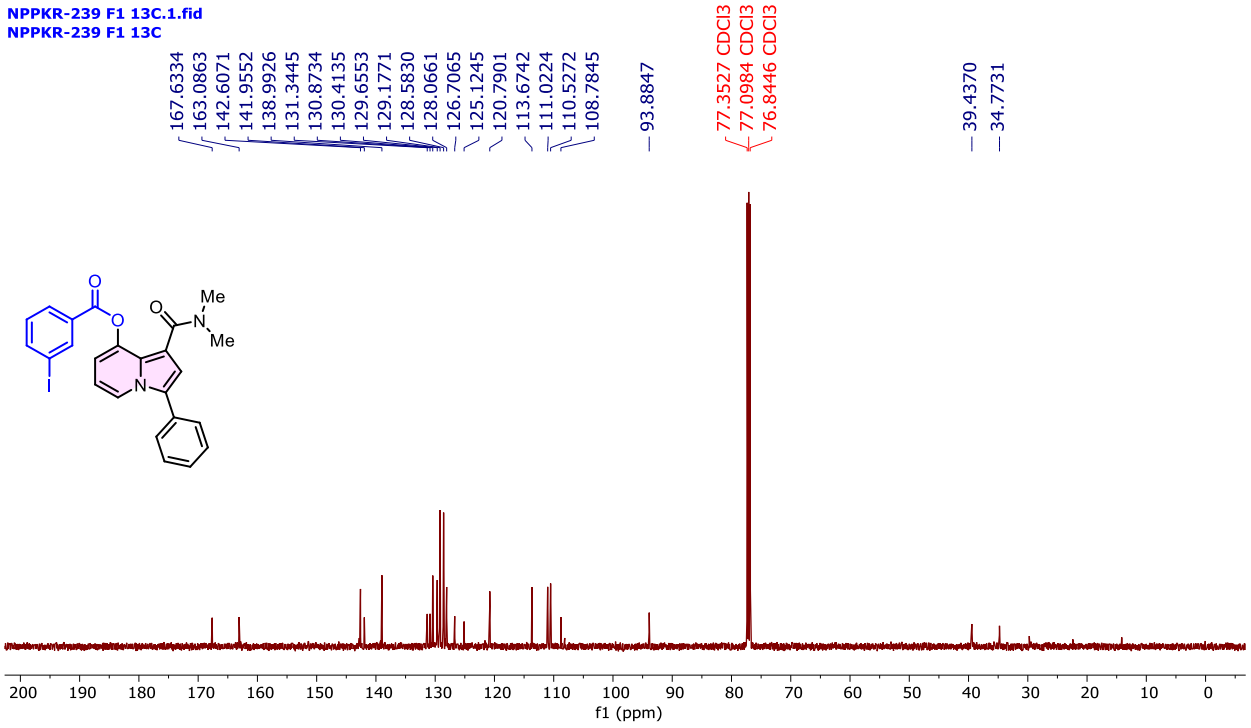
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-nitro benzoate. (**3ah)**



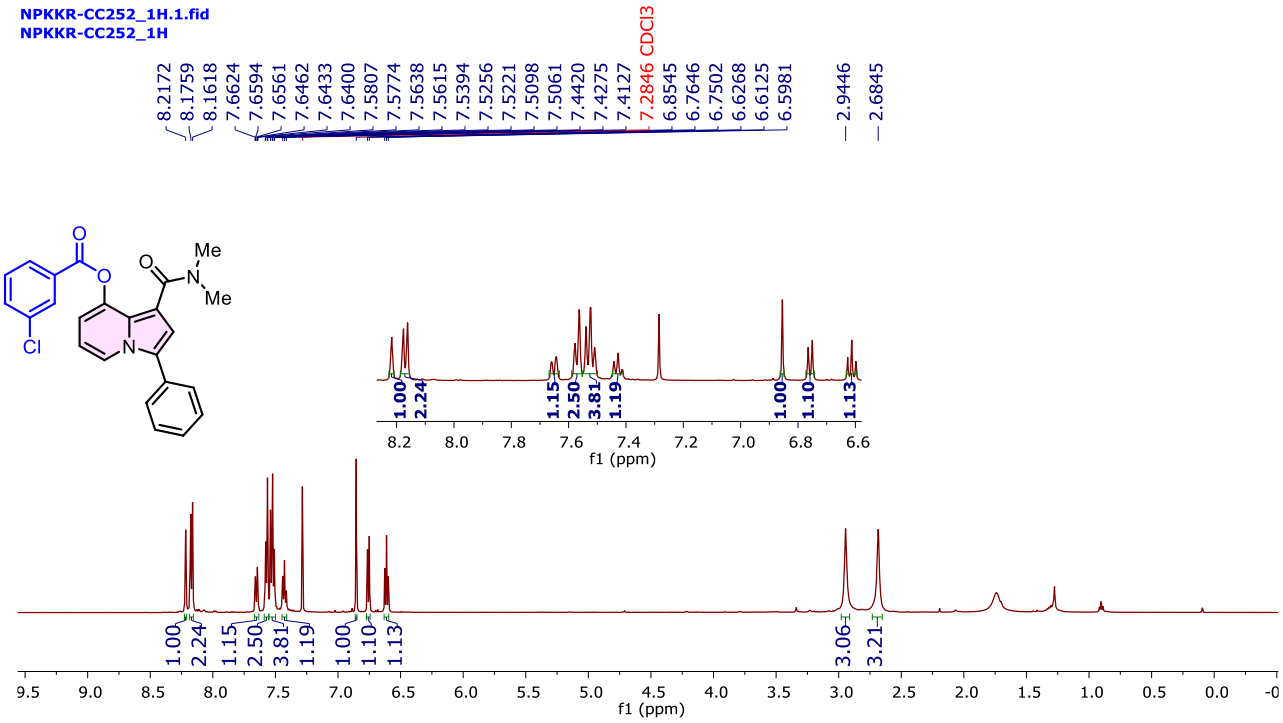
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 4-nitro benzoate. (**3ah)**



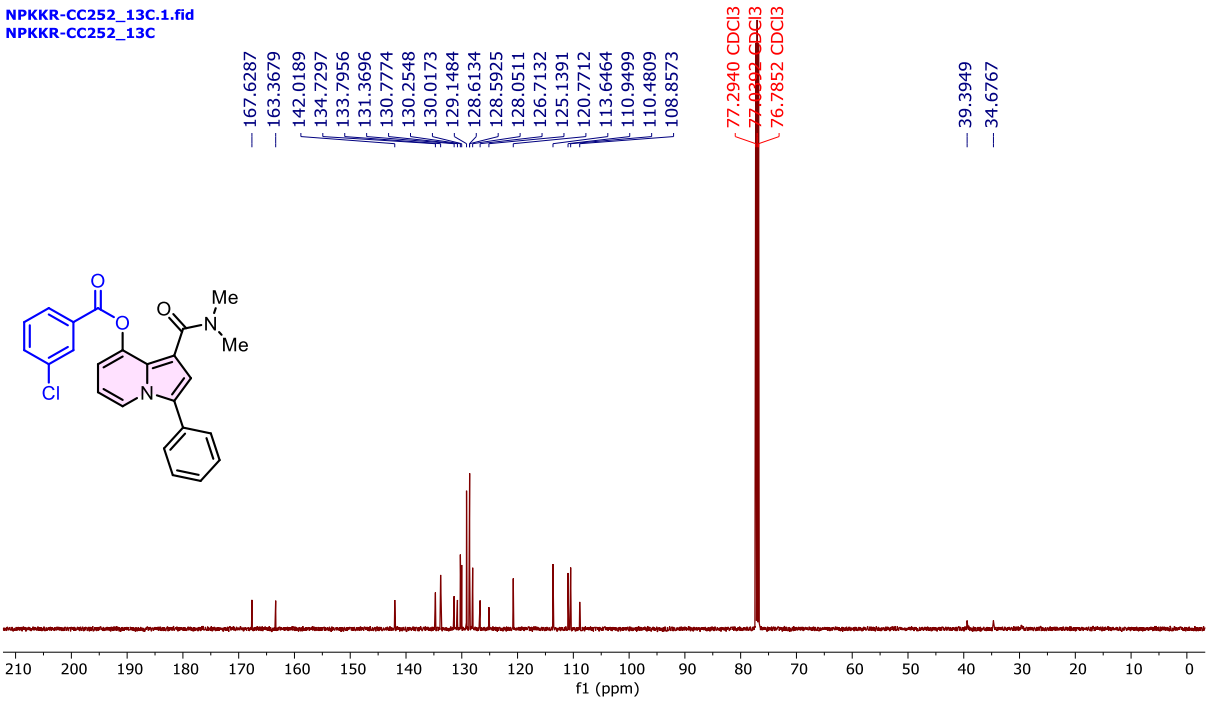
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-iodo benzoate. **(3ai)**



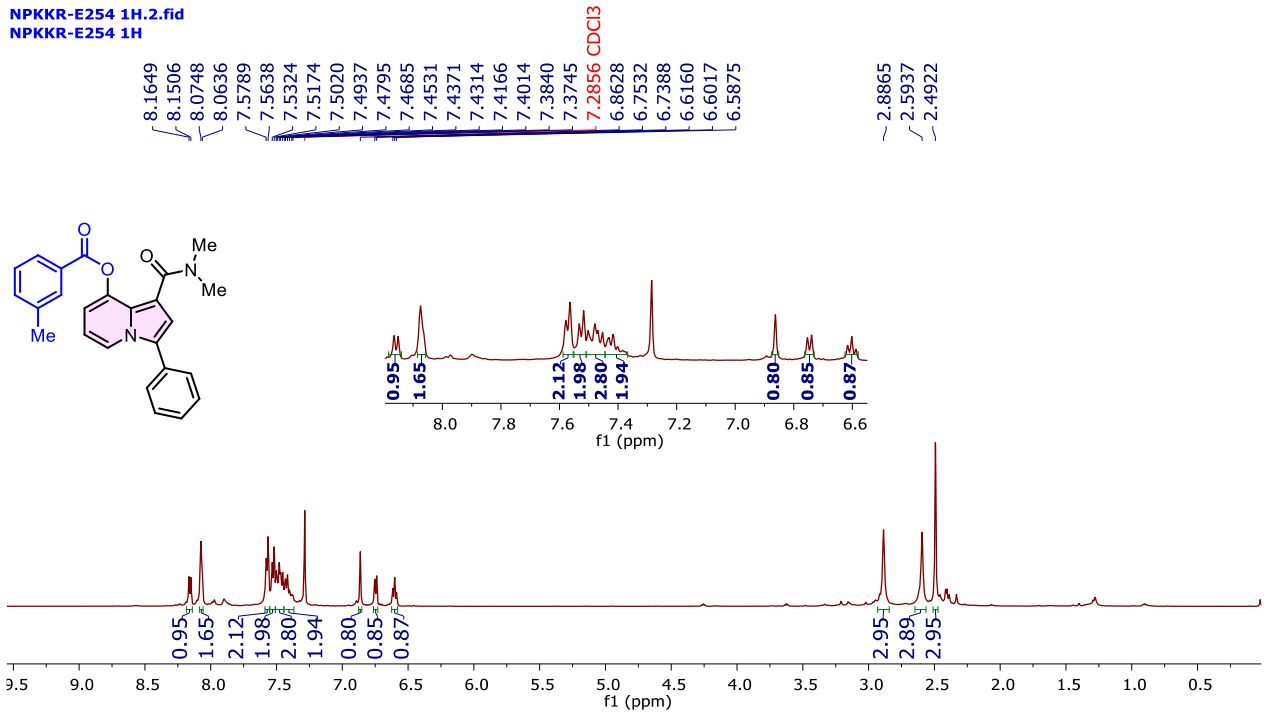
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-iodo benzoate. **(3ai)**



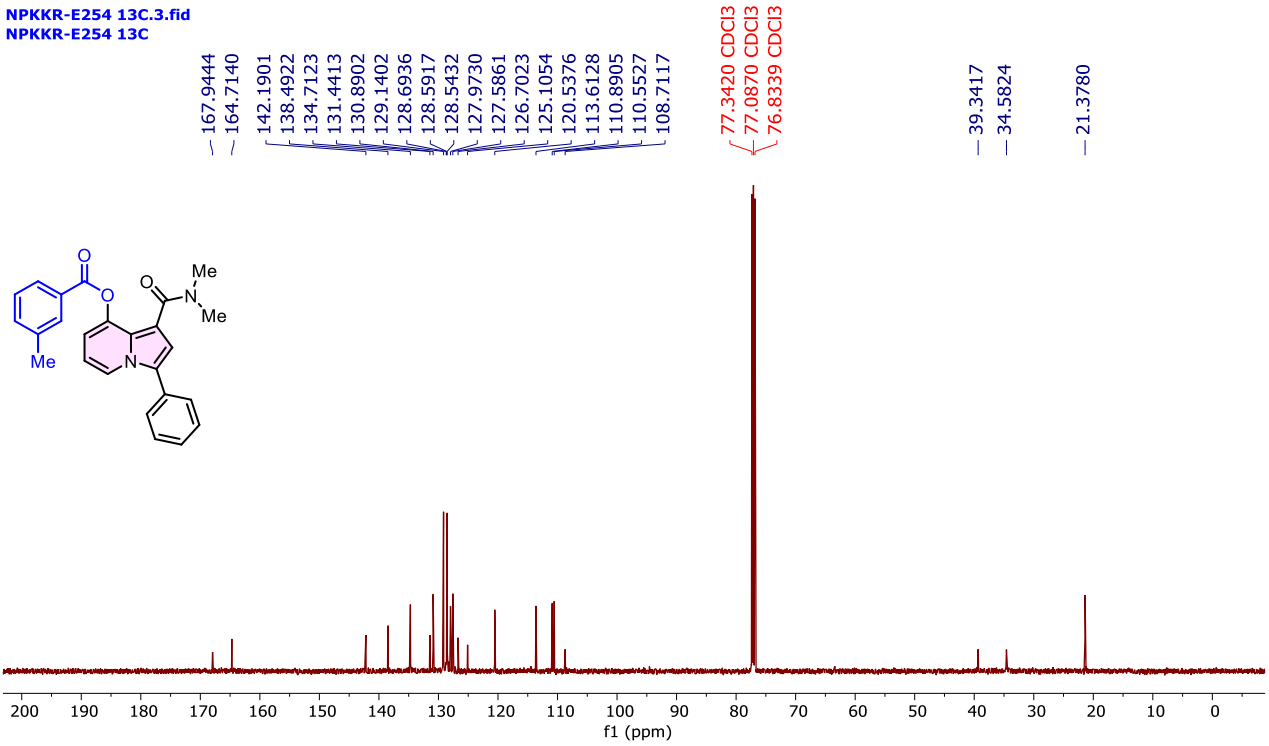
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-chloro benzoate **(3aj).**



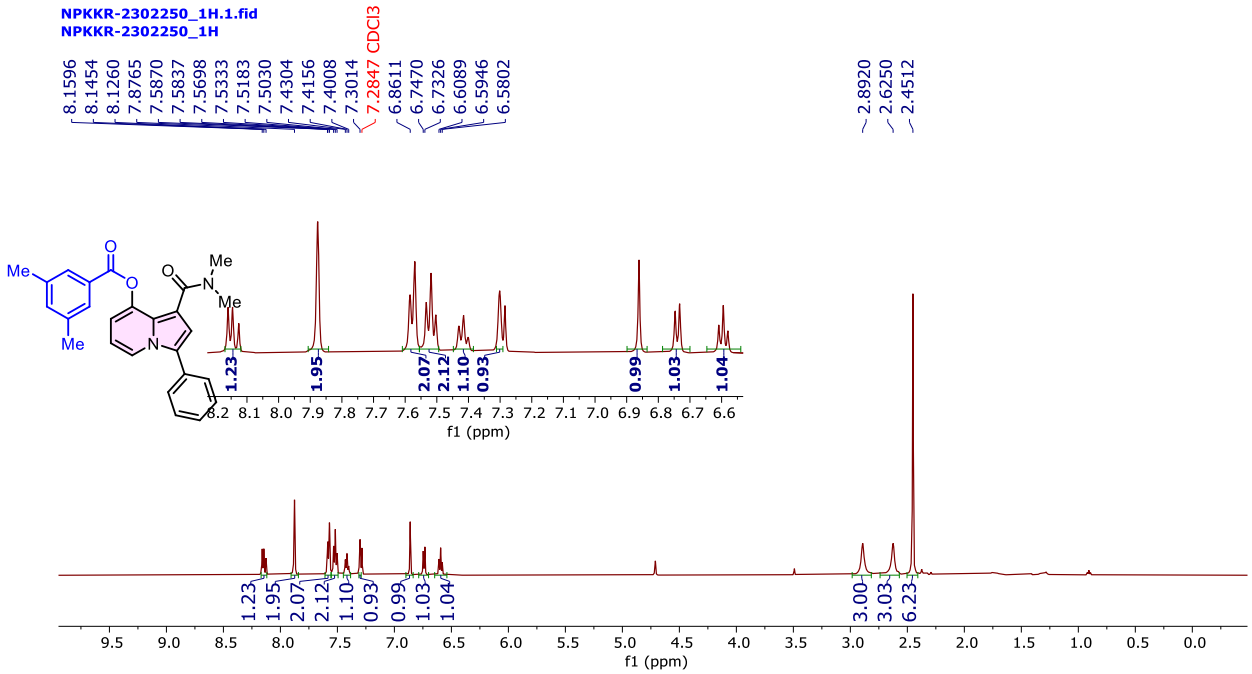
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-chloro benzoate. **(3aj).**



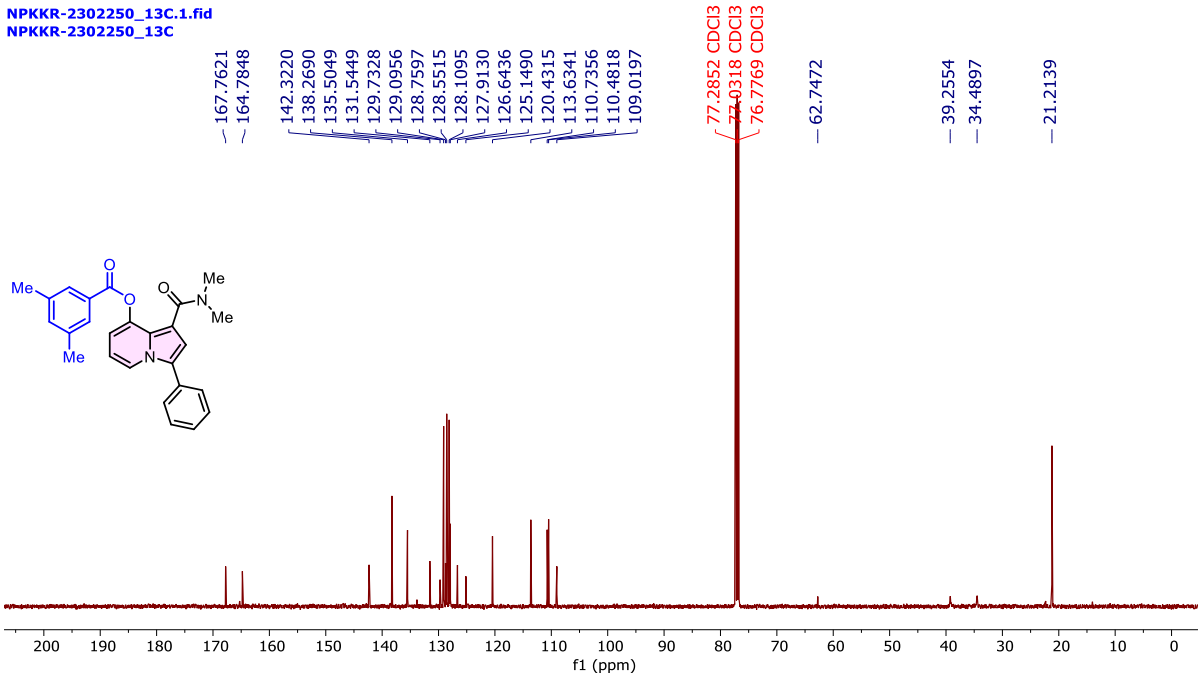
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-methylbenzoate. **(3ak).**



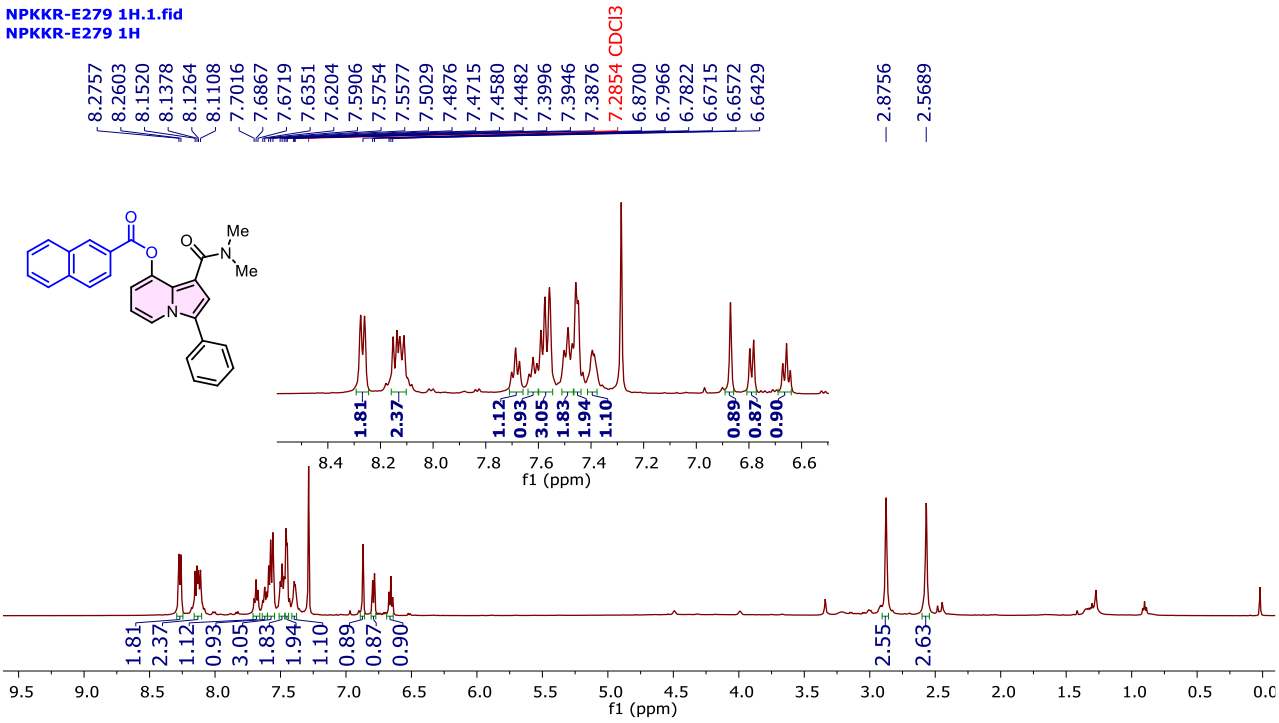
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3-methylbenzoate. **(3ak).**



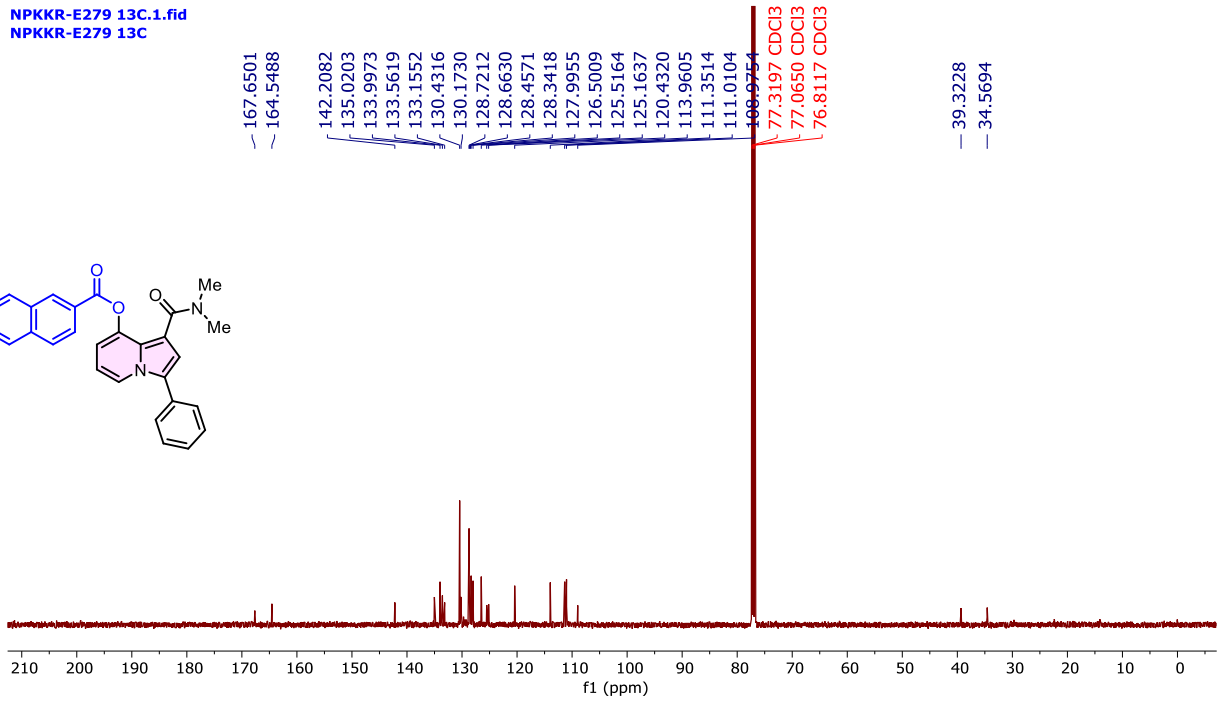
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3,5-dimethyl benzoate. **(3al).**



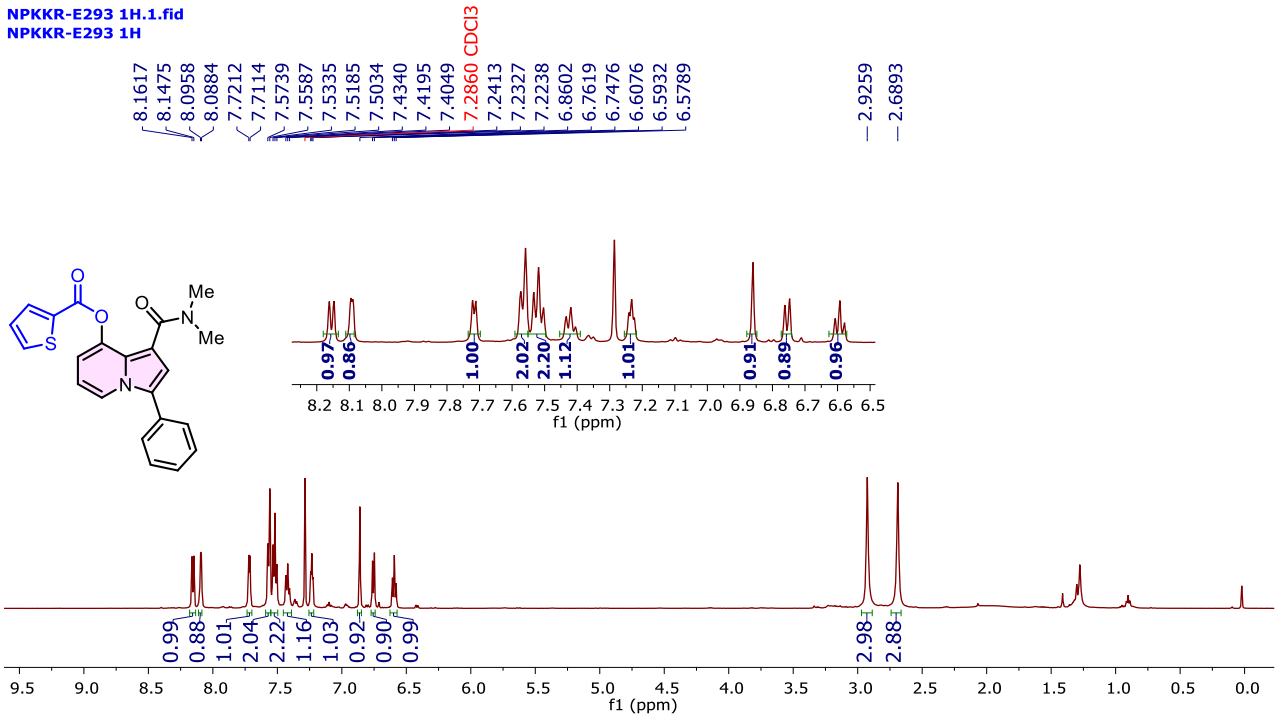
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 3,5-dimethyl benzoate. **(3al).**



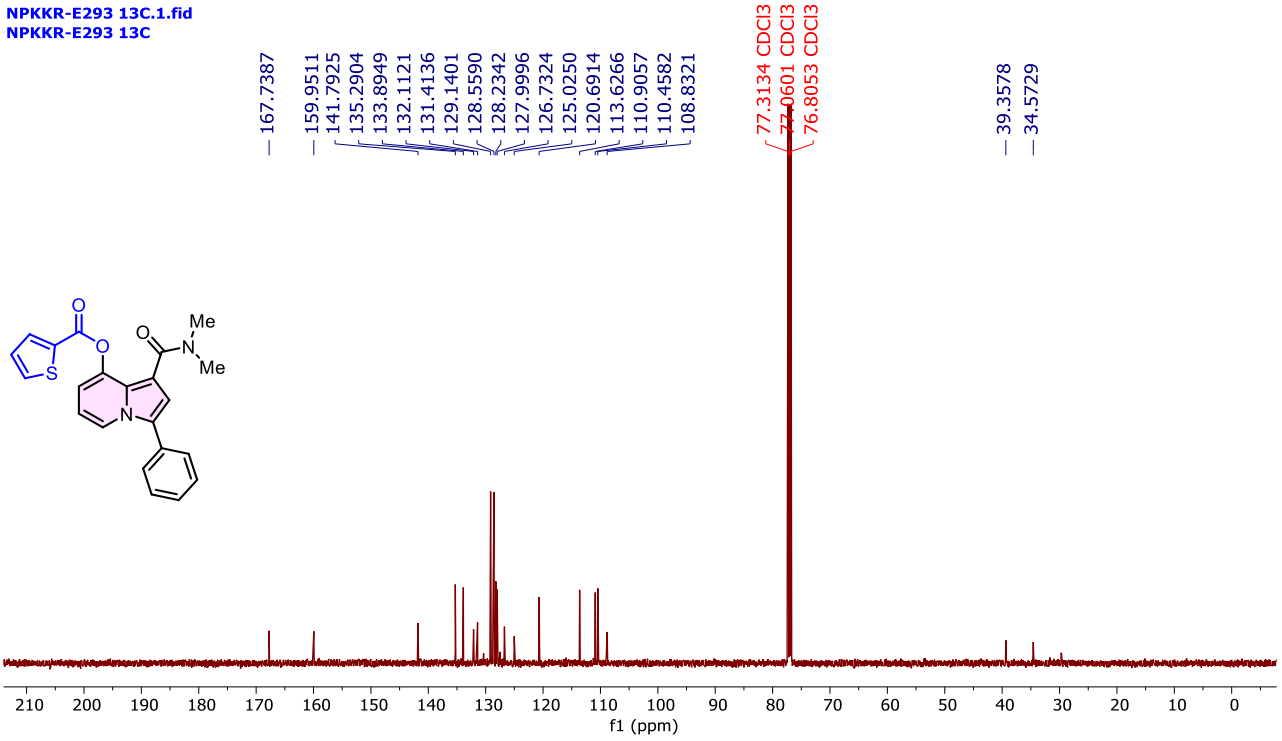
^{1}H NMR (500 MHz, $CDCl_3$) 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 2-naphthoate. (**3am)**



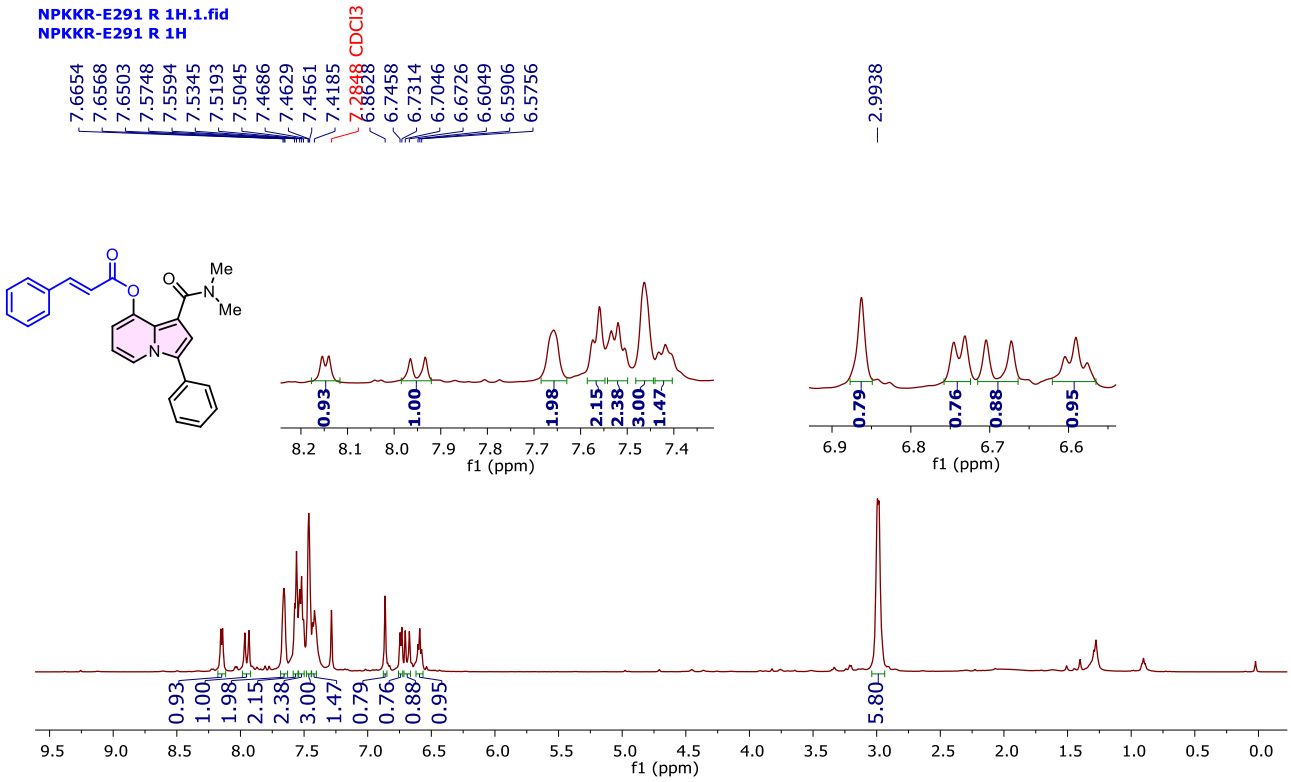
$^{13}C\{^{1}H\}$ NMR (125 MHz, $CDCl_3$) 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl 2-naphthoate. (**3am)**



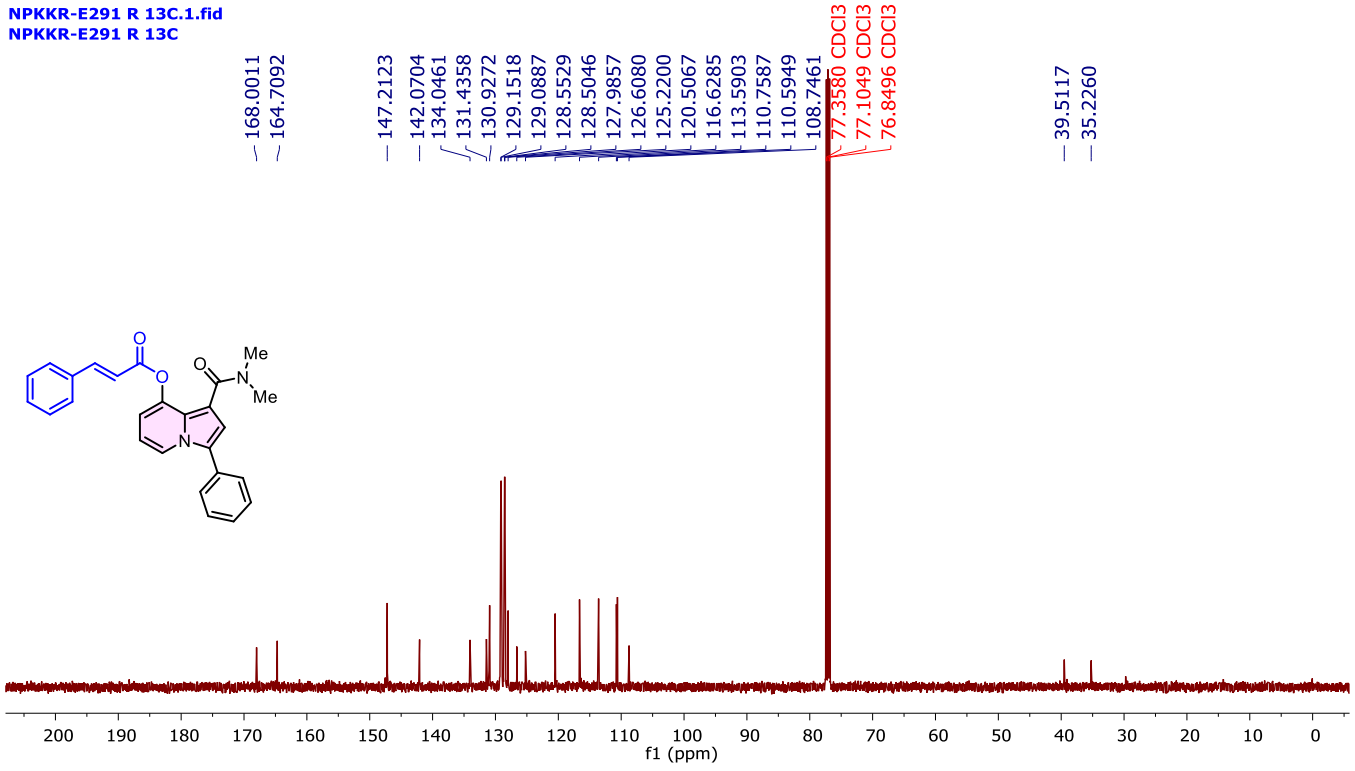
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl thiophene-2-carboxylate. (**3an)**



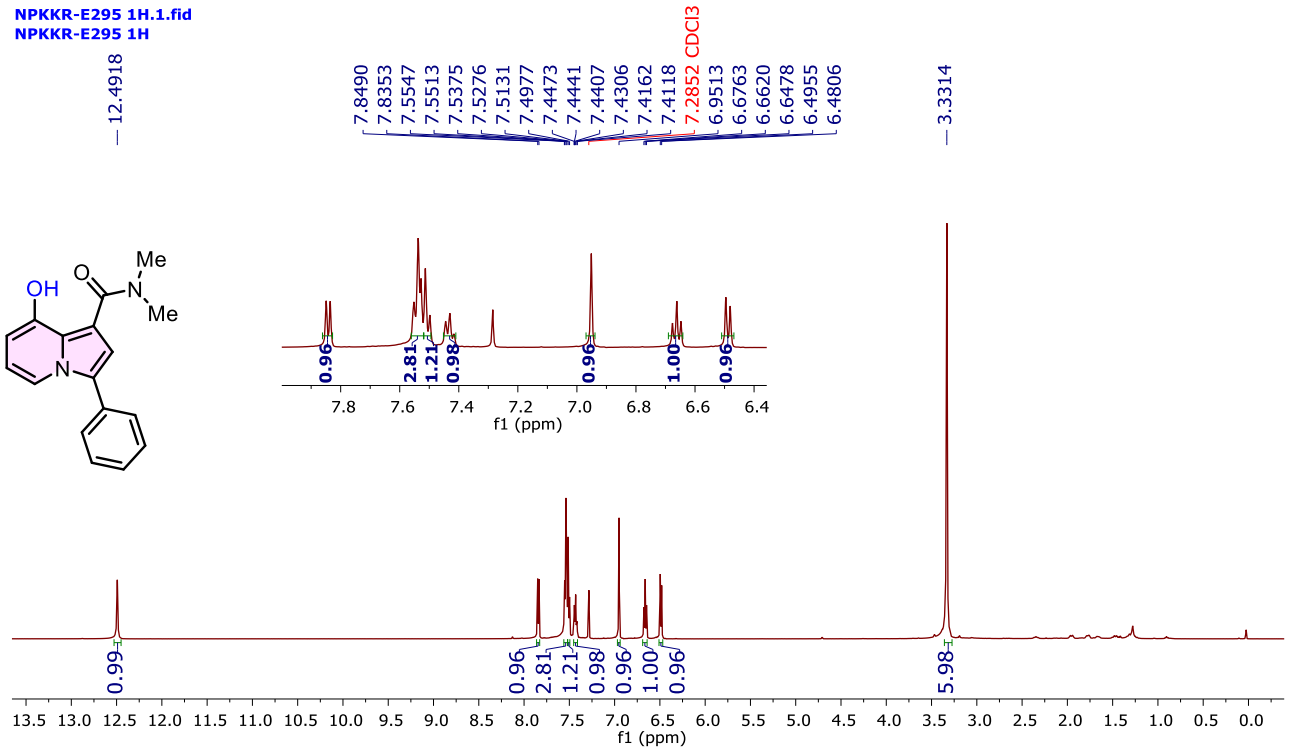
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl thiophene-2-carboxylate. (**3an)**



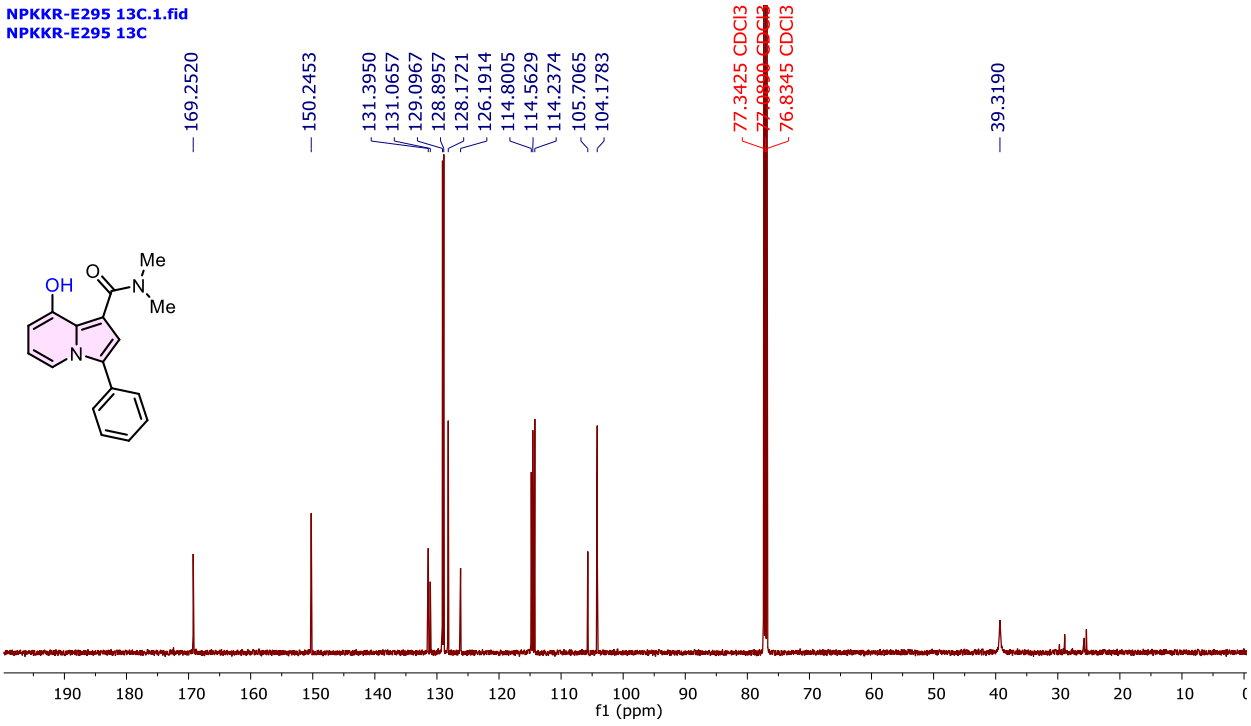
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl (E)-3-phenylacrylate **(3ao).**



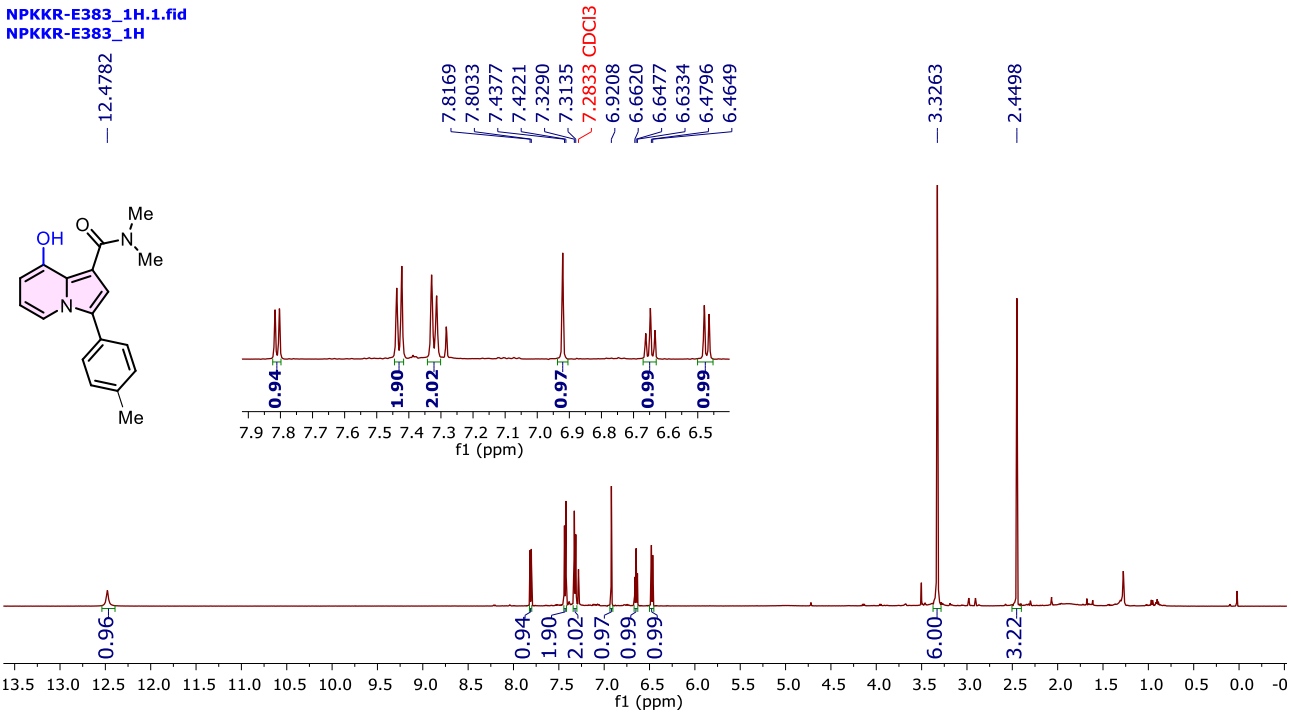
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-phenylindolizin-8-yl (E)-3-phenylacrylate **(3ao).**



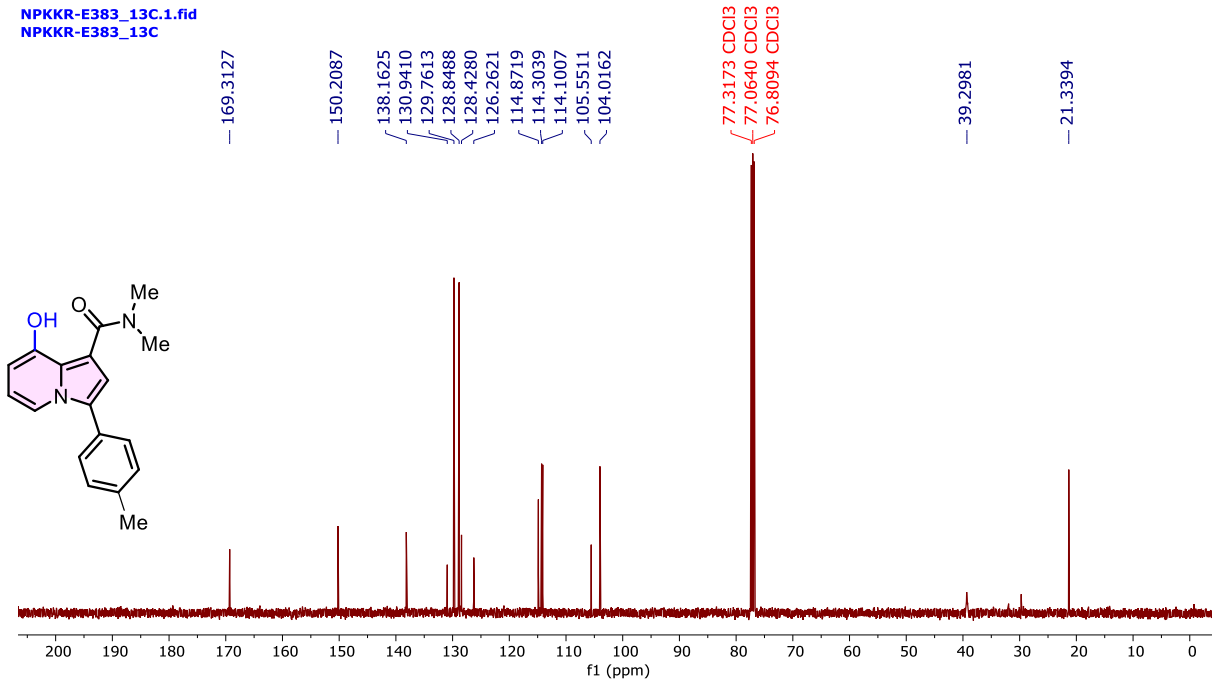
^{1}H NMR (500 MHz, $CDCl_3$) of 8-Hydroxy-N,N-dimethyl-3-phenylindolizine-1-carboxamide **(4a)**



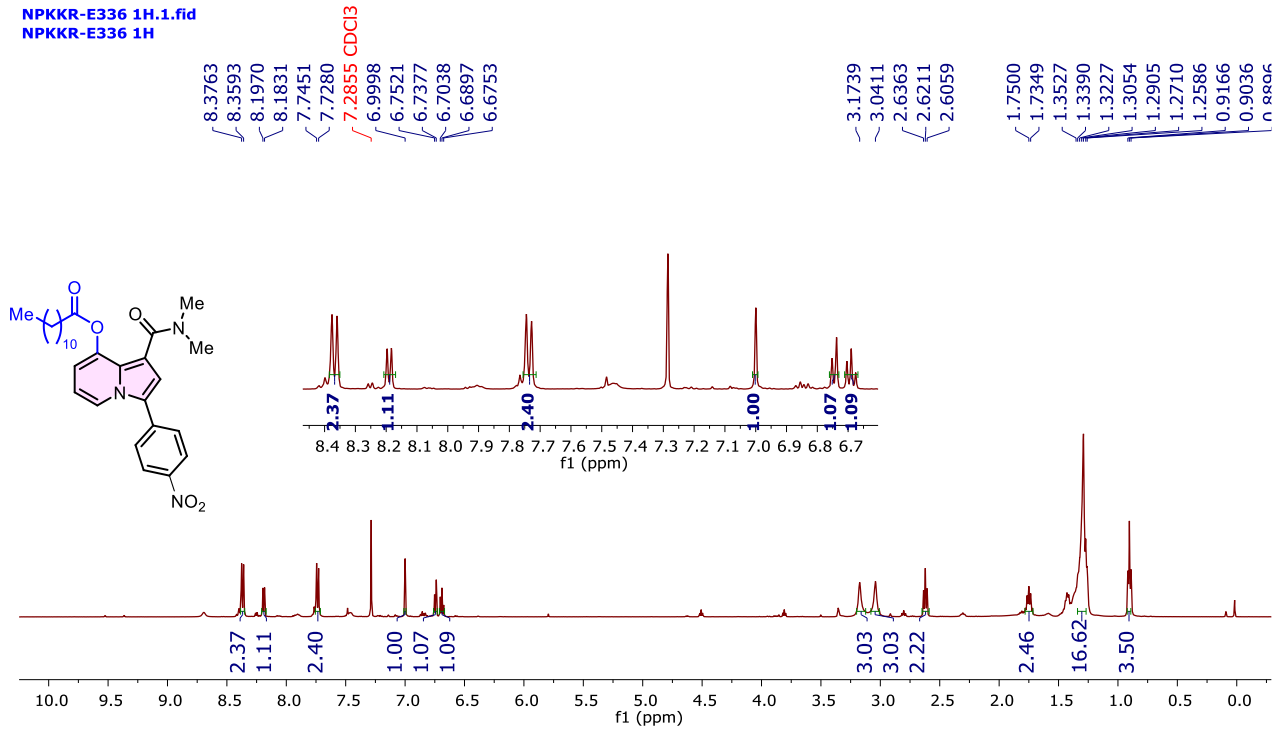
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 8-Hydroxy-N,N-dimethyl-3-phenylindolizine-1-carboxamide **(4a)**



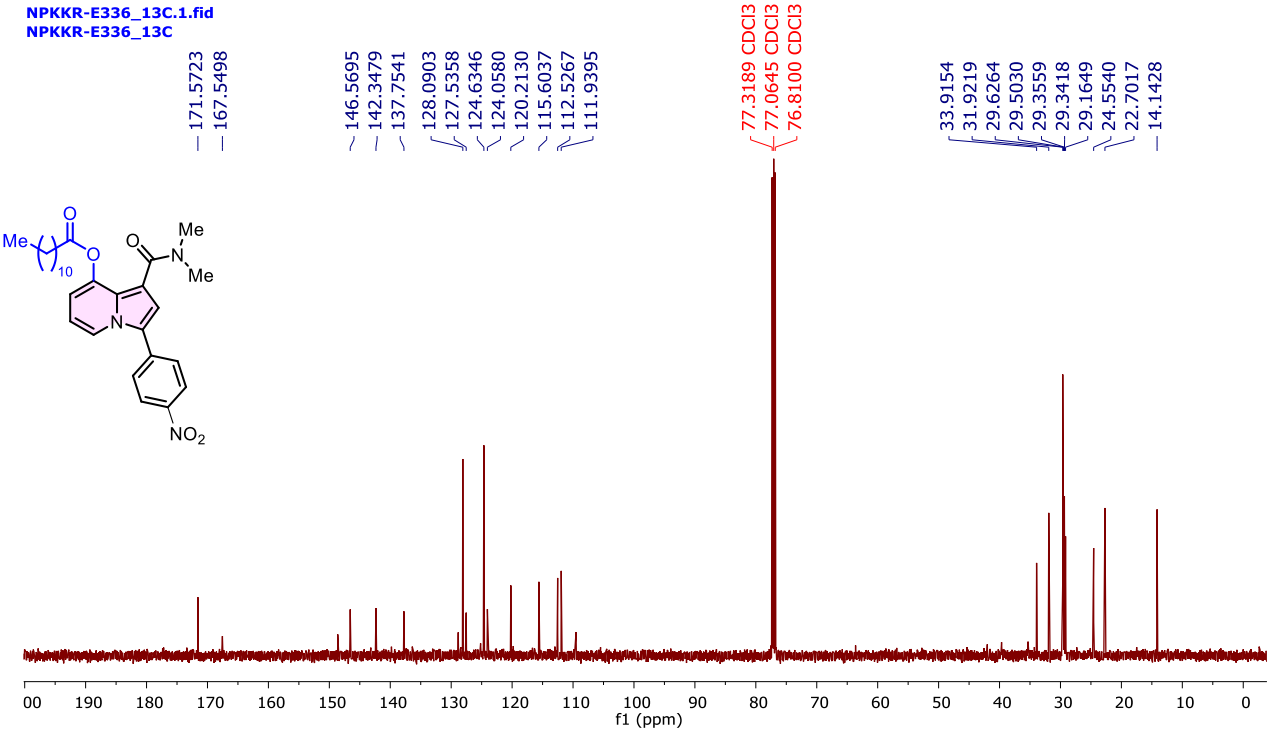
^{1}H NMR (500 MHz, $CDCl_3$) of 8-Hydroxy-N,N-dimethyl-3-(p-tolyl)indolizine-1-carboxamide **(4b)**



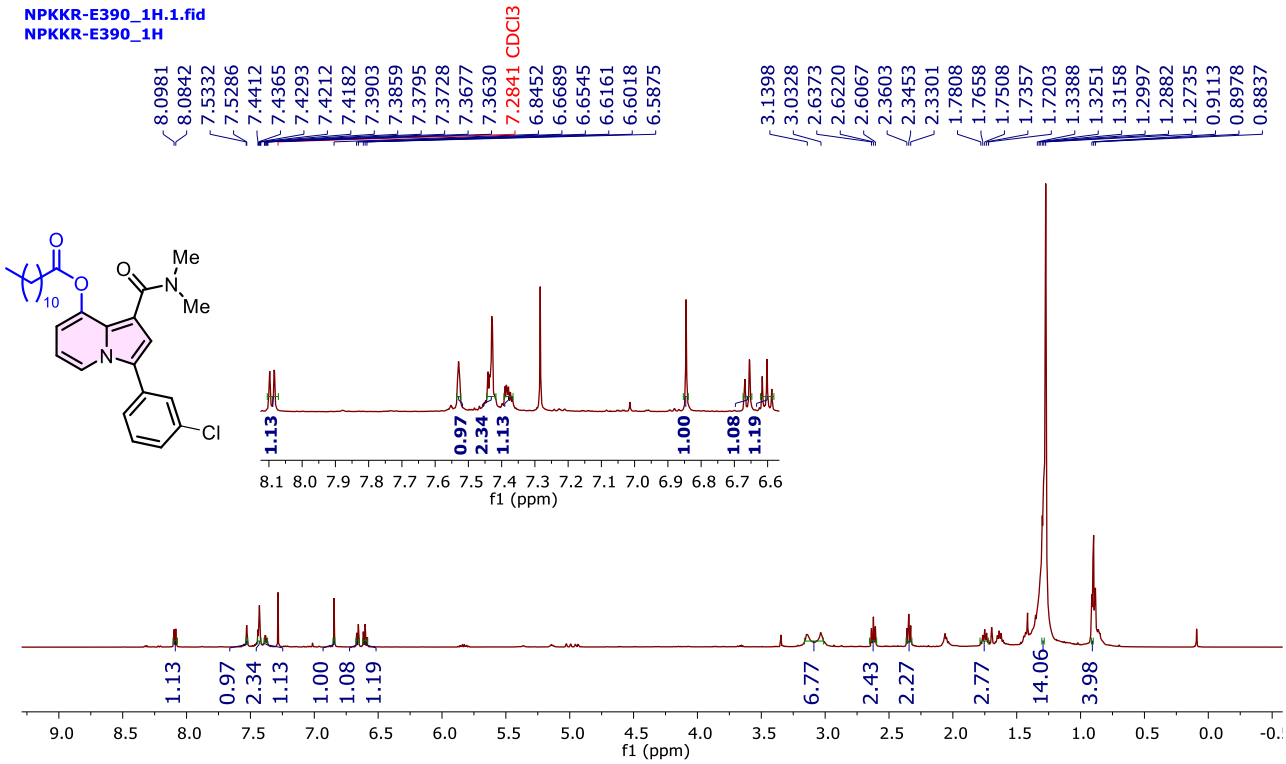
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 8-Hydroxy-N,N-dimethyl-3-(p-tolyl)indolizine-1-carboxamide **(4b)**



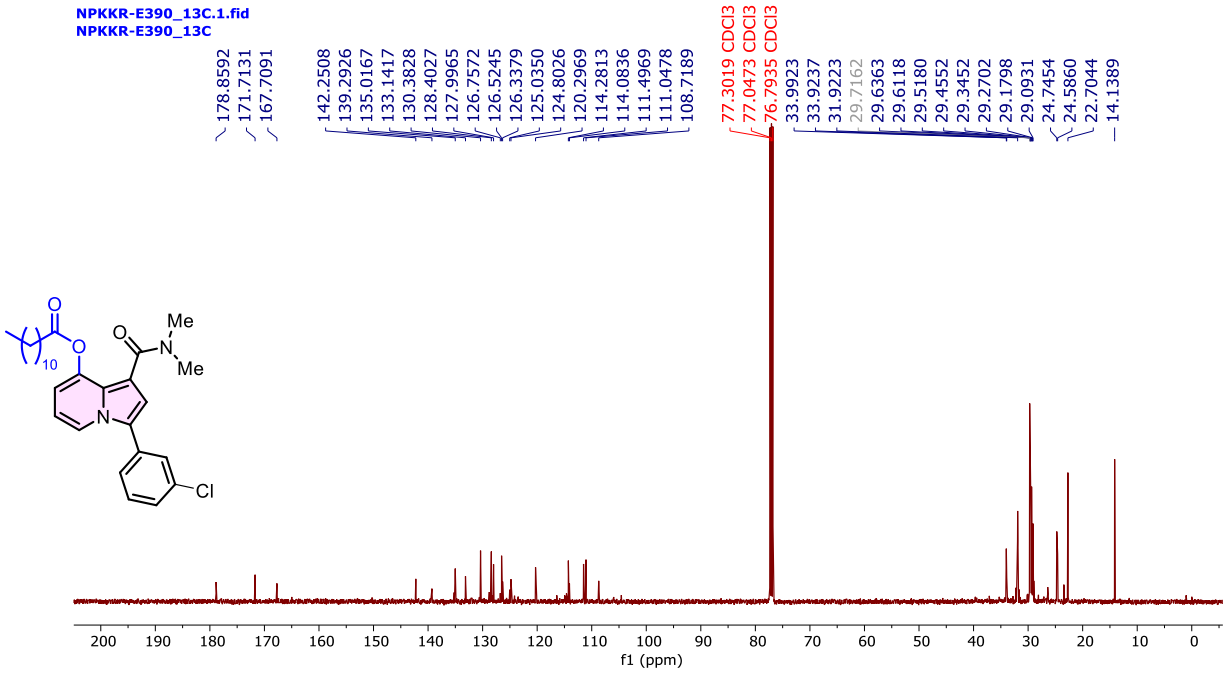
^{1}H NMR (500 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-nitrophenyl)indolizin-8-yl dodecanoate **(3eq).**



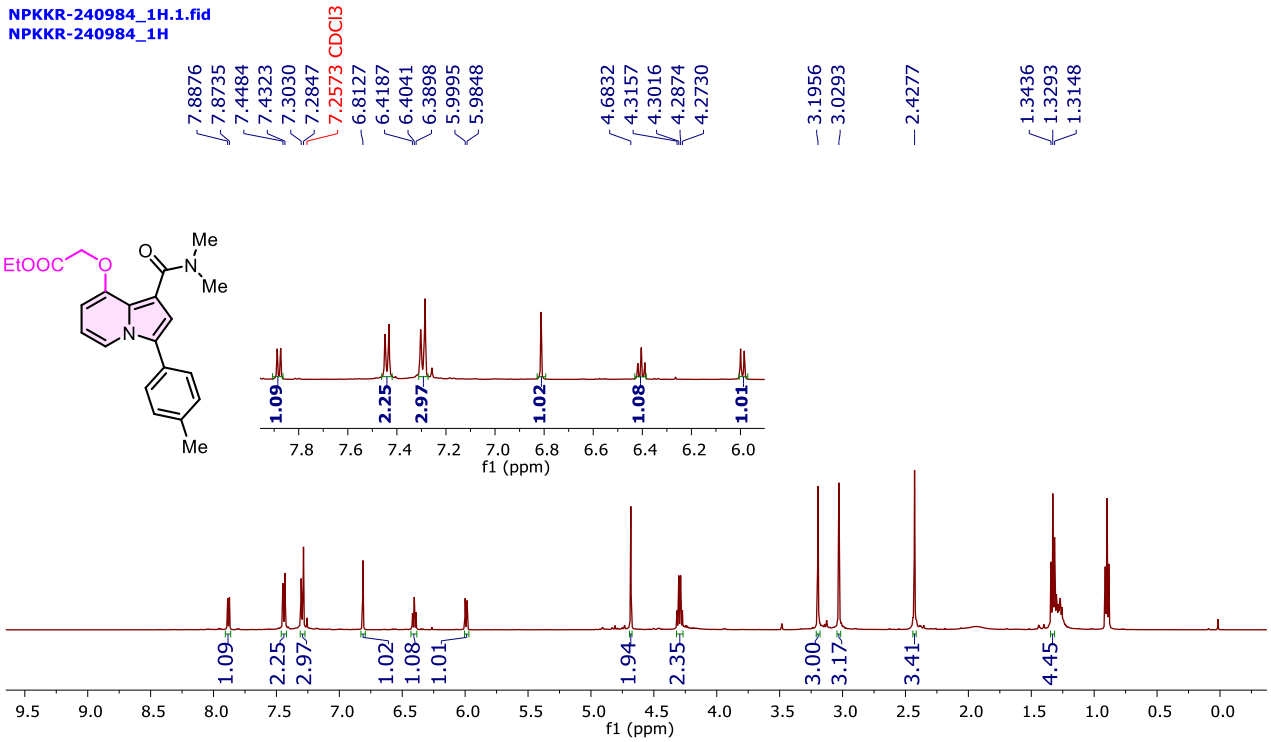
^{13}C{^{1}H} NMR (125 MHz, $CDCl_3$) of 1-(Dimethylcarbamoyl)-3-(4-nitrophenyl)indolizin-8-yl dodecanoate **(3eq).**



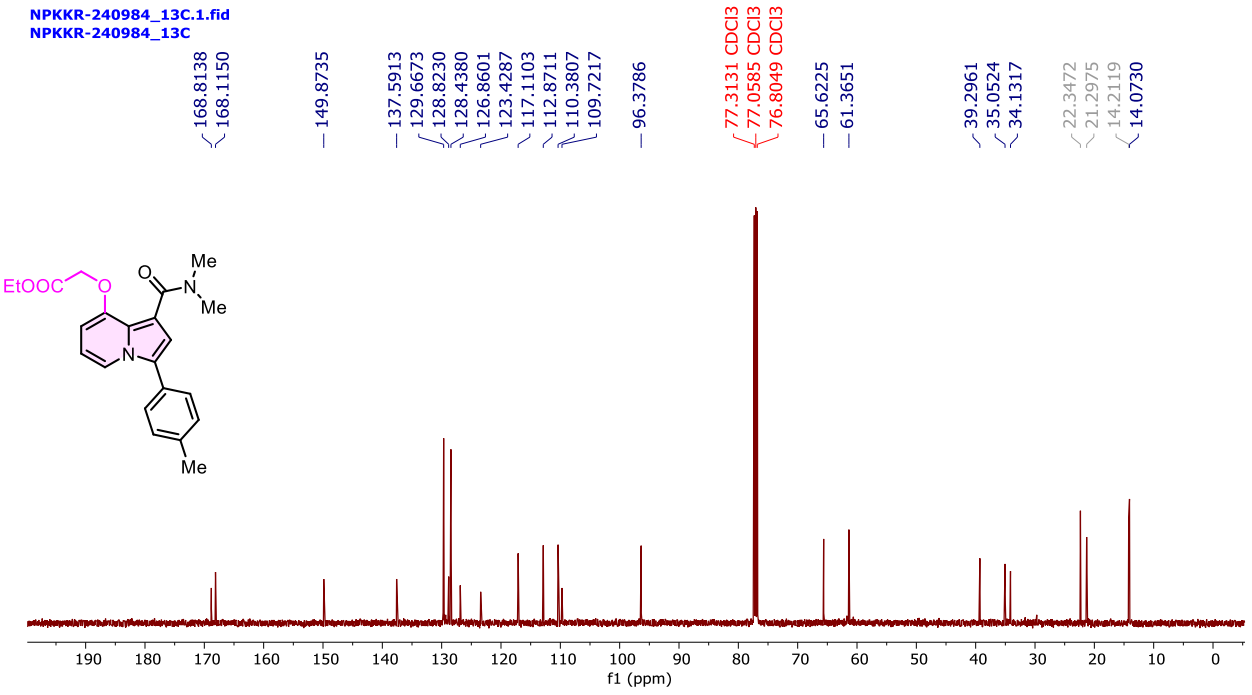
^{1}H NMR (500MHz) of 3-(3-chlorophenyl)-1-(dimethylcarbamoyl)indolizin-8-yl dodecanoate **(3fq).**



^{13}C{^{1}H} NMR (125MHz) of 3-(3-chlorophenyl)-1-(dimethylcarbamoyl)indolizin-8-yl dodecanoate **(3fq).**



^{1}H NMR (500MHz) of Ethyl 2-((1-(dimethylcarbamoyl)-3-(p-tolyl)indolizin-8-yl)oxy)acetate **(5).**



^{13}C{^{1}H} NMR (500MHz) of Ethyl 2-((1-(dimethylcarbamoyl)-3-(p-tolyl)indolizin-8-yl)oxy)acetate **(5).**