NEW SYNTHETIC APPROACH LEADING TO 1- OR 1,3-DISUBSTITUTED 2-THIOURACIL-5-CARBOXYLATES VIA DIMROTH REARRANGEMENT OF ISOMERIC THIAZINES

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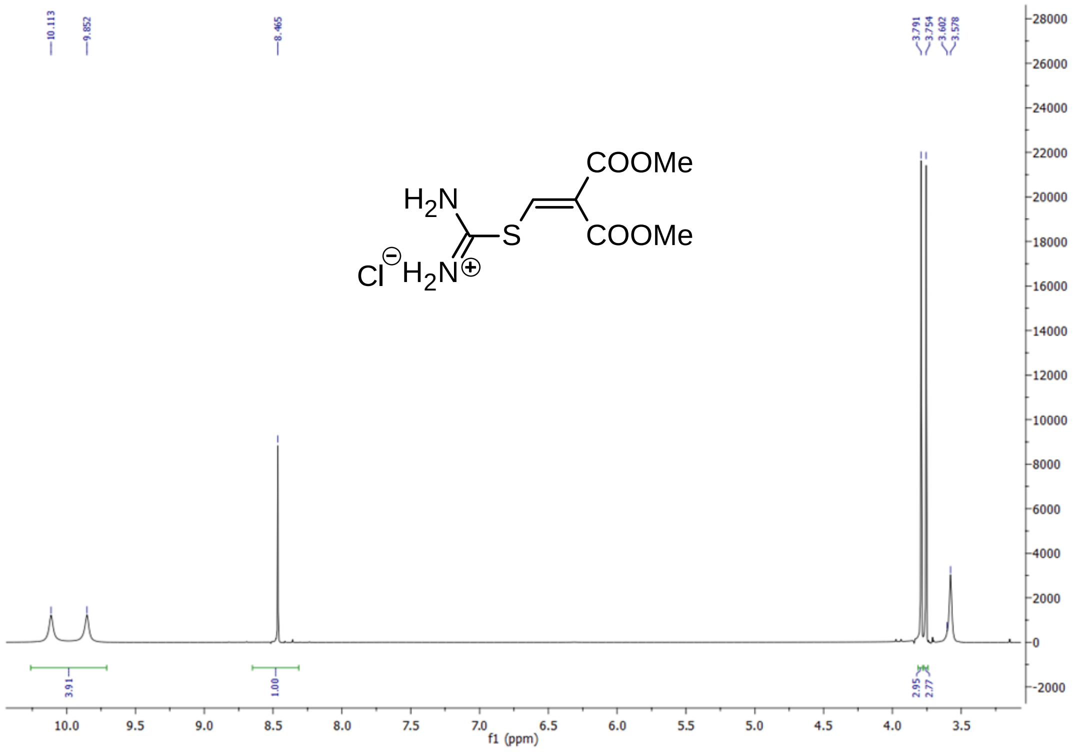
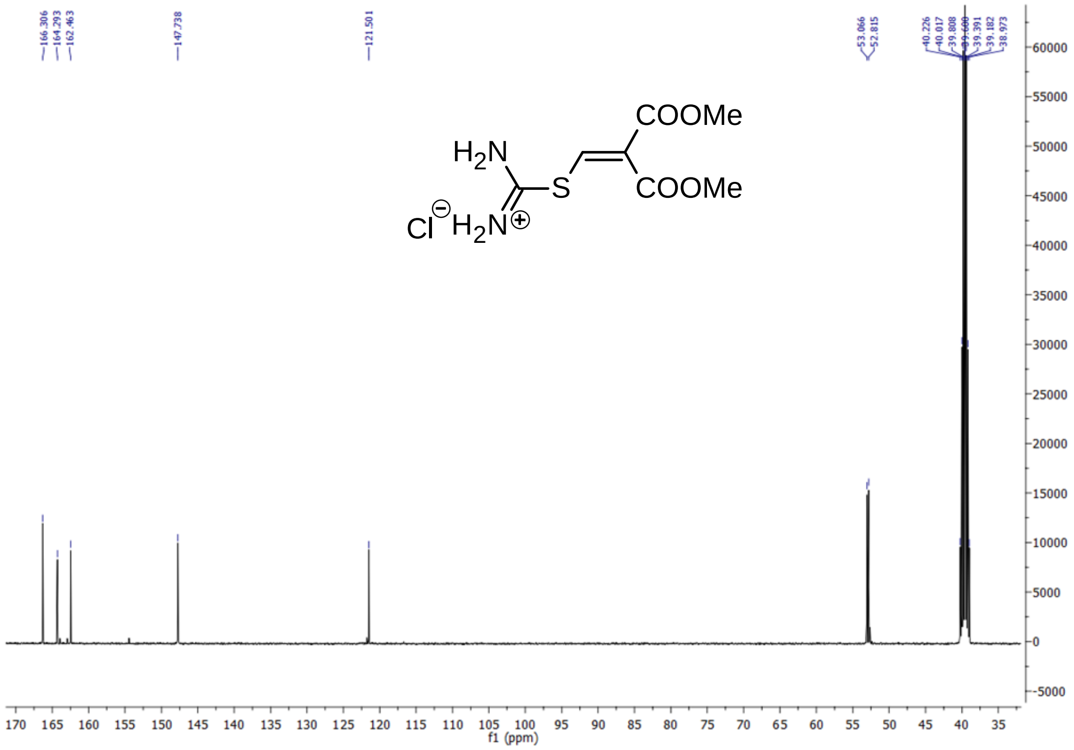
NMR spectra of compounds **1a-d**, **2a**, **3b-d** and **4**.

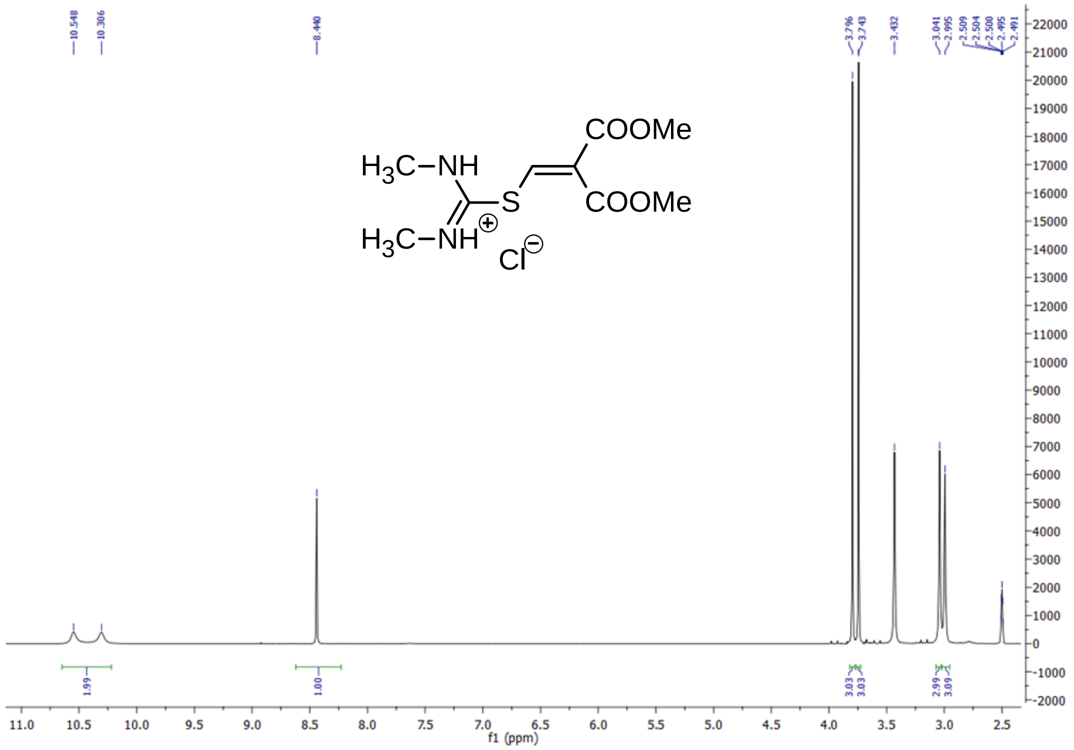
^{1}H NMR of compound **1a**



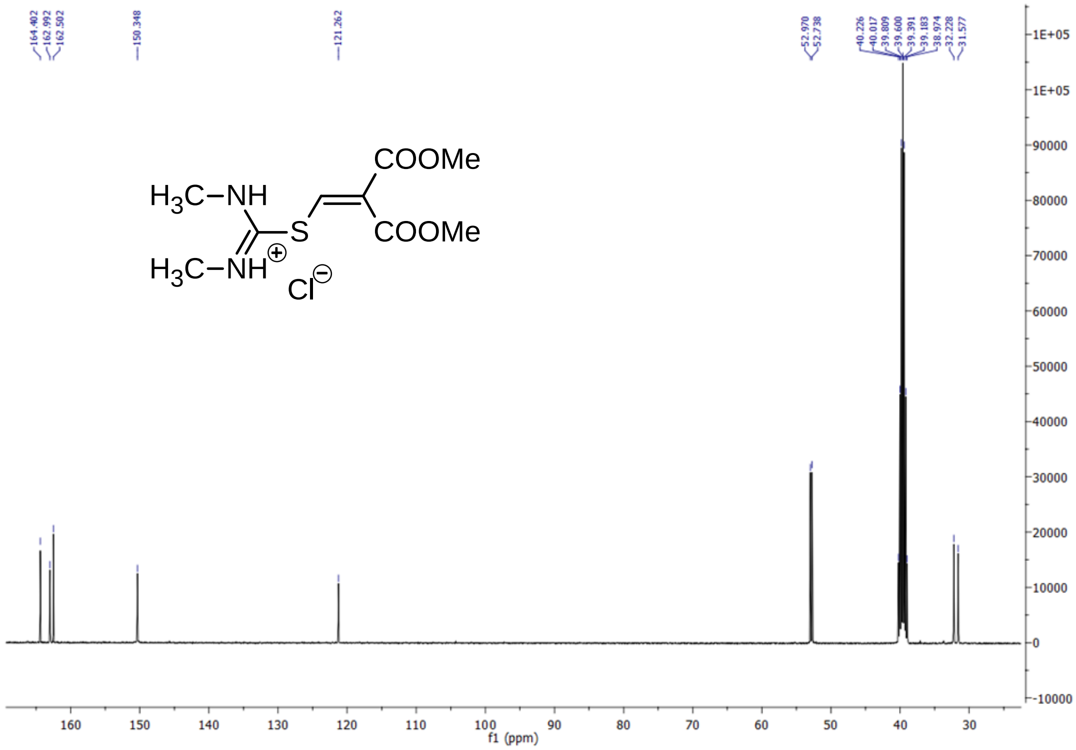
^{13}C NMR of compound **1a**



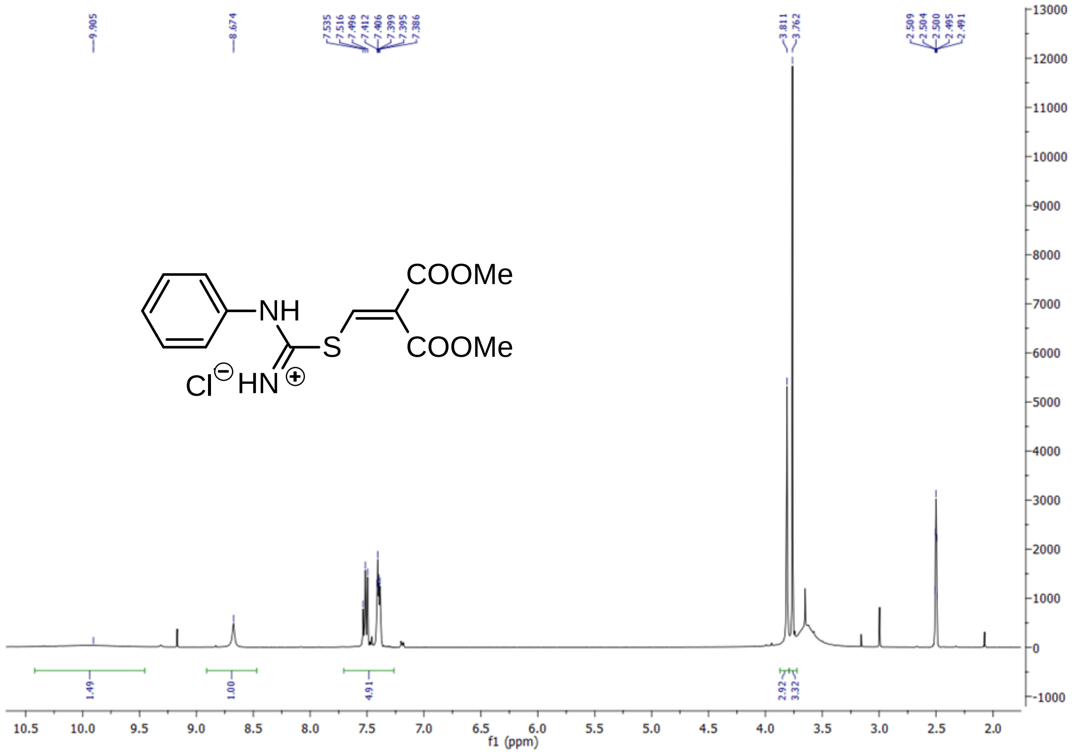
^{1}H NMR specreum of **1b**



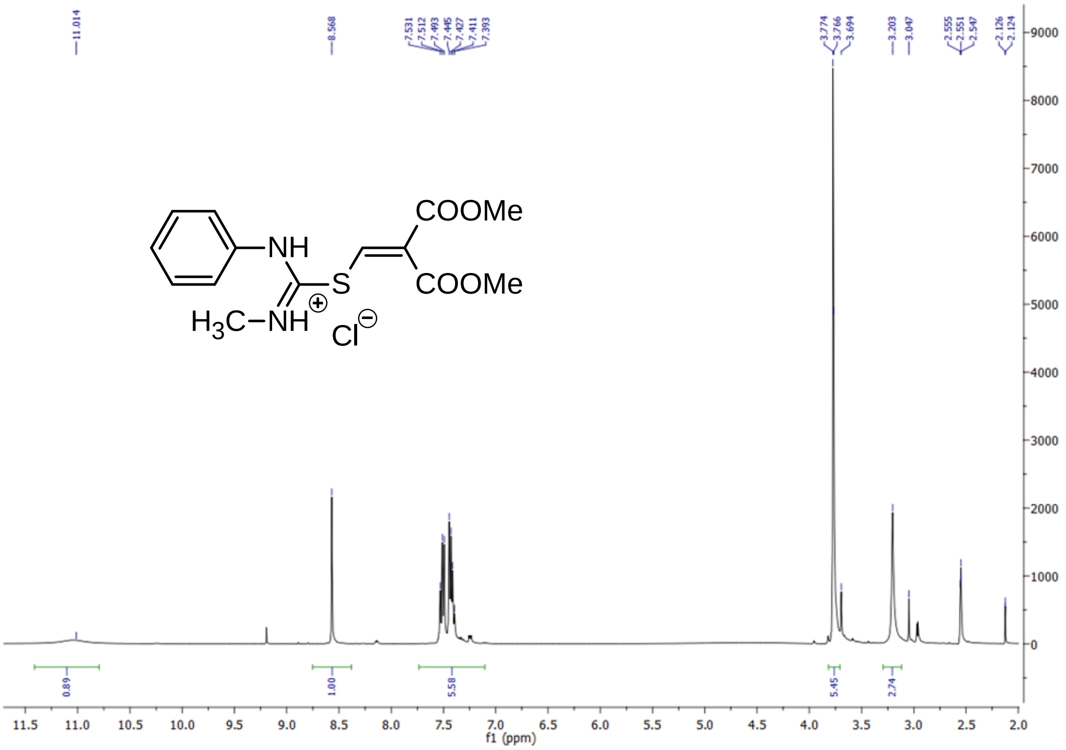
^{13}C NMR of compound **1b**



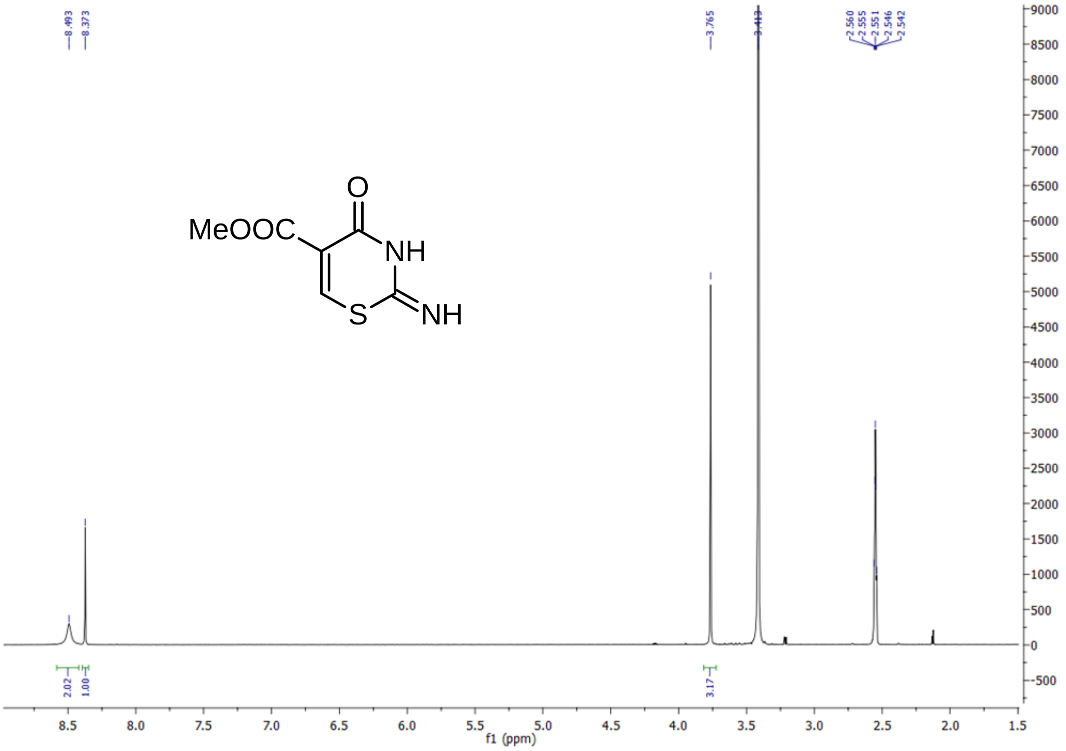
^{1}H NMR spectrum of **1c**



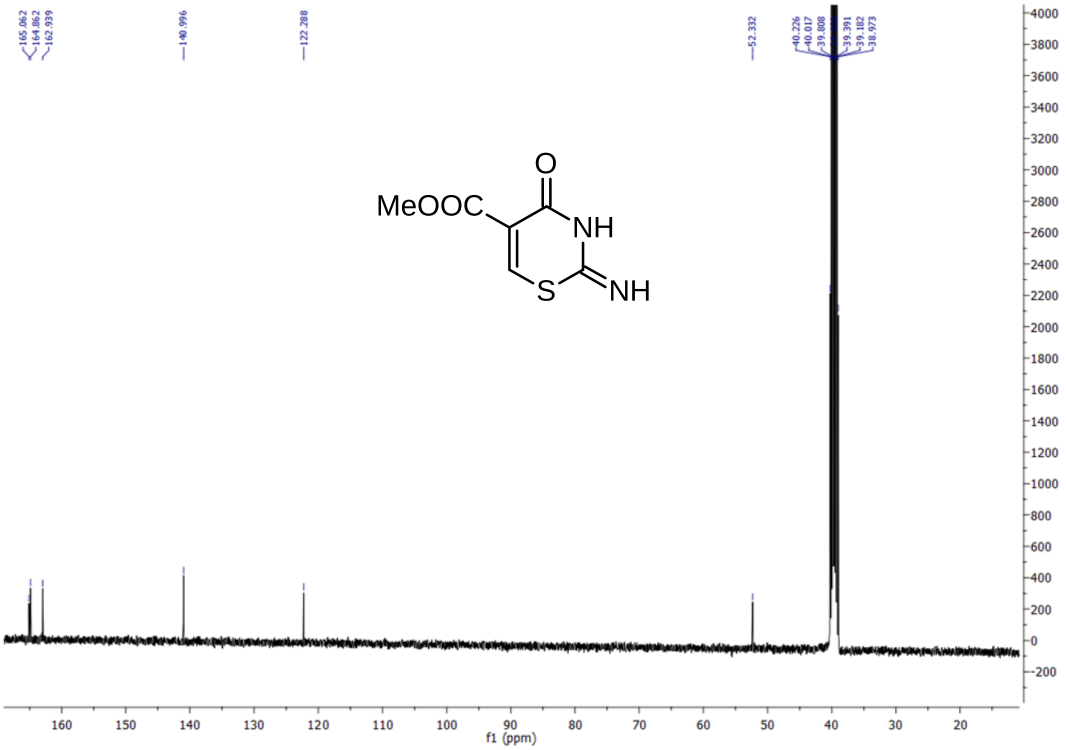
^{1}H NMR spectrum of **1d**



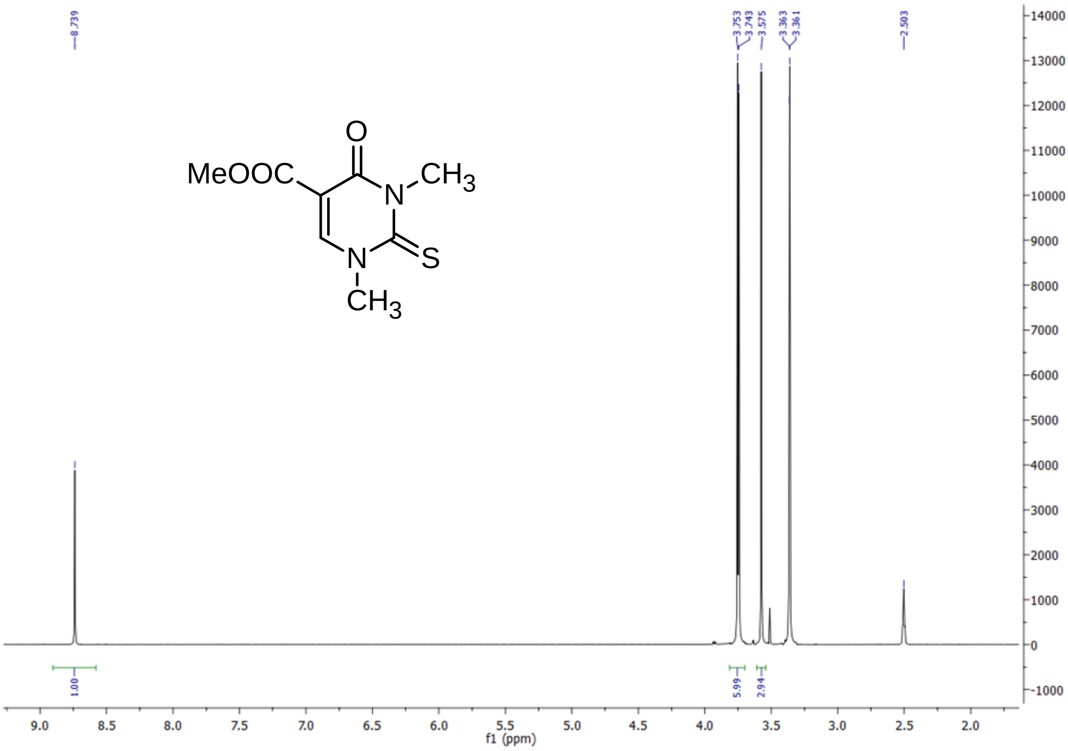
^{1}H NMR spectrum of **2a**



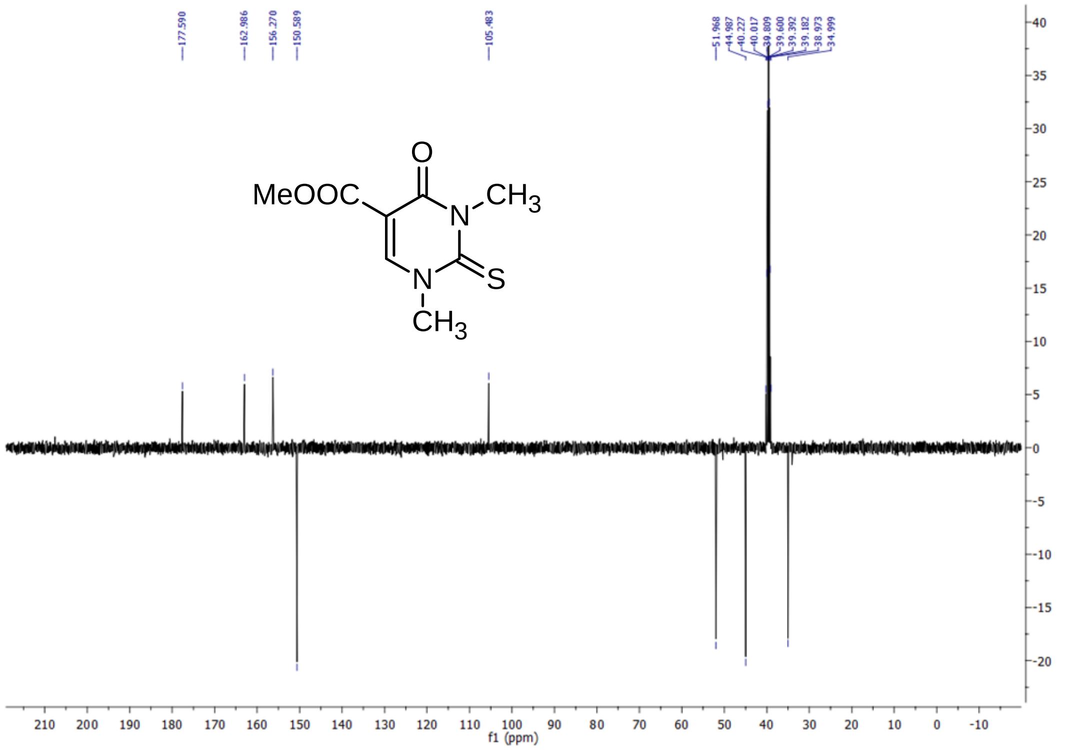
^{1}H NMR spectrum of **2a**



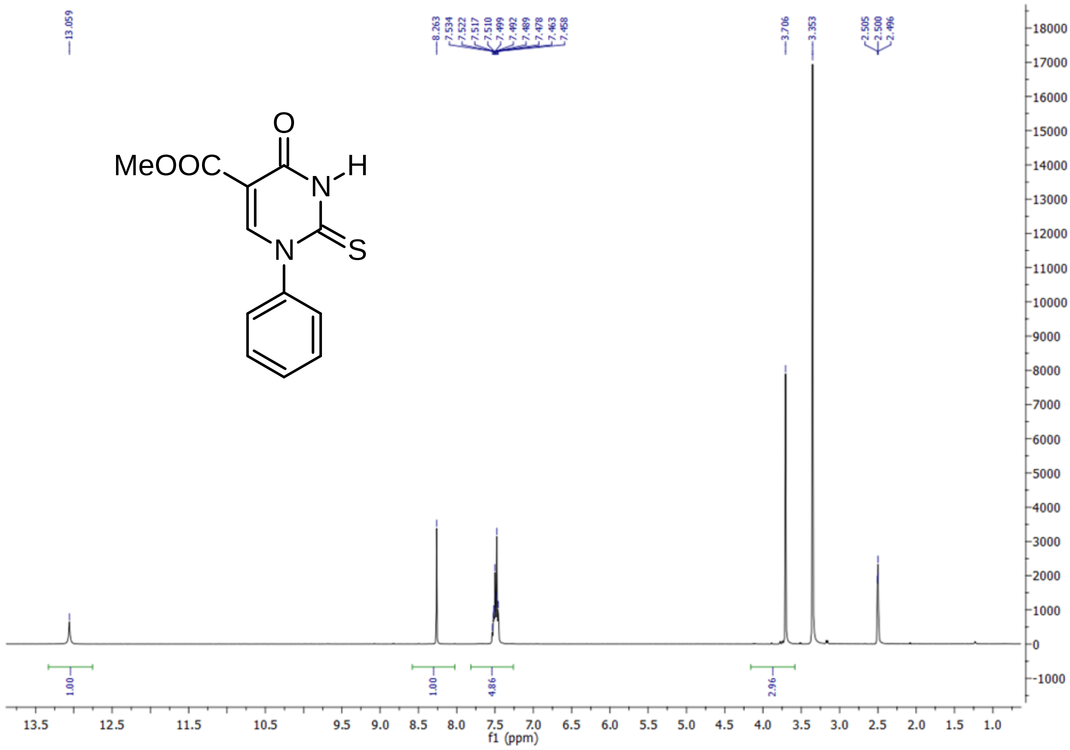
^{1}H NMR spectrum of **3b**



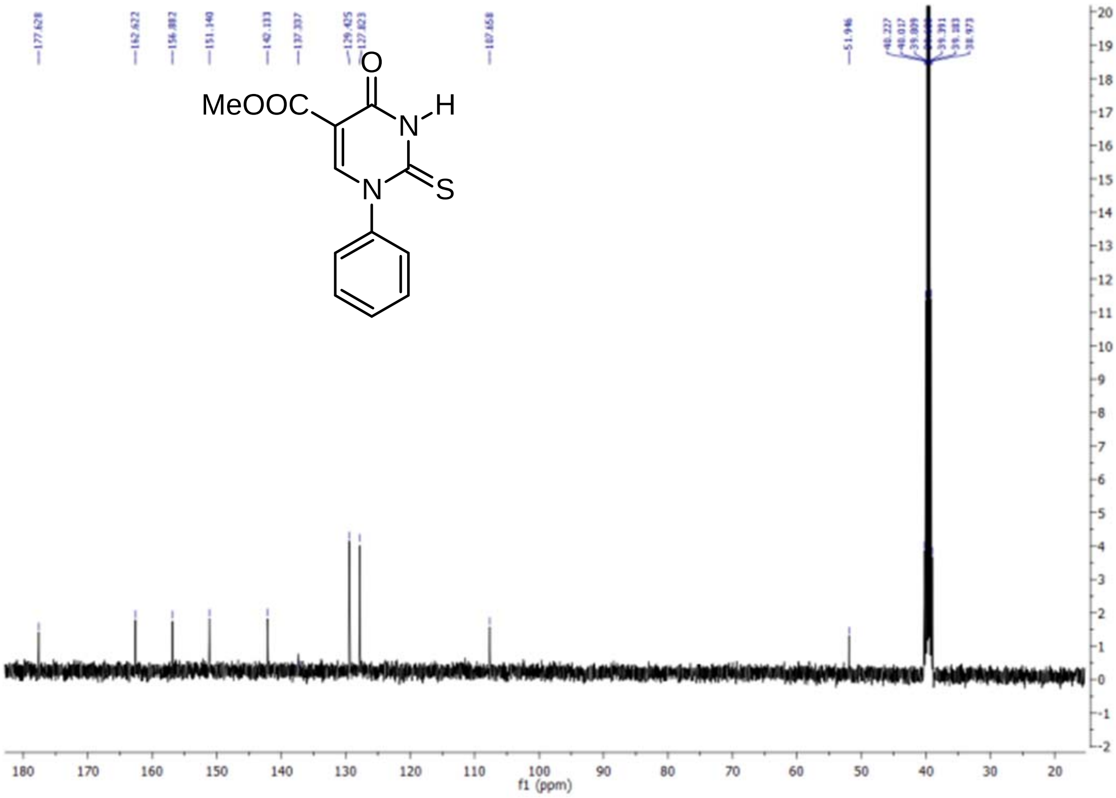
^{13}C NMR spectrum of **3b**



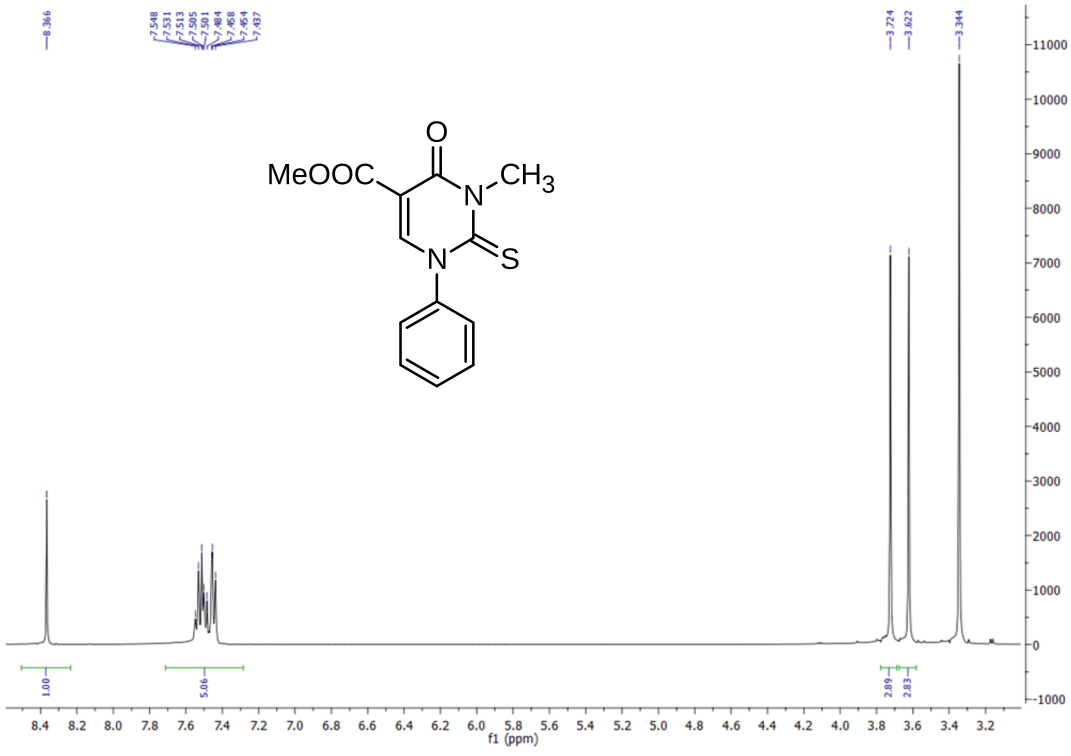
^{1}H NMR spectrum of **3c**



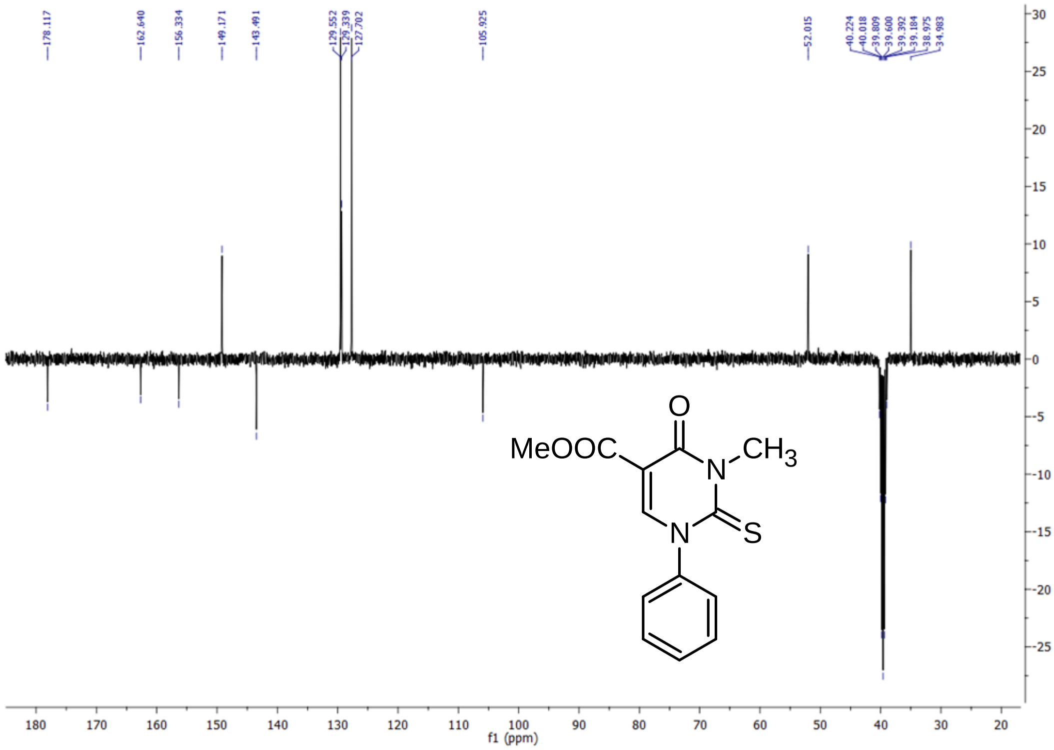
^{13}C NMR spectrum of **3c**



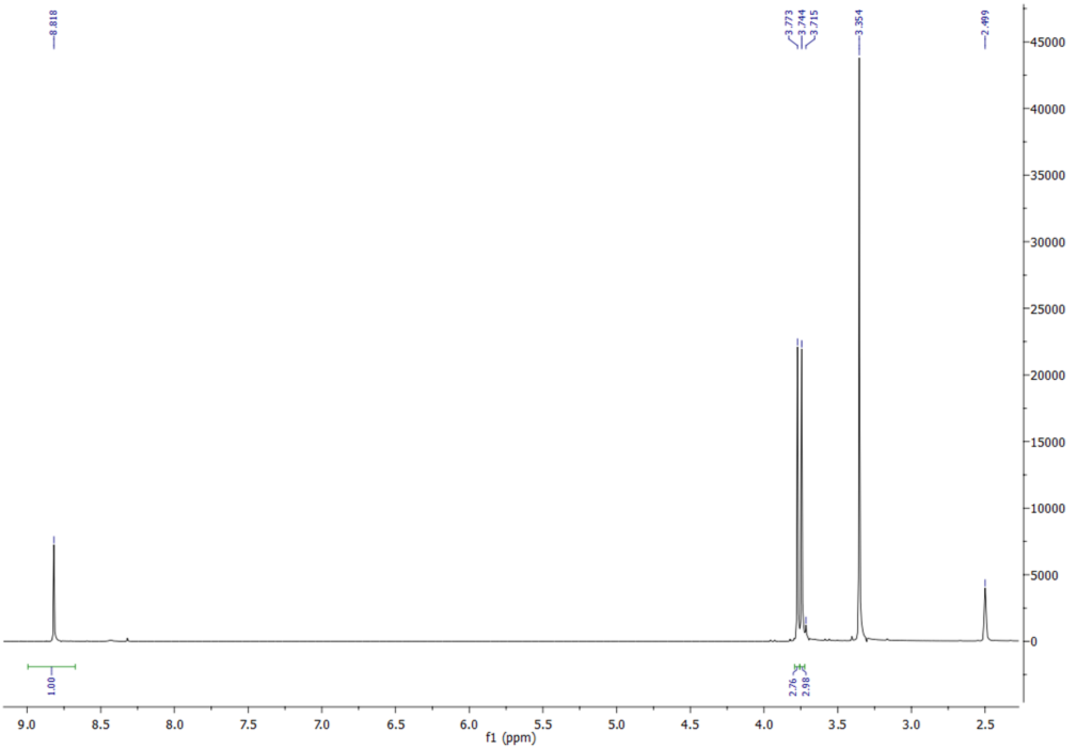
^1H NMR spectrum of **3d**



^{13}C NMR spectrum of **3d**



^{1}H NMR spectrum of **4**

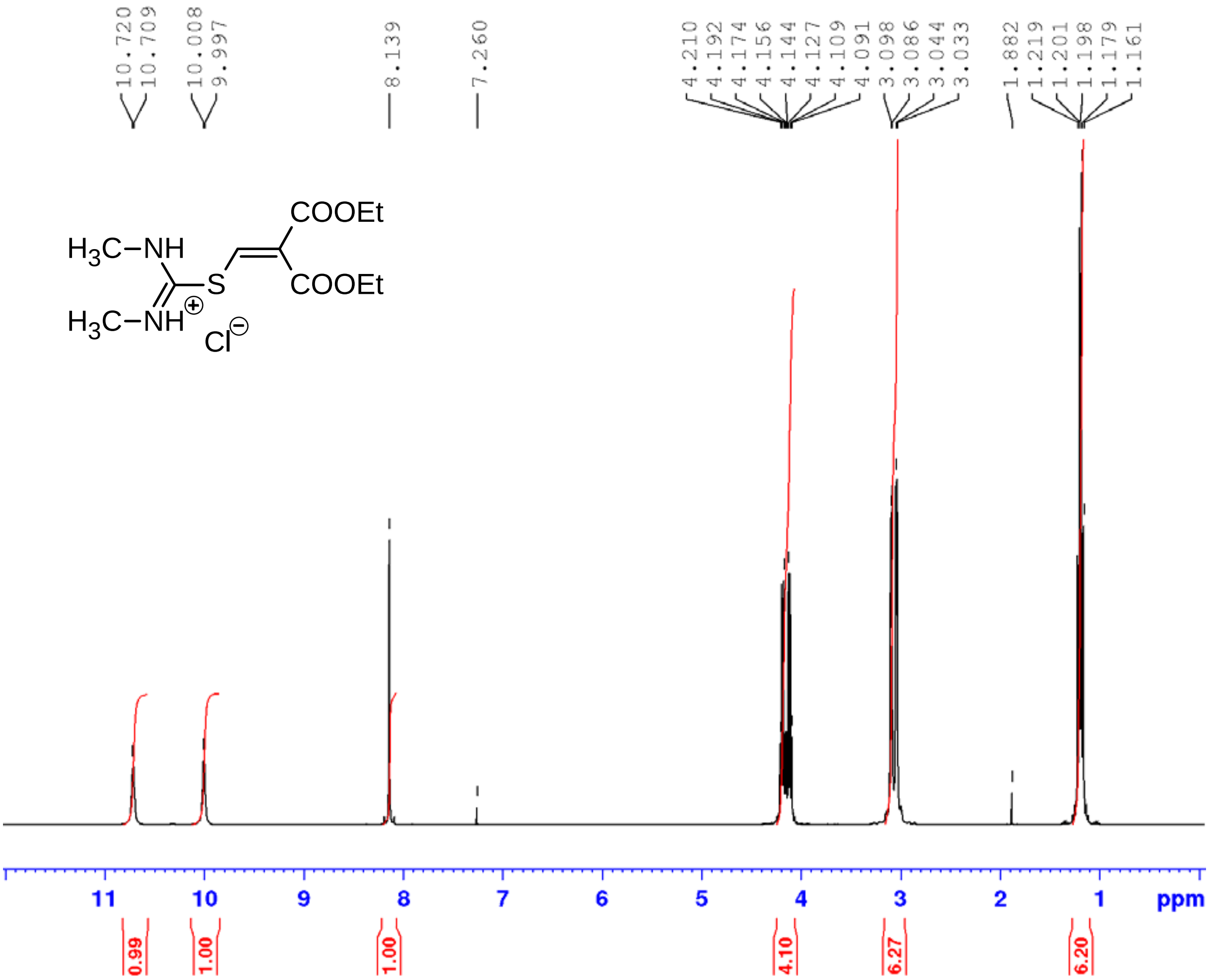


N-[(*Z*)-{[3-ethoxy-2-(ethoxycarbonyl)-3-oxoprop-1-en-1-yl]sulfanyl}(methylamino) methylidene]methanaminium chloride

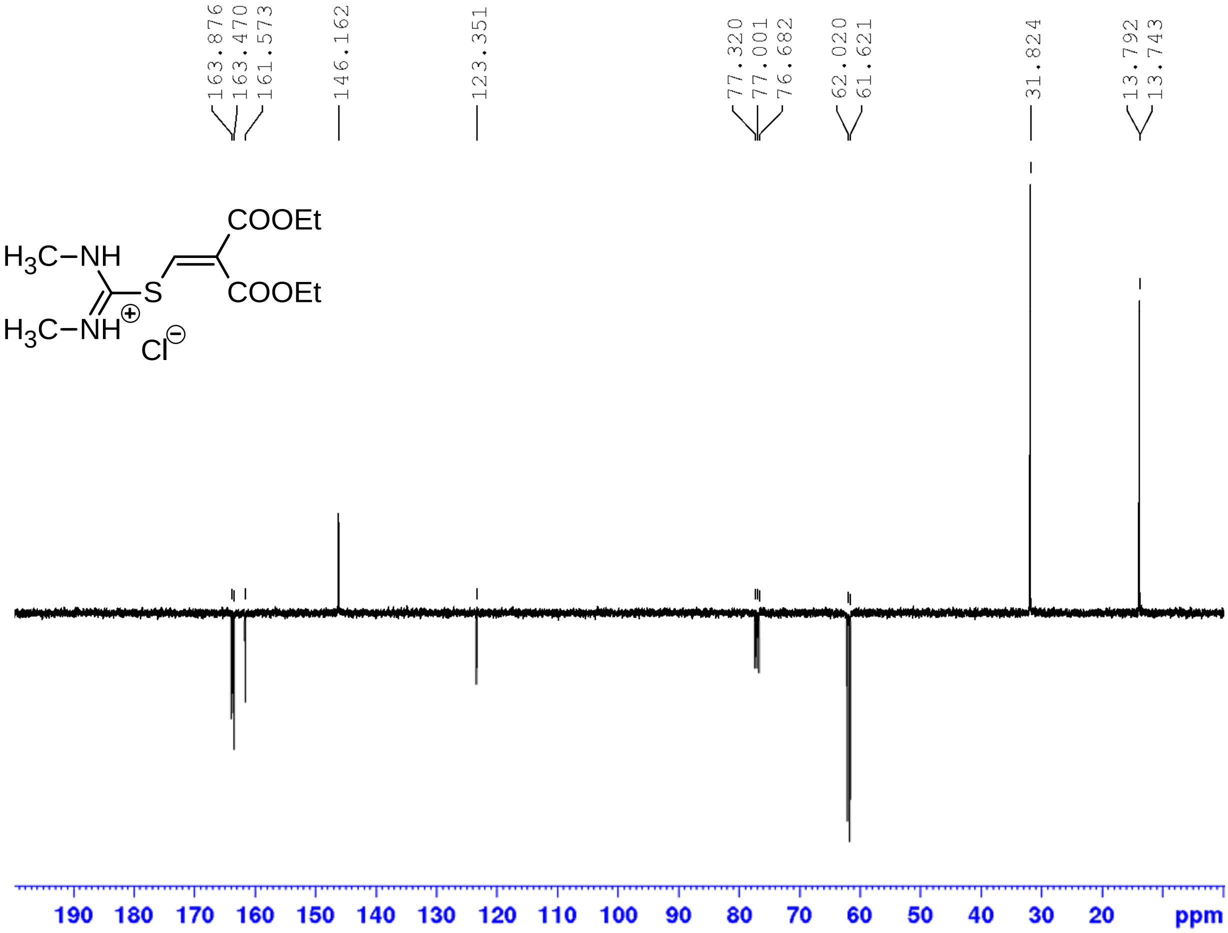
The title compound was prepared using the same procedure described in the main body of this article. It was also submitted to cyclization to ethyl 1,3-dimethyl-2-thiouracil-5-carboxylate but the yield was only 30% - probably due to steric hindrance of bulkier ethyl group(s).

M.p. 156-159 °C.

^{1}H NMR ($CDCl_3$): δ_H: 1.16-1.22 (m, 6H, 2×CH_3), 3.03 and 3.09 (2×d, *J* = 4.9 Hz, 6H, 2×NCH_3), 4.12 and 4.18 (2×q, *J* = 7.0 Hz, 4H, 2×OCH_2), 8.14 (s, 1H, CH), 10.0 and 10.71 (2×bd, 2H, 2×NH).



^{13}C-APT NMR ($CDCl_3$): δ_C: 13.7 and 13.8 (CH_3), 31.8 (NCH_3), 61.6 and 62.0 (OCH_2), 123.4 (=C<), 146.2 (=CH–S), 161.6 (S–C(NHMe)$_2$), 163.5 and 163.9 (C=O).

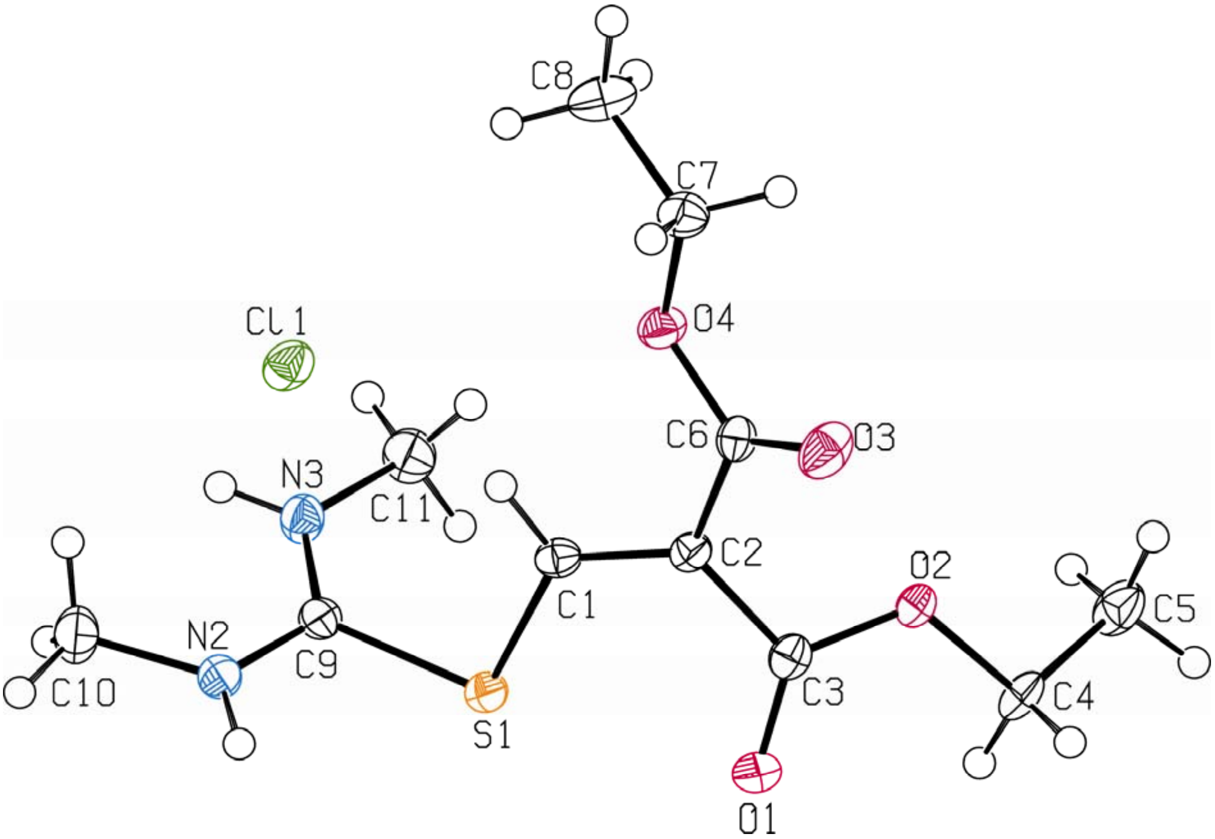


X-ray measurements:

The X-ray data for colorless crystal of *N*-[(*Z*)-{[3-ethoxy-2-(ethoxycarbonyl)-3-oxoprop-1-en-1-yl]sulfanyl}(methylamino)methylidene]methanaminium chloride were obtained at 150 K using Oxford Cryostream low-temperature device on a Nonius KappaCCD diffractometer with Mo K_α radiation (λ = 0.71073 Å), a graphite monochromator, and the ϕ and χ scan mode. Data reductions were performed[1] with DENZO-SMN. The absorption was corrected[2] by integration methods. Structures were solved[3] by direct methods (Sir92) and refined[4] by full matrix least-square based on F^2 (SHELXL97). Hydrogen atoms were mostly localized on a difference Fourier map, however to ensure uniformity of treatment of crystal, all hydrogen were recalculated into idealized positions (riding model) and assigned temperature factors $H_{iso}(H)$ =

1.2 U_{eq} (pivot atom) or of $1.5U_{eq}$ (methyl). H atoms in methyl, methylene, and vinylidene moieties were placed with C-H distances of 0.96, 0.97 and 0.93 Å and 0.86 Å for N-H bonds. $R_{int} = \sum|F_o^2 - F_{o,mean}^2|/\sum F_o^2$, GOF = $[\sum(w(F_o^2 - F_c^2)^2)/(N_{diffrs} - N_{params})]^{½}$ for all data, $R(F) = \sum||F_o| - |F_c||/\sum|F_o|$ for observed data, $wR(F^2) = [\sum(w(F_o^2 - F_c^2)^2)/(\sum w(F_o^2)^2)]^{½}$ for all data.

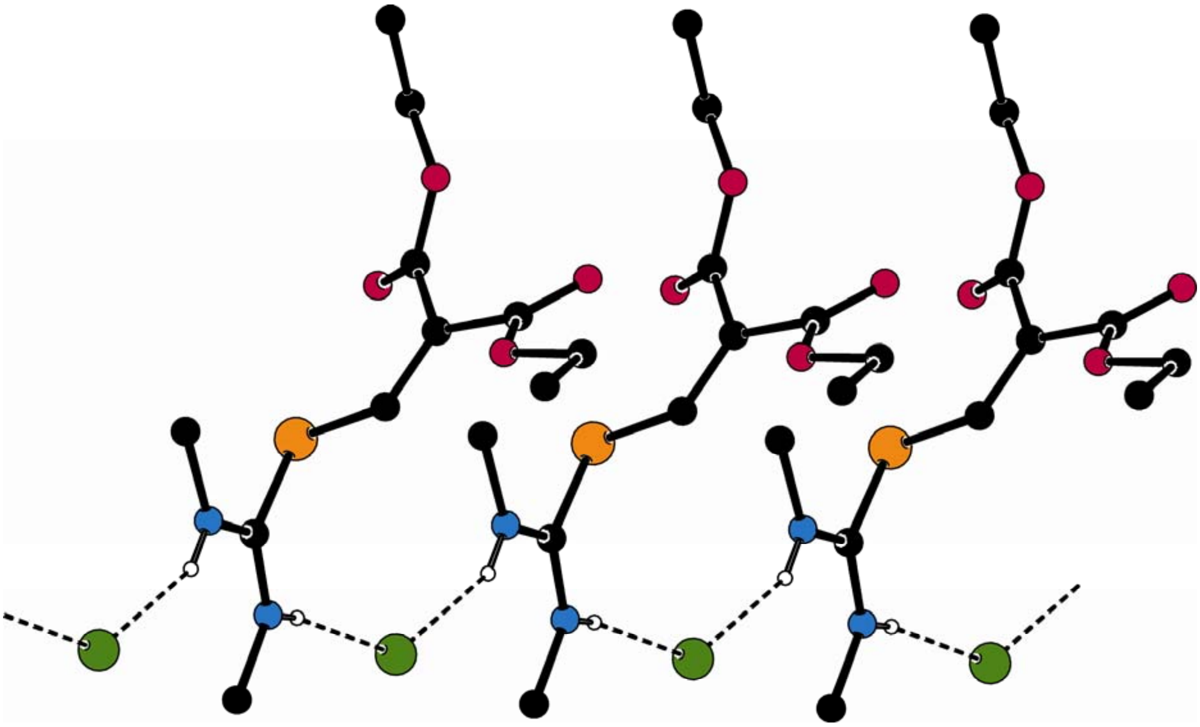
Crystallographic data for structural analysis have been deposited with the Cambridge Crystallographic Data Centre, CCDC no. 1421651. Copies of this information may be obtained free of charge from The Director, CCDC, 12 Union Road, Cambridge CB2 1EY, UK (fax: +44-1223-336033; e-mail: deposit@ccdc.cam.ac.uk or www: http:// www.ccdc.cam.ac.uk).



The molecular structure (ORTEP view, 50 % probability level) of *N*-[(*Z*)-{[3-ethoxy-2-(ethoxycarbonyl)-3-oxoprop-1-en-1-yl]sulfanyl}(methylamino)methylidene]methanaminium chloride (an analogous compound to salt **1b**).

Selected interatomic distances [Å] and angles [°]: O(1)-C(3) 1.209(2), O(3)-C(6) 1.201(2), C(2)-C(1) 1.340(2), S(1)-C(1) 1.7402(17), S(1)-C(9) 1.7869(18), C(9)-N(2) 1.307(2), C(9)-N(3) 1.308(2); N(2)-C(9)-N(3) 123.55(17), C(1)-S(1)-C(9) 97.61(8), C(3)-O(2)-C(4) 117.72(14), C(6)-O(4)-C(7) 116.93(14).

Crystallographic data: $[C_{11}H_{19}N_2O_4S]^+[Cl]^-$, M = 310.79, monoclinic, *P* 21/*c*, *a* = 14.9410(8), *b* = 7.3240(3), *c* = 14.6751(9) Å, β = 109.527(4) °, Z = 4, V = 1513.50(14) Å^3, D$_c$ = 1.364 g.cm^{-3}, μ = 0.401 mm^{-1}, T_{min}/T_{max} = 0.907/0.951; $-19 \leq h \leq 17$, $-8 \leq k \leq 9$, $-18 \leq l \leq 18$; 15373 reflections measured (θ_{max} = 27.50 °), 15310 independent (R_{int} = 0.0402), 2743 with $I > 2\sigma(I)$, 172 parameters, *S* = 1.146, *R1*(obs. data) = 0.0378, *wR2*(all data) = 0.0721; max., min. residual electron density = 0.343, -0.282 eÅ^{-3}.



H-bonding interactions found in the solid state structure for *N*-[(*Z*)-{[3-ethoxy-2-(ethoxycarbonyl)-3-oxoprop-1-en-1-yl]sulfanyl}(methylamino)methylidene]methanaminium chloride are forming chains of this molecule, color code: oxygen-red, carbon-black, sulfur-orange, nitrogen-blue, chlorine-green.

Hydrogen-bond geometry (Å, º):

D-H···A	d(D···A)	angle (DHA)	symmetry codes
N(2)-H(2)···Cl(1)	3.0674(17)	164	−*x*, *y*−1/2, −z+1/2
N(3)-H(3)··· Cl(1)	3.1126(16)	155	−*x*, *y*+1/2, −z+1/2.

References

1. Z. Otwinowski, W. Minor, *Methods in Enzymology* (Processing of X-ray diffraction data collected in oscillation mode) **1997**, *276*, 307-326.
2. P. Coppens In: F.R. Ahmed, S.R. Hall, C.P. Huber Editors, Crystallographic Computing, **1970**, pp. 255 – 270, Copenhagen, Munksgaard.

3. A. Altomare, G. Cascarano, C. Giacovazzo, A. Guagliardi, *Journal of Applied Crystallography* (Early Finding of Preferred Orientation - a New Method) **1994**, *27*, 1045-1050.
4. G. M. Sheldrick, SHELXL-97, University of Göttingen: Göttingen, **2008.**

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