New Substituted Indolizines by 1,3-Dipolar Cycloaddition Reactions

III. 7-Acetyl-indolizines

EMILIAN GEORGESCU,[1] FLORENTINA GEORGESCU, [1] PETRU FILIP,[2] DAN G. DUMITRESCU,[2] FLOREA DUMITRASCU[2]*

[1]Research Center Oltchim, 1 Uzinei, 240050, Ramnicu Valcea, Romania

[2] Romanian Academy,, Centre of Organic Chemistry “C. D. Nenitzescu”, 202B Spl. Independentei, 060023, Bucharest, Romania

*The new indolizine derivatives **6a-f** and **7** containing an acetyl group grafted on the pyridine ring were obtained by reaction of N-substituted pyridinium bromides **3** with acetylenic dipolarophiles in 1,2-epoxypropane as reaction medium. Structural assignment of the compounds was based on elemental analysis and NMR spectroscopy.*

Keywords: indolizine, pyridinium N-ylide, 1,3-dipolar cycloaddition

Recently, we described the synthesis of new 7-substituted indolizines [1-3] due to their inherent pharmacological activity and their analogy with numerous biologically important indole compounds. Although isoelectronic with indole, indolizine is a *N*-bridgehead heterocycle which has both a π-excessive pyrrole and a π-deficient pyridine fused in a bicyclic ring system. Synthetic indolizines [4] and azaindolizines [5] have been reported to play important roles as pharmaceutical agents, as well as versatile fluorescent building blocks for LEDs and other photoelectronic devices.

By varying the substituents grafted on the indolizine skeleton, one may improve active site binding of the compounds and/or their optical properties. It was found that by attaching the indolizine system or by substituting it at the 7 position, new applications such as chemosensors and conductive materials may arise [6, 7].

One of the most versatile synthetic methods for obtaining the indolizine derivatives are 1,3-dipolar cycloaddtions between pyridinium *N*-ylides and activated (electron deficient) alkynes or alkenes in the presence of an oxidant reagent, offering both high yields and regioselectivity [8-18].

In this paper we present the synthesis and NMR characterization for new 7-acetyl indolizines.

Experimental part

Melting points were determined on a Boëtius hot plate and are uncorrected. The NMR spectra were recorded on a Varian Gemini 300 BB instrument, operating at 300 MHz for ^{1}H and 75 MHz for ^{13}C. Supplementary evidence was given by HETCOR and COSY experiments.

General procedure for synthesis of 4-acetyl-pyridinium bromides 3

10 Mmol 4-acetyl-pyridine and 10 mmol 2-bromoketones **2a-g** in 30 mL of methanol were refluxed for 2 h and then were kept at room temperature until the next day. The pyridinium bromides **3a-g** obtained were collected on the filter and washed with chloroform and purified by recrystallization from methanol.

4-Acetyl-1-(2-phenyl-2-oxoethyl)-pyridinium bromide (3a). The product was recrystallized from methanol and pale yellow crystals with mp 226-228°C were obtained; Yield 89 %. Anal. Calcd. $C_{15}H_{14}BrNO_2$: C 56.27; H 4.41; Br 24.96; N 3.66. Found C 56.54; H 4.76; Br 25.31; N 3.85.

4-Acetyl-1-[2-(4-fluorophenyl)-2-oxoethyl]-pyridinium bromide (3b). The product was recrystallized from methanol and colorless crystals with mp 192-3°C were obtained; Yield 92 %. Anal. Calcd. $C_{15}H_{13}BrFNO_2$: N 4.14. Found N 4.31.

4-Acetyl-1-[2-(4-chlorophenyl)-2-oxoethyl]-pyridinium bromide (3c). The product was recrystallized from isopropanol and pale yellow crystals with mp 282-272°C were obtained; Yield 91 %. Anal. Calcd. $C_{15}H_{13}BrClNO_2$: N 3.95. Found N 4.13.

4-Acetyl-1-[2-(4-bromophenyl)-2-oxoethyl]-pyridinium bromide (3d). The product was recrystallized from methanol and pale yellow crystals with mp 264-266°C were obtained; Yield 94 %. Anal. Calcd. $C_{15}H_{13}Br_2NO_2$: C 45.15; H 3.28; Br 40.04; N 3.51. Found C 45.39; H 3.59; Br 40.33; N 3.80.

4-Acetyl-1-[2-(3-nitrophenyl)-2-oxoethyl]-pyridinium bromide (3e). The product was recrystallized from methanol and pale yellow crystals with mp 221-2°C were obtained; Yield 93 %. Anal. Calcd. $C_{15}H_{13}BrN_2O_4$: C 49.34; H 3.59; Br 21.88; N 7.67. Found C 49.68; H 3.91; Br 22.12; N 7.91.

4-Acetyl-1-[2-(3-methoxyphenyl)-2-oxoethyl]-pyridinium bromide (3f). The product was recrystallized from methanol and pale yellow crystals with mp 189-19°C were obtained; Yield 90 %. Anal. Calcd. $C_{16}H_{16}BrNO_3$: C 54.87; H 4.61; Br 22.82; N 4.00. Found C 55.09; H 4.85; Br 23.11; N 4.26.

^{1}H-NMR (300 MHz, $CDCl_3$+TFA) δ: 2.77 (s, 3H, MeCO); 3.82 (s, 3H, MeO); 6.59 (s, 2H, CH_2); 7.20 (dd, 1H, *J* = 8.3, 2.6 Hz, H-4’); 7.41 (t, 1H, *J* = 8.3, 7.8 Hz, H-5’); 7.47 (t, 1H, *J* = 2.6, 1.6 Hz, H-2’); 7.60 (dd, 1H, *J* = 7.8, 1.6 Hz, H-2’); 8.44 (d, *J* = 6.8 Hz, H-3, H-5); 9.10 (d, 2H, *J* = 6.8 Hz, H-2, H-6).

^{13}C-NMR (75 MHz, $CDCl_3$+TFA) δ: 26.8 (**Me**CO); 55.6 (OMe); 67.2 (CH_2); 112.7, 121.2, 121.9, 130.4 (C-2’, C-4’, C-5’, C-6’); 126.0 (C-3, C-5); 133.8 (C-1’); 147.9 (C-2, C-6); 148.7 (C-4); 160.0 (C-3’); 188.7 (COAr); 193.9 (COMe).

4-Acetyl-1-[2-(2-naphthyl)-2-oxoethyl]-pyridinium bromide (3g). The product was recrystallized from methanol and pale yellow crystals with mp 260-2°C were obtained; Yield 88 %. Anal. Calcd. $C_{19}H_{16}BrNO_2$: C 61.64; H 4.36; Br 21.58; N 3.78. Found C 61.92; H 5.12; Br 22.89; N 4.05.

General procedure for synthesis of 7-acetyl-indolizines 6 and 7

5 Mmol of 4-acetyl-pyridinium bromide **3** were suspended in 50 mL 1,2-epoxypropane, 7 Mmol of ethyl

---

* *email: fdumitra@yahoo.com*

propiolate or diethyl acetylenedicarboxylate were added and the mixture was stirred at room temperature for 20 days (with protection against moisture). The solvent was partly removed under reduced pressure then 8-10 mL of methanol was added under stirring and the mixture was left over night at room temperature. The solid was filtered off, washed with a mixture of methanol-diethyl ether (1:2) and recrystallized from chloroform/diethyl ether.

Ethyl 7-acetyl-3-benzoyl-indolizine-1-carboxylate (**6a**). Yellow crystals with mp 126-7^{o}C were obtained; Yield 43 %. Anal. Calc. $C_{20}H_{17}NO_4$: C 71.63; H 5.11; N 4.18. Found C 71.86; H 5.40; N 4.51.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.43 (t, 3H, *J* = 7.1 Hz, Me); 2.73 (s, 1H, COMe); 4.42 (q, 2H, *J* = 7.1 Hz, CH_2); 7.51-7.65 (m, 4H, H-6, H-3’, H-4’, H-5’); 7.83-7.87 (m, 2H, H-2’, H-6’); 7.85 (s, 1H, H-2); 8.98 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.90 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.4 (Me); 25.1 (MeCO); 60.4 (CH_2); 109.3 (C-1); 112.4 (C-6); 121.0 (C-8); 123.8 (C-3); 128.4, 129.0 (C-2', C-3', C-5', C-6'); 128.7 (C-5); 128.8 (C-2); 131.9 (C-4’); 134.2, 138.2 (C-7, C-8a); 139.3 (C-1’); 163.7 (COO); 185.9 (COAr); 195.7 (COMe).

Ethyl 7-acetyl-3-(4-fluorobenzoyl)-indolizine-1-carboxylate (6b). Yellow crystals with mp 151-3^{o}C were obtained; Yield 41 %. Anal. Calc. $C_{20}H_{16}FNO_4$: N 3.96. Found N 4.14.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.44 (t, 3H, *J* = 7.1 Hz, Me); 2.73 (s, 1H, COMe); 4.42 (q, 2H, *J* = 7.1 Hz, CH_2); 7.23 (t, 2H, *J* = 8.7 Hz, H-3’, H-5’); 7.61 (dd, 1H, *J* = 7.4, 1.9 Hz, H-6); 7.85 (s, 1H, H-2); 7.88 (dd, 2H, *J* = 8.7, 5.3 Hz, H-2’, H-6’); 8.98 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.86 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.5 (Me); 26.2 (MeCO); 60.6 (CH_2); 109.4 (C-1); 112.5 (C-6); 115.6 (d, $^{2}J_{CF}$ = 21.9 Hz, C-3’, C-5’); 121.0 (C-8); 123.6 (C-3); 128.5 (C-5); 128.7 (C-2); 131.5 (d, $^{3}J_{CF}$ = 9.0 Hz, C-3’, C-5’); 134.3, 138.2 (C-7, C-8a); 135.4 (d, $^{4}J_{CF}$ = 3.0 Hz, C-1’); 163.7 (COO); 165.1 (d, $^{1}J_{CF}$ = 253.5 Hz, C-4’);184.4 (COAr); 195.7 (COMe).

Ethyl 7-acetyl-3-(4-chlorobenzoyl)-indolizine-1-carboxylate (6c). Yellow crystals with mp 158-9^{o}C were obtained; Yield 43 %. Anal. Calcd. $C_{20}H_{16}ClNO_4$: C 64.96; H 4.36; Cl 9.59; N 3.79. Found C 65.27; H 4.63; Cl 9.87; N 4.08.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.44 (t, 3H, *J* = 7.1 Hz, Me); 2.73 (s, 1H, COMe); 4.42 (q, 2H, *J* = 7.1 Hz, CH_2); 7.52 (d, 2H, *J* = 8.5 Hz, H-3’, H-5’); 7.61 (dd, 1H, *J* = 7.4, 1.9 Hz, H-6); 7.79 (dd, 2H, *J* = 8.5 Hz, H-2’, H-6’); 7.82 (s, 1H, H-2); 8.97 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.86 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.5 (Me); 26.1 (MeCO); 60.6 (CH_2); 109.5 (C-1); 112.6 (C-6); 121.0 (C-8); 123.4 (C-3); 128.5 (C-5); 128.7 (C-2); 128.8 (C-3’, C-5’); 130.4 (C-2', C-6'); 134.4, 138.3 (C-7, C-8a); 137.5, 138.4 (C-1’, C-4’); 163.5 (COO); 184.4 (COAr); 195.7 (COMe).

Ethyl 7-acetyl-3-(4-bromobenzoyl)-indolizine-1-carboxylate (6d). Yellow crystals with mp 175-6^{o}C were obtained; Yield 42 %. Anal. Calcd. $C_{20}H_{16}BrNO_4$: C 57.99; H 3.89; Br 19.29; N 3.38. Found C 58.31; H 4.21; Br 19.67; N 3.60.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.44 (t, 3H, *J* = 7.1 Hz, Me); 2.73 (s, 1H, COMe); 4.42 (q, 2H, *J* = 7.1 Hz, CH_2); 7.61 (dd, 1H, *J* = 7.4, 1.9 Hz, H-6); 7.69, 7.70 (2d, 4H, *J* = 8.8 Hz, H-2’, H-3’, H-5’, H-6’); 7.81 (s, 1H, H-2); 8.97 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.85 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.5 (Me); 26.1 (MeCO); 60.5 (CH_2); 109.5 (C-1); 112.6 (C-6); 121.0 (C-8); 123.4 (C-3); 126.8 (C-4’); 128.6 (C-5); 128.7 (C-2); 130.5, 131.8 (C-2', C-3’, C-5’, C-6'); 134.4, 138.4 (C-7, C-8a); 138.0 (C-1’); 163.5 (COO); 184.5 (COAr); 195.7 (COMe).

Ethyl 7-acetyl-3-(3-nitrobenzoyl)-indolizine-1-carboxylate (6e). Yellow crystals with mp 177-9^{o}C were obtained; Yield 46 %. Anal. Calcd. $C_{20}H_{16}N_2O_6$: C 63.16; H 4.24; N 7.36. Found C 63.44; H 4.50; N 7.61.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.43 (t, 3H, *J* = 7.1 Hz, Me); 2.75 (s, 1H, COMe); 4.43 (q, 2H, *J* = 7.1 Hz, CH_2); 7.66 (dd, 1H, *J* = 7.4, 1.9 Hz, H-6); 7.77 (t, 1H, *J* = 7.9 Hz, H-5'); 7.84 (s, 1H, H-2); 8.14-8.18 (m, 1H, H-6'); 8.45-8.49 (m, 1H, H-8, H-4’); 8.67 (t, 1H, *J* = 1.9 Hz, H-2'); 8.99 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.99 (dd, 1H, *J* = 7.2, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.5 (Me); 26.2 (MeCO); 60.7 (CH_2); 110.0 (C-1); 113.0 (C-6); 121.0 (C-8); 122.9 (C-2'); 123.8 (C-3); 126.2 (C-4'); 128.6 (C-5); 128.7 (C-2); 129.8 (C-5') 134.5 (C-6'); 134.8, 138.8 (C-7, C-8a); 140.7 (C-1'); 148.2 (C-3'); 163.3 (COO); 182.9 (COAr); 195.6 (COMe).

Ethyl 7-acetyl-3-(3-methoxybenzoyl)-indolizine-1-carboxylate (6f). Yellow crystals with mp 154-5^{o}C were obtained; Yield 43 %. Anal. Calcd. $C_{21}H_{19}NO_5$: C 69.03; H 5.24; N 3.83. Found C 69.31; H 5.52; N 4.03.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.43 (t, 3H, *J* = 7.1 Hz, Me); 2.73 (s, 1H, COMe); 3.89 (s, 3H, MeO); 4.43 (q, 2H, *J* = 7.1 Hz, CH_2); 7.14-7.18 (m, 1H, H-4’); 7.35-7.42 (m, 2H, H-2’, H-6'); 7.45 (t, 1H, *J* = 7.6 Hz, H-5'); 7.61 (dd, 1H, *J* = 7.4, 1.9 Hz, H-6); 7.84 (s, 1H, H-2); 8.98 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.89 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.2 (Me); 26.0 (MeCO); 55.3 (MeO); 60.7 (CH_2); 109.2 (C-1); 112.3 (C-6'); 113.6 (C-6); 117.9 (C-4'); 120.9 (C-2') 121.4 (C-8); 123.6 (C-3); 128.6 (C-5); 128.7 (C-2); 129.3 (C-5'); 134.0, 138.2 (C-7, C-8a); 140.4 (C-1'); 159.5 (C-3'); 163.5 (COO); 185.4 (COAr); 195.6 (COMe).

Ethyl 7-acetyl-3-(2-naphthoyl)-indolizine-1-carboxylate (6g). Pale yellow crystals with mp 201-2^{o}C were obtained; Yield 57 %. Anal. Calcd. $C_{24}H_{19}NO_4$: C 74.79; H 4.97; N 3.63. Found C 75.06; H 5.22; N 3.89.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.41 (t, 3H, *J* = 7.1 Hz, Me); 2.73 (s, 1H, COMe); 4.42 (q, 2H, *J* = 7.1 Hz, CH_2); 7.58-7.67, 7.90-8.04 (2m, 7H, H-6, H-3’, H-4’, H-5’, H-6’, H-7’, H-8’); 8.35 (t, 1H, *J* = 1.6 Hz, H-1'); 7.90 (s, 1H, H-2); 8.99 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.91 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 14.4 (Me); 26.1 (MeCO); 60.4 (CH_2); 109.4 (C-1); 112.4 (C-6); 121.0 (C-8); 124.0 (C-3);, 126.9, 127.8, 128.0, 128.5, 129.2, 130.0 (C-1’, C-3’,C-4’, C-5’, C-6’, C-7’, C-8’); 132.0, 134.9, 136.5 (C-2’, C-4a’, C-8a’);128.7 (C-5); 128.8 (C-2); 134.1, 138.3 (C-7, C-8a); 163.7 (COO); 185.8 (COAr); 195.8 (COMe).

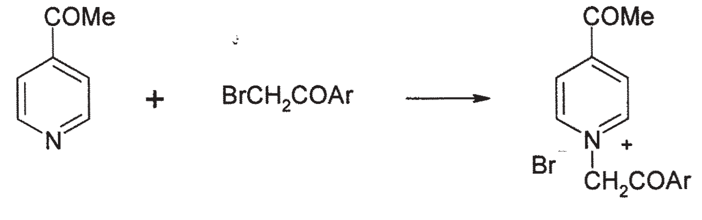
Diethyl 7-acetyl-3-(4-bromobenzoyl)-indolizine-1,2-carboxylate (7). Yellow crystals with mp 113-5^{o}C were obtained; Yield 41 %. Anal. Calcd. $C_{23}H_{10}BrNO_6$: C 56.81; H 4.15; Br 16.43; N 2.88. Found C 57.10; H 4.43; Br 16.76; N 3.14.

^{1}H-NMR (300 MHz, $CDCl_3$) δ: 1.11, 1.36 (2t, 6H, *J* = 7.1 Hz, 2Me); 2.72 (s, 1H, COMe); 3.76, 4.40 (2q, 2H, *J* = 7.1 Hz, 2CH_2); 7.27 (dd, 1H, *J* = 7.4, 1.9 Hz, H-6); 7.60 (s, 4H, H-2’, H-3’, H-5’, H-6’); 8.98 (dd, 1H, *J* = 1.9, 1.0 Hz, H-8); 9.45 (dd, 1H, *J* = 7.4, 1.0 Hz, H-5).

^{13}C-NMR (75 MHz, $CDCl_3$) δ: 13.6, 14.2 (2Me); 26.1 (MeCO); 60.9, 62.0 (2CH_2O); 107.2 (C-1); 113.2 (C-6); 121.5 (C-8); 121.7 (C-3); 127.4 (C-4’); 128.6 (C-5); 128.0 (C-2); 131.6 (C-2); 130.4, 131.4 (C-2', C-3’, C-5’, C-6'); 134.6, 137.0 137.7 (C-7, C-8a, C-1’); 162.5, 164.3 (COO); 185.6 (COAr); 195.5 (COMe).

Results and Discussion

Pyridinium salts **3a-g** were obtained by refluxing 4-acetylpyridine and the corresponding 2-bromoacetyl aromatics **2a-g** in methanol (Scheme 1) and were characterized by elemental analysis and by ^{1}H-NMR and



1 **2a-g** **3a-g**

Ar: a = C_6H_5; b = 4-FC_6H_4; c = 4-ClC_6H_4; d = 4-BrC_6H_4; e = 3-$O_2NC_6H_4$; f = 3-MeOC_6H_4 ;

g = 2-naphthyl

Scheme 1

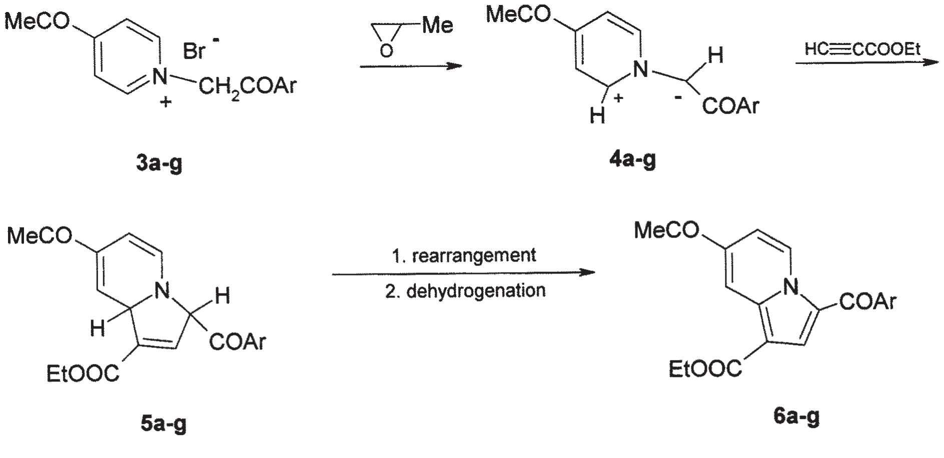
^{13}C-NMR for the reprezentative compound **3f**. The protons from the pyridine ring are highly deshielded, as a result of the combined effects of the 4-acetyl group and the quaternary nitrogen ring atom. Thus, protons H-2 and H-6 appear at δ = 9.10 ppm whereas protons H-3 and H-5 at δ = 8.44 ppm. In the ^{13}C-NMR spectrum of **3f**, the most deshielded carbon is C-4 (δ = 148.7 ppm), due to the γ position in respect to the quaternary ring nitrogen and to the presence of the 4-acetyl group.

Indolizines **6a-g** and **7** were obtained from *N*-ylides **4a-g** and ethyl propiolate (scheme 2) or diethyl acetylenedicarboxylate (scheme 3), as acetylenic dipolarophiles and 1,2-epoxypropane as reaction medium. As *N*-ylides are generally unstable compounds, they were generated *in situ* by the action of 1,2-epoxypropane as bromide scavanger. As opposed to other synthetic methods [17-20], where the *N*-ylide is generated by the removal of a proton from the methylene group of the pyridinium bromide by a base (i. e. Et$_3$N, K$_2$CO$_3$), the mechanism implies in the first step a nucleophilic oxirane ring opening by the bromide ion, followed by a subsequent deprotonation of the methylenic group by the alkoxide formed. The 1,3-dipolar cycloaddition between *N*-ylides **4a-g** and the acetylenic dipolarophiles led to the formation of the dihydroderivatives **5a-g** which underwent a subsequent rearrangement and dehydrogenation, resulting in the fully aromatic indolizines **6** and **7**.

Structural assignment for compounds **6** and **7** was provided by elemental analysis and NMR spectroscopy. The cycloaddition with ethyl propiolate (indolizines **6a-g**) was observed to be completly regioselective.

In the ^{1}H-NMR spectra of compounds **6a-g** the most deshielded proton is H-5 (δ = 9.85-9.99 ppm) due to its proximity to the pyrrole grafted aroyl group. However, by introducing a second carboethoxy moiety (in compound **7**) in the 2 position, the chemical shift for H-5 is decreased to δ= 9.45 ppm. This can be explained by the sterical crowding of the pyrrole ring, which leads to an increased distance between H-5 and the benzoyl group. Due to the combined effects of the 7-acetyl group and 1-carboethoxy moiety, H-8 is considerably deshielded, appearing at δ = 8.97-8.99 ppm. Also, a long range para coupling of 1.0 Hz between H-5 and H-8 was observed. H-7 is the least deshielded proton of the pyridinic ring appearing at δ ~7.60 ppm in the case of compounds **6a-g** and, similarly to H-5, at a lower δ= 7.27 ppm in the case of compound **7**. Proton H-2 appears at δ = 7.81-7.90 ppm.

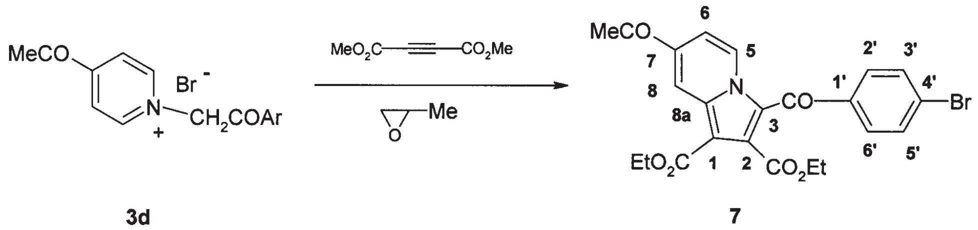
The ^{13}C-NMR spectra of indolizines **6** and **7** show all expected signals. The ketone groups appear at ~195.6 ppm for the 7-acetyl group and at δ~185.6 ppm for the pyrrole grafted aroyl moiety. The most deshielded carbon atoms are C-7 at δ~137.3 ppm and C-8a at δ~138.2 ppm in the case of indolizines **6a-g**. An additional carboethoxy moiety in compound **7** causes an overall decrease in the electron density of the pyrrole ring and thus, a small but significant decrease in the chemical shifts of C-1 (decrease of 2 ppm), C-3 (decrease of 2 ppm) and C-8a (decrease of 1.2 ppm). (table 1).



Ar: a = C_6H_5; b = 4-FC_6H_4; c = 4-ClC_6H_4; d = 4-BrC_6H_4; e = 3-$O_2NC_6H_4$; f = 3-MeOC_6H_4 ;

g = 2-naphthyl

Scheme 2



Scheme 3

Table 1

REPRESENTATIVE ^{13}C-NMR DATA FOR INDOLIZINES 6 AND 7

Compound	C1	C2	C3	C8a
ethyl 7-acetyl-3-benzoyl-indolizine-1-carboxylate (**6a**)	109.3	128.8	123.8	138,2
ethyl 7-acetyl-3-(4-chlorobenzoyl)-indolizine-1-carboxylate (**6c**)	109.5	128.7	123.4	138.3
ethyl 7-acetyl-3-(2-naphthoyl)-indolizine-1-carboxylate (**6g**)	109.4	128.8	124.0	138.4
diethyl 7-acetyl-3-(4-bromobenzoyl)-indolizine-1,2-carboxylate (**7**)	107.2	128.0	121.7	137.0

Conclusions

Eight new 7-acetyl indolizines were synthesized in moderate yields by a 1,3-dipolar cycloaddition between the corresponding *N*-ylides and ethyl propiolate and diethyl acetylenedicarboxylate as acetylenic dipolarophiles.

Structural proof for the compounds was provided by elemental analysis and NMR spectroscopy. The decrease in electron density by grafting two instead of one carboxyl groups to the pyrrole ring was put in evidence in the ^{13}C-NMR spectra.

References

1. GEORGESCU, E., GEORGESCU, F., DRAGHICI, C., FILIP, P., DUMITRAªCU, F., Rev. Chim. (Bucure°ti), **59**, nr. 3, 2008, p. 269

2. DUMITRAªCU, F., GEORGESCU, E., GEORGESCU, F., FILIP, P., MIU, B., DUMITRESCU, D. G., Rev. Roum. Chim., in press

3. GEORGESCU, E., GEORGESCU, F., FILIP, P., MIU, B., DUMITRAªCU, F., Rev. Chim.(Bucure°ti), 2008, in press

4. (a)MAHON, J., MEHTA, L. K., MIDDLETON, R. W., PARRICK, J., RAMI, H. K., J. Chem. Research (S), 1992, p. 362. (b) TROLL, T., BECKEL, H., LETTNER-BOHM, C., Tetrahedron, 53, 1997, p. 81. (c) CHENG, Y., MA, B., WUDL, F., J. Mater. Chem., 9, 1999, p. 2183-2188. (d) SONNENSCHEIN, H., HENNRICH, G., RESCH-GENGER, U., SCHULZ, B., Dyes Pigments, 46, 2000, p. 23. (e) VLAHOVICI, A., ANDREI, M., DRUTA, I. J. Lumin., 96, 2002, p. 279. (f) ROTARU, A., DRUTA, I., OESER, T., MULLER, TH., Helv Chim Acta, 88, 2005, p. 1798. (g) VASILESCU, M., BANDULA, R., DUMITRASCU, F., LEMMETYINEN, H., J. Fluoresc., 16, 2006, p. 631

5. (a) MITSUMORI, T., BENDIKOV, M., SEDÓ, J., WUDL, F., Chem. Mater., 15, 2003, p. 3759-3768. (b) SWAMY, K. M. K., PARK, M. S., HAN, S. J., KIM, S. K., KIM, J. H., LEE, C., BANG, H., KIM, Y., KIM, S.-J., YOON, J., Tetrahedron, 61, 2005, p. 10227. (c) VASILESCU, M., BANDULA, R., CRAMARIUC, O., HUKKA, T., LEMMETYINEN, H., RANTALA, T. T., DUMITRASCU, F., J. Photochem. Photobiol., A: 194, 2008, p. 308-317. (d) DUMITRASCU, F., DRAGHICI, C., ALBULESCU, A., DUMITRESCU, D. Rev. Chim. (Bucharest), **57**,nr. 8, 2006, p. 866

6. DELATTRE F., WOISEL, P., SURPATEANU, G., BRIA, M.G., CAZIER F., DECOCK, P., Tetrahedron, 60, 2004, p. 1557

7. SURPATEANU, G. G., BECUWE, M., LUNGU, N. C., DRON, P. I., FOURMENTIN, S., LANDY, D., SURPATEANU, G., J. Photochem. Photobiol., A: 185, 2007, p. 312

8. (a) ZUGRAVESCU, I., PETROVANU, M., "*N*-Ylid Chemistry", McGraw-Hill, 1976, p. 239. (b) KATRITZKY, A. R., BOULTON, A. J., Adv. Heterocycl. Chem., 23, 1978, p. 104. (c) KATRITZKY, A. R., REES, C. W., In Comprehensive Heterocyclic Chemistry, Ed. by K. POTTS, Pergamon Press, 1984. (d) NAJERA, C., SANSANO, J. M., Curr. Org. Chem., 7, 2003, p. 1105

9. GEORGESCU, E., GEORGESCU, F., ROIBU, C., DRAGHICI, C., CAPROIU, M. T. Rev. Roum. Chim., 46, 2001, p. 357

10. GEORGESCU, E., GEORGESCU, F., DANILA, M. D., FILIP, P. I., DRAGHICI, C., CAPROIU, M. T. Arkivoc, (ii), 2002, p. 30

11. IUHAS, P.C., GEORGESCU, F., GEORGESCU, E., DRAGHICI, C., CAPROIU, M.T. Rev. Roum. Chim., 47, 2002, p. 333-338

12. GEORGESCU, E., GEORGESCU, F., ROIBU, C., IUHAS, P.C., DRAGHICI, C., CAPROIU, M.T., Rev. Roum. Chim., 47, 2002, p. 885

13. GEORGESCU, E., GEORGESCU, F., IUHAS, P.C., DRAGHICI, C., DANILA, M.G., FILIP, P.I., Arkivoc, (x) , 2007, p. 381

14. GEORGESCU, E., DRUTA, I., PETROVANU, M., Rev. Roum. Chim., 26, 1981, p. 109

15. GEORGESCU, E., CHIRALEU, F., GEORGESCU, F., ZUGRAVESCU, I., Rev. Roum. Chim., 26, 1981, p. 879

16. GEORGESCU, E., GEORGESCU, F., GHEORGHIU, M., GEORGESCU, E. G., PETROVANU, M., Rev. Roum. Chim., 30, 1985, p. 611

17. GEORGESCU, F., GEORGESCU, E., DRAGHICI, C., CAPROIU, M. T., Rev. Roum. Chim., 42, 1997, p. 205

18. GEORGESCU, E., DRAGHICI, C., IUHAS, P.C., GEORGESCU, F., Arkivoc, (x), 2005, p. 95

Manuscript received: 6.03.2007