Tetrahedron Vol. 48, No. 25, pp. 5227-5234, 1992
Printed in Great Britain

0040-4020/92 $5.00+.00
Pergamon Press Ltd

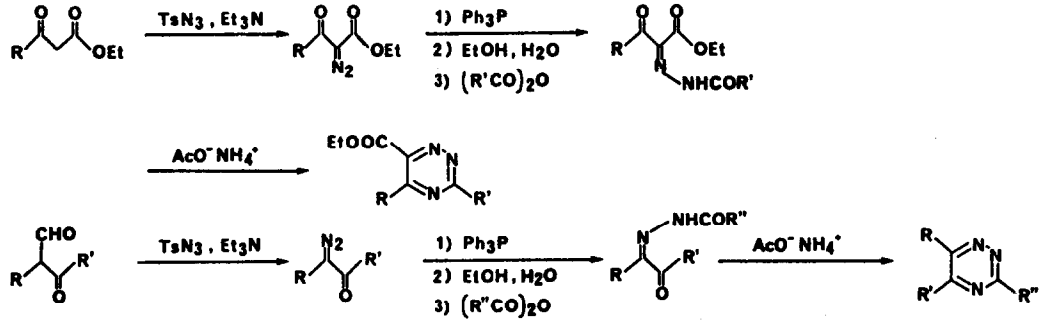
SYNTHESIS of 1,2,4-TRIAZINES - XIV.[1] Regioselective Synthesis of Ethyl 1,2,4-Triazine-5-carboxylates

Tadashi Ohsumi and Hans Neunhoeffer*
Institut für Organische Chemie der Technischen Hochschule Darmstadt
Petersenstraße 22, D-6100 Darmstadt, Germany

(*Received in Germany* 31 *January* 1992)

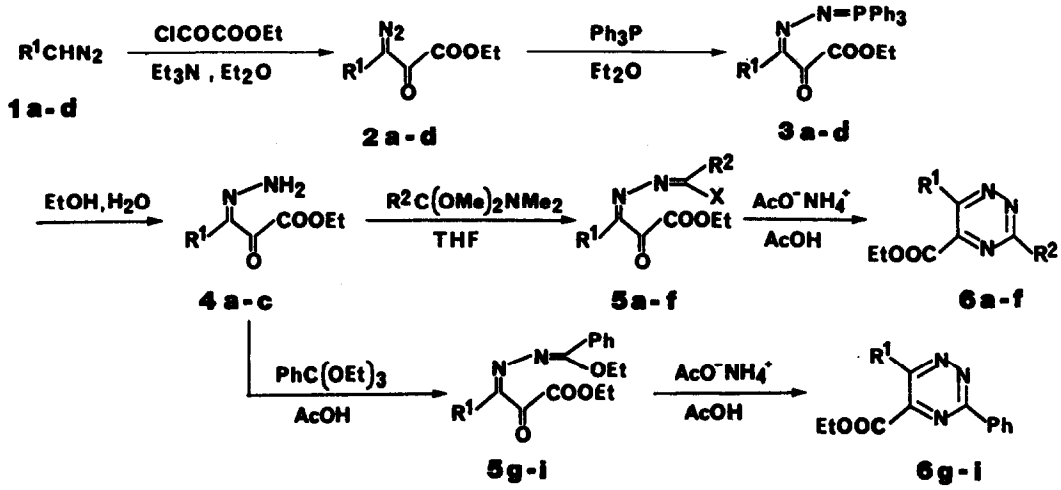
Abstract: Ethyl 1,2,4-triazine-5-carboxylates **6** were prepared by heating N,N-dimethylaminomethylene- or ethoxymethylenehydrazones **5** with ammonium acetate in acetic acid at 100°C. NMR studies confirmed the absence of their regio isomers (6-carboxylates), showing the high regioselectivity of this procedure.

Recently we reported the regioselective synthesis of ethyl 1,2,4-triazine-6-carboxylates and trialkyl-1,2,4-triazines by using α-ketoacylhydrazones as key intermediates as shown below.[1,2]



In these reactions the regioselective synthesis of α-ketohydrazones and cyclization of α-ketoacylhydrazones with ammonium acetate without isomerization played a very important role in giving high regioselectivity to the products. A slight modification of these procedures can provide a method to introduce an ester function into the 5-position of the 1,2,4-triazine system. 1,2,4-Triazine-5-carboxylates with alkyl and/or aryl groups in the 3- and 6-position are hitherto unknown. Only the synthesis of 1,2,4-triazine-5-carbonitriles and -5-carboxamides[3] is reported. 1,2,4-Triazine-5-carboxylates with hetero substituents in the 3- and/or 6-position are well known.[4]

Here we would like to report a regioselective synthesis of ethyl 1,2,4-triazine-5-carboxylates **6**.



1 - 4: **a**: R^1 = H; **b**: R^1 = Me; **c**: R^1 = n-Pr; **d**: R^1 = i-Pr

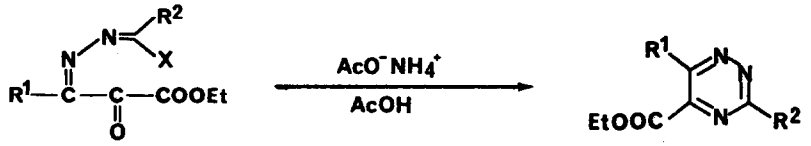
5,6: **a - i** : R^1, R^2, X in Table

Several problems were reported in reacting diazoalkanes **1** with acyl halides.[5,6] However, as we found, they react quite easily with ethyl (chloroformyl)formate in the presence of triethylamine to give ethyl 2-oxo-3-diazocarboxylates **2**. Thus obtained diazo esters **2** were treated with triphenylphosphine yielding the phosphazines **3**. The phosphazines **3** were hydrolyzed in aqueous ethanol to give ethyl 2,3-dioxocarboxylate 3-hydrazones **4**. Although hydrazones are the normal products in the hydrolysis of phosphazines,[7-10] the hydrolysis of ethyl 2,3-dioxo-4-methylpentanoate 3-triphenylphosphazine (**3d**) gave ethyl 2-oxo-3-diazo-4-methylpentanoate (**2d**) instead of ethyl 2,3-dioxo-4-methylpentanoate 3-hydrazone (**4d**). Staudinger et al.[10] showed that the phosphazines are in equilibrium with the diazo compound and triphenylphosphine. Therefore the isolation of **2d** can be explained by the dissociation of the phosphazine **3d** into its components in the reaction medium. The ethyl 2,3-dioxocarboxylate 3-hydrazones **4** could not be acetylated by acetic annhydride or acetyl chloride in the presence or absence of pyridine. Therefore the α-ketohydrazones **4** were treated with N,N-dimethylformamide or N,N-dimethylacetamide dimethyl acetal to yield N,N-dimethylaminomethylenehydrazones **5a-f** which were cyclized by heating with ammonium acetate in acetic acid to give ethyl 1,2,4-triazine-5-carboxylates **6a-f**.

The phenyl group could be introduced also very easily into the 3-position of the 1,2,4-triazine system by reaction of **4a-c** with triethyl orthobenzo-

ate, followed by cyclization with ammonium acetate in acetic acid. The results are summarized in the following Table.

Table: Synthesis of Ethyl 1,2,4-Triazine-5-carboxylates **6**



5 **6**

Compound **5**,**6**	X	R^1	R^2	yield (%)
a	NMe_2	H	H	47
b	NMe_2	Me	H	43
c	NMe_2	n-Pr	H	37
d	NMe_2	H	Me	55
e	NMe_2	Me	Me	42
f	NMe_2	n-Pr	Me	49
g	OEt	H	Ph	54
h	OEt	Me	Ph	36
i	OEt	n-Pr	Ph	40

Variously substituted ethyl 1,2,4-triazine-5-carboxylates **6** could be prepared in moderate yields. Isomerization of **5** into their 2-hydrazone isomers was not observed under these reaction conditions, which is in agreement with the results obtained for the cyclization of α-oxo N,N-dimethylaminomethylenehydrazones with ammonium acetate in acetic acid.[2] High regioselectivity was confirmed by NMR studies in all products.

Thus our new procedure provides an excellent method for the synthesis of ethyl 1,2,4-triazine-5-carboxylates with alkyl and/or aryl groups in the 3- and 6-position.

EXPERIMENTAL

General: Proton magnetic resonance spectra were recorded on a Varian EM 360 spectrometer, infrared spectra on the Perkin-Elmer infrared spectrometer 297. Melting points were determined on a Reichert melting point apparatus and are uncorrected. Column chromatography was performed with Macherey & Nagel silica gel (70-230 mesh ASTM).

Ethyl 2-Oxo-3-diazocarboxylates **2**:
General Procedure: To the solution of the diazoalkane **1**[5,6,11] (60 mmol) and triethylamine (6.06 g, 60 mmol) in ether (100 ml) was added a solution of ethyl (chlorgformyl)formate (6.83 g, 50 mmol) in ether (50 ml) with stirring below 5°C. After stirring at room temperature for 3 h, the reaction mixture was washed with water (2x50 ml), dried over anhydrous sodium sulfate and evaporated. The residue was chromatographed on silica gel, eluting with n-hexane/ethyl acetate (4:1) to give the 3-diazo-2-oxocarboxylates **2**.

Due to their instability the compounds prepared could not be characterized by elemental analysis and were used for the following reaction without

purification. Their physical data are listed below.

Ethyl 3-Diazo-2-oxopropanoate (**2a**): Yield: 39%; mp 72-74°C; Lit.[12] mp 75-76°C; ^{1}H NMR ($CDCl_3$) δ 1.37 (3H, t, J=7 Hz); 4.30 (2H, q, J=7 Hz); 6.12 (1H, s); IR (neat) 3050, 2960, 2140, 2080, 1720, 1620, 1340, 1250, 1140, 1100, 920, 860 cm^{-1}.

Ethyl 3-Diazo-2-oxobutanoate (**2b**): Yield: 41%; oil; ^{1}H NMR ($CDCl_3$) δ 1.38 (3H, t, J=7 Hz); 2.07 (3H, s); 4.35 (2H, q, J=7 Hz); IR (neat) 2950, 2100, 1730, 1620, 1450, 1400, 1370, 1350, 1250, 1040, 930, 860 cm^{-1}.

Ethyl 3-Diazo-2-oxohexanoate (**2c**): Yield: 36%; oil; ^{1}H-NMR ($CDCl_3$) δ 0.98 (3H, t, J=7 Hz); 1.38 (3H, t, J=7 Hz); 1.30-1.80 (2H, m); 2.43 (2H, t, J=7 Hz); 4.33 (2H, q, J=7 Hz); IR (neat) 2960, 2100, 1720, 1630, 1460, 1380, 1360, 1240, 1210, 1090, 1020, 960, 860 cm^{-1}.

Ethyl 3-Diazo-4-methyl-2-oxopentanoate (**2d**): Yield: 34%; oil; ^{1}H NMR ($CDCl_3$) δ 1.17 (6H, d, J=7 Hz); 1.38 (3H, t, J=7 Hz); 3.07 (1H, sept, J=7 Hz); 4.33 (2H, q, J=7 Hz); IR (neat) 2960, 2100, 1720, 1630, 1460, 1360, 1300, 1220, 1160, 1110, 1060, 1020, 960, 860 cm^{-1}.

Phosphazines **3**:
General Procedure: To a solution of the diazoesters **2** (20 mmol) in ether (30 ml) was added a solution of triphenylphosphine (5.23 g, 20 mmol) in ether (40 ml) with stirring below 5°C. After standing overnight at 5°C, the reaction mixture was filtered to give the phosphazines **3** as yellow crystals.
The compounds prepared are listed below with their physical data.

Ethyl 2,3-Dioxopropanoate 3-Triphenylphosphazine (**3a**): Yield: 76%; mp 115-116°C; Lit.[8] mp 112°C; ^{1}H NMR ($CDCl_3$) δ 0.97 (3H, t, J=7 Hz); 3.93 (2H, q, J=7 Hz); 7.10-7.90 (16H, m); IR (Nujol) 2960, 1730, 1640, 1460, 1280, 1170, 1160, 1120, 1100, 910, 870, 860 cm^{-1}; Anal. Calcd. for $C_{23}H_{21}N_2O_3P$: C 68.31, H 5.23, N 6.93; Found: C 68.01, H 5.24, N 6.88%.

Ethyl 2,3-Dioxobutanoate 3-Triphenylphosphazine (**3b**): Yield: 78%; mp 167-169°C; ^{1}H NMR ($CDCl_3$) δ 0.93 (3H, t, J=7 Hz); 2.12 (3H, s); 3.86 (2H, q, J=7 Hz); 7.20-8.00 (15H, m); IR (Nujol) 2960, 1740, 1650, 1520, 1460, 1240 1120, 1110, 1040, 910, 840 cm^{-1}; Anal. Calcd. for $C_{24}H_{23}N_2O_3P$: C 68.89, H 5.54, N 6.69; Found: C 68.86, H 5.54, N 6.76%.

Ethyl 2,3-Dioxohexanoate 3-Triphenylphosphazine (**3c**): Yield: 70%; mp 107-109°C; ^{1}H NMR ($CDCl_3$) δ 0.93 (6H, t, J=7 Hz); 1.20-2.00 (2H, m); 2.73 (2H, t, J=7 Hz); 3.83 (2H, q, J=7 Hz); 7.30-8.00 (15H, m); IR (Nujol) 2950, 1730, 1640, 1500, 1250, 1200, 1120, 1110, 1060, 970, 910 cm^{-1}; Anal. Calcd for $C_{26}H_{27}N_2O_3P$: C 69.94, H 6.10, N 6.27; Found: C 70.14, H 6.10, N 6.04%.

Ethyl 4-Methyl-2,3-dioxopentanoate 3-Triphenylphosphazine (**3d**): Yield 61%; mp 141-142°C; ^{1}H NMR ($CDCl_3$) δ 0.90 (3H, t, J=7 Hz); 1.27 (6H, d, J=7 Hz); 3.67 (1H, sept, J=7 Hz); 3.70 (2H, q, J=7 Hz); 7.10-7.90 (15H, m); IR (neat) 2970, 1740, 1650, 1510, 1470, 1320, 1130, 1110, 1080, 960, 920, 880 860 cm^{-1}; Anal. Calcd. for $C_{26}H_{27}N_2O_3P$: C 69.94, H 6.10, N 6.27; Found: C 69.94, H 6.13, N 6.41%.

Ethyl 2,3-Dioxocarboxylate 3-Hydrazones **4**:
General Procedure: A suspension of the phosphazines **3** (15 mmol) in 90% ethanol (30 ml) containing acetic acid (0.1 g) was stirred at room temperature for 6 h. The resulting clear solution was evaporated under reduced pressure. The residue was chromatographed on silica gel eluting with n-hexane/ethyl acetate (1:1) to give the ethyl 2,3-dioxocarboxylate 3-hydrazones **4**.
The compounds prepared could not be characterized by elemental analysis and were used for the next reaction without further purification.
Their physical data are listed below.

Ethyl 2,3-Dioxopropanoate 3-Hydrazone: (**4a**): Yield: 68%; oil; ^{1}H NMR ($CDCl_3$) δ 1.34, 1.37 (total 3H, each t, J=7 Hz); 4.34 (2H, q, J=7 Hz), 7.27, 7.57 (total 1H, each s); 7.30-7.70 (2H, br d); IR (neat) 3430, 3330, 3200, 2980, 1730, 1650, 1520, 1260, 1180, 1080 cm^{-1}.

Ethyl 2,3-Dioxobutanoate 3-Hydrazone (**4b**): Yield: 64%; oil; ^{1}H NMR ($CDCl_3$) δ 1.33 (3H, t, J=7 Hz); 1.87 (3H, s), 4.32 (2H, q, J=7 Hz); 6.30-7.00 (2H, br d); IR (neat) 3470, 3360, 3270, 2980, 1740, 1670, 1560, 1460, 1400, 1360, 1250, 1060, 880 cm^{-1}.

Ethyl 2,3-Dioxohexanoate 3-Hydrazone (**4c**): Yield: 41%; oil; ^{1}H NMR ($CDCl_3$) δ 0.97 (3H, t, J=7 Hz); 1.35 (3H, t, J=7 Hz); 1.30-1.90 (2H, m); 2.44 (2H, t, J=7 Hz); 4.36 (2H, q, J=7 Hz); 6.30-7.00 (2H, br d); IR (neat) 3440, 3330, 3240, 2960, 1730, 1680, 1540, 1440, 1380, 1240, 1200, 1090,1020 cm^{-1}.

Ethyl 2,3-Dioxocarboxylate 3-[(Dimethylamino)methylene]hydrazones **5** : (R^2 = H; X = NMe_2):

General Procedure: To a solution of the hydrazones **4** (3.0 mmol) in tetrahydrofuran (5.0 ml) was added a solution of N,N-dimethylformamide dimethyl acetal (0.39 g, 3.3 mmol) in tetrahydrofuran (2.0 ml) with stirring at room temperature. After stirring overnight the resulting solution was evaporated under reduced pressure. The residue was chromatographed on silica gel, eluting with ethyl acetate to give the 2,3-dioxocarboxylate 3-[(dimethylamino)methylene] hydrazones **5a-c**.

The compounds prepared are listed below with their physical data.

Ethyl 2,3-Dioxopropanoate 3-[(Dimethylamino)methylene]hydrazone (**5a**): Yield: 44%; oil; ^{1}H NMR ($CDCl_3$) δ 1.35 (3H, t, J=7 Hz); 3.12 (6H, s), 4.33 (2H, q, J=7 Hz); 7.80 (1H, s); 8.14 (1H, s); IR (neat) 3000, 2950, 1750, 1680, 1640, 1520, 1430, 1310, 1270, 1150, 1090, 880 cm^{-1}; Anal. Calcd. for $C_8H_{13}N_3O_3$: C 48.23, H 6.58, N 21.09; Found: C 47.87, H 6.40, N 20.65%.

Ethyl 2,3-Dioxobutanoate 3-[(Dimethylamino)methylene]hydrazone (**5b**): Yield 70%; mp 75-78°C; ^{1}H NMR ($CDCl_3$) δ 1.34 (3H, t, J=7 Hz); 2.08 (3H, s); 3.13 (6H, s); 4.33 (2H, q, J=7 Hz); 8.07 (1H, s); IR (neat) 2960, 1740, 1660, 1640, 1540, 1360, 1300, 1220, 1110, 1040, 880 cm^{-1}; Anal. Calcd. for $C_9H_{15}N_3O_3$: C 50.69, H 7.09, N 19.71; Found: C 50.58, H 7.16, N 19.67%.

Ethyl 2,3-Dioxohexanoate 3-[(Dimethylamino)methylene]hydrazone (**5c**): Yield 71%; oil; ^{1}H NMR ($CDCl_3$) δ 0.91 (3H, t, J=7 Hz); 1.33 (3H, t, J=7 Hz); 1.40 - 1.80 (2H, m); 2.64 (2H, t, J=7 Hz); 3.09 (6H, s); 4.32 (2H, q, J= 7 Hz); 8.00 (1H, s); IR (neat) 2970, 1740, 1680, 1640, 1550, 1540, 1430, 1380, 1300, 1250, 1200, 1090, 1020, 980, 920, 850 cm^{-1}; Anal. Calcd. for $C_{11}H_{19}N_3O_3$: C 54.76, H 7.94, N 17.41; Found: C 54.62, H 7.93, N 17.22%.

Ethyl 2,3-Dioxocarboxylate 3-[1-(Dimethylamino)ethylene]hydrazones **5d-f**: (R^2 = Me; X = NMe_2):

These compounds were prepared as described for the synthesis of **5a-c** using N,N-dimethylacetamide dimethyl acetal (0.44 g, 3.3 mmol) instead of N,N-dimethylformamide dimethyl acetal.

The compounds prepared are listed below with their physical data.

Ethyl 2,3-Dioxopropanoate 3-[1-(Dimethylamino)ethylene]hydrazone (**5d**): Yield: 36%; oil; ^{1}H NMR ($CDCl_3$) δ 1.34 (3H, t, J=7 Hz); 2.28 (3H, s); 3.16 (6H, s); 4.33 (2H, q, J=7 Hz); 7.71 (1H, s); IR (neat) 3000, 1740, 1670, 1600, 1520, 1470, 1400, 1330, 1260, 1120, 1020, 850 cm^{-1}; Anal. Calcd. for $C_9H_{15}N_3O_3$: C 50.69, H 7.09, N 19.71; Found: C 50.77, H 7.18, N 19.92%.

Ethyl 2,3-Dioxobutanoate 3-[1-(Dimethylamino)ethylene]hydrazone (**5e**): Yield: 72%; mp 53-55°C; ^{1}H NMR ($CDCl_3$) δ 1.33 (3H, t, J=7 Hz); 2.07 (3H, s); 2.27 (3H, s); 3.17 (6H, s); 4.32 (2H, q, J=7 Hz); IR (neat) 2950, 1740, 1670, 1590, 1530, 1420, 1370, 1320, 1260, 1220, 1130, 1040, 1020, 930, 850 cm^{-1}; Anal. Calcd. for $C_{10}H_{17}N_3O_3$: C 52.87, H 7.54, N 18.50; Found: C 52.68, H 7.62, N 18.30%.

Ethyl 2,3-Dioxohexanoate 3-[1-(Dimethylamino)ethylene]hydrazone (**5f**):
Yield: 59%; oil; ^{1}H NMR ($CDCl_3$) δ 0.90 (3H, t, J=7 Hz); 1.33 (3H, t, J= 7 Hz); 1.40-1.90 (2H, m); 2.25 (3H, s); 2.63 (2H, t, J=7 Hz); 3.15 (6H, s); 4.32 (2H, q, J=7 Hz); IR (neat) 2980, 1750, 1680, 1600, 1540, 1430, 1380, 1360, 1340, 1270, 1250, 1200, 1140, 1100, 1020, 940, 860 cm^{-1}; Anal. Calcd. for $C_{12}H_{21}N_3O_3$: C 56.45, H 8.29, N 16.46; Found: C 56.37, H 8.16, N 16.79%.

Ethyl 2,3-Dioxocarboxylate 3-(α-Ethoxybenzylidene)hydrazones **5g-i**:
(R^2 = Ph, X = OEt):
General Procedure: The hydrazones **4** (3.0 mmol) and triethyl orthobenzoate (0.74 g, 3.3 mmol) were dissolved in acetic acid (15 ml) and heated with stirring at 100°C for 3 h. The reaction mixture was neutralized with 2 N sodium bicarbonate solution and extracted with ethyl acetate (2x60 ml). After evaporation of the solvent the residue was chromatographed on silica gel eluting with n-hexane/ethyl acetate (4:1) to give the ethyl 2,3-dioxocarboxylate 3-(α-ethoxybenzylidene)hydrazones **5g-i**.
The compounds prepared could not be characterized by elemental analysis and were used for the next reaction without further purification. Their physical data are listed below.

Ethyl 2,3-Dioxopropanoate 3-(α-Ethoxybenzylidene)hydrazone (**5g**): Yield: 42%; oil; ^{1}H NMR ($CDCl_3$) δ 1.35 (3H, t, J=7 Hz); 1.41 (3H, t, J=7 Hz); 4.14 (2H, q, J=7 Hz); 4.37 (2H, q, J=7 Hz); 7.39 (1H, s); 7.20-8.20 (5H, m); IR (neat) 2980, 1740, 1600, 1530, 1440, 1360, 1310, 1270, 1140, 1100, 1060, 1010 cm^{-1}.

Ethyl 2,3-Dioxobutanoate 3-(α-Ethoxybenzylidene)hydrazone (**5h**): Yield 53%; oil; ^{1}H NMR ($CDCl_3$) δ 1.39 (3H, t, J=7 Hz); 1.46 (3H, t, J=7 Hz); 2.18 (3H, s); 4.12 (2H, q, J=7 Hz); 4.50 (2H, q, J=7 Hz); 7.20-8.20 (5H, m); IR (neat) 3050, 2980, 1740, 1720, 1700, 1600, 1550, 1440, 1370, 1330, 1280, 1230, 1180, 1110, 1070, 1040, 970 cm^{-1}.

Ethyl 2,3-Dioxohexanoate 3-(α-Ethoxybenzylidene)hydrazone (**5i**): Yield 69%; oil; ^{1}H NMR ($CDCl_3$) δ 0.95 (3H, t, J=7 Hz); 1.37 (3H, t, J=7 Hz); 1.43 (3H, t, J=7 Hz); 1.40-1.80 (2H, m); 2.70 (2H, t, J=7 Hz); 4.07 (2H, q, J= 7 Hz); 4.45 (2H, q, J=7 Hz); 7.20-8.20 (5H, m); IR (neat) 2970, 1720, 1600, 1540, 1440, 1360, 1310, 1270, 1200, 1100, 1080, 1060, 1020 cm^{-1}.

Ethyl 1,2,4-Triazine-5-carboxylates **6**:
General Procedure: The hydrazones **5** (2.0 mmol) and ammonium acetate (0.46 g, 6.0 mmol) were dissolved in acetic acid (20 ml) and heated with stirring at 90°C for 4 h. The resulting solution was neutralized with 2 N sodium bicarbonate solution and extracted with ethyl acetate (2x60 ml). After evaporation of the solvent the residue was chromatographed on silica gel eluting with n-hexane/ethyl acetate (4:1) to give the ethyl 1,2,4-triazine-5-carboxylates **6**.
The compounds prepared are listed below with their physical data.

Ethyl 1,2,4-Triazine-5-carboxylate (**6a**): Yield: 47%; oil; ^{1}H NMR ($CDCl_3$) δ 1.48 (3H, t, J=7 Hz); 4.55 (2H, q, J=7 Hz); 9.80 - 10.00 (2H, m); IR (neat) 3000, 1740, 1380, 1340, 1240, 1160, 1060, 1020, 980, 930, 740 cm^{-1}; Anal. Calcd. for $C_6H_7N_3O_2$: C 47.06; H 4.61; N 27.44; Found: C 46.76, H 4.71, N 27.03%.

Ethyl 6-Methyl-1,2,4-triazine-5-carboxylate (**6b**): Yield: 43%; oil; ^{1}H NMR ($CDCl_3$) δ 1.45 (3H, t, J=7 Hz); 3.00 (3H, s); 4.50 (2H, q, J=7 Hz); 9.70 (1H, s); IR (neat) 2980, 1740, 1420, 1380, 1370, 1330, 1300, 1220, 1130, 1030, 860, 810 cm^{-1}; Anal. Calcd. for $C_7H_9N_3O_2$: C 50.30, H 5.43, N 25.14; Found: C 50.41, H 5.46, N 25.59%.

Ethyl 6-n-Propyl-1,2,4-triazine-5-carboxylate (**6c**): Yield 37%; oil; ^{1}H NMR ($CDCl_3$) δ 1.04 (3H, t, J=7 Hz); 1.46 (3H, t, J=7 Hz); 1.50-2.20 (2H, m);

3.24 (2H, t, J=7 Hz); 4.50 (2H, q, J=7 Hz); 9.68 (1H, s); IR (neat) 2950, 1730, 1450, 1360, 1300, 1190, 1120, 1010 cm^{-1}; Anal. Calcd. for $C_9H_{13}N_3O_2$: C 55.37, H 6.71, N 21.52; Found: C 55.41, H 6.90, N 21.89%.

Ethyl 3-Methyl-1,2,4-triazine-5-carboxylate (**6d**): Yield: 55%; oil; ^1H NMR ($CDCl_3$) δ 1.46 (3H, t, J=7 Hz); 3.00 (3H, s); 4.52 (2H, q, J=7 Hz); 9.65 (1H, s); IR (neat) 2980, 1730, 1530, 1420, 1380, 1340, 1310, 1190, 1060, 1020, 920, 740 cm^{-1}; Anal. Calcd. for $C_7H_9N_3O_2$: C 50.30, H 5.43, N 25.14; Found: C 50.16, H 5.47, N 24.77%.

Ethyl 3,6-Dimethyl-1,2,4-triazine-5-carboxylate (**6e**): Yield: 42%; mp 45-46°C; ^1H NMR ($CDCl_3$) δ 1.45 (3H, t, J=7 Hz); 2.93 (3H, s); 2.97 (3H, s); 4.50 (2H, q, J=7 Hz); IR (Nujol) 2970, 1730, 1410, 1260, 1120, 1110, 1060, 1020 cm^{-1}; Anal. Calcd. for $C_8H_{11}N_3O_2$: C 53.03, H 6.12, N 23.19; Found: C 53.28, H 5.94, N 23.12%.

Ethyl 3-Methyl-6-n-propyl-1,2,4-triazine-5-carboxylate (**6f**): Yield: 49%; oil; ^1H NMR ($CDCl_3$) δ 1.02 (3H, t, J=7 Hz); 1.45 (3H, t, J=7 Hz); 1.50-2.10 (2H, m); 2.93 (3H, s); 3.17 (2H, t, J=7 Hz); 4.50 (2H, q, J=7 Hz); IR (neat) 2980, 1740, 1470, 1450, 1420, 1380, 1280, 1240, 1130, 1060, 1020 cm^{-1}; Anal. Calcd. for $C_{10}H_{15}N_3O_2$: C 57.40, H 7.23, N 20.08; Found: C 57.28, H 7.44, N 19.65%.

Ethyl 3-Phenyl-1,2,4-triazine-5-carboxylate (**6g**): Yield: 54%; mp. 96-98°C; ^1H NMR ($CDCl_3$) δ 1.49 (3H, t, J=7 Hz); 4.55 (2H, q, J=7 Hz); 7.30 - 7.80 (3H, m); 8.40 - 8.80 (2H, m); 9.70 (1H, s); IR (Nujol) 2980, 1710, 1520, 1320, 1180, 1050, 1020 cm^{-1}; Anal. Calcd. for $C_{12}H_{11}N_3O_2$: C 62.87, H 4.84, N 18.33; Found: C 62.41, H 4.78, N 18.36%.

Ethyl 6-Methyl-3-phenyl-1,2,4-triazine-5-carboxylate (**6h**): Yield: 36%; mp 50-53°C; ^1H NMR ($CDCl_3$) δ 1.48 (3H, t, J=7 Hz); 2.98 (3H, s); 4.50 (2H, q, J=7 Hz); 7.30-7.70 (3H, m), 8.30-8.70 (2H, m); IR (neat) 3030, 2980, 1730, 1530, 1400, 1370, 1350, 1300, 1260, 1180, 1120, 1070, 1040, 1020 cm^{-1}; Anal. Calcd. for $C_{13}H_{13}N_3O_2$: C 64.19, H 5.39, N 17.27; Found: C 63.82, H 5.31, N 17.31%.

Ethyl 3-Phenyl-6-n-propyl-1,2,4-triazine-5-carboxylate (**6i**): Yield: 40%; mp 40-42°C; ^1H NMR ($CDCl_3$) δ 1.03 (3H, t, J=7 Hz); 1.45 (3H, t, J=7 Hz); 1.50-2.10 (2H, m); 3.20 (2H, t, J=7 Hz); 4.50 (2H, q, J=7 Hz); 7.30-7.70 (3H, m); 8.40-8.70 (2H, m); IR (neat) 3070, 2980, 1730, 1610, 1560, 1440, 1400, 1380, 1280, 1250, 1180, 1120, 1040 cm^{-1}; Anal. Calcd. for $C_{15}H_{17}N_3O_2$ C 66.40, H 6.32, N 15.49; Found: C 66.51, H 6.22, N 15.61%.

REFERENCES

1. Ohsumi, T.; Neunhoeffer, H.; Heterocycles **1992**, *33*, in press.
2. Ohsumi, T.; Neunhoeffer, H.; Tetrahedron **1992**, *48*, 651-662.
3. Krass, D. K.; Paudler, W. W.: J. Heterocycl. Chem. **1974**, *11*, 43-44.
   Henning, H.; Ph. D. Thesis, Technische Hochschule Darmstadt, **1975**.
   Konno, S.; Ohba, S.; Agata, M.; Aizawa, Y.; Sagi, M.; Yamanaka, H.; Heterocycles **1987**, *26*, 3259-3264.
   Konno, S.; Ohba, S.; Sagi, M.; Yamanaka, H.; Heterocycles **1986**, *24*, 1243-1246.
   Konno, S.; Ohba, S.; Sagi, M.; Yamanaka, H.; Chem. Pharm. Bull. J. **1987**, *35*, 1378-1382.
   Neunhoeffer, H.; Reichel, D.; Cullmann, B.; Rehn, I.; Liebigs Ann. Chem. **1990**, 631-640.
4. Neunhoeffer, H.; in "The Chemistry of Heterocyclic Compounds" (Ed. Weissberger, A.; Taylor, E. C.), Vol. *33* 531-537, Wiley-Interscience, New York, **1974**.

5. Franzen, V.; Liebigs Ann. Chem. **1957**, *602*, 199-208.
6. Wilds, A. L.; Maeder, A. L. Jr.; J. Org. Chem. **1948**, *13*, 763-779.
7. Regitz, M.; Chem. Ber. **1966**, *99*, 3128-3147.
8. Bestmann, H. J.; Buckschewski, H.; Leube, H.; Chem. Ber. **1959**, *92*, 1345-1354.
9. Bestmann, H. J.; Kolm, H.; Chem. Ber. **1963**, *96*, 1948-1958.
10. Staudinger, H.; Lüscher, G.; Helv. Chim. Acta, **1922**, *5*, 75-86.
11. von Bruchhausen, E.; Hoffmann. H.; Chem. Ber. **1941**, *74*, 1584-1593.
12. Kirmse, W.; Horner, L.; Chem. Ber. **1956**, *89*, 2759-2765.