of alcohol saturated with ammonia (~10%); the mixture is left to stand for 2 days at 20°C. The reaction mixture is then evaporated to dryness in a vacuum. To the residue there are added 5 ml of ether. The residue separating out (0.3 g) is filtered and recrystallized from 6 ml of water. There are obtained 0.14 g (8%) of 2-(carboxyamidoaminomethyl)-4,6-dimethoxy-s-triazine (X). Colorless crystals, mp 186-187°C (decomp.). The substance is readily soluble in acetone and chloroform, and only slightly soluble in ether and water. IR spectrum: 1650 ($CONH_2$), 3140, 3330 cm^{-1} (NH_2). PMR spectrum (in DMSO): 3.82 (6H, s, OCH_3), 7.16 and 7.24 ppm (broad signals of NH). Mass spectrum: 213 [$(M^{+\bullet})$], 183 [$(M - OCH_2)^{+\bullet}$]. Found: C 39.7; H 5.2; N 32.6%. $C_7H_{11}N_5O_3$. Calculated: C 39.4; N 5.2; N 32.8%.

After separation of X, the ether filtrate is evaporated in a vacuum. To the residue there are added 10 ml of water. The crystalline substance which is insoluble in water is filtered and washed with water. There are obtained 0.47 g (21%) of 2-(dicarboethoxymethyl)-4-amino-6-methoxy-s-triazine (IX). Colorless crystals, mp 109-110°C (from water). The substance is readily soluble in acetone, alcohols, chloroform, benzene and ethyl acetate, and only slightly soluble in water. IR spectrum: 1745 ($COOC_2H_5$), 3320 and 3370 cm^{-1} (NH_2). PMR spectrum (in DMSO): 1.20 (6H, t, $CH_3{-}CH_2$), 3.83 (3H, s, OCH_3), 4.15 (4H, q, $CH_2{-}CH_3$), 4.65 ppm (1H, s, CH). Mass spectrum: 284 [$(M^{+\bullet})$], 254 [$(M - OCH_2)^{+\bullet}$], 239 [$(M - OC_2H_5)^{+}$], 212 [$(M - CO_2 - C_2H_4)^{+\bullet}$], 168 [$(M - CO_2 - C_2H_4 - OC_2H_5)^{+}$], 140 [$(M - 2CO_2 - 2C_2H_4)^{+\bullet}$]. Found: C 46.5; H 5.7; N 20.0%. $C_{11}H_{16}N_4O_5$. Calculated: C 46.5; H 5.6; N 19.8.

LITERATURE CITED

1. W. Kolb, J. Prakt. Chem., 49, 90 (1894).
2. G. F. Reynolds, R. Berner, and W. Bontwell, J. Heterocycl. Chem., 9, 1009 (1972).
3. G. F. Reynolds and Ch. H. Lachmüller, J. Heterocycl. Chem., 12, 1279 (1975).
4. G. F. Reynolds and A. F. Saari, J. Heterocycl. Chem., 12, 295 (1975).
5. J. R. Dudley, J. T. Thurston, F. C. Schaefer, D. Holm-Hansen, C. J. Hull, and P. Adams, J. Am. Chem. Soc., 73, 2986 (1951).
6. P. R. Speakman, Chem. Ind., 6, 232 (1977).

SYNTHESIS AND SOME CONVERSIONS OF 2,3-DIHYDRO-2-CARBALKOXYMETHYL-3-IMINO-5,6-DIPHENYL-1,2,4-TRIAZINE

V. P. Kruglenko and M. V. Povstyanoi

UDC 547.785'873.07

Continuing investigations of the alkylation of substituted 3-amino-1,2,4-triazine (I) by α-halocarbonyl compounds [1], with the aim of obtaining new representations of the series imidazo[1,2-b]-1,2,4-triazine, we made a study of the action of the esters of α-haloacetic acids on I, and some of the conversions of the 2,3-dihydro-2-carbalkoxymethyl-3-imino-5,6-diphenyl-1,2,4-triazines formed in this case (IIa-c). With the heating of I with the bromium (iodine) esters of acetic acids in low-boiling solvents (lower alcohols, acetone) the hydrohalide salts IIa, b are formed. An analogous product (IIc) is formed when the process is conducted without a solvent, for example, in a medium of the methyl ester of chloroacetic acid.

In the IR spectra of IIa-c there are observed two characteristic absorption bands of an ester grouping in the region 1740-1760 and 1230-1245 cm^{-1} due to the group C=O and the ordinary bond C—O. The absorption bands for the imino group appear at 3280-3310 cm^{-1}.

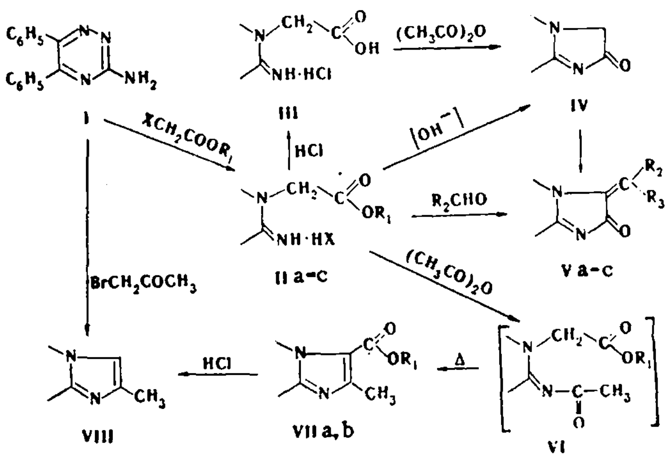
The compounds IIa-c are easily saponified in concentrated hydrochloric acid to the hydrochloride of 2,3-dihydro-3-imino-5,6-diphenyl-1,2,4-triazinyl-2-acetic acid (III), which is confirmed by the appearance of bands of the OH group in the IR spectrum.

Alkaline hydrolysis of the esters (IIa-c) leads to the formation of a dicyclic product, i.e., 2,3-diphenyl-6-oxo-6,7-dihydroimidazo[1,2-b]-1,2,4-triazine (IV). The process obviously takes place through a stage of the formation of a unstable acid (III), which in an

---

M. V. Lomonosov Odessa Technological Institute of the Food Industry, Kherson Branch, Kherson 325028. Translated from Khimiya Geterotsiklicheskikh Soedinenii, No. 11, pp. 1561-1563, November, 1979. Original article submitted October 4, 1978; revision submitted April 12, 1979.

0009-3122/79/1511-1255$07.50 © 1980 Plenum Publishing Corporation



II a $R_1=C_2H_5$, $X=Br$; b $R_1=C_2H_5$, $X=I$; c $R_1=CH_3$, $X=Cl$; V a $R_2=4\text{-}BrC_6H_4$, $R_3=H$; b $R_2=4\text{-}NO_2C_6H_4$, $R_3=H$; c $R_2=R_3=CH_3$; VII a $R_1=C_2H_5$; b $R_1=CH_3$

alkaline medium, is cyclicized to lactam (IV). This is confirmed by the fact that, with neutralization of the hydrochloride of the acid (III) by a solution of caustic soda, the reaction product IV is also separated. The latter is also easily formed with the short-term heating of the acid III in acetic anhydride. In the IR spectrum of IV there are absorption bands of the groups C=O and CN at 1770 and 1570 cm^{-1}.

The compound IV, containing an active methyl group, reacts with aldehydes with boiling in lower acids in the presence of catalytic amounts of piperidine with the formation of the corresponding ylidene derivatives (Va, b). The compound Vc is formed with the boiling of lactam IV in acetone. The ylidene derivatives Va, b can be obtained directly with the heating of the esters IIa-c with a carbonyl component in acetic acid in the presence of anhydrous sodium acetate. In the IR spectra of Va-c there are absorption bands of the group C=O at 1650-1660 cm^{-1}.

The boiling of the esters IIa-c in acetic anhydride leads to an unexpected result. Even with short-term heating, instead of N-acetyl derivatives of VI, the products of their cyclization are separated, i.e., esters of imidazo[1,2-b]-1,2,4-triazinyl-7-carboxylic acid (VIIa, b). The formation of the imidazole ring probably takes place due to cyclization of the intermediate N-acetyl derivatives VI. We were not successful in separating the latter in individual form, which indicates that they have a great tendency toward cyclization in comparison with the corresponding N-acetyl derivatives of benzimidazole [2]. In the IR spectra of VIIa, b there are intense absorption bands of the groups C=O in the region 1705-1710 cm^{-1} and the bond C=N at 1550-1570 cm^{-1}. The acid hydrolysis of VIIa, b is accompanied by decarboxylation and leads to 2,3-diphenyl-6-methylimidazo[1,2-b]-1,2,4-triazine, obtained earlier [1] by a reaction between I and α-bromoacetone.

Thus, the alkylation of I by esters of haloacetic acids, as well as by α-haloketones [1], takes place at an atom of nitrogen in position 2 of the triazine ring, and leads to 2,3-dihydro-2-carbalkoxymethyl-3-imino-5,6-diphenyl-1,2,4-triazines, which, under the action of cyclization agents, are converted into substituted imidazo[1,2-b]-1,2,4-triazine.

EXPERIMENTAL

The IR spectra were recorded in a UR-20 instrument in pellets of KBr; the PMR spectra were recorded in a ZKR-60 instrument in trifluoroacetic acid, internal standard TMS.

Hydrohalides of 2,3-Dihydro-2-carbalkoxymethyl-3-imino-5,6-diphenyl-1,2,4-triazine (IIa-c). A) To a solution of 12.4 g (5 mmole) of I [3] in 150 ml of acetone or 100 ml ethanol there are added 5.6 mmole of the ethyl ester of α-bromo(iodo)acetic acid; the mixture is boiled for 2-3 h and evaporated in a vacuum; the residue of IIa,b is filtered and washed with ether. The mother solutions are evaporated in a vacuum; under these circumstances, an additional amount of the substance IIa, b is evolved.

B) A mixture of 3.72 g (1.5 mmole) of I and 10.8 g (100 mmole) of the methyl ester of α-chloroacetic acid are heated to 90°C in an atmosphere of nitrogen for 5 h. The residue of IIc is filtered, washed with water, and dried.

TABLE 1. Characteristics of Compounds IIa-c, III-Va-c, and VIIa, b

Compound	mp, °C[a]	R_f[b]	IR spectrum, ν, cm⁻¹			Found, %			Empirical formula	Calculated, %			Yield, %
			C=O	C=N	NH	C	H	N		C	H	N	
IIa	224—225	0,33	1760	1670	3310	55,2	4,9	13,2	$C_{19}H_{18}N_4O_2 \cdot HBr$[c]	55,0	4,6	13,5	63
IIb	213—215	0,39	1750	1680	3280	49,7	4,0	11,8	$C_{19}H_{18}N_4O_2 \cdot HI$[d]	49,4	4,1	12,1	52
IIc	232—233	0,23	1740	1620	3290	—	—	15,8	$C_{18}H_{16}N_4O_2 \cdot HCl$	—	—	15,7	53
III	248—250	0,41	1735	1650	2810—3270	59,3	4,8	16,4	$C_{17}H_{14}N_4O_2 \cdot HCl$	59,6	4,4	16,3	86
IV	176—178	0,69	1770	1570		—	—	19,6	$C_{17}H_{12}N_4O$	—	—	19,4	20—42
Va	270—272	0,68	1650	1620	—	63,0	3,6	12,3	$C_{24}H_{15}BrN_4O$	63,3	3,3	12,3	57—76
Vb	258—260	0,52	1660	1620	—	68,6	4,0	16,2	$C_{24}H_{15}N_5O_3$	68,4	3,6	16,6	46—82
Vc	213—214	0,16	1660	1610	—	—	—	17,4	$C_{20}H_{16}N_4O$	—	—	17,0	66
VIIa	179—181	0,82	1705	1550	—	70,4	5,2	15,2	$C_{21}H_{18}N_4O_2$	70,4	5,1	15,6	82
VIIb	213—214	0,64	1710	1570	—	69,9	4,9	15,9	$C_{20}H_{16}N_4O_2$[e]	69,8	4,7	16,3	76

---

[a] For analysis the compounds were purified by crystallization from a mixture of ethanol—ether (IIa, b), methanol—ether (IIc, III), ethanol (VIIa), methanol (VIIb), or by reprecipitation with ether from methanol (IV). Substances Va-c were not subjected to purification. [b] Chromatography was carried out on plates of Silufol UV-254; the eluent was methanol—chloroform, 1:5 (IIIa-c, Vc), isopropanol (III-Va, b), methanol—butanol—water, 25:2:20 (VIIa, b). [c] PMR spectrum, δ: 1.22-1.75 (q, CH_3), 4.32-4.67 (t, OCH_2), 5.48 (s, CH_2), 7.30-7.84 ppm (m, 5- and 6-C_6H_5). [d] PMR spectrum, δ: 1.26-1.73 (q, CH_3), 4.3-4.64 (t, OCH_2), 5.50 (s, CH_2), 7.33-7.83 ppm (m, 5- and 6-C_6H_5). [e] PMR spectrum, δ: 3.05 (s, CH_3), 4.24 (s, OCH_3), 7.44 ppm (s, 5- and 6-C_6H_5).

Hydrochloride of 2,3-Dihydro-3-imino-5,6-diphenyl-1,2,4-triazinyl-2-acetic Acid (III). A suspension of 1 mmole IIa-c in 40-50 ml of concentrated HCl is heated at 90°C for 2-3 h. After cooling, the residue is filtered and washed with cooled acetone (10-15 ml).

2,3-Diphenyl-6-oxo-6,7-dihydroimidazo[1,2-b]-1,2,4-triazine (IV). A) A suspension of 1.6 g (5 mmole) of III and 10 ml of acetic anhydride is heated up to complete dissolution (8-10 min); the reaction mixture is cooled and the residue is filtered and washed with ether.

B) To a solution of 10 mmole IIa-c in 20-30 ml alcohol there are added 20 mmole of sodium hydroxide or potassium hydroxide and the mixture is boiled for 3 h. After cooling, the reaction mass is poured into 100 ml of water and acidified with a 10% solution of hydrochloric acid to pH 4-5; the residue is filtered and dried in a vacuum-desiccator over P_2O_5. The yield is 20-25%. The substance does not give a depression of the melting point with a sample obtained by method (a).

Ylidene Derivatives of 2,3-Diphenyl-6-oxo-6,7-dihydroimidazo[1,2-b]-1,2,4-triazine (Va-c). A) To a solution of 1.44 g (5 mmole) of IV and 40 ml of alcohol there are added 2-3 drops of piperidine and 5.5 mmole of the corresponding aldehyde; the mixture is boiled for 2-3 h. The residue of Va, b falling out is filtered and washed with hot alcohol. To obtain Vc, the compound IV is boiled for 2 h in acetone.

B) To 5 mmole of IIa-c in 35 ml of acetic acid there is added an equal amount by weight of anhydrous sodium acetate and 5 mmole of the corresponding aldehyde. The solution is boiled for 2-3 h; the forming residue of Va, b is filtered and washed with hot alcohol. The yield of the compounds Va, b is 43 and 48%, respectively.

2,3-Diphenyl-6-methyl-7-carbalkoxyimidazo[1,2-b]-1,2,4-triazine (VIIa, b). A mixture of 5 mmole IIa-c in 100 ml acetic anhydride and 5 mmole of anhydrous sodium acetate is boiled for 3 h or 3 h 30 min. The solvent is distilled off in a vacuum; to the dry residue there is added ice and, after neutralization with a solution of sodium bicarbonate, the residue of compounds VIIa, b is filtered.

2,3-Diphenyl-6-methylamidazo[1,2-b]-1,2,4-triazine (VIII). Five mmole of VIIa, b are boiled for 1 h in 40 ml of concentrated HCl. The suspension is put into water, neutralized with ammonia, and the residue is filtered. Yield 95-98%, mp 185-186°C (from aqueous DMFA).

LITERATURE CITED

1. M. V. Povstyanoi, V. P. Kruglenko, and P. M. Kochergin, Ukr. Khim. Zh., 42, 1166 (1976).
2. A. M. Simonov, V. A. Anisimova, and T. A. Borisova, Khim. Geterotsikl. Soedin., No. 1, 111 (1973).
3. J. Tile and H. Bihan, Ann., 302, 309 (1898).