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STUDIES ON QUINAZOLINE CHEMISTRY. 5.* SYNTHESIS OF 3,4-DIHYDROQUINAZOLINES WITH FUNCTIONAL SUBSTITUENTS AT C-2 ATOM AND THEIR ALKYLATION REACTIONS

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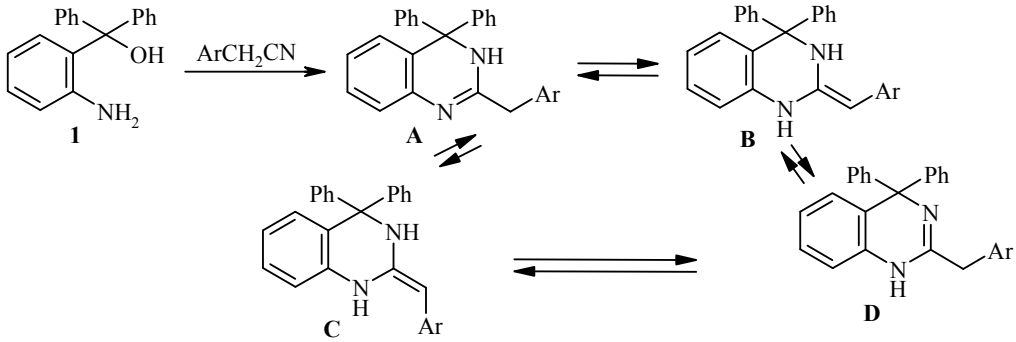
Syntheses are reported for a new series of 2-substituted 4,4-diphenyl-3,4-dihydroquinazolines by the reaction of o-aminophenyldiphenylcarbinol (APC) with various nitriles. The reaction of APC with substituted 5-bromo-3-cyano-2(1H)-pyridones leads to the formation of derivatives of two products: 3,4-dihydroquinazolines and 4H-3,1-benzoxazines. The alkylation of 3,4-dihydroquinazolines using dimethyl sulfate proceeds through N,N-dimethylation. The structure of these products is a function of the nature of the substituent at C-2 atom of the heterocycle.

Keywords: dimethyl sulfate, 4,4-diphenyl-3,4-dihydroquinazolines, alkylation, mass-spectral fragmentation.

In previous works [2, 3], we reported that *o*-aminophenyldiphenylcarbinol (APC, **1**) reacts with nitriles to give 2,4,4-trisubstituted 3,4- or 1,4-dihydroquinazolines, which exist in solution as tautomeric 1*H*- and 3*H*-forms. Furthermore, quinazolines with an active methylene group directly bound to the quinazoline system can exist in solution as four tautomeric forms **A-D** with migration of the double bond to an exocyclic position [2].



*For Communication 4, see [1].

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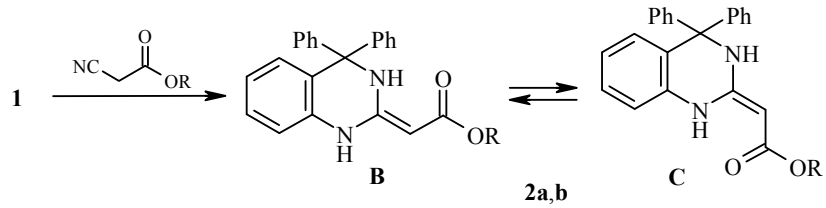
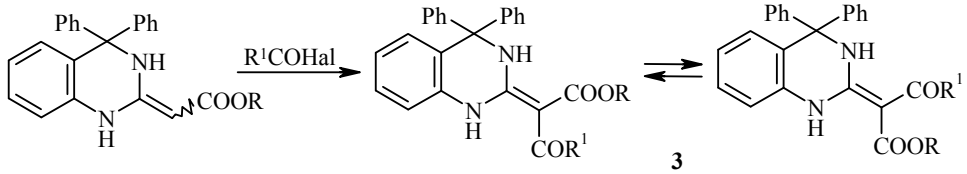
Esters of cyanoacetic acid react with APC **1** to give alkyl 2-(4,4-diphenyl-3,4-dihydroquinazolin-2(1*H*)-yl-idene)acetates **2a**,**b** as two geometric isomers (**B** and **C**) stabilized by intramolecular hydrogen bonding [2].



a R = Me, **b** R = Et

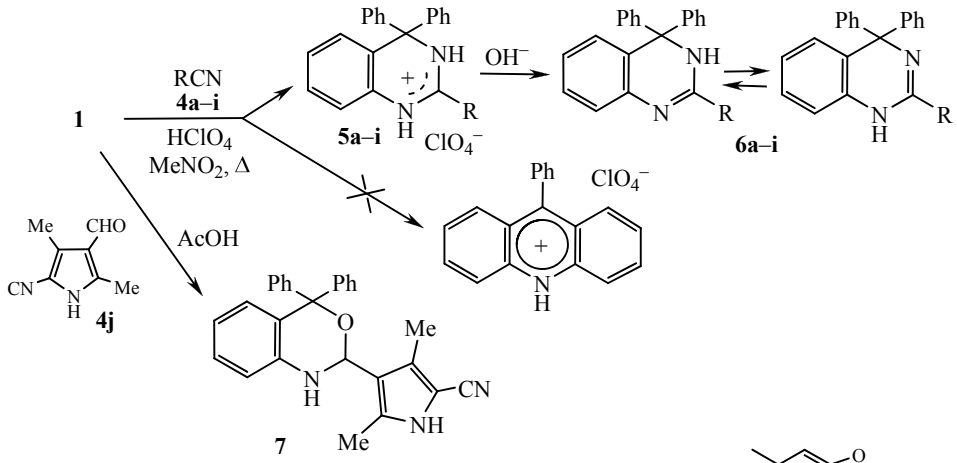
Our study of the chemical properties of such compounds has shown an unusual course for the alkylation and acylation reactions [1-3]. Thus, the methylation using dimethyl sulfate, which is a soft electrophile, proceeds as N- and C-dimethylation with migration of the double bond within the heterocyclic system [2]. Acylation with carboxylic acid halides, which are hard electrophiles, proceeds not at the nitrogen atoms, but rather as C-acylation at the α-position to the heterocycle, leading to an equilibrium mixture of π-diastereomers **3**.



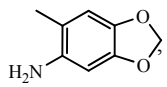
R = Alk, R^1 = Alk, Ar

In a continuation of our study of the reactions of APC **1** with nitriles in acidic medium [2, 3], we investigated the reaction of this compound with an expanded range of nitriles **4a-j**, containing various functional groups and also the alkylation of the products obtained.

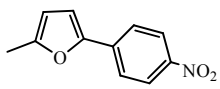
Carbinol **1** in the presence of $HClO_4$ transforms into the stable triaryl carbenium cation [2], which reacts with nitriles **4a-i** forming 3,4-dihydroquinazolinium perchlorates **5a-i** through a 1,4-dipolar cycloaddition mechanism [4].



a R = 3,4-$(EtO)_2C_6H_3CH_2$, **b** R = $MeOCH_2CH_2$, **c** 1-$AdCH_2$; **d** R =



e R = 4-BrC_6H_4, **f** R = 4-$Me_2NC_6H_4$, **g** R = 4-$(ClCH_2)C_6H_4$, **h** R =

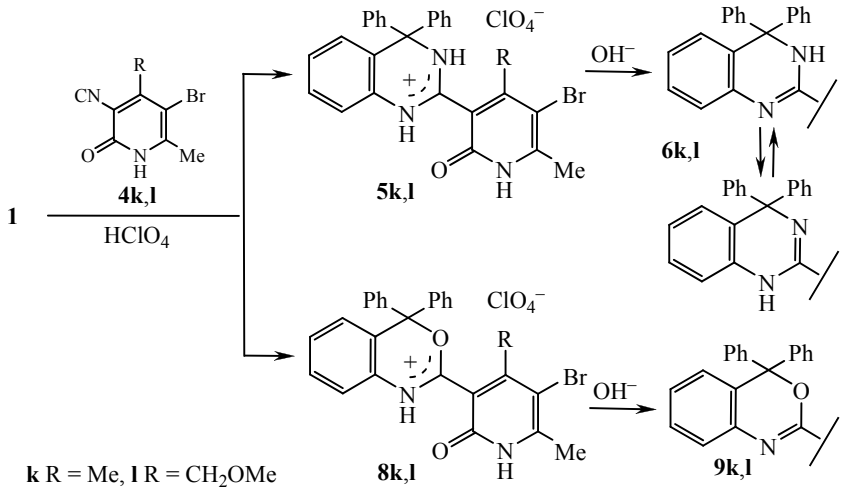


, **i** R = Me

In previous work [2, 3, 5], we established that APC **1** forms 9-phenylacridinium salts in acidic medium at room temperature. Thus, in order to suppress the side reaction leading to 9-phenylacridinium perchlorate in the synthesis of 3,4-dihydroquinazolinium perchlorates, we modified our previous procedure [2] and carried out the synthesis of perchlorates **5a-i**,**k**,**l** with a deficit of $HClO_4$. The reaction was carried out in nitromethane at reflux with equivalent amounts of the starting reagents and 70% perchloric acid, using gradual addition of the acid into the reaction medium.

4-Formyl-3,5-dimethyl-1*H*-pyrrole-2-carbonitrile (**4j**) does not react with carbinol **1** under the same reaction conditions (nitromethane solvent, equimolar amounts of reagents and perchloric acid). This nitrile reacts with APC **1** in acetic acid as an aldehyde, giving the dihydrobenzoxazine **7**.

An unusual course of the reaction of carbinol **1** with substituted 5-bromo-3-cyano-2(1*H*)-pyridones **4k**,**l**, leading to 3,4-dihydroquinazolinium perchlorates **5k**,**l** and 4*H*-3,1-benzoxazinium perchlorates **8k,l** was established under our conditions. Partial hydrolysis of the nitrile group of pyridones **4k**,**l** to a carboxyl group with subsequent acylation of the amino group in APC **1** and heterocyclization to the perchlorates **8k,l** is possible in this case, besides the formation of perchlorates **5k**,**l** [6]. However, no direct evidence has yet been obtained to support this hypothesis.



This is the first report of the preparation of perchlorates **5a-h**,**k**,**l** and **8k**,**l** and their corresponding bases, namely, 3,4-dihydroquinazolines **6a-h**,**k**,**l** and 4*H*-3,1-benzoxazines **9k**,**l**. The characteristics of these new products are given in Tables 1-3. The physicochemical properties of already reported 2-methyl-4,4-diphenyl-3,4-dihydroquinazolinium perchlorate (**5i**) and quinazoline **6i** were given in our previous work [2].

The structures of products **6a-h**,**k**,**l** and **9k**,**l** were supported by the presence of stretching bands for N–H bonds at 3150-3420 cm^{-1}, C=N bonds at 1580-1620 cm^{-1}, and C=O bonds at 1610-1690 cm^{-1} in the IR spectra of these compounds. Stretching bands for a primary amino group were found for the base **6d** at 3470, 3380, and 1590 cm^{-1}.

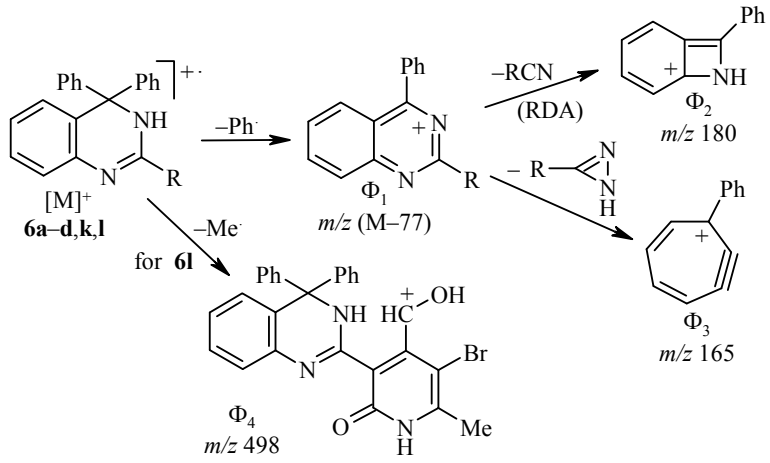
The ^1H NMR spectra of dihydroquinazolines **6a-c**,**g**,**h**,**k** showed a signal for the secondary amino group proton of the heterocycle as two singlets with the total intensity of 1H, confirming the existence of a tautomeric equilibrium in DMSO-d_6 solution between the 1*H*- and 3*H*-forms.

The initial decomposition of the molecular ions $[M]^+$ of dihydroquinazolines **6a-d**,**k**,**l** corresponds to our previously proposed scheme [3], and is characterized by the loss of a phenyl radical and formation of cation Φ_1, which decomposes through two competing pathways: elimination of nitrile molecules (retrodiene decomposition) and of diazirines RCN_2H to give the corresponding even-electron species Φ_2 and Φ_3 (Table 3). Cations such as Φ_1–Φ_3 are characteristic in the fragmentation of $[M]^+$ of 3,4-dihydroquinazolines [3]. The scheme below also gives cation Φ_4 with greatest mass spectral intensity, which is formed upon the loss of a methyl radical from the methoxymethyl substituent in dihydroquinazoline **6l**.

TABLE 1. Physicochemical Characteristics of the Compounds Synthesized

Compound	Empirical formula	Found, % / Calculated, %				Mp, °C	R_f*	Yield, %
		C	H	N	Hal			
5a	$C_{31}H_{31}ClN_2O_6$	66.05 / 66.13	5.72 / 5.55	4.82 / 4.98	6.54 / 6.30	228-230	—	75
5b	$C_{23}H_{23}ClN_2O_5$	62.48 / 62.37	5.31 / 5.23	6.45 / 6.32	8.25 / 8.00	189-190	—	70
5c	$C_{31}H_{33}ClN_2O_4$	69.67 / 69.85	6.36 / 6.24	5.18 / 5.26	6.42 / 6.65	>250	—	72
5d	$C_{27}H_{22}ClN_3O_6$	62.61 / 62.37	4.57 / 4.26	8.38 / 8.09	7.01 / 6.82	>200	—	55
5e	$C_{26}H_{20}BrClN_2O_4$	57.51 / 57.85	3.85 / 3.73	5.31 / 5.19	21.52 / 21.37	>220 (decomp.)	—	65
5f	$C_{28}H_{26}ClN_3O_4$	66.42 / 66.73	5.31 / 5.20	8.15 / 8.34	7.20 / 7.03	210–213	—	73
5g	$C_{27}H_{22}ClN_2O_4$	63.40 / 63.66	4.75 / 4.35	5.68 / 5.50	13.41 / 13.92	193–195	—	71
5h	$C_{30}H_{22}ClN_3O_7$	63.59 / 63.00	4.01 / 3.88	7.52 / 7.35	6.10 / 6.20	>210	—	65
5k	$C_{27}H_{23}BrClN_3O_5$	55.62 / 55.45	3.81 / 3.96	7.41 / 7.18	19.55 / 19.74	>220	—	53
5l	$C_{28}H_{25}BrClN_3O_6$	54.45 / 54.70	4.21 / 4.10	6.95 / 6.83	18.55 / 18.76	>250	—	15
6a	$C_{31}H_{30}N_2O_2$	80.28 / 80.49	6.31 / 6.54	6.25 / 6.06	—	132-134	0.19	72
6b	$C_{23}H_{22}N_2O$	80.55 / 80.67	6.32 / 6.48	8.45 / 8.18	—	139-140	0.38	75
6c	$C_{31}H_{32}N_2$	85.82 / 86.07	7.32 / 7.46	6.65 / 6.48	—	216-218	0.22	70
6d	$C_{27}H_{21}N_3O_2$	77.02 / 77.31	5.32 / 5.05	10.25 / 10.02	—	253-256	0.50	65
6e	$C_{26}H_{19}BrN_2$	71.15 / 71.08	4.50 / 4.36	6.15 / 6.38	18.45 / 18.19	123-126	0.75	80
6f	$C_{28}H_{25}N_3$	83.08 / 83.34	6.51 / 6.24	10.15 / 10.41	—	198-200	0.22	75
6g	$C_{27}H_{21}ClN_2$	79.55 / 79.30	5.01 / 5.18	6.67 / 6.85	8.51 / 8.67	151-153	0.85	93
6h	$C_{30}H_{21}N_3O_3$	76.68 / 76.42	4.31 / 4.49	9.08 / 8.91	—	134-136	0.43	50
6k	$C_{27}H_{22}BrN_3O$	66.59 / 66.95	4.35 / 4.58	8.42 / 8.67	16.84 / 16.50	232-233	0.06	85
6l	$C_{28}H_{24}BrN_3O_2$	65.21 / 65.38	4.82 / 4.70	8.03 / 8.17	15.38 / 15.53	240-242	0.13	70
7	$C_{27}H_{23}N_3O$	80.24 / 79.97	5.35 / 5.72	10.52 / 10.36	—	179-181	0.85	60
8k	$C_{27}H_{22}BrClN_2O_6$	55.61 / 55.36	3.62 / 3.79	4.93 / 4.78	19.54 / 19.69	>150 (decomp.)	—	38
8l	$C_{28}H_{24}BrClN_2O_7$	54.75 / 54.61	3.79 / 3.93	4.46 / 4.55	18.93 / 18.73	>250	—	75
9k	$C_{27}H_{21}BrN_2O_2$	66.96 / 66.81	4.18 / 4.36	5.52 / 5.77	16.71 / 16.46	238-240	0.51	80
9l	$C_{28}H_{23}BrN_2O_3$	65.38 / 65.25	4.35 / 4.50	5.62 / 5.44	15.75 / 15.50	241-243	0.17	73
10a	$C_{33}H_{34}N_2O_2$	81.10 / 80.78	6.72 / 6.98	5.85 / 5.71	—	146-149	0.65	45
13f	$C_{21}H_{22}N_2$	83.67 / 83.40	7.05 / 7.33	9.51 / 9.26	—	140-141	0.50	60

*Eluent – acetone–benzene, 1:9.



The first step in the fragmentation of the $[M]^+$ ion of benzoxazines **9k**,**l** is decomposition of the heterocycle, which is characteristic for decomposition of the $[M]^+$ ion of 4*H*-3,1-benzoxazine derivatives [7-9]. This step leads to formation of cation Φ_5, which then eliminates a hydrogen atom or phenyl radical to give cations Φ_6 or Φ_7.

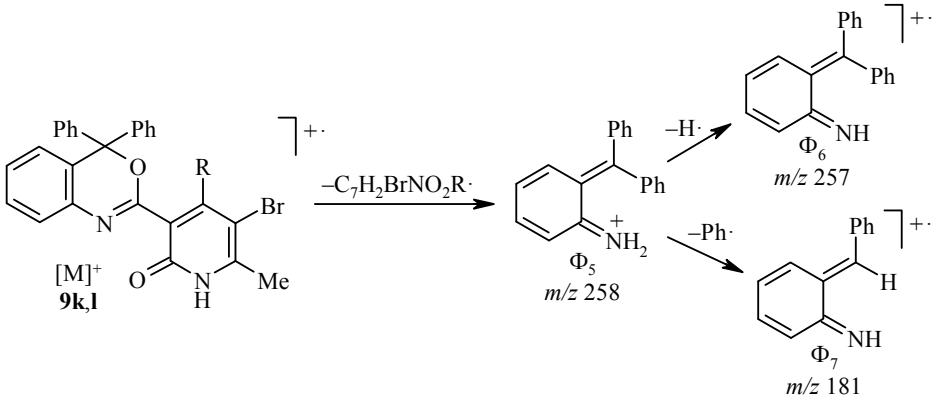
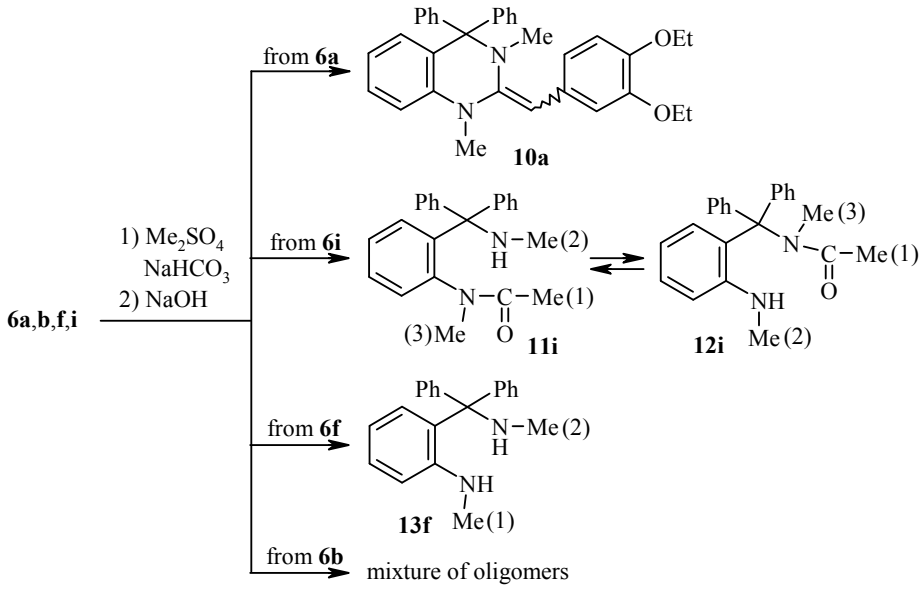


TABLE 2. IR Spectra of Salts **5a-h**,**k**,**l** and **8k**,**l**

Compound	ν, cm^{-1}		
	$NH\overset{+}{=}NH$	ClO_4^-	Others
5a	3300, 3210, 1630	1130, 1120, 1030	—
5b	3300, 3230, 1640	1140, 1100, 1630	—
5c	3300, 3200, 1620	1130, 1090, 1025	—
5d	3350, 3190, 1630	1100, 1060, 1020	3280 (NH_3^+)
5e	3170, 1620	1100, 1050, 1020	—
5f	3180, 1580	1120, 1050,	2300 (NH^+)
5g	3180, 1620	1130, 1090, 1010	—
5h	3150, 1630	1110, 1050	1370, 1520 (NO_2)
5k	3250, 3170, 1640	1100, 1090, 1010	1635 (C=O)
5l	3200, 3150, 1630	1100, 1075, 1010	1620 (C=O)
8k	2480, 1665, (NH^+)	1020, 1090, 1010	1630 (C=O)
8l	2700, 1645 (NH^+)	1105, 1081, 1030	1640 (C=O)

It was of interest to carry out alkylation and acylation reactions with a series of dihydroquinazoline products undertaken in our previous work [1, 2], in order to determine the reaction pathways and to possibly utilize synthetically one of the tautomeric forms (**A** or **D**).

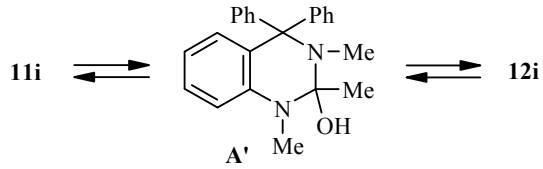
The methylation of dihydroquinazolines **6a**,**b**,**f**,**i** with excess dimethyl sulfate in aqueous medium in the presence of sodium bicarbonate with subsequent treatment with aqueous sodium hydroxide (see the review by Weygand [11], p. 463) leads to *N,N*-dimethylation products **10-13**.



Thus, 2-(3',4'-diethoxybenzyl)-4,4-diphenyl-3,4-dihydroquinazoline (**6a**) gives a dimethylation product with retention of the quinazoline system, namely, 2-(3,4-diethoxybenzylidene)-1,3-dimethyl-4,4-diphenyl-1,2,3,4-tetrahydroquinazoline (**10a**). The ^{1}H NMR spectrum indicates that this compound in trifluoroacetic acid solution exists as a 1:1 mixture of two geometric isomers. This conclusion is also supported by the finding of four singlets for the two N–CH_3 groups at 1.95, 2.92, 3.30, and 3.90 ppm, as well as two methine proton singlets at 5.60 and 5.85 ppm in the spectrum with the total intensity of 6H and 1H, respectively. The IR spectrum lacks NH group stretching bands (Table 3). This pathway for the reaction is determined, firstly, by the presence of an active exocyclic methylene group and, secondly, by the formation of a conjugated *N,N*-di-substituted styryl fragment in the final product **10a**. An analogous product, namely, 1,3-dimethyl-2-(4-nitro-benzylidene)-4,4-diphenyl-1,2,3,4-tetrahydroquinazoline, was obtained in our previous work in the dimethyl sulfate methylation of 2-(4-nitrobenzyl)-4,4-diphenyl-3,4-dihydroquinazoline [2].

3,4-Dihydroquinazolines **6i**,**f**, which lack an active methylene group at C-2 in the heterocycle, undergo methylation with ring opening.

Methylation of 2-methyl-4,4-diphenyl-3,4-dihydroquinazoline (**6i**) gives the dimethylation product **11i**. The ^{1}H NMR spectrum of this compound in DMSO-d_6 shows two broadened NH proton singlets and signals for three methyl groups, each of which appears as two singlets. This type of spectrum indicates a dynamic equilibrium in solution between two structural isomers, namely, *N*-methyl-*N*-{2-[(methylamino)-(diphenyl)methyl]phenyl}acetamide (**11i**) and *N*-methyl-*N*-{2-[(methylamino)phenyl](diphenyl)methyl}-acetamide (**12i**), which occurs by means of acetyl group migration between N-1 and N-3 atoms through the tetrahydroquinazoline species **A'** [13]. Comparison of the integral intensity of the methyl group proton signals in the ^{1}H NMR spectrum indicates a 3:2 ratio of isomers **11i** and **12i**.

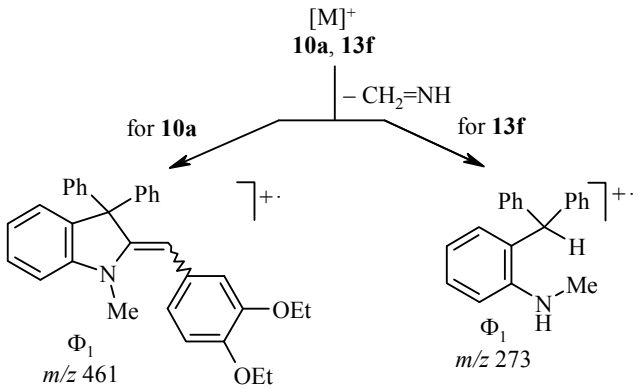


Only one of the two open forms (**11i** or **12i**) exists in the crystalline state, because the IR spectrum of crystals of this product shows only one C=O absorption band (amide 1, at 1635 cm^{-1}) and one narrow NH stretching band at 3300 cm^{-1} [12].

Elemental analysis and spectral data (Tables 1 and 3) indicate that the reaction of 2-(4-dimethylaminophenyl)-4,4-diphenyl-3,4-dihydroquinazoline (**6f**) with dimethyl sulfate proceeds through decomposition of the dihydroquinazoline system and concludes with formation of *N*-methyl-2-[(methylamino)-(diphenyl)methyl]aniline (**13f**). The lack of C=O group stretching bands in the IR spectrum of diamine **13f** indicates that the decomposition of excess dimethyl sulfate by aqueous alkali involves not only opening of the heterocyclic system but also hydrolysis of the amide group.

Methylation of 2-(2-methoxyethyl)-4,4-diphenyl-3,4-dihydroquinazoline (**6b**) under the conditions given by Weygand [11] leads to a mixture of unidentified oligomers.

The mass spectra of methylation products **10**-**13** contain molecular ion peaks $[M]^+$ with the charge of +1 (Table 3). The initial fragmentation step of the $[M]^+$ ions of products **10a** and **13f** is loss of an imine molecule (CH_2=NH) leading to ions Φ_1, which differs significantly from the initial mass-spectral decomposition of $[M]^+$ of dihydroquinazolines **6a**-**d**.



Attempts to carry out the acylation of dihydroquinazolines **6a**-**g**,**i** using acid halides or acetic anhydride were unsuccessful. No acylation of these compounds was detected [11].

Thus, we have shown that the nature of the substituent at C-2 atom of the heterocycle has a considerable effect on the direction of methylation of 3,4-dihydroquinazolines using dimethyl sulfate. In the future, we plan to use a broad range of 2-alkyl-, 2-aryl-, and 2-hetaryl-3,4-dihydroquinazolines in alkylation reactions and to continue our investigation of both the substituent and alkylating agent effect on the direction of the reaction.

EXPERIMENTAL

The IR spectra were recorded on a Specord IR-75 spectrometer at room temperature in vaseline mull. The ^{1}H NMR spectra were recorded on a Bruker DRX-500 spectrometer at 500 MHz. The spectra of compounds **6a**,**b** were recorded in $(CD_3)_2CO$, while the spectrum of compound **6c** was recorded in trifluoroacetic acid on a Tesla BS spectrometer at 60 MHz with TMS as internal standard. The mass spectra were recorded on a Varian

TABLE 3. Spectral Characteristics of Compounds **6a-h**,**k**,**l**, **7**, **9k**,**l**, **10a**, **13f**

Compound	IR spectrum, ν, cm^{-1}	^{1}H NMR spectrum		Mass spectrum*, *m/z* (I_{rel}, %)
		Solvent	Chemical shifts, δ, ppm (*J*, Hz)	
1	2	3	4	5
6a	3320 (NH), 1620 (C=N)	$(CD_3)_2CO$	1.20 (3H, t, *J* = 6.5, $OCH_2C\underline{H}_3$); 1.25 (3H, t, *J* = 6.5, $OCH_2C\underline{H}_3$); 3.44 (2H, s, $C\underline{H}_2Ar$); 3.75 (2H, q, *J* = 6.5, $2OC\underline{H}_2CH_3$); 6.55-6.80 (8H, m, H-5,6,7,8, H Ar, NH); 6.80-7.15 (10H, m, H Ph)	462 $[M]^+$ (13), 385 (100), 341 (18), 271 (10), 220 (4), 205 (11), 180 (8), 165 (35), 123 (21), 91 (5), 77 (25)
		DMSO-d_6	1.20-1.35 (6H, m, $2OCH_2C\underline{H}_3$); 3.50 (1H, s) and 3.55 (1H, s, $C\underline{H}_2Ar$); 3.80-4.00 (4H, m, $2OC\underline{H}_2CH_3$); 6.54 (1H, d, *J* = 8.0, H-8); 6.70-6.90 (3H, m, H-5,6,7); 7.00-7.30 (13H, m, H Ar, H Ph); 8.05 (0.5H, br. s) and 9.45 (0.5H, br. s, NH)	
6b	3180 (NH), 1620 (C=N)	$(CD_3)_2CO$	2.48 (2H, t, *J* = 8.2, α-CH_2); 3.16 (3H, s, OCH_3); 3.50 (2H, t, *J* = 8.2, β-CH_2); 5.85 (1H, br. s, NH); 6.45-6.75 (4H, m, H-5,6,7,8); 6.85-7.15 (10H, m, H Ph)	342 $[M]^+$ (10), 265 (100), 233 (67), 219 (5), 205 (6), 180 (5), 165 (4), 155 (21), 152 (6), 77 (23)
		DMSO-d_6	2.45-2.65 (2H, m, α-CH_2); 3.19 (1.5H, s) and 3.22 (1.5H, s, CH_3); 3.55-3.70 (2H, m, β-CH_2); 6.53 (1H, d, *J* = 8.0, H-8); 6.80-7.40 (13H, m, H-5,6,7, H Ph); 8.55 (0.5H, br. s) nd 9.50 (0.5H, br. s, NH)	
6c	3250 (NH), 1610 (C=N)	CF_3COOH	0.90-1.12 (12H, m, $6CH_2$); 1.40 (3H, s, 3CH); 2.00 (2H, s, $C\underline{H}_2Ad$); 6.55-6.75 (14H, m, H-5,6,7,8, H Ar); 7.95 (1H, br. s, NH)	432 $[M]^+$ (16), 355 (100), 297 (10), 221 (15), 220 (25), 219 (10), 180 (12), 165 (10), 135 (28), 93 (23), 77 (22)
		DMSO-d_6	1.40-1.65 (12H, m, $6CH_2$); 1.80-1.90 (3H, m, 3CH); 2.08 (2H, s, CH_2Ad); 6.50 (1H, d, *J* = 7.5, H-8); 6.85 (0.5H, br. s) and 9.20 (0.5H, br. s, NH); 7.00-7.40 (13H, m, H-5,6,7, H Ph)	
6d	3470, 3380, 1590 (NH_2), 3290 (NH), 1620 (C=N)	DMSO-d_6	5.91 (2H, s, OCH_2O); 6.35 (1H, s, H-3'); 6.55 (1H, d, *J* = 7.5, H-8); 6.98 (1H, dd, *J* = 7.2, *J* = 7.5, H-7); 7.10-7.40 (16H, m, H-5,6,6', H Ph, NH_2, NH)	419 $[M]^+$ (32), 342 (100), 284 (25), 210 (8), 180 (12), 171 (30), 165 (7), 142 (15), 104 (8), 77 (31)
6e	3150 (NH), 1610 (C=N)	DMSO-d_6	6.60 (1H, d, *J* = 7.5, H-8); 7.10-7.45 (14H, m, H-5,6,7, H Ph, NH); 7.77 (2H, d, *J* = 8.4, H Ar); 7.96 (2H, d, *J* = 8.4, H Ar)	—
6f	3390 (NH), 1600 (C=N)	DMSO-d_6	2.98 (6H, s, $N(CH_3)_2$); 6.52 (1H, d, *J* = 7.5, H-8); 6.76 (2H, d, *J* = 8.7, H Ar); 6.98 (1H, dd, *J* = 6.6, *J* = 7.5, H-7); 7.12-7.38 (13H, m, H-5,6, H Ph, NH); 7.95 (2H, d, *J* = 8.7, H Ar)	—

TABLE 3 (continued)

1	2	3	4	5
6g	3400 (NH), 1620 (C=N)	DMSO-d_6	4.82 (2H, s, CH_2Cl); 6.57 (1H, d, *J* = 6.0, H-8); 7.01 (1H, dd, *J* = 6.0, *J* = 6.0, H-7); 7.10-7.45 (12H, m, H-5,6, H Ph); 7.55 (2H, d, *J* = 9.0, H Ar); 8.05 (2H, d, *J* = 9.0, H Ar); 9.20 (0.5H, br. s) and 10.00 (0.5H, br. s, NH)	—
6h	3340 (NH), 1590 (C=N), 1350, 1500 NO_2)	DMSO-d_6	6.73 (1H, d, *J* = 7.7, H-8); 7.06 (1H, dd, *J* = 7.7, *J* = 8.2, H-7); 7.20-7.39 (12H, m, H-5,6, H Ph); 7.82 (1H, d, *J* = 8.7, H-4 Fur); 7.89 (2H, d, *J* = 8.7, H Ar); 8.29 (1H, d, *J* = 8.7, H-3 Fur); 8.33 (2H, d, *J* = 8.7, H Ar); 9.00 (0.5H, br. s) and 10.05 (0.5H, br. s, NH)	471 $[M^+]$ (7), 441 (13), 395 (100), 365 (18), 364 (25), 349 (8), 348 (27), 320 (7), 255 (20), 205 (8), 182 (9), 112 (12), 101 (16)
6k	3370, 3250 (NH), 1610 (C=O), 1580 (C=N)	DMSO-d_6	1.74 (3H, s, CH_3); 2.34 (3H, s, CH_3); 6.58 (1H, d, *J* = 9.0, H-8); 6.85-7.00 (2H, m, H-5,7); 7.05-7.40 (12H, m, H-6, H Ph, CONH); 9.80 (0.5H, br. s) and 11.90 (0.5H, br. s, NH)	483 $[M]^+$ (4), 406 (100), 363 (4), 328 (13), 308 (6), 219 (10), 194 (9), 180 (8), 165 (3), 152 (3), 120 (5), 110 (7), 77 (5)
6l	3360, 3270 (NH), 1625 (C=O), 1600 (C=N)	DMSO-d_6	2.35 (3H, s, CH_3); 2.75 (3H, s, OCH_3); 3.87 (2H, s, $C\underline{H}_2OCH_3$); 6.58 (1H, d, *J* = 7.8, H-8); 7.01 (1H, dd, *J* = 7.2, *J* = 7.8, H-7); 7.06 (1H, d, *J* = 7.5, H-5); 7.03-7.37 (13H, m, H-6, H Ph, 2NH)	513 $[M]^+$ (45), 498 (100), 436 (13), 418 (12), 404 (35), 326 (15), 258 (90), 180 (27), 165 (28), 152 (7), 77 (5)
7	3490 (NH_{benz}), 3400 (NH_{pyr}), 190 (C≡N)	DMSO-d_6	2.09 (3H, s, CH_3); 2.12 (3H, s, CH_3); 5.36 (1H, s, 2-CH); 6.52 (1H, dd, *J* = 8.0, *J* = 8.0, H-7); 6.55 (1H, s, 1-NH); 6.57 (1H, d, *J* = 8.0, H-8); 6.67 (1H, d, *J* = 7.2, H-5); 6.99 (1H, dd, *J* = 7.2, *J* = 8.0, H-6); 7.15-7.35 (10H, m, H Ph); 11.85 (1H, s, NH Pyr)	—
9k	3420 (NH), 1680 (C=O), 1620 (C=N)	DMSO-d_6	1.86 (3H, s, CH_3); 2.35 (3H, s, CH_3); 6.85 (1H, d, *J* = 6.0, H-8); 7.00-7.40 (13H, m, H-5,6,7, H Ph); 12.24 (1H, br. s, CONH)	484 $[M]^+$ (3), 258 (90), 257 (93), 228 (43), 226 (72), 200 (22), 197 (18), 181 (100), 165 (7), 152 (17), 119 (22), 91 (6), 77 (50)
9l	3400 (NH), 1690 (C=O), 1610 (C=N)	DMSO-d_6	2.37 (3H, s, CH_3); 2.73 (3H, s, OCH_3); 4.04(2H, s, $C\underline{H}_2OCH_3$); 6.86 (1H, d, *J* = 6.0, H-8); 7.05-7.45 (13H, m, H-5,6,7, H Ph); 12.35 (1H, br. s, CONH)	514 $[M]^+$ (4), 259 (35), 258 (75), 257 (100), 228 (55), 226 (40), 202 (20), 181 (95), 165 (13), 152 (16), 77 (7)
10a	1625 (C=S)	CF_3COOH	1.05 (3H, t, *J* = 7.5, $OCH_2C\underline{H}_3$); 1.15 (3H, t, *J* = 7.5, $OCH_2C\underline{H}_3$); 1.95 (1.5H, s), 2.92 (1.5H, s), 3.30 (1.5H, s) and 3.90 (1.5H, s, $2NCH_3$); 3.47-3.70 (4H, m, $2OC\underline{H}_2CH_3$); 5.60 (0.5H, s) and 5.85 (0.5H, s, =C$\underline{H}$Ar); 6.52-6.88 (17H, m, H-5,6,7,8,2',5',6', H Ph)	490 $[M]^+$ (20), 461 (18), 435 (10), 298 (31), 283 (22), 270 (10), 251 (23), 235 (12), 190 (37), 179 (18), 162 (41), 134 (47), 91 (11), 56 (100)
13f	3350 (NH)	DMSO-d_6	1.98 (3H, s, NCH_3(2)); 2.60 (3H, s, NCH_3(1)); 6.47 (2H, br. s, 2NH); 6.85-7.30 (14H, m, H-5,6,7,8, H Ph)	302 $[M]^+$ (10), 273 (17), 272 (25), 271 (80), 270 (54), 255 (18), 225 (7), 196 (10), 195 (13), 194 (100), 180 (12), 179 (20), 165 (25), 152 (11), 91 (22)

*Value *m/z* of compounds **6k**,**l** and **9k**,**l** ions calculated for the light halogen isotope (^{79}Br).

CH-6 spectrometer with direct sample inlet inlet into the ionization chamber at 50-180°C and electron ionization energy 70 eV. The elemental analysis was carried out on a Hewlett-Packard HP-185B C,H,N-analyzer. The melting points were determined on a Thiele melting-point apparatus. The reaction course was followed by thin-layer chromatography on Silufol UV-254 plates with iodine vapor visualization.

2-(3,4-Diethoxybenzyl)-4,4-diphenyl-3,4-dihydroquinazolinium Perchlorate (5a). 70% Perchloric acid (0.25 ml, 2.5 mmol) was added dropwise to a mixture of (3,4-diethoxyphenyl)acetonitrile (**4a**) (0.51 g, 2.5 mmol) and APC **1** (0.67 g, 2.5 mmol) in nitromethane (5 ml) at reflux. After 60 min, the reaction mixture was cooled on an ice bath. Salt **5a** was precipitated by adding ether and filtered off. Yield 1.06 g (75%). Colorless crystals.

Salts **5b-i** were obtained analogously.

2-(5-Bromo-4,6-dimethyl-2-oxo-1,2-dihydropyridin-3-yl)-4,4-diphenyl-3,4-dihydroquinazolinium perchlorate (5k) and **2-(5-bromo-4,6-dimethyl-2-oxo-1,2-dihydropyridin-3-yl)-4,4-diphenyl-4*H*-3,1-benzoxazinium perchlorate (8k)** were obtained analogously. Perchlorate **8k** precipitated from the reaction mixture upon cooling on an ice bath, while the perchlorate **5k** was precipitated by adding ether.

Salts **5l** and **8l** were obtained and isolated analogously.

Bases **6a-i**,**k,l** and **9k**,**l** were obtained by deprotonation of the corresponding salts in 25% aqueous ammonium hydroxide [3] and recrystallization from ethanol. The bases obtained form colorless crystals.

2-[(5-Cyano-2,4-dimethyl)pyrrol-3-yl]-4,4-diphenyl-1,4-dihydro-2*H*-3,1-benzoxazine (7). Formyl nitrile **4j (**0.37 g, 2.5 mmol) was added to a solution of APC **1** (0.67 g, 2.5 mmol) in glacial acetic acid (5 ml) cooled to 0°C. The mixture was stirred at room temperature for 1 h. The colorless crystalline precipitate was filtered off and washed with 1:3 ethanol–water.

2-(3,4-Diethoxybenzylidene)-1,3-dimethyl-4,4-diphenyl-1,2,3,4-tetrahydroquinazoline (10a). (2-(3,4-Di-ethoxybenzyl-4,4-diphenyl-3,4-dihydroquinazoline (**6a**) (1.03 g, 2.22 mmol) was added to a suspension of sodium bicarbonate (2.65 g, 31.55 mmol) in water (4 ml). Then dimethyl sulfate (3.52 g, 28.00 mmol) was added. The reaction was carried out with stirring on a water bath at 30-35°C for 4 h. At the end of the reaction, excess dimethyl sulfate was decomposed by raising the temperature of the reaction mixture to 50-55°C and maintaining for about 30 min at this temperature. The methyl sulfate salt was then decomposed by heating the reaction mixture with excess 5% aqueous sodium hydroxide on a steam bath. The reaction mixture was cooled and the organic fraction was extracted with chloroform. After distilling off the solvent, the residue was recrystallized from ethanol to give tetrahydroquinazoline **10a**. Yield 0.49 g (45%). Colorless crystals.

Compound **13f** was obtained analogously.

Mixture of *N*-methyl-*N*-{2-[(methylamino)(diphenyl)methyl]phenyl}acetamide (11i) and *N*-methyl-*N*-{2-[(methylamino)phenyl](diphenyl)methyl}acetamide (12i) was obtained analogously. Yield 0.50 g (65%). Colorless crystals; mp 139-141°C (EtOH), R_f 0.45 (1:9 acetone–benzene). IR spectrum, ν, cm-^{1}: 3300 (NH), 1635 (C=O). ^{1}H NMR spectrum (DMSO-d_6), δ, ppm: 0.75 (1.8H, s, CH_3(2) (**11i**)); 1.60 (1.2H, s, CH_3(2) (**12i**)); 1.85 (1.2H, s, CH_3(3) (**12i**)); 1.90 (1.8H, s, CH_3(3) (**11i**)); 2.55 (1.2H, s, CH_3(1) (**12i**)); 2.65 (1.8H, s, CH_3(1) (**11i**)); 2.76 (0.6H, br. s, NH (**11i**)); 3.20 (0.4H, br. s, NH (**12i**)); 7.00-7.51 (14H, m, H Ar (**11i**+**12i**)). Mass spectrum, *m/z* (I_{rel}, %): 344 $[M]^+$ (25). Found, %: C 80.05; H 6.65; N 8.19. $C_{23}H_{24}N_2O$. Calculated, %: C 80.23; H 6.97; N 8.14.

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