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CONDENSED ISOQUINOLINES

23*. REACTION OF *o*-BROMOMETHYLPHENYL-ACETONITRILE WITH ANTHRANILIC ACIDS: SYNTHESIS OF 6H,12H,17H-DIBENZO[3,4:6,7][1,8]-NAPHTHYRIDINO[1,8-*ab*]QUINAZOLINE-6,17-DIONES

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The direction of the reaction of anthranilic acids with o-bromomethylphenylacetonitrile upon fusion depends on the temperature and nature of the substituent in the anthranilic acid. The reaction may lead to three types of products: Derivatives of 7,12-dihydro-5H-isoquino[2,3-a]quinazolin-5-ones below 150°C and to 6,11-dihydro-13H-isoquino[3,2-b]quinazolin-13-one or derivatives of 6H,12H,17H-dibenzo[3,4:6,7][1,8]naphthyridino[1,8-ab]quinazoline-6,17-diones above 150°C depending on the nature of the substituent in the anthranilic acid. A study was carried out on the mechanism for the formation of 6H,12H,17H-dibenzo[3,4:6,7][1,8]naphthyridino[1,8-ab]quinazoline-6,17-diones, which permitted the preparation of 6-(4-methylphenyl)-6,12-dihydro-5H-isoquino[2,3-a]quinazolin-5-one.

Keywords: anthranilic acid, *o*-bromomethylphenylacetonitrile, 6H,12H,17H-dibenzo[3,4:6,7][1,8]-naphthyridino[1,8-*ab*]quinazoline-6,17-dione, 6-(4-methylphenyl)-6,12-dihydro-5H-isoquino[2,3-*a*]quinazolin-5-one.

In previous work [1, 2], we showed that the reaction of *o*-bromomethylphenylacetonitrile (*o*-BMPA) with anthranilic acids **1** leads to derivatives of 7,12-dihydro-5H-isoquino[2,3-*a*]quinazolin-5-ones **2** or products of their rearrangements, namely, derivatives of 6,11-dihydro-13H-isoquino[3,2-*b*]quinazolin-13-one (**3**) (when there are substituents at the positions *ortho* to the amino group of the acid). The reaction was carried out by fusion at a temperature not exceeding 145°C or in a 2-propanol solution. In this case, 2- (**3b**) and 3-halo-6,11-dihydro-13H-isoquino[3,2-*b*]quinazolin-13-ones (**3c**) were obtained by rearrangement of their angular isomers **2b** or **2c** in N-methyl-2-pyrrolidone [1]. In order to improve the synthesis of linear isoquinoquinazolines, we studied the reaction of *o*-BMPA with anthranilic acids above 150°C, i.e., under conditions permitting high-temperature rearrangement [3].

As in the case of fusion of *o*-BMPA with the methyl ester of anthranilic acid [3], fusion with the acid at >150°C gives already the product of the rearrangement of isoquino[2,3-*a*]quinazoline **2a**, namely, isoquino[3,2-*b*]quinazoline **3a**. The best yield of this product was obtained at 165-170°C, which is a temperature higher than when using the ester since the rate of formation of **2a** is slower due to the lower carbonyl activity of

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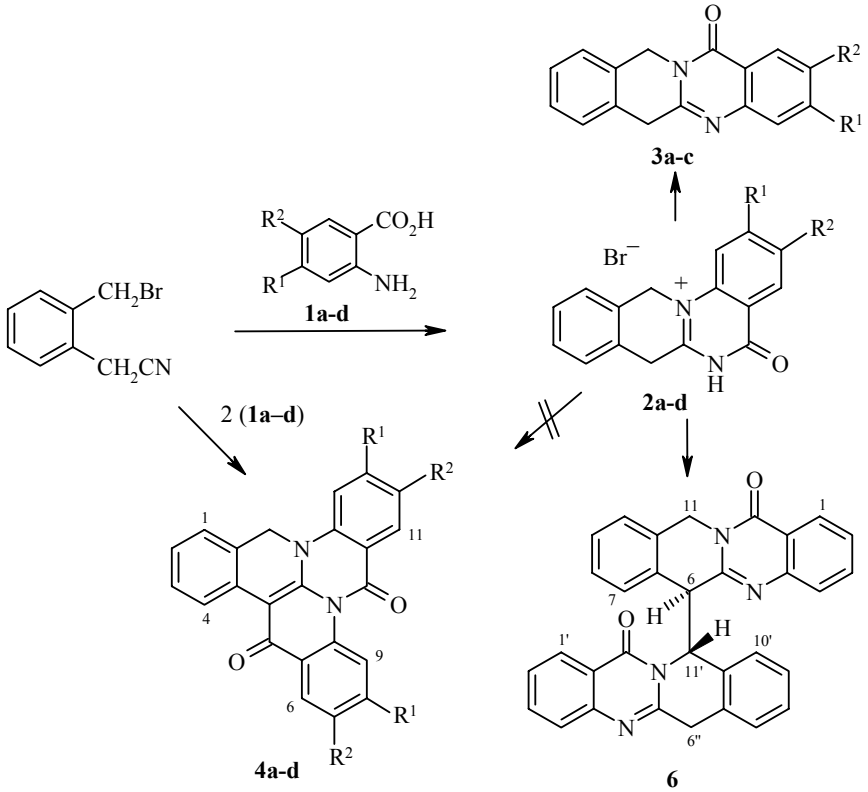
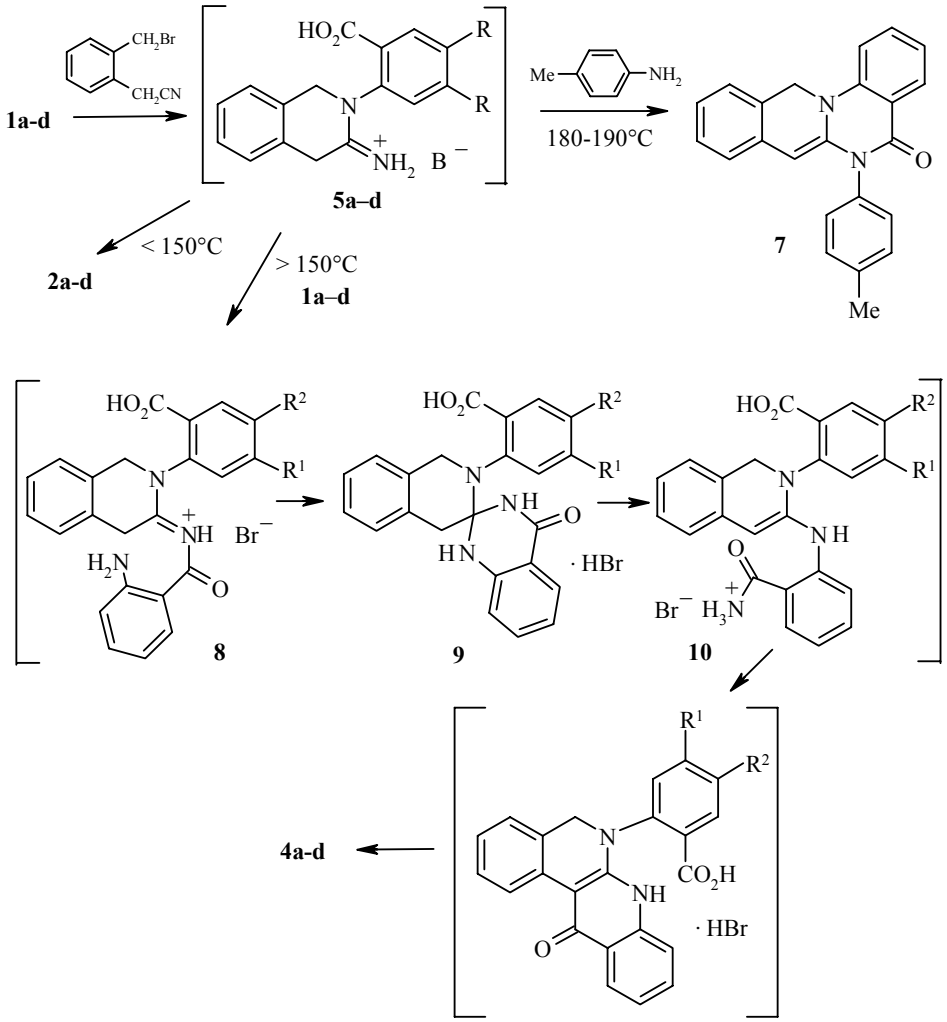
the acid in comparison with the ester. We expected a similar result in the case of halo-substituted anthranilic acids **1b-d**. However, fusion at only 150-160°C is already sufficient for the facile formation of a product, whose spectral data were not in accord with the expected characteristics of isoquino[3,2-*b*]quinazolines **3b-d**. The ^{1}H NMR spectra of the reaction products show only one signal in the region for the aliphatic methylene group protons, namely, a singlet at 5.23-5.26 ppm, while the total integral intensity of the aromatic protons proved greater than for the expected reaction products. The mass spectrometric data of one of the products (the product of the reaction with acid **1b**) suggest that this product is formed from one molecule of *o*-BMPA and two molecules of anthranilic acid. The finding of only one signal for the aliphatic methylene group protons in the ^{1}H NMR spectrum indicated the formation of the product of substitution both at the carbon and nitrogen atoms. This led us to propose the structure 6H,12H,17H-dibenzo[3,4:6,7][1,8]naphthyridino[1,8-*a*]quinazoline-6,17-dione (**4**), which was in complete agreement with the mass spectral and elemental analysis data. Further evidence for this assignment was found in the ^{13}C NMR spectra, which showed signals for 23 carbon atoms, including two corresponding to C=O group carbon atoms in regions characteristic for amides (159-160 ppm, $C_{(10)}$, Table 1) and ketones (~173 ppm, $C_{(5)}$).



1–4 a, **c**, **d** R^1 = H, **b** R^1 = Cl, **a**, **b** R^2 = H, **c** R^2 = Br, **d** R^2 = Cl

Comparison with the ^{13}C NMR spectra of structurally similar 6-methyl-5,6-dihydro-5H-isoquino[2,3-*a*]-quinazolin-5-one and 7-acyl-7,12-dihydro-5H-isoquino[2,3-*a*]quinazolin-5-ones [4] permitted us to assign the signal at 102 ppm to $C_{(4b)}$ in **4** since the corresponding signal for $C_{(7)}$ in 6-methyl- and 7-acyl-isoquino[2,3-*a*]quinazolines is seen at 82-94 ppm.

The fusion of *o*-BMPA with anthranilic acid **1a** at 180-190°C also led to a compound with the structure of naphthyridino[1,8-*ab*]quinazoline (**4a**). Support for the structure of the unknown reaction products as 6H,12H,17H-dibenzo[3,4:6,7]naphthyridino[1,8-*ab*]quinazoline-6,17-diones **4a-d** was obtained by a NOE experiment. Saturation of the frequency of the methylene group protons in **4a** led to an increase in the intensity of the signals of the two aromatic protons (7.88 and 7.38 ppm), which was found to be a criterion for assigning an angular isoquinoquinazoline structure [3]. The observed pattern for the aromatic protons corresponds to



structure of **4** and the signals were assigned on the basis of COSY HH experiments. A characteristic feature of the spectra of **4a-d** (Table 1) is the presence of signals for four protons at low field (δ > 8.0 ppm). Two of these signals are for the protons in the *peri* position to the carbonyl groups (8.14-8.33, H-6 and 8.05-8.20 ppm, H-11) and two signals are for the protons in the deshielding region of the carbonyl groups (8.63-8.78, H-4 and 8.50-8.57 ppm, H-9).

We attempted to elucidate several features of the mechanism of formation of naphthyridino[1,8-*ab*]-quinazolines **4a-d**, which, as suggested by their structure, result from the nucleophilic substitution of the imino group nitrogen atom and acylation of the methylene group. In previous work [2, 5, 6], we have already noted that the formation of 7,12-dihydro-5H-isoquino[2,3-*a*]quinazolin-5-ones **2** is a multistep process involving cyclization of 2-(2-carboxyphenyl)-1,4-dihydro-3(2H)-isoquinoliniminium bromides **5**. The structures of isoquinolinimines **5** and isoquinoquinazolines **2** both have electrophilic sites (the carbonyl group and imino group carbon atoms), at which nucleophilic substitution may proceed. In order to determine the step in which this reaction occurs, we fused isoquinoquinazoline hydrobromide **2a** with anilines and their protic salts. In all cases, irrespective of the reactivity of the nucleophilic reagent, the thermal rearrangement of salt **2a** took place to give isoquino[3,2-*b*]quinazoline **3a**. However, the fusion with anthranilic acid **1a** gave an unexpectedly high yield (50%) of the product of oxidative dimerization of isoquino[3,2-*b*]quinazoline **3a**, namely, 6,11,6',11'-tetrahydro-11'H-[6,11']bi[isoquino[3,2-*b*]quinazolinyl]-13,13'-dione (**6**).

TABLE 1. Spectral Characteristics of 6H,12H,17H-dibenzo[3,4:6,7][1,8]naphthyridino[1,8-*ab*]quinazoline-6,17-diones

Compound	IR spectrum, ν, cm^{-1}	^{1}H NMR spectrum, δ, ppm (*J*, Hz)			^{13}C NMR spectrum, δ, ppm		
		ArH		$C_{(15)}H_2$ (2H, s)	Quaternary	Tertiary	$C_{(15)}$
4a	1700 (br., C=O), 1595, 1505, 1460, 750	8.78 (1H, d, ^oJ = 8.0, H-4); 8.57 (1H, d, ^oJ = 8.5, H-9); 8.28 (1H, d, ^oJ = 8.0, H-6); 8.17 (1H, d, ^oJ = 8.0, H-11)	7.88 (1H, dd, ^oJ = 8.0, ^mJ = 1.8, H-14); 7.81 (1H, t, ^oJ = 8.0, H-13); 7.61 (1H, t, ^oJ = 8.5, H-8); 7.50 (1H, t, ^oJ = 8.0, H-7); 7.38 (1H, d, ^oJ = 7.2, H-1); 7.32 (1H, br. t, ^oJ = 8.0, H-12); 7.28 (1H, t, ^oJ = 8.0, H-3); 7.21 (1H, t, ^oJ = 7.2, H-2)	5.28	174.03 (**5**), 160.15 (10), 147.16 (14c), 140.53, 135.09, 130.53, 127.82, 127.52, 117.31, 101.73 (**4b**)	136.50, 130.61, 128.95, 127.96, 126.76, 126.65, 125.68, 125.61, 125.52, 123.94, 122.65, 115.53	48.98
4b	1705 (br., C=O), 1585, 1490, 1438, 770, 750	8.63 (1H, d, ^oJ = 7.2, H-4); 8.55 (1H, s, H-9); 8.14 (1H, d, ^oJ = 8.0, H-6); 8.05 (1H, d, ^oJ = 8.5, H-11)	8.04 (1H, s, H-14); 7.51 (1H, d, ^oJ = 8.2, H-7); 7.41 (1H, d, ^oJ = 7.5, H-1); 7.35 (1H, d, ^oJ = 8.5, H-12); 7.24 (2H, m, H-2,3)	5.23	173.25 (**5**), 159.73 (10), 147.09 (14c), 141.84 (8, 13), 141.49, 129.90, 127.12, 126.02, 115.88, 102.59 (**4b**)	135.51, 130.97, 127.99, 127.60, 127.01, 125.73, 125.58, 124.20, 122.30, 115.48	49.08
4c	1700 (br., C=O), 1585, 1505, 1445, 740	8.69 (1H, d, ^oJ = 8.0, H-4); 8.57 (1H, d, ^oJ = 9.0, H-9); 8.17 (1H, d, ^mJ = 2.3, H-6); 8.20 (1H, d, ^mJ = 2.5, H-11)	7.98 (1H, d, ^oJ = 8.8, H-14); 7.81 (1H, dd, ^oJ = 9.0, ^mJ = 2.3, H-8); 7.59 (1H, dd, ^oJ = 8.8, ^mJ = 2.5, H-13); 7.37 (1H, d, ^oJ = 7.2, H-1); 7.28 (1H, t, ^oJ = 7.8, H-2); 7.22 (1H, t, ^oJ = 7.8, H-3)	5.26	172.56 (**5**), 159.03 (10), 147.00 (14c), 139.70, 139.10 (7, 12), 133.99, 130.06, 129.14, 127.05, 118.92, 102.37 (**4b**)	133.43, 130.76, 128.00, 127.82, 125.90, 125.64, 125.10, 120.06, 118.34, 115.93	49.36
4d	1700 (br., C=O), 1590, 1495, 1450, 740	8.68 (1H, d, ^oJ = 8.0, H-4); 8.50 (1H, d, ^oJ = 9.0, H-9); 8.33 (1H, d, ^mJ = 2.4, H-6); 8.20 (1H, s, H-11)	7.93 (2H, m, H-13,14); 7.74 (1H, dd, ^oJ = 8.8, ^mJ = 2.4, H-8); 7.38 (1H, d, ^oJ = 7.2, H-1); 7.28 (1H, t, ^oJ = 8.0, H-2); 7.22 (1H, t, ^oJ = 8.0, H-3)	5.26	—	—	—

In previous work [7], in a study of the rearrangement of protic salts of isoquino[2,3-*a*]quinazoline **2a** to give isoquino[3,2-*b*]quinazoline **3a**, we noted the strong tendency of isoquino[3,2-*b*]quinazoline **3a** to undergo oxidation by atmospheric oxygen at high temperatures, leading to a mixture of oxidation products and dimeric products. The structures of some of these dimers have been reliably established. The spectral data of the mixtures obtained suggest the formation unsymmetrical dimer **6** but this product could not be isolated as a pure compound.

The ^{1}H NMR spectrum of dimer **6**, similar to the spectrum of 6,11-dihydro-11'H-[6,11']bi[isoquino-[3,2-*b*]quinazolinyl]-13,6',13'-trione [7] with analogous structure, showed an extremely complex pattern in the aromatic region with total integral intensity 17H. Four signals were found in the aliphatic proton region at 20°C: two single-proton doublets with different coupling constants at 5.73 and 4.10 ppm and two broad multiplets at 4.64 (2H) and 4.30 ppm (1H). However, at 80°C, we observed five single-proton doublets (see Experimental). The NOE and COSY HH experiments indicated that these signals belong to methylene group protons $C_{(11)}H_2$ (5.27 ppm, dd, $\Delta\delta$ = 1.0 ppm, ^2J = 16.8 Hz) and $C_{(6')}H_2$ (4.30 ppm, dd, $\Delta\delta$ = 0.3 ppm, ^2J = 19.2 Hz) and methine proton H-6 (4.62 ppm, ^3J = 9.8 Hz). The signal of the second methine proton H-11' was found in the aromatic proton region at 6.37 ppm. The temperature dependence of the pattern of the signals of H_B-11 and H_A-6' is attributed to conformational changes in the pyridine rings of the isoquinoline fragments in **6**. Analysis of the coupling constants of the methine protons (H-11' and H-6) and the spatial models, it appears most likely that the structure for dimer **6** has transoid arrangement of the hydrogen atoms in the $C_{(6)}$–$C_{(11')}$ fragment. We used the modified Karplus equation [8] and the coupling constant to find that the H–$C_{(6)}$–$C_{(11')}$–H dihedral angle is 143°. Indirect evidence justifying this hypothesis is found in the position of the two doublets of aromatic protons H-10' and H-7 upfield (6.50 and 6.46 ppm) relative to the other Ar-H protons and the corresponding signals of isoquinazoline **3a** [7]. These protons fall in the shielding region of double bonds $N_{(5)}$=$C_{(5a)}$ and $C_{(13')}$=O only in the *trans* isomer with virtually parallel orientation of the planes of the isoquino[3,2-*b*]quinazoline fragments. The linear structure of the isoquinoquinazoline fragments in dimer **6** is supported by comparative analysis of the electronic spectra of isoquinoquinazoline **3a** and product **6**, which display considerable similarity.

Since isoquinoliniminium bromide **5a** could not be isolated as a pure compound due to its instability [2, 5], we attempted to carry out nucleophilic substitution in imine **5a** by the consecutive addition of the reagents in the fusion (180-190°C) of *o*-BMPA with acid **1a** and anilines. In the experiment with *p*-toluidine, which was added to the reaction mixture 1.5 h after the onset of heating of a mixture of *o*-BMPA with acid **1a**, we obtained 6-(4-methylphenyl)-6,12-dihydro-5H-isoquino[2,3-*a*]quinazolin-7-one (**7**) in low yield. This result is indicated by the ^{1}H NMR spectrum of this product, which showed a single-proton signal of methine proton H-7 at 4.21 ppm along with the signals of the introduced *p*-tolyl group. 6-Arylisoquinoquinazoline **7** is formed as the result of two consecutive nucleophilic substitution reactions. In order to determine whether the initial attack of the nucleophilic reagent occurs at the C=O or C=N electrophilic site in isoquinolinimine **5a**, we fused *o*-BMPA with the N-benzylamide of anthranilic acid. We assumed that the anthranilic acids with this reagent at high temperatures (>150°C) may form diamides [9], which are likely intermediates in the synthesis of naphthyridino[1,8-*ab*]quinazolines **4a-d**. However, using N-alkylamide, which is a more reactive nucleophilic reagent than N-arylamide, we assumed that the reaction would proceed under milder conditions and give a better yield of the 6-substituted isoquinoquinazoline product. Indeed, fusing with the N-benzylamide led to the reaction product at a lower temperature (140°C), which proved, however, to be isoquino[2,3-*a*]quinazoline **2a**.

The formation of halo-substituted naphthyridino[1,8-*ab*]quinazolines **4b-d** at relatively lower temperatures than for unsubstituted **4a** is probably a consequence of the difference in the carbonyl activity of the anthranilic acids. This finding along with the considerable difficulty in obtaining the nucleophilic substitution products in the reaction with other anilines, including more reactive compounds, suggested that acylation is the likely first step in the formation of **4a-d**, namely, intermolecular acylation at the imine group in isoquinoline **5**, leading to intermediate **8**. The imino group in **8** is additionally activated by the electrophilic substituent, which facilitates the nucleophilic addition of the amino group of the anthranilic acid fragment. This

intramolecular reaction may give spiro compound **9**. Since triaminomethane derivatives are extremely unstable, opening of the resultant pyrimidine ring occurs readily. The intramolecular acylation of enamine **10** by the amide completes formation of the new isoquinoline system. The reaction is accompanied by loss of ammonium bromide, which was detected in the reaction products using ^{1}H NMR spectroscopy. We should note that acylation by amides at the β-position of enamines was observed in our previous work for the intramolecular reaction leading to the formation of spiro[benzimidazo[1,2-*b*]isoquinoline-6(11H),2'-indane]-1',11-dione from the amide of 2-[(11-oxo-5,11-dihydrobenzimidazo[1,2-*b*]isoquinoline-6-yl]benzoic acid. Cyclization in the final step leads to naphthyridino[1,8-*ab*]quinazolines **4a-d.**

We made additional attempts to obtain further proof of the proposed mechanism for the formation of **4a-d**. In particular, we attempted to obtain products of the reaction of already reported 2-aryl-1,4-dihydro-3(2H)-isoquinilinium bromides [6] with anilines, benzoic acids, and anthranilic acids under conditions for the formation of naphthyridino[1,8-*ab*]quinazolines **4a-d**. However, these attempts did not lead to the expected results, probably due both to the insufficient activity of the imino group for nucleophilic substitution and the instability of the products of acylation at the imino group.

EXPERIMENTAL

The melting points were determined on a Boetius block and not corrected. The IR spectra were taken for KBr pellets on a Pye Unicam SP3-300 spectrometer. The ^{1}H and ^{13}C NMR spectra were taken on a Varian Mercury 400 spectrometer at 400 and 100 MHz, respectively in DMSO-d_6 with TMS as the internal standard. The UV spectra were taken on a Specord M-400 spectrophotometer. The mass spectrum of **4b** was taken on a Waters Integrity System with a Thermabeam detector (acetonitrile as the mobile phase), while the mass spectrum of **6** was obtained using high-pressure liquid chromatography on a AGILENT/100-Series instrument (CI, acetonitrile, 0.05% formic acid as the mobile phase). The course of the reactions and purity of the products were monitored by thin-layer chromatography on Silufol UV-254 plates.

6,11-Dihydro-13H-isoquino[3,2-*b*]quinazolin-13-one (3a). A mixture of *o*-bromomethylphenyl-acetonitrile (2.1 g, 10 mmol) and anthranilic acid **1a** (1.37 g, 10 mmol) was heated on an oil bath at 165-170°C for 5 h. The melt gradually hardened during the reaction. After cooling, the melt was triturated with acetone (5 ml). The precipitate was filtered off and washed with acetone. The solid was dissolved in morpholine (3 ml) and water (20 ml) was added. The precipitate was filtered off and washed with acetone to give **3a** (1.24 g, 50%), mp 161-163°C (DMF, mp 162°C [3]).

6H,12H,17H-Dibenzo[3,4:6,7][1,8]naphthyridino[1,8-*ab*]quinazoline-6,17-diones 4a-d. A mixture of *o*-bromomethylphenylacetonitrile (2.1 g, 10 mmol) and anthranilic acid **1b-d** (20 mmol) was heated on an oil bath at 150-160°C for 4 h. After cooling, the melt was triturated with acetone (5 ml). The precipitate was filtered off and washed with acetone. The solid was dissolved in morpholine (3 ml) upon heating. The mixture was cooled and water (15 ml) was added. The precipitate was filtered off and washed with water and acetone. Acid **1a** was used to obtain naphthyridinoquinazoline **4a** (the bath temperature in this case was 185-190°C).

Dione 4a. Yield 1.4 g (40%); mp 250-252°C (DMF). Found, %: C 78.76; H 3.98; N 8.01. $C_{23}H_{14}N_2O_2$. Calculated %: C 78.84; H 4.03; N 8.00.

Dione 4b. Yield 2.73 g (65%); mp 240-242°C (DMF) (2.73 g). Mass spectrum, *m/z* (I_{rel}, %): 418* $[M]^+$ (100), 389 (20), 353 (8). Found, %: C 65.81; H 2.79; Cl 16.93; N 6.70. $C_{23}H_{12}Cl_2N_2O_2$. Calculated, %: C 65.89; H 2.88; Cl 16.91; N 6.68.

Dione 4c. Yield 3.05 g (60%); mp 236-238°C (DMF). Found, %: C 54.29; H 2.30; Br 31.46; N 5.52. $C_{23}H_{12}Br_2N_2O_2$. Calculated, %: C 54.36; H 2.38; Br 31.45; N 5.51.

* Calculated for isotope ^{35}Cl.

Dione 4d. Yield 2.64 g (63%); mp 256-256°C (DMF). Found, %: C 65.79; H 2.80; Cl 16.92; N 6.70. $C_{23}H_{12}Cl_2N_2O_2$. Calculated, %: C 65.89; H 2.88; Cl 16.91; N 6.68.

6,11,6',11'-Tetrahydro-11'H-[6,11']bi[isoquino[3,2-*b*]quinazolinyl]-13,13'-dione (6). A mixture of hydrobromide salt of isoquino[2,3-*a*]quinazoline **2a** (1 g, 3.04 mmol) and anthranilic acid **1a** (0.42 g, 3.04 mmol) was heated on an oil bath at 175-180°C for 2 h. The reaction proceeded vigorously in the first 30 min and the melt then gradually hardened. After cooling, the melt was triturated with acetone (5 ml). The precipitate was filtered off and washed with acetone. The solid was dissolved in morpholine (2 ml) upon heating. After cooling, water (15 ml) was added. The precipitate was filtered off and washed with water and acetone to give 2.48 g (50%) **6**, mp >300°C (dec.) (DMF). IR spectrum (neat), ν, cm^{-1}: 1670 (C=O), 1598, 1472, 1398, 774, 757, 694. UV spectrum (MeOH), λ_{max}, nm, (qualitative): 270, 306, 317. ^{1}H NMR spectrum at 80°C, δ, ppm (*J*, Hz): 8.12 (1H, d, ^oJ = 7.2, H-1'); 7.73-7.02 (13H, m, Ar-H); 6.50 (1H, d, ^oJ = 7.6, H-10'); 6.46 (1H, d, ^oJ = 7.6, H-7); 6.37 (1H, d, ^3J = 9.8, H-11'); 5.75 (1H, d, ^2J = 16.8, $C_{(11)}\underline{H}_AH_B$); 4.78 (1H, d, ^2J = 16.8, $C_{(11)}H_A\underline{H}_B$); 4.62 (1H, d, ^3J = 9.8, H-6); 4.45 (1H, d, ^2J = 19.2, $C_{(6')}\underline{H}_AH_B$); 4.15 (1H, d, ^2J = 19.2, $C_{(6')}H_A\underline{H}_B$). ^{13}C NMR spectrum at 20°C, δ, ppm: 161.02 (C_{5a}); 160.84 ($C_{(5a')}$); 153.71 ($C_{(13)}$); 152.93 ($C_{(13')}$); 147.29 ($C_{(4a)}$); 147.19 ($C_{(4a')}$); 134.80, 134.28, 131.37 (br.); 129.64, 129.07, 128.43, 128.34, 127.64 (br.); 126.85 (br.); 126.67, 126.43 (br.); 126.34, 126.25 (br.); 126.19, 119.76, 119.70, 56.43 ($C_{(11')}$); 50.94 ($C_{(6)}$), 44.15 ($C_{(11)}$); 36.57 ($C_{(6')}$). Mass spectrum (CI), *m/z* (I_{rel}, %): 495 $[M+1]^+$ (50), 247 $[1/2\ M]^+$ (100). Found, %: C 77.66; H 4.40; N 11.34. $C_{32}H_{22}N_4O_2$. Calculated, %: C 77.72; H 4.48; N 11.33.

6-(4-Methylphenyl)-6,12-dihydro-5H-isoquino[2,3-*a*]quinazolin-5-one (7). A mixture of *o*-bromomethylphenylacetonitrile (2.1 g, 10 mmol) and anthranilic acid **1a** (1.37 g, 10 mmol) was heated on an oil bath at 125-130°C for 1.5 h. Then, *p*-toluidine (1.07 g, 10 mmol) was added to the melt and heating was continued at 175-180°C for an additional 2 h. After cooling, the melt was triturated with acetone (5 ml). The precipitate was filtered off and washed with acetone to give 0.85 g (25%) **7**, mp 138-140°C (DMF). IR spectrum (neat), ν, cm^{-1}: 1673 (C=O), 1619, 1570, 1481, 755. ^{1}H NMR spectrum, δ, ppm (*J*, Hz): 7.89 (1H, d, ^oJ = 7.2, H-4); 7.61 (1H, t, ^oJ = 8.0, H-2); 7.37 (2H, d, ^oJ = 8.4, H-2',6'); 7.33 (1H, d, *J* = 8.8, H-1); 7.16 (2H, d, ^oJ = 8.4, H-3',5'); 7.12 (1H, d, ^oJ = 7.6, H-8); 7.00 (2H, m, H-3,10); 6.90 (1H, t, ^oJ = 7.2, H-9); 6.57 (1H, d, ^oJ = 7.2, H-11); 5.15 (2H, s, $C_{(12)}H_2$); 4.21 (1H, s, H-7); 2.48 (3H, s, CH_3). Found,%: C 81.55; H 5.30; N 8.29. $C_{23}H_{18}N_2O$. Calculated, %: C 81.63; H 5.36; N 8.28.

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