Synthesis and Spectral Data of Quinoline Products Obtained by Reaction of *N*-(4-Pyridinyliden)anilines and *N*-Benzylidenaniline with 2,2-Dimethoxypropane (Kametani Reaction)

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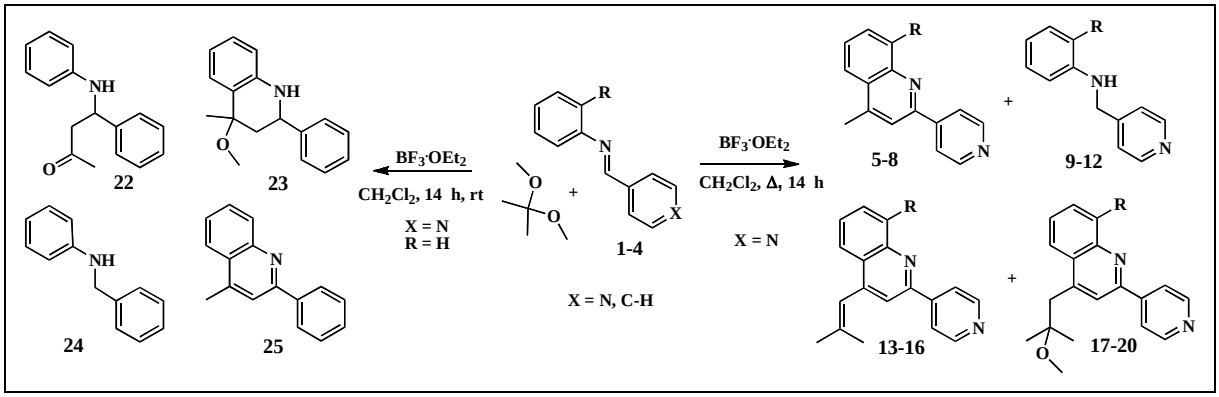

A study on interaction between *N*-(4-pyridinyliden)anilines **1-4** and 2,2-dimethoxypropane under Kametani reaction conditions was realized. According to the GC-MS analysis of crude reaction, besides the needed 4-methyl-2-(4-pyridinyl)quinolines **5-8**, three collateral products: secondary amines **9-12**, 4-(2-methylprop-1-enyl)quinolines **13-16** and 4-(2-methoxy-2-methylpropyl)quinolines **17-20** were formed. Unexpected quinolines **13-16** as well the desired quinolines **5-8** were isolated and fully characterized. In contrast, a condensation of *N*-benzylidenaniline **21** with 2,2-dimethoxypropane afforded a set of different quinoline products.

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INTRODUCTION

The quinoline nucleus occurs in several natural compounds [1] and in some pharmacologically active substances [2]. For instance, the 8-(diethylaminohexyl-amino)-6-methoxy-4-methylquinoline is highly effective against the protozoan parasite *Trypanosoma cruzy*, which is the agent of Chagas' disease [3]. Several antitumoral antibiotics are based on the 2-(2-pyridinyl)quinoline-quinone tricyclic molecule [4]. Many syntheses of quinolines are known, but due to their importance, the development of new synthetic approaches remains an active research area [5]. An acid-mediated cycloaddition between the C=C-N=C azadiene moieties of *N*-aryl aldimines and nucleophilic olefins like vinyl ethers is one of the most convenient methods for quinoline preparation, which is usually catalyzed by Lewis acids. BF_3•OEt_2 has been mainly used for this purpose since the pioneering work of Povarov [6]. Both Povarov reaction and Kametani reaction [7] can be considered as [4+2] imino Diels-Alder cycloaddition reactions. The latter consists on the interaction between *N*-aryl aldimines and acetals (mainly, 2,2-dimethoxypropane and 1,1-diethoxypropane) in the presence of Lewis acids. Until now, Kametani reaction is little used in preparation of quinoline derivatives, maybe, because its low efficiency. However, this reaction could become a simple route to various substituted 4-methylquinolines if appropriate acid catalysts would be developed. The acetals are more stable and available than the vinyl ethers or ketene acetals. Keeping in view the above facts, we wanted to prepare new C-2 4-pyridinyl substituted 8-alkyl-4-methylquinolines needed in our investigations on the search for antifungal quinolines [8,9]. Here we report our comparative study on condensation of *N*-(4-pyridinyliden)anilines and *N*-benzyl-idenaniline with 2,2-dimethoxypropane under Kametani reaction conditions.

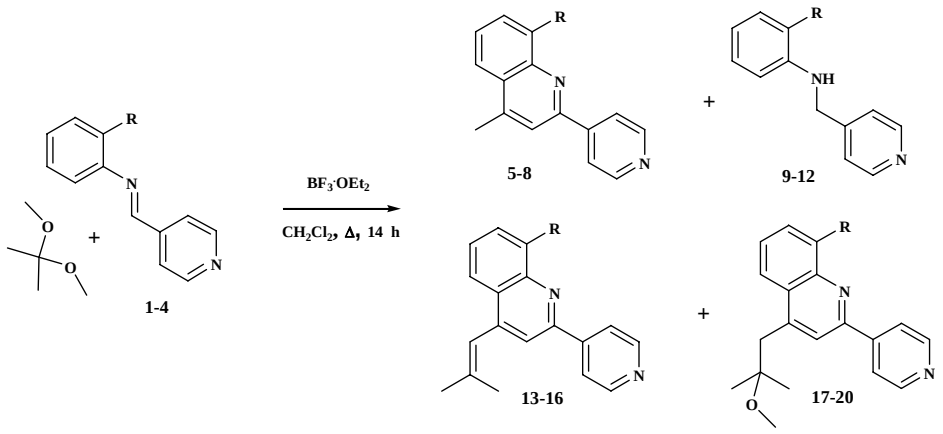
RESULTS AND DISCUSSION

The selected *N*-aldimines **1-4** were prepared by refluxing a mixture in dry ethanol of 4-pyridinecarboxy

aldehyde and aniline or substituted anilines such as *o*-methylaniline, *o*-ethylaniline, and *o*-isopropylaniline. These *N*-(4-pyridinyliden)-2-alkylanilines were treated with 2,2-dimethoxypropane in the presence of BF_3•OEt_2 in boiling dichloromethane (their interaction at room temperature was not observed). We anticipated that the presence of the pyridine nitrogen of aldehyde component would complicate the course of the reaction. To obtain the desired 4-methyl-2-(4- pyridinyl)quinolines **5-8**, an excess BF_3•OEt_2 was used in this reaction. Common workup procedure allowed us to obtain the resulting crudes, as red oils, which were first analyzed by GC-MS method and then purified by means of column chromatography on silica gel. According to the GC-MS analysis of crude reaction, besides the needed quinolines **5-8**, three different products: secondary amines **9-12**, 4-(2-methylprop-1-enyl)quinolines **13-16** and 4-(2-methoxy-2-methyl-propyl)quinolines **17-20** were formed (Scheme I).

All attempts to isolate the quinolines **17-20** by conventional column chromatography were unsuccessful, however, we were able to isolate and fully characterize the desired quinolines **5-8** and unexpected quinolines **13-16**. The quinoline **15** was not obtained in pure form. The reduced products **9-12** of initial aldimines, which were formed with yield 20-30% (GC-MS), are known compounds [10,11].

Scheme I



The mass spectra of the compounds **5-8** and **13-16** contain respective molecular ion $M^{+\cdot}$ peaks of high abundance, which confirms their molecular formula (Table 1).

The structures of the C-2 pyridinyl substituted quinolines **5-8** and **13-14**,**16** were strongly confirmed by ^{1}H-, ^{13}C-NMR spectra and 2D NMR spectroscopy. The ^{1}H NMR spectra of quinolines **5-8** registered the characteristic signals generated by the two aromatic rings,- quinoline and pyridine protons appeared as clean signals with their respective common constants in the region from 7.10 to 8.82 ppm. 2-Methylprop-1-enyl fragment in the quinolines **13-14** and **16** was also confirmed by the ^{1}H NMR spectra, where two three-

Table 1

GC-MS Analysis

R	Compounds	t_R, min	Found. M^+, m/z	Min. Form.	Yield, %
	5	27.25	220	$C_{15}H_{12}N_2$	25
H	**13**	31.51	260	$C_{18}H_{16}N_2$	6.5
	17	35.02	292	$C_{19}H_{20}N_2O$	*
	6	28.99	234	$C_{16}H_{14}N_2$	20
Me	**14**	32.51	274	$C_{19}H_{18}N_2$	7.5
	18	35.81	306	$C_{20}H_{22}N_2O$	*
	7	29.86	248	$C_{17}H_{16}N_2$	30
Et	**15**	33.89	288	$C_{20}H_{20}N_2$	**
	19	36.74	320	$C_{21}H_{24}N_2O$	*
	8	30.25	262	$C_{18}H_{18}N_2$	26
i-Pr	**16**	33.75	302	$C_{21}H_{22}N_2$	10.5
	20	37.00	334	$C_{22}H_{26}N_2O$	*

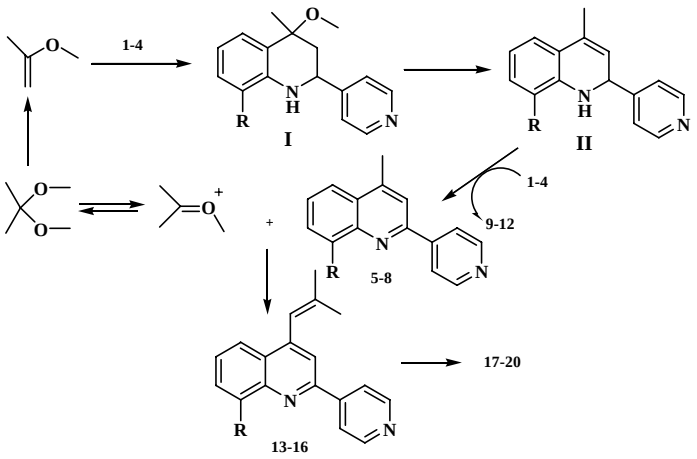
* - not isolated from the crude; ** - not obtained in pure form.

proton doublets at 1.81-1.85 and 2.11-2.12 ppm and one-proton multiplet at 6.68-6.71 ppm were observed. The ^{13}C-NMR spectra and bi-dimensional techniques as ^{1}H,^{1}H-COSY and HMQC also indicated the presence of this fragment, for the case of compound **16**, COSY spectra show the correlations corresponding to the quinoline system are observed and confirm that this stays intact, besides the existence of the interactions among the methyl protons (2'-CH_3 and 3'-CH_3) and olefin proton (1'-H) (δ, 2.06/6.65).

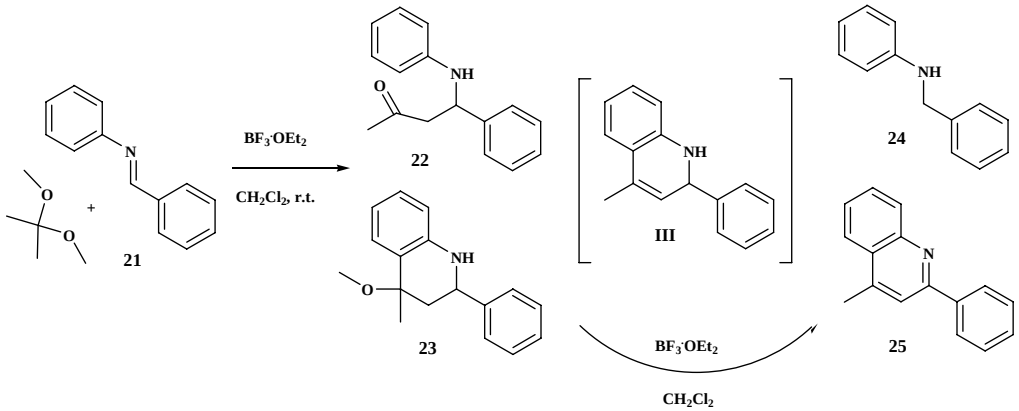
Based on previous works [7,12,13], the formation of obtained compounds from interaction between *N*-(4-pyridinyliden)anilines and 2,2-dimethoxypropane under Kametani reaction conditions could be better explained by the following possible mechanistic scheme (Scheme II). In the presence of an excess BF_3•OEt_2 and under heating, 2,2-dimethoxypropane could generate molecules of 2-methoxypropene and O-methyl acetone oxonium ion that play a key role in the formation of identified compounds. A molecule of 2-methoxypropene and Lewis acid-complex of initial aldimine might provide fist 4-methoxy-4-methyltetrahydroquinoline derivative **I** and then 4-methyl-1,2-dihydroquinoline derivative **II**, which could serve as an hydride source for initial aldimine to give the quinolines **5-8** and amines **9-12** [14]. These formed quinolines, having reactive methyl group at 4-position, could react with a molecule of O-methyl acetone oxonium ion affording small amounts of collateral quinolines, first **13-16** and then **17-20**.

In contrast, a catalyzed interaction between *N*-benzylidenaniline **21** and 2,2-dimethoxypropane did not need heating of the reaction mixture and afforded a set of different compounds. According to the GC-MS analysis of crude reaction, besides the expected quinoline **25** and *N*-benzylaniline **24**, two different products **22**,**23** that could be intermediates in Kametani reaction (Scheme III). However, 4-methyl-1,2-dihydroquinoline derivative **III** was not detected in this experiment, the major product (62%) in this crude was the 4-methoxy-4- methyltetrahydroquinoline **23**, which have been isolated as a red oil. Their GC-MS analysis indicated at two diastereoisomers with t_R 10.91 and 12.53 min. Moreover, when this inter-

Scheme II



Scheme III



mediate was subjected in the same reaction conditions, the 4-methyl-2-phenylquinoline **25** was formed in 42% yields. These results agree with other investigations about Povarov reaction [6,15] and can help with investigations on the mechanistic aspects of the imino Diels-Alder reactions.

Although the yields of the desired 4-methyl-2-(4-pyridinyl)quinolines **5-8** were low, it was possible to screen them for antifungal and anticancer activities. These quinolines were active against a panel of standardized dermatophytes, and also active against breast (MCF-7), lung (H-460) and central nervous system (SF-268) human cancer cell lines that make them attractive models in the search for potential bioactive agents [16]. The search of appropriate acid catalyst in this reaction and its mechanistic details are currently under study in our laboratories.

EXPERIMENTAL

Melting points were uncorrected and measured in a FISHER-JOHNS melting point apparatus. Infrared spectra were recorded on a Nicolet Avatar 360 FT-IR spectrometers as KBr pellets or neat. The ^{1}H and ^{13}C nmr spectra were determined on either Inova-400 or Bruker AM-400, in deuterochloroform with tetramethylsilane as internal standard. Data are reported as follows: chemical shifts (multiplicity, number of protons, coupling constants and group). Mass spectra were recorded with a HP 5890 A Series II, link to a network Mass selective detector HP 5972, a mass spectrometer with 70 eV electron impact ionization. The purities of the obtained substance were monitored by thin layer chromatography on Silufol UV_{254} sheets. Elemental analyses were performed on a Leco CHN-600 analyzer. Solvents and common reagents obtained from Merck and Aldrich were reagent grade.

General procedure for the reaction of 4-Pyridine-carboxyaldehyde with Anilines. Equimolar solutions of the anilines (1.00 mol) and 4-pyridinecarboxyaldehyde (1.00 mol) in dry ethanol (15 ml) were heated at reflux during 1 h. The ethanol was removed by distillation and the residual material crystallized from petroleum ether. The substituted *N*-(4-pyridinyliden)anilines **1-4** were isolated as red oils, which were used in the Kamateni reaction without further purification.

General procedure for Reaction of Aldimines 1-4 with 2,2-Dimethylpropane. A solution of the appropriate aldimine **1-4** (1.00 mmol) in anhydrous CH_2Cl_2 (15 mL) was cooled to 0 °C. Over a period of 20 min, 0.39 g (2.8 mmol) of BF_3•OEt_2 was added dropwise. The resulting mixture was allowed to warm to room temperature and 2,2-dimethoxypropane (1.02 g, 9.8 mmol) in CH_2Cl_2 (10 mL) was then rapidly added with vigorous stirring. The reaction mixture was stirred at gentile reflux for 15 h and then quenched with H_2O. The organic layer was separated, and dried with Na_2SO_4. The organic solvent was removed *in vacuo*. The residue was purified by chromatography column (silica gel) to afford the respective 4-methylquinolines **5-8** and 4-(2-methylprop-1-enyl)quinolines **13-16**.

4-Methyl-2-(4-piridinyl)quinoline (5) and 4-(2-methyl-prop-1-enyl)-2-(4-pyridinyl)quinoline (13). Compound **5** was obtained in 25% yield, red oil. ir (potassium bromide): ν =3034 cm^{-1}, ν = 2950 cm^{-1}. ^{1}H nmr (deuterium chloroform): δ 8.82 (dd, 2H, J = 4.5, 1.5 Hz, $H_{\alpha,\alpha'\text{-Py}}$), 8.14 (dd, 2H, J = 4.5, 1.5 Hz, $H_{\beta,\beta'\text{-Py}}$), 8.24 (d, 1H, J = 8.6 Hz, 8-H), 8.08 (dd, 1H, J = 8.4, 0.8 Hz, 5-H), 7.81 (ddd, 1H, J = 8.4, 6.0, 1.5 Hz, 7-H), 7.80 (d, 1H, J = 1.0, 3-H), 7.66 (ddd, 1H, J = 8.4, 6.0, 1.3 Hz, 6-H), 2.85 (d, 3H, J =1.0, 4-CH_3); gc-ms: t_R: 24.93 min., ms: m/z: 220 (molecular ion). *Anal.* Calcd. for $C_{15}H_{12}N_2$: C, 81.79; H, 5.49; N, 12.72. Found: C, 81.66; H, 5.76; N, 12.50.

The compound **13** was obtained in 6.5% yield, red oil. ^{1}H nmr (deuterium chloroform): δ 8.78 (d, 2H, J = 5.0 Hz, $H_{\alpha,\alpha'\text{-Py}}$), 8.18 (d, 1H, J = 8.0 Hz, 8-H), 8.05 (d, 2H, J = 5.0, 3.0 Hz, $H_{\beta,\beta'\text{-Py}}$), 8.02 (d, 1H, J = 9.0 Hz, 5H), 7.74 (m, 1H, 7-H), 7.70 (s, 1H, 3-H), 7.39 (m, 1H, 6-H), 6.68 (m, 1H, 1'-H), 2.11 (d, 3H, J = 1.2 Hz, 2'-CH_3), 1.81 (d, 3H, J = 1.1 Hz, 3'-CH_3), ^{13}C nmr (100 MHz): δ 153.1 (2-C), 150.5 ($C_{\alpha,\alpha'\text{-Py}}$), 147.3 (5a-C), 145.2 (8a-C), 141.4 (2'-C), 138.4 ($C_{\beta''\text{-Py}}$), 130.4 (8-C), 129.5 (7-C), 127.6 (6-C), 126.2 (4-C), 124.7 (5-C), 122.1 ($C_{\beta,\beta'\text{-Py}}$), 120.3 (1'-C), 118.7 (3-C), 26.4 (2'-CH_3), 19.8 (3'-CH_3); COSY correlations [δ_H/δ_H (H/H)]: 8.78/8.02 ($H_{\alpha,\alpha'\text{-Py}}$ /$H_{\beta,\beta'\text{-Py}}$), 8.18/7.74($H_8/H_7$), 8.05/7.39 ($H_5/H_6$), 8.02/8.78 ($H_{\beta,\beta'\text{-Py}}/H_{\alpha,\alpha'\text{-Py}}$), 7.74/8.18/7.39 ($H_7/H_8/H_6$), 7.39/8.05/7.74 ($H_6/H_5/H_7$), 6.68/2.11/1.81 ($H_{1'}/H_{2'\text{-Me3}}/H_{3'\text{-Me3}}$), 2.11/6.68 ($H_{2'\text{-Me3}}/H_{1'}$), 1.81/6.68 ($H_{3'\text{-Me3}}/H_{1'}$); HMQC correlations [$\delta_H/\delta_C$ (C/H)]: 8.78/150.5 ($H_{\alpha,\alpha'\text{-Py}}/C_{\alpha,\alpha'\text{-Py}}$), 8.02/122.1 ($H_{\beta,\beta'\text{-Py}}/C_{\beta,\beta'\text{-Py}}$), 8.18/130.4 ($H_8/C_8$), 8.05/124.7 ($H_5/C_5$), 7.74/129.5 ($H_7/C_7$), 7.70/118.7 ($H_3/C_3$), 7.39/127.6 ($H_6/C_6$), 6.68/120.3 ($H_{1'}/C_{1'}$), 2.11/26.4 ($H_{2'\text{-Me3}}/C_{2'\text{-Me3}}$), 1.81/19.8 ($H_{3'\text{-Me3}}$/3'-C); gc-ms: t_R: 31.51 min., m/z: 260 (molecular ion). *Anal.* Calcd. for $C_{18}H_{16}N_2$: C, 83.04; H, 6.19; N, 10.76. Found: C, 82.95; H, 6.34; N, 10.75.

4,8-Dimethyl-2-(4-piridinyl)quinoline (6) and 4-(2-methylprop-1-enyl)-8-methyl-2-(4-pyridinyl)-quinoline (14). The compound **6** was obtained in 20% yield, m.p. 72-74°C. ir: 3026, 2951, 1592 cm^{-1}. ^{1}H nmr (deuterium chloroform): δ 8.82 (dd, 2H, J = 4.8, 1.8 Hz, $H_{\alpha,\alpha'\text{-py}}$), 8.26 (dd, 2H, J = 4.5, 1.5 Hz, $H_{\beta,\beta'\text{-py}}$), 7.92 (d, 1H, J = 8.3 Hz, 5-H), 7.82 (s, 1H, 3-H), 7.66 (d, 1H, J = 7.1 Hz, 7-H), 7.53 (dd, 1H, J = 8.3, 7.1 Hz, 6-H), 2.94 (s, 3H, 8-CH_3), 2.83 (d, 3H, J = 0.8 Hz , 4-CH_3). gc-ms: t_r: 25.94 min., m/z: 234 (molecular ion). *Anal.* Calcd. for: $C_{16}H_{14}N_2$: C, 82.02; H, 6.02; N, 11.96. Found: C, 82.14; H, 6.23; N 11.67.

The compound **14** was obtained in 7.3% yield, red oil. ^{1}H nmr (deuterium chloroform) δ 8.81 (dd, 2H, J = 4.6, 1.7 Hz, $H_{\alpha,\alpha'\text{-Py}}$), 8.05 (dd, 2H, J = 4.6, 1.7 Hz, $H_{\beta,\beta'\text{-Py}}$), 7.89 (d, 1H, J = 8.3 Hz, 5-H), 7.76 (s, 1H, 3-H), 7.62 (d, 1H, J = 6.8 Hz, 7-H), 7.47 (dd, 1H, J = 8.3, 7.0 Hz, 6-H), 6.70 (m, 1H, 1'-H), 2.95 (s, 3H, 8-CH_3), 2.11 (d, 3H, J = 1.5 Hz, 2'-CH_3), 1.83 (d, 3H, J = 1.1 Hz, 3'-CH_3); ^{13}C nmr (100 MHz): δ 152.8 (2-C), 150.4 ($C_{\alpha\ ,\alpha'\text{-Py}}$), 148.9 (8a-C), 145.5 (4-C), 131.7 ($C_{\beta''\text{-Py}}$), 129.3 (7-C), 128.8 (2'-C), 128.6 (8-C), 122.4 (5a-C), 122.2 (5-C), 120.8 ($C_{\beta,\beta'\text{-Py}}$), 120.9 (1'-C), 118.0 (3-C), 26.6 (2'-CH_3), 18.2 (8-CH_3); COSY correlations [δ_H/δ_H (H/H)]: 8.75/8.11 ($H_{\alpha,\alpha'\text{-Py}}/H_{\beta,\beta'\text{-Py}}$), 8.11/8.75 ($H_{\beta,\beta'\text{-Py}}/H_{\alpha,\alpha'\text{-Py}}$), 7.83/7.42 ($H_5/H_6$), 7.56/7.42 ($H_7/H_6$), 7.42/7.82/7.56 ($H_6/H_5/H_7$), 6.65/2.06/1.79 ($H_{1'}/H_{2'\text{-Me3}}/H_{3'\text{-Me3}}$), 2.06/6.65 ($H_{2'\text{-Me3}}/H_{1'}$), 1.78/6.66 ($H_{3'\text{-Me3}}/H_{1'}$); HMQC correlations [$\delta_H/\delta_C$ (C/H)]: 8.75/150.4 ($H_{\alpha,\alpha'\text{-Py}}/C_{\alpha,\alpha'\text{-Py}}$), 8.11/120.8 ($H_{\alpha,\alpha'\text{-Py}}$/ $C_{\beta,\beta'\text{-Py}}$), 7.83/ 122.2 ($H_5/C_5$), 7.70/118.0 ($H_3/C_3$), 7.56/129.3 ($H_7/C_7$), 7.41/126.4 ($H_6/C_6$), 6.65/120.8 ($H_{1'}/C_{1'}$), 2.89/18.5 ($H_{8\text{-Me3}}/C_{8\text{-Me3}}$), 2.06/26.6 ($H_{2'\text{-Me3}}/C_{2'\text{-Me3}}$), 1.78/19.6 ($H_{3'\text{-Me3}}$/3'-C); gc-ms: t_R: 32.51 min., m/z: 274 (molecular ion). *Anal.* Calcd. for $C_{19}H_{18}N_2$:C, 83.18; H, 6.61; N, 10.21. Found: C, 83.23; H, 6.75; N, 10.03.

8-Ethyl-4-methyl-2-(4-piridinyl)quinoline (7) and 4-(2-methylprop-1-enyl)-8-ethyl-2-(4-piridinyl)quinoline (15). The

compound 7 was obtained in 30% yield, m.p. 72-74°C. ^{1}H nmr (deuterium chloroform) δ 8.82 (dd, 2H, J = 4.8, 1.8 Hz, $H_{\alpha,\alpha'\text{-Py}}$), 8.25 (dd, 2H, J = 4.8, 1.7 Hz, $H_{\beta,\beta'\text{-Py}}$), 7.92 (dd, 1H, J = 8.3, 1.5 Hz, 5-H), 7.83 (d, 1H, J = 0.8 Hz, 3-H), 7.66 (d, 1H, J = 7.1 Hz, 7-H), 7.57 (dd, 1H, J = 8.3, 7.1 Hz, 6-H), 3.46 (c, 2H, J = 7.6, 7.3 Hz, 8-CH_2-CH_3), 2.83 (d, 3H, J = 0.8 Hz, 4-CH_3), 1.48 (t, 3H, J = 7.6 Hz, 8-CH_2-CH_3). gc-ms t_R: 34.97 min., m/z: 248 (molecular ion). *Anal.* Calcd. for $C_{17}H_{16}N_2$: C, 82.22; H, 6.49; N, 11.28. Found: C, 82.12; H, 6.79; N, 11.07. The compound **15** was not separated in pure form.

8-Isopropyl-4-methyl-2-(4-piridinyl)quinoline (8) and 4-(2-methylprop-1-enyl)-8-isopropyl-2-(4-piridinyl)quinoline (16). The compound **8** was obtained in 26% yield red oil. ir: 2960, 2926, 1596 cm^{-1}. ^{1}H RMN (deuterium chloroform) δ 8.77 (dd, 2H, J = 5.0, 2.0, Hz, $H_{\alpha,\alpha'\text{-Py}}$), 8.13 (dd, 2H, J = 4.0, 1.0 Hz, $H_{\beta,\beta'\text{-Py}}$), 7.88 (dd, 1H, J = 8.0, 1.0 Hz, 5-H), 7.77 (s, 1H, 3-H), 7.64 (dd, 1H, J = 7.0, 1.0 Hz, 7-H), 7.55 (dd, 1H, J = 7.0, 1.0 Hz, 6-H), 4.50 (sept, 1H, J = 7.0 Hz, 8-$CH(CH_3)_2$), 2.78 (d, 3H, J = 0.8 Hz, 4-CH_3), 1.44 (d, 6 H, J = 7.0 Hz, 8-CH(CH_3)$_2$); gc-ms: t_R: 27.48 min., m/z: 262 (molecular ion). *Anal.* Calcd. for $C_{18}H_{18}N_2$: C, 82.41; H, 6.92; N, 10.68. Found: C, 82.45; H, 6.57; N, 10.89.

The compound **16** was obtained in 10.5% yield, red oil. ^{1}H nmr (deuterium chloroform) δ 8.81 (dd, 2H, J = 4.4, 1.5 Hz, $H_{\alpha,\alpha'\text{-Py}}$), 8.18 (dd, 2H, J = 4.6, 1.7 Hz, $H_{\beta,\beta'\text{-Py}}$), 7.89 (dd, 1H, J = 8.3, 1.3 Hz, 5-H), 7.77 (s, 1H, 3-H), 7.68 (dd, 1H, J = 7.0, 1.1 Hz, 7-H), 7.56 (dd, 1H, J = 8.1, 7.2 Hz, 6-H), 6.71 (m, 1H, 1'-H), 4.56 (Sep, 1H, J = 7.0 Hz, 8-CH), 2.12 (d, 3H, J = 1.3 Hz, 2'-CH_3), 1.85 (d, 3H, J = 1.3 Hz, 3'-CH_3), 1.50 (d, 6H, J = 7.0 Hz, 8-CH_3); ^{13}C nmr (100 MHz): δ 151.7 (2-C), 150.6 ($C_{\alpha,\alpha'\text{-Py}}$), 147.3 (8a-C), 145.6 (4-C), 133.2 (8-C), 131.8 ($C_{\beta''\text{-Py}}$), 126.9 (6-C), 125.6 (7-C), 122.6 (5-C), 121.6 ($C_{\beta,\beta'\text{-Py}}$), 121.1 (1'-C), 119.4 (5a-C), 118.0 (3-C), 28.0 (8-CH), 26.5 (2-CH_3), 23.7 (8-CH_3), 20.0 (3'-CH_3); COSY correlations [δ_H/δ_H (H/H)]: 8.75/8.12 ($H_{\alpha,\alpha'\text{-Py}}/H_{\beta,\beta'\text{-Py}}$), 8.12/8.75 ($H_{\beta,\beta\text{-Py}}/H_{\alpha,\alpha'\text{-Py}}$), 7.84/7.50($H_5/H_6$), 7.62/7.50 ($H_7/H_6$), 7.50/7.84/7.63 ($H_6/H_5/H_7$), 6.64/2.05/1.79 ($H_{1'}/H_{2'\text{-Me3}}/H_{3'\text{-Me3}}$), 4.50/1.46 ($H_{8\text{-CH}}/H_{8\text{-Me3}}$), 2.06/6.65 ($H_{2'\text{-Me3}}/H_{1'}$), 1.79/6.65 ($H_{3'\text{-Me3}}/H_{1'}$), 1.45/4.50 ($H_{8\text{-Me3}}/H_{8\text{-CH}}$); HMQC correlations [$\delta_H/\delta_C$ (C/H)]: 8.75/150.6 ($H_{\alpha,\alpha'\text{-Py}}/C_{\alpha,\alpha'\text{-Py}}$), 8.12/121.5 ($H_{\beta,\beta'\text{-Py}}/C_{\beta,\beta'\text{-Py}}$), 7.84/ 122.6 ($H_5/C_5$), 7.72/118.0 ($H_3/C_3$), 7.62/125.6 ($H_7/C_7$), 7.50/126.9 ($H_6/C_6$), 6.66/121.6 ($H_{1'}/C_{1'}$), 4.50/28.0 ($H_{8\text{-CH}}/C_{8\text{-CH}}$), 2.06/26.5 ($H_{2'\text{-Me3}}/C_{2'\text{-Me3}}$), 1.79/20.0 ($H_{3'\text{-Me3}}$/3'-C), 1.45/23.4 ($H_{8\text{-Me3}}/C_{8\text{-Me3}}$); gc-ms: t_R: 32.51 min., m/z: 274 (molecular ion). *Anal.* Calcd. for $C_{21}H_{22}N_2$: C, 83.40; H, 7.33; N, 9.26. Found: C, 83.23; H, 7.57; N, 9.19.

Procedure for Reaction of Aldimine 21 with 2,2-Dimethylpropane. A solution of the aldimine **21** (5.0 g, 0.028 mol) in anhydrous CH_2Cl_2 (45 mL) was cooled to 0 °C. Over a period of 20 min, 3.92 g (0.034 mol) of BF_3•OEt_2 was added dropwise. The resulting mixture was allowed to warm to room temperature and 2,2-dimethoxypropane (2.87 g, 0.028 mol) in CH_2Cl_2 (20 mL) was then rapidly added with vigorous stirring. The reaction mixture was stirred at room temperature for 48 h and then quenched with saturated aquous $NaHCO_3$ (pH ~ 10). The organic layer was separated, and dried with Na_2SO_4. The organic solvent was removed *in vacuo*. The residue (6.98 g, 98%) was fractionated by conventional column chromatography (alumina, heptane and heptane-ether mixture) to afford two major fractions that were analyzed by GC-MS method. Fraction 1 (heptane) – yellow liquid, 0.15 g (15%) - contains N-benzyl-aniline **24** (t_R = 22.02 min, m/z 183 - molecular ion) and quinoline **25** (t_R = 31.12 min, m/z 219 - molecular ion). Fraction 2 (heptane-ether, 1:10) – red oil, 4.20 g, (70%) - contains 4-methoxy-4-methyltetrahydroquinoline **23** (two diastereomers, t_R 10.91 and 12.53 min, m/z 145 (M-CH_3OH)) and aminoketone **22** (t_R 27.86 min, m/z 239 - molecular ion) that was not obtained in pure form.

4-Methyl-2-phenylquinoline (**25**) was obtained in 7.0% yield; spectral data are agreed with published data [14]. 4-Methoxy-4-methyl-1,2,3,4-tetrahydroquinoline (**23**) was obtained in 62% yield; spectral data are agreed with published data [14].

Procedure for Conversion of 4-Methoxy-4-methyl-1,2,3,4-tetrahydroquinoline 23 into the corresponding quinoline 25. A mixture of tetrahydroquinoline **23** (2.63 g, 0.011 mol) and BF_3•OEt_2 (2.42 g, 0.021mol) was stirred at gentile reflux for 2 h and then pored into H_2O and $NaHCO_3$ (pH ~ 10). After common work-up, the quinoline **25** was obtained in 42 % yield. Its spectral data was identical with previously reported data [14].

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