A convenient method of facilitating aryl-aryl bond formation reaction in the synthesis of biquinoline and quinoline bearing chromene derivatives

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Supplementary materials

Methods and materials

All common reagents and solvents were obtained from commercial suppliers and used without further purification. $^1$H and $^{13}$C NMR spectra were recorded on a Bruker (Advance) 400 as well as 500 MHz instrument in DMSO-$d_6$ using TMS as internal standard. Chemical shifts are given in parts per million (δ-scale) and the coupling constants are given in Hertz. IR spectra were recorded on a JASCO FT IR instrument (KBr) pellet in case of solids and CHCl$_3$ in case of viscous liquids. Elemental analyses were performed on a Perkin Elmer 2400 Series II Elemental CHNS analyser. Chemical reaction courses were monitored by silica gel (GF254) thin layer chromatography plates. Column chromatography was carried out with silica gel (60-120 mesh). Melting points were measured in open capillaries.

General procedure for the synthesis of biquinoline (3a-j)

To a stirred suspension of 2-aminobenzophenone/ 2-aminoacetophenone 2a-d (1 mmol) in acetic acid (20 mL), appropriate 4-substituted 3-acetylquinolin-2-one 1a-d (1 mmol) was added, followed by the addition of a catalytic amount of H$_2$SO$_4$. The reaction mixture was heated to reflux for 3-4 h. The reaction course was monitored with TLC. After being cooled to room temperature, it was poured into 500 gm of crushed ice; the resulting residue was filtered to afford the desired
product, In exceptional cases it was purified by silica gel column chromatography (hexane+ethyl acetate 8:2 v/v) to afford the target compound.

**6'-chloro-4, 4'-diphenyl-2, 3'-biquinolin-2'(1'H)-one (3a)**

Pale green solid (85%) mp. 242–245° C; IR (KBr) ν<sub>max</sub>; 3143.4, 2988.16, 2840.63, 883.23, 824.42 cm<sup>-1</sup>. <sup>1</sup>H NMR (400 MHz, DMSO-<sub>d6</sub>) δ 12.43 (s, 1H, Q-NH) 7.93 (t, 1H, J=8.10 Hz, ArH), 7.73 (m, 2H, ArH), 7.62 (dd, 1H, J<sub>1</sub>=2.4 Hz, J<sub>2</sub>= 6.5 Hz, ArH), 7.45-7.53 (m, 5H, ArH), 7.21-7.34 (m, 8H, ArH), 7.01 (d, 1H, J=2.4 Hz, ArH); <sup>13</sup>C NMR (100 MHz, DMSO-<sub>d6</sub>) δ 161.60, 155.48, 149.35, 147.89, 138.34, 137.85, 135.52, 132.98, 131.64, 130.41, 130.13, 129.76, 129.58, 129.47, 128.96, 127.97, 126.83, 125.91, 124.70, 121.79, 118.40, 39.48 Anal. Calcd. for C<sub>30</sub>H<sub>19</sub>ClN<sub>2</sub>O (458.9) C, 78.51; H, 4.17; N, 6.10. Found C, 78.49; H, 4.22; N, 6.15%.

**6'-chloro-6-nitro-4,4'-diphenyl-2,3'-biquinolin-2'(1'H)-one (3b)**

Pale green solid (88%) mp. 250-255° C; IR(KBr) ν<sub>max</sub>; 3641.91, 3452.92, 3335.28, 3148.22, 2994.91, 2834.85, 2355.62, 1904.36, 1764.55, 1646.91, 1480.10, 1448.28, 1376.93, 1261.22, 1054.87, 947.84, 841.77, 766.56, 698.10, 549.61 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, DMSO-<sub>d6</sub>) δ 12.45 (s, 1H, Q-NH), 8.60 (s, 1H, ArH), 8.07 (d, 1H, J=9.3 Hz, ArH), 7.63 (dd, 1H, J<sub>1</sub>=2.4 Hz, J<sub>2</sub>= 6.5 Hz, ArH), 7.55-7.59 (m, 4H, ArH), 7.40-7.52 (m, 4H, ArH), 7.22-7.35 (m, 6H, ArH), 7.01 (d, 1H, J=2.4 Hz, ArH); <sup>13</sup>C NMR (100 MHz, DMSO-<sub>d6</sub>) δ 161.38, 159.96, 149.67, 146.72, 138.41, 136.72, 135.31, 134.32, 133.97, 132.70, 131.84, 130.54, 130.12, 129.94, 129.23, 127.13, 126.90, 124.23, 123.71, 122.73, 121.68, 118.46, 108.67, 39.46; Anal. Calcd. for C<sub>30</sub>H<sub>18</sub>ClN<sub>3</sub>O<sub>3</sub> (503) C, 71.50; H, 3.60; N, 8.34. Found, C, 71.55; H, 3.56; N, 8.38%.

**6,6'-dichloro-4,4'-diphenyl-2,3'-biquinolin-2'(1'H)-one (3c)**

Pale yellow solid (84%) mp. 248–252° C; IR(KBr) ν<sub>max</sub>; 3641.91, 3054.6, 2356.59, 1904.36, 1764.55, 1646.91, 1480.10, 1448.28, 1376.93, 1261.22, 1054.87, 947.84, 841.77, 766.56, 698.10, 549.61 cm<sup>-1</sup>; <sup>1</sup>H NMR (400 MHz, DMSO-<sub>d6</sub>) δ 12.41 (s, 1H, Q-NH), 7.92 (d, 1H, J=8.7 Hz, ArH), 7.74 (s, 1H, ArH), 7.63 (dd, 1H, J<sub>1</sub>=2.2 Hz, J<sub>2</sub>= 6 Hz, ArH), 7.51-7.56 (m, 3H, ArH), 7.48 (d, 1H, J=9.0 Hz, ArH), 7.39 (s, 1H, ArH), 7.23-7.36 (m, 7H, J=8.10, ArH), 6.93 (d, 1H, J=2.4 Hz, ArH),
$^{13}$C NMR (100 MHz, DMSO-$d_6$) $\delta$ 161.57, 156.34, 149.38, 146.82, 146.67, 138.31, 137.26, 135.48, 133.00, 132.42, 132.34, 131.59, 130.67, 130.00, 129.60, 128.90, 126.62, 126.05, 125.55, 124.44, 121.76, 118.38; Anal. Calcd. for C$_{30}$H$_{18}$Cl$_2$N$_2$O (493) C, 73.03; H, 3.68; N, 5.68; Found, C, 73.05; H, 3.72; N, 5.72%.

**6-nitro-4', 4'-diphenyl-2, 3'-biquinolin-2'(1'H)-one (3d)**

Off white solid (68%) mp. 244–249 °C; IR(KBr) $\nu_{max}$; 3150.15, 3004.55, 2887.88, 2357.55, 1911.11, 1663.30, 1601.59, 1543.74, 1483.96, 1427.07, 1382.71, 879.38 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) $\delta$ 11.99 (s, 1H, Q-NH), 8.30 (s, 1H, ArH), 8.15 (dd, 1H, $J_1=3$ Hz, $J_2=7.0$ Hz, ArH), 7.81–7.89 (m, 4H, ArH), 7.53–7.65 (m, 9H, ArH), 7.23–7.40 (m, 3H, ArH); $^{13}$C NMR (100 MHz, DMSO-$d_6$) $\delta$ 204.47, 161.79, 160.37, 157.45, 147.09, 146.35, 144.53, 138.82, 137.43, 133.69, 132.47, 131.53, 130.27, 129.80, 126.47, 125.67, 124.67, 122.94, 120.65, 119.96, 116.30, 93.79, 32.40; Anal. Calcd. For C$_{30}$H$_{19}$N$_3$O$_3$ (469) C, 76.75; H, 4.08; N, 8.95; Found, C, 76.72; H, 4.12; N, 8.91%.

**4'-methyl-4-phenyl-2, 3'-biquinolin-2'(1'H)-one (3e)**

Pale yellow solid (82%) mp. 240–244° C; IR(KBr) $\nu_{max}$; 3331.43, 3022.87, 2356.59, 1954.50, 1638.23, 1551.45, 1485.88, 1424.17, 1385.60, 1269.90, 968.09, cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) $\delta$ 12.00 (s, 1H, Q-NH), 8.12 (d, 1H, $J$=8.4 Hz, ArH), 7.91 (d, 1H, $J$=8.4 Hz, ArH), 7.79 (q, 2H, ArH), 7.48-7.61 (m, 8H, ArH), 7.40 (d, 1H, $J$=7.8 Hz, ArH), 7.22 (t, 1H, $J$=7.50 Hz, ArH), 2.32 (s, 3H, CH$_3$); $^{13}$C NMR (100 MHz, DMSO-$d_6$) $\delta$ 161.91, 156.79, 148.71, 146.17, 139.01, 138.09, 131.93, 130.32, 129.44, 127.92, 126.26, 125.69, 124.73, 122.88, 120.70, 116.28, 112.63, 16.78. Anal. Calcd. For C$_{25}$H$_{18}$N$_2$O (362) C, 82.85; H, 5.01; N, 7.73. Found C, 82.81; H, 5.07; N, 7.69%.

**4'-methyl-6-nitro-4-phenyl-2, 3'-biquinolin-2'(1'H)-one (3f)**

Pale green solid (77%) mp. 252–255° C; IR(KBr) $\nu_{max}$; 3303.46, 2850.27, 2356.59, 1662.34, 1599.66, 1535.06, 1484.92, 1430.92, 1337.39, 745.35, cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-$d_6$) $\delta$ 12.03 (s, 1H, Q-NH), 8.77 (s, 1H, ArH), 8.53 (dd, 1H, $J_1$= 2.4 Hz, $J_2$= 7.0 Hz, ArH), 8.23 (d, 1H, $J$= 9.3 Hz, ArH), 7.73 (s, 1H, ArH), 7.56-7.67 (m, 6H, ArH), 7.39 (d, 1H, $J$=8.1 Hz, ArH), 7.28 (t,
1H, J=7.5 Hz, ArH), 2.32 (s, 3H, CH₃); ¹³C NMR (100 MHz, DMSO-d₆) δ 161.65, 160.70, 150.88, 149.74, 146.82, 146.20, 139.07, 136.89, 131.29, 130.23, 126.46, 124.79, 123.07, 120.59, 116.35, 16.98; Anal. Calcd. For C₂₅H₁₇N₃O₃ (407.4) C, 73.70; H, 4.21; N, 10.31 Found, C, 73.74; H, 4.17; N, 10.32%.

6,6'-dinitro-4,4'-diphenyl-2,3'-biquinolin-2'(1'H)-one (3g)
Pale yellow solid (72%) mp. 254–258°C; IR(KBr) vmax ; 3311.18, 2865.7, 1822.4, 1653.66, 1532.17, 1334.5, 1258.32, 1069.33, 897.70, 703.89 cm⁻¹ ¹H NMR (400 MHz, DMSO-d₆) δ 12.88 (s, 1H, Q-NH), 8.63 (d, 1H, J=2.5 Hz, ArH), 8.42-8.45 (m, 2H, ArH), 8.11 (d, 1H, J=9.0 Hz, ArH), 7.98 (d, 1H, J=2.5 Hz, ArH), 7.61-7.65 (m, 5H, ArH), 7.46 (dd, 2H, J₁=1.5 Hz, J₂=8 Hz, ArH), 7.33-7.36 (m, 5H, ArH); ¹³C NMR (100 MHz, DMSO-d₆) δ 161.36, 158.77, 150.02, 149.08, 145.87, 143.61, 142.16, 136.31, 134.45, 132.98, 131.69, 129.88, 129.58, 129.04, 128.77, 125.86, 123.93, 113.33, 119.71, 117.21. Anal. Calcd. For C₃₀H₁₈N₄O₅ (514) C, 70.03; H, 3.53; N, 10.89% Found, C, 69.98.; H, 3.55; N, 10.92%

4-methyl-6'-nitro-4'-phenyl-2,3'-biquinolin-2'(1'H)-one (3h)
Off white solid (76%) mp. 238–243°C; IR(KBr) vmax ; 3309.25, 2830.03, 1817.58, 1658.48, 1559.17, 1339.32, 1068.37, 761.74 cm⁻¹; ¹H NMR (400 MHz, DMSO-d₆) δ 12.80 (s, 1H, Q-NH), 8.42 (d, 1H, J=2.0 Hz, ArH), 7.90 (dd, 1H, J₁=2.5 Hz, J₂=17.5 Hz, ArH), 7.81 (d, 1H, J=8.5 Hz, ArH), 7.68 (t, 1H, J=7 Hz, ArH), 7.56-7.62 (m, 5H, ArH), 7.39 (d, 2H, J=7.5 Hz, ArH), 7.29 (d, 1H, J=2.0 Hz, ArH), 2.23 (s, 3H, CH₃); Anal. Calcd. For C₂₅H₁₇N₃O₃ (407) C, 73.70; H, 4.21; N, 10.31; Found, C, 73.74; H, 4.18; N, 10.28%

6'-nitro-4,4'-diphenyl-2,3'-biquinolin-2'(1'H)-one (3i)
White solid (75%) mp. 245–250°C; IR(KBr) vmax ; 3058.55, 2922.59, 1661.37, 1530.24, 1484.92, 1335.46, 1253.5, 838.88, 700.03 cm⁻¹; ¹H NMR (400 MHz, DMSO-d₆) δ 12.86 (s, 1H, Q-NH), 8.42 (dd, 1H, J₁=2.0 Hz, J₂=11.5 Hz, ArH), 7.97 (d, 2H, J=2.0 Hz, ArH), 7.75-7.78 (m, 2H, ArH), 7.50-7.64 (m, 6H, ArH), 7.31-7.38 (m, 7H, ArH); ¹³C NMR (100 MHz, DMSO-d₆) δ 162.58, 153.11, 151.81, 150.13, 148.42, 146.51, 145.94, 142.86, 142.54, 142.02, 140.09, 138.53, 137.05, 136.12, 134.55, 133.55, 132.62, 132.07, 131.51, 129.89, 128.96, 127.61, 125.80, 125.41, 124.47,
Anal. Calcd. For C\textsubscript{30}H\textsubscript{19}N\textsubscript{3}O\textsubscript{3} (469) C, 76.75; H, 4.08; N, 8.95 Found, C, 76.70; H, 4.06; N, 8.97%.

6-chloro-6'-nitro-4', 4'-diphenyl-2',3'-biquinolin-2'(1'H)-one (3j)
Green solid (73%) mp. 236–240 °C; IR (KBr) $\nu_{\text{max}}$; 3344.93, 3080.73, 1659.45, 1553.13, 1482.99, 1339.32, 1257.36, 837.91, 703.89 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 12.85 (s, 1H, Q-NH), 8.22-8.29 (m, 2H, ArH), 8.06 (d, 1H, $\text{J}=$10.00 Hz, ArH), 7.85 (d, 1H, $\text{J}=$2.0 Hz, ArH), 7.68 (dd, 1H, $\text{J}_1=$2.50 Hz, $\text{J}_2=$9.00 Hz, ArH), 7.50-7.59 (m, 4H, ArH),7.34-7.37 (m, 3H, ArH), 7.24-7.28 (m, 2H, ArH), 7.20 (s, 1H, ArH); $^{13}$C NMR (100 MHz, DMSO-d$_6$) $\delta$ 162.24, 157.71, 151.56, 148.11, 144.05, 142.16, 141.55, 135.13, 133.45, 132.23, 131.10, 129.15, 128.15, 128.26, 124.97, 122.16, 121.31, 119.76, 116.02; Anal. Calcd. For C\textsubscript{30}H\textsubscript{18}ClN\textsubscript{3}O\textsubscript{3} (503) C, 71.50; H, 3.60; N, 8.34; Found, C, 71.45; H, 3.58; N, 8.33%.

General procedure for the synthesis of chromene comprising biquinolines (5a-g)
To a stirred suspension of 2-aminobenzophenone/ 2-aminoacetophenone 2a-d (1 mmol) in acetic acid (20 mL), appropriate 3-acetylquinolin-2-one 4a-b (1 mmol) was added, followed by the addition of a catalytic amount of H$_2$SO$_4$. The reaction mixture was heated to reflux for 3-4 h. The reaction course was monitored with TLC. After being cooled to room temperature, it was poured into 500 gm of crushed ice; the resulting residue was filtered to afford the desired product. In exceptional cases it was purified by silica gel column chromatography (hexane+ethyl acetate 8:2 v/v) to afford the target compound.

3-(6-nitro-4-phenylquinolin-2-yl)-2H-chromen-2-one (5a)
Pale green solid (81%) mp. 225–230° C; IR(KBr) $\nu_{\text{max}}$; 3101.94, 1727.91, 1590.02, 1543.74, 1484.92, 1448.28, 1334.5, 1190.83, 1080.91 cm$^{-1}$; $^1$H NMR (400 MHz, DMSO-d$_6$) $\delta$ 9.10 (s, 1H, ArH), 8.73 (d, 1H, $\text{J}=$2.4 Hz, ArH), 8.56 (dd, 1H, $\text{J}_1=$2.4 Hz, $\text{J}_2=$ 7.0 Hz, ArH), 8.46 (s, 1H, ArH), 8.40 (d, 1H, $\text{J}=$ 9.0 Hz, ArH), 8.05 (dd, 1H, $\text{J}_1=$1.5 Hz, $\text{J}_2=$ 6.3 Hz, ArH), 7.64-7.78 (s, 1H, ArH), 7.52 (t, 1H, $\text{J}=$ 8.10 Hz, ArH), 7.46 (d, 1H, $\text{J}=$ 7.20 Hz, ArH); $^{13}$C NMR (100 MHz, DMSO-d$_6$) $\delta$ 195.15, 168.85, 138.17, 135.12, 135.00, 132.70, 131.25, 130.36, 129.14, 128.05, 125.44, 24.65; Anal. Calcd. For C\textsubscript{24}H\textsubscript{14}N\textsubscript{2}O\textsubscript{4} (394.1) C, 73.09; H, 3.58; N, 7.10; Found. C, 73.15; H, 3.56; N, 7.12%. 

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3-(6-chloro-4-phenylquinolin-2-yl)-7-methoxy-2H-chromen-2-one (5b)
Pale green solid (86%) mp. 216–218° C; IR(KBr) \( \nu_{\text{max}} \); 3063.37, 2938.02, 2842.56, 2362.37, 1715.37, 1616.06, 1535.06, 1503.24, 1362.46, 1246.75, 1187.94, 1118.51, 1024.02, 827.31, 775.24, 701.96, 623.85, 571.79 cm\(^{-1}\); \(^1\)H NMR (400 MHz, DMSO-\(d_6\)) \( \delta \) 8.29 (s, 1H, ArH), 8.17 (d, 1H, \( J=9.0 \) Hz, ArH), 7.82 (q, 2H, ArH), 7.77 (s, 1H, ArH), 7.57-7.66 (m, 5H, ArH), 7.04 (t, 2H, \( J=8.50 \) Hz, ArH), 7.04 (t, 2H, \( J=8.50 \) Hz, ArH), 3.89 (s, 3H, OCH\(_3\)); \(^13\)C NMR (100 MHz, DMSO-\(d_6\)) \( \delta \) 194.25, 166.05, 138.40, 135.76, 133.83, 132.96, 131.15, 130.67, 129.74, 128.66, 125.50, 55.74; Anal. Calcd. For C\(_{25}\)H\(_{16}\)ClNO\(_3\) (414) C, 72.55; H, 3.90; N, 3.38. Found; C, 72.50; H, 3.93; N, 3.32%.

7-methoxy-3-(4-methylquinolin-2-yl)-2H-chromen-2-one (5c)
White solid (82%) mp. 220–223° C; IR(KBr) \( \nu_{\text{max}} \); 3356.50, 3083.62, 2923.56, 2849.31, 2356.59, 1714.41, 1613.16, 1589.06, 1507.10, 1229.40, 1024.02, 754.03 cm\(^{-1}\). \(^1\)H NMR (400 MHz, DMSO-\(d_6\)) \( \delta \) 8.22 (s, 1H, ArH), 8.03-8.10 (m, 2H, ArH), 7.86 (d, 1H, \( J=8.7 \) Hz, ArH), 7.77 (t, 1H, \( J=7.2 \) Hz, ArH), 7.62 (t, 1H, \( J=7.20 \) Hz, ArH), 7.05 (d, 1H, \( J=2.1 \) Hz, ArH), 6.99 (dd, 1H, \( J_1=2.4 \) Hz, \( J_2=6.50 \) Hz, ArH), 3.88 (s, 3H, OCH\(_3\)), 2.71 (s, 3H, CH\(_3\)); \(^13\)C NMR (100 MHz, DMSO-\(d_6\)) \( \delta \) 164.05, 160.79, 156.46, 152.82, 148.00, 145.05, 144.27, 131.53, 130.23, 127.86, 127.39, 124.95, 122.35, 113.61, 100.97, 56.66, 19.12; Anal. Calcd. For C\(_{20}\)H\(_{15}\)NO\(_3\) (317) C, 75.70; H, 4.76; N, 4.41; Found, C, 75.67; H, 4.71; N, 4.34%.

3-(4-phenylquinolin-2-yl)-2H-chromen-2-one (5d)
White solid (82%) mp. 218–222° C; IR(KBr) \( \nu_{\text{max}} \); 3641.91, 3059.51, 2355.62, 2152.98, 1608.34, 1535.06, 1449.24, 1409.71, 1186.97, 960.37, 759.81, 701.96, 565.04 cm\(^{-1}\); \(^1\)H NMR (400 MHz, DMSO-\(d_6\)) \( \delta \) 8.98 (s, 1H, ArH), 8.19 (d, 1H, \( J=8.1 \) Hz, ArH), 8.01 (dd, 1H, \( J_1=1.5 \) Hz, \( J_2=6.30 \) Hz, ArH), 7.90 (d, 2H, \( J=9.0 \) Hz, ArH), 7.73 (t, 1H, \( J=8.7 \) Hz, ArH), 7.55-7.64 (m, 6H, ArH), 7.51 (d, 1H, \( J=8.10 \) Hz, ArH), 7.43 (d, 1H, \( J=7.2 \) Hz, ArH); \(^13\)C NMR (100 MHz, DMSO-\(d_6\)) \( \delta \) 196.03, 168.12, 138.55, 136.76, 135.83, 133.85, 132.97, 131.20, 129.96, 129.22, 125.47, 27.87; Anal. Calcd. For C\(_{24}\)H\(_{15}\)NO\(_2\) (349) C, 82.50; H, 4.33; N, 4.01; Found; C, 82.48; H, 4.30; N, 4.05%.
3-(4-methylquinolin-2-yl)-2H-chromen-2-one (5e)
Off white solid (74%) mp. 223–225° C; IR(KBr) v_{max} ; 3666.98, 3059.51, 2355.62, 1728.87, 1601.59, 1450.21, 1200.47, 748.24 cm^{-1}; ¹H NMR (400 MHz, DMSO-δ) δ 8.71 (s, 1H, Q-ArH), 7.96-8.01 (m, 3H, ArH), 7.82 (d, 1H, J=7.2 Hz, ArH), 7.71 (t, 1H, J=7.50 Hz, ArH), 7.53-7.62 (m, 2H, ArH), 7.33 (t, 2H, J=8.1 Hz, ArH); ¹³C NMR (100 MHz, DMSO-δ) δ 160.39, 154.31, 152.40, 147.94, 145.09, 145.06, 144.32, 143.88, 133.41, 130.27, 129.26, 127.98, 127.54, 126.07, 125.52, 124.87, 122.59, 119.89, 116.69, 19.08; Anal. Calcd. For C_{19}H_{13}NO_{2} (287) C, 79.43; H, 4.56; N, 4.88; Found; C, 79.43; H, 4.56; N, 4.88%.

3-(6-chloro-4-phenylquinolin-2-yl)-2H-chromen-2-one (5f)
Pale yellow solid (76%) mp. 215–220° C; IR(KBr) v_{max} ; 3667.94, 3060.48, 2357.55, 1718.26, 1607.38, 1536.02, 1481.06, 1358.6, 1193.72, 825.38, 566.0 cm^{-1}; ¹H NMR (400 MHz, DMSO-δ) δ 8.91 (s, 1H, Cum-H), 8.15-8.24 (m, 2H, ArH), 7.94 (s, 1H, Q-H), 7.60-7.81 (m, 9H, ArH), 7.42 (t, 2H, J=7.8 Hz, ArH); ¹³C NMR (100 MHz, DMSO-δ) δ 194.18, 169.05, 137.37, 135.76, 134.83, 133.70, 132.96, 132.13, 130.36, 129.74, 129.35, 126.52, 23.74; Anal. Calcd. For C_{24}H_{14}ClNO_{2} (384) C, 75.10; H, 3.68; N, 3.65; Found, C, 75.07; H, 3.73; N, 3.60%.

7-methoxy-3-(4-phenylquinolin-2-yl)-2H-chromen-2-one (5g)
Pale green solid (82%) mp. 216-220 °C; IR(KBr) v_{max} ; 3059.51, 1718.26, 1617.02, 1583.27, 1502.28, 1358.6, 1237.11, 1187.94, 1021.12, 834.06, 703.89 cm^{-1}; ¹H NMR (400 MHz, DMSO-δ) δ 8.99 (s, 1H, C4-H), 8.40 (s, 1H, C_{3}^{1} H), 8.22 (d, 1H, J=8.50 Hz, ArH), 7.97 (d, 1H, J=8.50 Hz, ArH), 7.76 (t, 1H, J=8.00 Hz, ArH), 7.51-7.60 (m, 6H, ArH), 6.95 (d, 1H, J=2.00 Hz, ArH), 6.93 (dd, 1H, J_{1}=2.50 Hz, J_{2}=10.00 Hz, ArH); ¹³C NMR (100 MHz, DMSO-δ) δ 163.46, 160.80, 156.23, 152.16, 148.69, 148.52, 143.82, 138.22, 130.08, 129.76, 129.74, 129.48, 128.53, 128.38, 126.65, 126.26, 125.79, 122.57, 121.81, 113.41, 113.19, 100.31, 55.86; MS Anal. Calcd. For C_{25}H_{17}NO_{3} (379) C, 79.14; H, 4.52; N, 3.69; Found, C, 7.19; H, 4.49; N, 3.71%.
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1 H NMR spectrum of 3-acetyl-4-phenylquinolin-2(1H)-one (2a)
$^1$H NMR spectrum of 3-acetyl-4-methylquinolin-2(1H)-one (2b)
$^1$H NMR spectrum of 6,6'-dinitro-4,4'-diphenyl-2,3'-biquinolin-2'(1'H)-one (3g)
$^1$H NMR spectrum of 6,6'-dinitro-4,4'-diphenyl-2,3'-biquinolin-2'(1H)-one (3g)
$^{13}$C NMR Spectrum of 6,6'-dinitro-4,4'-diphenyl-2,3'-biquinolin-2'(1'H)-one (3g)
Chromatogram (All TIC)

Chromatogram (Zoom)

Spectrum

Line#1  R.Time:13.458(Scan#1544)
MassPeaks:77
RawMode:Averaged 10.317-17.517(1167-2031) BasePeak:514.15(16502)
BG Mode:None  Group 1 - Event 1

Mass spectrum of 6,6'-diaceto-4,4'-diphenyl-2,3'-biquinolin-2'(1H)-one (3g)
$^1$H NMR spectrum of 7-methoxy-3-(4-phenylquinolin-2-yl)-2H-chromen-2-one (5g)
1H NMR spectrum of 7-methoxy-3-(4-phenylquinolin-2-yl)-2H-chromen-2-one (5g)
$^{13}$C NMR spectrum of 7-methoxy-3-(4-phenylquinolin-2-yl)-2H-chromen-2-one (5g)