



SUPPLEMENTARY MATERIAL TO
**Modern Friedel–Crafts chemistry. Part 36. Facile synthesis of
some new pyrido[3,2,1-*jk*]carbazoles via
Friedel–Crafts cyclialkylations**

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CHARACTERIZATION DATA FOR THE SYNTHESIZED COMPOUNDS

4-(9H-Carbazol-9-yl)-2,4-dimethylpentan-2-ol (1a). White crystals; m.p.: 122 °C (methanol); Anal. Calcd. for C₁₉H₂₃NO (FW: 281): C, 81.13; H, 8.18; N, 4.98 %. Found: C, 80.86; H, 8.30; N, 5.20 %; IR (KBr, cm⁻¹): 3360, 3255, 3070, 2950, 2850, 1590, 1485, 1450, 1440, 1340, 1145, 750; ¹H-NMR (90 MHz, CDCl₃, δ / ppm): 1.10 (6H, s, 2CH₃), 1.60 (6H, s, 2CH₃), 2.10 (2H, s, CH₂) 2.80 (1H, s, OH exchangeable with D₂O), 7.00–7.90 (8H, m, Ar-H); MS (EI, 70 eV, *m/z* (%)): 281 (M⁺, 10.7), 263 (82.4), 222 (100), 208 (43.5), 191 (25.0), 181 (62.5), 177 (20.2), 167 (5.3), 166 (4.8), 90 (7.3), 77 (4.6), 66 (2.5).

5-(9H-Carbazol-9-yl)-3-ethyl-5-methylhexan-3-ol (1b). Yellow needles; m.p.: 115 °C (benzene/PE 60–80 °C); Anal. Calcd. for C₂₁H₂₇NO (FW: 309): C, 81.55; H, 8.73; N, 4.53 %. Found: C, 81.80; H, 8.54; N, 4.42 %; IR (KBr, cm⁻¹): 3370, 3060, 2960, 2850, 1590, 1480, 1460, 1450, 1345, 1220, 720; ¹H-NMR (90 MHz, CDCl₃, δ / ppm): 0.90 (6H, t, *J* = 7.5 Hz, 2CH₃), 1.30 (4H, q, *J* = 7.5 Hz, 2CH₂), 1.70 (6H, s, 2CH₃), 1.80 (2H, s, CH₂), 2.40 (1H, s, OH exchangeable with D₂O), 6.70–7.30 (8H, m, Ar-H); MS (EI, 70 eV, *m/z* (%)): 309 (M⁺, 14.5), 291 (100), 222 (85.3), 208 (38.2), 190 (22.4), 180 (55.2), 178 (11.2), 167 (3.2), 91 (17.5), 77 (3.5).

3-(9H-Carbazol-9-yl)-3-methyl-1,1-diphenylbutan-1-ol (1c). Reddish viscous oil; *n*_D²⁵: 1.542; Anal. Calcd. for C₂₉H₂₇NO (FW: 405): C, 85.92; H, 6.66; N, 3.45 %. Found: C, 85.67; H, 6.35; N, 3.71 %; IR (film, cm⁻¹): 3380, 3060, 2990, 1585, 1555, 1445, 1370, 1220, 1130, 725; ¹H-NMR (90 MHz, CDCl₃, δ / ppm): 1.60 (6H, s, 2CH₃), 2.30 (2H, s, CH₂), 4.20 (1H, s, OH exchangeable with D₂O), 6.70–7.30 (8H, m, Ar-H); MS (EI, 70 eV, (*m/z* (%))): 405 (M⁺, 5.5),

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387 (100), 310 (40.5), 233 (29.5), 222 (61.4), 207 (31.4), 191 (28.5), 180 (41.5), 177 (15.0), 91 (9.5), 77 (4.2).

5-(9H-Carbazol-9-yl)-3,5-dimethylhexan-3-ol (Id). Yellowish viscous oil; n_D^{25} : 1.558; IR (film, cm^{-1}): 3530, 3050, 2990, 1600, 1465, 1445, 1340, 1190, 920, 740, 695; ^1H NMR (90 MHz, CDCl_3 , δ / ppm): 0.90 (3H, *t*, $J = 9$ Hz, CH_3), 1.20 (3H, *s*, CH_3), 1.50 (2H, *q*, $J = 9$ Hz, CH_2), 1.70 (6H, *s*, 2 CH_3), 1.80 (2H, *s*, CH_2), 2.90 (1H, *s*, OH exchangeable with D_2O), 7.00–7.70 (8H, *m*, Ar-H); MS (EI, 70 eV, m/z (%)): 295 (M^+ , 1.5), 208 (4.8), 277 (100), 251 (6.4), 222 (53.2), 208 (65.2), 190 (19.7), 182 (28.5), 178 (11.3), 90 (6.3), 77 (3.6). Anal. Calcd. for $\text{C}_{20}\text{H}_{25}\text{NO}$ (295): C, 81.35; H, 8.47; N, 4.74. Found: C, 81.55; H, 8.24; N, 4.90.

5-(9H-Carbazol-9-yl)-5-methyl-3-phenylhexan-3-ol (Ie). Cream plates; m.p.: 112 °C (benzene); Anal. Calcd. for $\text{C}_{25}\text{H}_{27}\text{NO}$ (FW: 357): C, 84.03; H, 7.56; N, 3.92 %. Found: C, 84.26; H, 7.48; N, 3.85 %; IR (KBr, cm^{-1}): 3450, 3054, 2975, 1600, 1486, 1440, 1370, 1210, 1180, 740, 695; ^1H -NMR (90 MHz, CDCl_3 , δ / ppm): 0.90 (3H, *t*, $J = 9$ Hz, CH_3), 1.20 (1H, *s*, OH exchangeable with D_2O), 1.60 (6H, *s*, 2 CH_3), 1.80 (2H, *q*, $J = 9$ Hz, CH_2), 2.20 (2H, *s*, CH_2), 7.10–7.60 (13H, *m*, Ar-H); MS (EI, 70 eV, m/z (%)): 357 (M^+ , 2.7), 339 (72.3), 280 (11.5), 222 (100), 208 (32.4), 190 (22.8), 180 (37.6), 178 (25.3), 91 (7.5), 77 (3.8).

4-(9H-Carbazol-9-yl)-4-methyl-2-phenylpentan-2-ol (If). Yellow viscous oil; n_D^{25} : 1.538; Anal. Calcd. for $\text{C}_{24}\text{H}_{25}\text{NO}$ (FW: 343): C, 83.96; H, 7.28; N, 4.08 %. Found: C, 84.25; H, 7.18; N, 3.85 %; IR (film, cm^{-1}): 3375, 3120, 2980, 1610, 1550, 1520, 1480, 1365, 1145, 950, 740, 680; ^1H -NMR (90 MHz, CDCl_3 , δ / ppm): 1.50 (3H, *s*, CH_3), 1.65 (6H, *s*, 2 CH_3), 2.20 (2H, *s*, CH_2), 2.80 (1H, *s*, OH exchangeable with D_2O), 6.70–7.40 (13H, *m*, Ar-H); MS (EI, 70 eV, m/z (%)): 343 (M^+ , 2.4), 325 (92.4), 266 (12.5), 222 (100), 208 (41.2), 190 (18.4), 177 (22.5), 90 (16.3), 77 (2.6).

4-(9H-Carbazol-9-yl)-4-methylpentan-2-ol (Ig). Pale yellow viscous oil; n_D^{25} : 1.533; Anal. Calcd. for $\text{C}_{18}\text{H}_{21}\text{NO}$ (FW: 267): C, 80.89; H, 7.86; N, 5.24 %. Found: C, 81.32; H, 7.51; N, 5.10 %; IR (film, cm^{-1}): 3355, 3055, 2980, 1610, 1470, 1450, 1370, 1210, 740, 690; ^1H -NMR (90 MHz, CDCl_3 , δ / ppm): 1.30 (3H, *d*, $J = 7.5$ Hz, CH_3), 1.60 (6H, *s*, 2 CH_3), 1.80 (2H, *d*, $J = 7.5$ Hz, CH_2), 2.40 (1H, *s*, OH exchangeable with D_2O), 3.30 (1H, *m*, CH), 6.90–7.40 (8H, *m*, Ar-H); MS (EI, 70 eV, m/z (%)): 249 ($\text{M}^+ - \text{H}_2\text{O}$, 100), 252 (9.4), 222 (65.2), 208 (32.4), 190 (18.2), 180 (33.5), 178 (11.4), 166 (5.7), 91 (4.3), 77 (4.6).

5-(9H-Carbazol-9-yl)-5-methylhexan-3-ol (Ih). Reddish viscous oil; n_D^{25} : 1.536; Anal. Calcd. for $\text{C}_{19}\text{H}_{23}\text{NO}$ (FW: 281): C, 81.13; H, 8.18; N, 4.98 %. Found: C, 80.77; H, 8.05; N, 4.82 %; IR (film, cm^{-1}): 3620, 3060, 2995, 1595, 1460, 1450, 1370, 1220, 1175, 740, 695; ^1H -NMR (90 MHz, CDCl_3 , δ / ppm): 0.90 (3H, *t*, $J = 7.5$ Hz, CH_3), 1.42 (2H, *q*, $J = 7.5$ Hz, CH_2), 1.55 (6H, *s*, 2 CH_3), 1.80 (2H, *d*, $J = 7.5$ Hz, CH_2), 3.20 (1H, *m*, CH), 3.80 (1H, *s*, OH exchangeable with D_2O), 6.80–7.50 (8H, *m*, Ar-H); MS (EI, 70 eV, m/z (%)): 281 (M^+ , 1.2),

263 ($M^+ - H_2O$, 100), 204 (7.5), 222 (41.5), 208 (39.0), 191 (38.5), 180 (10.2), 177 (8.4), 167 (6.3), 91 (4.9).

3-(9H-Carbazol-9-yl)-3-methyl-1-phenylbutan-1-ol (1i). Yellowish viscous oil; n_D^{25} : 1.541; Anal. Calcd. for $C_{23}H_{23}NO$ (FW: 329): C, 83.89; H, 6.99; N, 4.25 %. Found: C, 83.80; H, 7.10; N, 4.45 %; IR (film, cm^{-1}): 3450, 3085, 2975, 1600, 1475, 1450, 1370, 1210, 1180, 740, 695; 1H -NMR (90 MHz, $CDCl_3$, δ / ppm): 1.60 (6H, s, 2 CH_3), 2.20 (2H, m, CH_2), 3.30 (1H, s, OH exchangeable with D_2O), 4.30 (1H, m, CH), 6.90–7.40 (13H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 329 (M^+ , 3.5), 311 ($M^+ - H_2O$, 100), 252 (15.4), 223 (6.9), 222 (22.7), 208 (52.9), 191 (12.6), 182 (16.3), 177 (27.0), 166 (7.4), 90 (10.4), 77 (3.2).

3-(9H-Carbazol-9-yl)-3-methylbutanenitrile (4). Yield: 86.6 %, white crystals; m.p.: 122 °C (acetone); Anal. Calcd. for $C_{17}H_{16}N_2$ (FW: 248): C, 82.25; H, 6.45; N, 11.29. Found: C, 82.47; H, 6.62; N, 10.92; IR (KBr, cm^{-1}): 3060, 2970, 2250, 1595, 1480, 1455, 1330, 1170, 745; 1H -NMR (90 MHz, $CDCl_3$, δ / ppm): 1.70 (6H, s, 2 CH_3), 2.80 (2H, s, CH_2), 7.10–7.90 (8H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 248 (M^+ , 4.2), 221 ($M^+ - HCN$, 32.4), 208 (100), 204 (14.2), 191 (14.3), 177 (6.4), 166 (3.3), 91 (4.1), 77 (6.4), 66 (2.8).

Ethyl 3-(9H-carbazol-9-yl)-3-methylbutanoate (5). Yield: 85.7 %; n_D^{25} : 1.5722; Anal. Calcd. for $C_{19}H_{21}NO_2$ (FW: 295): C, 77.28; H, 7.11; N, 4.74 %. Found: C, 77.15; H, 6.85; N, 5.10 %; IR (film, cm^{-1}): 3040, 2995, 1740, 1600, 1580, 1480, 1450, 1320, 1170, 740; 1H -NMR (90 MHz, $CDCl_3$, δ / ppm): 1.30 (3H, t, $J = 9$ Hz, CH_3), 1.60 (6H, s, 2 CH_3), 2.60 (2H, s, CH_2), 4.10 (2H, q, $J = 9$ Hz, CH_2), 6.90–7.90 ppm (8H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 296 ($M^+ + 1$, 4.7), 295 (M^+ , 32.5), 250 ($M^+ - OC_2H_5$, 100), 222 (21.6), 208 (52.4), 191 (20.4), 177 (6.5), 166 (3.2), 91 (5.6), 77 (4.4), 66 (2.7).

4-(9H-Carbazol-9-yl)-4-methylpentan-2-one (6a). Yield: 75 %; m.p.: 92 °C (acetone); Anal. Calcd. for $C_{18}H_{19}NO$ (FW: 265): C, 81.51; H, 7.16; N, 5.28 %. Found: C, 81.90; H, 6.75; N, 5.17 %; IR (KBr, cm^{-1}): 3070, 2985, 1715, 1585, 1480, 1440, 1375, 1275, 1060, 1020, 740, 690; 1H -NMR (90 MHz, $CDCl_3$, δ / ppm): 1.40 (2H, s, 2 CH_3), 2.10 (3H, s, CH_3), 2.70 (2H, s, CH_2), 7.10–8.20 (8H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 265 (M^+ , 28.4), 250 (100), 222 (72.5), 207 (13.7), 192 (19.7), 177 (6.3), 167 (4.2), 166 (4.8), 91 (3.5), 77 (2.3), 66 (3.0).

5-(9H-Carbazol-9-yl)-5-methylhexan-3-one (6b). Yield: 77 %; m.p.: 85 °C (methanol); Anal. Calcd. for $C_{19}H_{21}NO$ (FW: 279): C, 81.72; H, 7.52; N, 5.01 %. Found: C, 81.69; H, 7.63; N, 5.18 %; IR (KBr, cm^{-1}): 3050, 2990, 2910, 1718, 1580, 1470, 1450, 1370, 1260, 1060, 1030, 735, 680; 1H -NMR (90 MHz, $CDCl_3$, δ / ppm): 1.0 (3H, t, $J = 7.5$ Hz, CH_3), 1.60 (6H, s, 2 CH_3), 2.35 (2H, q, $J = 7.5$ Hz, CH_2), 2.80 (2H, s, CH_2), 6.80–7.50 (8H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 279 (M^+ , 24.6), 250 (100), 222 (72.5), 207 (68.5), 191 (29.7), 178 (12.5), 167 (9.2), 166 (7.3), 91 (5.9), 77 (6.4).

3-(9H-Carbazol-9-yl)-3-methyl-1-phenylbutan-1-one (6c). Yield: 71 %; m.p.: 122 °C (acetone); Anal. Calcd. for C₂₃H₂₁NO (FW: 327): C, 84.40; H, 6.42; N, 4.28 %. Found: C, 84.65; H, 6.25; N, 4.44 %; IR (KBr, cm⁻¹): 3055, 3010, 2980, 1725, 1580, 1480, 1450, 1375, 1275, 1060, 1020, 740, 690; ¹H-NMR (90 MHz, CDCl₃, δ / ppm): 1.60 (6H, s, 2CH₃), 2.90 (2H, s, CH₂), 6.90–8.00 (13H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 327 (M⁺, 45.8), 250 (68.4), 222 (100), 209 (43.6), 191 (10.7), 178 (7.6), 166 (5.4), 90 (5.7), 77 (4.1), 68 (20.5).

5,6-Dihydro-4,4,6,6-tetramethyl-4H-pyrido[3,2,1-jk]carbazole (8a). Yellow plates; R_f: 0.47 (1:3, EtOAc/hexane); m.p.: 105 °C (benzene); Anal. Calcd. for C₁₉H₂₁N (FW: 263): C, 86.69; H, 7.98; N, 5.32 %. Found: C, 86.50; H, 7.65; N, 5.52 %; IR (KBr, cm⁻¹): 3060, 2980, 1610, 1570, 1490, 1445, 1430, 1330, 1060; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 1.22 (6H, s, 2CH₃), 1.71 (6H, s, 2CH₃), 1.94 (6H, s, CH₂), 6.85–7.40 (7H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 263 (M⁺, 55.6), 248 (M⁺-CH₃, 100), 233 (10.8), 232 (M⁺-2CH₃-H, 22.8), 218 (8.3), 204 (6.2), 190 (4.7), 177 (6.4), 166 (11.3), 151 (1.6), 109 (3.3), 90 (2.3), 77 (6.1), 66 (1.2).

4,4-Diethyl-5,6-dihydro-6,6-dimethyl-4H-pyrido[3,2,1-jk]carbazole (8b). Brownish viscous oil; R_f: 0.53 (1:3, EtOAc/hexane); n_D²⁵: 1.635; Anal. Calcd. for C₂₁H₂₅N (FW: 291): C, 86.59; H, 8.59; N, 4.81 %. Found: C, 86.33; H, 8.82; N, 5.12 %; IR (film, cm⁻¹): 3070, 2990, 1610, 1560, 1450, 1445, 1330, 745; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 0.90 (6H, t, J = 9 Hz, 2CH₃), 1.50 (4H, q, J = 9 Hz, 2CH₂), 1.70 (6H, s, 2CH₃), 1.93 (2H, s, CH₂), 6.61–7.41 (7H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 291 (M⁺, 35.6), 290 (M⁺-H, 100), 276 (4.2), 262 (M⁺-C₂H₅, 15.8), 261 (4.2), 247 (M⁺-CH₃-C₂H₅, 18.4), 233 (4.8), 217 (6.3), 203 (4.1), 190 (2.5), 177 (3.4), 166 (1.7), 151 (2.7), 109 (1.3), 90 (5.3), 77 (6.7), 66 (3.6).

5,6-Dihydro-6,6-dimethyl-4,4-diphenyl-4H-pyrido[3,2,1-jk]carbazole (8c). Pale brown solid; R_f: 0.28 (1:3, EtOAc/hexane); m.p.: 125 °C (methanol); Anal. Calcd. for C₂₉H₂₅N (FW: 387): C, 89.92; H, 6.46; N, 3.61 %. Found: C, 89.90; H, 6.52; N, 3.42 %; IR (KBr, cm⁻¹): 3090, 2920, 1610, 1475, 1450, 1315, 745; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 1.72 (6H, s, 2CH₃), 2.61 (2H, s, CH₂), 6.63–7.37 (17H, m, Ar-H); MS (EI, 70 eV, m/z (%)): 388 (M⁺+1, 7.3), 387 (M⁺, 15.5), 371 (M⁺-CH₃-H, 100), 357 (M⁺-2CH₃, 33.2), 309 (M⁺-Ph-H, 8.9), 295 (81.5), 280 (77.2), 233 (2.5), 218 (1.6), 203 (2.4), 190 (7.5), 177 (5.4), 166 (4.6), 151 (6.4), 109 (0.3), 90 (3.3), 77 (3.5), 66 (2.6)..

4-Ethyl-5,6-dihydro-4,6,6-trimethyl-4H-pyrido[3,2,1-jk]carbazole (8d). Reddish viscous oil; R_f: 0.6 (1:3, EtOAc/hexane); n_D²⁵: 1.605; Anal. Calcd. for C₂₀H₂₃N (FW: 277): C, 86.64; H, 8.3; N, 5.05 %. Found: C, 86.4; H, 8.45; N, 5.12 %; IR (film, cm⁻¹): 3095, 2920, 1620, 1565, 1490, 1445, 1365, 1070, 745, 690; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 0.87 (3H, t, J = 9 Hz, CH₃), 1.35 (3H, s, CH₃), 1.52 (2H, q, J = 9 Hz, CH₂), 1.73 (6H, s, 2CH₃), 2.15 (2H, m,

CH₂), 6.83–7.35 (7H, *m*, Ar-H); MS (EI, 70 eV, *m/z* (%)): 278 (M⁺+1, 3.3), 277 (M⁺, 15.5), 262 (M⁺-CH₃, 62.4), 261 (18.4), 248 (42.1), 247 (M⁺-2CH₃, 100), 233 (4.6), 218 (7.6), 203 (7.4), 190 (6.4), 177 (2.1), 166 (6.4), 151 (3.0), 109 (1.5), 91 (2.5), 77 (1.3), 66 (3.6).

4-Ethyl-5,6-dihydro-6,6-dimethyl-4-phenyl-4H-pyrido[3,2,1-jk]carbazole (8e). Brown crystals; *R*_f: 0.38 (1:3, EtOAc/hexane); m.p.: 82 °C (methanol); Anal. Calcd. for C₂₅H₂₅N (FW: 339): C, 88.49; H, 7.37; N, 4.13 %. Found: C, 88.57; H, 7.42; N, 3.84 %; IR (KBr, cm⁻¹): 3065, 2965, 1600, 1568, 1465, 1440, 1360, 1070, 740, 695; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 0.93 (3H, *t*, *J* = 7.5 Hz, CH₃), 1.55 (6H, *s*, 2CH₃), 1.82 (2H, *q*, *J* = 7.5 Hz, CH₂), 2.36 (2H, *m*, CH₂), 6.94–7.43 (12H, *m*, Ar-H); MS (EI, 70 eV, *m/z* (%)): 339 (M⁺, 7.3), 323 (M⁺-CH₃-H, 100), 309 (M⁺-2CH₃, 40.4), 295 (60.2), 280 (20.4), 262 (4.1), 247 (M⁺-CH₃-Ph, 11.4), 232 (2.6), 218 (5.6), 203 (1.4), 190 (6.4), 177 (2.4), 168 (15.4), 154 (0.5), 109 (2.5), 90 (4.2), 77 (2.1), 66 (1.4)..

5,6-Dihydro-4,6,6-trimethyl-4-phenyl-4H-pyrido[3,2,1-jk]carbazole (8f). Buff crystals; *R*_f: 0.35 (1:3, EtOAc/hexane); m.p.: 115 °C (benzene); Anal. Calcd. for C₂₄H₂₃N (FW: 325): C, 88.61; H, 7.07; N, 4.30 %. Found: C, 88.70; H, 7.22; N, 4.06 %; IR (KBr, cm⁻¹): 3075, 2950, 1610, 1558, 1482, 1443, 1360, 1073, 745, 690; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 1.62 (6H, *s*, 2CH₃), 1.75 (3H, *s*, CH₃), 2.25 (2H, *m*, CH₂), 6.93–7.51 (12H, *m*, Ar-H); MS (EI, 70 eV, *m/z* (%)): 326 (M⁺+H, 7.3), 325 (M⁺-CH₃-H, 100), 310 (M⁺-2CH₃, 22.4), 295 (14.5), 280 (3.7), 248 (M⁺-Ph, 7.4), 233 (4.2), 218 (2.2), 203 (0.7), 190 (3.4), 177 (4.3), 168 (18.2), 154 (2.3), 109 (1.6), 90 (3.7), 77 (1.3), 66 (1.8)..

5,6-Dihydro-4,6,6-trimethyl-4H-pyrido[3,2,1-jk]carbazole (8g). Reddish viscous oil; *R*_f: 0.57 (1:3, EtOAc/hexane); *n*_D²⁵: 1.624; Anal. Calcd. for C₁₈H₁₉N (FW: 249): C, 86.74; H, 7.63; N, 5.62 %. Found: C, 87.10; H, 7.44; N, 5.47 %; IR (film, cm⁻¹): 3072, 2984, 1620, 1585, 1480, 1440, 1370, 1065, 750, 685; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 1.25 (3H, *d*, *J* = 7.5 Hz, CH₃), 1.60 (6H, *s*, 2CH₃), 2.05 (2H, *m*, CH₂), 2.85 (1H, *m*, CH), 6.85–7.40 (7H, *m*, Ar-H); MS (EI, 70 eV, *m/z* (%)): 249 (M⁺, 11.4), 234 (M⁺-CH₃, 55.2), 218 (M⁺-CH₃-H, 100), 204 (M⁺-3CH₃, 44.5), 219 (6.9), 190 (32.5), 177 (11.7), 167 (9.4), 166 (6.5), 91 (5.3), 77 (14.2), 66 (3.7).

4-Ethyl-5,6-dihydro-6,6-dimethyl-4H-pyrido[3,2,1-jk]carbazole (8h). Reddish viscous oil; *R*_f: 0.63 (1:3, EtOAc/hexane); *n*_D²⁵: 1.594; Anal. Calcd. for C₁₉H₂₁N (FW: 263): C, 86.7; H, 7.90; N, 5.32 %. Found: C, 86.84; H, 7.62; N, 5.35 %; IR (film, cm⁻¹): 3066, 2935, 1605, 1562, 1475, 1455, 1346, 1065, 740, 695; ¹H-NMR (400 MHz, CDCl₃, δ / ppm): 0.92 (3H, *s*, CH₃), 1.57 (2H, *m*, *J* = 9 Hz, CH₂), 1.64 (6H, *s*, 2CH₃), 2.10 (2H, *m*, CH₂), 2.65 (1H, *m*, CH), 6.80–7.41 (7H, *m*, Ar-H); MS (EI, 70 eV, *m/z* (%)): 264 (M⁺+1, 18.4), 263 (M⁺, 86.8), 248 (M⁺-CH₃, 100), 234 (11.5), 232 (M⁺-2CH₃-H, 15.3), 219 (6.5), 217 (7.9), 204 (4.2), 192 (30.4), 177 (5.3), 167 (3.7), 166 (5.2), 91 (6.8), 77 (5.4), 66 (2.1).

5,6-Dihydro-6,6-dimethyl-4-phenyl-4H-pyrido[3,2,1-jk]carbazole (8i): Yellowish viscous oil; Anal. Calcd. for $C_{23}H_{21}N$ (311): C, 88.74; H, 6.75; N, 4.5. Found: C, 88.75; H, 6.84; N, 4.25; R_f 0.45 (1:3, EtOAc/hexane); n_D^{25} : 1.615; IR (film, cm^{-1}): 3060, 2970, 1600, 1568, 1480, 1440, 1360, 1070, 740, 695 cm^{-1} ; 1H NMR (400 MHz, $CDCl_3$, δ / ppm): 1.63 (6H, s, 2 CH_3), 2.30 (2H, m, CH_2), 3.83 (1H, m, CH), 6.70–7.35 (12H, m, Ar-H); MS (EI, 70 eV), m/z (%): 312 ($M^{+}+1$, 16.9), 311 (M^{+} , 41.5), 296 ($M^{+}-CH_3$, 12.5), 281 ($M^{+}-2CH_3$, 100), 234 (17.9), 219 (21.2), 204 (3.5), 191 (22.4), 177 (6.2), 168 (11.2), 166 (2.7), 91 (4.3), 77 (6.2), 66 (2.1).