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Synthesis of Some Pyrimido[4,5-*b*]quinoline Derivatives

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A series of pyrimidoquinoline derivatives was synthesized in good yield and short reaction times by reaction of 3-arylaminoisoxazol-5(2*H*)-ones with derivatives of 2-chloro-3-formylquinoline in toluene under reflux conditions.

Key Words : Arylaminoisoxazolones, Azetidinone, Pyrimido[4,5-*b*]quinolines, Rearrangements, 2-Chloro-3-formylquinolines

Introduction

Among various heterocyclic compounds, quinolines, pyrimidines and pyrimidoquinoline derivatives have been prepared and their pharmacological properties evaluated. Many of these compounds have shown anticancer,[1,2] anti-inflammatory,[3] antiallergic[4] or antimicrobial activity.[5,6] Further, the utility of quinoline derivatives in the preparation of some dyes and pigments has been reported.[7]

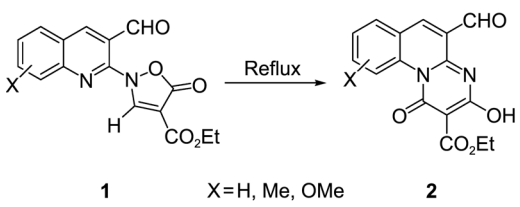
Pyrimido[4,5-*b*]quinolines have been synthesized by diverse procedures which involve the cyclocondensation from 2-aminoquinoline-3-carboxamide with reagents such as formamide, acetic anhydride, phenylisocyanate, phenylisothiocyanate and diethyl carbonate; from 2-amino-3-cyanoquinoline using reagents such as ammonia, urea and formamide; or by reduction of 2-amino-3-cyanoquinoline to 2-amino-3-aminomethylquinoline, followed by cyclization with a variety of reagents.[8]

We have recently reported[9] the synthesis of pyrimido[1,2-*a*]quinolines (**2**) by rearrangement of *N*-quinolinylisoxazol-5(2*H*)-ones (**1**), under mild base-catalysed conditions (Scheme 1).

In this article we report the direct synthesis of some novel derivatives of pyrimido[4,5-*b*]quinoline by reaction of 3-arylaminoisoxazol-5(2*H*)-ones with 2-chloro-3-formylquinolines in toluene under reflux conditions in high yield.

Results and Discussion

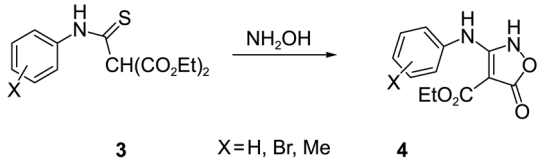
We envisaged an extension of the work summarised in Scheme 1 by replacing H-3 of the isoxazolone by an arylamino group, which could conceivably interact with the quinolinyl formyl group. The required 3-arylaminoisoxazolones (**4**) were synthesized by the reaction of the corresponding thiocarbamates (**3**) with hydroxylamine, following the general method of Worrall[10,11] (Scheme 2).



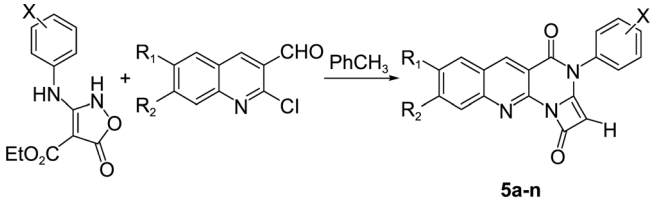
Scheme 1. Synthesis of pyrimido[1,2-*a*]quinolines.

The *N*-quinolinylisoxazolones (**1**) had been prepared simply by reaction of the corresponding 2-chloroquinoline with the *N*-unsubstituted isoxazolone,[9] under reflux conditions. However, the reaction of 3-arylaminoisoxazolones with a number of 2-chloro-3-formylquinolines in toluene in the same way did not give the expected compounds analogous to (**1**), but instead gave, in good yields, a series of deeply coloured compounds and attempted crystallisation led only to the formation of an amorphous solid, to which we ascribe the azeto[2',1':2,3]pyrimido[4,5-*b*]quinoline structures **5a-n**. This ring system appears to be novel, and the synthesis of their derivatives has the advantage of being concise (Scheme 3). The yields and melting points of products **5a-n** are listed in the Table 1.

We believe that the displacement of the chlorine is the first step, as expected, to give (**6**), followed by nucleophilic



Scheme 2. Synthesis of 3-arylaminoisoxazolones.



Scheme 3. Synthesis of pyrimido[4,5-*b*]quinolines.

Table 1. The yields and melting points of product (**5a-n**)

R_1	R_2	X	Product	Yield (%)	mp (°C)
H	H	H	**5a**	70	186-187
H	H	3-Me	**5b**	74	260-262
H	H	4-Br	**5c**	69	268-269
H	H	4-Me	**5d**	73	264-266
Me	H	H	**5e**	64	179-181
Me	H	3-Br	**5f**	68	271-273
Me	H	3-Me	**5g**	71	202-204
Me	H	4-Br	**5h**	75	231-233
Me	H	4-Me	**5i**	72	199-201
OMe	H	H	**5j**	67	233-235
H	Me	3-Br	**5k**	70	264-266
H	Me	3-Me	**5l**	72	238-240
H	Me	4-Br	**5m**	68	231-233
H	Me	4-Me	**5n**	74	265-266

attack by the arylamino nitrogen on the formyl group to form the corresponding tetracyclic intermediate (**7**). Subsequent loss of carbon dioxide and ethanol could lead to the formation of the corresponding ketene, cyclization of which leads to the isolated products (**5a-n**), as suggested in Scheme 4.

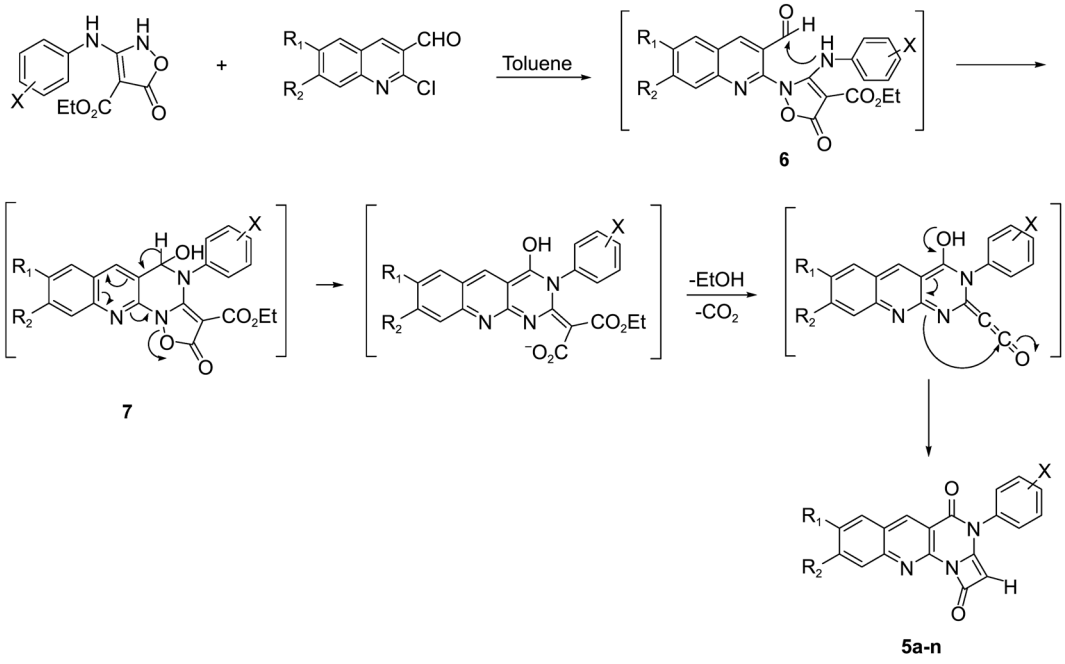
All the isolated compounds (**5a-n**) showed two strong infrared absorptions in the region 1738-1760 cm^{-1} and another at 1658-1670 cm^{-1}. We suggest that the former are associated with the carbonyl and double bond groups in the azetidinone and the latter is due to the pyrimidinone carbonyl group. Their ^{13}C-NMR spectra showed two different amide carbonyl resonances at δ 153.13-157.41 ppm and 163.41-167.91 ppm. Their ^{1}H-NMR spectra were characterised by two singlets in the region δ 8.35-8.60 ppm, which we ascribe to the hydrogens in the azetidinone and pyridine rings.

In conclusion, a simple one step synthesis of pyrimido-[4,5-*b*]quinolines, with functionality capable of further elaboration has been discovered. This new ring system with different substituents may have pharmaceutical and biological applications.

Experimental

Materials and Instruments. ^{1}H and ^{13}C NMR spectra were recorded with a Bruker spectrometer at 300 and 75.5 MHz, respectively. The spectra were measured in $CDCl_3$ using TMS as the internal standard. Infrared spectra were recorded on a Thermonicolet (Nexus 670) FT-IR spectrometer, using KBr disks. Mass spectra were recorded on a Varian Matt 311 spectrometer and relative abundances of fragments are quoted in parentheses after the *m/z* values. Melting points were determined on a digital melting point apparatus (Electrothermal) and remain uncorrected. Microanalyses were performed on a Leco Analyzer 932.

3-Phenyl-1*H*-azeto[2',1':2,3]pyrimido[4,5-*b*]quinoline-1,4(3*H*)-dione (5a). A mixture of the isoxazolone[10] (100 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (77 mg, 0.4 mmol) was refluxed in toluene (10 mL) for 24 h, while the reaction mixture turned red during this time. The reaction mixture was cooled to room temperature and removal of the solvent gave a red precipitate which was washed with ethanol to give product (88 mg) as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 7.51-7.79 (m, 8H), 7.93 (d, *J* = 8.1 Hz, 1H), 8.39 (s, 1H), 8.60 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 116.06, 118.23, 119.32, 126.16, 128.34, 128.51, 128.59, 129.36, 129.81, 133.59, 133.69, 134.53, 134.75, 139.73, 141.92, 155.01, 167.32; FT-IR (KBr, ν_{max}/cm^{-1}) 3053, 1749, 1667, 1615, 1561, 1509, 780; MS *m/z* (%) 314 [(M^++1), 25], 313 (M^+, 20), 270 (54), 268 (100), 242 (13),



Scheme 4. Mechanism of pyrimido[4,5-*b*]quinolines formation (**5a-n**).

153 (4), 78 (9). Anal. Calc. for $C_{19}H_{11}N_3O_2$: C, 72.84; H, 3.54; N, 13.41. Found: C, 72.67; H, 3.62; N, 13.25%.

The following compounds were prepared by the same method using the appropriate isoxazolone and quinoline derivatives.

3-(3-Methylphenyl)-1*H*-azeto[2',1':2,3]pyrimido[4,5-*b*]-quinoline-1,4(3*H*)-dione (5b). Using the corresponding isoxazolone[11] (105 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (77 mg, 0.4 mmol) gave **5b** (97 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.48 (s, 3H), 7.33-7.42 (m, 3H), 7.44-7.58 (m, 2H), 7.71-7.84 (m, 2H), 7.92 (bd, J = 8.4 Hz, 1H), 8.38 (s, 1H), 8.59 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.50, 116.04, 125.28, 126.11, 128.15, 128.58, 128.63, 128.69, 129.60, 129.63, 130.24, 133.54, 133.69, 135.54, 139.70, 139.93, 141.89, 148.32, 154.40, 166.89; FT-IR (KBr, ν_{max}/cm^{-1}) 3049, 1738, 1663, 1613, 1558, 1503, 1167, 762; MS *m/z* (%) 328 [(M^++1), 21], 327 (M^+, 21), 283 (55), 282 (100), 134 (23), 91 (43), 77 (30), 65 (52), 51 (22). Anal. Calc. for $C_{20}H_{13}N_3O_2$: C, 73.38; H, 4.00; N, 12.84. Found: C, 73.49; H, 3.88; N, 13.01.

3-(4-Bromophenyl)-1*H*-azeto[2',1':2,3]pyrimido[4,5-*b*]-quinoline-1,4(3*H*)-dione (5c). Using the corresponding isoxazolone[10] (131 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (77 mg, 0.4 mmol) gave **5c** (108 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 7.41 (d, J = 8.1 Hz, 2H), 7.45-7.56 (m, 1H), 7.68-7.82 (m, 4H), 7.93 (d, J = 7 Hz, 1H), 8.37 (s, 1H), 8.58 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 124.60, 125.06, 126.34, 128.02, 128.48, 128.65, 130.12, 130.45, 132.62, 133.05, 133.69, 133.79, 139.85, 142.10, 149.38, 154.65, 164.20; FT-IR (KBr, ν_{max}/cm^{-1}) 3054, 1742, 1664, 1610, 1554, 1487, 763. Anal. Calc. for $C_{19}H_{10}BrN_3O_2$: C, 58.18; H, 2.57; N, 10.71. Found: C, 58.35; H, 2.44; N, 10.52.

3-(4-Methylphenyl)-1*H*-azeto[2',1':2,3]pyrimido[4,5-*b*]-quinoline-1,4(3*H*)-dione (5d). Using the corresponding isoxazolone[10] (105 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (77 mg, 0.4 mmol) gave **5d** (96 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.51 (s, 3H), 7.39 (d, J = 7.8 Hz, 2H), 7.44 (d, J = 7.8 Hz, 2H), 7.52 (t, J = 7 Hz, 1H), 7.77 (t, J = 7 Hz, 1H), 7.79 (d, J = 7.5 Hz, 1H), 7.92 (d, J = 8.7 Hz, 1H), 8.37 (s, 1H), 8.58 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.39, 116.10, 119.96, 124.97, 127.95, 128.56, 128.60, 129.48, 130.48, 132.07, 133.49, 134.14, 139.38, 139.59, 141.85, 149.38, 156.58, 163.41; FT-IR (KBr, ν_{max}/cm^{-1}) 3041, 1740, 1666, 1615, 1601, 1557, 1515, 1071, 764. Anal. Calc. for $C_{20}H_{13}N_3O_2$: C, 73.38; H, 4.00; N, 12.84. Found: C, 73.15; H, 4.29; N, 12.71.

7-Methyl-3-phenyl-1*H*-azeto[2',1':2,3]pyrimido[4,5-*b*]-quinoline-1,4(3*H*)-dione (5e). Using the corresponding isoxazolone[10] (100 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5e** (84 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.55 (s, 3H), 7.52 (d, J = 8.4 Hz, 2H), 7.57-7.71 (m, 6H), 8.38 (s, 1H), 8.50 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.43, 115.74, 115.94, 125.06, 127.14, 128.27, 128.36, 129.31, 129.78, 130.24, 134.78, 136.10, 136.20, 139.91, 141.13, 148.18, 157.02, 167.91; FT-IR (KBr, ν_{max}/cm^{-1}) 3056, 1744, 1666, 1609, 1558, 1512, 778, 544; MS *m/z* (%) 328 [(M^++1), 70], 327 (M^+, 49), 283 (100), 269 (28), 202 (21), 104 (21), 92 (28), 78 (18). Anal. Calc. for $C_{20}H_{13}N_3O_2$: C, 73.38; H, 4.00; N, 12.84. Found: C, 73.49; H, 3.79; N, 12.98.

3-(3-Bromophenyl)-7-methyl-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5f). Using the corresponding isoxazolone[11] (131 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5f** (111 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.55 (s, 3H), 7.38-7.55 (m, 3H), 7.57-7.76 (m, 4H), 8.36 (s, 1H), 8.50 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.42, 115.66, 115.83, 122.90, 125.15, 127.19, 127.29, 128.23, 130.93, 131.74, 132.52, 135.80, 136.27, 136.45, 139.97, 141.26, 147.61, 148.01, 156.69, 167.01; FT-IR (KBr, ν_{max}/cm^{-1}) 3063, 1760, 1667, 1607, 1607, 1584, 1559, 1069, 682. Anal. Calc. For $C_{20}H_{12}BrN_3O_2$: C, 59.13; H, 2.98; N, 10.34. Found: C, 59.33; H, 2.87; N, 10.62.

7-Methyl-3-(3-methylphenyl)-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5g). Using the corresponding isoxazolone[11] (105 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5g** (97 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.48 (s, 3H), 2.54 (s, 3H), 7.26 (d, J = 7.2 Hz, 1H), 7.31 (s, 1H), 7.37 (d, J = 7.2 Hz, 1H), 7.53 (t, J = 7.5 Hz, 1H), 7.60 (d, J = 8.7 Hz, 1H), 7.67 (s, 1H), 7.71 (d, J = 8.7 Hz, 1H), 8.37 (s, 1H), 8.49 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.40, 21.50, 115.95, 124.32, 125.03, 125.32, 127.13, 128.29, 128.71, 129.56, 130.18, 134.68, 136.03, 136.13, 139.81, 139.87, 141.09, 146.32, 148.52, 153.13, 167.49; FT-IR (KBr, ν_{max}/cm^{-1}) 3038, 1751, 1665, 1605, 1561, 1068, 694. Anal. Calc. for $C_{21}H_{15}N_3O_2$: C, 73.89; H, 4.43; N, 12.31. Found: C, 73.69; H, 4.57; N, 12.39.

3-(4-Bromophenyl)-7-methyl-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5h). Using the corresponding isoxazolone[10] (131 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5h** (122 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.55 (s, 3H), 7.41 (d, J = 7.2 Hz, 2H), 7.63 (d, J = 8.1 Hz, 1H), 7.69 (s, 1H), 7.71 (t, J = 8.0 Hz, 1H), 7.76 (d, J = 7.2 Hz, 2H), 8.37 (s, 1H), 8.50 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.43, 115.63, 115.86, 123.29, 125.13, 127.20, 128.16, 130.14, 133.01, 133.66, 136.29, 136.41, 139.97, 141.27, 147.71, 148.03, 156.70, 167.25; FT-IR (KBr, ν_{max}/cm^{-1}) 3038, 1751, 1665, 1605, 1561, 1068, 694; MS *m/z* (%) 407 [(M^++2), 100], 405 (M^+, 99), 363 (76), 362 (82), 361 (76), 360 (24), 282 (67), 267 (45), 134 (47), 75 (51), 53 (31), 50 (30). Anal. Calc. for $C_{20}H_{12}BrN_3O_2$: C, 59.13; H, 2.98; N, 10.34. Found: C, 59.35; H, 2.77; N, 10.47.

7-Methyl-3-(4-methylphenyl)-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5i). Using the corresponding isoxazolone[10] (105 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5i** (98 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.15 (s, 3H), 2.54 (s, 3H), 7.39 (d, J = 8.4 Hz, 2H), 7.44 (d, J = 8.4 Hz, 2H), 7.61 (dd, J_1 = 8.7 Hz, J_2 = 2.1 Hz, 1H), 7.67 (s, 1H), 7.71 (d, J = 8.7 Hz, 1H), 8.37 (s, 1H), 8.49 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.41, 30.89, 115.79, 115.99, 125.03,

127.11, 127.97, 128.29, 130.47, 132.12, 132.77, 136.01, 136.10, 139.32, 139.77, 141.06, 148.25, 157.17, 164.19; FT-IR (KBr, ν_{max}/cm^{-1}) 3048, 1755, 1670, 1603, 1557, 1514, 1066, 661, 539. Anal. Calc. for $C_{21}H_{15}N_3O_2$: C, 73.89; H, 4.43; N, 12.31. Found: C, 73.72; H, 4.59; N, 12.12.

7-Methoxy-3-phenyl-1*H*-azeto[2',1':2,3]pyrimido[4,5-*b*]-quinoline-1,4(3*H*)-dione (5j). Using the corresponding isoxazolone[10] (100 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (89 mg, 0.4 mmol) gave **5j** (93 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 3.96 (s, 3H), 7.15 (bs, 1H), 7.43 (bd, J = 9 Hz, 1H), 7.51 (d, J = 8.4 Hz, 2H), 7.55-7.66 (m, 3H), 7.70 (d, J = 9 Hz, 1H), 8.37 (s, 1H), 8.48 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 55.68, 104.98, 115.11, 125.62, 125.88, 126.96, 128.36, 129.27, 129.75, 129.97, 129.98, 135.02, 139.65, 139.96, 146.21, 152.12, 157.41, 164.70; FT-IR (KBr, ν_{max}/cm^{-1}) 3069, 1751, 1664, 1605, 1556, 1513, 1236, 1026, 778. Anal. Calc. for $C_{20}H_{13}N_3O_3$: C, 69.96; H, 3.82; N, 12.24. Found: C, 69.77; H, 3.95; N, 12.45.

3-(3-Bromophenyl)-8-methyl-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5k). Using the corresponding isoxazolone[11] (131 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5k** (114 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.55 (s, 3H), 7.37 (d, J = 7.2 Hz, 1H), 7.48 (s, 1H), 7.51 (t, J = 7.5 Hz, 1H), 7.60 (s, 1H), 7.67-7.71 (m, 2H), 7.82 (t, J = 7.2 Hz, 1H), 8.36 (s, 1H), 8.54 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.44, 115.63, 115.87, 123.29, 125.13, 127.21, 128.16, 128.40, 130.15, 133.01, 133.68, 135.97, 136.29, 136.42, 139.98, 141.27, 147.71, 148.04, 156.72, 167.25; FT-IR (KBr, ν_{max}/cm^{-1}) 3070, 1751, 1662, 1608, 1557, 776. Anal. Calc. for $C_{20}H_{12}BrN_3O_2$: C, 59.13; H, 2.98; N, 10.34. Found: C, 59.36; H, 2.85; N, 10.49.

8-Methyl-3-(3-methylphenyl)-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5l). Using the corresponding isoxazolone[11] (105 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5l** (98 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.48 (s, 3H), 2.53 (s, 3H), 7.21-7.31 (m, 2H), 7.35 (d, J = 8.4 Hz, 1H), 7.38 (d, J = 7.5 Hz, 1H), 7.53 (d, J = 7.5 Hz, 1H), 7.61 (s, 1H), 7.81 (d, J = 8.4 Hz, 1H), 8.36 (s, 1H), 8.53 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.50, 22.22, 115.33, 123.17, 125.30, 127.68, 128.24, 128.53, 128.71, 129.58, 129.90, 130.19, 134.73, 139.85, 141.49, 142.30, 145.09, 148.01, 149.85, 157.18, 165.41; FT-IR (KBr, ν_{max}/cm^{-1}) 3042, 1750, 1662, 1607, 1560, 1164, 776; MS *m/z* (%) 342 [(M^++1), 23], 341 (M^+, 86), 340 (35), 297 (61), 296 (100), 282 (27), 140 (16), 91 (17), 65 (28). Anal. Calc. for $C_{21}H_{15}N_3O_2$: C, 73.89; H, 4.43; N, 12.31. Found: C, 74.05; H, 4.32; N, 12.42.

3-(4-Bromophenyl)-8-methyl-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5m). Using the corresponding isoxazolone[10] (131 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5m** (111 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.55 (s, 3H), 7.38 (d, J = 8.4 Hz, 1H), 7.41 (d, J = 8.4 Hz, 2H), 7.60 (s, 1H), 7.77 (d, J = 8.4 Hz, 2H), 7.82 (d, J = 8.4 Hz, 1H), 8.36 (s, 1H), 8.54 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 22.27, 115.18, 115.26, 119.27, 123.26, 123.33, 127.53, 128.32, 128.77, 130.14, 133.03, 133.70, 139.98, 141.70, 145.44, 149.63, 156.78, 168.64; FT-IR (KBr, ν_{max}/cm^{-1}) 3060, 1746, 1668, 1606, 1560, 1072, 779. Anal. Calc. for $C_{20}H_{12}BrN_3O_2$: C, 59.13; H, 2.98; N, 10.34. Found: C, 58.94; H, 3.12; N, 10.49.

8-Methyl-3-(4-methylphenyl)-1*H*-azeto[2',1':2,3]pyrimido-[4,5-*b*]quinoline-1,4(3*H*)-dione (5n). Using the corresponding isoxazolone[10] (105 mg, 0.4 mmol) and 2-chloro-3-formylquinoline[12] (82 mg, 0.4 mmol) gave **5n** (101 mg), as a red solid. ^{1}H NMR ($CDCl_3$, 300 MHz) δ 2.48 (s, 3H), 2.50 (s, 3H), 7.30-7.48 (m, 5H), 7.60 (s, 1H), 7.79 (bd, J = 8.1 Hz, 1H), 8.35 (s, 1H), 8.52 (s, 1H); ^{13}C NMR ($CDCl_3$, 75.5 MHz) δ 21.40, 22.21, 115.37, 123.16, 123.97, 127.64, 127.95, 128.23, 128.51, 130.49, 132.31, 139.34, 139.83, 141.50, 145.07, 148.42, 149.85, 157.13, 165.42; FT-IR (KBr, ν_{max}/cm^{-1}) 3036, 1758, 1658, 1601, 1560, 1511, 811, 709. Anal. Calc. for $C_{21}H_{15}N_3O_2$: C, 73.89; H, 4.43; N, 12.31. Found: C, 73.77; H, 4.56; N, 12.11.

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