

Synthesis of Nitro and Amino *N*-Heterocycles via Ring Transformation of 2-Methyl-3-nitrochromone

Kaname Takagi*, Masaaki Tanaka, Yukitoshi Murakami, Kuniyoshi Ogura

Katsuyuki Ishii, Hikari Morita and Tomoji Aotsuka

Central Research Laboratories, Zeria Pharmaceutical Co., Konan-machi,

Osato-gun, Saitama 360-01, Japan

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2-Methyl-3-nitrochromone (**1**) reacted with acid hydrazides, *S*-methylisothiourea, hydroxylamine and ethyl aminoethanoate to give the nitro derivatives of pyrazole **2**, pyrimidine **6**, isoxazole **11** and pyrrole **13**, respectively. These nitro compounds were reduced by catalytic hydrogenation to the corresponding amino derivatives. In the case of **2**, a rearrangement of the acyl group took place during the reduction. Substitution reactions of the 2-methylthio group in **6** were also described.

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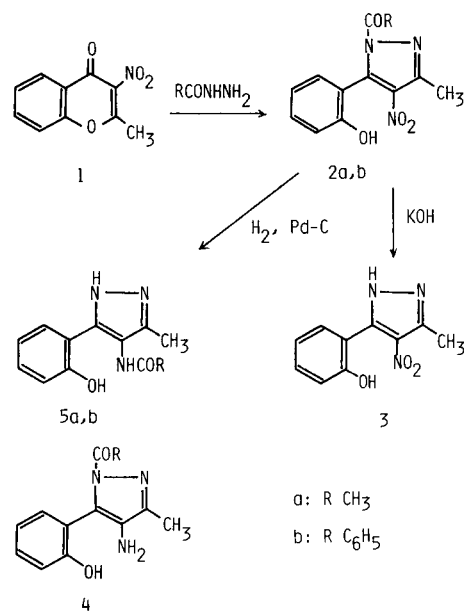
Previously, we reported that 2-methyl-3-nitrochromone (**1**) acted as an efficient Michael acceptor at the 2-position for nucleophiles such as hydrazines and amidines to give readily 3(5)-(2-hydroxyphenyl)-4-nitropyrazoles [**1**] and 4-(2-hydroxyphenyl)-5-nitropyrimidines [**2**], respectively. These nitro compounds were reduced to the corresponding amino derivatives, some of which exhibited potent analgesic activity and inhibitory effect for platelet aggregation [**1**]. The above results prompted us to examine reactions of **1** with different bifunctional nitrogen nucleophiles in order to prepare a variety of *N*-heterocyclic compounds. In these reactions, C², C³ and carbonyl-C in **1** served effectively as a source of three carbons for the formation of an *N*-containing aromatic ring. This report describes the synthesis of new nitro and amino derivatives of pyrazole, pyrimidine, isoxazole and pyrrole starting from **1**.

Chromone **1** reacted with acid hydrazides under mild conditions to give pyrazoles. Treatment of **1** with acetic acid hydrazide and benzoic acid hydrazide in ethanol at room temperature for 5 hours gave 1-acetyl and 1-benzoyl-5-(2-hydroxyphenyl)-3-methyl-4-nitropyrazoles **2a,b** in 81 and 94% yields, respectively. The position of *N*-acyl group on the pyrazole ring of **2a,b** could not be distinguished by the spectral data. However, we propose the structures **2a,b** taking into consideration that the terminal amino group of the hydrazides might react at C² in **1**. Compounds **2a,b** were readily hydrolyzed in an alkaline solution to 3(5)-(2-hydroxyphenyl)-5(3)-methyl-4-nitropyrazole (**3**) which was previously synthesized from **1** and hydrazine [**1**] (Scheme 1).

Catalytic hydrogenation of **2a,b** over 5% palladium on charcoal (Pd-C) in ethanol did not give the corresponding 1-acyl-4-aminopyrazoles **4**, but 4-acylamino-3(5)-(2-hydroxyphenyl)-5(3)-methylpyrazoles **5a,b** (Scheme 1) which were formed by migration of the acyl group during the reduction. The structures of **5a,b** were determined on the basis of elemental analysis and spectral data. In particular, ¹H-nmr spectra of **5a,b** showed three broad deuterium-exchangeable signals (1H each) at lower magnetic field

(see Experimental), and the signal corresponding to NH₂-protons was not observed. These findings indicate that the acyl group in **5a,b** is attached not to the nitrogen atom in the pyrazole ring, but to the amino group at 4-position. In fact, **5a** was identical with 4-acetamido-3(5)-(2-hydroxyphenyl)-5(3)-methylpyrazole synthesized from 3-acetamido-2-methylchromone and hydrazine [**1**].

Scheme 1



We previously described [**2**] that the reaction of **1** with thiourea in the presence of an alkali did not give the expected pyrimidinethione derivative because of the decomposition of the starting chromone **1**. However, upon treatment with *S*-methylisothiourea in the presence of triethylamine in hydroalcoholic medium, **1** readily underwent ring transformation to give 4-(2-hydroxyphenyl)-6-methyl-2-methylthio-5-nitropyrimidine (**6**) in 83% yield (Scheme 2). The structural assignment of **6** was based on elemental analysis and spectral data. Compound **6** was hydrolyzed to

Table I

Physical Data for Compounds **8a-j**

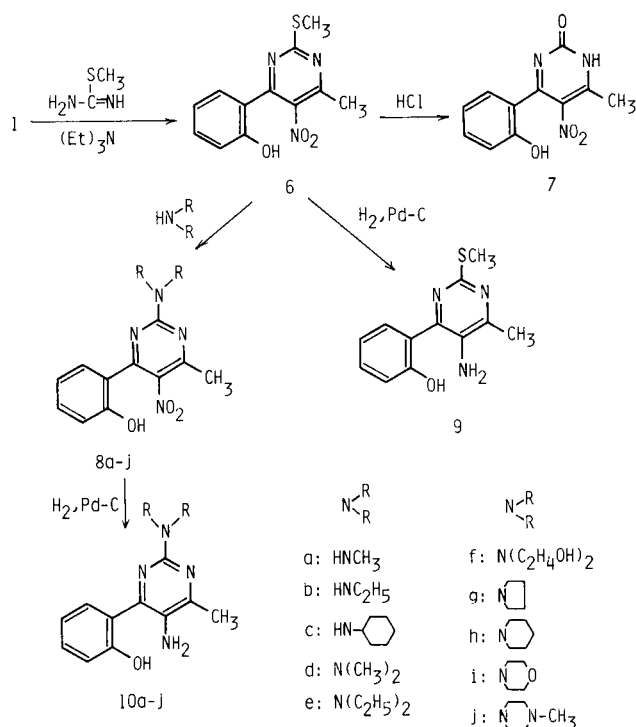
Compound No.	Yield %	Mp °C	Molecular Formula	Analyses		
				Calcd. %	Found %	
				C	H	N
8a	95	201-202	C ₁₂ H ₁₂ N ₄ O ₃ (260.26)	55.38 55.12	4.65 4.63	21.53 21.40
8b	94	134-135	C ₁₃ H ₁₄ N ₄ O ₃ (274.28)	56.93 56.60	5.15 5.12	20.43 20.53
8c	90	115-116	C ₁₇ H ₂₀ N ₄ O ₃ (328.37)	62.18 61.88	6.14 6.10	17.06 17.04
8d	93	184-185	C ₁₃ H ₁₄ N ₄ O ₃ (274.28)	56.93 56.71	5.15 5.09	20.43 20.49
8e	77	108-109	C ₁₅ H ₁₆ N ₄ O ₃ (302.34)	59.59 59.42	6.00 6.00	18.53 18.40
8f	63	144-145	C ₁₅ H ₁₈ N ₄ O ₃ (334.33)	53.88 53.71	5.43 5.46	16.76 16.66
8g	91	179-180	C ₁₅ H ₁₆ N ₄ O ₃ (300.32)	59.99 59.80	5.37 5.37	18.66 18.60
8h	90	152-153	C ₁₆ H ₁₈ N ₄ O ₃ (314.35)	61.13 61.05	5.77 5.77	17.83 17.77
8i	91	186-187	C ₁₅ H ₁₆ N ₄ O ₄ (316.32)	56.96 56.69	5.10 5.11	17.71 17.57
8j	90	250-251	C ₁₆ H ₁₉ N ₅ O ₃ (329.36)	58.35 58.01	5.82 5.77	21.27 21.15

Table II

Spectral Data for Compounds **8a-k**

Compound No.	MS		IR (cm ⁻¹) KBr	¹ H-NMR (ppm) DMSO-d ₆
	m/z	M ⁺		
8a	260	214	1550, 1343	2.54 (s, 3H, CH ₃), 2.97 (d, J = 5 Hz, 3H, CH ₃), 6.82-7.85 (m, 5H, aromatic and NH), 9.8-10.6 (br, 1H, OH)
8b	274	228	1553, 1337	1.25 (t, J = 7 Hz, 3H, CH ₃ CH ₂), 2.47 (s, 3H, CH ₃), 3.49 (m, 2H, CH ₂ CH ₃), 5.3-6.1 (br, 1H, NH), 6.76-7.56 (m, 4H, aromatic), 10.9-11.7 (br, 1H, OH)
8c	328	282	1555, 1335	0.83-2.26 (m, 10H, -(CH ₂) ₅), 2.46 (s, 3H, CH ₃), 3.78 (br s, 1H, CH), 5.2-6.0 (br, 1H, NH), 6.71-7.54 (m, 4H, aromatic), 11.1-11.9 (br, 1H, OH)
8d	274	228	1567, 1342	2.54 (s, 3H, CH ₃), 3.26 (s, 6H, N(CH ₃) ₂), 6.77-7.56 (m, 4H, aromatic), 9.7-10.5 (br, 1H, OH)
8e	302	256	1556, 1343	1.24 (t, J = 7 Hz, 6H, -(CH ₂ CH ₃) ₂), 2.48 (s, 3H, CH ₃), 3.69 (q, J = 7 Hz, 4H, -(CH ₂ CH ₃) ₂), 6.73-7.55 (m, 4H, aromatic), 11.2-12.1 (br, 1H, OH)
8f	334	288	1556, 1345	2.52 (s, 3H, CH ₃), 3.83 (s, 8H, -(C ₂ H ₄) ₂), 4.5-5.2 (br, 2H, 2 × OH), 6.80-7.52 (m, 4H, aromatic), 9.4-10.2 (br, 1H, OH)
8g	300	254	1553, 1332	1.91-2.13 (m, 4H, -CH ₂ CH ₂ -), 2.48 (s, 3H, CH ₃), 3.40-3.81 (m, 4H, N(CH ₂) ₂), 6.70-7.43 (m, 4H, aromatic), 11.6-12.5 (br, 1H, OH)
8h	314	268	1550, 1347	1.68 (s, 6H, -CH ₂ CH ₂ CH ₂ -), 2.47 (s, 3H, CH ₃), 3.85 (br s, 4H, N(CH ₂) ₂), 6.73-7.56 (m, 4H, aromatic), 9.9-10.7 (br, 1H, OH)
8i	316	270	1552, 1347	2.53 (s, 3H, CH ₃), 3.80 (s, 4H, 2 × CH ₂), 3.86 (s, 4H, 2 × CH ₂), 6.80-7.57 (m, 4H, aromatic), 9.4-10.2 (br, 1H, OH)
8j	329	—	1548, 1344	2.45 (s, 3H, CH ₃), 2.55 (s, 3H, CH ₃), 2.63-2.87 (m, 4H, 2 × CH ₂), 3.91-4.35 (m, 4H, 2 × CH ₂), 6.80-7.70 (m, 4H, aromatic), 9.7-10.5 (br, 1H, OH)

Scheme 2



4-(2-hydroxyphenyl)-6-methyl-5-nitropyrimidin-2(1H)-one (**7**) in 94% yield on heating with aqueous hydrochloric acid in ethanol. The 2-methylthio group in **6** was also reacted with various amines. Heating of **6** with primary and secondary aliphatic amines in water afforded 2-(substitut-

ed amino)-4-(2-hydroxyphenyl)-6-methyl-5-nitropyrimidines **8a-j** in good yields (Scheme 2, Table I and II). The nitropyrimidines **6** and **8a-j** were reduced to the corresponding 5-aminopyrimidines **9** and **10a-j** by catalytic hydrogenation over 5% Pd-C in ethanol.

Scheme 3

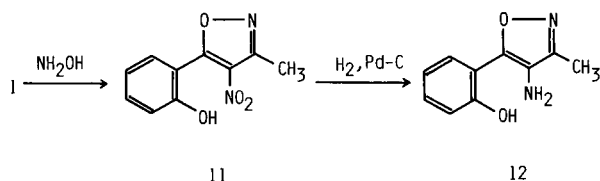
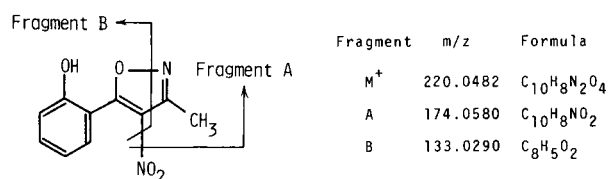
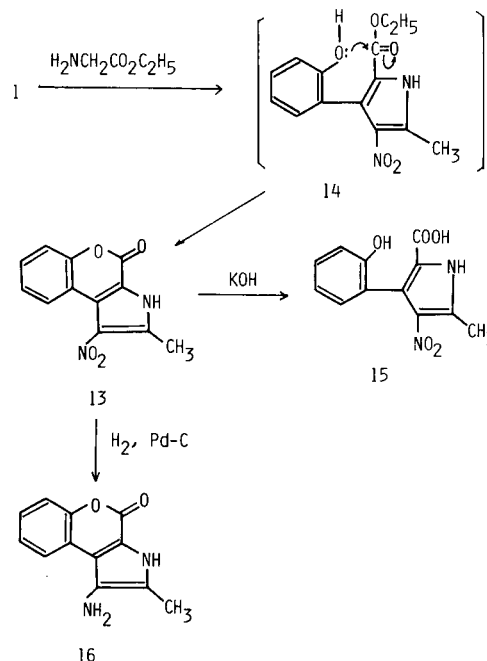


Figure 1



It is well known that reaction of alkylchromones with hydroxylamine gave 5-(2-hydroxyphenyl)isoxazoles [3,4]. The nitrochromone **1** also provided 5-(2-hydroxyphenyl)-3-methyl-4-nitroisoxazole (**11**) in 73% yield on heating with

Scheme 4



hydroxylamine liberated from its hydrochloride in ethanol (Scheme 3). The analytical and spectral data of **11** were consistent with the proposed structure. The high resolu-

Table III

Physical and Spectral Data for Compounds **10a-j**

Compound No	Yield %	Mp °C	Molecular Formula	Analysis			MS m/z M ⁺	IR (cm ⁻¹) KBr
				Calcd. %	Found %			
				C	H	N		
10a	41	159-160	C ₁₂ H ₁₄ N ₄ O (230.27)	62.59	6.13	24.33	230	3390, 3260, 1600
				62.57	6.13	24.37		
10b	42	88-89	C ₁₃ H ₁₆ N ₄ O (244.30)	63.91	6.60	22.94	244	3420, 3300, 1590
				63.89	6.63	23.18		
10c	67	138-140	C ₁₇ H ₂₂ N ₄ O (298.39)	68.43	7.43	18.78	298	3410, 3360, 3330, 1615
				68.33	7.45	18.76		
10d	56	112-113	C ₁₃ H ₁₆ N ₄ O (244.30)	63.91	6.60	22.94	244	3450, 3440, 1612, 1585
				63.70	6.58	22.98		
10e	49	120-121	C ₁₅ H ₂₀ N ₄ O (272.35)	66.15	7.40	20.57	272	3420, 3350, 1625, 1590
				66.02	7.40	20.55		
10f	34	64-66	C ₁₅ H ₂₀ N ₄ O ₃ (304.35)	59.19	6.62	18.41	304	3470, 3310, 3250, 1609
				58.88	6.65	18.24		
10g	55	191-192	C ₁₅ H ₁₈ N ₄ O (270.34)	66.66	6.71	20.73	270	3400, 3330, 1613, 1590
				66.46	6.68	20.74		
10h	80	190-191	C ₁₆ H ₂₀ N ₄ O (284.36)	67.58	7.09	19.71	284	3400, 3315, 1609, 1582
				67.40	7.05	19.70		
10i	69	146-147	C ₁₅ H ₁₈ N ₄ O ₂ (286.34)	62.93	6.34	19.57	286	3400, 3330, 1613, 1590
				62.62	6.30	19.54		
10j	52	134-135	C ₁₆ H ₂₁ N ₅ O (299.38)	64.19	7.07	23.40	299	3390, 3260, 1609, 1580
				64.37	7.11	23.58		

tion mass analysis of **11** assured the orientation of N-O bond in the isoxazole ring as shown in Figure 1. The compound **11** was converted to the 4-amino derivative **12** by catalytic hydrogenation.

Reaction of **1** with ethyl aminoethanoate in the presence of sodium ethoxide in boiling ethanol afforded 2-methyl-1-nitropyrrolo[2,3-*c*][1]benzopyran-4-one (**13**) [5] which was presumably formed *via* the intermediate phenolic ester **14** (Scheme 4). A similar attempt to condense **1** with aminoacetonitrile under the same conditions provided many unidentified product. The lactone structure of **13** was supported by elemental analysis, spectral data and its ring opening reaction to 3-(2-hydroxyphenyl)-5-methyl-4-nitropyrrrole-2-carboxylic acid (**15**) in an aqueous sodium hydroxide solution. Reduction of **13** by catalytic hydrogenation over 5% Pd-C gave the corresponding amino derivative **16**.

EXPERIMENTAL

Melting points were determined using a Yanagimoto micro melting point apparatus and are uncorrected. Analyses were done by Perkin-Elmer Model 240B elemental analyser. Nuclear magnetic resonance (¹H-nmr) spectra were measured with a JNM-PMX 60 spectrometer (JEOL) with tetramethylsilane as an internal standard. Mass spectra (ms) were taken on a JMS-DX 300 spectrometer (JEOL). Infrared (ir) spectra were recorded from potassium bromide discs on a JASCO A-102 spectrophotometer.

1-Acyl-5-(2-hydroxyphenyl)-3-methyl-4-nitropyrroles **2a,b**.

A mixture of **1** (2.1 g, 10 mmoles) and acetic acid hydrazide or benzoic acid hydrazide (11 mmoles) in ethanol (40 ml) was stirred at room temperature for 5 hours. After removal of the solvent under reduced pressure, the residue was treated with water to give a crystalline solid which was collected and recrystallized from benzene/*n*-hexane (**2a**) or ethanol/water (**2b**).

Compound **2a** was obtained in 80% yield (2.1 g) mp 109-111°; ir: ν cm⁻¹ 1765, 1360, ¹H-nmr (deuteriochloroform): δ 2.06 (s, 3H, CH₃), 2.17 (s, 3H, CH₃), 7.13-7.77 (m, 4H, aromatic), 11.9-13.0 (br, 1H, OH); ms: *m/z* 261 (M⁺).

Anal. Calcd. for C₁₂H₁₁N₃O₄: C, 55.17; H, 4.24; N, 16.09. Found: C, 54.95; H, 4.20; N, 16.08.

Compound **2b** was obtained in 93% yield (3.0 g) mp 156-157°; ir: ν cm⁻¹ 1710, 1360, ¹H-nmr (deuteriochloroform): δ 2.07 (s, 3H, CH₃), 7.19-8.07 (m, 9H, aromatic), 11.3-13.7 (br, 1H, OH); ms: *m/z* 323 (M⁺).

Anal. Calcd. for C₁₇H₁₃N₃O₄: C, 63.15; H, 4.05; N, 13.00. Found: C, 63.13; H, 4.07; N, 12.90.

Hydrolysis of **2a,b** to 3(5)-(2-Hydroxyphenyl)-5(3)-methyl-4-nitropyrrole (**3**).

A solution of **2a,b** (1 mmole) and potassium hydroxide (0.4 g, 7 mmoles) in water (10 ml) was heated on a water bath for 20 minutes and then acidified by addition of 10% hydrochloric acid with cooling. The precipitates were collected by filtration and washed with 5% sodium bicarbonate solution and water. Recrystallization from ethanol/water gave **3** (0.18 g, 82% from **2a**; 0.17 g, 78% from **2b**), mp 201-202°. The ir spectra and melting points of these samples coincided with those of an authentic sample [1].

4-Acylamino-3(5)-(2-hydroxyphenyl)-5(3)-methylpyrroles **5a,b**.

A solution of **2a,b** (5 mmoles) in ethanol (50 ml) was stirred under a

hydrogen atmosphere over 5% Pd-C (0.3 g) at room temperature. The catalyst was removed by filtration and the filtrate was concentrated under reduced pressure. The residual oily product was triturated in benzene/*n*-hexane (1:1, v/v) to give a crystalline solid which was recrystallized from benzene/ethanol.

Compound **5a** was obtained in 52% yield (0.6 g) mp 164-165°; ir: ν cm⁻¹ 3340, 3230, 1642; ¹H-nmr (DMSO-*d*₆): δ 2.05 (s, 3H, CH₃), 2.13 (s, 3H, CH₃), 6.69-7.87 (m, 4H, aromatic), 9.21 (br s, 1H, NH), 10.9-11.7 (br, 1H, CONH), 12.6-13.4 (br, 1H, OH); ms: *m/z* 231 (M⁺). The ir spectrum and melting point of this compound coincided with those of an authentic sample [1].

Compound **5b** was obtained in 65% yield (0.95 g) mp 261-262°; ir: ν cm⁻¹ 3400, 3270, 1640; ¹H-nmr (DMSO-*d*₆): δ 2.20 (s, 3H, CH₃), 6.59-8.30 (m, 9H, aromatic), 9.75 (br s, 1H, NH), 10.8-11.6 (br, 1H, CONH), 12.8-13.4 (br, 1H, OH); ms: *m/z* 293 (M⁺).

Anal. Calcd. for C₁₇H₁₅N₃O₂: C, 69.69; H, 5.16; N, 14.34. Found: C, 69.81; H, 5.03; N, 14.56.

4-(2-Hydroxyphenyl)-6-methyl-2-methylthio-5-nitropyrimidine (**6**).

A mixture of **1** (2.1 g, 10 mmoles), *S*-methylisothiourrea sulfate (2.8 g, 20 mmoles) and triethylamine (3.0 g, 30 mmoles) in ethanol/water (1:3, v/v, 80 ml) was heated at 60° for 30 minutes with stirring. The reaction mixture was concentrated under reduced pressure and the precipitates separated were collected, washed with water and recrystallized from ethanol/water to yield **6** (2.3 g, 83%) as yellow leaflets, mp 159-160°; ir: ν cm⁻¹ 1609, 1528, 1353; ¹H-nmr (deuteriochloroform): δ 2.59 (s, 3H, CH₃), 2.66 (s, 3H, CH₃), 6.79-7.59 (m, 4H, aromatic), 10.7-11.2 (br, 1H, OH); ms: *m/z* 277 (M⁺), 231 (M⁺-NO₂).

Anal. Calcd. for C₁₂H₁₁N₃O₃S: C, 51.98; H, 4.00; N, 15.15. Found: C, 51.91; H, 3.99; N, 15.20.

4-(2-Hydroxyphenyl)-6-methyl-5-nitropyrimidin-2(1*H*)-one (**7**).

A solution of **6** (1.4 g, 5 mmoles) and concentrated hydrochloric acid (20 ml) in ethanol (20 ml) was refluxed for 6 hours. The reaction mixture was concentrated to a half volume and neutralized by addition of sodium bicarbonate with cooling. The precipitates were collected, washed with water and recrystallized from dimethylformamide/water to yield **7** (1.1 g, 89%) as orange prisms, mp 262-263°; ir: ν cm⁻¹ 1656, 1593, 1523; ¹H-nmr (DMSO-*d*₆): δ 2.57 (s, 3H, CH₃), 6.78-7.63 (m, 4H, aromatic); the signals of NH and OH were not observed clearly; ms: *m/z* 247 (M⁺), 201 (M⁺-NO₂).

Anal. Calcd. for C₁₁H₉N₃O₄: C, 53.44; H, 3.67; N, 17.00. Found: C, 53.26; H, 3.55; N, 17.34.

2-(Substituted amino)-4-(2-hydroxyphenyl)-6-methyl-5-nitropyrimidines **8a-j**.

A solution of **6** (1.4 g, 5 mmoles) in 40% aqueous solution (10 ml) of an appropriate aliphatic amine (Scheme 2) was heated under reflux for 2 hours (in the reactions with diethylamine and diethanolamine, the heating was continued for 24 hours to complete the reactions). The reaction mixture was acidified by addition of 10% hydrochloric acid with cooling and the whole was extracted with chloroform. The organic layer was washed with water, dried over anhydrous sodium sulfate and evaporated to give a crystalline solid which was recrystallized from ethanol/water to yield **8a-j** (Table I and II).

Catalytic Hydrogenation of **6** and **8a-j** to the Corresponding 5-Aminopyrimidines **9** and **10a-j**.

A solution of **6** or **8a-j** (3 mmoles) in ethanol (50 ml) was stirred under a hydrogen atmosphere over 5% Pd-C (0.3 g) at room temperature. The catalyst was removed by filtration and the filtrate was concentrated under reduced pressure to give a residue which was recrystallized from ethanol/water to yield **9** or **10a-j**.

Compound **9** was obtained in 61% yield (0.45 g) mp 164-165°; ir: ν cm⁻¹ 3410, 3340; ¹H-nmr (DMSO-*d*₆): δ 2.47 (s, 3H, CH₃), 2.57 (s, 3H, CH₃), 3.6-4.2 (br, 2H, NH₂), 6.83-8.00 (m, 4H, aromatic), 11.20 (br s, 1H, OH); ms: *m/z* 247 (M⁺).

Anal. Calcd. for $C_{12}H_{13}N_3OS$: C, 58.28; H, 5.30; N, 16.99. Found: C, 58.21; H, 5.16; N, 17.25.

The data for **10a-j** are given in Table III.

5-(2-Hydroxyphenyl)-3-methyl-4-nitroisoxazole (**11**).

Hydroxylamine hydrochloride (0.84 g, 12 mmoles) was added to an ethanolic potassium hydroxide solution (0.6 g of potassium hydroxide in 40 ml of ethanol) and the mixture was stirred at room temperature for 20 minutes. Chromone **1** (2.1 g, 10 mmoles) was then added and the mixture was refluxed for 24 hours. After removal of the solvent, the residue was treated with water to give a crystalline solid which was recrystallized from ethanol/water to yield **11** (1.6 g, 73%), mp 202-204°; $^1\text{H-nmr}$ (DMSO- d_6): δ 2.53 (s, 3H, CH_3), 6.74-7.73 (m, 4H, aromatic), 10.62 (br s, 1H, OH); ms: m/z 220 (M^+), 174 ($\text{M}^+\text{-NO}_2$), 133 ($\text{M}^+\text{-NO}_2$ and CH_3CN).

Anal. Calcd. for $C_{10}H_8N_2O_4$: C, 54.55; H, 3.66; N, 12.72. Found: C, 54.44; H, 3.65; N, 12.77.

4-Amino-5-(2-hydroxyphenyl)-3-methylisoxazole (**12**).

A mixture of **11** (2.2 g, 10 mmoles) and 5% Pd-C (0.6 g) in ethanol (100 ml) containing concentrated hydrochloric acid (2 ml) was treated under a hydrogen atmosphere in the same manner as described for the preparation of **10a-j**. The crude reduction product was recrystallized from ethanol/ether to give **12** as the monohydrochloride (1.1 g, 49%), mp 150-152°; $^1\text{H-nmr}$ (DMSO- d_6): δ 2.42 (s, 3H, CH_3), 6.80-7.79 (m, 4H, aromatic), 8.0-9.7 (br, 4H, N^+H_3 and OH); ms: m/z 190 (M^+), 149 ($\text{M}^+\text{-CH}_3\text{CN}$), 121 ($\text{M}^+\text{-CH}_3\text{CN}$ and CNH_2).

Anal. Calcd. for $C_{10}H_{10}N_2O_2\text{-HCl}$: C, 52.99; H, 4.89; N, 12.36. Found: C, 52.87; H, 5.01; N, 12.48.

2-Methyl-1-nitropyrrolo[2,3-c][1]benzopyran-4-one (**13**).

A mixture of **1** (2.1 g, 10 mmoles) and ethyl aminoethanoate hydrochloride (2.1 g, 15 mmoles) in an ethanolic sodium ethoxide solution (0.7 g of sodium in 50 ml of anhydrous ethanol) was refluxed for 5 hours. After evaporation of the solvent under reduced pressure, the residue was dissolved in water and the solution was acidified with 10% hydrochloric acid. The precipitates were collected, washed with water and recrystallized from ethanol/chloroform to give **13** (0.81 g, 33%), mp 305-307°; ν cm^{-1} 3200, 1690, 1560, 1350; $^1\text{H-nmr}$ (DMSO- d_6): δ 2.68 (s, 3H, CH_3), 7.11-8.63 (m, 4H, aromatic), 13.2-14.0 (br, 1H, NH); ms: m/z 244 (M^+), 197 ($\text{M}^+\text{-NO}_2$ and H).

Anal. Calcd. for $C_{12}H_8N_2O_4$: C, 59.07; H, 3.30; N, 11.48. Found: C, 58.71; H, 3.15; N, 11.61.

3-(2-Hydroxyphenyl)-5-methyl-4-nitropyrrole-2-carboxylic Acid (**15**).

A suspension of **13** (0.24 g, 1 mmole) in 5% sodium hydroxide solution (15 ml) was heated on a water-bath for 2 hours. After cooling, the reaction mixture was acidified by addition of concentrated hydrochloric acid and the precipitates were collected, washed with cold water and recrystallized from water to yield **15** (0.19 g, 73%), mp > 300°; ν cm^{-1} 3380, 1680, 1370; $^1\text{H-nmr}$ (DMSO- d_6): δ 2.65 (s, 3H, CH_3), 6.67-7.40 (m, 4H, aromatic), 8.6-9.7 (br, 1H, NH), 12.63 (br s, 2H, $2 \times \text{OH}$); ms: m/z 262 (M^+).

Anal. Calcd. for $C_{12}H_{10}N_2O_5$: C, 54.97; H, 3.84; N, 10.68. Found: C, 54.76; H, 3.68; N, 10.68.

1-Amino-2-methylpyrrolo[2,3-c][1]benzopyran-4-one (**16**).

A mixture of **13** (0.5 g, 2 mmoles) and 5% Pd-C (0.2 g) in ethanol (100 ml) was treated under a hydrogen atmosphere in the same manner as described for the preparation of **10a-j**. Recrystallization from ethanol gave **16** (0.19 g, 44%), mp 259-261°; ν cm^{-1} 3390, 3340, 3200, 1690; $^1\text{H-nmr}$ (DMSO- d_6): δ 2.30 (s, 3H, CH_3), 4.16 (s, 2H, NH_2), 7.11-8.50 (m, 4H, aromatic), 11.7-12.2 (br, 1H, NH); ms: m/z 214 (M^+).

Anal. Calcd. for $C_{12}H_{10}N_2O_2$: C, 67.28; H, 4.71; N, 13.08. Found: C, 67.39; H, 4.68; N, 12.86.

REFERENCES AND NOTES

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- [3] G. P. Ellis, ed, "Chromenes, Chromanones and Chromones", John Wiley and Sons, Inc, New York, London, Sydney and Toronto, 1977, pp 599-600.
- [4] Recently, it was reported that the reaction of chromone with hydroxylamine in an alkaline solution gave several products, mainly ring-opened oxime and isoxazole derivatives: V. Szabó, J. Borbély, E. Theisz, J. Borda and G. Janzsó, *Tetrahedron*, **40**, 413 (1984), and references cited therein.
- [5] An analogous result was reported in the reaction of 3-nitrochromone with ethyl aminoethanoate: G. Haas, J. L. Stanton and T. Winkler, *J. Heterocyclic Chem.*, **18**, 619 (1981).