A Modified, Economical and Efficient Synthesis of Variably Substituted Pyrazolo[4,3-*d*]pyrimidin-7-ones

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Received December 16, 2004

1-Methyl-3-propyl-1*H*-pyrazole-5-carboxylic acid (**3**) was exclusively brominated at the 4-position by bromine in the dark. Brominated product **8** was then converted into 1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide **9** by successive treatment with thionyl chloride and ammonium hydroxide. Carboxamide **9** was treated with various aroyl amides under microwave (MW) irradiation to afford 4-aroylamino-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamides **10-22** and 5-aryl-1-methyl-3-propyl-1,6-dihydro-1*H*-pyrazolo[4,3-*d*]pyrimidin-7-ones **23-35**. The 1*H*-pyrazole-5-carboxamides **10-22** were also converted to pyrimidinones **23-35** either by conventional heating or by MW irradiation. However, MW irradiation method gives excellent yields in very short time.

J. Heterocyclic Chem., **42**, 1085 (2005).

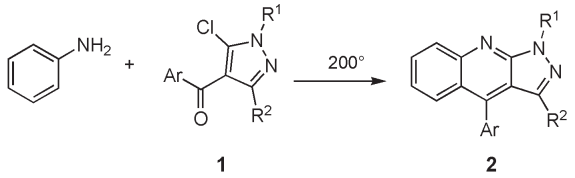
Introduction.

In 1986 Richard Gedye and co-workers first described the utilization and advantages of microwave irradiation for organic synthesis [1,2]. The advantages of using microwave irradiation (MW) technology high-speed synthesis of organic molecules has grown quickly with publications growing from ~200 in 1995 to ~1000 in 2001 [3]. In addition, an unusually large number of review articles and commentaries (~60) have been published on this subject covering various aspects of microwave-assisted synthesis.

Solvent free reactions [4,5] provide ease to synthetic transformations; this cuts down the hazards of high-pressure development and allows to conduct the reaction on large scale. Conventional heating has certain drawbacks due to poor thermal conductivity in solid support synthesis. Nevertheless microwave activation has uniformity of temperatures throughout the solid support reactions [6,7].

Nucleophilic aromatic substitution S_NAr reactions are of importance due to their use in industrial chemistry including the synthesis of *N*-alkyl aminoheterocycles [8], bioactive diarylethers [9] and *N,N*-disubstituted-5-aminothiophene-2-carboxaldehyde [9-10]. S_NAr reactions are also used to functionalize the pyrrole nucleus [11,12] and in the preparation of quinoxalinedione [13], which are AMPA receptor antagonists, as well as in synthesis of labeled 2'-deoxyinosine and 2'-deoxyadenosine [14]. Various catalysts [8,9,15-20] are used to carry out S_NAr reactions involving invariably higher temperature, toxic metal ions, excess of reagents and are not environmental friendly. Earlier, Hennig *et al*. reported the aromatic nucleophilic substitution (S_NAr) reaction of aniline with 4-aroyl-5-chloro-1,3-disubstituted pyrazoles **1** (Scheme 1). Depending upon the identity of the starting material, the reaction proceeded over 3 h at 200-220 °C and provided 1*H*-pyrazolo[3,4-*b*]quinolines **2** with up to 70% yield along with difficult purification of the products [21].

Scheme 1

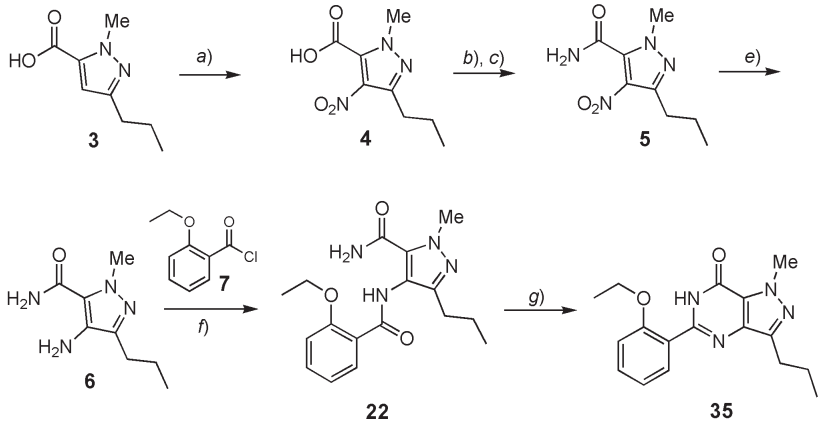


Alkylxanthines possess a variety of biological properties like prototype antagonists for adenosine receptors. Many of their physiological functions such as changes in conductance in the heart, CNS stimulators, and effects of the lung and trachea have been described to their ability to block AMPA receptors and antagonize endogenous adenosine [22]. The pyrazolo[4,3-*d*]pyrimidines is the only class of compounds that has been reported to have adenosine receptor affinity [23]. Pyrazolo[4,3-*d*]pyrimidin-7-ones are potent adenosine A_1 receptors [24] and serve as intermediates for the synthesis of sildenafil (Viagra®) [25] and its analogues which are potent inhibitors of the phosphodiesterase type 5 (PDE5) [26].

Previously, the synthesis of pyrazolo[4,3-*d*]pyrimidin-7-ones was reported in six steps [25a,25b] from 1-methyl-3-propyl-5-pyrazole-carboxylic acid (**3** [25a,27-29]), which involves nitration, acid chloride formation, amidation, reduction of nitro- group, *N*-benzoylation followed by ring closure to afford 5-(2-ethoxyphenyl)-1-methyl-3-propyl-

1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**35**), (Scheme 2).

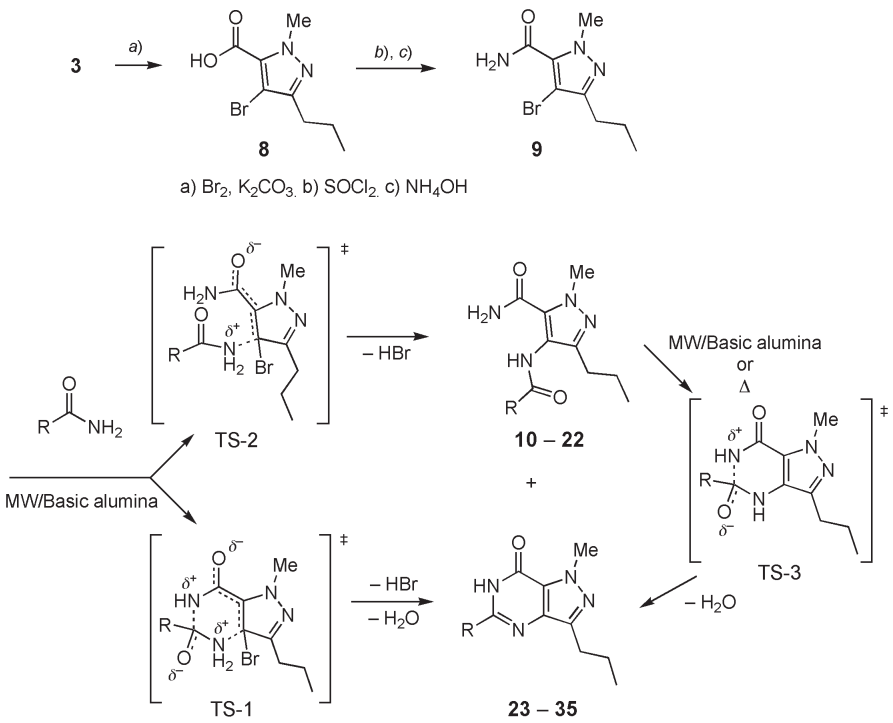
Scheme 2



a) HNO_3, H_2SO_4. b) $SOCl_2$. c) NH_4OH. e) $SnCl_2$, HCl. f) DMAP, Et_3N. g) NaOH, EtOH/H_2O

Our research group is involved in methods development in organic synthesis to produce known as well as new bioactive molecules for the investigation of their unknown biological effects [30]. Herein, we want to report an economical and efficient method for the preparation of different pyrazolo[4,3-*d*]pyrimidin-7-ones using MW irradiation. In order to generalize our newly developed methodology, we have prepared a variety of variably substituted 5-aroyl-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-ones **23-35**. It is established, that by using new emerging MW-assisted synthetic methodology for the conversion of bromo-1-methyl-3-propyl-5-pyrazolecar-

Scheme 3



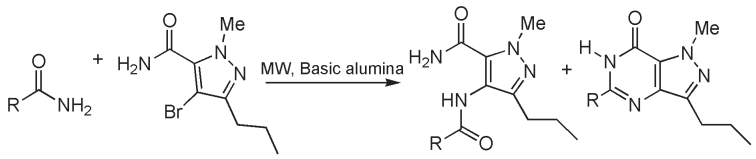
boxamide (**9**) into pyrazolo[4,3-*d*]pyrimidin-7-ones **23-35**, reactions take place in shorter time to afford products in high yields under mild conditions.

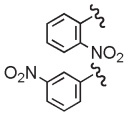
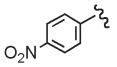
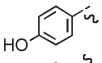
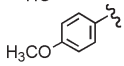
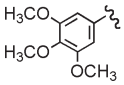
Results and Discussion.

In our case, the synthetic procedure reported in the literature [25a,25b] was significantly modified and improved by the applications of microwave heating. Our modified synthesis (Scheme 3) starts with the bromination at activated 4-position to give the corresponding 4-bromo-1-methyl-3-propyl-5-pyrazolecarboxylic acid (**8**) (see Experimental), which was then converted into the respective acid chloride in refluxing thionyl chloride and into the respective amide **9** upon treating of the chloride with aqueous ammonium hydroxide at room temperature. The microwave (MW) assisted nucleophilic aromatic substitution (S_NAr) reaction on the activated C-4 position of 4-bromo-1-methyl-3-propyl-5-pyrazolecarboxamide (**9**) by the NH_2 group of various aroylamides led to the products identified as compounds **10-22** and compounds **23-35** as the key products. The reactions were performed on basic alumina (5-7 min, MW) in dry media to trap the HBr formed. On the other hand, the same reactions under conventional heating by using potassium *t*-butoxide in *t*-butanol, yielded either no products or only traces of compounds **10-22** (Scheme 3).

The reaction proceeding through the transition states **TS-2** and **TS-1** (Scheme 3) yielded compounds **10-22** (17-25%) and **23-35** (58-76%) along with some unidentified side products (Scheme 4). Compounds **10-22** were easily converted to their corresponding pyrazolo[4,3-*d*]pyrim-

Scheme 4



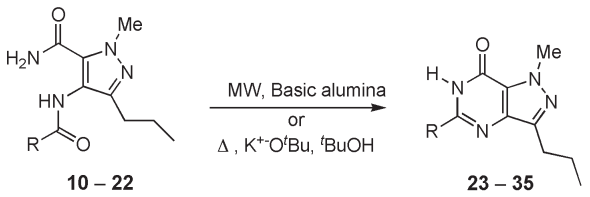
Products	R	Time (min)	Yields %
10/23		6	18/76
11/24		7	21/71
12/25		6	17/75
13/26		7	25/65
14/27		7	22/60
15/28		7	20/62
16/29		6	18/58
17/30		5	20/72
18/31		5	19/75
19/32		6	23/72
20/33		6	21/70
21/34		7	24/68
22/35		7	20/75

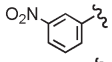
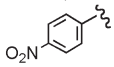
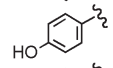
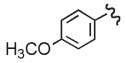
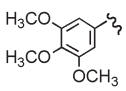
idin-7-ones **23-35** under the same MW irradiation reaction protocol for 1-2 min following transition state **TS-3** (Scheme 3), or by conventional heating in 98-100% yields (Scheme-5).

These high-energy transition states (TS) can be achieved under microwave irradiation by acquiring the certain vibrational levels of the molecules, by exciting them through a speedy MW heating, which can not be obtained sufficiently by the conventional heating even after 60 h. The formation of intermediates **10-22** provides an additional evidence for the hypothetical pathway to afford the compounds **23-35**. Compounds **10-22** were isolated by silica gel column chromatography (CH_2Cl_2:EtOAc, 1:1) along with some other unidentified minor side products; the key products and were characterized by spectroscopic analysis. These side products may be due to decomposition of target compounds **23-35**, while prolonged heating (> 7 min) results in the complete decomposition of the products. The transformation of compounds **10-22** into compounds **23-35** was achieved by both MW and conventional heating (Scheme 5) through transition TS (**TS-3**) as shown in Scheme 3.

To the best of our knowledge, this is the first report on the synthesis of pyrazolo[4,3-*d*]pyrimidin-7-ones using microwave irradiation.

Scheme 5



Products	R	Time		Yields %
		MW(min)	Δ (h)	MW/ Δ
23		1	9	100/80
24		1	10	98/83
25		1	9	99/85
26		2	10	97/81
27		2	10	98/90
28		1	9	97/89
29		2	9	98/91
30		2	10	98/93
31		2	10	99/91
32		1	9	99/82
33		1	9	99/84
34		1	9	98/81
35		1	10	100/85

Conclusion.

Reaction of 4-bromo-1-methyl-3-propyl-5-pyrazolecarboxamide (**9**) with various aroylamides provides a facile route for pyrazolo[4,3-*d*]pyrimidin-7-ones **23-35**, particularly, when microwave irradiation is used as a source of energy. This method provides a convenient, efficient, economical, time saving, and high yielding synthesis of 5-substituted-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one derivatives **23-35**, which otherwise would be available with difficulty using a classical method [25a]. This method is also advantageous for the synthesis of sildenafil (Viagra®), its analogs as PDE5 inhibitors, and various other AMPA receptor antagonists in higher yields and shorter time.

EXPERIMENTAL

General.

M.p.'s were obtained in open capillaries, *Büchi 434* apparatus; uncorrected. ^{1}H-NMR spectra were acquired using a Bruker apparatus operating at 300 and 500 MHz in ppm (δ) relative to $SiMe_4$ (= 0 ppm) as internal standard. IR spectra were acquired using a JASCO IR-A-302. EI-MS spectra were obtained using a Finnigan-MAT-311A apparatus; *m/z* (rel %). Microwave-assisted reactions were performed using 900 W, 2,450 MHz (LG Domestic Microwave Appliance) oven. CHN analysis was performed by Mr. Munawar Rasheed on a Carlo Erba Strumentazion-Mod-1106 Italy. TLC: Kieselgel (60-254 mesh, E. Merck); chromatograms were visualized by iodine vapour; ultraviolet light (uv) at 254 and 365 nm; Ceric sulphate solution followed by heating and Dragendroff's reagent. Column chromatography: silica gel (70-230 mesh and 230-400 mesh, E. Merck) using commercial grade solvents. Diethyl oxalate, dimethyl sulfate, bromine, and 2-pentanone were purchased from E. Merck. The solvents used in reactions were of analytical reagent grade (E. Merck) and dried before use, whenever necessary by using standard protocols.

4-Bromo-1-methyl-3-propyl-1*H*-pyrazole-5-carboxylic acid (**8**).

To a solution of **3** (0.168 g, 1 mmol) and K_2CO_3 (0.414 g, 3 mmol) in CH_2Cl_2 (20 mL) at r.t., was added Br_2 (3 mmol) in the dark. After 6 h at r.t., the reaction was quenched with 1 *M* $Na_2S_2O_3$ (30 mL), extracted with CH_2Cl_2 (3 x 25 mL), the extract dried (Na_2SO_4) and evaporated under reduced pressure to dryness. The residue was chromatographed (CH_2Cl_2:AcOEt, 1:1) to give the title compound as brown amorphous powder 0.148 g, (Yield 88%); mp 112-113°; R_f = 0.46 (AcOEt: CH_2Cl_2, 6:4); ir.

(potassium bromide): ν_{max} 2933, 2873 (O-H, C-H br. str. overlapped), 1709 (C=O), 1465 (C=C str.), 1534 (CH_2 bend.), 1390, 1362 (CH_3 bend.), 1240 (C-N str.), 610 (C-Br str.) cm^{-1}; ^1H nmr (MeOD-d_4, 300 MHz): δ 0.98 (t, J = 7.2 Hz, 3H, CH_2-CH_2-CH_3), 1.67 (m, 2H, CH_2-CH_2-CH_3), 2.81 (dd, J = 7.2 Hz, 7.8 Hz, 2H, CH_2-CH_2-CH_3), 3.92 (s, 3H, N1-CH_3); EIMS: *m/z* 249 (M^+, 18), 247 (20), 233 (18), 203 (60), 191 (8), 189 (10), 168 (100), 154 (10), 141 (14), 124 (30), 97 (11), 44 (5%).

Anal. Calcd. for $C_8H_{11}BrN_2O_2$: C, 38.89; H, 4.49; N, 11.34. Found: C, 38.92; H, 4.47; N, 11.33.

4-Bromo-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**9**).

Compound **8** (0.247 g, 1 mmol) was refluxed with thionyl chloride (15 mL) for 2 h (oil bath). Excess of thionyl chloride was distilled under reduce pressure and the crude acid chloride was added slowly to a cooled (≈ 0 °C) aqueous NH_4OH (20 mL, 25%). Stirring the reaction mixture for 2 h at room temperature. Cold water (50 mL) was then added and the precipitated solid product **7** was collected by suction filtration, and dried to obtain light yellow powder 0.21 g (Yield 85%). mp 133-134°; R_f = 0.42 (AcOEt: CH_2Cl_2, 7:3); ir. (potassium bromide): ν_{max} 3400 (amide-NH_2), 2873 (C-H str.), 1710 (C=O), 1460 (C=C str.), 1532 (CH_2 bend.), 1388, 1359 (CH_3 bend.), 1245 (C-N str.), 617 (C-Br str.) cm^{-1}; ^1H nmr ($CDCl_3$, 300 MHz): δ 0.96 (t, J = 7.4 Hz, 3H, CH_2-CH_2-CH_3), 1.68 (m, 2H, CH_2-CH_2-CH_3), 2.80 (dd, J = 7.1Hz, 7.6 Hz, 2H, CH_2-CH_2-CH_3), 2.85 (br s, 2H, -NH_2), 3.92 (s, 3H, N1-CH_3); EIMS: *m/z* 248 (M^+, 22), 246 (25), 231 (13), 203 (35), 189 (10), 167 (100), 141 (19), 110 (48), 97 (11), 71 (16), 44 (5%).

Anal. Calcd. for $C_8H_{12}BrN_3O$: C, 39.04; H, 4.91; N, 17.07. Found: C, 39.01; H, 4.89; N, 17.10.

General Procedure for the Synthesis of Compounds (**10-22**) and Compounds (**23-35**).

Microwave Irradiation Method.

Various aroylamides (1 mmol) and 4-bromo-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**9**) (1 mmol) was adsorbed on basic alumina (≈ 1 g). The reaction mixture enclosed in closed vessel of Teflon was irradiated inside the microwave oven for 5-7 min. at 2,450 MHz. The reaction mixture was cooled down to room temperature and eluted with CH_2Cl_2 (3 x 15 mL). The eluent was evaporated to dryness and subjected to the column chromatography (CH_2Cl_2:AcOEt, increasing polarity) to afford the title compounds **10-22** (17-25%) and compounds **23-35** (58-76%). The compounds **10-22** which were obtained as one of the reaction products were recycled by subjecting to the 1-2 min microwave irradiations following the same reaction protocol into compounds **23-35** in 97-100% yields. The structures of the compounds **10-22** and **23-35** were determined by the spectroscopic analysis.

Conventional Heating Method for the Preparation of Compounds **23-35**.

Potassium *t*-butoxide (2 mmol) was added to a stirred suspension of the amides **10-22** (1 mmol) in *t*-butyl alcohol (10 mL). The resulted mixture was refluxed for 10 h at 95 °C (oil bath), and then allowed to cool at room temperature. Water (15 mL) was added and then the solution was neutralized with HCl (5%) to pH ≈ 7, and cooled to about 5-10 °C. The precipitated solid product was collected by suction filtration, washed with cold water and dried. This afforded the title compounds **23-35** in 80-93% yields.

4-Benzoylamino-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**10**) [31].

This compound was obtained as a white powder; Yield 18%; mp 169-170 °C; R_f = 0.51 (AcOEt: CH_2Cl_2, 7:3); ir. (potassium bromide): ν_{max} 3399, 3335, 3306 (NH), 1677, 1647 (C=O) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.98 (t, J = 7.4 Hz, 3H, $CH_2CH_2CH_3$), 1.58-1.69 (m, 2H, $CH_2CH_2CH_3$), 2.55 (dd, 2H, J = 7.7 Hz, J = 7.3 Hz, $CH_2CH_2CH_3$), 4.09 (s, 3H, NCH_3), 5.53 (br s, 2H, $CONH_2$), 7.48-7.69 (m, 5H, Ar-*H*), 7.89 (br s, 1H, CON*H*); EIMS: *m/z* 286 (M^+, 15), 181 (3), 149 (100), 121 (82), 93 (21), 65 (23%).

Anal. Calcd. for $C_{15}H_{18}N_4O_2$: C, 62.92; H, 6.34; N, 19.57. Found: C, 62.90; H, 6.35; N, 19.57.

4-[(2-Nitrobenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**11**) [25a,25b,32].

This compound was obtained as yellow crystals; Yield 21%; mp 187-188 °C; R_f = 0.44 (AcOEt); ir. (potassium bromide): ν_{max} 3400, 3329, 3300 (NH), 1679, 1645 (C=O), 1588, 1365 (NO_2) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.93 (t, J = 7.2 Hz, 3H, $CH_2CH_2CH_3$), 1.57-1.70 (m, 2H, $CH_2CH_2CH_3$), 2.54 (dd, 2H, J = 7.8 Hz, J = 7.0 Hz, $CH_2CH_2CH_3$), 4.06 (s, 3H, NCH_3), 5.55 (br s, 2H, $CONH_2$), 7.36-7.42 (overlapped m, 2H, H-4'/ H-5'), 7.83 (dd, 1H, J = 8.6 Hz, J = 1.2 Hz, H-3'), 7.89 (br s, 1H, CON*H*), 8.30 (dd, 1H, J = 8.6 Hz, J = 1.2 Hz, H-6'); EIMS: *m/z* 331 (M^+, 18), 286 (5), 181 (4), 149 (100), 121 (67), 93 (26), 65 (11%).

Anal. Calcd. for $C_{15}H_{17}N_5O_4$: C, 54.38; H, 5.17; N, 21.14. Found: C, 54.38; H, 5.16; N, 21.15.

4-[(3-Nitrobenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**12**).

This compound was obtained as light yellow crystals; Yield 17%; mp 177-178 °C; R_f = 0.49 (AcOEt); ir. (potassium bromide): ν_{max} 3397, 3333, 3305 (NH), 1675, 1646 (C=O), 1595, 1366 (NO_2) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.99 (t, J = 7.1 Hz, 3H, $CH_2CH_2CH_3$), 1.55-1.71 (m, 2H, $CH_2CH_2CH_3$), 2.51 (dd, 2H, J = 7.5 Hz, J = 7.3 Hz, $CH_2CH_2CH_3$), 4.05 (s, 3H, NCH_3), 5.54 (br s, 2H, $CONH_2$), 7.84 (td, 1H, J = 8.3 Hz, J = 1.5 Hz, H-5'/), 7.88 (br s, 1H, CON*H*), 8.41 (dd, 1H, J = 8.3 Hz, J = 1.5 Hz, H-6'), 8.45 (dd, 1H, J = 8.3 Hz, J = 1.5 Hz, H-4'), 8.01 (d, 1H, J = 8.3 Hz, J = 1.5 Hz, H-2'); EIMS: *m/z* 331 (M^+, 23), 285 (11), 181 (9), 149 (100), 121 (70), 93 (22), 65 (11%).

Anal. Calcd. for $C_{15}H_{17}N_5O_4$: C, 54.38; H, 5.17; N, 21.14. Found: C, 54.40; H, 5.17; N, 21.14.

4-[(4-Nitrobenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**13**).

This compound was obtained as yellow needles; Yield 25%; mp 191-192 °C; R_f = 0.43 (AcOEt); ir. (potassium bromide): ν_{max} 3398, 3331, 3302 (NH), 1674, 1646 (C=O), 1581, 1365 (NO_2) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.00 (t, J = 7.0 Hz, 3H, $CH_2CH_2CH_3$), 1.55-1.72 (m, 2H, $CH_2CH_2CH_3$), 2.55 (dd, 2H, J = 7.8 Hz, J = 7.2 Hz, $CH_2CH_2CH_3$), 4.03 (s, 3H, NCH_3), 5.49 (br s, 2H, $CONH_2$), 7.91 (br s, 1H, CON*H*), 8.20 (d, 2H, J = 9.2 Hz, H-2'/ H-6'), 8.35 (d, 1H, J = 9.2 Hz, H-3'/ H-5'); EIMS: *m/z* 331 (M^+, 9), 285 (3), 181 (8), 149 (100), 121 (67), 93 (26), 65 (17%).

Anal. Calcd. for $C_{15}H_{17}N_5O_4$: C, 54.38; H, 5.17; N, 21.14. Found: C, 54.35; H, 5.18; N, 21.13.

4-[(2-Bromobenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**14**).

This compound was obtained as a brown powder; Yield 22%; mp 188-189 °C; R_f = 0.52 (AcOEt: CH_2Cl_2, 9:1); ir. (potassium bromide): ν_{max} 3399, 3335, 3306 (NH), 1677, 1647 (C=O), 610 (C-Br) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.93 (t, J = 7.0 Hz, 3H, $CH_2CH_2CH_3$), 1.57-1.69 (m, 2H, $CH_2CH_2CH_3$), 2.56 (dd, 2H, J = 7.7 Hz, J = 7.2 Hz, $CH_2CH_2CH_3$), 4.00 (s, 3H, NCH_3), 5.57 (br s, 2H, $CONH_2$), 7.20 (td, 1H, J = 7.7 Hz, J = 1.2 Hz, H-4'), 7.35 (dd, 1H, J = 7.7 Hz, J = 1.2 Hz, H-3'), 7.42 (td, 1H, J = 7.7 Hz, J = 1.2 Hz, H-5'), 7.62 (dd, 1H, J = 7.7 Hz, J = 1.2 Hz, H-6'), 7.89 (br s, 1H, CONH); EIMS: *m/z* 367 (M^+, 20), 365 (18), 285 (6), 181 (3), 149 (100), 121 (82), 93 (21), 65 (23%).

Anal. Calcd. for $C_{15}H_{17}BrN_4O_2$: C, 49.33; H, 4.69; N, 15.34. Found: C, 49.29; H, 4.70; N, 15.35.

4-[(3-Bromobenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**15**).

This compound was obtained as brown crystals; Yield 20%; mp 185-186 °C; R_f = 0.50 (AcOEt: CH_2Cl_2, 9:1); ir. (potassium bromide): ν_{max} 3405, 3328, 3298 (NH), 1676, 1646 (C=O), 619 (C-Br) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.95 (t, J = 6.9 Hz, 3H, $CH_2CH_2CH_3$), 1.53-1.66 (m, 2H, $CH_2CH_2CH_3$), 2.51 (dd, 2H, J = 7.5 Hz, J = 7.1 Hz, $CH_2CH_2CH_3$), 4.01 (s, 3H, NCH_3), 5.56 (br s, 2H, $CONH_2$), 7.06 (td, 1H, J = 7.9 Hz, J = 1.6 Hz, H-5'), 7.37 (dd, 1H, J = 7.9 Hz, J = 1.6 Hz, H-4'), 7.53 (d, 1H, J = 1.6 Hz, H-2'), 8.01 (dd, 1H, J = 7.9 Hz, J = 1.6 Hz, H-6'), 7.84 (br s, 1H, CONH); EIMS: *m/z* 367 (M^+, 20), 365 (18), 285 (6), 181 (3), 149 (100), 121 (82), 93 (21), 65 (23%).

Anal. Calcd. for $C_{15}H_{17}BrN_4O_2$: C, 49.33; H, 4.69; N, 15.34. Found: C, 49.31; H, 4.71; N, 15.33.

4-[(4-Bromobenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**16**).

This compound was obtained as brown crystals; Yield 18%; mp 182.5-183.5 °C; R_f = 0.51 (AcOEt: CH_2Cl_2, 9:1); ir. (potassium bromide): ν_{max} 3399, 3334, 3300 (NH), 1670, 1641 (C=O), 619 (C-Br) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.97 (t, J = 7.4 Hz, 3H, $CH_2CH_2CH_3$), 1.51-1.65 (m, 2H, $CH_2CH_2CH_3$), 2.54 (dd, 2H, J = 7.8 Hz, J = 7.1 Hz, $CH_2CH_2CH_3$), 4.03 (s, 3H, NCH_3), 5.57 (br s, 2H, $CONH_2$), 7.38 (d, 2H, J = 8.5 Hz, H-3'/ H-5'), 7.60 (d, 2H, J = 8.5 Hz, H-2'/ H-6'), 7.90 (br s, 1H, CONH); EIMS: *m/z* 367 (M^+, 20), 365 (18), 285 (6), 181 (3), 149 (100), 121 (82), 93 (21), 65 (23%).

Anal. Calcd. for $C_{15}H_{17}BrN_4O_2$: C, 49.33; H, 4.69; N, 15.34. Found: C, 49.36; H, 4.69; N, 15.35.

4-[(Nicotinoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**17**).

This compound was obtained as yellow crystals; Yield 20%; mp 200-201 °C; R_f = 0.47 (AcOEt: CH_2Cl_2, 8:2); ir. (potassium bromide): ν_{max} 3389, 3333, 3298 (NH), 1671, 1642 (C=O) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.99 (t, J = 7.4 Hz, 3H, $CH_2CH_2CH_3$), 1.53-1.67 (m, 2H, $CH_2CH_2CH_3$), 2.56 (dd, 2H, J = 7.7 Hz, J = 7.0 Hz, $CH_2CH_2CH_3$), 4.07 (s, 3H, NCH_3), 5.57 (br s, 2H, $CONH_2$), 7.60 (t, 1H, J = 7.8 Hz, H-5'), 7.87 (br s, 1H, CONH), 8.33 (d, 1H, J = 7.8 Hz, H-6'), 8.65 (d, 1H, J = 7.8 Hz, H-4'), 9.09 (s, 1H, H-2'); EIMS: *m/z* 287 (M^+, 12), 285 (8), 181 (7), 149 (100), 121 (55), 93 (31), 65 (26%).

Anal. Calcd. for $C_{14}H_{17}N_5O_2$: C, 58.52; H, 5.96; N, 24.38. Found: C, 58.50; H, 5.97, N, 24.36.

4-[(Isonicotinoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**18**) [33].

This compound was obtained as yellow powder; Yield 19%; mp 197.5-198.5 °C; R_f = 0.48 (AcOEt: CH_2Cl_2, 8:2); ir. (potassium bromide): ν_{max} 3399, 3335, 3306 (NH), 1677, 1647 (C=O) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.95 (t, J = 7.1 Hz, 3H, $CH_2CH_2CH_3$), 1.53-1.71 (m, 2H, $CH_2CH_2CH_3$), 2.53 (dd, 2H, J = 7.6 Hz, J = 7.3 Hz, $CH_2CH_2CH_3$), 4.01 (s, 3H, NCH_3), 5.49 (br s, 2H, $CONH_2$), 7.90 (br s, 1H, CONH), 7.97 (d, 2H, J = 7.3 Hz, H-2'/ H-6'), 8.89 (d, 2H, J = 7.3 Hz, H-3'/ H-5'); EIMS: *m/z* 287 (M^+, 17), 285 (6), 181 (3), 149 (100), 121 (74), 93 (22), 65 (34%).

Anal. Calcd. for $C_{14}H_{17}N_5O_2$: C, 58.52; H, 5.96; N, 24.38. Found: C, 58.56; H, 5.94; N, 24.38.

4-[(4-Hydroxybenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**19**).

This compound was obtained as white crystals; Yield 23%; mp 183-184 °C; R_f = 0.46 (AcOEt); ir. (potassium bromide): ν_{max} 3388, 3337, 3309 (NH), 1675, 1639 (C=O) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.00 (t, J = 7.2 Hz, 3H, $CH_2CH_2CH_3$), 1.55-1.73 (m, 2H, $CH_2CH_2CH_3$), 2.55 (dd, 2H, J = 7.7 Hz, J = 7.3 Hz, $CH_2CH_2CH_3$), 4.04 (s, 3H, NCH_3), 5.56 (br s, 2H, $CONH_2$), 6.92 (d, 2H, J = 8.2 Hz, H-3'/ H-5'), 7.77 (d, 2H, J = 8.2 Hz, H-2'/ H-6'), 7.90 (br s, 1H, CONH); EIMS: *m/z* 302 (M^+, 25), 285 (4), 272 (9), 181 (8), 149 (100), 121 (77), 93 (24), 65 (19%).

Anal. Calcd. for $C_{15}H_{18}N_4O_3$: C, 59.59; H, 6.00; N, 18.53. Found: C, 59.55; H, 6.01; N, 18.51.

4-[(4-Methoxybenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**20**).

This compound was obtained as white powder; Yield 21%; mp 174.2-175.4 °C; R_f = 0.49 (AcOEt: CH_2Cl_2, 9:1); ir. (potassium bromide): ν_{max} 3391, 3340, 3310 (NH), 1670, 1641 (C=O) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.01 (t, J = 7.1 Hz, 3H, $CH_2CH_2CH_3$), 1.57-1.71 (m, 2H, $CH_2CH_2CH_3$), 2.53 (dd, 2H, J = 7.8 Hz, J = 7.1 Hz, $CH_2CH_2CH_3$), 3.61 (s, 3H, OCH_3), 4.01 (s, 3H, NCH_3), 5.51 (br s, 2H, $CONH_2$), 6.93 (d, 2H, J = 8.8 Hz, H-2'/ H-6'), 7.79 (d, 2H, J = 8.8 Hz, H-3'/ H-5'), 7.88 (br s, 1H, CONH); EIMS: *m/z* 316 (M^+, 22), 285 (6), 181 (8), 149 (100), 121 (77), 93 (24), 65 (19%).

Anal. Calcd. for $C_{16}H_{20}N_4O_3$: C, 60.75; H, 6.37; N, 17.71. Found: C, 60.71; H, 6.35; N, 17.70.

4-[(3,4,5-Trimethoxybenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**21**).

This compound was obtained as white powder; Yield 24%; mp 167.5-168.5 °C; R_f = 0.51 (AcOEt: CH_2Cl_2, 8:2); ir. (potassium bromide): ν_{max} 3395, 3329, 3299 (NH), 1670, 1649 (C=O) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.99 (t, J = 7.3 Hz, 3H, $CH_2CH_2CH_3$), 1.53-1.67 (m, 2H, $CH_2CH_2CH_3$), 2.52 (dd, 2H, J = 7.7 Hz, J = 7.1 Hz, $CH_2CH_2CH_3$), 3.78 (s, 3H, OCH_3), 3.84 (s, 6H, OCH_3), 4.05 (s, 3H, NCH_3), 5.54 (br s, 2H, $CONH_2$), 7.27 (s, 2H, H-2'/ H-6'), 7.85 (br s, 1H, CONH); EIMS: *m/z* 376 (M^+, 18), 345 (3), 315 (5), 285 (2), 181 (3), 149 (100), 121 (82), 93 (21), 65 (23%).

Anal. Calcd. for $C_{18}H_{24}N_4O_5$: C, 57.44; H, 6.43; N, 14.88. Found: C, 57.42; H, 6.44; N, 14.87.

4-[(2-Ethoxybenzoyl)amino]-1-methyl-3-propyl-1*H*-pyrazole-5-carboxamide (**22**).

The structure of the compound **22** was determined by the spectroscopic analysis and was found in agreement with the reported

literature values [25a,25b].

5-Phenyl-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]-pyrimidin-7-one (**23**) [25a,31,34].

This compound was obtained as a white powder; Yield: Scheme 4 (76%); Scheme 5 (100%); cumulative (88%); mp 203-204 °C; R_f = 0.59 (CH_2Cl_2); ir. (potassium bromide): ν_{max} 3306 (N-H), 2933, 2873 (C-H), 1703 (C=O), 1244 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.02 (t, J = 7.3 Hz, 3H, CH_2-CH_2-CH_3), 1.79 (m, 2H, CH_2-CH_2-CH_3), 3.03 (dd, J = 7.6 Hz, J = 7.2 Hz, 2H, CH_2-CH_2-CH_3), 4.25 (s, 3H, N1-CH_3), 7.42-7.77 (m, 5H, Ar-H), 12.30 (s, 1H, N*H*); EIMS: *m/z* 268 (M^+, 20), 254 (6), 192 (23), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{16}N_4O$: C, 67.15; H, 6.01; N, 20.88. Found: C, 67.11; H, 6.01; N, 20.87.

5-(2-Nitrophenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**24**) [25a].

This compound was obtained as yellow crystals; Yield: Scheme 4 (71%); Scheme 5 (98%); cumulative (85%); mp 215-216 °C; R_f = 0.51 (CH_2Cl_2: AcOEt, 8:2); ir. (potassium bromide): ν_{max} 3300 (N-H), 2936, 2870 (C-H), 1707 (C=O), 1365 (NO_2), 1240 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.01 (t, J = 7.3 Hz, 3H, CH_2-CH_2-CH_3), 1.78 (m, 2H, CH_2-CH_2-CH_3), 3.07 (dd, J = 7.5 Hz, J = 7.1 Hz, 2H, CH_2-CH_2-CH_3), 4.24 (s, 3H, N1-CH_3), 7.86-7.99 (m, 3H, H-3', H-4', H-5'), 8.32 (d, 2H, J = 8.4 Hz, H-6'), 12.15 (s, 1H, N*H*). EIMS: *m/z* 313 (M^+, 17), 298 (4), 268 (21), 191 (23), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{15}N_5O_3$: C, 57.50; H, 4.83; N, 22.35. Found: C, 57.54; H, 4.84; N, 22.33.

5-(3-Nitrophenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**25**) [34].

This compound was obtained as yellow crystals; Yield: Scheme 4 (75%); Scheme 5 (99%); cumulative (87%); mp 208-209 °C; R_f = 0.49 (CH_2Cl_2: AcOEt, 8:2); ir. (potassium bromide): ν_{max} 3310 (N-H), 2928, 2868 (C-H), 1708 (C=O), 1361 (NO_2), 1242 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.05 (t, J = 7.3 Hz, 3H, CH_2-CH_2-CH_3), 1.75 (m, 2H, CH_2-CH_2-CH_3), 3.06 (dd, J = 7.6 Hz, J = 7.0 Hz, 2H, CH_2-CH_2-CH_3), 4.20 (s, 3H, N1-CH_3), 7.88 (td, 1H, J = 8.3 Hz, J = 2.3 Hz, H-5'), 8.31 (dd, 1H, J = 8.3 Hz, J = 2.3 Hz, H-4'), 8.43 (d, 1H, J = 2.3 Hz, H-2'), 8.31 (dd, 1H, J = 8.3 Hz, J = 2.3 Hz, H-6'), 12.15 (s, 1H, N*H*); EIMS: *m/z* 313 (M^+, 17), 298 (4), 268 (21), 191 (23), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{15}N_5O_3$: C, 57.50; H, 4.83; N, 22.35. Found: C, 57.47; H, 4.81; N, 22.36.

5-(4-Nitrophenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**26**).

This compound was obtained as light yellow crystals; Yield: Scheme 4 (65%); Scheme 5 (97%); cumulative (81%); mp 202.5-203.5 °C; R_f = 0.50 (CH_2Cl_2: AcOEt, 8:2); ir. (potassium bromide): ν_{max} 3310 (N-H), 2929, 2871 (C-H), 1707 (C=O), 1365 (NO_2), 1240 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.02 (t, J = 7.4 Hz, 3H, CH_2-CH_2-CH_3), 1.80 (m, 2H, CH_2-CH_2-CH_3), 3.07 (dd, J = 7.7 Hz, J = 7.1 Hz, 2H, CH_2-CH_2-CH_3), 4.21 (s, 3H, N1-CH_3), 7.90 (d, 2H, J = 8.1 Hz, H-2'/H-6'), 8.27 (d, 2H, J = 8.1 Hz, H-3'/H-5'), 12.15 (s, 1H, N*H*); EIMS: *m/z* 313 (M^+, 17), 298 (4), 268 (21), 191 (23), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{15}N_5O_3$: C, 57.50; H, 4.83; N, 22.35. Found: C, 57.55; H, 4.80; N, 22.35.

5-(2-Bromophenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**27**).

This compound was obtained as a brown powder; Yield: Scheme 4 (60%); Scheme 5 (98%); cumulative (79%); mp 193-194 °C; R_f = 0.53 (CH_2Cl_2:AcOEt, 9:1); ir. (potassium bromide): ν_{max} 3311 (N-H), 2930, 2873 (C-H), 1700 (C=O), 1240 (C-N), 619 (C-Br) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.99 (t, J = 7.3 Hz, 3H, CH_2-CH_2-CH_3), 1.73 (m, 2H, CH_2-CH_2-CH_3), 3.01 (dd, J = 7.6 Hz, J = 7.2 Hz, 2H, CH_2-CH_2-CH_3), 4.25 (s, 3H, N1-CH_3), 7.35 (td, 1H, J = 7.8 Hz, J = 1.5 Hz, H-4'), 7.57 (td, 1H, J = 7.8 Hz, J = 1.5 Hz, H-5'), 7.65 (dd, 1H, J = 7.8 Hz, J = 1.5 Hz, C3'-H), 7.94 (dd, 2H, J = 7.8 Hz, J = 1.5 Hz, H-6_), 12.30 (s, 1H, N*H*); EIMS: *m/z* 349 (M^+, 17), 347 (20), 268 (43), 192 (23), 178 (17), 152 (7), 137 (11), 125 (24), 110 (21), 84 (70), 64 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{15}BrN_4O$: C, 51.89; H, 4.35; N, 16.14. Found: C, 51.85; H, 4.37; N, 16.15.

5-(3-Bromophenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**28**).

This compound was obtained as light brown crystals; Yield: Scheme 4 (62%); Scheme 5 (97%); cumulative (80%); mp 197.5-198.5 °C; R_f = 0.51 (CH_2Cl_2:AcOEt, 9:1); ir. (potassium bromide): ν_{max} 3305 (N-H), 2933, 2876 (C-H), 1708 (C=O), 1241 (C-N), 615 (C-Br) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.00 (t, J = 7.3 Hz, 3H, CH_2-CH_2-CH_3), 1.80 (m, 2H, CH_2-CH_2-CH_3), 3.07 (dd, J = 7.7 Hz, J = 7.1 Hz, 2H, CH_2-CH_2-CH_3), 4.20 (s, 3H, N1-CH_3), 7.38 (td, 1H, J = 8.0 Hz, J = 1.6 Hz, H-5'), 7.72 (td, 1H, J = 8.0 Hz, J = 1.6 Hz, H-4'), 7.91 (dd, 1H, J = 8.0 Hz, J = 1.6 Hz, C6'-H), 8.33 (d, 1H, J = 1.6 Hz, H-2'), 12.11 (s, 1H, N*H*); EIMS: *m/z* 349 (M^+, 17), 347 (20), 268 (43), 192 (23), 178 (17), 152 (7), 137 (11), 125 (24), 110 (21), 84 (70), 64 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{15}BrN_4O$: C, 51.89; H, 4.35; N, 16.14. Found: C, 51.87; H, 4.34; N, 16.16.

5-(4-Bromophenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**29**).

This compound was obtained as brown crystals; Yield: Scheme 4 (58%); Scheme 5 (98%); cumulative (78%); mp 190-191 °C; R_f = 0.52 (CH_2Cl_2: AcOEt, 9:1); ir. (potassium bromide): ν_{max} 3315 (N-H), 2928, 2869 (C-H), 1708 (C=O), 1239 (C-N), 615 (C-Br) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.98 (t, J = 7.3 Hz, 3H, CH_2-CH_2-CH_3), 1.82 (m, 2H, CH_2-CH_2-CH_3), 3.07 (dd, J = 7.7 Hz, J = 7.4 Hz, 2H, CH_2-CH_2-CH_3), 4.22 (s, 3H, N1-CH_3), 7.37 (d, 2H, J = 8.6 Hz, H-3'/5'), 7.72 (d, 2H, J = 8.6 Hz, H-2'/6'), 12.11 (s, 1H, N*H*); EIMS: *m/z* 349 (M^+, 17), 347 (20), 268 (43), 192 (23), 178 (17), 152 (7), 137 (11), 125 (24), 110 (21), 84 (70), 64 (100), 56 (43%).

Anal. Calcd. for $C_{15}H_{15}BrN_4O$: C, 51.89; H, 4.35; N, 16.14. Found: C, 51.87; H, 4.34; N, 16.16.

5-(3-Pyridinyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**30**) [33].

This compound was obtained as yellow shiny needles; Yield: Scheme 4 (72%); Scheme 5 (98%); cumulative (85%); mp 218-219 °C; R_f = 0.48 (CH_2Cl_2); ir. (potassium bromide): ν_{max} 3306 (N-H), 2933, 2873 (C-H), 1703 (C=O), 1244 (C-N) cm^{-1}; ^1H nmr

($CDCl_3$, 400 MHz): δ 1.06 (t, J = 7.1 Hz, 3H, CH_2-CH_2-C*H*$_3$), 1.78 (m, 2H, CH_2-C*H*$_2$-CH_3), 3.05 (dd, J = 7.7 Hz, J = 6.9 Hz, 2H, C*H*$_2$-CH_2-CH_3), 4.23 (s, 3H, N1-C*H*$_3$), 7.63 (td, 1H, J = 7.7 Hz, J = 1.3 Hz, H-5'), 8.46 (dd, 1H, J = 7.7 Hz, J = 1.3 Hz, H-6'), 9.16 (dd, 1H, J = 7.7 Hz, J = 1.3 Hz, H-4'), 9.33 (d, 1H, J = 1.3 Hz, H-2'), 12.11 (s, 1H, N*H*); EIMS: *m/z* 269 (M^+, 20), 254 (6), 191 (23), 176 (4), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{14}H_{15}BrN_5O$: C, 62.44; H, 5.61; N, 26.01. Found: C, 62.44; H, 5.62; N, 26.00.

5-(4-Pyridinyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**31**) [33].

This compound was obtained as pale yellow crystals; Yield: Scheme 4 (75%); Scheme 5 (99%); cumulative (87%); mp 221.5-222.5 °C; R_f = 0.50 (CH_2Cl_2); ir. (potassium bromide): ν_{max} 3309 (N-H), 2939, 2866 (C-H), 1703 (C=O), 1238 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.97 (t, J = 7.0 Hz, 3H, CH_2-CH_2-C*H*$_3$), 1.80 (m, 2H, CH_2-C*H*$_2$-CH_3), 3.07 (dd, J = 7.8 Hz, J = 7.2 Hz, 2H, C*H*$_2$-CH_2-CH_3), 4.21 (s, 3H, N1-C*H*$_3$), 8.13 (d, 2H, J = 7.3 Hz, H-2'/H-6'), 8.91 (d, 2H, J = 7.3 Hz, H-3'/H-5'), 12.15 (s, 1H, N*H*); EIMS: *m/z* 269 (M^+, 20), 254 (6), 191 (23), 176 (4), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{14}H_{15}BrN_5O$: C, 62.44; H, 5.61; N, 26.01. Found: C, 62.40; H, 5.59; N, 26.01.

5-(4-Hydroxyphenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**32**).

This compound was obtained as white powder; Yield: Scheme 4 (72%) Scheme 5 (99%); cumulative (86%); mp 207.5-208.5 °C; R_f = 0.49 (CH_2Cl_2); ir. (potassium bromide): ν_{max} 3300 (N-H, OH), 2930, 2870 (C-H), 1700 (C=O), 1240 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 0.99 (t, J = 7.1 Hz, 3H, CH_2-CH_2-C*H*$_3$), 1.83 (m, 2H, CH_2-C*H*$_2$-CH_3), 3.03 (dd, J = 7.8 Hz, J = 7.3 Hz, 2H, C*H*$_2$-CH_2-CH_3), 4.20 (s, 3H, N1-C*H*$_3$), 6.97 (d, 2H, J = 8.4 Hz, H-3'/5'), 7.21 (d, 2H, J = 8.4 Hz, H-2'/6'), 11.99 (s, 1H, N*H*); EIMS: *m/z* 284 (M^+, 15), 270 (6), 267 (12), 192 (28), 166 (19), 136 (15), 120 (29), 102 (21), 91 (70), 67 (100), 56 (48%).

Anal. Calcd. for $C_{15}H_{16}N_4O_2$: C, 63.73; H, 5.67; N, 19.71. Found: C, 63.68; H, 5.68; N, 19.71.

5-(4-Methoxyphenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**33**).

This compound was obtained as an off-white powder; Yield: scheme 4 (70%); Scheme 5 (99%); cumulative (85%); mp 199-200 °C; R_f = 0.47 (CH_2Cl_2:AcOEt, 9:1); ir. (potassium bromide): ν_{max} 3300 (N-H), 2930, 2870 (C-H), 1700 (C=O), 1240 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.02 (t, J = 7.4 Hz, 3H, CH_2-CH_2-C*H*$_3$), 1.81 (m, 2H, CH_2-C*H*$_2$-CH_3), 3.07 (dd, J = 7.6 Hz, J = 7.1 Hz, 2H, C*H*$_2$-CH_2-CH_3), 3.57 (s, 3H, OCH_3), 4.21 (s, 3H, N1-C*H*$_3$), 6.68 (d, 2H, J = 8.9 Hz, H-3'/5'), 7.70 (d, 2H, J = 8.9 Hz, H-2'/6'), 12.03 (s, 1H, N*H*); EIMS: *m/z* 298 (M^+, 20), 284 (7), 268 (11), 191 (23), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{16}H_{18}N_4O_2$: C, 64.41; H, 6.08; N, 18.78. Found: C, 64.37; H, 6.06; N, 18.77.

5-(3,4,5-Trimethoxyphenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]-pyrimidin-7-one (**34**).

This compound was obtained as white pellets; Yield: Scheme 4 (68%) Scheme 5 (98%); cumulative (83%); mp 190.5-191.5 °C; R_f = 0.54 (CH_2Cl_2: AcOEt, 9:1); ir. (potassium bromide): ν_{max} 3303 (N-H), 2943, 2863 (C-H), 1703 (C=O), 1234 (C-N) cm^{-1}; ^1H nmr ($CDCl_3$, 400 MHz): δ 1.07 (t, J = 6.9 Hz, 3H, CH_2-CH_2-C*H*$_3$), 1.82 (m, 2H, CH_2-C*H*$_2$-CH_3), 3.05 (dd, J = 7.7 Hz, J = 7.2 Hz, 2H, C*H*$_2$-CH_2-CH_3), 3.76 (s, 6H, OCH_3), 3.83 (s, 3H, OCH_3) 4.20 (s, 3H, N1-C*H*$_3$), 7.00 (d, 2H, J = 8.9 Hz, H-2'/6'), 12.11 (s, 1H, N*H*); EIMS: *m/z* 358 (M^+, 11), 344 (3), 328 (8), 313 (16), 297 (6), 284 (21), 268 (12), 192 (23), 166 (17), 136 (11), 120 (24), 102 (21), 91 (70), 67 (100), 56 (43%).

Anal. Calcd. for $C_{18}H_{22}N_4O_4$: C, 60.32; H, 6.19; N, 15.63. Found: C, 60.37; H, 6.18; N, 15.63.

5-(2-Ethoxyphenyl)-1-methyl-3-propyl-1,6-dihydro-7*H*-pyrazolo[4,3-*d*]pyrimidin-7-one (**35**).

The structure of the compound **35** was determined by the spectroscopic analysis and was found in agreement with the reported literature values [25a,25b].

Acknowledgement.

The authors gratefully acknowledge for the financial supports of the Pakistan Telecommunication Limited (PTCL) under "Research Grant Program" and Higher Education Commission (HEC) Pakistan under "Research Grants Program for Universities".

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