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RECYCLIZATION OF 7-HYDROXY-3-(4-PHENYL-1,2,4-TRIAZOL-3-YL)-CHROMONES USING BINUCLEOPHILES

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The recyclization of 2-R-7-hydroxy-3-(4-phenyl-1,2,4-triazol-3-yl)chromones using the binucleophiles hydroxylamine, hydrazine, or guanidine gave isoxazoles, 2-aminochromones, pyrazoles, or pyrimidines with a 4-phenyl-1,2,4-triazol-3-yl substituent.

Keywords: isoxazoles, pyrazoles, pyrimidines, chromones.

It is known that 3-aryl-4-triazolylpyrazoles show fungicidal, herbicidal, and growth regulator activity [1, 2]. 5-Aryl-4-triazolylisoxazoles have been patented as insecticides and acaricides [3]. It was of interest to prepare similar, potentially biologically active compounds based on one starting product. With this in mind we decided to use a route based on the recyclization of chromones using the binucleophiles hydrazine, hydroxylamine, and amidines [4, 5]. It is known the chromone ring undergoes fission with nucleophiles to form a substituted acetophenone and the presence of a second nucleophilic center leads to an attack at the carbonyl carbon atom with closure of the corresponding five- or six-membered ring.

The 2,6,8-substituted 7-hydroxy-3-(4-phenyl-1,2,4-triazol-3-yl)chromones **1a,f** [6, 7] were selected as starting materials. It has previously been found that reaction of 2-substituted chromones with hydroxylamine forms isoxazoles while the recyclization of chromones unsubstituted in the 2 position can proceed further with a subsequent recyclization of the isoxazole ring to 2-aminochromone. Moreover, the ratio of isoxazole to 2-aminochromone depends on the heterocycle in position 3 of the chromone [8].

Refluxing 2-carbethoxy-3-(4-phenyl-1,2,4-triazol-3-yl)chromones **1d,e** in pyridine with an excess of hydroxylamine hydrochloride gave the isoxazoles **2d,e**. The ^{1}H NMR spectra of these compounds show the absence of a low field singlet near 11 ppm typical of the 7-OH group in the starting chromones **1d,e**. At the same time there are observed two singlets at higher field 8.9-9.7 ppm which are assigned to the 4- and 2-OH groups of a phenol ring. The aromatic proton signals are also shifted to higher field by 0.5 ppm when compared with the protons signals in the chromone ring.

Introduction into the reaction with hydroxylamine of 2-unsubstituted chromones **1b,c** under the same conditions gave the 2-aminochromones **3b,c**, the majority of whose ^{1}H NMR signals occurred in the same regions as the starting chromones **1b,c**. A difference is observed only in that, in place of the singlet at 8.6 ppm for the H-2 proton, in the products **1b,c** there appears a broadened, two-proton 2-amino group singlet which exchanges with D_2O and actually appears in the aromatic proton absorption region (7.45-7.48 ppm). In contrast to the isoxazoles **2** the 2-aminochromones **3b,c** are high melting compounds, poorly soluble in the majority of organic solvents.

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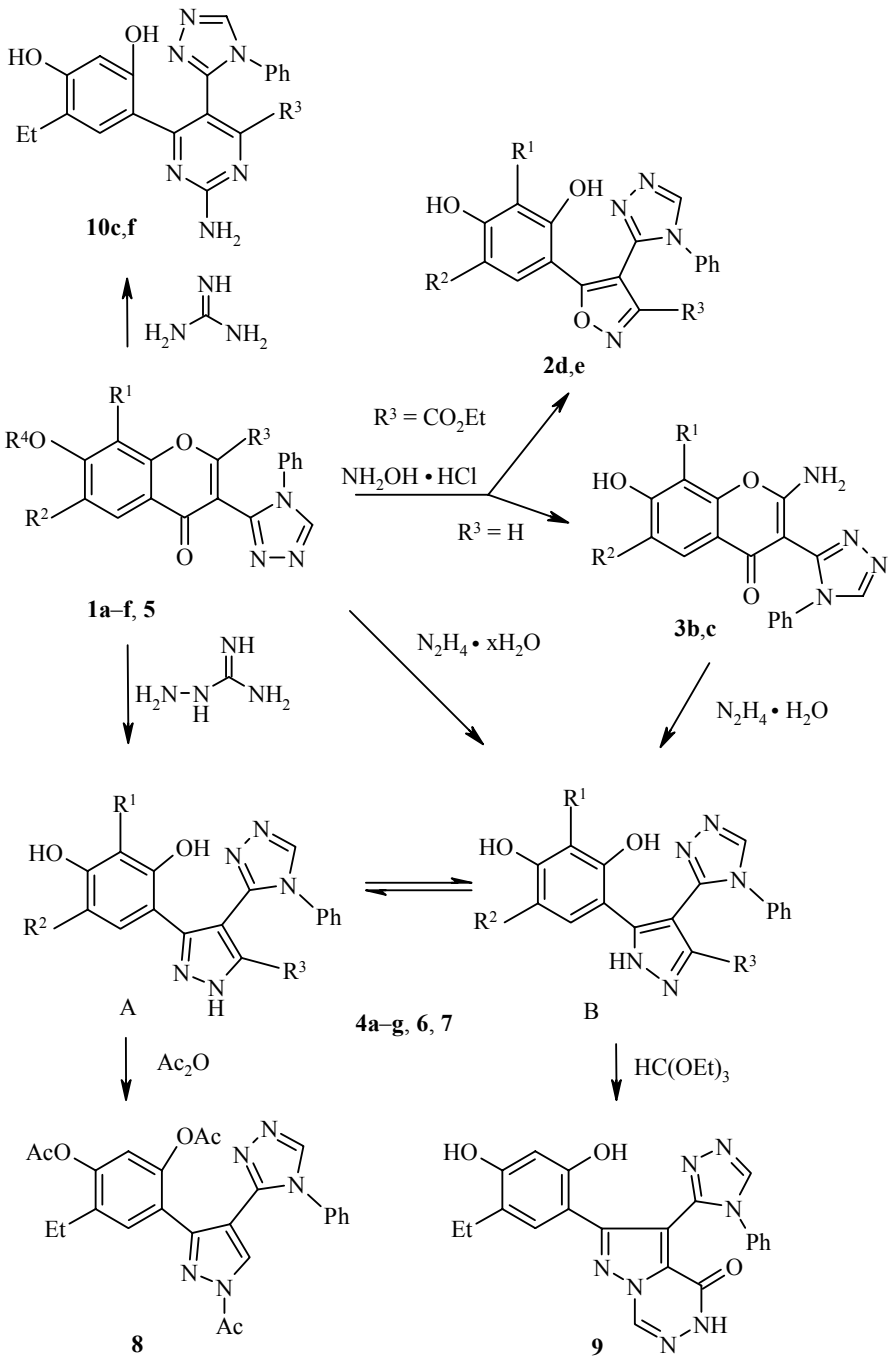

1a $R^1 = R^2 = R^3 = H$; **b** $R^1 = Me$, $R^2 = R^3 = H$; **c** $R^1 = R^3 = H$, $R^2 = Et$; **d** $R^1 = H$, $R^2 = Et$, $R^3 = CO_2Et$; **e** $R^1 = OH$, $R^2 = H$, $R^3 = CO_2Et$; **f** $R^1 = H$; $R^2 = Et$; $R^3 = CF_3$; **a–f** $R^4 = H$; **2d** $R^1 = H$, $R^2 = Et$, $R^3 = CO_2Et$, **e** $R^1 = OH$, $R^2 = H$, $R^3 = CO_2Et$; **3 b** $R^1 = Me$, $R^2 = H$, **c** $R^1 = H$, $R^2 = Et$; **4 a** $R^1 = R^2 = R^3 = H$; **b** $R^1 = Me$, $R^2 = R^3 = H$, **c** $R^1 = R^3 = H$, $R^2 = Et$, **d** $R^1 = H$, $R^2 = Et$, **c** $R^3 = CO_2Et$, **e** $R^1 = OH$, $R^2 = H$, $R^3 = CO_2Et$, **f** $R^1 = H$, $R^2 = Et$, $R^3 = CF_3$, **g** $R^1 = H$, $R^2 = Et$, $R^3 = Me$; **5** $R^1 = H$, $R^2 = Et$, $R^3 = Me$, $R^4 = Ac$; **6** $R^1 = H$, $R^2 = Et$, $R^3 = CONHNH_2$; **7** $R^1 = H$, $R^2 = Et$, $R^3 = NH_2$; **10 c** $R^3 = H$, **f** $R^3 = CF_3$

Previously, a short reflux of 2-carbethoxy-7-hydroxy-3-(4-phenyl-1,2,4-triazol-3-yl)chromone in an alcoholic solution of hydrazine hydrate gave 5-carbethoxy-3-(2,4-dihydroxyphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazole [6]. Under the same conditions, the 7-hydroxychromones **1a-f** are converted to the pyrazoles **4a-f** in high yields. When 7-acetoxy-2-methyl-3-(4-phenyl-1,2,4-triazol-3-yl)chromone (**5**) was introduced into the reaction the recyclization was accompanied by desacetylation of the acetoxy group to form the pyrazole **4g**.

A more prolonged reflux (4-7 h) of the 2-carbethoxychromone **1d** in alcohol with an excess of hydrazine hydrate gave a mixture of the ester **4d** and hydrazide **6**. The pure hydrazide **6** could only be obtained by refluxing a mixture of the products **4d** and **6** with hydrazine hydrate in DMF. The 2-aminochromone **3c** containing a strongly electron-donor group in position 2 also recyclizes to the 2-aminopyrazole **7** but only upon prolonged heating in high boiling alcohols (2-propanol, butanol) or in DMF. It should be noted that the yields of the product **7** do not exceed 40%. The pyrazoles **4,6,7** are colorless, high melting solids giving a characteristic blue-green color with a solution of ferric chloride as a result of chelate complex formation.

The IR spectra of pyrazoles **4,6,7** show OH and NH stretching bands at 3317-3452 and 3120-3200 cm^{-1} and triazole ring stretching at 1505-1520 cm^{-1}. The ^1H NMR spectra of the pyrazoles are characterized by the presence of three low field singlets: at lowest field (11.7-13.4 ppm) the N–H proton of the pyrazole ring and at 8-10 ppm the signals for the 4- and 2-OH protons. The spectra of compounds **4a,c,g** show doubling of these signals and also broadening of the pyrazole H-5 signal in compounds **4a,c** or the methyl group in position 5 of the pyrazole ring in product **4g** as a result of possible prototropism (**A**⇄**B**). According to the integrated intensity data the tautomer ratios of **A** to **B** in compounds **4a,c,g** are 2:1, 2.5:1, and 1:1.6 respectively. The ^1H NMR spectrum of the 5-aminopyrazole **7** shows a further D_2O exchangeable signal which is a broad, two-proton singlet for the amino group at 5.39 ppm. In the hydrazide **6** the NH_2 group protons absorb at 4.2 ppm and the N–H at 9.12 ppm. As a result of hindered rotation of the phenyl substituent in the triazole ring of compounds **4, 6, 7** its protons are nonequivalent and are seen as two signals of two and three protons in contrast to the starting chromones.

The presence of several functional groups in the pyrazoles **4, 6, 7** molecules permits their modification. The acetylation of compound **4c** with acetic anhydride gives the triacetyl derivative **8** whose ^1H NMR spectrum shows the presence of three three-proton singlets for the N-acetyl and two acetoxy groups at 1.98, 2.34, and 2.73 ppm respectively and also the absence of low field signals which are characteristic of the starting product **4c**.

Reaction of the hydrazide **6** with orthoformate gives the closed ring system pyrazolo[1,5-*d*]-[1,2,4]triazin-4(5H)one (**9**). The ^1H NMR of this compound shows singlets for the N–H proton at 12.33 ppm and the aromatic proton of the triazine ring at 8.82 ppm.

The signal for the proton at position 6 of the dihydroxyphenyl substituent is shifted by 0.43 ppm to low field when compared with the starting hydrazide **6**. The IR spectra of the ester **4d**, hydrazide **6**, and pyrazolotriazinone **9** show C=O stretching bands at 1705, 1649, and 1701 cm^{-1} respectively.

Treatment of the chromones **1c,f** with guanidine carbonate gives the pyrimidines **10c,f** which give a characteristic yellow color with an alcoholic solution of titanium tetrachloride. The ^1H NMR spectrum of compound **10c** shows a pyrimidine ring H-6 proton at 8.32 ppm and a broad, two-proton singlet for the amino group at 7.16 ppm.

In the 6-trifluoromethyl derivative **10f** this signal is shifted to lower field to 7.76 ppm. The protons of the N-phenyl substituent are nonequivalent and are seen as two signals as a consequence of hindered rotation for this ring. A particular feature of the ^1H NMR spectrum of the 6-trifluoromethylpyrimidine **10f** is the nonequivalence of the methylene protons of the ethyl group at position 5 of the dihydroxyphenyl ring and this is likely due to hindered rotation around the ethyl group $C_{(5)}$–CH_2 bond.

The reaction of the chromone **1c** with aminoguanidine (which contains both a hydrazine and also an amidine fragment) can occur by two routes to give both pyrazoles and pyrimidines. Refluxing equivalent amounts of the chromone **1c** with aminoguanidine hydrochloride in alcohol did not lead to a reaction. Addition of an equivalent of triethylamine as in the reaction with K_2CO_3 in DMF (under the conditions for the synthesis of the pyrimidines **10**) gave the same product which gives the characteristic blue-green coloration for pyrazoles

TABLE 1. Characteristics of Compounds **2-10**

Compound	Empirical formula	Found, %, N / Calculated, %, N	mp, °C	Recrystallizing solvent	Yield, %
2d	$C_{22}H_{20}N_4O_5$	13.40 / 13.33	123-124	Acetonitrile	40
2e	$C_{20}H_{16}N_4O_6$	13.64 / 13.72	126	Aqueous methanol	82
3b	$C_{18}H_{14}N_4O_3$	16.81 / 16.76	212	Aqueous DMF	30
3c	$C_{19}H_{16}N_4O_3$	16.28 / 16.08	>300	Ethanol	57
4a	$C_{17}H_{13}N_5O_2$	21.87 / 21.93	187-188	Aqueous methanol	60
4b	$C_{18}H_{15}N_5O_2$	21.06 / 21.01	182	Aqueous methanol	84
4c	$C_{19}H_{17}N_5O_2$	20.31 / 20.16	>300	Ethanol	86
4d	$C_{22}H_{21}N_5O_4$	16.88 / 16.70	168-169	Aqueous ethanol	60
4e	$C_{20}H_{17}N_5O_5$	17.22 / 17.19	172-173	Aqueous ethanol	95
4f	$C_{20}H_{16}F_3N_5O_2$	16.89 / 16.86	125-126	Ethanol	84
4g	$C_{20}H_{19}N_5O_2$	19.43 / 19.38	286-287	Ethanol	95
6	$C_{20}H_{19}N_7O_3$	24.49 / 24.19	>300	Aqueous DMF	82
7	$C_{19}H_{18}N_6O_2$	23.01 / 23.19	>300	Aqueous DMF	40
8	$C_{25}H_{23}N_5O_5$	14.95 / 14.79	99-100	Benzene	95
9	$C_{21}H_{17}N_7O_3$	23.54 / 23.60	184-185	Aqueous DMF	50
10c	$C_{20}H_{18}N_6O_2$	22.65 / 22.45	>300	DMF	53
10f	$C_{21}H_{17}F_3N_6O_2$	18.89 / 19.00	248-249	Methanol	51

with an alcoholic solution of ferric chloride. The ^{1}H NMR spectrum of this compound is identical to that of the product **4c**. The IR fingerprint regions for both of these products are identical. No depression of melting point was observed. Hence we can deduce that the reaction occurs with decomposition of the amidine molecular fragment to give the 3-(5-ethyl-2,4-dihydroxyphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazole (**4c**).

Thus the recyclization of 3-(4-phenyl-1,2,4-triazol-3-yl)-7-hydroxychromones with binucleophiles gives pyrazoles, isoxazoles, 2-aminochromones, and pyrimidines containing a triazole substituent.

EXPERIMENTAL

The purity of the compounds synthesized was monitored using TLC on Silufol UV-254 plates and chloroform–methanol (9:1) as eluent. ^{1}H NMR spectra were recorded using DMSO-d_6 on a Varian Mercury-400 (400 MHz) spectrometer with TMS as internal standard. IR spectra were taken for KBr tablets on a Nexus 475 spectrometer.

The physicochemical and spectroscopic characteristics of compounds **2-10** are given in Tables 1 and 2.

3-Carbethoxy-5-(3-R^1-5-R^2-2,4-dihydroxyphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)isoxazoles (2d-e). Hydroxylamine hydrochloride (0.31 g, 4.5 mmol) was added to a solution of the 2-carbethoxychromone **1d,e** (1.5 mmol) in pyridine (3 ml) and refluxed for 7 h (monitoring by TLC). The reaction product was poured into water and the precipitate obtained was recrystallized from the appropriate solvent.

TABLE 2. ^{1}H NMR Spectra of the Compounds Synthesized

Com-pound	Chemical, δ, ppm (*J*, Hz)
2d	1.14 (6H, t, *J* = 7.6, $\underline{CH_3}CH_2$ + $\underline{CH_3}CH_2OC(O)$); 2.50 (2H, q, *J* = 7.6, $\underline{CH_2}CH_3$); 4.08 (2H, q, *J* = 7.6, $CH_3\underline{CH_2}O$); 6.35 (1H, s, H_{Ar}-3); 7.15 (1H, s, H*$_{Ar}$-6); 7.37 (5H, m, C_6H_5); 8.80 (1H, s, $H_{triazole}$-5); 9.70 (1H, s, 4-OH); 9.74 (1H, s, 2-OH)
2e	1.14 (3H, t, *J* = 6.8, CH_3); 4.09 (2H, q, *J* = 6.8, CH_2); 6.43 (1H, d, *J* = 8.4, H_{Ar}-5); 6.86 (1H, d, *J* = 8.4, H_{Ar}-6); 7.37 (5H, s, C_6H_5); 8.51 (1H, s, 3-OH); 8.73 (1H, s, $H_{triazole}$-5); 9.00 (1H, s, 4-OH); 9.70 (1H, s, 2-OH)
3b	2.18 (3H, s, 8-CH_3); 6.75 (1H, d, *J* = 8.4, H-6); 7.36 (5H, s, C_6H_5); 7.44 (1H, d, *J* = 8.4, H-5); 7.48 (2H, br. s, NH_2); 8.64 (1H, s, $H_{triazole}$-5); 10.09 (1H, s, 7-OH)
3c	1.18 (3H, t, *J* = 7.6, CH_3); 2.57 (2H, q, *J* = 7.6, CH_2); 6.70 (1H, s, H-8); 7.38 (5H, s, C_6H_5); 7.45 (2H, br. s, NH_2); 7.49 (1H, s, H-5); 8.68 (1H, s, $H_{triazole}$-5); 10.32 (1H, s, 7-OH)
4a	6.17 (1H, d, *J* = 8, H_{Ar}-5); 6.24 (1H, s, H_{Ar}-3); 6.80 (1H, d, *J* = 8, H_{Ar}-6); 7.20 (2H, s, H_{Ph}-2',6'); 7.37 (3H, s, H_{Ph}-3',4',5'); 7.95 (1H, br. s, 4-OH); 8.81 (1H, br. s, $H_{pyrazole}$-5); 9.48 (1H, s, $H_{triazole}$-5); 9.70 (br. s, 2-OH(A)); 10.09 (br. s, 2-OH(B)); 12.93 (br. s, NH(A)); 13.29 (br. s, NH(B))
4b	1.98 (3H, s, CH_3); 6.19 (1H, d, *J* = 8, H_{Ar}-5); 6.55 (1H, d, *J* = 8, H_{Ar}-6); 7.17 (2H, s, H_{Ph}-2',6'); 7.33 (3H, s, H_{Ph}-3',4',5'); 7.93 (1H, br. s, 4-OH); 8.79 (1H, br. s, $H_{pyrazole}$-5); 9.19 (1H, s, $H_{triazole}$-5); 10.87 (1H, br. s, 2-OH); 13.39 (1H, br. s, NH)
4c	1.03 (3H, t, *J* = 7.6, CH_3); 2.34 (2H, q, *J* = 7.6, CH_2); 6.25 (1H, s, H_{Ar}-3); 6.59 (1H, s, H_{Ar}-6); 7.13 (2H, s, H_{Ph}-2',6'); 7.30 (3H, s, H_{Ph}-3',4',5'); 7.46 (1H, br. s, 4-OH); 8.63 (1H, s, $H_{triazole}$-5); 9.14 (1H, br. s, $H_{pyrazole}$-5); 9.69 (1H, br. s, 2-OH); 12.78 (1H, br. s, NH)
4d	1.04 (3H, t, *J* = 7.6, 5-$\underline{CH_3}CH_2$); 1.10 (3H, t, *J* = 6.8, $\underline{CH_3}CH_2CO$); 2.39 (2H, q, *J* = 7.6, 5-$CH_3\underline{CH_2}$); 4.02 (2H, q, *J* = 6.8, $CH_3\underline{CH_2}CO$); 6.38 (1H, s, H_{Ar}-3); 6.76 (1H, s, H_{Ar}-6); 7.18 (2H, d, *J* = 8.4, H_{Ph}-2',6'); 7.33 (3H, m, H_{Ph}-3',4',5'); 8.74 (1H, s, $H_{triazole}$-5); 9.37 (1H, s, 4-OH); 9.62 (1H, s, 2-OH); 13.41 (1H, s, NH)
4e	1.08 (3H, t, *J* = 7.6, CH_3); 3.97 (2H, q, *J* = 7.6, CH_2); 6.30 (1H, d, *J* = 8, H_{Ar}-5); 6.48 (1H, d, *J* = 8, H_{Ar}-6); 7.18 (2H, s, H_{Ph}-2',6'); 7.32 (3H, s, H_{Ph}-3',4',5'); 8.40 (1H, br. s, 3-OH); 8.72 (1H, s, $H_{triazole}$-5); 9.06 (1H, br. s, 4-OH); 9.30 (1H, br. s, 2-OH); 13.52 (1H, br. s, NH)
4f	1.00 (3H, t, *J* = 7.6, CH_3); 2.33 (2H, q, *J* = 7.6, CH_2); 6.30 (1H, s, H_{Ar}-3); 6.49 (1H, s, H_{Ar}-6); 6.93 (2H, s, H_{Ph}-2',6'); 7.27 (3H, s, H_{Ph}-3',4',5'); 8.67 (1H, s, $H_{triazole}$-5); 9.33 (1H, s, 4-OH); 9.44 (1H, s, 2-OH); 13.47 (1H, s, NH)
4g	0.98 (3H, t, *J* = 7.6, 5-$\underline{CH_3}CH_2$); 2.04 (3H, br. s, 5-$CH_{3pyrazole}$); 2.30 (2H, q, *J* = 7.6, 5-$CH_3\underline{CH_2}$); 6.22 (1H, s, H_{Ar}-3); 6.46 (1H, s, H_{Ar}-6); 7.06 (2H, s, H_{Ph}-2',6'); 7.27 (3H, s, H_{Ph}-3',4',5'); 8.75 (1H, br. s, 4-OH); 9.11 (1H, s, $H_{triazole}$-5); 10.14 (1H, br. s, 2-OH); 12.36 (br. s, N–H(A)); 12.99 (br. s, N–H(B))
6	1.01 (3H, t, *J* = 7.6, CH_3); 2.33 (2H, q, *J* = 7.6, CH_2); 4.20 (2H, br. s, NH_2); 6.35 (1H, s, H_{Ar}-3); 6.57 (1H, s, H_{Ar}-6); 7.21 (2H, s, H_{Ph}-2',6'); 7.29 (3H, s, H_{Ph}-3',4',5'); 8.66 (1H, s, $H_{triazole}$-5); 9.12 (1H, s, CONH); 9.30 (1H, s, 4-OH); 9.56 (1H, s, 2-OH); 13.08 (1H, s, NH_{ring})
7	0.96 (3H, t, *J* = 7.6, CH_3); 2.27 (2H, q, *J* = 7.6, CH_2); 5.29 (2H, br. s, NH_2); 6.16 (1H, s, H_{Ar}-3); 6.31 (1H, s, H_{Ar}-6); 8.68 (1H, s, $H_{triazole}$-5); 9.03 (1H, s, 4-OH); 10.73 (1H, br. s, 2-OH); 11.66 (1H, br. s, NH)
8	1.07 (3H, t, *J* = 7.6, 5-$\underline{CH_3}CH_2$); 1.98 (3H, s, $CH_3C(O)N$); 2.34 (5H, s + q, 4-$CH_3C(O)O$ + 5-$CH_3\underline{CH_2}$); 2.73 (3H, s, 2-$CH_3C(O)O$); 6.59 (1H, s, H_{Ar}-3); 6.78 (1H, s, H_{Ar}-6); 6.82 (2H, d, *J* = 7.2, H_{Ar}-2',6'); 7.18 (3H, m, H_{Ar}-3',4',5'); 8.61 (1H, s, $H_{triazole}$-5); 8.77 (1H, s, $H_{pyrazole}$-5)
9	1.12 (3H, t, *J* = 7.6, CH_3); 2.45 (2H, q, *J* = 7.6, CH_2); 6.30 (1H, s, H_{Ar}-3); 7.00 (1H, s, H_{Ar}-6); 7.34 (5H, m, C_6H_5); 8.76 (1H, s, $H_{triazole}$-5); 8.82 (1H, s, $H_{triazine}$-7); 9.22 (1H, s, 4-OH); 9.35 (1H, s, 2-OH); 12.33 (1H, s, NH)
10c	0.93 (3H, t, *J* = 7.6, CH_3); 2.24 (2H, q, *J* = 7.6, CH_2); 6.05 (1H, s, H_{Ar}-3); 6.25 (1H, s, H_{Ar}-6); 6.78 (2H, d, *J* = 7.2, H_{Ph}-2',6'); 7.16 (2H, br. s, NH_2); 7.23 (3H, m, H_{Ph}-3',4',5'); 8.32 (1H, s, $H_{pyrimidine}$-6); 8.67 (1H, s, $H_{triazole}$-5); 9.62 (1H, s, 4-OH); 11.71 (1H, s, 2-OH)
10f	0.92 (3H, t, *J* = 7.6, CH_3); 2.22 (2H, dq, $J_{H\alpha,H\beta}$ = 34.8, $CH_3\underline{CH_2}$); 6.15 (1H, s, H_{Ar}-3); 6.25 (1H, s, H_{Ar}-6); 6.63 (2H, d, H_{Ph}-2',6'); 7.25 (3H, m, H_{Ph}-3',4',5'); 7.76 (2H, br. s, NH_2), 8.73 (1H, s, $H_{triazole}$-5); 9.80 (1H, s, 4-OH); 11.26 (1H, s, 2-OH)

* H_{Ar} = phenyl ring protons.

8-R^1-6-R^2-2-Amino-7-hydroxy-3-(4-phenyl-1,2,4-triazol-3-yl)-chromones (3b,c) were prepared from the chromones **1b,c** by the preceding method with refluxing for 10-17 h.

5-R^3-3-(3-R^1-5-R^2-2,4-Dihydroxyphenyl-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazoles (4a-g). Hydrazine hydrate (2 g, 60 mmol) was added to a suspension of the corresponding chromone **1a-f** or 7-acetoxychromone **5** [7] (2 mol) in ethanol (2 ml) and refluxed for 5-10 min (monitoring by TLC). The reaction mixture was cooled and the precipitate formed was filtered off (or separated in water and the precipitate then filtered).

3-(5-Ethyl-2,4-dihydroxyphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazol-5-yl Carboxylic Acid Hydrazide (6). A solution of ester **4e** (0.5 g) and hydrazine hydrate (0.5 ml) was refluxed in DMF (1 ml) for 30 min, cooled, poured into water (50 ml), and the precipitate was filtered off.

5-Amino-3-(5-ethyl-2,4-dihydroxyphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazole (7) was prepared from the ethylchromone **3c** (1 g, 3 mmol) using the method for compound **4** with refluxing in 2-propanol, butanol, or DMF over 14-26 h (monitored by TLC).

1-Acetyl-3-(2,4-diacetoxy-5-ethylphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazole (8) was prepared by refluxing the pyrazole **4c** (0.35 g, 1 mmol) in acetic anhydride (1.63 g, 16 mmol) for 2 h. After cooling the reaction product was poured into ice, triturated, and the precipitate was filtered off.

2-(5-Ethyl-2,4-dihydroxyphenyl)-3-(4-phenyl-1,2,4-triazol-3-yl)pyrazolo[1,5-*d*][1,2,4]triazin-4(5H)-one (9). A solution of the hydrazide **6** (0.2 g, 0.5 mmol) and triethylorthoformate (0.26 g, 1.5 mmol) in DMF (2 ml) was refluxed for 4.5 h. After cooling and pouring into water (100 ml) the precipitate formed was filtered off.

6-R^3-2-Amino-4-(5-ethyl-2,4-dihydroxyphenyl)-5-(4-phenyl-1,2,4-triazol-3-yl)pyrimidines 10c,f. A solution of the corresponding 6-ethylchromone **1c** or **1f** (1 mmol) and guanidine carbonate (0.18 g, 1 mmol) in DMF (1 ml) was refluxed for 3.5-9 h. The product was cooled, poured into water (50 ml), neutralized with acetic acid, and the precipitate filtered off.

3-(5-Ethyl-2,4-dihydroxyphenyl)-4-(4-phenyl-1,2,4-triazol-3-yl)pyrazole (4c) was prepared by treating the 6-ethylchromone **1c** (0.33 g, 1 mmol), aminoguanidine hydrochloride (0.11 g, 1 mmol), and K_2CO_3 (0.069 g, 0.5 mmol) in DMF by the method reported for compound **10** or from the product **1c**, aminoguanidine hydrochloride, and triethylamine (1 mmole of each) according to the method for compound **4**.

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