Ethyl-3,4-diaroyl-2-cyanobutyrate: A Synthon for Novel Heterocycles

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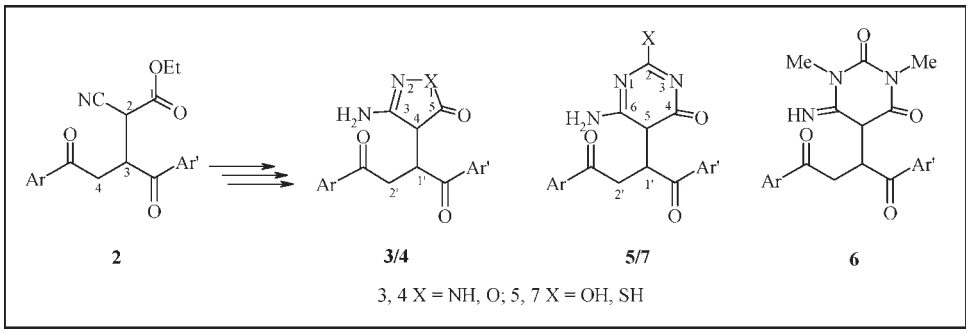

A new class of aminopyrazolones, aminoisoxazolones, aminopyrimidinones, and thioxopyrimidinones were synthesized from Michael adduct, ethyl-3,4-diaroyl-2-cyanobutyrate, on reaction with different nucleophiles, hydrazine hydrate, hydroxylamine hydrochloride, and urea derivatives.

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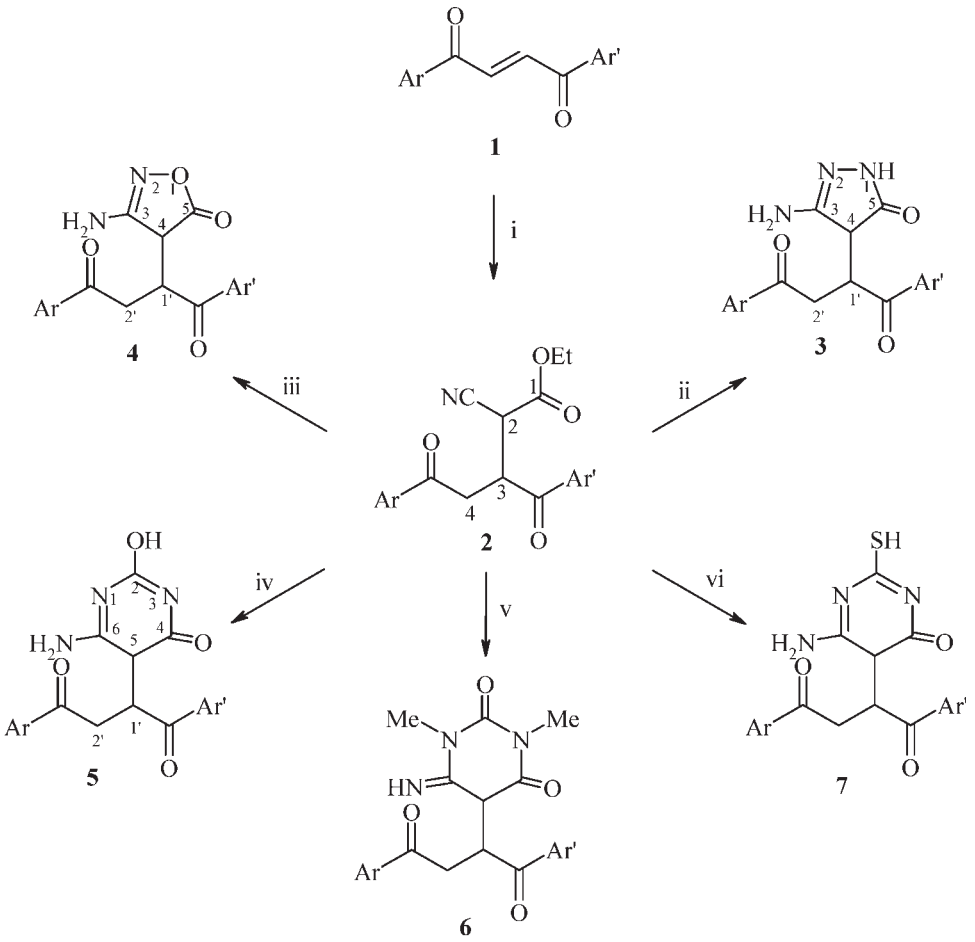
INTRODUCTION

A large number of heterocyclic compounds play a vital role as drugs and pharmaceutical agents. A number of barbiturate and thiobarbiturate derivatives exhibit anticonvulsant, anaesthetic, sedative, and hypnotic properties [1–5]. In fact, phenobarbital and mephobarbital are used for clinical treatment of epilepsy [6]. Besides, methohexital is still used worldwide in hospitals as injection narcotics [7]. Increasing evidence suggests that pyrazole and isoxazole derivatives possess a broad spectrum of biological activity such as bacteriostatic, antidiabetic, analgesic, antiarrhythmic, anti-inflammatory, antifungal, and antiviral properties [8–13]. Celecoxib, a pyrazole derivative, valdecoxib, an isoxazole derivative are now being used as anti-inflammatory drugs [14]. Thus, the development of practical and convenient method for the construction of nitrogen containing heterocycles is an important goal. Michael adducts afford a rich and diverse array of options for the synthesis of variety of five and six membered heterocycles. In fact, we have exploited a variety of Michael adducts to develop different heterocycles [15–19]. In a continuing quest for further ways of utilizing Michael adducts, the present work has been taken up.

RESULTS AND DISCUSSION

The synthetic scheme involves the Michael addition of ethyl cyanoacetate to (*E*)-1,4-diaroylbut-2-ene-1,4-dione (**1**) in the presence of K_2CO_3 in MEK to get ethyl-3,4-diaroyl-2-cyanobutyrate (**2**) (Scheme 1 and Table 1). The IR spectra of **2** displayed absorption bands at 2241–2250 (CN), 1698–1715 (ArCO), 1731–1748 cm^{-1} (CO_2Et) (Table 2). The ^1H NMR spectrum of **2a** showed a doublet at 4.53 (C_2—H), a multiplet at 4.02–4.07 (C_3—H), and two double doublets at 3.27 and 3.35 ppm (C_4—H). Apart from these, a quartet and a triplet are observed at 3.54, 1.25 ppm due to carboethoxy group (Table 3). The *gem*-cyanoester functionality in **2** is exploited to get the desired heterocycles. The cyclocondensation of **2** with hydrazine hydrate in the presence of piperidine in ethanol produced 3-amino-4(1′,2′-diaroylethyl)-1*H*-pyrazol-5(4*H*)-one (**3**). Likewise, the reaction of **2** with hydroxylamine hydrochloride gave 3-amino-4-(1′,2′-diaroylethyl)isoxazolo-5(4*H*)-one (**4**) (Scheme 1 and Table 1). The IR spectra of **3** and **4** displayed absorption bands at 3342–3375, 3438–3479 (NH_2), 1604–1624 (C=N), 1624–1636 (*C*ONH), 1692–1711 (Ar-CO), and at 1738–1749 cm^{-1} (*C*O—O) (Table 2). The ^1H NMR spectra of **3a** and **4a** exhibited a doublet at 4.37, 4.34 for C_4—H, a multiplet at 4.17–4.22, 4.15–4.24 for C_1'—H and two double doublets at 3.14 and 3.82 and 3.11 and 3.72 ppm for C_2'—H. Further, a broad singlet is observed at 5.87, 5.90 ppm due to NH_2 which disappeared on deuteration (Table 3). Similar reaction of **2** with urea, *N*,*N*′-dimethylurea, and thiourea produced 6-amino-5-(1′,2′-diaroylethyl)-2-hydroxypyrimidine-4(5*H*)-one (**5**), 6-imino-5-(1′,2′-diaroylethyl)-1,3-

Scheme 1



(i) $CNCH_2CO_2Et$ / K_2CO_3 / MEK
(ii) $NH_2NH_2.H_2O$ / Piperidine / EtOH
(iii) $NH_2OH.HCl$ / Piperidine / EtOH
(iv) NH_2CONH_2 / Piperidine / EtOH
(v) MeNHCONHMe / Piperidine / EtOH
(vi) NH_2CSNH_2 / Piperidine / EtOH

	Ar	Ar'
a	C_6H_5,	C_6H_5
b	*p*-$CH_3C_6H_4$	*p*-$CH_3C_6H_4$
c	*p*-ClC_6H_4	*p*-ClC_6H_4
d	C_6H_5	*p*-$CH_3C_6H_4$
e	C_6H_5	*p*-ClC_6H_4
f	*p*-$CH_3C_6H_4$	*p*-ClC_6H_4

dimethyl-pyrimidine-2,4(5*H*)-dione (**6**), and 6-amino-5-(1′,2′-diaroylethyl)-2-mercapto-pyrimidine-4(5*H*)-one (**7**), respectively (Scheme 1 and Table 1). The IR spectra of **5–7** showed absorption bands in the regions 3345–3460 (NH_2), 1625–1645 (*CO*—N), and 1695–1715 cm^{-1} (Ar-CO). In addition to these, the compound **5** displayed a band at 3315–3321 (OH), **6** at 1629–1642 (C=O of pyrimidine ring), and 3311–3238 cm^{-1} (NH), while **7** at 2543–2564 cm^{-1} (SH). The compounds **5** and **7** also showed an absorption band at 1603–1617 cm^{-1} (C=N) (Table 2). The ^1H NMR spectra of **5a, 6a,** and **7a** displayed a doublet at 4.37, 4.39, 4.33 for C_5—H, a multiplet at 4.18–4.24, 4.15–4.21, 4.13–4.25 for C_1'—H and two doublet of doublets at 3.08 and 3.82, 307 and 3.76, 3.04 and 3.77 ppm for C_2'—H. Besides these, **6a** showed two singlets at 2.73 and 2.75 for *N*-methyl protons and a broad singlet at 9.24 ppm for =NH. The compounds **5a** and **7a** also displayed a broad singlet at 5.87 and 5.73 ppm for NH_2. Another singlet is observed at 6.90 in **5a** due to OH and at 1.33 ppm in **7a** due to SH. The signals of NH, NH_2, OH, and SH are disappeared on deuteration. The structures of all the new compounds are further confirmed by ^{13}C NMR spectra (Table 3).

Table 1

Physical and analytical data of compounds **2–10.**

Compound	Mp (°C)	Yield (%)	Ar	Ar′	Molecular formula	Analysis % Calcd./Found		
						C	H	N
2a	116–118	72	C_6H_5	C_6H_5	$C_{21}H_{19}NO_4$ (349.38)	72.19	5.48	4.01
						72.29	5.46	4.14
2b	130–132	70	*P*-$CH_3C_6H_4$	*P*-$CH_3C_6H_4$	$C_{23}H_{23}NO_4$ (377.43)	73.19	6.14	3.71
						73.22	6.12	3.75
2c	144–146	78	*P*-ClC_6H_4	*P*-ClC_6H_4	$C_{21}H_{17}Cl_2NO_4$ (418.27)	60.30	4.10	3.35
						60.24	4.06	3.37
2d	138–140	74	C_6H_5	*P*-$CH_3C_6H_4$	$C_{22}H_{21}NO_4$ (363.41)	72.71	5.82	3.85
						72.67	5.85	3.80
2e	152–154	76	C_6H_5	*P*-ClC_6H_4	$C_{21}H_{18}ClNO_4$ (383.82)	65.71	4.73	3.65
						65.79	4.71	3.67
2f	126–128	73	*P*-$CH_3C_6H_4$	*P*-ClC_6H_4	$C_{22}H_{20}ClNO_4$ (397.85)	66.42	5.07	3.52
						66.51	5.02	3.50
3a	156–158	85	C_6H_5	C_6H_5	$C_{19}H_{17}N_3O_3$ (335.36)	68.05	5.11	12.53
						68.00	5.15	12.59
3b	165–167	82	*P*-$CH_3C_6H_4$	*P*-$CH_3C_6H_4$	$C_{21}H_{21}N_3O_3$ (363.41)	69.41	5.82	11.56
						69.50	5.80	11.66
3c	172–174	87	*P*-ClC_6H_4	*P*-ClC_6H_4	$C_{19}H_{15}Cl_2N_3O_3$ (404.25)	56.45	3.74	10.39
						56.38	3.71	10.45
3d	175–177	80	C_6H_5	*P*-$CH_3C_6H_4$	$C_{20}H_{19}N_3O_3$ (349.38)	68.75	5.48	12.03
						68.81	5.50	12.09
3e	180–182	78	C_6H_5	*P*-ClC_6H_4	$C_{19}H_{16}ClN_3O_3$ (369.8)	61.71	4.36	11.36
						61.76	4.40	11.30
3f	166–168	84	*P*-$CH_3C_6H_4$	*P*-ClC_6H_4	$C_{20}H_{18}ClN_3O_3$ (383.83)	62.58	4.73	10.95
						62.52	4.70	11.02
4a	151–153	75	C_6H_5	C_6H_5	$C_{19}H_{16}N_2O_4$ (336.34)	67.85	4.79	8.33
						67.89	4.84	8.37
4b	164–166	77	*P*-$CH_3C_6H_4$	*P*-$CH_3C_6H_4$	$C_{21}H_{20}N_2O_4$ (364.39)	69.22	5.53	7.69
						69.18	5.51	7.66
4c	170–172	72	*P*-ClC_6H_4	*P*-ClC_6H_4	$C_{19}H_{14}Cl_2N_2O_4$ (405.23)	56.31	3.48	6.91
						56.35	3.49	6.94
4d	176–178	74	C_6H_5	*P*-$CH_3C_6H_4$	$C_{20}H_{18}N_2O_4$ (350.37)	68.56	5.18	8.00
						68.60	5.17	8.08
4e	161–163	70	C_6H_5	*P*-ClC_6H_4	$C_{19}H_{15}ClN_2O_4$ (370.79)	61.55	4.08	7.56
						61.58	4.06	7.52
4f	154–156	67	*P*-$CH_3C_6H_4$	*P*-ClC_6H_4	$C_{20}H_{17}ClN_2O_4$ (384.81)	62.42	4.45	7.28
						62.38	4.48	7.24
5a	182–184	65	C_6H_5	C_6H_5	$C_{20}H_{17}N_3O_4$ (363.37)	66.11	4.72	11.56
						66.08	4.71	11.66
5b	201–203	68	*P*-$CH_3C_6H_4$	*P*-$CH_3C_6H_4$	$C_{22}H_{21}N_3O_4$ (391.42)	67.51	5.41	10.74
						67.57	5.45	10.80
5c	215–217	70	*P*-ClC_6H_4	*P*-ClC_6H_4	$C_{20}H_{15}Cl_2N_3O_4$ (432.26)	55.57	3.50	9.72
						55.61	3.51	9.80
5d	188–190	73	C_6H_5	*P*-$CH_3C_6H_4$	$C_{21}H_{19}N_3O_4$ (377.39)	66.83	5.07	11.13
						66.89	5.10	11.20
5e	194–196	76	C_6H_5	*P*-ClC_6H_4	$C_{20}H_{16}ClN_3O_4$ (397.81)	60.38	4.05	10.56
						60.35	4.04	10.60
5f	207–209	69	*P*-$CH_3C_6H_4$	*P*-ClC_6H_4	$C_{21}H_{18}ClN_3O_4$ (411.84)	61.24	4.41	10.20
						61.28	4.44	10.15
6a	186–188	64	C_6H_5	C_6H_5	$C_{22}H_{21}N_3O_4$ (391.42)	67.51	5.41	10.74
						67.45	5.42	10.71
6b	204–206	66	*P*-$CH_3C_6H_4$	*P*-$CH_3C_6H_4$	$C_{24}H_{25}N_3O_4$ (419.47)	68.72	6.01	10.02
						68.80	6.00	10.08
6c	219–221	62	*P*-ClC_6H_4	*P*-ClC_6H_4	$C_{22}H_{19}Cl_2N_3O_4$ (460.31)	57.40	4.16	9.13
						57.45	4.14	9.08
6d	193–195	65	C_6H_5	*P*-$CH_3C_6H_4$	$C_{23}H_{23}N_3O_4$ (405.45)	68.13	5.72	10.36
						68.19	5.75	10.42
6e	198–200	68	C_6H_5	*P*-ClC_6H_4	$C_{22}H_{20}ClN_3O_4$ (425.86)	62.05	4.73	9.87
						62.09	4.71	9.82
6f	211–213	63	*P*-$CH_3C_6H_4$	*P*-ClC_6H_4	$C_{23}H_{22}ClN_3O_4$ (439.89)	62.80	5.04	9.55
						62.87	5.02	9.59

(*Continued*)

Table 1
(*Continued*)

Compound	Mp (°C)	Yield (%)	Ar	Ar′	Molecular formula	Analysis % Calcd./Found C	H	N
7a	195–197	74	C_6H_5	C_6H_5	$C_{20}H_{17}N_3O_3S$ (379.43)	63.31	4.52	11.07
						63.28	4.51	11.14
7b	214–216	72	*P*-$CH_3C_6H_4$	*P*-$CH_3C_6H_4$	$C_{22}H_{21}N_3O_3S$ (407.49)	64.85	5.19	10.31
						64.89	5.22	10.36
7c	220–222	66	*P*-ClC_6H_4	*P*-ClC_6H_4	$C_{20}H_{15}Cl_2N_3O_3S$ (448.32)	53.58	3.37	9.37
						53.57	3.40	9.32
7d	218–220	77	C_6H_5	*P*-$CH_3C_6H_4$	$C_{21}H_{19}N_3O_3S$ (393.46)	64.10	4.87	10.68
						64.13	4.86	10.74
7e	205–207	71	C_6H_5	*P*-ClC_6H_4	$C_{20}H_{16}ClN_3O_3S$ (413.88)	58.04	3.90	10.15
						58.00	3.88	10.17
7f	225–227	69	*P*-$CH_3C_6H_4$	*P*-ClC_6H_4	$C_{21}H_{18}ClN_3O_3S$ (427.9)	58.94	4.24	9.82
						58.97	4.27	9.88

Table 2
IR data of compounds **2–10**.

Compound	IR (KBr) cm^{-1} C≡N/C=N	C=O	Ar-C=O	CO_2Et	OH/SH	NH	NH_2	
2a	2243	–	1710	1733	–	–	–	–
2b	2250	–	1702	1735	–	–	–	–
2c	2246	–	1698	1731	–	–	–	–
2d	2241	–	1704	1736	–	–	–	–
2e	2245	–	1715	1742	–	–	–	–
2f	2244	–	1701	1748	–	–	–	–
3a	1608	1634	1695	–	–	3210	3361	3472
3b	1613	1628	1702	–	–	3204	3357	3479
3c	1606	1631	1707	–	–	3209	3361	3474
3d	1624	1636	1698	–	–	3201	3358	3444
3e	1619	1630	1690	–	–	3206	3342	3438
3f	1621	1624	1696	–	–	3200	3350	3442
4a	1605	1741	1703	–	–	–	3352	3449
4b	1609	1749	1700	–	–	–	3349	3451
4c	1613	1746	1692	–	–	–	3364	3448
4d	1610	1738	1695	–	–	–	3375	3452
4e	1604	1744	1704	–	–	–	3357	3445
4f	1610	1742	1711	–	–	–	3338	3443
5a	1603	1644	1707	–	3328	–	3351	3457
5b	1610	1634	1713	–	3315	–	3347	3449
5c	1612	1640	1699	–	3331	–	3361	3452
5d	1618	1636	1711	–	3324	–	3359	3445
5e	1616	1638	1702	–	3322	–	3361	3448
5f	1609	1645	1709	–	3319	–	3352	3454
6a	–	1634	1715	–	–	3211	–	–
6b	–	1642	1712	–	–	3216	–	–
6c	–	1632	1697	–	–	3234	–	–
6d	–	1629	1692	–	–	3222	–	–
6e	–	1634	1701	–	–	3227	–	–
6f	–	1631	1694	–	–	3238	–	–
7a	1610	1633	1702	–	2564	–	3350	3451
7b	1612	1639	1709	–	2557	–	3346	3446
7c	1601	1643	1705	–	2545	–	3362	3454
7d	1609	1637	1699	–	2543	–	3351	3444
7e	1604	1635	1711	–	2559	–	3362	3446
7f	1617	1640	1702	–	2561	–	3353	3453

Table 3

^{1}H and ^{13}C NMR data of compounds **2–7**.

Compound	^{1}H NMR ($CDCl_3$/DMSO-d_6) δ, ppm	^{13}C NMR ($CDCl_3$/DMSO-d_6) δ, ppm
2a	1.25 (t, 3H, OCH_2CH_3), 3.27 (dd, 1H, C_4—H, J = 8.6, 14.4 Hz), 3.35 (dd, 1H, C_4—H, J = 4.2, 14.6 Hz), 3.54 (q, 2H, OCH_2CH_3), 4.02–4.07 (m, 1H, C_3—H), 4.53 (d, 1H, C_2—H, J = 8.6 Hz), 7.16–7.48 (m, 10H, Ar-H)	13.9 (OCH_2CH_3), 36.1 (C-3), 41.6 (C-2), 52.9 (C-4), 61.1 (OCH_2CH_3), 116.2 (CN), 166.8 (CO_2Et), 205.8 (Ar-CO), 206.2 (Ar′-CO), 125.7, 127.7, 128.5, 129.1, 131.4, 134.2, 134.7, 135.9 (aromatic carbons)
2b	1.28 (t, 3H, OCH_2CH_3), 2.26 (s, 6H, Ar-CH_3 and Ar′-CH_3), 3.24 (dd, 1H, C_4—H, J = 9.0, 14.3 Hz), 3.29 (dd, 1H, C_4—H, J = 4.5, 14.8 Hz), 3.51 (q, 2H, OCH_2CH_3), 3.97–3.99 (m, 1H, C_3—H), 4.48 (d, 1H, C_2—H, J = 8.5 Hz), 7.21–7.46 (m, 8H, Ar-H)	22.7 (Ar-CH_3 and Ar′-CH_3), 13.4 (OCH_2CH_3), 36.8 (C-3), 42.1 (C-2), 51.6 (C-4), 62.0 (OCH_2CH_3), 114.9 (CN), 167.6 (CO_2Et), 205.1 (Ar-CO), 206.6 (Ar′-CO), 126.1, 128.4, 128.9, 129.7, 132.5, 134.3, 134.7, 135.1 (aromatic carbons)
2c	1.31 (t, 3H, OCH_2CH_3), 3.28 (dd, 1H, C_4—H, J = 8.8, 14.5 Hz), 3.31 (dd, 1H, C_4—H, J = 4.4, 14.6 Hz), 3.57 (q, 2H, OCH_2CH_3), 3.92–4.01 (m, 1H, C_3—H), 4.51 (d, 1H, C_2—H, J = 8.7 Hz), 7.26–7.58 (m, 8H, Ar-H)	13.7 (OCH_2CH_3), 37.4 (C-3), 42.9 (C-2), 52.1 (C-4), 62.6 (OCH_2CH_3), 114.2 (CN), 167.9 (CO_2Et), 205.9 (Ar-CO), 206.0 (Ar′-CO), 126.8, 128.9, 129.9, 132.2, 134.5, 134.2, 136.9 (aromatic carbons)
2d	1.27 (t, 3H, OCH_2CH_3), 2.25 (s, 3H, Ar′-CH_3), 3.25 (dd, 1H, C_4—H, J = 8.5, 14.2 Hz), 3.34 (dd, 1H, C_4—H, J = 4.6, 14.4 Hz), 3.55 (q, 2H, OCH_2CH_3), 3.91–4.03 (m, 1H, C_3—H), 4.54 (d, 1H, C_2—H, J = 8.6 Hz), 7.21–7.51 (m, 9H, Ar-H)	13.0 (OCH_2CH_3), 22.4 (Ar′-CH_3), 37.1 (C-3), 42.4 (C-2), 52.3 (C-4), 62.2 (OCH_2CH_3), 114.8 (CN), 167.2 (CO_2Et), 205.6 (Ar-CO), 206.8 (Ar′-CO), 126.2, 128.4, 129.3, 132.0, 134.1, 134.8, 135.1 (aromatic carbons)
2e	1.34 (t, 3H, OCH_2CH_3), 3.21 (dd, 1H, C_4—H, J = 8.3, 14.5 Hz), 3.31 (dd, 1H, C_4—H, J = 4.5, 14.3 Hz), 3.58 (q, 2H, OCH_2CH_3), 3.94–4.01 (m, 1H, C_3—H), 4.52 (d, 1H, C_2—H, J = 8.6 Hz), 7.28–7.67 (m, 9H, Ar-H)	13.2 (OCH_2CH_3), 37.6 (C-3), 42.7 (C-2), 52.6 (C-4), 62.8 (OCH_2CH_3), 114.3 (CN), 167.1 (CO_2Et), 205.7 (Ar-CO), 206.4 (Ar′-CO), 126.8, 127.9, 129.2, 132.8, 134.7, 135.9, 135.1 (aromatic carbons)
2f	1.26 (t, 3H, OCH_2CH_3), 2.27 (s, 3H, Ar-CH_3), 3.25 (dd, 1H, C_4—H, J = 8.2, 14.2 Hz), 3.34 (dd, 1H, C_4—H, J = 4.6, 14.4 Hz), 3.50 (q, 2H, OCH_2CH_3), 3.93–4.04 (m, 1H, C_3—H), 4.50 (d, 1H, C_2—H, J = 8.8 Hz), 7.31–7.74 (m, 9H, Ar-H)	13.8 (OCH_2CH_3), 21.9 (Ar-CH_3), 37.3 (C-3), 42.9 (C-2), 52.3 (C-4), 62.0 (OCH_2CH_3), 114.1 (CN), 167.1 (CO_2Et), 205.2 (Ar-CO), 206.9 (Ar′-CO), 126.1, 127.6, 129.0, 132.2, 133.4, 134.9, 136.4 (aromatic carbons)
3a	3.14 (dd, 1H, C_2'—H, J = 4.3, 14.1 Hz), 3.82 (dd, 1H, C_2'—H, J = 9.1, 14.3 Hz), 4.17–4.22 (m, 1H, C_1'—H), 4.37 (d, 1H, C_4—H, J = 5.6 Hz), 5.87 (bs, 2H, NH_2), 7.10–7.85 (m, 10H, Ar-H), 9.11 (bs, 1H, NH)	53.1 (C-2′), 55.8 (C-1′), 62.9 (C-4), 156.6 (C-5), 171.5 (C-3), 205.5 (Ar-CO), 206.2 (Ar′-CO), 129.6, 130.2, 131.8, 132.9, 133.6, 134.9, 135.4, 136.2 (aromatic carbons)
3b	2.24 (s, 6H, Ar-CH_3 and Ar′-CH_3), 3.10 (dd, 1H, C_2'—H, J = 4.1, 14.0 Hz), 3.79 (dd, 1H, C_2'—H, J = 9.2, 14.1 Hz), 4.12–4.25 (m, 1H, C_1'—H), 4.35 (d, 1H, C_4—H, J = 5.4 Hz), 5.82 (bs, 2H, NH_2), 7.12–7.81 (m, 8H, Ar-H), 9.19 (bs, 1H, NH)	22.4 (Ar-CH_3 and Ar′-CH_3), 53.8 (C-2′), 56.1 (C-1′), 63.3 (C-4), 156.9 (C-5), 169.5 (C-3), 205.6 (Ar-CO), 206.6 (Ar′-CO), 128.5, 129.1, 130.6, 131.5, 132.2, 133.5, 134.1, 135.4 (aromatic carbons)
3c	3.08 (dd, 1H, C_2'—H, J = 4.0, 14.2 Hz), 3.74 (dd, 1H, C_2'—H, J = 9.1, 14.3 Hz), 4.15–4.21 (m, 1H, C_1'—H), 4.34 (d, 1H, C_4—H, J = 5.4 Hz), 5.84 (bs, 2H, NH_2), 7.14–7.86 (m, 8H, Ar-H), 9.78 (bs, 1H, NH)	53.3 (C-2′), 56.5 (C-1′), 63.9 (C-4), 157.1 (C-5), 169.9 (C-3), 205.2 (Ar-CO), 206.9 (Ar′-CO), 128.9, 129.7, 130.2, 131.2, 132.9, 133.9, 134.9, 136.4 (aromatic carbons)
3d	2.28 (s, 3H, Ar′-CH_3), 3.12 (dd, 1H, C_2'—H, J = 4.3, 14.4 Hz), 3.78 (dd, 1H, C_2'—H, J = 9.2, 14.4 Hz), 4.11–4.24 (m, 1H, C_1'—H), 4.38 (d, 1H, C_4—H, J = 5.7 Hz), 5.89 (bs, 2H, NH_2), 7.10–7.82 (m, 9H, Ar-H), 9.86 (bs, 1H, NH)	21.5 (Ar′-CH_3), 53.5 (C-2′), 56.3 (C-1′), 63.6 (C-4), 156.7 (C-5), 169.1 (C-3), 205.0 (Ar-CO), 206.2 (Ar′-CO), 128.1, 129.4, 130.8, 131.9, 132.1, 133.7, 134.2, 135.9 (aromatic carbons)
3e	3.07 (dd, 1H, C_2'—H, J = 4.1, 14.2 Hz), 3.74 (dd, 1H, C_2'—H, J = 9.0, 14.3 Hz), 4.16–4.27 (m, 1H, C_1'—H), 4.36 (d, 1H, C_4—H, J = 5.4 Hz), 5.86 (bs, 2H, NH_2), 7.19–7.69 (m, 9H, Ar-H), 9.71 (bs, 1H, NH)	52.6 (C-2′), 56.0 (C-1′), 63.2 (C-4), 157.2 (C-5), 169.6 (C-3), 205.4 (Ar-CO), 206.8 (Ar′-CO), 128.5, 129.9, 130.2, 131.2, 132.2, 133.3, 134.8, 135.2 (aromatic carbons)
3f	2.25 (s, 3H, Ar-CH_3), 3.16 (dd, 1H, C_2'—H, J = 4.4, 14.4 Hz), 3.77 (dd, 1H, C_2'—H, J = 9.2, 14.5 Hz), 4.18–4.28 (m, 1H, C_1'—H), 4.42 (d, 1H, C_4—H, J = 5.7 Hz), 5.89 (bs, 2H, NH_2), 7.16–7.85 (m, 8H, Ar-H), 9.77 (bs, 1H, NH)	22.1 (Ar-CH_3), 52.8 (C-2′), 55.6 (C-1′), 62.7 (C-4), 156.6 (C-5), 169.4 (C-3), 205.9 (Ar-CO), 206.4 (Ar′-CO), 128.7, 129.2, 130.9, 131.7, 132.1, 133.9, 134.7, 136.9 (aromatic carbons)
4a	3.11 (dd, 1H, C_2'—H, J = 4.6, 14.7 Hz), 3.72 (dd, 1H, C_2'—H, J = 9.1, 14.6 Hz), 4.15–4.24 (m, 1H, C_1'—H), 4.34 (d, 1H, C_4—H, J = 5.4 Hz), 5.90 (bs, 2H, NH_2), 7.22–7.74 (m, 10H, Ar-H)	53.1 (C-2′), 57.2 (C-1′), 63.0 (C-4), 159.3 (C-3), 174.1 (C-5), 205.1 (Ar-CO), 206.8 (Ar′-CO), 128.1, 129.5, 130.1, 131.2, 132.6, 133.2, 134.0, 135.2 (aromatic carbons)
4b	2.22 (s, 6H, Ar-CH_3 and Ar′-CH_3), 3.04 (dd, 1H, C_2'—H, J = 4.5, 14.5 Hz), 3.69 (dd, 1H, C_2'—H, J = 9.0, 14.7 Hz), 4.19–4.27 (m, 1H, C_1'—H), 4.36 (d, 1H, C_4—H, J = 5.4 Hz), 5.92 (bs, 2H, NH_2), 7.08–7.65 (m, 8H, Ar-H)	22.9 (Ar-CH_3 and Ar′-CH_3), 53.8 (C-2′), 57.7 (C-1′), 62.8 (C-4), 158.8 (C-3), 174.6 (C-5), 205.9 (Ar-CO), 206.1 (Ar′-CO), 128.7, 129.3, 130.9, 131.9, 132.2, 133.9, 134.8, 135.1 (aromatic carbons)

(*Continued*)

Table 3
(*Continued*)

Compound	^{1}H NMR ($CDCl_3$/DMSO-d_6) δ, ppm	^{13}C NMR ($CDCl_3$/DMSO-d_6) δ, ppm
4c	3.09 (dd, 1H, C_2'—H, J = 4.7, 14.4 Hz), 3.71 (dd, 1H, C_2'—H, J = 9.1, 14.6 Hz), 4.13–4.24 (m, 1H, C_1'—H), 4.32 (d, 1H, C_4—H, J = 5.5 Hz), 5.84 (bs, 2H, NH_2), 7.12–7.77 (m, 8H, Ar-H)	53.4 (C-2′), 57.6 (C-1′), 61.7 (C-4), 158.0 (C-3), 173.7 (C-5), 204.9 (Ar-CO), 206.7 (Ar′-CO), 128.1, 129.8, 131.4, 132.3, 133.7, 134.8, 135.2, 136.9 (aromatic carbons)
4d	2.24 (s, 3H, Ar′-CH_3), 3.12 (dd, 1H, C_2'—H, J = 4.6, 14.6 Hz), 3.76 (dd, 1H, C_2'—H, J = 9.0, 14.4 Hz), 4.17–4.27 (m, 1H, C_1'—H), 4.35 (d, 1H, C_4—H, J = 5.7 Hz), 5.86 (bs, 2H, NH_2), 7.08–7.71 (m, 9H, Ar-H)	22.3 (Ar′-CH_3), 52.6 (C-2′), 58.7 (C-1′), 61.5 (C-4), 158.9 (C-3), 173.9 (C-5), 205.2 (Ar-CO), 206.3 (Ar′-CO), 128.7, 129.4, 131.7, 132.5, 133.1, 134.2, 135.1, 136.2 (aromatic carbons)
4e	3.07 (dd, 1H, C_2'—H, J = 4.5, 14.5 Hz), 3.78 (dd, 1H, C_2'—H, J = 8.9, 14.6 Hz), 4.12–4.23 (m, 1H, C_1'—H), 4.30 (d, 1H, C_4—H, J = 5.5 Hz), 5.94 (bs, 2H, NH_2), 7.10–7.75 (m, 9H, Ar-H)	52.1 (C-2′), 58.2 (C-1′), 61.8 (C-4), 158.1 (C-3), 173.6 (C-5), 205.7 (Ar-CO), 206.2 (Ar′-CO), 127.9, 128.6, 130.4, 131.5, 132.9, 134.2, 135.6, 136.9 (aromatic carbons)
4f	2.22 (s, 3H, Ar-CH_3), 3.10 (dd, 1H, C_2'—H, J = 4.7, 14.7 Hz), 3.72 (dd, 1H, C_2'—H, J = 8.3, 14.4 Hz), 4.14–4.27 (m, 1H, C_1'—H), 4.31 (d, 1H, C_4—H, J = 5.3 Hz), 5.89 (bs, 2H, NH_2), 7.15–7.79 (m, 8H, Ar-H),	21.9 (Ar-CH_3), 53.7 (C-2′), 57.9 (C-1′), 62.4 (C-4), 157.8 (C-3), 174.4 (C-5), 204.6 (Ar-CO), 206.1 (Ar′-CO), 127.2, 128.9, 130.7, 131.1, 132.2, 134.9, 135.2, 136.1 (aromatic carbons)
5a	3.08 (dd, 1H, C_2'—H, J = 4.4, 14.5 Hz), 3.82 (dd, 1H, C_2'—H, J = 9.0, 14.4 Hz), 4.18–4.24 (m, 1H, C_1'—H), 4.37 (d, 1H, C_5—H, J = 5.3 Hz), 5.87 (bs, 2H, NH_2), 6.90 (bs, 1H, OH), 7.20–7.71 (m, 10H, Ar-H)	52.9 (C-2′), 57.7 (C-1′), 64.2 (C-5), 158.6 (C-6), 164.3 (C-2), 174.2 (C-4), 205.9 (Ar-CO), 206.8 (Ar′-CO), 127.9, 129.9, 130.9, 131.8, 132.1, 133.6, 134.9, 135.4 (aromatic carbons)
5b	2.23 (s, 6H, Ar-CH_3 and Ar′-CH_3), 3.09 (dd, 1H, C_2'—H, J = 4.5, 14.3 Hz), 3.76 (dd, 1H, C_2'—H, J = 9.1, 14.1 Hz), 4.12–4.21 (m, 1H, C_1'—H), 4.34 (d, 1H, C_5—H, J = 5.0 Hz), 5.80 (bs, 2H, NH_2), 6.86 (bs, 1H, OH), 7.20–7.62 (m, 8H, Ar-H)	22.7 (Ar-CH_3 and Ar′-CH_3), 51.8 (C-2′), 55.1 (C-1′), 64.9 (C-5), 157.8 (C-6), 164.9 (C-2), 170.6 (C-4), 205.1 (Ar-CO), 206.2 (Ar′-CO), 127.1, 129.3, 130.2, 131.4, 132.9, 133.4, 134.4, 136.9 (aromatic carbons)
5c	3.11 (dd, 1H, C_2'—H, J = 4.6, 14.6 Hz), 3.83 (dd, 1H, C_2'—H, J = 9.0, 14.4 Hz), 4.11–4.23 (m, 1H, C_1'—H), 4.36 (d, 1H, C_5—H, J = 5.3 Hz), 5.84 (bs, 2H, NH_2), 6.87 (bs, 1H, OH), 7.25–7.81 (m, 8H, Ar-H)	52.4 (C-2′), 55.8 (C-1′), 64.0 (C-5), 158.3 (C-6), 163.7 (C-2), 170.9 (C-4), 205.6 (Ar-CO), 206.7 (Ar′-CO), 127.8, 129.4, 130.8, 131.6, 132.3, 133.9, 135.8, 136.9 (aromatic carbons)
5d	2.26 (s, 3H, Ar′-CH_3), 3.07 (dd, 1H, C_2'—H, J = 4.4, 14.2 Hz), 3.79 (dd, 1H, C_2'—H, J = 8.9, 14.3 Hz), 4.13–4.21 (m, 1H, C_1'—H), 4.32 (d, 1H, C_5—H, J = 5.1 Hz), 5.82 (bs, 2H, NH_2), 6.89 (bs, 1H, OH), 7.16–7.61 (m, 9H, Ar-H)	21.8 (Ar′-CH_3), 52.3 (C-2′), 55.2 (C-1′), 64.7 (C-5), 159.1 (C-6), 164.2 (C-2), 170.2 (C-4), 205.3 (Ar-CO), 206.8 (Ar′-CO), 127.2, 129.5, 130.4, 131.7, 132.0, 134.6, 135.1, 136.7 (aromatic carbons)
5e	3.10 (dd, 1H, C_2'—H, J = 4.6, 14.5 Hz), 3.84 (dd, 1H, C_2'—H, J = 8.6, 14.4 Hz), 4.18–4.23 (m, 1H, C_1'—H), 4.35 (d, 1H, C_5—H, J = 5.5 Hz), 5.86 (bs, 2H, NH_2), 6.82 (bs, 1H, OH), 7.21–7.78 (m, 9H, Ar-H)	52.8 (C-2′), 56.0 (C-1′), 64.1 (C-5), 159.8 (C-6), 164.7 (C-2), 169.9 (C-4), 205.7 (Ar-CO), 207.2 (Ar′-CO), 127.9, 128.7, 130.9, 131.6, 132.9, 134.1, 135.8, 136.4 (aromatic carbons)
5f	2.21 (s, 3H, Ar-CH_3), 3.14 (dd, 1H, C_2'—H, J = 4.7, 14.4 Hz), 3.81 (dd, 1H, C_2'—H, J = 8.3, 14.1 Hz), 4.16–4.25 (m, 1H, C_1'—H), 4.30 (d, 1H, C_5—H, J = 5.3 Hz), 5.89 (bs, 2H, NH_2), 6.87 (bs, 1H, OH), 7.20–7.72 (m, 8H, Ar-H)	22.4 (Ar-CH_3), 52.5 (C-2′), 55.6 (C-1′), 63.7 (C-5), 159.2 (C-6), 164.1 (C-2), 169.6 (C-4), 206.0 (Ar-CO), 207.4 (Ar′-CO), 127.0, 128.5, 130.6, 131.9, 132.3, 134.8, 135.2, 136.8 (aromatic carbons)
6a	2.73 and 2.75 (s, 6H, N—CH_3), 3.07 (dd, 1H, C_2'—H, J = 4.0, 14.1 Hz), 3.76 (dd, 1H, C_2'—H, J = 8.1, 14.0 Hz), 4.15–4.21 (m, 1H, C_1'—H), 4.39 (d, 1H, C_5—H, J = 5.1 Hz), 7.01–7.48 (m, 10H, Ar-H), 9.24 (bs, 1H, NH)	26.8 (N—CH_3), 27.4 (N—CH_3), 52.4 (C-2′), 54.8 (C-1′), 64.0 (C-5), 159.9 (C-2), 163.7 (C-6), 174.2 (C-4), 205.1 (Ar-CO), 207.0 (Ar′-CO), 126.4, 127.2, 128.2, 130.1, 131.5, 132.0, 134.5, 135.7 (aromatic carbons)
6b	2.26 (s, 6H, Ar-CH_3 and Ar′-CH_3), 2.74 and 2.79 (s, 6H, N—CH_3), 3.11 (dd, 1H, C_2'—H, J = 4.2, 14.3 Hz), 3.68 (dd, 1H, C_2'—H, J = 8.0, 14.1 Hz), 4.12–4.24 (m, 1H, C_1'—H), 4.31 (d, 1H, C_5—H, J = 5.3 Hz), 7.12–7.71 (m, 8H, Ar-H), 9.12 (bs, 1H, NH)	22.1 (Ar-CH_3 and Ar′-CH_3), 26.2 (N—CH_3), 27.9 (N—CH_3), 51.9 (C-2′), 54.1 (C-1′), 64.7 (C-5), 158.8 (C-2), 164.1 (C-6), 173.9 (C-4), 204.8 (Ar-CO), 207.6 (Ar′-CO), 126.9, 128.4, 128.9, 130.4, 131.4, 132.7, 133.8, 134.1, 135.4 (aromatic carbons)
6c	2.71 and 2.76 (s, 6H, N—CH_3), 3.06 (dd, 1H, C_2'—H, J = 4.0, 14.2 Hz), 3.71 (dd, 1H, C_2'—H, J = 8.0, 14.0 Hz), 4.16–4.23 (m, 1H, C_1'—H), 4.36 (d, 1H, C_5—H, J = 5.1 Hz), 7.04–7.88 (m, 8H, Ar-H), 8.99 (bs, 1H, NH)	27.9 (N—CH_3), 28.4 (N—CH_3), 51.1 (C-2′), 54.7 (C-1′), 64.2 (C-5), 158.2 (C-2), 164.9 (C-6), 173.4 (C-4), 205.3 (Ar-CO), 207.9 (Ar′-CO), 126.1, 128.9, 129.4, 130.9, 131.7, 132.3, 133.6, 135.8, 139.4 (aromatic carbons)
6d	2.25 (s, 3H, Ar′-CH_3), 2.74 and 2.79 (s, 6H, N—CH_3), 3.10 (dd, 1H, C_2'—H, J = 4.1, 14.3 Hz), 3.74 (dd, 1H, C_2'—H, J = 8.2, 14.2 Hz), 4.13–4.24 (m, 1H, C_1'—H), 4.30 (d, 1H, C_5—H, J = 5.1 Hz), 7.08–7.68 (m, 9H, Ar-H), 9.17 (bs, 1H, NH)	22.1 (Ar′-CH_3), 28.3 (N—CH_3), 29.7 (N—CH_3), 52.8 (C-2′), 54.1 (C-1′), 65.4 (C-5), 158.7 (C-2), 164.2 (C-6), 173.8 (C-4), 205.9 (Ar-CO), 207.1(Ar′-CO), 125.6, 127.8, 128.6, 130.1, 131.2, 132.6, 133.9, 134.4 (aromatic carbons)

(*Continued*)

Table 3
(*Continued*)

Compound	^{1}H NMR ($CDCl_3$/DMSO-d_6) δ, ppm	^{13}C NMR ($CDCl_3$/DMSO-d_6) δ, ppm
6e	2.78 and 2.81 (s, 6H, N—CH_3), 3.16 (dd, 1H, C_2'—H, J = 4.3, 14.4 Hz), 3.78 (dd, 1H, C_2'—H, J = 8.3, 14.3 Hz), 4.18–4.27 (m, 1H, C_1'—H), 4.37 (d, 1H, C_5—H, J = 5.3 Hz), 7.11–7.77 (m, 9H, Ar-H), 9.06 (bs, 1H, NH)	28.0 (N—CH_3), 29.9 (N—CH_3), 52.3 (C-2′), 54.8 (C-1′), 65.0 (C-5), 158.1 (C-2), 164.9 (C-6), 174.3 (C-4), 205.2 (Ar-CO), 207.4 (Ar′-CO), 125.2, 128.4, 130.9, 131.8, 132.2, 133.2, 134.7, 136.4 (aromatic carbons)
6f	2.24 (s, 3H, Ar-CH_3), 2.71 and 2.79 (s, 6H, N—CH_3), 3.12 (dd, 1H, C_2'—H, J = 4.0, 14.2 Hz), 3.72 (dd, 1H, C_2'—H, J = 8.0, 14.1 Hz), 4.11–4.23 (m, 1H, C_1'—H), 4.32 (d, 1H, C_5—H, J = 5.2 Hz), 7.21–7.89 (m, 8H, Ar-H), 9.09 (bs, 1H, NH)	21.9 (Ar-CH_3), 28.5 (N—CH_3), 28.7 (N—CH_3), 52.9 (C-2′), 54.0 (C-1′), 65.5 (C-5), 158.9 (C-2), 164.2 (C-6), 173.9 (C-4), 205.4 (Ar-CO), 208.1 (Ar′-CO), 125.9, 128.1, 130.1, 131.2, 132.9, 133.6, 134.1, 136.9 (aromatic carbons)
7a	1.33 (bs, 1H, SH), 3.04 (dd, 1H, C_2'—H, J = 4.1, 14.2 Hz), 3.77 (dd, 1H, C_2'—H, J = 9.1, 14.1 Hz), 4.13–4.25 (m, 1H, C_1'—H), 4.33 (d, 1H, C_5—H, J = 5.3 Hz), 5.73 (bs, 2H, NH_2), 7.11–7.79 (m, 10H, Ar-H)	52.1 (C-2′), 55.0 (C-1′), 63.8 (C-5), 161.6 (C-6), 174.3 (C-4), 184.2 (C-2), 205.1 (Ar-CO), 206.4 (Ar′-CO), 127.2, 129.4, 130.2, 131.6, 132.4, 133.1, 134.9, 135.6 (aromatic carbons)
7b	2.21 (s, 6H, Ar-CH_3 and Ar′-CH_3), 1.39 (bs, 1H, SH), 3.01 (dd, 1H, C_2'—H, J = 4.0, 14.1 Hz), 3.73 (dd, 1H, C_2'—H, J = 9.0, 14.2 Hz), 4.12–4.23 (m, 1H, C_1'—H), 4.36 (d, 1H, C_5—H, J = 5.4 Hz), 5.78 (bs, 2H, NH_2), 7.10–7.69 (m, 8H, Ar-H)	22.6 (Ar-CH_3 and Ar′-CH_3), 52.6 (C-2′), 55.4 (C-1′), 63.1 (C-5), 161.9 (C-6), 174.0 (C-4), 184.6 (C-2), 205.7 (Ar-CO), 206.9 (Ar′-CO), 127.8, 129.2, 130.6, 131.3, 132.9, 133.5, 134.6, 135.1 (aromatic carbons)
7c	1.32 (bs, 1H, SH), 3.08 (dd, 1H, C_2'—H, J = 4.1, 14.3 Hz), 3.77 (dd, 1H, C_2'—H, J = 9.2, 14.4 Hz), 4.18–4.27 (m, 1H, C_1'—H), 4.32 (d, 1H, C_5—H, J = 5.3 Hz), 5.72 (bs, 2H, NH_2), 7.14–7.89 (m, 8H, Ar-H)	52.9 (C-2′), 54.7 (C-1′), 63.7 (C-5), 161.3 (C-6), 174.7 (C-4), 184.9 (C-2), 206.4 (Ar-CO), 207.7 (Ar′-CO), 127.2, 129.9, 130.1, 131.8, 132.2, 133.9, 135.9, 136.3 (aromatic carbons)
7d	2.26 (s, 3H, Ar′-CH_3), 1.37 (bs, 1H, SH), 3.02 (dd, 1H, C_2'—H, J = 4.0, 14.2 Hz), 3.73 (dd, 1H, C_2'—H, J = 9.1, 14.3 Hz), 4.11–4.25 (m, 1H, C_1'—H), 4.33 (d, 1H, C_5—H, J = 5.4 Hz), 5.79 (bs, 2H, NH_2), 7.12–7.77 (m, 9H, Ar-H)	22.4 (Ar′-CH_3), 52.2 (C-2′), 53.9 (C-1′), 63.1 (C-5), 161.8 (C-6), 174.1 (C-4), 184.4 (C-2), 205.5 (Ar-CO), 206.1 (Ar′-CO), 127.6, 129.2, 130.6, 131.4, 132.6, 133.2, 134.2, 135.4 (aromatic carbons)
7e	1.35 (bs, 1H, SH), 3.06 (dd, 1H, C_2'—H, J = 4.1, 14.4 Hz), 3.70 (dd, 1H, C_2'—H, J = 9.0, 14.2 Hz), 4.13–4.23 (m, 1H, C_1'—H), 4.37 (d, 1H, C_5—H, J = 5.6 Hz), 5.84 (bs, 2H, NH_2), 7.16–7.79 (m, 9H, Ar-H)	52.9 (C-2′), 54.5 (C-1′), 62.8 (C-5), 162.4 (C-6), 174.7 (C-4), 184.1 (C-2), 205.0 (Ar-CO), 207.0 (Ar′-CO), 127.1, 129.8, 130.9, 131.1, 132.3, 133.5, 134.8, 136.2 (aromatic carbons)
7f	2.27 (s, 3H, Ar-CH_3), 1.31 (bs, 1H, SH), 3.09 (dd, 1H, C_2'—H, J = 4.2, 14.5 Hz), 3.74 (dd, 1H, C_2'—H, J = 9.1, 14.3 Hz), 4.16–4.27 (m, 1H, C_1'—H), 4.35 (d, 1H, C_5—H, J = 5.5 Hz), 5.76 (bs, 2H, NH_2), 7.18–7.83 (m, 9H, Ar-H)	22.9 (Ar-CH_3), 52.2 (C-2′), 54.0 (C-1′), 62.3 (C-5), 163.1 (C-6), 173.4 (C-4), 183.7 (C-2), 205.3 (Ar-CO), 207.4 (Ar′-CO), 127.8, 129.2, 130.1, 131.8, 132.4, 133.9, 134.1, 136.8 (aromatic carbons)

EXPERIMENTAL

General. Melting points were determined in open capillaries on a Mel-Temp apparatus and are uncorrected. The purity of the compounds was checked by TLC (silica gel H, BDH, ethyl acetate/hexane, 1:3). The IR spectra were recorded on a Thermo Nicolet IR 200 FT-IR spectrometer as KBr pellets and the wave numbers were given in cm^{-1}. The ^{1}H NMR spectra were recorded in $CDCl_3$/DMSO-d_6 on a Varian EM-360 spectrometer (300 MHz). The ^{13}C NMR spectra were recorded in $CDCl_3$/DMSO-d_6 on a Varian VXR spectrometer operating at 75.5 MHz. All chemical shifts are reported in δ (ppm) using TMS as an internal standard. The microanalyses were performed on a Perkin-Elmer 240C elemental analyzer. The starting compounds (*E*)-1,4-diaroylbut-2-ene-1,4-dione (**1**) was prepared by the literature procedure [20].

Ethyl-3,4-diaroyl-2-cyanobutyrate (2): General procedure. A mixture of ethyl cyanoacetate (15 mmol), methyl ethyl ketone (5 mL), and potassium carbonate (10 mmol) was cooled to 5–10°C. To this, compound **1** (10 mmol) was added and stirred for 3–5 h maintaining the same temperature. The contents of the flask were diluted with water and extracted with dichloromethane. The organic layer was washed with water, brine and dried (anhyd. Na_2SO_4). The solvent was removed *in vacuo*. The resultant solid was recrystallized from 2-propanol.

3-Amino-4(1′,2′-diaroylethyl)-1H-pyrazol-5(4H)-one (3): General procedure. The compound **2** (10 mmol), hydrazine hydrate (15 mmol), ethanol (20 mL), and piperidine (5 mL) was refluxed for 6–8 h. It was cooled and poured onto crushed ice containing conc. HCl. The reaction mixture was extracted with ethyl acetate. The organic layer was washed with brine, dried over anhydrous Na_2SO_4, and the solvent was removed under reduced pressure. The resultant solid was recrystallized from methanol.

3-Amino-4-(1′,2′-diaroylethyl)isoxazolo-5(4H)-one (4): General procedure. To a solution of **2** (10 mmol) in ethanol (20 mL), hydroxylamine hydrochloride (10 mmol) and piperidine (5 mL) were added and refluxed for 4–6 h. It was cooled and poured onto crushed ice containing conc. HCl. The reaction mixture was extracted with ethyl acetate. The organic layer was washed with brine and dried over

anhydrous Na_2SO_4. Removal of the solvent under vacuum gave crude product which was purified by recrystallization from methanol.

6-Amino-5-(1′,2′-diaroylethyl)-2-hydroxy-pyrimidine-4(5H)-one (5): General procedure. The compound **2** (10 mmol) was dissolved in ethanol (10 mL). To this, urea (10 mmol) in ethanol (10 mL) and piperidine (5 mL) were added and refluxed for 6–10 h. The contents were cooled, poured onto crushed ice containing conc. HCl, and extracted with ethyl acetate. The organic layer was washed with brine and dried over anhydrous Na_2SO_4. Removal of the solvent *in vacuo* gave crude product which was recrystallized from methanol.

6-Imino-5-(1′,2′-diaroylethyl)-1,3-dimethyl-pyrimidine-2,4(5H)-dione (6): General procedure. A mixture of **2** (10 mmol), 1,3-dimethylurea (10 mmol), ethanol (15 mL), and piperidine (5 mL) was refluxed for 8–12 h. The contents were diluted with ice-cold water, acidified with conc. HCl, and extracted with ethyl acetate. The organic layer was washed with brine and dried over anhydrous Na_2SO_4. Removal of the solvent with rotary evaporator afforded crude product which was purified by recrystallization from methanol.

6-Amino-5-(1′,2′-diaroylethyl)-2-mercapto-pyrimidine-4(5H)-one (7): General procedure. To an equimolar mixture (10 mmol) of **2** and thiourea, ethanol (20 mL) and piperidine (5 mL) were added and refluxed for 10–15 h. The reaction mixture was cooled, poured onto crushed ice containing conc. HCl, and extracted with ethyl acetate. The organic layer was washed with brine and dried over anhydrous Na_2SO_4. The solvent was removed under reduced pressure. The resultant solid was recrystallized from methanol.

CONCLUSION

The *gem*-cyanoester functionality in ethyl-3,4-diaroyl-2-cyanobutyrate is conveniently exploited to get a new class of aminopyrazolones, isoxazolones, pyrimidinediones, and thioxopyrimidinones adopting facile, simple, and well-versed synthetic methodologies.

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