Synthesis of 2-Amino-3,4-dihydroquinazolines and Imidazo[2,1-*b*]quinazoline-2-ones[1]

Amita Mishra, Sanjay Batra*

Medicinal and Process Chemistry Division, Central Drug Research Institute, PO Box 173, Lucknow 226001, India
Fax +91(522)2623405; E-mail: batra_san@yahoo.co.uk

Received 5 May 2009

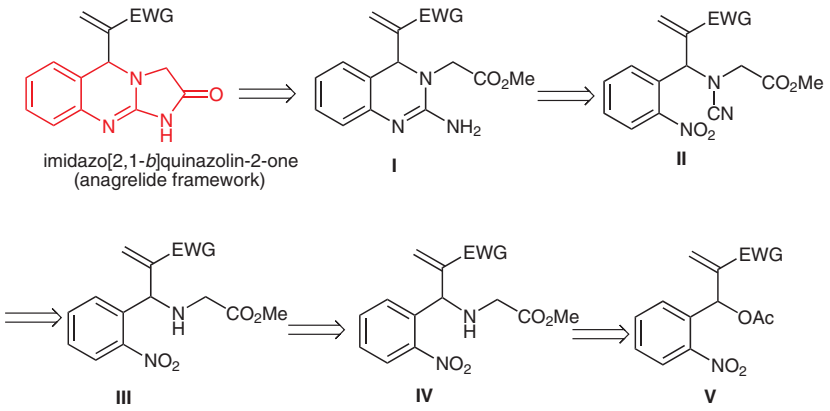
Abstract: A straightforward method for the synthesis of 2-amino-3,4-dihydroquinazolines from Baylis–Hillman derivatives is disclosed. The protocol involves sequential S_N2 reaction of a primary amine on the Baylis–Hillman acetate derived from 2-nitrobenzaldehyde, cyanogen bromide-mediated nitrile addition, and iron–acetic acid promoted reductive cyclization. This approach is also applied to the preparation of imidazo[2,1-*b*]quinazoline-2-ones and imidazo[2,1-*b*]quinazolines in one pot.

Key words: quinazoline, anagrelide, Baylis–Hillman, imidazo[2,1-*b*]quinazoline, allyl amine

As part of our program to develop heterocyclic systems of biological relevance from Baylis–Hillman derivatives,[2] we recently reported a general protocol for obtaining pyrimido[2,1-*b*]quinazolines from primary allyl amines prepared from Baylis–Hillman acetates.[3] In continuation of this work, we have extended this methodology to the synthesis of substituted imidazo[2,1-*b*]quinazoline-2-ones; this particular framework is found in the drug, anagrelide.[4] The retrosynthesis shown in Scheme 1 provides the basis for our work in this direction. Cleavage of the imidazole ring leads to 2-aminoquinazoline **I** which in turn can be generated from the cyanamide **II**. Intermediate **II** can be obtained from the allyl amine **III**, itself prepared via an S_N2'–S_N2' displacement reaction (S_N2 reaction) of a primary amine with the Baylis–Hillman acetate **V**.

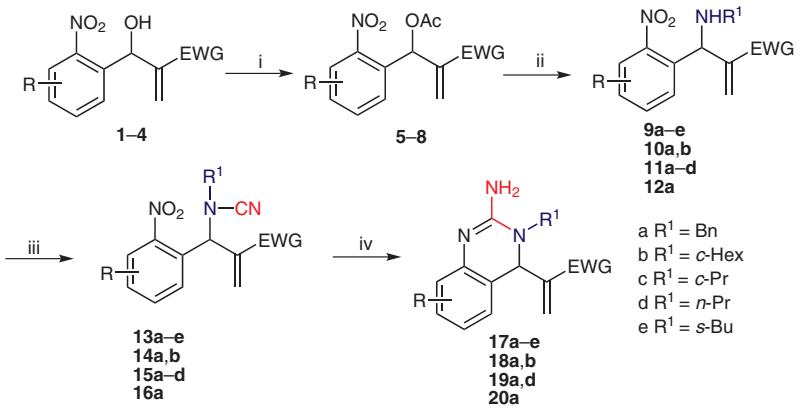
A survey of the literature revealed that substituted 2-aminoquinazolines have been used as precursors for the synthesis of imidazo[2,1-*b*]quinazoline-2-ones which are component units of hypotensive, ionotropic, antimetastatic and hypoglycemic agents.[5] Various 2-amino-3,4-dihydroquinazolines are reported to display pharmacological properties,[6] and numerous strategies are available for their preparation.[7] Notably, these derivatives are either unsubstituted at C-4, or possess an aromatic group or a carbonyl moiety at this position. An approach using Baylis–Hillman chemistry would provide a new method to obtain 2-aminoquinazolines bearing a vinyl chain at C-4 which may serve as a handle for further synthetic modifications.

This investigation commenced with the synthesis of Baylis–Hillman adducts **1–4** starting from 2-nitrobenzaldehydes following a standard procedure.[2c] Conversion of **1–4** into the corresponding acetates **5–8** was achieved using acetyl chloride in the presence of pyridine. The S_N2 reaction of compound **5** with benzylamine in the presence of 1,4-diazabicylo[2.2.2]octane under aqueous conditions gave the required allyl amine **9a** in 71% yield. Treatment of **9a** with cyanogen bromide and sodium bicarbonate in methanol at room temperature for 48 hours resulted in the formation of the cyanamide derivative **13a** in 81% yield (Scheme 2). Next, following optimization of the reaction conditions, reductive cyclization of cyanamide **13a** was accomplished using a mixture of iron powder and acetic acid with heating at 95 °C for 20 minutes to afford the desired 2-aminoquinazoline **17a**. This protocol was general in nature and 2-aminoquinazolines **17b–e** and **18a,b** were obtained in moderate to good yields from amines **9b–e**



Scheme 1 Retrosynthesis of imidazo[2,1-*b*]quinazoline-2-ones

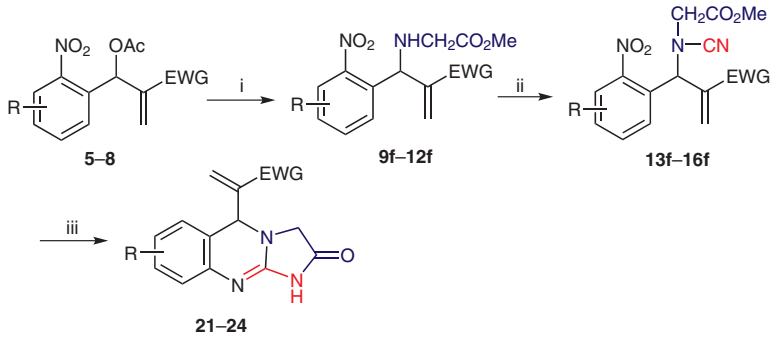
SYNTHESIS 2009, No. 18, pp 3077–3088
Advanced online publication: 10.07.2009
DOI: 10.1055/s-0029-1217603; Art ID: P06809SS



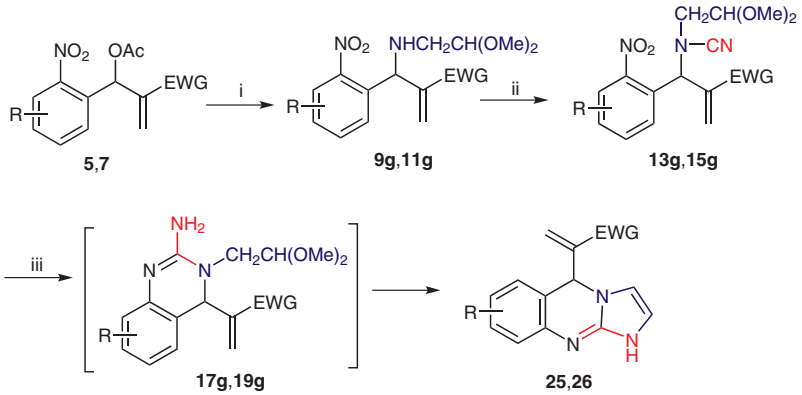
Scheme 2 *Reagents and conditions*: (i) AcCl, py, CH_2Cl_2, 0 °C, 30 min; (ii) R^1NH_2, DABCO, THF–H_2O (1:1), 2 h; (iii) CNBr, $NaHCO_3$, MeOH, r.t., 40–48 h (EWG = CN), 6–7 h (EWG = CO_2Me); (iv) Fe–AcOH, 95 °C, 20 min.

and **10a**,**b** (Table 1). Acetates **7** and **8**, obtained from adducts **3** and **4**, were converted into allyl amines **11a–d** and **12a** in good yields. Interestingly, and unlike cyanamides **13a–e** and **14a**,**b**, cyanamides **15a–d** and **16a** were obtained in only six to seven hours. Reduction of the nitro group in **15b–d** and **16a** in the presence of iron–acetic acid followed by cyclization produced the corresponding 2-aminoquinazolines **19b–d** and **20a**. In contrast, cyanamide **15a** did not undergo neat transformation in the presence of iron–acetic acid. Fortunately, however, we found that replacing acetic acid with hydrochloric acid gave 2-aminoquinazoline **19a** in 60% yield.

Having established efficient conditions for the synthesis of 2-aminoquinazolines, we next turned our attention towards the synthesis of imidazo[2,1-*b*]quinazoline-2-ones. Consequently, secondary allyl amines **9f–12f** were prepared by reaction between Baylis–Hillman acetates **5–8** and methyl glycinate (Scheme 3).[8] Applying the optimized conditions, these amines were initially converted into cyanamides **13f–16f** by reaction with cyanogen bromide. Reduction of the aromatic nitro group with iron–acetic acid resulted in clean reactions leading to the desired products **21–24** in 55–60% yields. These products were identified as imidazo[2,1-*b*]quinazoline-2-ones **21–24** based on spectroscopic analyses These results indicate



Scheme 3 *Reagents and conditions*: (i) methyl glycinate, DABCO, THF–H_2O (1:1), 2 h; (ii) CNBr, $NaHCO_3$, MeOH, r.t., 48 h (EWG = CN), 5 h (EWG = CO_2Me); (iii) Fe–AcOH, 95 °C, 20 min.



Scheme 4 *Reagents and conditions*: (i) 2,2-dimethoxyethanamine, DABCO, THF–H_2O (1:1), 2 h; (ii) CNBr, $NaHCO_3$, MeOH, r.t., 42 h (EWG = CN), 6 h (EWG = CO_2Me); (iii) a) Fe–AcOH, 95 °C, 20 min; b) AcOH–HCl, 100 °C, 30 min.

that reduction of the nitro group triggered a cascade reaction to afford the final products.

Table 1 Structures and Yields of Intermediates and Products

Compound	R	EWG	R^1	Yield (%)
9a	H	CN	CH_2Ph	71
9b	H	CN	cyclohexyl	70
9c	H	CN	cyclopropyl	80
9d	H	CN	^{n}Pr	87
9e	H	CN	$CH(CH_3)Et$	63
9f	H	CN	CH_2CO_2Me	60
9g	H	CN	$CH_2CH(OMe)_2$	81
10a	4,5-$(MeO)_2$	CN	CH_2Ph	71
10b	4,5-$(MeO)_2$	CN	cyclohexyl	64
10f	4,5-$(MeO)_2$	CN	CH_2CO_2Me	64
11a	H	CO_2Me	CH_2Ph	65
11b	H	CO_2Me	cyclohexyl	70
11c	H	CO_2Me	cyclopropyl	75
11d	H	CO_2Me	^{n}Pr	70
11f	H	CO_2Me	CH_2CO_2Me	68
11g	H	CO_2Me	$CH_2CH(OMe)_2$	71
12a	4,5-$(MeO)_2$	CO_2Me	CH_2Ph	82
12f	4,5-$(MeO)_2$	CO_2Me	CH_2CO_2Me	61
13a	H	CN	CH_2Ph	81
13b	H	CN	cyclohexyl	88
13c	H	CN	cyclopropyl	73
13d	H	CN	^{n}Pr	77
13e	H	CN	$CH(CH_3)Et$	63
13f	H	CN	CH_2CO_2Me	70
13g	H	CN	$CH_2CH(OMe)_2$	72
14a	4,5-$(MeO)_2$	CN	CH_2Ph	80
14b	4,5-$(MeO)_2$	CN	cyclohexyl	70
14f	4,5-$(MeO)_2$	CN	CH_2CO_2Me	80
15a	H	CO_2Me	CH_2Ph	94
15b	H	CO_2Me	cyclohexyl	82
15c	H	CO_2Me	cyclopropyl	96
15d	H	CO_2Me	^{n}Pr	87
15f	H	CO_2Me	CH_2CO_2Me	71
15g	H	CO_2Me	$CH_2CH(OMe)_2$	83
16a	4,5-$(MeO)_2$	CO_2Me	CH_2Ph	75
16f	4,5-$(MeO)_2$	CO_2Me	CH_2CO_2Me	57
17a	H	CN	CH_2Ph	53
17b	H	CN	cyclohexyl	66
17c	H	CN	cyclopropyl	67
17d	H	CN	^{n}Pr	60
17e	H	CN	$CH(CH_3)Et$	61
17g	H	CN	$CH_2CH(OMe)_2$	65
18a	6,7-$(MeO)_2$	CN	CH_2Ph	55
18b	6,7-$(MeO)_2$	CN	cyclohexyl	66
19a	H	CO_2Me	CH_2Ph	60[a]
19b	H	CO_2Me	cyclohexyl	58
19c	H	CO_2Me	cyclopropyl	60
19d	H	CO_2Me	^{n}Pr	60
19g	H	CO_2Me	$CH_2CH(OMe)_2$	60
20a	6,7-$(MeO)_2$	CO_2Me	CH_2Ph	56
21	H	CN	CH_2CO_2Me	55
22	7,8-$(OMe)_2$	CN	CH_2CO_2Me	60
23	H	CO_2Me	CH_2CO_2Me	55
24	7,8-$(OMe)_2$	CO_2Me	CH_2CO_2Me	53
25	H	CN	$CH_2CH(OMe)_2$	72
26	H	CO_2Me	$CH_2CH(OMe)_2$	65

[a] Fe–HCl used instead of Fe–AcOH.

These results encouraged us to investigate the utility of the strategy further. In principle, installing an amino acetaldehyde dimethyl acetal as the amine component, under similar reaction conditions, should result in imidazo[2,1-*b*]quinazolines as the products. Thus, amine **9g** (prepared from **5**) was transformed into the cyanamide **13g** in 72% yield. Iron–acetic acid-promoted reduction of the aromatic nitro group gave the expected product **17g** in 65% yield. This result indicated that acetic acid was inefficient in unmasking the formyl group for further reaction. In a modified protocol, instead of isolating **17g**, concentrated hydrochloric acid was added to the reaction mixture in the same pot to afford the desired product **25** in 72% yield. To demonstrate the general nature of this protocol cyanamide **15g** was prepared from **11g** and then subjected to the same sequence of reactions to furnish methyl 2-(1,5-dihydroim-

idazo[2,1-*b*]quinazolin-5-yl)acrylate (**26**) in 65% yield (Scheme 4).

In summary, we have demonstrated a straightforward approach for the preparation of 4-vinyl-3,4-dihydro-2-aminoquinazolines which has been extended to the one-pot synthesis of substituted imidazo[2,1-*b*]quinazoline-2-ones and imidazo[2,1-*b*]quinazolines. The synthesis of a range of polycyclic quinazolines should be possible following this strategy by simple variation of the amine component.

Melting points were determined in capillary tubes using a Precision melting point apparatus containing silicon oil and are uncorrected. Column chromatography was carried out using silica gel (Spectrochem India, 100–200 mesh). IR spectra were obtained using a Perkin Elmer RX I FTIR spectrophotometer. ^{1}H and ^{13}C NMR spectra were recorded on a Bruker DPX-200 FT or a Bruker Avance DRX-300 spectrometer. Chemical shifts are expressed in δ values (ppm) relative to TMS (0.00 ppm) as internal standard. MS data were recorded on a MICROMASS Quadro-II LCMS system. HRMS spectra were recorded on a JEOL system. Elemental analyses were run using a Carlo Erba 108 or an Elementar Vario EL *III* microanalyzer.

Allyl Amines 9a–g, 10a,b,f, 11a–d,f,g and 12a,f; Typical Procedure

To a soln of Baylis–Hillman acetate **5** (2.00 g, 8.13 mmol) in a mixture of THF–H_2O (30 mL, 1:1, v/v) was added DABCO (1.37 g, 12.20 mmol) and the reaction mixture was stirred for 15 min at r.t. Benzylamine (0.98 mL, 8.94 mmol) was added and the reaction was stirred for a further 2 h. After completion of the reaction (as indicated by TLC), the solvent was evaporated under vacuum and the aq residue was extracted with EtOAc (3 × 30 mL). The organic layers were combined, washed with brine (50 mL), dried over Na_2SO_4 and concentrated to yield the crude product. Purification via silica gel column chromatography (EtOAc–hexanes, 1:9) afforded **9a** as a brown oil; yield: 1.70 g (71%).

2-[(Benzylamino)(2-nitrophenyl)methyl]acrylonitrile (9a)

R_f = 0.53 (EtOAc–hexanes, 1:4).

IR (neat): 3430 (NH), 2220 (CN) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 3.75 (d, J = 1.6 Hz, 2 H, CH_2), 5.09 (s, 1 H, CH), 6.12 (s, 1 H, =CH_2), 6.13 (d, J = 0.8 Hz, 1 H, =CH_2), 7.27–7.35 (m, 5 H, ArH), 7.46–7.54 (m, 1 H, ArH), 7.69 (dt, J_1 = 7.6 Hz, J_2 = 1.3 Hz, 1 H, ArH), 7.90 (s, 1 H, ArH), 7.94 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 52.1, 59.7, 117.4, 124.8, 125.3, 127.9, 128.6, 129.0, 129.6, 129.7, 133.1, 134.0, 134.1, 139.2.

MS (ES+): m/z = 294.1 (M$^+$ + 1).

Anal. Calcd for $C_{17}H_{15}N_3O_2$: C, 69.61; H, 5.15; N, 14.33. Found: C, 69.82; H, 4.89; N, 14.67.

2-[(Cyclohexylamino)(2-nitrophenyl)methyl]acrylonitrile (9b)

Brown oil; yield: 1.60 g (70%); R_f = 0.61 (EtOAc–hexanes, 1:4).

IR (neat): 3428 (NH), 2226 (CN) cm^{-1}.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 1.03–1.25 (m, 6 H, 3 × CH_2), 1.70–1.90 (m, 4 H, 2 × CH_2), 2.37–2.41 (m, 1 H, CH), 5.25 (s, 1 H, CH), 6.01 (d, J = 0.8 Hz, 1 H, =CH_2), 6.04 (s, 1 H, =CH_2), 7.45–7.50 (m, 1 H, ArH), 7.66 (dt, J_1 = 7.6 Hz, J_2 = 1.2 Hz, 1 H, ArH), 7.86 (dt, J_1 = 8.7 Hz, J_2 = 1.2 Hz, 2 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 25.2, 26.4, 33.9, 50.1, 117.0, 125.5, 129.4, 130.7, 131.4, 132.2, 133.7, 134.5, 140.9, 147.6.

MS (ES+): m/z = 286.1 (M$^+$ + 1).

Anal. Calcd for $C_{16}H_{19}N_3O_2$: C, 67.35; H, 6.71; N, 14.73. Found: C, 67.63; H, 6.43; N, 14.92.

2-[(Cyclopropylamino)(2-nitrophenyl)methyl]acrylonitrile (9c)

Brown oil; yield: 1.50 g (80%); R_f = 0.61 (EtOAc–hexanes, 1:4).

IR (neat): 3426 (NH), 2226 (CN) cm^{-1}.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 0.37–0.53 (m, 4 H, 2 × CH_2), 2.04–2.12 (m, 1 H, CH), 5.15 (s, 1 H, CH), 6.06 (s, 1 H, =CH_2), 6.08 (s, 1 H, =CH_2), 7.48 (t, J = 7.8 Hz, 1 H, ArH), 7.66 (t, J = 7.5 Hz, 1 H, ArH), 7.73 (d, J = 7.7 Hz, 1 H, ArH), 7.88 (d, J = 8.1 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 6.6, 7.5, 29.3, 60.7, 117.6, 125.0, 125.2, 129.3, 129.5, 132.6, 133.7, 134.4, 149.7.

MS (ES+): m/z = 244.0 (M$^+$ + 1).

Anal. Calcd for $C_{13}H_{13}N_3O_2$: C, 64.19; H, 5.39; N, 17.27. Found: C, 64.38; H, 5.72; N, 17.11.

2-[(2-Nitrophenyl)(propylamino)methyl]acrylonitrile (9d)

Yellow oil; yield: 1.30 g (87%); R_f = 0.71 (EtOAc–hexanes, 1:4).

IR (neat): 3428 (NH), 2200 (CN) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 0.93 (t, J = 7.4 Hz, 3 H, CH_3), 1.43–1.61 (m, 2 H, CH_2), 2.41–2.65 (m, 2 H, CH_2), 5.02 (s, 1 H, CH), 6.08 (s, 1 H, =CH_2), 6.10 (d, J = 0.8 Hz, 1 H, =CH_2), 7.48 (dt, J_1 = 8.5 Hz, J_2 = 1.5 Hz, 1 H, ArH), 7.67 (dt, J_1 = 7.6 Hz, J_2 = 1.3 Hz, 1 H, ArH), 7.87 (dt, J_1 = 7.5 Hz, J_2 = 1.4 Hz, 2 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 12.1, 23.5, 50.0, 50.8, 117.5, 125.5, 129.5, 130.4, 132.7, 133.9, 134.7, 141.2.

MS (ES+): m/z = 246.2 (M$^+$ + 1).

Anal. Calcd for $C_{13}H_{15}N_3O_2$: C, 63.66; H, 6.16; N, 17.13. Found: C, 63.69; H, 5.89; N, 17.48.

2-[(*sec*-Butylamino)(2-nitrophenyl)methyl]acrylonitrile (9e)

Brown oil (1:1 mixture of diastereoisomers); yield: 1.00 g (63%); R_f = 0.68 (EtOAc–hexanes, 3:17).

IR (neat): 3452 (NH), 2223 (CN) cm^{-1}.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 0.86 (t, J = 7.4 Hz, 3 H, CH_3), 0.93 (t, J = 7.4 Hz, 3 H, CH_3), 1.01 (d, J = 6.3 Hz, 3 H, CH_3), 1.06 (d, J = 6.3 Hz, 3 H, CH_3), 1.24–1.51 (m, 4 H, 2 × CH_2), 2.46–2.56 (m, 2 H, 2 × CH), 5.20–5.21 (m, 2 H, 2 × CH), 6.02–6.04 (m, 4 H, 2 × =CH_2), 7.45–7.50 (m, 2 H, 2 × ArH), 7.67 (t, J = 7.7 Hz, 2 H, 2 × ArH), 7.86 (d, J = 1.6 Hz, 2 H, 2 × ArH), 7.88 (s, 2 H, 2 × ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 10.4, 10.5, 20.0, 20.4, 29.9, 30.2, 52.3, 52.5, 57.27, 57.33, 117.5, 125.1 (2C), 125.5, 125.8, 129.4, 129.5, 129.6, 132.1, 132.4, 133.7, 134.8.

MS (ES+): m/z = 260.1 (M$^+$ + 1).

Anal. Calcd for $C_{14}H_{17}N_3O_2$: C, 64.85; H, 6.61; N, 16.20. Found: C, 65.02; H, 6.85; N, 15.94.

Methyl *N*-[2-Cyano-1-(2-nitrophenyl)prop-2-en-1-yl]glycinate (9f)

White solid; yield: 1.00 g (60%); mp 122–123 °C; R_f = 0.45 (EtOAc–hexanes, 1:4).

IR (KBr): 3491 (NH), 2228 (CN), 1727 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 3.39 (s, 2 H, CH_2), 3.73 (s, 3 H, OCH_3), 5.13 (s, 1 H, CH), 6.09 (s, 1 H, =CH_2), 6.17 (d, J = 0.4 Hz, 1 H, =CH_2), 7.49–7.53 (m, 1 H, ArH), 7.68–7.72 (m, 1 H, ArH), 7.91–7.96 (m, 2 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 48.6, 52.5, 59.4, 117.1, 124.4, 125.3, 129.6, 129.9, 133.4, 134.1, 149.7, 172.2.

MS (ES+): m/z = 276.0 (M^+ + 1).

Anal. Calcd for $C_{13}H_{13}N_3O_4$: C, 56.72; H, 4.76; N, 15.27. Found: C, 56.97; H, 4.58; N, 15.58.

2-{[(2,2-Dimethoxyethyl)amino](2-nitrophenyl)methyl}acrylonitrile (9g)
Brown oil; yield: 2.50 g (81%); R_f = 0.21 (EtOAc–hexanes, 1:4).

IR (neat): 3414 (NH), 2218 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 2.61–2.76 (m, 2 H, CH_2), 3.36 (s, 3 H, OCH_3), 3.38 (s, 3 H, OCH_3), 4.47 (t, J = 5.3 Hz, 1 H, CH), 5.08 (s, 1 H, CH), 6.09 (s, 1 H, =CH_2), 6.12 (s, 1 H, =CH_2), 7.47–7.52 (m, 1 H, ArH), 7.66–7.71 (m, 1 H, ArH), 7.84–7.92 (m, 2 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 55.0, 55.6, 57.8, 105.1, 114.4, 117.6, 125.5, 130.3, 131.0, 131.5, 134.7, 143.1, 147.6.

MS (ES+): m/z = 292.1 (M^+ + 1).

Anal. Calcd for $C_{14}H_{17}N_3O_4$: C, 57.72; H, 5.88; N, 14.42. Found: C, 58.02; H, 5.68; N, 14.74.

2-[(Benzylamino)(4,5-dimethoxy-2-nitrophenyl)methyl]acrylonitrile (10a)
Yellow oil; yield: 1.23 g (71%); R_f = 0.51 (EtOAc–hexanes, 1:4).

IR (neat): 3428 (NH), 2200 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.74 (d, J = 2.3 Hz, 2 H, CH_2), 3.96 (s, 3 H, OCH_3), 4.00 (s, 3 H, OCH_3), 5.28 (d, J = 5.6 Hz, 1 H, CH), 6.06 (s, 1 H, =CH_2), 6.15 (d, J = 0.7 Hz, 1 H, =CH_2), 7.29–7.35 (m, 5 H, ArH), 7.50 (s, 1 H, ArH), 7.58 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 52.0, 56.8, 57.0, 59.6, 108.7, 110.0, 110.9, 117.7, 125.0, 127.9, 128.6, 129.0, 129.2, 132.9, 139.3, 141.8, 148.9, 154.0.

MS (ES+): m/z = 354.0 (M^+ + 1).

Anal. Calcd for $C_{19}H_{19}N_3O_4$: C, 64.58; H, 5.42; N, 11.89. Found: C, 64.86; H, 5.34; N, 11.66.

2-[(Cyclohexylamino)(4,5-dimethoxy-2-nitrophenyl)methyl]acrylonitrile (10b)
Brown oil; yield: 1.45 g (64%); R_f = 0.25 (EtOAc–hexanes, 1:4).

IR (neat): 3428 (NH), 2200 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 1.09–1.23 (m, 6 H, 3 × CH_2), 1.68–1.81 (m, 4 H, 2 × CH_2), 2.35–2.42 (m, 1 H, CH), 3.97 (s, 3 H, OCH_3), 4.03 (s, 3 H, OCH_3), 5.47 (s, 1 H, CH), 5.99 (s, 1 H, =CH_2), 6.05 (s, 1 H, =CH_2), 7.51 (s, 1 H, ArH), 7.59 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 25.2, 29.8, 30.1, 32.3, 56.9, 57.2, 112.7, 119.6, 128.8, 129.1, 130.5, 133.6, 136.2, 139.1, 146.2.

MS (ES+): m/z = 346.0 (M^+ + 1).

Anal. Calcd for $C_{18}H_{23}N_3O_4$: C, 62.59; H, 6.71; N, 12.17. Found: C, 62.78; H, 6.66; N, 12.10.

Methyl *N*-[2-Cyano-1-(4,5-dimethoxy-2-nitrophenyl)prop-2-en-1-yl]glycinate (10f)
Brown oil; yield: 0.70 g (64%); R_f = 0.21 (EtOAc–hexanes, 1:4).

IR (neat): 3428 (NH), 2220 (CN), 1716 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.38 (s, 2 H, CH_2), 3.74 (s, 3 H, OCH_3), 3.96 (s, 3 H, OCH_3), 4.02 (s, 3 H, OCH_3), 5.32 (s, 1 H, CH), 6.07 (s, 1 H, =CH_2), 6.21 (s, 1 H, =CH_2), 7.50 (s, 1 H, ArH), 7.58 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 75 MHz): δ = 48.1, 52.1, 56.4, 56.7, 58.9, 110.3, 117.0, 124.0, 128.1, 130.0, 133.1, 141.3, 148.6, 153.6, 172.0.

MS (ES+): m/z = 336.0 (M^+ + 1).

Anal. Calcd for $C_{15}H_{17}N_3O_6$: C, 53.73; H, 5.11; N, 12.53. Found: C, 53.78; H, 5.24; N, 12.46.

Methyl 2-[(Benzylamino)(2-nitrophenyl)methyl]acrylate (11a)
Brown oil; yield: 1.30 g (65%); R_f = 0.53 (EtOAc–hexanes, 3:17).

IR (neat): 3426 (NH), 1710 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.67 (s, 3 H, OCH_3), 3.75–3.86 (m, 2 H, CH_2), 5.34 (s, 1 H, CH), 5.97 (s, 1 H, =CH_2), 6.44 (s, 1 H, =CH_2), 7.28–7.34 (m, 5 H, ArH), 7.40–7.44 (m, 1 H, ArH), 7.53–7.61 (m, 1 H, ArH), 7.71–7.75 (m, 1 H, ArH), 7.79–7.83 (m, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 52.4, 52.8, 57.7, 124.7, 125.2, 127.1, 127.6, 128.6, 128.7, 128.9, 129.9, 132.0, 136.4, 139.0, 140.2, 141.0, 166.8.

MS (ES+): m/z = 327.2 (M^+ + 1).

Anal. Calcd for $C_{18}H_{18}N_2O_4$: C, 66.25; H, 5.56; N, 8.58. Found: C, 66.34; H, 5.23; N, 8.87.

Methyl 2-[(Cyclohexylamino)(2-nitrophenyl)methyl]acrylate (11b)
Brown oil; yield: 1.60 g (70%); R_f = 0.63 (EtOAc–hexanes, 1:4).

IR (neat): 3427 (NH), 1726 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 1.05–1.21 (m, 6 H, 3 × CH_2), 1.55 (br s, 4 H, 2 × CH_2), 2.32–2.45 (m, 1 H, CH), 3.68 (s, 3 H, OCH_3), 5.45 (s, 1 H, CH), 5.79 (s, 1 H, =CH_2), 6.35 (s, 1 H, =CH_2), 7.37 (t, J = 7.7 Hz, 1 H, ArH), 7.55 (t, J = 7.5 Hz, 1 H, ArH), 7.72 (d, J = 7.8 Hz, 1 H, ArH), 7.79 (d, J = 8.0 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 75 MHz): δ = 25.2, 26.5, 33.6, 43.5, 52.7, 56.3, 125.2, 129.6, 131.6, 132.2, 132.5, 133.9, 138.6, 148.0, 168.1.

MS (ES+): m/z = 319.2 (M^+ + 1).

Anal. Calcd for $C_{17}H_{22}N_2O_4$: C, 64.13; H, 6.97; N, 8.80. Found: C, 63.92; H, 7.33; N, 8.60.

Methyl 2-[(Cyclopropylamino)(2-nitrophenyl)methyl]acrylate (11c)
Brown oil; yield: 1.49 g (75%); R_f = 0.55 (EtOAc–hexanes, 1:4).

IR (neat): 3414 (NH), 1758 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 0.32–0.46 (m, 4 H, 2 × CH_2), 2.16–2.21 (m, 1 H, CH), 3.68 (s, 3 H, OCH_3), 5.40 (s, 1 H, CH), 5.79 (t, J = 1.1 Hz, 1 H, =CH_2), 6.38 (t, J = 0.7 Hz, 1 H, =CH_2), 7.35–7.42 (m, 1 H, ArH), 7.50–7.63 (m, 2 H, ArH), 7.79 (dd, J_1 = 7.2 Hz, J_2 = 1.4 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 7.0, 29.8, 52.4, 58.2, 124.7, 126.7, 128.4, 129.7, 132.8, 136.7, 141.3, 150.2, 166.8.

MS (ES+): m/z = 277.1 (M^+ + 1).

Anal. Calcd for $C_{14}H_{16}N_2O_4$: C, 60.86; H, 5.84; N, 10.14. Found: C, 61.26; H, 5.96; N, 9.89.

Methyl 2-[(2-Nitrophenyl)(propylamino)methyl]acrylate (11d)
Brown oil; yield: 1.39 g (70%); R_f = 0.47 (EtOAc–hexanes, 3:17).

IR (neat): 3425 (NH), 1716 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 0.92 (t, J = 7.3 Hz, 3 H, CH_3), 1.46–1.60 (m, 2 H, CH_2), 2.43–2.64 (m, 2 H, CH_2), 3.66 (s, 3 H, OCH_3), 5.21 (s, 1 H, CH), 5.89 (s, 1 H, =CH_2), 6.40 (s, 1 H, =CH_2), 7.34–7.42 (m, 1 H, ArH), 7.55 (dt, J_1 = 7.9 Hz, J_2 = 1.2 Hz, 1 H, ArH), 7.65 (dd, J_1 = 7.8 Hz, J_2 = 1.5 Hz, 1 H, ArH), 7.80 (dd, J_1 = 8.0 Hz, J_2 = 1.2 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 12.0, 23.7, 50.5, 52.3, 57.7, 124.6, 126.7, 128.4, 129.8, 133.0, 136.7, 141.3, 150.2, 166.8.

MS (ES+): m/z = 279.1 (M^+ + 1).

Anal. Calcd for $C_{14}H_{18}N_2O_4$: C, 60.42; H, 6.52; N, 10.07. Found: C, 60.63; H, 6.85; N, 9.89.

Methyl 2-{[(2-Methoxy-2-oxoethyl)amino](2-nitrophenyl)methyl}acrylate (11f)

Brown oil; yield: 1.50 g (68%); R_f = 0.32 (EtOAc–hexanes, 1:4).

IR (neat): 3430 (NH), 1726 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 3.35–3.48 (m, 2 H, CH_2), 3.64 (s, 3 H, OCH_3), 3.74 (s, 3 H, OCH_3), 5.31 (s, 1 H, CH), 5.99 (s, 1 H, =CH_2), 6.42 (s, 1 H, =CH_2), 7.37–7.42 (m, 1 H, ArH), 7.56 (t, *J* = 7.6 Hz, 1 H, ArH), 7.65 (d, *J* = 7.9 Hz, 1 H, ArH), 7.79 (d, *J* = 8.0 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 49.3, 52.3, 52.4, 56.3, 124.6, 126.4, 128.8, 130.0, 133.2, 135.6, 141.3, 150.5, 166.3, 172.7.

MS (ES+): *m*/*z* = 309.1 (M^+ + 1).

Anal. Calcd for $C_{14}H_{16}N_2O_6$: C, 54.54; H, 5.23; N, 9.09. Found: C, 54.31; H, 5.58; N, 9.23.

Methyl 2-{[(2,2-Dimethoxyethyl)amino](2-nitrophenyl)methyl}acrylate (11g)

Brown oil; yield: 1.65 g (71%); R_f = 0.30 (EtOAc–hexanes, 1:4).

IR (neat): 3449 (NH), 1717 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 2.64–2.84 (m, 2 H, CH_2), 3.35 (s, 3 H, OCH_3), 3.37 (s, 3 H, OCH_3), 3.66 (s, 3 H, OCH_3), 4.50 (t, *J* = 5.4 Hz, 1 H, CH), 5.26 (s, 1 H, CH), 5.93 (t, *J* = 1.2 Hz, 1 H, =CH_2), 6.41 (t, *J* = 0.8 Hz, 1 H, =CH_2), 7.34–7.43 (m, 1 H, ArH), 7.51–7.66 (m, 2 H, ArH), 7.81 (dd, J_1 = 8.0 Hz, J_2 = 1.4 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 49.6, 52.4, 54.0, 54.3, 57.2, 103.9, 124.7, 126.8, 128.6, 129.8, 133.1, 136.3, 141.1, 150.3, 166.7.

MS (ES+): *m*/*z* = 325.0 (M^+ + 1).

Anal. Calcd for $C_{15}H_{20}N_2O_6$: C, 55.55; H, 6.22; N, 8.64. Found: C, 55.60; H, 5.97; N, 8.89.

Methyl 2-[(Benzylamino)(4,5-dimethoxy-2-nitrophenyl)methyl]acrylate (12a)

Yellow oil; yield: 1.40 g (82%); R_f = 0.58 (EtOAc–hexanes, 3:7).

IR (neat): 3429 (NH), 1716 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.68–3.80 (m, 5 H, CH_2, OCH_3), 3.94 (s, 6 H, 2 × OCH_3), 5.48 (s, 1 H, CH), 5.79 (t, *J* = 1.1 Hz, 1 H, =CH_2), 6.36 (d, *J* = 0.5 Hz, 1 H, =CH_2), 7.29–7.35 (m, 6 H, ArH), 7.54 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 30.1, 52.5, 53.1, 56.8, 57.9, 108.5, 111.3, 126.6, 127.6, 128.1, 128.6, 128.8, 128.9, 131.5, 140.3, 141.8, 142.2, 148.2, 153.4, 167.0.

MS (ES+): *m*/*z* = 387.1 (M^+ + 1).

Anal. Calcd for $C_{20}H_{22}N_2O_6$: C, 62.17; H, 5.74; N, 7.25. Found: C, 62.52; H, 5.44; N, 7.45.

Methyl 2-{(4,5-Dimethoxy-2-nitrophenyl)[(2-methoxy-2-oxoethyl)amino]methyl}acrylate (12f)

Yellow oil; yield: 1.00 g (61%); R_f = 0.50 (EtOAc–hexanes, 3:7).

IR (neat): 3445 (NH), 1736 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.33–3.52 (m, 2 H, CH_2), 3.69 (s, 3 H, OCH_3), 3.74 (s, 3 H, OCH_3), 3.94 (s, 6 H, 2 × OCH_3), 5.44 (s, 1 H, CH), 5.88 (t, *J* = 1.1 Hz, 1 H, =CH_2), 6.37 (s, 1 H, =CH_2), 7.17 (s, 1 H, ArH), 7.47 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 49.4, 52.3, 52.4, 56.6, 56.7, 56.8, 108.2, 111.0, 126.1, 130.3, 141.8, 142.5, 148.3, 153.3, 166.5, 172.7.

MS (ES+): *m*/*z* = 369.0 (M^+ + 1).

Anal. Calcd for $C_{16}H_{20}N_2O_8$: C, 52.17; H, 5.47; N, 7.61. Found: C, 52.07; H, 5.24; N, 7.85.

Cyanamides 13a–g, 14a,b,f, 15a–d,f,g and 16a,f; Typical Procedure

To a soln of compound **9a** (1.50 g, 5.12 mmol) in MeOH (20 mL) were added CNBr (0.65 g, 6.14 mmol) and $NaHCO_3$ (0.52 g, 6.14 mmol) and the reaction was allowed to stir at r.t. for 48 h. After completion of the reaction, MeOH was removed and the residue was dissolved in EtOAc (40 mL) and H_2O (40 mL). The aq layer was separated and extracted with EtOAc (4 × 20 mL). The combined organic layer was dried over Na_2SO_4 and concentrated to afford a crude product which was purified by column chromatography on silica gel (EtOAc–hexanes, 1:3) to give pure compound **13a** as yellow oil; yield: 1.32 g (81%).

Benzyl[2-cyano-1-(2-nitrophenyl)prop-2-en-1-yl]cyanamide (13a)

R_f = 0.43 (EtOAc–hexanes, 1:4).

IR (neat): 2200 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 4.23 (d, *J* = 14.0 Hz, 1 H, CH_2), 4.41 (d, *J* = 13.7 Hz, 1 H, CH_2), 5.59 (s, 1 H, CH), 5.91 (s, 1 H, =CH_2), 6.27 (s, 1 H, =CH_2), 7.27–7.38 (m, 5 H, ArH), 7.63 (t, *J* = 7.5 Hz, 1 H, ArH), 7.79 (t, *J* = 7.5 Hz, 1 H, ArH), 7.85 (d, *J* = 7.5 Hz, 1 H, ArH), 8.09 (d, *J* = 8.1 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 34.4, 62.1, 114.3, 116.8, 120.9, 126.5, 129.5, 129.7, 131.3, 134.75, 134.78, 148.8.

MS (ES+): *m*/*z* = 319.1 (M^+ + 1).

Anal. Calcd for $C_{18}H_{14}N_4O_2$: C, 67.91; H, 4.43; N, 17.60. Found: C, 68.28; H, 4.78; N, 17.89.

[2-Cyano-1-(2-nitrophenyl)prop-2-en-1-yl]cyclohexylcyanamide (13b)

White solid; yield: 0.70 g (88%); mp 107–109 °C; R_f = 0.31 (EtOAc–hexanes, 1:4).

IR (KBr): 2211 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 1.18–1.31 (m, 4 H, 2 × CH_2), 1.50–1.67 (m, 6 H, 3 × CH_2), 2.08–2.98 (m, 1 H, CH), 5.74 (s, 1 H, CH), 5.85 (s, 1 H, =CH_2), 6.27 (s, 1 H, =CH_2), 7.62–7.67 (m, 1 H, ArH), 7.77–7.86 (m, 2 H, ArH), 8.13 (d, *J* = 8.1 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 25.3, 25.48, 25.51, 31.7, 31.8, 60.5, 61.6, 113.8, 116.8, 121.6, 126.4, 129.9, 130.5, 131.1, 134.8.

MS (ES+): *m*/*z* = 311.1 (M^+ + 1).

Anal. Calcd for $C_{17}H_{18}N_4O_2$: C, 65.79; H, 5.85; N, 18.05. Found: C, 65.97; H, 6.11; N, 17.71.

[2-Cyano-1-(2-nitrophenyl)prop-2-en-1-yl]cyclopropylcyanamide (13c)

Yellow oil; yield: 1.21 g (73%); R_f = 0.31 (EtOAc–hexanes, 3:7).

IR (neat): 2221 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 0.85–0.93 (m, 2 H, CH_2), 0.95–1.00 (m, 2 H, CH_2), 2.78–2.83 (m, 1 H, CH), 5.73 (t, *J* = 1.2 Hz, 1 H, CH), 5.87–5.88 (m, 1 H, =CH_2), 6.30 (t, *J* = 0.7 Hz, 1 H, =CH_2), 7.66–7.70 (m, 1 H, ArH), 7.80 (d, *J* = 1.2 Hz, 1 H, ArH), 7.83 (d, *J* = 0.9 Hz, 1 H, ArH), 8.13–8.17 (m, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 8.4, 8.8, 34.4, 62.1, 114.3, 116.8, 120.9, 126.5, 129.5, 129.7, 131.3, 134.8, 148.8.

MS (ES+): *m*/*z* = 269.1 (M^+ + 1).

Anal. Calcd for $C_{14}H_{12}N_4O_2$: C, 62.68; H, 4.51; N, 20.88. Found: C, 62.87; H, 4.69; N, 20.52.

[2-Cyano-1-(2-nitrophenyl)prop-2-en-1-yl]propylcyanamide (13d)

Brown oil; yield: 1.04 g (77%); R_f = 0.30 (EtOAc–hexanes, 1:4).

IR (neat): 2215 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 1.01 (t, J = 7.4 Hz, 3 H, CH_3), 1.69–1.87 (m, 2 H, CH_2), 3.01–3.23 (m, 2 H, CH_2), 5.64 (s, 1 H, CH), 5.99 (t, J = 0.6 Hz, 1 H, =CH_2), 6.32 (s, 1 H, =CH_2), 7.61–7.72 (m, 1 H, ArH), 7.77–7.82 (m, 2 H, ArH), 8.15 (d, J = 7.9 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 11.4, 21.6, 54.7, 61.9, 114.8, 116.7, 120.9, 126.6, 129.6, 129.8, 131.3, 134.8, 135.0.

MS (ES+): m/z = 271.2 (M^+ + 1).

Anal. Calcd for $C_{14}H_{14}N_4O_2$: C, 62.21; H, 5.22; N, 20.73. Found: C, 62.54; H, 4.98; N, 20.86.

***sec*-Butyl[2-cyano-1-(2-nitrophenyl)prop-2-en-1-yl]cyanamide (13e)**

Brown oil (1:1 mixture of diastereoisomers); yield: 1.04 g (63%); R_f = 0.38 (EtOAc–hexanes, 3:17).

IR (neat): 2212 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 0.91 (t, J = 7.4 Hz, 3 H, CH_3), 1.04 (t, J = 7.4 Hz, 3 H, CH_3), 1.27 (d, J = 6.6 Hz, 3 H, CH_3), 1.35 (d, J = 6.5 Hz, 3 H, CH_3), 1.58–1.98 (m, 4 H, 2 × CH_2), 3.00–3.11 (m, 2 H, 2 × CH), 5.70–5.71 (m, 2 H, 2 × CH), 5.86–5.89 (m, 2 H, 2 × =CH_2), 6.27–6.28 (m, 2 H, 2 × =CH_2), 7.64–7.72 (m, 2 H, 2 × ArH), 7.80–7.90 (m, 4 H, 4 × ArH), 8.12 (dd, J_1 = 8.1 Hz, J_2 = 1.2 Hz, 2 H, 2 × ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 10.5, 10.7, 18.2, 18.4, 28.0, 28.2, 59.8, 60.3, 60.5, 113.3, 116.4, 121.0, 121.2, 125.9, 129.4, 129.6, 130.1, 130.3, 130.7, 134.3, 134. 4, 134.8, 135.0, 148.1.

MS (ES+): m/z = 285.0 (M^+ + 1).

Anal. Calcd for $C_{15}H_{16}N_4O_2$: C, 63.37; H, 5.67; N, 19.71. Found: C, 63.68; H, 5.48; N, 19.98.

Methyl *N*-Cyano-*N*-[2-cyano-1-(2-nitrophenyl)prop-2-en-1-yl]glycinate (13f)

White solid; yield: 1.22 g (70%); mp 105–106 °C; R_f = 0.23 (EtOAc–hexanes, 1:4).

IR (KBr): 2224 (CN), 1752 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 3.81 (s, 3 H, OCH_3), 3.88–4.08 (m, 2 H, CH_2), 5.88 (s, 1 H, CH), 6.31 (s, 1 H, =CH_2), 6.39 (s, 1 H, =CH_2), 7.67 (t, J = 7.5 Hz, 1 H, ArH), 7.81–7.89 (m, 2 H, ArH), 8.14 (d, J = 8.1 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 53.0, 53.4, 61.9, 116.2, 120.2, 126.5, 129.0, 130.0, 131.5, 134.8, 136.6, 167.8.

MS (ES+): m/z = 301.2 (M^+ + 1).

Anal. Calcd for $C_{14}H_{12}N_4O_4$: C, 56.00; H, 4.03; N, 18.66. Found: C, 56.24; H, 3.87; N, 18.89.

2-Cyano-1-(2-nitrophenyl)allyl(dimethoxymethyl)cyanamide (13g)

Brown oil; yield: 1.80 g (72%); R_f = 0.25 (EtOAc–hexanes, 3:7).

IR (neat): 2217 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 3.15–3.22 (m, 1 H, CH_2), 3.32–3.38 (m, 4 H, OCH_3, C*H*H), 3.44 (s, 3 H, OCH_3), 4.55 (t, J = 4.9 Hz, 1 H, CH), 5.84 (s, 1 H, CH), 5.99 (s, 1 H, =CH_2), 6.32 (s, 1 H, =CH_2), 7.61–7.67 (m, 1 H, ArH), 7.78–7.85 (m, 2 H, ArH), 8.13 (d, J = 8.0 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 75 MHz): δ = 53.5, 54.9, 55.3, 61.4, 102.6, 114.8, 116.3, 120.5, 125.9, 129.3, 129.5, 130.7, 134.3, 135.3, 148.4.

MS (ES+): m/z = 317.0 (M^+ + 1).

Anal. Calcd for $C_{15}H_{16}N_4O_4$: C, 56.96; H, 5.10; N, 17.71. Found: C, 57.28; H, 4.93; N, 17.45.

Benzyl[2-cyano-1-(4,5-dimethoxy-2-nitrophenyl)prop-2-en-1-yl]cyanamide (14a)

Yellow solid; yield: 1.03 g (80%); mp 120–121 °C; R_f = 0.34 (EtOAc–hexanes, 2:3).

IR (KBr): 2208 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.98 (s, 3 H, OCH_3), 3.99 (s, 3 H, OCH_3), 4.22–4.40 (m, 2 H, CH_2), 5.74 (t, J = 1.1 Hz, 1 H, CH), 5.96 (d, J = 1.1 Hz, 1 H, =CH_2), 6.25 (s, 1 H, =CH_2), 7.21 (s, 1 H, ArH), 7.24–7.29 (m, 2 H, ArH), 7.35–7.39 (m, 3 H, ArH), 7.66 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 56.85, 56.94, 57.1, 60.5, 109.1, 110.7, 115.4, 116.6, 120.9, 123.9, 129.3, 129.5, 129.6, 133.4, 135.5, 141.3, 149.8, 154.1.

MS (ES+): m/z = 379.1 (M^+ + 1).

Anal. Calcd for $C_{20}H_{18}N_4O_4$: C, 63.48; H, 4.79; N, 14.81. Found: C, 63.79; H, 4.58; N, 15.01.

[2-Cyano-1-(4,5-dimethoxy-2-nitrophenyl)prop-2-en-1-yl]cyclohexylcyanamide (14b)

White solid; yield: 0.60 g (70%); mp 84–85 °C; R_f = 0.28 (EtOAc–hexanes, 3:7).

IR (KBr): 2208 (CN) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 1.22–1.37 (m, 4 H, 2 × CH_2), 1.44–1.67 (m, 4 H, 2 × CH_2), 1.85–2.07 (m, 2 H, CH_2), 2.82–2.97 (m, 1 H, CH), 3.99 (s, 3 H, OCH_3), 4.03 (s, 3 H, OCH_3), 5.87 (s, 1 H, CH), 5.89 (s, 1 H, =CH_2), 6.24 (s, 1 H, =CH_2), 7.26 (s, 1 H, ArH), 7.72 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 25.3, 25.50, 25.54, 31.7, 31.8, 57.0, 57.2, 60.5, 61.4, 109.3, 110.9, 114.2, 117.0, 121.9, 125.3, 134.6, 140.9, 149.9, 154.2.

MS (ES+): m/z = 371.0 (M^+ + 1).

Anal. Calcd for $C_{19}H_{22}N_4O_4$: C, 61.61; H, 5.99; N, 15.13. Found: C, 61.93; H, 5.87; N, 15.38.

Methyl *N*-Cyano-*N*-[2-cyano-1-(4,5-dimethoxy-2-nitrophenyl)prop-2-en-1-yl]glycinate (14f)

Brown oil; yield: 0.43 g (80%); R_f = 0.32 (EtOAc–hexanes 3:7).

IR (neat): 2224 (CN), 1753 (CO_2Me) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 3.79 (s, 3 H, OCH_3), 3.98 (s, 2 H, CH_2), 4.00 (s, 3 H, OCH_3), 4.05 (s, 3 H, OCH_3), 6.01 (s, 1 H, =CH), 6.32 (d, J = 1.2 Hz, 1 H, =CH_2), 6.35 (s, 1 H, =CH_2), 7.29 (s, 1 H, ArH), 7.70 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 52.8, 53.3, 57.0, 57.3, 62.1, 109.3, 111.1, 114.6, 116.5, 120.4, 123.4, 136.6, 141.4, 150.1, 154.3, 168.0.

MS (ES+): m/z = 361.1 (M^+ + 1).

Anal. Calcd for $C_{16}H_{16}N_4O_6$: C, 53.33; H, 4.48; N, 15.55. Found: C, 53.51; H, 4.78; N, 15.61.

Methyl 2-{[Benzyl(cyano)amino](2-nitrophenyl)methyl}acrylate (15a)

White solid; yield: 0.91 g (94%); mp 78–80 °C; R_f = 0.38 (EtOAc–hexanes, 3:7).

IR (KBr): 2212 (CN), 1724 (CO_2CH_3) cm^{-1}.

^1H NMR ($CDCl_3$, 300 MHz): δ = 3.78 (s, 3 H, OCH_3), 4.31–4.42 (m, 2 H, CH_2), 5.56 (s, 1 H, CH), 5.96 (s, 1 H, =CH_2), 6.55 (s, 1 H,

=CH_2), 7.31 (s, 5 H, ArH), 7.52 (t, J = 7.6 Hz, 1 H, ArH), 7.68–7.75 (m, 2 H, ArH), 8.03 (d, J = 8.1 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 75 MHz): δ = 52.9, 57.7, 59.3, 116.0, 126.0, 129.2, 129.3, 129.5, 129.7, 129.86, 129.94, 132.6, 133.9, 134.0, 137.8, 148.3, 165.5.

MS (ES+): m/z = 351.9 (M^+ + 1).

Anal. Calcd for $C_{19}H_{17}N_3O_4$: C, 64.95; H, 4.88; N, 11.96. Found: C, 65.24; H, 4.68; N, 12.25.

Methyl 2-{[Cyano(cyclohexyl)amino](2-nitrophenyl)methyl}acrylate (15b)
Yellow oil; yield: 0.80 g (82%); R_f = 0.50 (EtOAc–hexanes, 1:4).

IR (neat): 2207 (CN), 1722 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 1.47–1.65 (m, 6 H, 3 × CH_2), 1.79–1.91 (m, 4 H, 2 × CH_2), 2.82–2.98 (m, 1 H, CH), 3.82 (s, 3 H, OCH_3), 5.51 (d, J = 1.1 Hz, 1 H, CH), 6.04 (s, 1 H, =CH_2), 6.53 (s, 1 H, =CH_2), 7.51–7.59 (m, 1 H, ArH), 7.69–7.83 (m, 2 H, ArH), 8.09 (dd, J_1 = 8.1 Hz, J_2 = 1.4 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 25.4, 25.5, 25.6, 31.6, 32.2, 53.0, 58.9, 61.6, 115.0, 126.2, 129.6, 129.9, 130.0, 133.7, 134.2, 138.5, 148.3, 165.7.

MS (ES+): m/z = 344.1 (M^+ + 1).

Anal. Calcd for $C_{18}H_{21}N_3O_4$: C, 62.96; H, 6.16; N, 12.24. Found: C, 62.67; H, 6.47; N, 12.50.

Methyl 2-{[Cyano(cyclopropyl)amino](2-nitrophenyl)methyl}acrylate (15c)
Yellow solid; yield: 1.05 g (96%); mp 67–70 °C; R_f = 0.35 (EtOAc–hexanes, 1:4).

IR (KBr): 2215 (CN), 1723 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 0.78–0.84 (m, 2 H, CH_2), 0.89–0.93 (m, 1 H, CH_2), 1.05–1.09 (m, 1 H, CH_2), 2.84–2.87 (m, 1 H, CH), 3.81 (s, 3 H, OCH_3), 5.52 (s, 1 H, CH), 6.03 (s, 1 H, =CH_2), 6.52 (s, 1 H, =CH_2), 7.56–7.59 (m, 1 H, ArH), 7.75 (d, J = 3.0 Hz, 2 H, ArH), 8.10 (d, J = 8.2 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 8.2, 8.3, 34.3, 53.0, 60.3, 115.5, 126.3, 129.2, 129.6, 130.0, 132.8, 134.3, 137.9, 148.4, 165.6.

MS (ES+): m/z = 302.1 (M^+ + 1).

Anal. Calcd for $C_{15}H_{15}N_3O_4$: C, 59.79; H, 5.02; N, 13.95. Found: C, 59.48; H, 4.73; N, 14.18.

Methyl 2-{[Cyano(propyl)amino](2-nitrophenyl)methyl}acrylate (15d)
Yellow solid; yield: 0.85 g (87%); mp 80–82 °C; R_f = 0.28 (EtOAc–hexanes, 2:3).

IR (KBr): 2207 (CN), 1718 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 0.98 (t, J = 7.4 Hz, 3 H, CH_3), 1.67–1.82 (m, 2 H, CH_2), 3.16 (dt, J_1 = 7.5 Hz, J_2 = 1.8 Hz, 2 H, CH_2), 3.81 (s, 3 H, OCH_3), 5.59 (d, J = 1.1 Hz, 1 H, CH), 5.93 (s, 1 H, =CH_2), 6.56 (s, 1 H, =CH_2), 7.52–7.61 (m, 1 H, ArH), 7.74 (dd, J_1 = 5.1 Hz, J_2 = 1.2 Hz, 2 H, ArH), 8.10 (d, J = 8.0 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 11.5, 21.6, 53.0, 55.1, 60.0, 116.0, 126.3, 129.4, 129.5, 130.1, 132.7, 134.3, 138.0, 148.5, 165.6.

MS (ES+): m/z = 303.9 (M^+ + 1).

Anal. Calcd for $C_{15}H_{17}N_3O_4$: C, 59.40; H, 5.65; N, 13.85. Found: C, 59.76; H, 5.98; N, 13.61.

Methyl 2-{[Cyano(2-methoxy-2-oxoethyl)amino](2-nitrophenyl)methyl}acrylate (15f)
Green oil; yield: 1.00 g (71%); R_f = 0.32 (EtOAc–hexanes, 2:3).

IR (neat): 2220 (CN), 1726 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 3.73 (s, 3 H, OCH_3), 3.80 (s, 3 H, OCH_3), 4.00–4.22 (m, 2 H, CH_2), 5.67 (d, J = 0.9 Hz, 1 H, CH), 5.99 (s, 1 H, =CH_2), 6.54 (s, 1 H, =CH_2), 7.52–7.61 (m, 1 H, ArH), 7.76 (dt, J_1 = 7.6 Hz, J_2 = 1.3 Hz, 1 H, ArH), 7.92 (d, J = 6.9 Hz, 1 H, ArH), 8.08 (dd, J_1 = 8.1 Hz, J_2 = 1.2 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 53.0, 54.5, 61.5, 115.3, 126.1, 129.4, 129.8, 130.2, 132.1, 134.3, 137.8, 148.2, 165.7, 168.4.

MS (ES+): m/z = 334.1 (M^+ + 1).

Anal. Calcd for $C_{15}H_{15}N_3O_6$: C, 54.05; H, 4.54; N, 12.61. Found: C, 54.28; H, 4.89; N, 12.32.

Methyl 2-{[Cyano(dimethoxyethyl)amino](2-nitrophenyl)methyl}acrylate (15g)
White solid; yield: 0.90 g (83%); mp 62–65 °C; R_f = 0.20 (EtOAc–hexanes, 1:4).

IR (KBr): 2214 (CN), 1721 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 3.28 (s, 3 H, OCH_3), 3.32 (d, J = 5.0 Hz, 1 H, CH_2), 3.36–3.39 (m, 4 H, OCH_3, CH_2), 3.82 (s, 3 H, OCH_3), 4.54 (t, J = 5.2 Hz, 1 H, CH), 5.56 (d, J = 1.1 Hz, 1 H, CH), 5.99 (s, 1 H, =CH_2), 6.54 (s, 1 H, =CH_2), 7.52–7.58 (m, 1 H, ArH), 7.74 (dt, J_1 = 8.0 Hz, J_2 = 1.2 Hz, 1 H, ArH), 7.80–7.83 (m, 1 H, ArH), 8.08 (dd, J_1 = 8.2 Hz, J_2 = 1.2 Hz, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 53.0, 54.6, 54.8, 54.9, 60.6, 102.4, 116.2, 126.1, 129.5, 129.7, 129.9, 133.0, 134.2, 138.0, 148.4, 165.7.

MS (ES+): m/z = 350.3 (M^+ + 1).

Anal. Calcd for $C_{16}H_{19}N_3O_6$: C, 55.01; H, 5.48; N, 12.03. Found: C, 54.89; H, 5.66; N, 12.33.

Methyl 2-{[Benzyl(cyano)amino](4,5-dimethoxy-2-nitrophenyl)methyl}acrylate (16a)
Yellow solid; yield: 0.80 g (75%); mp 110–111 °C; R_f = 0.31 (EtOAc–hexanes, 3:7).

IR (KBr): 2211 (CN), 1718 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 3.81 (s, 3 H, OCH_3), 3.91 (s, 3 H, OCH_3), 3.95 (s, 3 H, OCH_3), 4.31–4.46 (m, 2 H, CH_2), 5.53 (d, J = 1.1 Hz, 1 H, CH), 6.08 (s, 1 H, =CH_2), 6.50 (s, 1 H, =CH_2), 7.06 (s, 1 H, ArH), 7.30–7.35 (m, 5 H, ArH), 7.66 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 53.0, 56.9, 57.0, 58.0, 60.1, 109.3, 110.8, 116.4, 127.6, 129.3, 129.37, 129.44, 129.7, 134.4, 138.3, 140.5, 149.0, 153.8, 165.8.

MS (ES+): m/z = 412.0 (M^+ + 1).

Anal. Calcd for $C_{21}H_{21}N_3O_6$: C, 61.31; H, 5.14; N, 10.21. Found: C, 61.42; H, 5.38; N, 10.19.

Methyl 2-{[Cyano(2-methoxy-2-oxoethyl)amino](4,5-dimethoxy-2-nitrophenyl)methyl]acrylate (16f)
Yellow solid; yield: 0.43 g (57%); mp 128–129 °C; R_f = 0.79 (EtOAc–hexanes, 1:4).

IR (KBr): 2219 (CN), 1725 (CO_2CH_3) cm^{-1}.

^{1}H NMR ($CDCl_3$, 200 MHz): δ = 3.74 (s, 3 H, OCH_3), 3.82 (s, 3 H, OCH_3), 3.97 (s, 3 H, OCH_3), 4.08–4.23 (m, 5 H, OCH_3, CH_2), 5.61 (d, J = 0.9 Hz, 1 H, CH), 6.06 (s, 1 H, =CH_2), 6.48 (s, 1 H, =CH_2), 7.50 (s, 1 H, ArH), 7.71 (s, 1 H, ArH).

^{13}C NMR ($CDCl_3$, 50 MHz): δ = 53.1, 54.8, 56.9, 57.2, 62.4, 109.3, 111.4, 115.5, 127.3, 128.9, 138.3, 140.1, 149.0, 154.0, 168.6.

MS (ES+): m/z = 394.1 (M^+ + 1).

Anal. Calcd for $C_{17}H_{19}N_3O_8$: C, 51.91; H, 4.87; N, 10.68. Found: C, 52.09; H, 4.98; N, 10.45.

2-Amino-3,4-dihydroquinazolines 17a–e,g, 18a,b, 19b–d,g, 20a and Imidazo[2,1-*b*]quinazoline-2-ones 21–24; Typical Procedure

To a soln of compound **13a** (0.50 g, 1.57 mmol) in AcOH (10 mL) was added Fe powder (0.44 g, 7.86 mmol) and the mixture was heated at 95 °C for 20 min. After cooling to r.t., the soln was poured onto ice-water (20 mL) and neutralized with aq $NaHCO_3$ soln. The precipitated solid was removed by filtration through Celite and then rinsed with EtOAc. The organic layer was washed with brine (70 mL), dried over Na_2SO_4 and concentrated. The residue was crystallized from EtOAc–hexanes to furnish pure **17a** as a brown solid; yield: 0.24 g (53%).

2-(2-Amino-3-benzyl-3,4-dihydroquinazolin-4-yl)acrylonitrile (17a)

Mp 120–121 °C; R_f = 0.21 (MeOH–$CHCl_3$, 1:4).

IR (KBr): 3424 (NH_2), 2225 (CN), 1657 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 4.51–4.60 (m, 2 H, CH_2), 5.69 (s, 1 H, CH), 6.23 (s, 1 H, =CH_2), 6.28 (s, 1 H, =CH_2), 7.30–7.38 (m, 9 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 51.1, 61.0, 116.0, 116.8, 117.7, 121.3, 125.2, 127.5, 127.8, 128.6, 129.3, 130.7, 132.6, 134.7, 135.1, 152.1.

MS (ES+): *m*/*z* = 289.3 (M^+ + 1).

Anal. Calcd for $C_{18}H_{16}N_4$: C, 74.98; H, 5.59; N, 19.43. Found: C, 75.15; H, 5.77; N, 19.41.

2-(2-Amino-3-cyclohexyl-3,4-dihydroquinazolin-4-yl)acrylonitrile (17b)

White solid; yield: 0.30 g (66%); mp 129–130 °C; R_f = 0.23 (MeOH–$CHCl_3$, 1:4).

IR (KBr): 3367 (NH_2), 2225 (CN), 1645 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 1.09–1.42 (m, 4 H, 2 × CH_2), 1.49–1.61 (m, 3 H, CH_2), 1.70–1.76 (m, 3 H, CH_2), 4.01–4.08 (m, 1 H, CH), 5.89 (s, 1 H, CH), 6.16 (s, 1 H, =CH_2), 6.20 (s, 1 H, =CH_2), 7.03 (d, *J* = 7.8 Hz, 1 H, ArH), 7.15 (t, *J* = 7.3 Hz, 1 H, ArH), 7.31–7.39 (m, 2 H, ArH).

^{13}C NMR (DMSO-d_6, 50 MHz): δ = 25.3, 26.0, 26.3, 30.8, 31.2, 54.7, 58.2, 116.6, 117.7, 120.5, 124.2, 124.6, 127.1, 130.4, 148.3, 153.9.

MS (ES+): *m*/*z* = 281.3 (M^+ + 1).

Anal. Calcd for $C_{17}H_{20}N_4$: C, 72.83; H, 7.19; N, 19.98. Found: C, 72.56; H, 7.34; N, 19.76.

2-(2-Amino-3-cyclopropyl-3,4-dihydroquinazolin-4-yl)acrylonitrile (17c)

White solid; yield: 0.60 g (67%); mp 137–139 °C; R_f = 0.21 (MeOH–$CHCl_3$ 1:4).

IR (KBr): 3424 (NH_2), 2225 (CN), 1680 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 0.70–0.85 (m, 3 H, CH_2), 1.02–1.04 (m, 1 H, CH_2), 2.58 (s, 1 H, CH), 5.34 (s, 1 H, CH), 6.13 (s, 1 H, =CH_2), 6.17 (s, 1 H, =CH_2), 6.82 (d, *J* = 7.9 Hz, 1 H, ArH), 6.90 (t, *J* = 7.3 Hz, 1 H, ArH), 7.08 (d, *J* = 7.4 Hz, 1 H, ArH), 7.18 (t, *J* = 7.4 Hz, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 7.7, 29.0, 61.2, 117.3, 118.9, 122.5, 123.4, 127.5, 130.4, 134.0, 137.1, 154.6, 177.2.

MS (ES+): *m*/*z* = 239.2 (M^+ + 1).

Anal. Calcd for $C_{14}H_{14}N_4$: C, 70.57; H, 5.92; N, 23.51. Found: C, 70.48; H, 5.87; N, 23.83.

2-(2-Amino-3-propyl-3,4-dihydroquinazolin-4-yl)acrylonitrile (17d)

White solid; yield: 0.46 g (60%); mp 157–158 °C; R_f = 0.15 (MeOH–$CHCl_3$, 1:9).

IR (KBr): 3417 (NH_2), 2210 (CN), 1678 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 0.82 (d, *J* = 6.8 Hz, 3 H, CH_3), 1.57 (d, *J* = 5.9 Hz, 2 H, CH_2), 3.03 (t, *J* = 6.6 Hz, 2 H, CH_2), 5.46 (s, 1 H, CH), 6.11 (s, 1 H, =CH_2), 6.14 (s, 1 H, =CH_2), 6.84–6.95 (m, 2 H, ArH), 7.07 (d, *J* = 6.4 Hz, 1 H, ArH), 7.13–7.18 (m, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 50 MHz): δ = 11.3, 24.9, 49.7, 61.4, 117.2, 117.6, 123.2, 127.2, 130.3, 133.4, 137.6, 153.2.

MS (ES+): *m*/*z* = 241.3 (M^+ + 1).

Anal. Calcd for $C_{14}H_{16}N_4$: C, 69.97; H, 6.71; N, 23.32. Found: C, 70.11; H, 6.53; N, 23.57.

2-(2-Amino-3-*sec*-butyl-3,4-dihydroquinazolin-4-yl)acrylonitrile (17e)

White solid (1:1 mixture of diastereoisomers); yield: 0.44 g (61%); mp 157–158 °C; R_f = 0.15 (MeOH–$CHCl_3$, 1:9).

IR (neat): 3458 (NH_2), 2212 (CN), 1665 (C=N) cm^{-1}.

^1H NMR ($CDCl_3$, 200 MHz): δ = 0.76 (t, *J* = 7.4 Hz, 3 H, CH_3), 1.05 (t, *J* = 7.3 Hz, 3 H, CH_3), 1.30–1.40 (m, 6 H, 2 × CH_3), 1.58–1.72 (m, 3 H, CH_2), 1.82–1.96 (m, 1 H, CH_2), 4.07–4.18 (m, 1 H, CH), 4.30–4.37 (m, 1 H, CH), 5.01 (s, 1 H, CH), 5.10 (s, 1 H, CH), 5.85 (s, 2 H, 2 × =CH_2), 5.97 (s, 2 H, 2 × =CH_2), 7.08–7.17 (m, 3 H, ArH), 7.23–7.38 (m, 5 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 11.4, 11.5, 17.9, 19.4, 27.1, 27.5, 53.3, 53.5, 55.7, 56.2, 117.0, 117.5, 120.2, 120.3, 123.2, 124.3, 124.5, 129.8, 131.7, 132.1, 153.6, 154.4, 176.6.

MS (ES+): *m*/*z* = 255.2 (M^+ + 1).

Anal. Calcd for $C_{15}H_{18}N_4$: C, 70.84; H, 7.13; N, 22.03. Found: C, 71.11; H, 6.87; N, 22.14.

2-[2-Amino-3-(2,2-dimethoxyethyl)-3,4-dihydroquinazolin-4-yl]acrylonitrile (17g)

White solid; yield: 1.00 g (65%); mp 157–158 °C; R_f = 0.21 (MeOH–$CHCl_3$, 1:4).

IR (KBr): 3406 (NH_2), 2224 (CN), 1650 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 3.12 (dd, J_1 = 15.1 Hz, J_2 = 6.5 Hz, 1 H, CH_2), 3.27 (s, 6 H, 2 × OCH_3), 3.73 (dd, J_1 = 15.2 Hz, J_2 = 3.5 Hz, 1 H, CH_2), 4.48–4.52 (m, 1 H, CH), 5.27 (s, 1 H, CH), 5.92 (s, 1 H, =CH_2), 5.99 (s, 2 H, NH_2), 6.05 (s, 1 H, =CH_2), 6.69 (d, *J* = 7.8 Hz, 1 H, ArH), 6.78 (t, *J* = 6.7 Hz, 1 H, ArH), 6.97 (d, *J* = 7.1 Hz, 1 H, ArH), 7.08 (t, *J* = 7.0 Hz, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 50.7, 54.3, 55.5, 62.3, 103.1, 118.0, 120.6, 121.3, 123.9, 126.2, 129.1, 130.6, 145.4, 153.5.

MS (ES+): *m*/*z* = 287.0 (M^+ + 1).

HRMS (EI): *m*/*z* calcd for $C_{15}H_{18}N_4O_2$: 286.1430; found: 286.1427.

2-(2-Amino-3-benzyl-6,7-dimethoxy-3,4-dihydroquinazolin-4-yl)acrylonitrile (18a)

Yellow solid; yield: 0.40 g (55%); mp 141–142 °C; R_f = 0.21 (MeOH–$CHCl_3$, 1:4).

IR (KBr): 3424 (NH_2), 2225 (CN), 1662 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 3.69 (s, 6 H, 2 × OCH_3), 3.99–4.17 (m, 2 H, CH_2), 6.00–6.06 (m, 1 H, CH), 6.37 (s, 1 H, =CH_2), 6.54 (s, 1 H, =CH_2), 7.23–7.32 (m, 7 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 51.4, 56.3, 57.0, 60.9, 110.6, 118.5, 123.7, 128.1, 128.5, 129.7, 137.7, 144.7, 150.8, 171.6

MS (ES+): m/z = 349.3 (M^+ + 1).

Anal. Calcd for $C_{20}H_{20}N_4O_2$: C, 68.95; H, 5.79; N, 16.08. Found: C, 69.06; H, 6.01; N, 15.84.

2-(2-Amino-3-cyclohexyl-6,7-dimethoxy-3,4-dihydroquinazolin-4-yl)acrylonitrile (18b)

Brown solid; yield: 0.30 g (66%); mp 129–130 °C; R_f = 0.21 (MeOH–$CHCl_3$, 1:4).

IR (KBr): 3367 (NH_2), 2225 (CN), 1645 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 1.09–1.22 (m, 6 H, 3 × CH_2), 1.30–1.43 (m, 4 H, 2 × CH_2), 1.85–1.97 (m, 1 H, CH), 3.67 (s, 3 H, OCH_3), 3.69 (s, 3 H, OCH_3), 5.42 (s, 1 H, CH), 5.93 (s, 1 H, =CH_2), 6.00 (s, 1 H, =CH_2), 6.40 (s, 1 H, ArH), 6.81 (s, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 25.3, 25.50, 25.54, 31.7, 31.8, 57.0, 57.2, 110.9, 114.2, 117.0, 125.3, 134.6, 140.9, 148.3, 149.9, 154.2, 171.1.

MS (ES+): m/z = 341.3 (M^+ + 1).

Anal. Calcd for $C_{19}H_{24}N_4O_2$: C, 67.04; H, 7.11; N, 16.46. Found: C, 67.23; H, 6.93; N, 16.51.

Methyl 2-(2-Amino-3-cyclohexyl-3,4-dihydroquinazolin-4-yl)acrylate (19b)

White solid; yield: 0.42 g (58%); mp 119–120 °C; R_f = 0.29 (MeOH–$CHCl_3$, 3:17).

IR (KBr): 3391 (NH_2), 1728 (CO_2CH_3), 1657 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 1.05–1.37 (m, 6 H, 3 × CH_2), 1.70–1.76 (m, 4 H, 2 × CH_2), 3.68 (s, 3 H, OCH_3), 3.98–4.05 (m, 1 H, CH), 5.77 (s, 1 H, CH), 5.88 (s, 1 H, =CH_2), 6.19 (s, 1 H, =CH_2), 7.00 (d, J = 8.0 Hz, 1 H, ArH), 7.09 (t, J = 7.4 Hz, 1 H, ArH), 7.26–7.30 (m, 2 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 24.7, 25.0, 29.7, 30.6, 52.6, 53.9, 57.7, 124.6, 125.5, 126.9, 127.4, 129.9, 132.9, 140.0, 141.0, 168.7.

MS (ES+): m/z = 314.3 (M^+ + 1).

Anal. Calcd for $C_{18}H_{23}N_3O_2$: C, 68.98; H, 7.40; N, 13.41. Found: C, 68.62; H, 7.73; N, 13.64.

Methyl 2-(2-Amino-3-cyclopropyl-3,4-dihydroquinazolin-4-yl)acrylate (19c)

White solid; yield: 0.54 g (60%); mp 137–139 °C; R_f = 0.28 (MeOH–$CHCl_3$, 3:17).

IR (KBr): 3423 (NH_2), 1723 (CO_2CH_3), 1652 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 0.72–1.02 (m, 4 H, 2 × CH_2), 2.42 (br s, 1 H, CH), 3.66 (s, 3 H, OCH_3), 5.48 (s, 1 H, CH), 5.89 (s, 1 H, =CH_2), 6.23 (s, 1 H, =CH_2), 6.84–6.92 (m, 2 H, ArH), 7.05 (d, J = 7.4 Hz, 1 H, ArH), 7.15 (t, J = 7.3 Hz, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 7.5, 28.9, 52.8, 60.1, 116.2, 120.2, 123.4, 127.1, 128.5, 129.6, 135.2, 139.0, 155.0, 165.9.

MS (ES+): m/z = 272.3 (M^+ + 1)

Anal. Calcd for $C_{15}H_{17}N_3O_2$: C, 66.40; H, 6.32; N, 15.49. Found: C 66.76; H, 6.53; N, 15.68.

Methyl 2-(2-Amino-3-propyl-3,4-dihydroquinazolin-4-yl)acrylate (19d)

White solid; yield: 0.44 g (60%); mp 148–149 °C; R_f = 0.28 (MeOH–$CHCl_3$, 3:17).

IR (KBr): 3385 (NH_2), 1716 (CO_2CH_3), 1670 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 0.82 (t, J = 7.3 Hz, 3 H, CH_3), 1.45–1.64 (m, 2 H, CH_2), 2.99–3.09 (m, 1 H, CH_2), 3.44–3.54 (m, 1 H, CH_2), 3.64 (s, 3 H, OCH_3), 5.53 (s, 1 H, CH), 5.87 (s, 1 H, =CH_2), 6.22 (s, 1 H, =CH_2), 6.89–6.95 (m, 2 H, ArH), 7.07 (d, J = 7.3 Hz, 1 H, ArH), 7.18 (t, J = 7.3 Hz, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 50 MHz): δ = 11.5, 20.8, 49.6, 52.9, 60.3, 116.1, 120.0, 123.4, 127.1, 129.7, 139.5, 153.3, 165.7, 177.4.

MS (ES+): m/z = 274.3 (M^+ + 1).

Anal. Calcd for $C_{15}H_{19}N_3O_2$: C, 65.91; H, 7.01; N, 15.37. Found: C, 65.78; H, 6.89; N, 15.67.

Methyl 2-[2-Amino-3-(2,2-dimethoxyethyl)-3,4-dihydroquinazolin-4-yl]acrylate (19g)

White solid; yield: 0.44 g (60%); mp 118–119 °C; R_f = 0.30 (MeOH–$CHCl_3$, 3:17).

IR (KBr): 3417 (NH_2), 1722 (CO_2CH_3), 1668 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 3.11–3.26 (m, 5 H, OCH_3, CH_2), 3.44 (s, 3 H, OCH_3), 4.06 (s, 3 H, OCH_3), 4.31 (br s, 1 H, CH), 6.17 (s, 1 H, CH), 6.30 (s, 1 H, =CH_2), 6.42 (s, 1 H, =CH_2), 7.17 (s, 1 H, ArH), 7.30 (d, J = 7.0 Hz, 1 H, ArH), 7.46 (s, 1 H, ArH), 7.65 (s, 1 H, ArH).

MS (ES+): m/z = 320.3 (M^+ + 1).

Anal. Calcd for $C_{16}H_{21}N_3O_4$: C, 60.17; H, 6.63; N, 13.16. Found: C, 60.45; H, 6.59; N, 13.33.

Methyl 2-(2-Amino-3-benzyl-6,7-dimethoxy-3,4-dihydroquinazolin-4-yl)acrylate (20a)

White solid; yield: 0.28 g (56%); mp 161–162 °C; R_f = 0.28 (MeOH–$CHCl_3$, 1:9).

IR (KBr): 3746 (NH_2), 1728 (CO_2CH_3), 1671 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 3.70 (s, 3 H, OCH_3), 3.77 (s, 3 H, OCH_3), 3.79 (s, 3 H, OCH_3), 4.21 (d, J = 5.8 Hz, 2 H, CH_2), 5.30 (s, 1 H, CH), 5.78 (s, 1 H, =CH_2), 6.21 (s, 1 H, =CH_2), 6.49 (s, 1 H, ArH), 6.85 (s, 1 H, ArH), 7.23–7.35 (m, 5 H, ArH).

^{13}C NMR (DMSO-d_6, 50 MHz): δ = 50.3, 52.5, 56.1, 56.3, 59.6, 110.3, 110.6, 127.0, 127.5, 127.6, 127.9, 128.2, 128.6, 129.2, 138.6, 145.2, 149.9, 162.0, 165.5.

MS (ES+): m/z = 382.2 (M^+ + 1).

Anal. Calcd for $C_{21}H_{23}N_3O_4$: C, 66.13; H, 6.08; N, 11.02. Found: C, 66.45; H, 5.79; N, 11.25.

2-(2-Oxo-1,2,3,5-tetrahydroimidazo[2,1-*b*]quinazolin-5-yl)acrylonitrile (21)

Yellow solid; yield: 0.26 g (55%); mp 137–139 °C; R_f = 0.28 (MeOH–$CHCl_3$, 1:9).

IR (KBr): 3449 (NH), 2210 (CN), 1648 (C=N) cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 3.73–3.88 (m, 2 H, CH_2), 5.58 (s, 1 H, CH), 6.33 (s, 1 H, =CH_2), 6.43 (s, 1 H, =CH_2), 7.03–7.12 (m, 3 H, ArH), 7.33 (s, 1 H, ArH), 11.30 (s, 1 H, NH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 51.6, 58.4, 116.5, 117.3, 117.4, 121.5, 123.9, 127.4, 129.9, 134.9, 135.5, 163.7, 182.4.

MS (ES+): m/z = 239.2 (M^+ + 1).

Anal. Calcd for $C_{13}H_{10}N_4O$: C, 65.54; H, 4.23; N, 23.52. Found: C, 65.50; H, 4.37; N, 23.58.

2-(7,8-Dimethoxy-2-oxo-1,2,3,5-tetrahydroimidazo[2,1-*b*]quinazolin-5-yl)acrylonitrile (22)

Brown solid; yield: 0.22 g (60%); mp 104–105 °C; R_f = 0.21 (MeOH–$CHCl_3$, 1:4).

IR (KBr): 3428 (NH), 2191 (CN), 1653 (C=N), cm^{-1}.

^1H NMR (DMSO-d_6, 300 MHz): δ = 3.62–3.87 (m, 8 H, 2 × OCH_3, CH_2), 5.46 (s, 1 H, CH), 6.28 (s, 1 H, =CH_2), 6.40 (s, 1 H, =CH_2), 6.64–6.65 (m, 2 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 49.0, 52.7, 106.9, 117.5, 128.6, 146.3, 148.5, 152.3, 153.1, 153.9, 154.2, 155.3, 171.0.

MS (ES+): *m*/*z* = 299.3 (M^+ + 1).

Anal. Calcd for $C_{15}H_{14}N_4O_3$: C, 60.40; H, 4.73; N, 18.78. Found: C, 60.67; H, 4.64; N, 18.65.

Methyl 2-(2-Oxo-1,2,3,5-tetrahydroimidazo[2,1-*b*]quinazolin-5-yl)acrylate (23)

Yellow solid; yield: 0.36 g (55%); mp 156–157 °C; R_f = 0.28 (MeOH–$CHCl_3$, 1:9).

IR (KBr): 3438 (NH), 1729 (CO_2CH_3), 1649 (C=N) cm^{-1}.

^{1}H NMR (DMSO-d_6, 300 MHz): δ = 3.60 (s, 3 H, OCH_3), 3.76–3.84 (m, 2 H, CH_2), 5.63 (s, 1 H, CH), 6.08 (s, 1 H, =CH_2), 6.31 (s, 1 H, =CH_2), 6.97–7.03 (m, 3 H, ArH), 7.21–7.24 (m, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 52.4, 56.4, 62.1, 117.4, 121.9, 122.7, 123.3, 127.3, 129.2, 134.2, 145.7, 163.2, 165.0, 172.6.

MS (ES+): *m*/*z* = 272.3 (M^+ + 1).

Anal. Calcd for $C_{14}H_{13}N_3O_3$: C, 61.99; H, 4.83; N, 15.49. Found: C, 62.23; H, 5.19; N, 15.18.

Methyl 2-(7,8-Dimethoxy-2-oxo-1,2,3,5-tetrahydroimidazo[2,1-*b*]quinazolin-5-yl)acrylate (24)

Brown solid; yield: 0.10 g (53%); mp 137–139 °C; R_f = 0.28 (MeOH–$CHCl_3$, 1:9).

IR (KBr): 3460 (NH), 1723 (CO_2CH_3), 1653 (C=N) cm^1.

^{1}H NMR (DMSO-d_6, 300 MHz): δ = 3.60–3.72 (m, 9 H, 3 × OCH_3), 3.80 (s, 2 H, CH_2), 5.52 (s, 1 H, CH), 6.01 (s, 1 H, =CH_2), 6.28 (s, 1 H, =CH_2), 6.58 (s, 1 H, ArH), 6.62 (s, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 50 MHz): δ = 52.4, 56.4, 56.6, 56.8, 98.3, 113.1, 120.1, 121.8, 129.2, 134.2, 145.7, 165.0, 172.6.

MS (ES+): *m*/*z* = 332.2 (M^+ + 1).

Anal. Calcd for $C_{16}H_{17}N_3O_5$: C, 58.00; H, 5.17; N, 12.68. Found: C, 58.34; H, 5.48; N, 12.66.

Methyl 2-(2-Amino-3-benzyl-3,4-dihydroquinazolin-4-yl)acrylate (19a)

To a soln of compound **15a** (0.80 g, 2.29 mmol) in absolute EtOH (15 mL) were added Fe powder (0.64 g, 11.45 mmol) and concd HCl (0.50 mL), and the resulting mixture was heated at 100 °C for 45 min. The solvent was evaporated under reduced pressure and the residue was diluted with EtOAc (50 mL) and neutralized with sat. $NaHCO_3$ soln. The soln was passed through a bed of Celite which was washed thoroughly with EtOAc. The organic layer was washed with brine (100 mL), dried over Na_2SO_4 and concentrated. The residue was crystallized from EtOAc–hexanes to furnish **19a** as a white solid; yield: 0.44 g (60%).

Mp 120–121 °C; R_f = 0.25 (MeOH–$CHCl_3$, 3:17).

IR (KBr): 3417 (NH_2), 1722 (CO_2CH_3), 1659 (C=N) cm^{-1}.

^{1}H NMR (DMSO-d_6, 300 MHz): δ = 3.63 (s, 3 H, OCH_3), 3.99–4.07 (m, 2 H, CH_2), 5.56 (s, 1 H, CH), 5.98 (s, 1 H, =CH_2), 6.25 (s, 1 H, =CH_2), 7.22–7.27 (m, 5 H, ArH), 7.31–7.36 (m, 4 H, ArH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 51.1, 52.9, 60.7, 119.8, 124.6, 127.3, 127.8, 128.1, 128.8, 129.3, 129.7, 130.1, 133.7, 135.6, 138.4, 152.9, 165.4.

MS (ES+): *m*/*z* = 322.3 (M^+ + 1).

Anal. Calcd for $C_{19}H_{19}N_3O_2$: C, 71.01; H, 5.96; N, 13.08. Found: C, 71.13; H, 6.21; N, 12.95.

2-(1,5-Dihydroimidazo[2,1-*b*]quinazolin-5-yl)acrylonitrile (25)

To a soln of **17g** (0.86 g, 3.01 mmol) in AcOH (0.74 mL) was added concd HCl (1.23 mL) and the resulting mixture was heated at 100 °C for 30 min. The reaction mixture was cooled to r.t. and poured onto ice-water (30 mL) and neutralized with aq $NaHCO_3$ soln. The mixture was extracted with EtOAc (3 × 25 mL) and the combined organic layers washed with brine (100 mL), dried over Na_2SO_4 and concentrated. The residue was crystallized from EtOAc–hexanes to furnish analytically pure **25** as a white solid; yield: 0.46 g (72%).

Mp 140–141 °C; R_f = 0.28 (MeOH–$CHCl_3$, 1:9).

IR (KBr): 3443 (NH), 2210 (CN), 1642 (C=N) cm^{-1}.

^{1}H NMR (DMSO-d_6, 300 MHz): δ = 6.24 (s, 1 H, CH), 6.31 (s, 1 H, =CH_2), 6.35 (s, 1 H, =CH_2), 6.75 (s, 1 H, =CH), 6.78 (s, 1 H, =CH), 6.90–6.95 (m, 2 H, ArH), 7.13 (d, 1 H, *J* = 7.4 Hz, ArH), 7.25 (t, 1 H, *J* = 7.3 Hz, ArH), 10.2 (s, 1 H, NH).

^{13}C NMR (DMSO-d_6, 75 MHz): δ = 59.4, 113.1, 113.9, 115.6, 117.1, 121.1, 124.3, 127.2, 128.5, 130.2, 133.8, 137.7.

MS (ES+): *m*/*z* = 223.2 (M^+ + 1).

Anal. Calcd for $C_{13}H_{10}N_4$: C, 70.26; H, 4.54; N, 25.21. Found: C, 70.22; H, 4.50; N, 25.25.

One-Pot Preparation of Imidazo[2,1-*b*]quinazolines 25,26; Typical Procedure

To a soln of compound **15g** (0.80 g, 2.29 mmol) in AcOH (15 mL) was added Fe powder (0.64 g, 11.46 mmol) and the resulting mixture was heated at 95 °C for 20 min. Concd HCl (1.20 mL) was added and heating was continued at 100 °C for 30 min. The reaction mixture was cooled to r.t. and poured onto ice-water H_2O (30 mL) and neutralized with aq $NaHCO_3$ soln. The precipitated solid was removed by filtration through a bed of Celite which was then rinsed thoroughly with EtOAc. The organic layer was washed with brine (100 mL), dried over Na_2SO_4 and concentrated. The residue was crystallized from EtOAc–hexanes to furnish **26**. A similar one-pot procedure starting from **13g** gave **25** in 75% yield.

Methyl 2-(1,5-Dihydroimidazo[2,1-*b*]quinazolin-5-yl)acrylate (26)

White solid; yield: 0.38 g (65%); mp 139–140 °C; R_f = 0.30 (EtOAc).

IR (KBr): 3445 (NH), 1719 (CO_2CH_3), 1628 (C=N) cm^1.

^{1}H NMR ($CDCl_3$, 300 MHz): δ = 3.72 (s, 3 H, OCH_3), 6.31 (s, 1 H, CH), 6.33 (s, 1 H, =CH_2), 6.60 (s, 1 H, =CH_2), 6.83–6.97 (m, 4 H, ArH), 7.11 (d, *J* = 7.6 Hz, 1 H, ArH), 7.20 (t, *J* = 7.5 Hz, 1 H, ArH).

^{13}C NMR (DMSO-d_6, 50 MHz): δ = 52.6, 57.5, 114.5, 116.4, 121.7, 127.5, 129.0, 129.8, 139.6, 140.7, 165.0, 170.6.

MS (ES+): *m*/*z* = 256.2 (M^+ + 1).

Anal. Calcd for $C_{14}H_{13}N_3O_2$: C, 65.87; H, 5.13; N, 16.46. Found: C, 66.09; H, 5.32; N, 16.74.

Acknowledgment

One of the authors (A.M.) is grateful for the financial support from CSIR, New Delhi in the form of a fellowship. This work was supported by a DST grant.

References

(1) CDRI Communication No. 7780.
(2) (a) Singh, V.; Batra, S. *Tetrahedron* **2008**, *64*, 4511; and references cited therein. (b) Nag, S.; Mishra, A.; Batra, S. *Eur. J. Org. Chem.* **2008**, 4334. (c) Singh, V.; Hutait, S.; Batra, S. *Eur. J. Org. Chem.* **2009**, 3454.

(3) Nag, S.; Mishra, A.; Batra, S. *Tetrahedron* **2008**, *64*, 10162.
(4) (a) Franklin, R.; Golding, B. T.; Cicala, P. A. US 2008/176875, **2008**; *Chem. Abstr*. **2008**, *149*, 183694. (b) Pathi, S. L.; Kankan, R. N.; Rao, D. R. WO 2008/096145, **2008**; *Chem Abstr*. **2008**, *149*, 246279. (c) Widmann, R. S. WO 2005/080398, **2005**; *Chem. Abstr*. **2005**, *144*, 370110.
(5) (a) Bell, A. S.; Campbell, S. F.; Roberts, D. A.; Ruddock, K. S. *J. Med. Chem.* **1989**, *32*, 2042. (b) Jones, G. H.; Venuti, M. C.; Alvarez, R.; Bruno, J. J. EP 116948, **1984**; *Chem. Abstr*. **1984**, *102*, 78902. (c) Ishikawa, F.; Ashida, S. EP 129258, **1984**; *Chem. Abstr*. **1984**, *102*, 166773. (d) Kosasayama, A.; Higashi, K.; Ishikawa, F. *Chem. Pharm. Bull.* **1979**, *27*, 880.
(6) (a) Baxter, E. W.; Conway, K. A.; Kennis, L.; Bischoff, F.; Mercken, M. H.; De Winter, H. L.; Reynolds, C. H.; Tounge, B. A.; Luo, C.; Scott, M. K.; Huang, Y.; Braeken, M.; Pieters, S. M. A.; Berthelot, D. J. C.; Masure, S.; Bruinzeel, W. D.; Jordan, A. D.; Parker, M. H.; Boyd, R. E.; Qu, J.; Alexander, R. S.; Brenneman, D. E.; Reitz, A. B. *J. Med. Chem.* **2007**, *50*, 4261. (b) Ishikawa, F.; Watanabe, Y.; Saegusa, J. *Chem. Pharm. Bull.* **1980**, *28*, 1357. (c) Franklin, R.; Golding, B. WO 2008/065445, **2008**; *Chem. Abstr*. **2008**, *149*, 17568. (d) Fried, J. H.; Venuti, M. C. EP 254327, **1988**; *Chem Abstr*. **1988**, *109*, 6541.
(7) (a) Kundu, B.; Partani, P.; Duggineni, S.; Sawant, D. *J. Comb. Chem.* **2005**, *7*, 909. (b) Srivastava, G. K.; Kesarwani, A. P.; Grover, R. K.; Roy, R.; Srinivasan, T.; Kundu, B. *J. Comb. Chem.* **2003**, *5*, 769. (c) Shakhidoyatov, Kh. M.; Yun, L. M.; Samiev, R. A. *Uzb. Khim. Zh.* **1990**, 42; *Chem. Abstr*. **1990**, *115*, 135414. (d) Spindler, J. *Chem. Ztg*. **1991**, *115*, 224. (e) Yamaguchi, H.; Ishikawa, F. *J. Heterocycl. Chem.* **1981**, *18*, 67.
(8) Pathak, R.; Batra, S. *Tetrahedron* **2007**, *63*, 9448.