Indian Journal of Chemistry
Vol. 62, May 2023, pp. 445-453
DOI: 10.56042/ijc.v62i5.1423

Synthesis and antimicrobial activity of novel (1-phenyl-1*H*-1,2,3-triazo-4-yl) methyl-2-acetamido-1-phenyl-1*H*-benzo[f]chromene-3-carboxylate and 2-amino-octahydro-4-phenyl-2*H*-chromene-3-carbonitrile

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Received 28 July 2022; accepted (revised) 12 April 2023

A series of novel (1-phenyl-1*H*-1,2,3-triazol-4-yl)methyl-2-acetamido-1-phenyl-1*H*-benzo[f] benzo[f]chromene-3-carboxylate **6a-i** compounds have been synthesised from prop-2-yn-1yl-3-acetamido-1-phenyl-1*H*-benzo[f]chromene-2-carboxylate **5**. 3-Amino-1-phenyl-1*H*-benzo[f]chromene-2-carbonitrile and 2-amino-4-phenyl-4a,5,6,7,8,8a-hexahydro-4*H*-chromene-3-carbonitrile (**1** and **2a**) are generated when benzaldehyde, β-naphthol, (or) cyclohexanol, and malononitrile are incorporated into the mixture. Activity of two conventional antibiotics, Chloramphenicol and Amphotericin-B, have been compared to the antibacterial and antifungal properties of the prepared synthetic compounds. A study has been conducted on the spectroscopic properties of Schlenter products.

Keywords: 3-Amino-1*H*-chromene-2-carbonitriles, Chromenes, Multicomponent reaction, Chloramphenicol, Amphotericin-B

The fused pyran ring structure is a well-known heterocycle and amplet core unit in a variety of intrinsic products. Pyran and benzochromene or benzopyran derivatives have piqued the interest of researchers due to their association with a wide range of biological characteristics. In the modern treatment of infectious illnesses, a multidrug unit is used over a lengthy period of time. Chromenes biological significance as an anticoagulant, aflatoxins as mycotoxins and coumestrol as an oestrogen and phytoalexin has resulted in a significant amount of research in the field of fused ring structures.

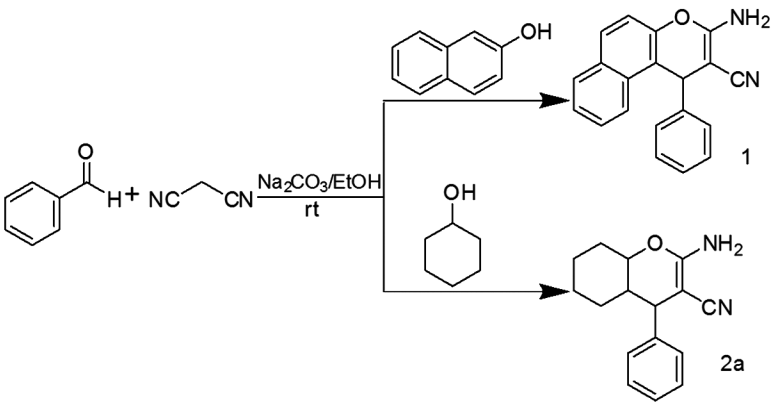
Chromenes exhibits a variety of pharmacological actions[1], such as spasmolytic[2], and is a valuable component in the production of a wide range of natural products[3]. Chromene derivative arena has a wide range of biological actions, including antitumor[4], antimicrobial[5], antiviral[6], and so on. In order to continue our efforts in the advancement of environmentally benign synthetic approaches for the design and synthesis of heterocyclic compounds[7-9], we would like to synthesise chromene heterocyclic compounds, by reacting with benzaldehyde, malononitrile, and β–Naphthol at RT and recrystalised with ethanol.

Results and Discussion

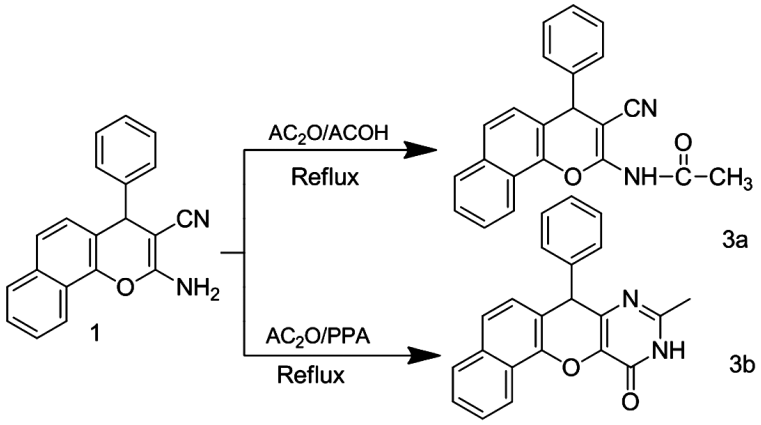
The synthesis of 3-amino-4*H*-Chromene-3-carbonitriles 1 and 2 in ethanol catalysed by began with the condensation of equimolar quantities of benzaldehyde, malononitrile, and β-Naphthol, sodium carbonate in ethanol (Scheme 1).

The pyran type 1 reaction process was chosen as an exemplary example because it comprises two stages of condensation first, the Knoevenagel condensation of benzaldehyde and malononitrile in the presence of Sodium carbonate, resulting in the formation of arylidene malononitrile. Following Michael addition of the naphtholic form of β-naphthol to an electron deficient carbon of cyanoolefin, 3-amino-1-phenyl-1*H*-benzo(f)chromene-2-carbonitriles 1 are formed (Scheme 1). The pyrans 1 with the β - naphthaminonitrile moiety described above form a class of intermediates that are known to be very reactive and are utilised as precursors in the synthesis of freshly fused chromene co factors.

The IR, ^{1}H, and ^{13}C NMR spectra of the newly generated chromene 1 and 2 were used to describe them. As an instance, the IR spectra of compound 1 revealed an absorption band at 2215 cm^{-1} due to the cyano group, while the NH_2 stretching bands emerged



Scheme 1 — Synthetic pathway to 3-amino-1-phenyl-1*H*-benzo chromene-2-carbonitriles **1-2a**



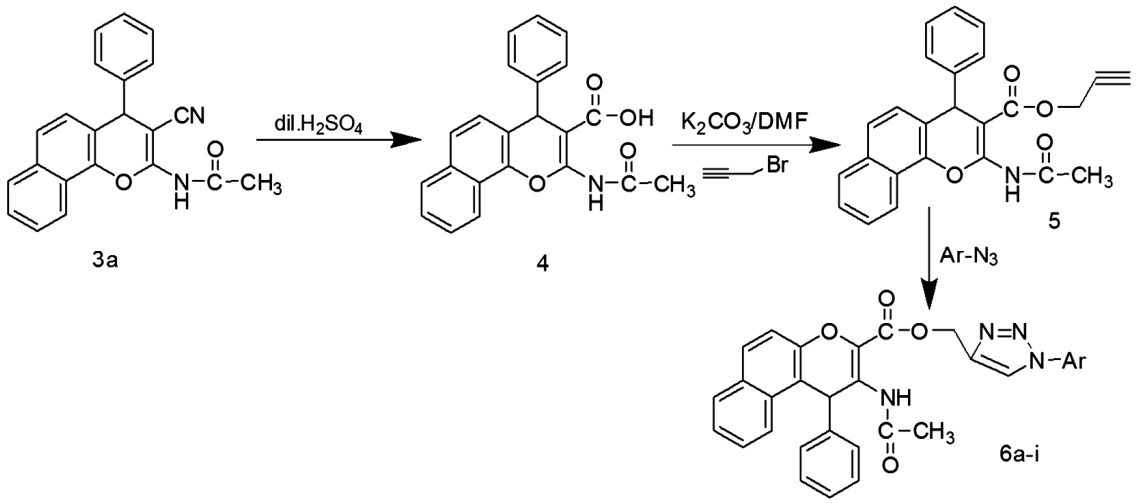
Scheme 2 — Synthetic pathway to N-{2-cyano-1-phenyl-1*H*-benzo chromen-3-yl}acetamide **3a-b**

at 3415 and 3327 cm^{-1}. Furthermore, when compound 1 is reacted in the presence of acetic anhydrade, acetic acid and a catalytic quantity of polyphosphoric acid (PPA), it produces 3(a-b) after being refluxed for 2 h (Scheme 2). The response mechanism appears to follow a two-step development from an involuntary stand point. First, chromenes 1 should react with acetic anhydride to produce the non-isolable intermediate 3(a&b), which cyclizes following a nucleophilic assault on the nitrile group. Intramolecular rearrangement of the so generated intermediate results in the formation of additional pyrimidinones. Furthermore, compound 3a was treated in acid hydrolysis (H_2O/H_2SO_4) for 4-5 h under refluxed conditions to get compound 4. Indeed, at these more aggressive circumstances, the cyanide group was clearly hydrolysed to the corresponding carboxylic acid, which under went easy decarboxylation to provide the observed novel products 4. It is also reacted in the presence of K_2CO_3/DMF and 3-bromoprop-1-yne to produce the product 5. 3-bromoprop-1-yne was employed as an alkylating agent because it interacted with the hydroxyl group in carboxylic acid. To obtain the final product 6a, the isolated component was further processed with Aromatic azids (Scheme 3). On the basis of their spectral data, the structure of the isolated compounds 4,5 and 6a was verified.

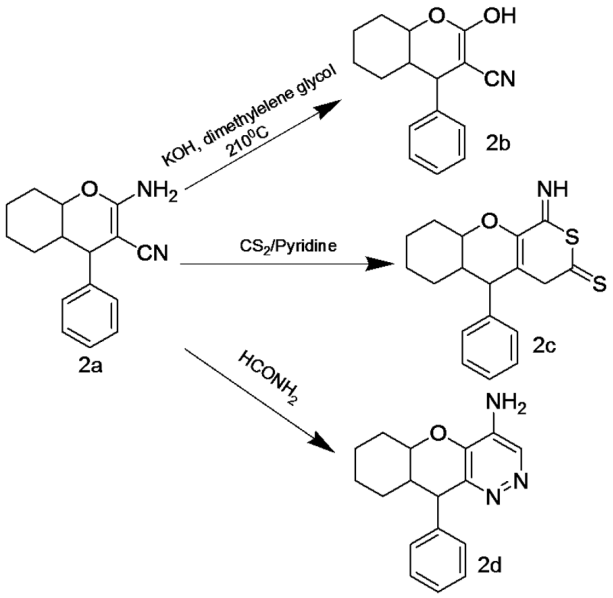
The novel pyran derivatives 6(a-i) were obtained by reacting with various aromatic azids. Following that, the novel pyran derivatives 2b and 2c were obtained by heating 2a with KOH, dimethylene glycol under reflux for 6 h. The amine group had clearly been hydrolyzed as well under these more aggressive conditions. A novel pyran derivative 2d was obtained by reacting additional 2a with $HCONH_2$ (Scheme 4).

In vitro anti-microbial activity

Using the well diffusion technique, the antimicrobial activity of extracts was assessed. The material was solubilized with specified doses of Dimethyl sulfoxide (1 mg/mL) for



Scheme 3 — Synthetic pathway to 3-acetamido-1-phenyl-1*H*-benzo[f]chromene carboxylic acid **4-6a-i**



Scheme 4 — Synthetic pathway to derivatives **2a-d**

sample preparation[10]. The anti-microbial activity (antibacterial and antifungal) was then investigated using media (Fig. 1).

Antibacterial Method

The newly synthesised compounds were tested *in vitro* against gram-positive bacteria such as *Staphylococcus aureus*[11] and gram-negative bacteria such as *Escherichia coli*[12]. The lowest concentration (maximum dilution) necessary to halt the growth of bacteria was considered as the minimum inhibitory concentration (MIC, μg/mL)[13,14], was determined and compared with the Chloramphenicol conventional antibiotics, the MIC values of the substances tested are provided in Table 1.

Among the studied compounds, the compound 3-Amino-1-phenyl-1*H*-benzo (f)chromene- 2-carbonitrile (1) showed 10 (mm)[15] in *E. coli* and 20 (mm) in *S. aureus* [16], while the compound 2-Amino-4-phenyl-4a,5,6,7,8,8a–hexahydro-4*H*-chromene-3-carbonitrile (2a) showed 12 (mm) in *E. coli* and 23 (mm) in *S. aureus*, and in the compound, (2d) was found in *E. coli* at 06 (mm) and *S. aureus* at 25 (mm)[17-19], and in the combination (1-phenyl-1*H*- (6a) was found in *E. coli* at 06 (mm) and *S. aureus* at 25 (mm). The compounds 2b, 2c, 6b-I demonstrated moderate to excellent inhibition against *S. aureus* and *E. coli*, which was quantified and tabulated.

Antifungal Activity

The newly synthesised compounds were tested for antifungal activity against Aspergillus fumigatus. The antifungal activity of each compound was compared to that of the standard medication Amphotericin B. The MIC (μg/mL) was calculated and compared to that of controls the MIC values of the compounds tested are included in a table. The antifungal screening findings revealed that the test compounds were active.

The inhibition zones were measured in millimetres (mm), and the results are shown in Table 1. The mixture (1-phenyl-1*H*-1,2,3-triazo-4-yl) Methyl-2-acetamido-1-phenyl-1*H*-benzo [f] Chromene-3-Carboxylate (6a) Excellent action was demonstrated, And the remaining compounds 2a-d,1,3,4,5,6b-i were found to be moderate to compatible.

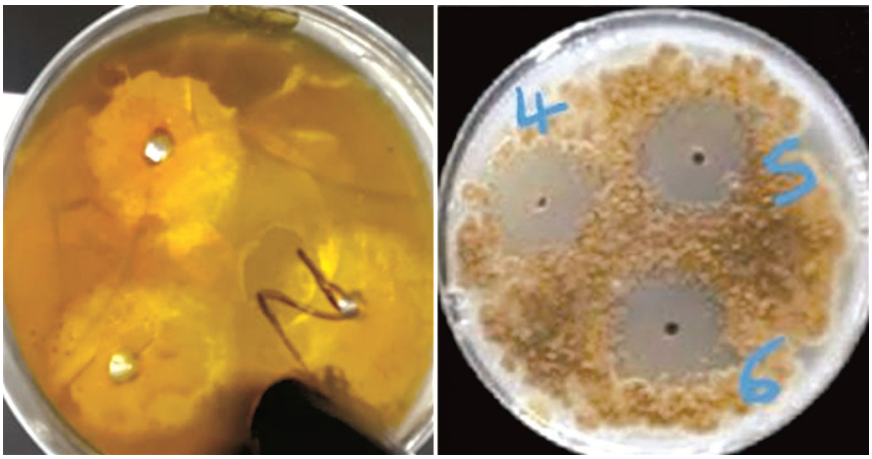


Fig. 1 — Selected photographs of *in vitro* anti-microbial activity of compounds

Table 1 — *In vitro* anti-microbial activity of compounds

Compd	Bacteria		Fungi
	Escherichia coli (Gram negative)	*Staphylococcus aureus* (Gram positive)	*Aspergillus fumigatus*
1	10	20	15
2a	12	23	42
2b	14	20	15
2c	15	22	20
2d	06	25	35
3a	10	20	15
3b	05	18	38
4	07	19	30
5	10	20	18
6a	06	25	40
6b	15	22	20
6c	14	15	15
6d	13	16	13
6e	12	19	19
6f	09	21	16
6g	11	17	18
6h	14	22	20
6i	12	19	25

Experimental Section

Materials and Methods

Melting points were calculated using the Electrothermal 9002 melting point equipment and are unavenged. IR spectra were also collected using the FTS-6000 BIO-RAD instrument. On a Bruker AC-300, ^{1}H and ^{13}C NMR spectra were recorded in DMSO-d_6, with non deuterated solvents used as an internal reference. All chemical shifts were measured in parts per million (ppm), and coupling constants (J) were measured in Hertz (Hz). For mass spectra, Micromass LCT (ESI method, positive mode) spectrometers were utilised using High Resolution Mass Spectra (HRES-MS). TLC was used to monitor all reactions, which were carried out on aluminium sheets of sds silica gel 60 F254, 0.2 mm.

General procedure for synthetic pathway to 3-amino-1-phenyl-1*H*-benzo[f]chromene-2-carbonitriles, 1

Anhydrous sodium carbonate (2 g) was added to a combination of arylaldehyde (10 mmol), malononitrile (10 mmol), and β-naphthol (or) cyclohexanol (10 mmol) in absolute ethanol (30 mL) and stirred for 3 h at RT. The solvent was mostly evaporated, and the mixture was diluted

with cold water and allowed to sit for 45 min at RT. Filtration was used to recover the precipitated solid, which was then rinsed with cold water before being dried and crystallised from ethanol to yield 1 and 2.

White solid. Yield 78%. m.p.237-240°C. IR (KBr): 2215, 3415, 3327 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 0.44 (s, 2H-NH_2), 5.11 (s, 1H, Ar-H), 7.29-7.17 (m, 3H, Ar-H), 7.34 (d, 2H, *J*=13.1Hz, Ar-H), 7.48-7.39 (m, 3H, Ar-H) 7.49 (m, 1H, Ar-H), 7.73 (s, 1H,Ar-H),7.81 (s,1H=CH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 43.88, 64.27, 115.47, 117.28,118.66, 125.37, 125.38, 126.73, 127.01, 127.77, 128.84, 131.00, 132.95, 141.49, 147.07,154.81; MS: *m*/*z* 298.35[M^+] 222(15.9), 196(14.6), 183(14.2), 103(8.7), 77(6.5). Anal. Calcd for $C_{20}H_{14}N_2O$: C, 80.52; H, 4.73; N, 9.39. Found: C, 80.51; H, 4.75; N, 9.37%.

2-Amino-4-phenyl-4a,5,6,7,8a-hexahydro-4*H*-chromene-3-carbonitrile, 2a

White solid. Yield 80%. m.p. 95-97°C. IR (KBr): 2215, 3415, 3335 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 1.16 (s, 1H=CH_2), 1.34 (d, 2H,*J*=5.5Hz, Ar-CH_2) 1.52 (s,1H- CH_2), 1.69 (s,1H-CH_2),1.73 (s, 1H-CH_2), 1.82 (s,1H-CH_2), 2.11 (s, 1H-CH_2), 2.31 (s,1H-CH_2), 3.36 (s, 1H-CH), 3.44 (s, 1H-CH), 7.34-7.23 (m, 3H), 7.42-7.34 (m, 2H-CH) 7.59-7.55 (m, 2H- NH_2); ^{13}C NMR(75 MHz, DMSO-d_6): δ 24.53, 25.04, 28.02, 29.62, 44.95, 47.32, 53.33,78.10, 117.30, 128.47, 129.09, 140.63, 159.26; MS: *m*/*z* 253.33[M^+] (178(11.0), 152(10.1), 136(9.7), 85(5.5). Anal. Calcd for $C_{16}H_{18}N_2O$: C, 75.56; H, 7.13; N, 11.01. Found: C, 75.54; H, 7.10; N, 11.05%.

2-Oxo-4-phenyloctahydro-2*H*-chromene-3-carbonitrile, 2b

White solid. Yield 70%. m.p. 236-239°C. IR (KBr): 1760, 3415-3442 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 1.09 (s,1H, Ar-CH_2), 1.27 (s,1H, Ar-CH_2), 1.33 (s, 1H-CH_2), 1.50 (s,1H, Ar-CH_2), 1.71-1.63 (m,3H, Ar-H), 1.75 (s, 1H, Ar-CH_2), 1.99 (s, 1H, Ar-CH_2), 2.45 (s,1H,OH), (3.51 (s,1H, Ar-H), 3.78 (s, 1H, Ar-H), 4.12 (s, 1H, Ar-CH_2), 7.17 (s, 1H, Ar-H), 7.32-7.24 (m,3H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 24.53, 25.14, 27.33, 29.62, 38.33, 40.91, 44.71,78.33, 114.06, 126.71, 128.23, 128.82, 141.64, 163.50; MS: *m*/*z* 255.48[M^+] 219(11.0), 157(9.8), 85(6.6). Anal. Calcd for $C_{16}H_{17}NO_2$: C, 75.27; H, 6.71; N, 5.49. Found: C, 75.24; H, 6.70; N, 5.46%.

4-Phenyloctahydro-2*H*-chromen-2one, 2c

White solid. Yield 70%. m.p. 102-104°C. IR (KBr): 1760 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 1.06 (s, 1H, Ar-CH_2), 1.27 (s, 1H, Ar- CH_2), 1.33 (s, 1H, Ar- CH_2), 1.50 (s,1H, Ar- CH_2), 1.68 (m, 4H-CH), 1.96 (s, 1H, Ar- CH_2), 2.50 (s, 1H, Ar- CH_2), 3.05 (s,1H-CH), 4.07(s, 1H-CH), 7.16 (s, 1H,Ar-H), 7.42-7.23 (m, 5H,Ar-H), 10.70 (s, 1H, NH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 24.53, 25.14, 27.77, 29.62, 36.64, 38.58, 43.78, 76.42, 126.98, 128.32,129.32, 142.28, 170.51; MS: *m*/*z*[M^+] 154(9.7), 85(6.6). Anal. Calcd for $C_{18}H_{19}NOS_2$: C, 78.23; H, 7.88. Found: C, 78.20; H, 7.79%.

2-Methyl-5-phenyl-5a,6,7,8,9,9a-hexahydro-3*H*-chromeno[2,3-d]pyrimidin-4(5*H*)-one, 2d

White solid. Yield 65%, m.p. 105-107°C. IR (KBr): 3300-3500 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 1.01 (s, 1H, Ar- CH_2), 1.31 (d, *J* =14.01, 2H, Ar- CH_2), 1.42 (s, 2H, Ar- CH_2), 1.65 (s, 1H, Ar-CH_2), 1.71 (s, 2H, Ar- CH_2), 2.31 (s, 1H, Ar-H), 2.53-2.49 (m, 2H-CH_3), 3.37 (s, 1H, Ar-H), 3.92 (s, 2H, NH_2), 4.35 (s, 1H, Ar-H), 7.28 (m, 3H, Ar-H), 7.35 (s, 1H, Ar-H); ^{13}C NMR (150 MHz,DMSO-d_6): δ 20.51, 24.53, 25.14, 28.02, 29.62, 42.49, 45.07, 79.89, 90.58, 128.47, 129.46, 140.63, 155.83, 160.22; MS: *m*/*z* 296.36 [M^+] 220(13.2), 139(9.9), 77(6.5). Anal. Calcd for $C_{17}H_{19}N_3O$: C, 72.95; H, 6.80; N, 9.45. Found: C, 72.97; H, 6.82; N,9.46%.

N-{2-Cyano-1-phenyl-1*H*-benzo[f]chromene-3-yl}acetamide, 3a

Compound **1** (10 mmol) and redistilled acetic anhydride (25 mL) (or) ortho polyphosphoric acid (5 mL) (PPA) were carefully combined and refluxed for 3 h (or 6 h). After cooling, the precipitated white solid product was carefully washed and filtered before being recrystallized with ethanol to yield **3a** and **3b**.White solid. Yield 70%. m.p. 236-239°C. IR (KBr): 1760,3070-3350 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 2.05 (m, 3H-CH_3), 5.14 (s, 1H, Ar-H), 7.22 (s, 1H-NH), 7.26dd *J*=6.4, 2.6 Hz 3H, Ar-H), 7.74 (dd *J*=7.4, 3.9Hz 2H-CH), 8.14-7.55(m, 6H-CH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 44.84, 69.43, 115.78, 117.33, 119.33, 125.28,125.47, 126.78, 127.77, 128.84, 131.00, 132.95, 141.49, 147.18, 147.45, 171.62; MS: *m*/*z* 340.38, [M^+] 264(17.5) 183(14.2), 103(8.7), 77(6.5). Anal. Calcd for $C_{22}H_{16}N_2O_2$: C, 77.63; H, 4.74; N, 8.23. Found: C, 77.61; H, 4.72; N, 8.20%.

9 - Methyl - 12- phenyl - 10*H*- benzo [5,6] chromeno [2,3,d] pyrimidine -11 (12*H*) one, 3b

White solid. Yield 70%. m.p. 170-175°C. IR (KBr): 3070-3350 cm^{-1} (NH); ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.59 (s, 3H-CH_3), 5.11 (s, 1H-Ar-H), 5.78 (s, 1H-NH), 7.26-7.10 (m,3H, Ar-H), 7.31 (d, *J*=10.1Hz, 2H, Ar-H), 7.44 (dd, *J*=10.8 Hz,7.4, 4H, Ar-H), 7.69 (s, 1H, Ar-H), 7.84 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 20.51, 35.97, 94.42, 116.17, 117.42, 125.28, 125.47, 126.69, 127.77, 128.84, 131.00, 132.95, 141.49, 147.34, 155.72, 160.41; MS: *m*/*z* 340.38 [M^+] 264(17.5), 183(14.2), 129(10.9), 77(6.5). Anal. Calcd for $C_{22}H_{16}N_2O_2$: C, 77.63; H, 4.74; N, 8.23. Found: C, 77.60; H, 4.71; N, 8.25%.

3-Acetamido-1-phenyl-1*H*-benzo[f]chromene-2carboxylic acid, 4

Dil. H_2SO_4 was carefully added and hydrolyzed before a mixture of compound **3a** (10 mmol) was refluxed for 4 h. Following cooling, a solid material was produced, the product extracted with 40 mL of ethyl acetate in portions evaporated the solvent under reduced pressure, which was recovered through filtering and crystallisation from ethanol.

White solid. Yield 60%. m.p. 270-275°C. IR (KBr): 3070-3350, 3000-3700 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.11 (s, 3H-CH_3), 5.26 (s,1H, Ar-H), 7.62-7.13 (m, 10H,Ar-H),7.81 (s, *J*= 15.5Hz, 2H, Ar-H), 8.76 (s, 1H- NH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 33.96, 88.76, 115.78, 117.33, 125.37, 126.78, 127.77, 128.95, 131.00, 132.95, 141.49, 147.18, 151.64, 171.62; MS: *m*/*z* 359.38, [M^+] 284(17.6), 240(16.4), 184(14.2), 129(10.9), 78(6.6). Anal. Calcd for $C_{22}H_{17}NO_4$: C, 73.53; H, 4.77; N, 3.90. Found: C, 73.51; H, 4.74; N, 3.94%.

Prop-2-yn-1yl-3-acetamido-1-phenyl-1*H*-benzo[f]chromene-2-carboxylate, 5

To the mixture of compound **4** (10 mmol) potassium carbonate 1.25 g, and dimethyl formamide (DMF) 15 mL, and propargyl bromide 1.35 mL was carefully added at 0°C, and reflux for 4 h. On evapotating the solvent, the liquid product could be collected.

Brown liquid. Yield 70%. b.p.160-162°C. IR (KBr): 3070-3350 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.07 (s,3H-CH_3), 2.70 (t, *J*=3.0Hz, 1H-CH), 4.89 (d, *J*=2.9Hz,2H-CH_2), 5.08, (s,1H-CH), 7.22 (s, 1H-NH), 7.46-7.04 (m, 8H, Ar-H), 7.50 (d, *J*=2.1Hz, 1H, Ar-H), 8.33-7.69 (m,2H-CH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 34.85, 56.53, 78.06, 79.75, 91.48, 115.78, 117.33, 125.37, 125.78, 127.77, 128.84, 131.00, 132.95, 141.12,141.49, 147.18, 166.78, 171.62; MS: *m*/*z* 397.42, [M^+] 321(20.9), 282(17.8), 240(16.4), 182(14.1), 129(10.9). Anal. Calcd for $C_{25}H_{19}NO_4$: C, 75.55; H, 4.82; N, 3.52. Found: C, 75.52; H, 4.80; N, 3.56%.

(1-Argio-1*H*-1,2,3-triazol-4-yl)methyl 2-acetamido -1-phenyl-1*H*-benzo[f]chromene-3-carboxylate, 6a-i

At 0°C, a solution containing alkyne **5** (8.28mmol), alkylamine (8.11mmol), $NaNO_2$ (2.168mmol), and dil.HCL (3 mL) was added and agitated for 45 min. After 3 h of stirring, NaN_3 was added and the mixture stirred for another 3 h. TLC was checked and the reaction mass extracted with ether. The organic layer was collected and $CuSO_4.5H_2O$ (0.110 g) and sodium ascorbate (0.114 g) were added. The suspension that resulted was stirred at RT for 6 h. The solution was then diluted with 5 mL dichloromethane and 5 mL water. The organic phase was separated and concentrated under decreased pressure after being dried with sodium sulphate. Ethanol was used to purify the crude product (Fig. 2, Table 2).

(1-Phenyl-1*H*-1,2,3-Triazo -4-yl) Methyl 2-Acetamido 1-Phenyl -1*H*-Benzo [f] Chromene-3-Carboxylate, 6a

White solid. Yield 60%. m.p. 215-218°C. IR (KBr): 3070-3350 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.13 (s,3H-CH_3), 4.95, (s,1H-CH), 5.39 (s,2H-CH_2), 6.51 (s,1H-NH),7.01-6.87 (m,1H-CH), 7.55-7.08 (m, 11H, Ar-H), 8.30-7.66(m,4H, Ar-H), 9.36 (s,1H-CH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.32, 122.60, 125.37, 125.83, 126.73, 127.96, 128.58, 129.46, 131.00, 132.95, 137.08, 137.08, 138.71, 139.12, 144.37, 153.49, 162.44, 171.81; MS: *m*/*z* 516.55 [M^+] 440(28.7), 359(24.1), 315(23.3), 257(20.6), 180(14.1), 79(6.6).

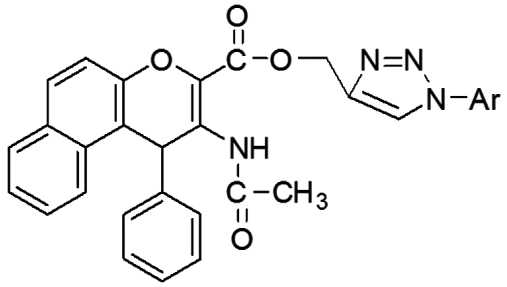


Fig. 2 — General structure of product 6a-i

Table 2 — Physical parameters of (1-argio-1*H*-1,2,3-triazol-4-yl)methyl 2-acetamido-1-phenyl-1*H*-benzo[f]chromene-3-carboxylate **6a-i**

Compd	Substituent (Ar)	Mol. Formula	Yield (%)	m.p. (°C)
6a	$C_6H_5NH_2$	$C_{31}H_{24}N_4O_4$	60	215-218
6b	C_6H_6ClN	$C_{31}H_{23}ClN_4O_4$	65	225-228
6c	$C_6H_6N_2O_2$	$C_{31}H_{23}N_5O_6$	72	210-215
6d	$C_6H_4Br_3N$	$C_{31}H_{21}N_4O_4Br_3$	68	222-227
6e	$C_8H_{11}N$	$C_{33}H_{28}N_4O_4$	76	215-220
6f	$C_7H_8N_2O_3$	$C_{32}H_{25}N_5O_7$	67	226-230
6g	$C_6H_4INH_2$	$C_{31}H_{23}IN_4O_4$	70	220-225
6h	C_6H_6FN	$C_{31}H_{23}FN_4O_4$	67	227-230
6i	$C_8H_5N_2$	$C_{32}H_{23}N_5O_4$	65	230-235

Anal. Calcd for $C_{31}H_{24}N_4O_4$: C, 72.08; H, 4.68; N, 10.85. Found: C, 72.04; H, 4.64; N, 10.87%.

(1-(4-Chlorophenyl)-1*H*-1,2,3-triazol-4-yl)methyl 2-acetamido-1 phenyl-1*H* benzo[f]chromene-3-carboxylate, 6b

White solid. Yield 65%. m.p. 225-228°C. IR (KBr): 3070-3350, 750-500, 3330 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 2.12 (s, 3H-CH_3), 4.95 (s,1H-CH), 5.37(s,1H, Ar-H), 6.49 (s,1H-NH), 7.36 (m, 9H, Ar-H), 7.52 (m, 4H, Ar-H), 8.10 (m, 5H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.32, 122.60, 122.93, 123.15, 125.28, 125.47, 125.83, 126.73, 127.78, 128.19, 128.35 129.01, 131.01, 132.65, 132.94, 136.01, 137.52, 138.70, 139.12, 144.27, 153.49, 162.44, 171.81; MS: *m*/*z* 550.19, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.), 180(14.1), 127(10.9), 776.5). Anal. Calcd for $C_{31}H_{24}ClN_4O_4$: C, 67.57; H, 4.21; N, 10.17. Found: C, 67.59; H, 4.23; N, 10.20%.

(1-(4-Nitrophenyl)-1*H*-1,2,3-triazol-4-yl)methyl 2-acetamido -1-phenyl-1*H*- benzo[f]chromene-3-carboxylate, 6c

White solid. Yield 72%. m.p. 210-215°C. IR (KBr): 3070-3350, 850-500, 3330 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 2.12 (s, 3H-CH_3), 4.87 (s,1H-CH), 5.40(s, 2H-CH), 6.04 (s, 1H-NH), 7.35 (m, 5H, Ar-H), 7.44 (m, 4H, Ar-H), 7.79 (d, 2H, *J*=4.3Hz, Ar-H), 7.84 (m, 3H, Ar-H), 8.02 (d,2H, *J*=7.5Hz, Ar-H), 8.08, (s,1H-Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.32, 122.53, 123.15, 125.28, 125.47, 125.83, 126.02,126.73, 127.78, 128.19, 128.35, 131.01, 132.65, 132.94, 137.52, 138.70, 139.12, 140.69, 144.27, 146.86, 153.49, 162.44, 171.81; MS: *m*/*z* 561.54, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.), 180(14.1), 127(10.9), 776.5). Anal. Calcd for $C_{31}H_{24}N_5O_6$: C, 66.30; H, 4.13; N, 12.47. Found: C, 66.34; H, 4.15; N, 12.49%.

[1-(2,4,6-Tribromophenyl)-1*H*-1,2,3-triazo-4-yl]methyl 2-acetamido-1-phenyl-1*H*- benzo[f] chromene-3-carboxylate, 6d

White solid. Yield 68%. m.p. 222-225°C. IR (KBr): 3070-3350, 750-500, 3330 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 2.12 (s, 3H-CH_3), 5.00 (s, 1H-CH) 5.34 (s, 2H-CH_2), 6.47(s, 1H-NH), 7.52-7.13 (m, 9H, Ar-H), 8.06-7.68 (m, 7H, Ar-H), 8.08 (s, 1H-CH); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.52, 121.38, 122.60, 123.15, 125.37, 125.83, 126.73, 127.78, 128.30, 128.50, 131.00, 132.95, 135.15, 137.53, 138.61, 139.12, 144.27, 152.54, 162.44, 171.81; MS: *m*/*z* 753.91,[M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.7), 180(14.1), 127(10.9), 77(6.9). Anal. Calcd for $C_{31}H_{24}N_4O_4Br_3$: C, 49.43; H, 2.81; N, 7.44. Found: C, 49.42; H, 2.80; N, 7.42%.

[1-(3,5-Dimethylphenyl)-1*H*-1,2,3,triazol-4-yl]methyl2-acetamido-1-phenyl-1*H*-benzo[f] chromene-3-carboxylate, 6e

White solid. Yield 76%. m.p. 215-220°C. IR (KBr): 3070-3350, 3330 cm^{-1}; ^1H NMR (500 MHz, DMSO-d_6): δ 2.13 (s,3H- CH_3), 2.38 (s,3H- CH_3), 4.95 (s, 1H,Ar-H), 5.38 (m, 2H-CH_2), 6.49 (s,1H-NH), 6.72 (s, 1H, Ar-H), 7.29 (m, 8H,Ar-H) 7.49 (m, 6H,Ar-H) 7.77 (d,2H, *J*=1.5Hz, Ar-H) 9.35 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 21.13, 23.31, 40.78, 51.31, 113.08, 114.32, 122.60, 123.15, 125.31, 125.83, 126.84, 127.78, 128.59, 131.00, 129.04, 132.95, 137.53, 137.96, 138.71, 138.17, 139.44, 144.27, 153.49, 162.44, 171.81. MS: *m*/*z* 554.60, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.7), 180(14.1), 127(10.9), 77(6.9). Anal. Calcd for $C_{31}H_{28}N_4O_4$: C, 72.78; H, 5.18; N, 10.29. Found: C, 72.79; H, 5.20; N, 10.32%.

[1-(4-Methoxy-2-nitrophenyl)-1*H*-1,2,3,triazol-4-yl]methyl 2-acetamido-1-phenyl-1*H*- benzo[f] chromene-3-carboxylate, 6f

White solid. Yield 67%. m.p. 226-230°C. IR (KBr): 3070-3350, 850-500, 3330 cm^{-1}; ^1H NMR

(500 MHz, DMSO-d_6): δ 2.14 (s, 3H-CH_3), 3.82 (s, 3H-CH_3) 5.18 (s, 1H, Ar-H) 5.39 (s,2H-CH_2), 7.05 (s,1H,Ar-H), 7.24 (d, *J*=1.8Hz, 4H) 7.34 (d, *J*=6.5Hz, 2H, Ar-H), 7.47 (m, 5H, Ar-H) 7.73 (s, 1H, Ar-H) 7.82 (s, 1H, Ar-CH) 8.08 (s, 1H, Ar-H) 8.21 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 115.01, 121.26, 122.60,123.15, 124.68, 125.37, 125.83, 126.73, 127.78, 128.30, 128.50, 131.00, 132.95, 137.53, 138.71, 139.12, 144.27, 145.26, 153.30, 162.02, 162.44, 171.81; MS: *m*/*z* 591.57, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.7), 180(14.1), 127(10.9), 77(6.9). Anal. Calcd for $C_{32}H_{25}N_5O_7$: C, 64.97; H, 4.26; N, 11.84. Found: C, 64.99; H, 4.24; N, 11.85%.

[1-(4-Iodophenyl)-1*H*-1,2,3,triazol-4-yl]methyl2-acetamido-1-phenyl-1*H*-benzo[f] chromene-3-carboxylate, 6g

White solid. Yield 70%. m.p. 220-225°C. IR (KBr): 3070-3350, 3330 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.07 (s, 3H-CH_3), 5.00 (s, 1H-CH) 5.32 (s, 2H, CH_2) 6.48 (s, 1H-NH), 7.22 (m, 5H, Ar-H), 7.33 (d, *J*=10.7Hz, 2H) 7.41 (t, *J*=7.9Hz, 3H, Ar-H), 7.48 (s, 1H, Ar-H)7.67 (m, 2H, Ar-H) 7.73 (s, 1H, Ar-CH) 7.81 (s, 1H, Ar-H) 8.08 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.32, 122.60, 122.60, 123.80, 125.37, 125.48, 125.83, 131.00, 132.02, 137.53, 138.71, 139.12, 140.21, 144.27, 153.49, 162.44, 171.81; MS: *m*/*z* 642.44, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.7), 180(14.1), 127(10.9), 77(6.9). Anal. Calcd for $C_{31}H_{23}IN_4O_4$: C, 57.96; H, 3.61; N, 8.72. Found: C, 57.98; H, 3.65; N, 8.75%.

[1-(4-Flourophenyl)-1*H*-1,2,3,triazol-4-yl]methyl2-acetamido-1-phenyl-1*H*-benzo[f] chromene-3-carboxylate, 6h

White solid. Yield 67%. m.p. 227-230°C. IR (KBr): 3070-3350, 850-500, 3330 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.13 (s, 3H-CH_3), 4.95 (s, 1H-CH) 5.38 (s, 2H, CH_2) 6.50 (s, 1H-NH), 7.06 (m, 2H,Ar-H), 7.26 (m, 3H, Ar-H) 7.33 (d, *J*=12.5Hz, 2H, Ar-H), 7.45 (dd, 4H, *J* =15.3, 8.3Hz Ar-H) 7.73 (s, 1H, Ar-H) 7.79 (t, *J* =5.7Hz 3H Ar-H) 9.32 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.32, 118.34, 122.60, 123.15, 124.09, 125.37, 125.48, 125.83, 126.73, 127.78, 128.30, 128.50, 131.00, 132.95, 133.22, 137.53, 138.71, 139.12, 144.27, 152.57, 162.44, 171.81; MS: *m*/*z* 534.4, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.7), 180(14.1), 127(10.9), 77(6.9). Anal. Calcd for $C_{31}H_{23}FN_4O_4$: C, 69.95; H, 4.34; N, 10.48. Found: C, 69.99; H, 4.36; N, 10.50%.

[1-(4-Cyanophenyl)-1*H*-1,2,3,triazol-4-yl]methyl2-acetamido-1-phenyl-1*H*-benzo[f] chromene-3-carboxylate, 6i

White solid. Yield 65%. m.p. 230-235°C. IR (KBr): 3070-3350, 3330 cm^{-1}; ^{1}H NMR (500 MHz, DMSO-d_6): δ 2.07 (s, 3H-CH_3), 5.00 (s, 1H-CH) 5.32 (s, 2H, CH_2) 6.48 (s, 1H-NH), 7.22 (m,5H,Ar-H), 7.33 (d, *J*=10.7Hz, 2H) 7.41 (t, *J*=7.9Hz, 3H, Ar-H), 7.48 (s, 1H, Ar-H) 7.67 (m, 2H, Ar-H) 7.73 (s, 1H Ar-CH) 7.81 (s, 1H, Ar-H) 8.08 (s, 1H, Ar-H); ^{13}C NMR (75 MHz, DMSO-d_6): δ 23.31, 40.78, 51.31, 113.08, 114.32, 122.60, 122.60, 123.80, 125.37,125.48, 125.83, 131.00, 132.02, 137.53, 138.71, 139.12, 140.21, 144.27, 153.49, 162.44, 171.81; MS: *m*/*z* 541.56, [M^+] 440(28.7), 359(24.1), 282(17.8), 238(16.7), 180(14.1), 127(10.9), 77(6.9). Anal. Calcd for $C_{32}H_{23}N_5O_4$: C, 70.97; H, 4.28; N, 12.93. Found: C, 70.98; H, 4.30; N, 12.95%.

Conclusion

In conclusion, we have disclosed a very efficient method for synthesising (1-Phenyl-1*H*-1,2,3-Triazo -4-YL) Methyl 2-Acetamido 1-Phenyl -1*H*-Benzo [f] Chromene-3-Carboxylate (6a-i), and the derivatives ranged from good to mediocre. The obtained compounds had high yields and were tested for antimicrobial activity. Synthesised compounds were tested *in vitro* against gram-positive bacteria such as Staphylococcus aureus and gram-negative bacteria such as *Escherichia coli* and antifungal activity against *Aspergillus fumigatus*. This transformation, which gives discriminating technique for the synthesis of highly functionalized derivatives, clearly presents the optimum efficiency of a process in mild circumstances, quick reaction times, and operational simplicity. The current agreement may also be extended to a wide range of substrates.

Supplementary Information

Supplementary information is available in the website http://nopr.niscpr.res.in/handle/123456789/58776.

Acknowledgement

The authors would like to express their gratitude to the Director of the Indian Institute of Chemical Technology in Hyderabad. Principal, Chaitanya (Deemed to be the university), Hanumakonda, Vaagdevi Degree and PG College, Department of Microbiology, Hanumakonda For providing spectral data and biological activity.

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