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Synthesis and Characterization of Some Novel Coumarin-1,2,3-triazole Derivatives *Via* Click Reaction as Novel and Evaluation of Anti bacterial and Anti fungal Agents

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ABSTRACT

A new series of diverse 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one and its derivatives **(4a-l)** has been synthesized *via* click reaction and [2 + 2] cycloaddition in the presence of different Copper catalysts between various 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** and substituted benzyl azides **(3a-e)** in good to excellent yields by using diverse 7-hydroxy-2*H*-chromen-2-ones **(1a-c)**. All the newly prepared intermediates and products are characterized by elemental analysis and various spectroscopic techniques. Finally all the title compounds have been used to evaluate their antibacterial and antifungal activity against some bacterial and fungal organisms.

Keywords: synthesized *via* click reaction, 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one, 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** .

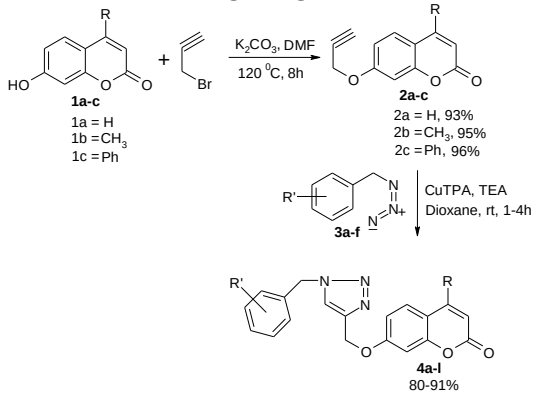
INTRODUCTION

1,2,3-Triazoles are an important class of heterocycles due to their wide range of applications as synthetic intermediates and pharmaceuticals[1]. Several therapeutically interesting 1,2,3-triazoles have been reported, including anti-HIV agents[2], antimicrobial compounds[3], β-3 selective adrenergic receptor agonists[4], kinase inhibitors[5] and other enzyme inhibitors[6]. The 1,2,3-triazole moiety is also present in a number of drugs, for example, the β-lactam antibiotic tazobactam[7] and cefatrizine[8]. On the other hand, coumarins are structural units of several natural products[9] and feature widely in pharmacologically and biologically active compounds[10]. They have been used widely as anticoagulants[11], as additives in food and cosmetics[10] and in the preparation of insecticides, optical brighteners[12], dispersed fluorescent and laser dyes[13].

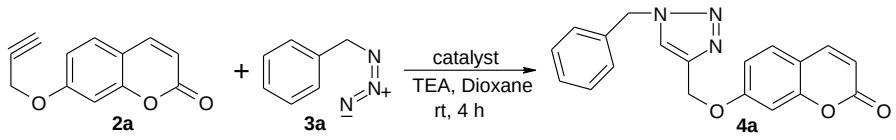
RESULTS AND DISCUSSION

Encouraged by the potential clinical and other applications of both coumarins and 1,2,3-triazoles, we have decided to synthesis a novel series of various coumarine based 1,2,3-triazoles like 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one **(4a-l)** as biologically potent moieties through click chemistry. The synthetic route leading to the title compounds is summarized in Scheme 1. Thus, the initial intermediate, 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** has been achieved through substitution reaction between the raw material, 7-hydroxy-2*H*-chromen-2-ones **(1a-c)** and propargyl bromide in the presence of anhydrous potassium carbonate in dry N,N-dimethyl formamide at 120 ^{0}C for 8 h on constant stirring in excellent yields (93-96%). Simultaneously, this intermediate, 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** was converted into the target compound 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one **(4a-l)** on reaction with various benzyl azides **(3a-f)**. Encouraged by these results, our synthetic study is extended by using different catalysts such as CuTPA, $Cu(AcAc)_2$, $Cu(OTf)_2$, $Cu(NO_3)_2$, $CuSO_4$ and $Cu(OAc)_2$ in the conversion of 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** with benzyl azides **(3a-f)** into 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one **(4a-l)**.

This novel [2+2] cycloaddition of 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** with benzyl azides **(3a-f)** to offer the corresponding 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one **(4a-l)** is also carried out independently in the presence of several catalysts such as CuTPA, $Cu(AcAc)_2$, $Cu(OTf)_2$, $Cu(NO_3)_2$, $CuSO_4$ and $Cu(OAc)_2$ in the presence of tryethylamine in dioxane at ambient temperature with constant stirring for 4 h in order to select the efficient catalyst. The product **4a** was obtained in lowest yield (Table 2, entry 6, 20%) with using $Cu(OAc)_2$ as catalyst. However, the same product was achieved in 25%, 35%, 52% and 60% of yield by employing catalyst like $CuSO_4$, $Cu(NO_3)_2$, $Cu(OTf)_2$ and $Cu(AcAc)_2$ respectively under similar conditions. The highest yield (97 %) of the product **4a** was obtained in the presence of Cu-TPA [Cu-12-Tungstophosphoric acid] as catalyst and thus concluded that the conversion disclosed excellent performance in terms of yield and was selected as model reaction. Finally, all the target compounds have been used to study their efficiency against various bacterial and fungal organisms.



Scheme 1: Synthesis of compounds 4a-l



Scheme 1: Study of catalyst effect on synthesis of compound 4a

Table 1: Study of catalyst effect on synthesis of compound 4a

S.No	Entry	Catalyst	Yield (%)
1	4a	CuTPA	91
2	4a	$Cu(AcAc)_2$	60
3	4a	$Cu(OTf)_2$	52
4	4a	$Cu(NO_3)_2$	35
5	4a	$CuSO_4$	25
6	4a	$Cu(OAc)_2$	20

Anti bacterial activity

The antibacterial activity of the newly synthesized title compound, 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one and its derivatives **(4a-l)** was tested against various bacteria strains such as *Micrococcus luteus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli* and *Klebsiella planticola* using their single concentration in DMSO as a control and ciprofloxacin as standard. The inhibition zone in mm against the growth of the verified bacteria for the synthesized compounds is given in Table 1. According screening results and the antibacterial assay data, it is evident that all the tested compounds exhibited moderate to good antibacterial activity levels with degree of variation. Thus, among the all title compounds against all investigated bacterial strains, compound 4e disclosed highest activity against *K. planticola* with zone of inhibition 15 mm. On the other hand target compound 4f offered lowest potential towards examined bacteria *M. luteus* in the whole screening study. The rest of study revealed that remaining compounds towards all bacteria showed good antibacterial activity.

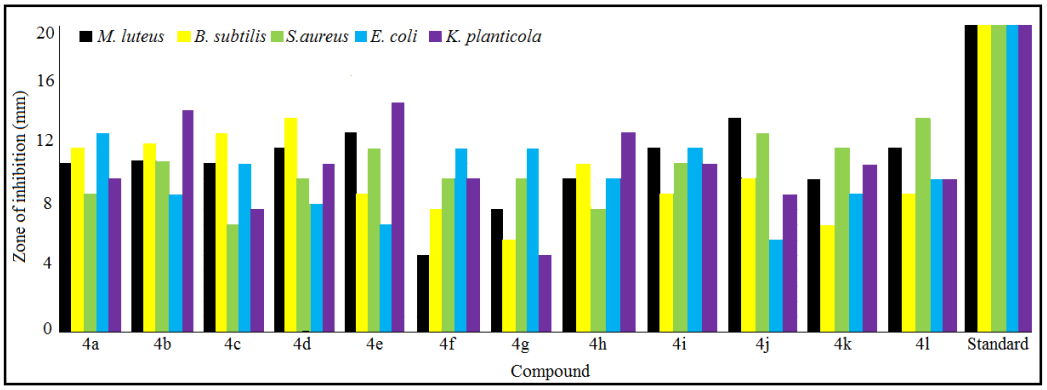
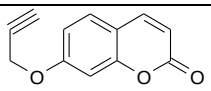
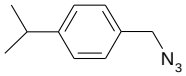
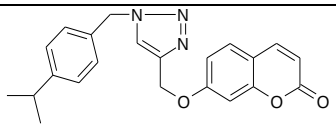
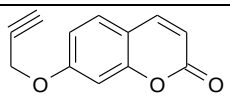
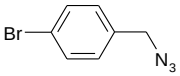
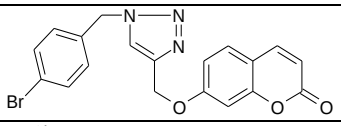
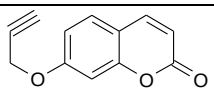
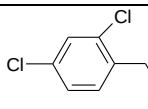
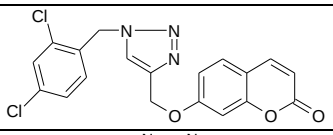
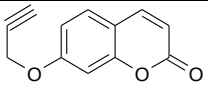
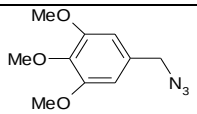
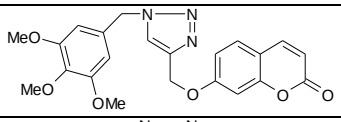
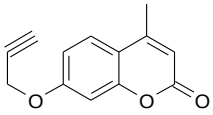
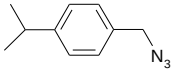
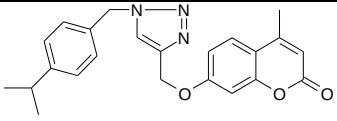
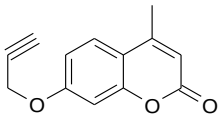
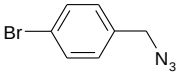
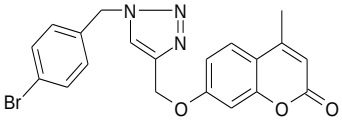
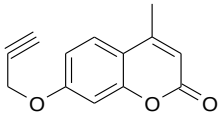
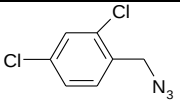
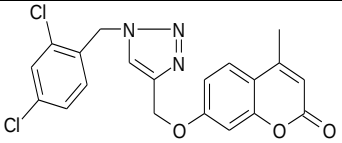
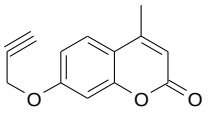
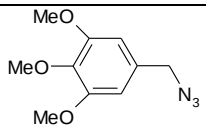
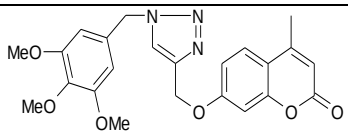
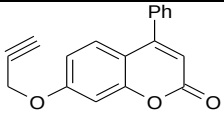
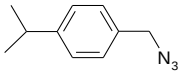
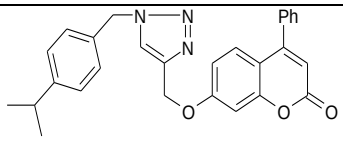
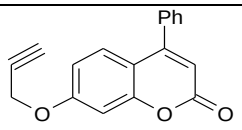
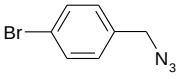
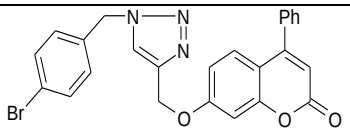
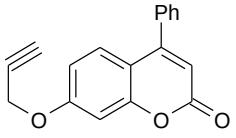
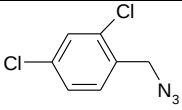
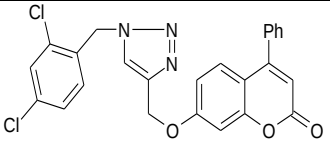
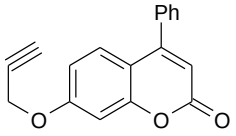
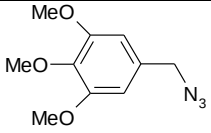
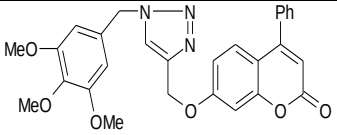


Table 2: Synthesis of 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-ones (4a-l)

Entry	Chromone	Azide	Product	Time (h)	Yield[a] (%)
4a				3.5	85
4b				3.0	82
4c				2.5	80
4d				3.5	88
4e				4.0	91
4f				2.0	82
4g				1.5	80
4h				1.0	83
4i				3.0	89

4j				2.5	90
4k				3.5	87
4l				4.0	80

[a]Isolated yield after purification

EXPERIMENTAL

All the reagents and solvents were used as received from the suppliers without any purification. The TLC was performed on Merck Kiesel gel 60, F_{254} plates with the layer thickness of 0.25 mm. Column chromatography was performed on silica gel (100-200 mesh) using a gradient of ethyl acetate and hexane as mobile phase. Melting points were determined on a Fisher John's melting point apparatus and are uncorrected. IR spectra were recorded on a Perkin–Elmer RX-1 FT-IR system. ^{1}H NMR spectral data were collected at 300 MHz and given as chemical shifts in ppm followed by multiplicity singlet-s, doublet-d, triplet-t, quartet-q, multiplet-m. HRMS spectral data were collected using ORBITRAP High Resolution Mass Spectrometer.

Synthesis of 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones (2a-c)

A mixture of 7-hydroxy-2*H*-chromen-2-ones **(1a-c)** (0.01 mol), propargyl bromide (0.01 mol) and potassium carbonate in *N*,*N*-dimethyl formamide (20 ml) was refluxed with uniform stirring on oil bath for 8 h. After fulfilment of the reaction (tested by TLC), the reaction mixture was then poured onto ice-cold water. The solid that precipitated was collected, washed with water several times, dried and recrystallized from ethyl acetate to give the compounds 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones (2a-c) in pure form.

Synthesis of 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-ones (4a-l)

A mixture of 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones (2a-c) (0.01 mol), benzyl azide (0.01 mol), triethyl amine (0.02 mol) and CuTPA (10 mol%) in 1,4-dioxane (5 ml) was stirred constantly at room temperature. After completion of the reaction (examined by TLC), the mixture was filtered, concentrated *invacuo* and then diluted with water. The aqueous layer was extracted with ethyl acetate (3 X 30 ml). The combined organic layers were dried over

anhydrous sodium sulfate and concentrated *in vacuo* and then purified by column chromatography on silica gel to afford pure 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-ones (4a-l).

Spectral characterization data

7-(Prop-2-ynyloxy)2*H*-chromen-2-one (2a): Solid, m.p. 125-127 °C IR (KBr, cm^{-1}): 3315 (≡C-H), 3045 (C-H, Ar), 2954 (C-H, CH_2), 1738 (C=O), 1647 (C=C, Ar), 1132 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.58 (s, 1H, Ar-H), 7.51 (d, 1H, *J* = 7.2 Hz, Ar-H), 7.45 (d, 1H, *J* = 7.2 Hz, Ar-H), 5.56 (d, 1H, *J* =11.2 Hz, CH), 5.21 (d, 1H, *J* =11.2 Hz, CH), 3.65 (s, 2H, CH_2), 3.25 (s, 1H, CH). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 163.5, 152.7, 141.0, 136.5, 133.8, 129.6, 127.1, 123.2, 118.2, 111.2, 103.5, 56.5. MS: *m/z* 200 (M^+). Elemental Analalysis: Calcd. for $C_{12}H_8O_3$: C-72.05, H-4.03, O-23.98. Found: C-71.35, H-4.03, O-23.87.

4-Methyl-7-(Prop-2-ynyloxy)2*H*-chromen-2-one (2b): Solid, m.p. 115-117 °C IR (KBr, cm^{-1}): 3325 (≡C-H), 3038 (C-H, Ar), 2945 (C-H, CH_2), 1736 (C=O), 1638 (C=C, Ar), 1137 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.61 (s, 1H, Ar-H), 7.55 (d, 1H, *J* = 7.4 Hz, Ar-H), 7.42 (d, 1H, *J* = 7.4 Hz, Ar-H), 5.51 (s, 1H, CH), 3.62 (s, 2H, CH_2), 3.28 (s, 1H, CH), 2.89 (s, 3H, CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 160.6, 155.3, 142.1, 137.2, 135.1, 126.7, 123.3, 121.5, 117.6, 110.7, 105.2, 52.5, 46.7. MS: *m/z* 214 (M^+). Elemental Analalysis: Calcd. for $C_{13}H_{10}O_3$: C-72.89, H-4.71, O-22.41. Found: C-72.89, H-4.71, O-22.41.

4-Phenyl-7-(Prop-2-ynyloxy)2*H*-chromen-2-one (2c): Solid, m.p. 132-134 °C IR (KBr, cm^{-1}): 3318 (≡C-H), 3029 (C-H, Ar), 2935 (C-H, CH_2), 1739 (C=O), 1645 (C=C, Ar), 1135 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.72-7.32 (s, 5H, Ar-H), 7.59 (s, 1H, Ar-H), 7.53 (d, 1H, *J* = 7.5 Hz, Ar-H), 7.45 (d, 1H, *J* = 7.5 Hz, Ar-H), 5.56 (s, 1H, CH), 3.67 (s, 2H, CH_2), 3.31 (s, 1H, CH). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 161.6, 153.2, 144.0, 135.9, 134.3, 132.5, 130.5, 128.2, 125.6, 123.2, 121.0, 119.2, 117.2, 115.2, 107.1, 53.0. MS: *m/z* 276 (M^+). Elemental Analalysis: Calcd. for $C_{18}H_{12}O_3$: C-78.25, H-4.38, O-17.37. Found: C-77.65, H-4.37, O-17.35.

7-((1-(4-Isopropylbenzyl)-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4a): Solid, m.p. 189–192 °C IR (KBr, cm^{-1}): 3038 (C-H, Ar), 2960 (C-H, CH_3), 1745 (C=O), 1611 (C=C, Ar), 1435 (C=N), 1124 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.68 (s, 1H, Ar-H), 7.52 (d, 1H, *J* = 7.5 Hz, Ar-H), 7.48 (d, 1H, *J* = 7.5 Hz, Ar-H), 7.38 (d, 2H, *J* = 7.1 Hz, Ar-H), 7.35 (d, 2H, *J* = 7.1 Hz, Ar-H), 5.51 (d, 1H, *J* =10.5 Hz, CH), 5.23 (d, 1H, *J* =10.5 Hz, CH), 5.18 (s, 1H, CH), 3.25 (s, 2H, CH_2), 3.21 (s, 2H, CH_2), 2.51 (m, 1H, J = 5.8 Hz, CH), 1.21 (d, 6H, J = 5.8 Hz, 2 X CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 162.7, 154.5, 151.1, 148.2, 142.8, 135.2, 132.8, 131.0, 128.4, 127.7, 126.7, 119.6. 112.8, 112.4, 112.2, 101.5, 61.8, 53.7, 33.3, 23.3. MS: *m/z* 375 (M^+). Elemental Analalysis: Calcd. for $C_{22}H_{21}N_3O_3$: C-70.38, H-5.64, N-11.19, O-12.79. Found: C-69.75, H-5.63, N-11.17, O-12.77.

7-((1-(4-Bromobenzyl)-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4b): Solid, m.p. 158-160 °C IR (KBr, cm^{-1}): 3032 (C-H, Ar), 2963 (C-H, CH_3), 1740 (C=O), 1622 (C=C, Ar), 1429 (C=N), 1129 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.65 (s, 1H, Ar-H), 7.54 (d, 1H,

J = 7.3 Hz, Ar-H), 7.45 (d, 1H, *J* = 7.3 Hz, Ar-H), 7.35 (d, 2H, *J* = 7.5 Hz, Ar-H), 7.32 (d, 2H, *J* = 7.5 Hz, Ar-H), 5.53 (d, 1H, *J* =10.8 Hz, CH), 5.27 (d, 1H, *J* =10.8 Hz, CH), 5.20 (s, 1H, CH), 3.28 (s, 2H, CH_2), 3.24 (s, 2H, CH_2). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 161.8, 156.3, 152.0, 146.7, 141.8, 137.6, 131.5, 130.8, 126.5, 125.9, 124.7, 113.6, 111.2, 110.8, 103.7, 60.8, 55.6. MS: *m/z* 411 (M^+). Elemental Analalysis: Calcd. for $C_{19}H_{14}BrN_3O_3$: C-55.36, H-3.42, Br-19.38, N-10.19, O-11.64. Found: C-54.68, H-3.41, Br-19.29, N-10.17, O-11.62.

7-((1-(2,4-Dichlorobenzyl)-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4c): Solid, m.p. 129-131 °C IR (KBr, cm^{-1}): 3042 (C-H, Ar), 2962 (C-H, CH_3), 1741 (C=O), 1625 (C=C, Ar), 1432 (C=N), 1127 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.71 (s, 1H, Ar-H), 7.69 (s, 1H, Ar-H), 7.57 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.48 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.38 (d, 1H, *J* = 7.7 Hz, Ar-H), 7.36 (d, 1H, *J* = 7.7 Hz, Ar-H), 5.57 (d, 1H, *J* =11.0 Hz, CH), 5.31 (d, 1H, *J* =11.0 Hz, CH), 5.25 (s, 1H, CH), 3.30 (s, 2H, CH_2), 3.26 (s, 2H, CH_2). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 163.6, 155.2, 150.3, 145.7, 143.2, 135.1, 134.1, 133.2, 132.0, 129.7, 127.6, 126.2, 123.2, 117.5, 114.6, 112.8, 102.1, 62.6, 57.6. MS: *m/z* 401 (M^+). Elemental Analalysis: Calcd. for $C_{19}H_{13}Cl_2N_3O_3$: C-56.73, H-3.26, Cl-17.63, N-10.45, O-11.93. Found: C-55.58, H-3.25, Cl-17.61, N-10.44, O-11.91.

7-((1-(3,4,5-Trimethoxybenzyl)-1H-1,2,3-triazol-4-yl)methoxy)-2H-chromen-2-on (4d): Solid, m.p. 136-138 °C. IR (KBr, cm^{-1}): 3038 (C-H, Ar), 2968 (C-H, CH_3), 1746 (C=O), 1632 (C=C, Ar), 1435 (C=N), 1130 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.68 (s, 1H, Ar-H), 7.64 (s, 2H, Ar-H), 7.52 (d, 1H, *J* = 7.6 Hz, Ar-H), 7.47 (d, 1H, *J* = 7.6 Hz, Ar-H), 5.57 (d, 1H, *J* =11.2 Hz, CH), 5.41 (d, 1H, *J* =11.2 Hz, CH), 5.32 (s, 1H, CH), 3.37 (s, 2H, CH_2), 3.28 (s, 2H, CH_2), 3.25 (s, 6H, 2 X OCH_3), 3.21 (s, 3H, OCH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 165.3, 153.6, 148.7, 146.5, 138.7, 135.6, 133.6, 130.2, 126.7, 125.3, 121.7, 118.7, 115.3, 110.2, 105.7, 65.6, 55.8, 52.3, 48.3. MS: *m/z* 423 (M^+). Elemental Analalysis: Calcd. for $C_{22}H_{21}N_3O_6$: C-62.41, H-5.00, N-9.92, O-22.67. Found: C-61.85, H-4.99, N-9.90, O-22.63.

4-Methyl-7-((1-(4-isopropylbenzyl)-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4e): Solid, m.p. 155-157 °C. IR (KBr, cm^{-1}): 3044 (C-H, Ar), 2956 (C-H, CH_3), 1738 (C=O), 1625 (C=C, Ar), 1439 (C=N), 1132 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.71 (s, 1H, Ar-H), 7.63 (d, 1H, *J* = 7.0 Hz, Ar-H), 7.52 (d, 1H, *J* = 7.0 Hz, Ar-H), 7.42 (d, 2H, *J* = 7.3 Hz, Ar-H), 7.39 (d, 2H, *J* = 7.3 Hz, Ar-H), 5.27 (s, 1H, CH), 5.21 (s, 1H, CH), 3.21 (s, 2H, CH_2), 3.18 (s, 2H, CH_2), 2.48 (m, 1H, J = 6.4 Hz, CH), 2.30 (s, 3H, CH_3), 1.18 (d, 6H, J = 6.4 Hz, 2 X CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 160.8, 156.3, 150.2, 147.2, 140.7, 138.6, 135.1, 133.5, 130.5, 128.6, 120.1, 115.2, 113.2, 110.7, 106.3, 65.8, 55.7, 49.3, 35.7, 22.8. MS: *m/z* 389 (M^+). Elemental Analalysis: Calcd. for $C_{23}H_{23}N_3O_3$: C-70.93, H-5.95, N-10.79, O-12.32. Found: C-69.91, H-5.94, N-10.77, O-12.30.

4-Methyl-7-((1-(4-bromobenzyl)-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4f): Solid, m.p. 123-125 °C IR (KBr, cm^{-1}): 3038 (C-H, Ar), 2959 (C-H, CH_3), 1740 (C=O), 1635 (C=C, Ar), 1436 (C=N), 1135 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.61 (s, 1H, Ar-H), 7.51 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.42 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.37 (d, 2H, *J* = 7.7 Hz,

Ar-H), 7.28 (d, 2H, *J* = 7.7 Hz, Ar-H), 5.50 (s, 1H, CH), 5.27 (s, 1H, CH), 3.31 (s, 2H, CH_2), 3.21 (s, 2H, CH_2), 2.33 (s, 3H, CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 163.2, 152.3, 149.3, 145.3, 143.2, 139.7, 135.1, 132.7, 128.5, 123.2, 122.1, 117.5, 115.2, 109.6, 105.3, 62.7, 58.6, 46.3. MS: *m/z* 425 (M^+). Elemental Analalysis: Calcd. for $C_{20}H_{16}BrN_3O_3$: C-56.35, H-3.78, Br-18.75, N-9.86, O-11.26. Found: C-55.67, H-3.77, Br-18.71, N-9.85, O-11.24.

4-Methyl-7-((1-(2,4-dichlorobenzyl)-1H-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4g): Solid, m.p. 131-133 °C. IR (KBr, cm^{-1}): 3052 (C-H, Ar), 2968 (C-H, CH_3), 1737 (C=O), 1642 (C=C, Ar), 1438 (C=N), 1127 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.65 (s, 1H, Ar-H), 7.62 (s, 1H, Ar-H), 7.55 (d, 1H, *J* = 7.5 Hz, Ar-H), 7.51 (d, 1H, *J* = 7.5 Hz, Ar-H), 7.42 (d, 1H, *J* = 7.3 Hz, Ar-H), 7.38 (d, 1H, *J* = 7.3 Hz, Ar-H), 5.54 (s, 1H, CH), 5.27 (s, 1H, CH), 3.32 (s, 2H, CH_2), 3.28 (s, 2H, CH_2), 2.28 (s, 3H, CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 160.3, 153.5, 148.7, 146.3, 141.2, 138.6, 136.3, 135.2, 131.2, 128.6, 125.3, 123.2, 121.7, 119.3, 112.5, 110.5, 103.7, 65.1, 59.5, 44.8. MS: *m/z* 415 (M^+). Elemental Analalysis: Calcd. for $C_{20}H_{15}Cl_2N_3O_3$: C-57.71, H-3.63, Cl-17.03, N-10.09, O-11.53. Found: C-56.39, H-3.61, Cl-17.00, N-10.08, O-11.51.

4-Methyl-7-((1-(3,4,5-trimethoxybenzyl)-1*H*-1,2,3-triazol-4-yl)methoxy)-2H-chromen-2-one (4h): Solid, m.p. 109-111 °C. IR (KBr, cm^{-1}): 3045 (C-H, Ar), 2971 (C-H, CH_3), 1738 (C=O), 1641 (C=C, Ar), 1439 (C=N), 1142 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.65 (s, 1H, Ar-H), 7.62 (s, 2H, Ar-H), 7.55 (d, 1H, *J* = 7.3 Hz, Ar-H), 7.45 (d, 1H, *J* = 7.3 Hz, Ar-H), 5.61 (s, 1H, CH), 5.37 (s, 1H, CH), 3.39 (s, 2H, CH_2), 3.31 (s, 2H, CH_2), 3.28 (s, 6H, 2 X OCH_3), 3.19 (s, 3H, OCH_3), 2.32 (s, 3H, CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 161.2, 151.5, 146.5, 143.2, 139.8, 136.5, 131.2, 129.8, 125.3, 123.2, 120.8, 117.5, 116.2, 113.7, 103.5, 67.8, 53.2, 50.8, 45.6, 41.7. MS: *m/z* 437 (M^+). Elemental Analalysis: Calcd. for $C_{23}H_{23}N_3O_6$: C-63.15, H-5.30, N-9.61, O-21.94. Found: C-62.69, H-5.29, N-9.60, O-21.90.

4-Phenyl-7-((1-(4-isopropylbenzyl)-1H-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4i): Solid, m.p. 120-122 °C. IR (KBr, cm^{-1}): 3052 (C-H, Ar), 2968 (C-H, CH_3), 1740 (C=O), 1632 (C=C, Ar), 1445 (C=N), 1137 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.65 (s, 1H, Ar-H), 7.60 (d, 1H, *J* = 7.0 Hz, Ar-H), 7.58-7.42 (m, 5H, Ar-H), 7.48 (d, 1H, *J* = 7.0 Hz, Ar-H), 7.40 (d, 2H, *J* = 7.3 Hz, Ar-H), 7.36 (d, 2H, *J* = 7.3 Hz, Ar-H), 5.23 (s, 1H, CH), 5.19 (s, 1H, CH), 3.18 (s, 2H, CH_2), 3.15 (s, 2H, CH_2), 2.51 (m, 1H, J = 6.4 Hz, CH), 1.21 (d, 6H, J = 6.4 Hz, 2 X CH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 165.5, 154.3, 148.2, 145.3, 142.5, 136.7, 133.2, 131.7, 130.5, 128.6, 126.7, 124.2, 123.8, 121.5, 119.7, 117.2, 115.1, 112.3, 109.2, 63.1, 58.7, 39.5, 25.3. MS: *m/z* 451 (M^+). Elemental Analalysis: Calcd. for $C_{28}H_{25}N_3O_3$: C-74.48, H-5.58, N-9.31, O-10.63. Found: C-73.67, H-5.57, N-9.30, O-10.61.

4-Phenyl-7-((1-(4-bromobenzyl)-1H-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4j): Solid, m.p. 130-132 °C. IR (KBr, cm^{-1}): 3052 (C-H, Ar), 2959 (C-H, CH_3), 1736 (C=O), 1635 (C=C, Ar), 1436 (C=N), 1127 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.62 (s, 1H, Ar-H), 7.58 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.54-7.37 (m, 5H, Ar-H), 7.43 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.37 (d, 2H, *J* = 7.3 Hz, Ar-H), 7.35 (d, 2H, *J* = 7.3 Hz, Ar-H), 5.56 (s, 1H, CH), 5.25 (s, 1H,

CH), 3.31 (s, 2H, CH_2), 3.27 (s, 2H, CH_2). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 165.3, 157.6, 153.5, 144.7, 143.5, 136.7, 133.6, 132.5, 129.6, 127.2, 125.8, 123.7, 122.1, 119.6, 117.6, 115.2, 113.2, 111.8, 105.7, 62.1, 56.8. MS: *m/z* 487 (M^+). Elemental Analalysis: Calcd. for $C_{25}H_{18}BrN_3O_3$: C-61.49, H-3.72, Br-16.36, N-8.60, O-9.83. Found: C-60.69, H-3.71, Br-16.33, N-8.59, O-9.82.

4-Phenyl-7-((1-(2,4-dichlorobenzyl)-1H-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4k): Solid, m.p. 108-110 °C. IR (KBr, cm^{-1}): 3058 (C-H, Ar), 2962 (C-H, CH_3), 1739 (C=O), 1648 (C=C, Ar), 1433 (C=N), 1122 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.67 (s, 1H, Ar-H), 7.65 (s, 1H, Ar-H), 7.62-7.35 (m, 5H, Ar-H), 7.59 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.55 (d, 1H, *J* = 7.1 Hz, Ar-H), 7.47 (d, 1H, *J* = 7.2 Hz, Ar-H), 7.35 (d, 1H, *J* = 7.2 Hz, Ar-H), 5.59 (s, 1H, CH), 5.25 (s, 1H, CH), 3.36 (s, 2H, CH_2), 3.25 (s, 2H, CH_2). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 165.2, 156.3, 145.2, 143.7, 142.7, 140.7, 139.6, 137.5, 136.7, 133.6, 132.1, 130.2, 129.5, 127.8, 125.7, 123.0, 122.6, 120.1, 115.7, 115.6, 106.3, 63.7, 57.1. MS: *m/z* 477 (M^+). Elemental Analalysis: Calcd. for $C_{25}H_{17}Cl_2N_3O_3$: C-62.77, H-3.58, Cl-14.82, N-8.78, O-10.03. Found: C-61.85, H-3.57, Cl-14.80, N-8.77, O-10.01.

4-Phenyl-7-((1-(3,4,5-trimethoxybenzyl)-1H-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one (4l): Solid, m.p. 139-141 °C. IR (KBr, cm^{-1}): 3049 (C-H, Ar), 2977 (C-H, CH_3), 1735 (C=O), 1649 (C=C, Ar), 1432 (C=N), 1146 (C-O). ^{1}H NMR (300 MHz, $CDCl_3$, *δ*, ppm): 7.68 (s, 1H, Ar-H), 7.63 (s, 2H, Ar-H), 7.60-7.32 (m, 5H, Ar-H), 7.52 (d, 1H, *J* = 7.6 Hz, Ar-H), 7.47 (d, 1H, *J* = 7.6 Hz, Ar-H), 5.65 (s, 1H, CH), 5.37 (s, 1H, CH), 3.35 (s, 2H, CH_2), 3.32 (s, 2H, CH_2), 3.26 (s, 6H, 2 X OCH_3), 3.21 (s, 3H, OCH_3). ^{13}C NMR (100 MHz, $CDCl_3$, *δ*, ppm): 166.3, 153.7, 148.5, 145.7, 141.7, 138.6, 133.2, 130.2, 128.5, 126.5, 125.2, 123.5, 121.2, 119.8, 118.5, 115.7, 114.2, 112.5, 108.5, 69.6, 55.3, 51.7, 48.6. MS: *m/z* 499 (M^+). Elemental Analalysis: Calcd. for $C_{28}H_{25}N_3O_6$: C-67.33, H-5.04, N-8.41, O-19.22. Found: C-66.52, H-5.03, N-8.40, O-19.20.

CONCLUSION

A novel series of 7-((1-(benzyl-1*H*-1,2,3-triazol-4-yl)methoxy)-2*H*-chromen-2-one and its derivatives **(4a-l)** has been achieved *via* click reaction in presence of different catalysts from various 7-(prop-2-ynyloxy)-2*H*-chromen-2-ones **(2a-c)** and substituted benzyl azides **(3a-e)** in good to excellent yields. The title compounds were also used to evaluate for their antibacterial activity against different bacterial strains

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