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Unprecedented Synthesis of 1,2,3-Triazolo-Cinnolinone *via* Sonogashira Coupling and Intramolecular Cyclization

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Copper mediated an unprecedented one pot sequential synthesis of 1,2,3-triazolo cinnolinone derivatives from 2-halo-phenyl triazoles and terminal alkynes has been reported. Under the optimized reaction conditions, a broad range of substituted triazoles and alkynes were found to participate in this transformation, thus affording unknown 1,2,3-triazolo cinnolinone derivatives in moderate to excellent yield. This method proceeds through sequential C-C coupling followed by annulation cascade sequence in the same vessel under atmospheric air as the sole oxidant, thus representing a simple, efficient and atom economical approach to aza-cinnolinones.

The cinnoline and its derivatives are an important class of nitrogen-containing heterocyclic compounds, frequently encountered in various biologically and pharmaceutically important molecules,[1] displaying a broad range of biological properties such as anticancer, anti-inflammatory, antifungal, LRRK2 inhibitor, LXR agonist, GABAA modulator, antibacterial (Fig.-1).[2] These derivatives also exhibit luminescent and fluorescent properties for cell-based imaging[3], antitrypanosomiasis activity, and inhibitory activity towards Bruton's tyrosine kinase and antiallergic activities.[4a-e] In addition, they also have useful electrochemical, n-channel semiconductors properties and play an important role in organic synthesis.

Owing to their chemical and physical properties numerous elegant methods have been developed for the synthesis of heterofusedcinnolines in recent past.[5-6] A careful literature survey revealed that arylhydrazones, arylhydrazines, arenediazonium salts, and aryl phenylallylidenehydrazone are the most preferred starting materials for the synthesis of cinnoline derivatives, as they are already embedded with two nitrogen atoms.[7-9] Although, the hydrazones, hydrazines and diazonium salts have been employed as starting materials in various organic transformation reactions but the commercial unavailability, stability and handling issues are some serious drawbacks associated with these materials. Therefore, a direct access to biologically important cinnoline derivatives from simpler starting materials remains an important research objective.

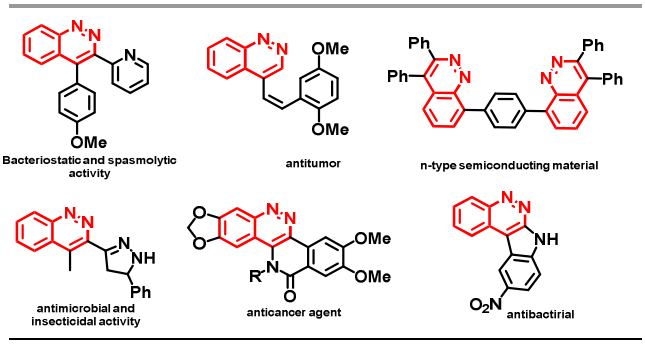

Figure 1. Biologically active cinnoline derivatives.

The 1,2,3-triazoles are some of the most prevalent structural motifs in several biologically active organic compounds, electronic materials and agrochemicals.[10] In particular, the transition metal catalyzed functionalization of triazoles through C-H activation has emerged as a powerful tool for construction of complex compounds, which are usually difficult to synthesize by conventional methods.[11] In this regard, Wu and coworkers, recently developed oxidative annulation between triazoles and internal alkynes, catalyzed by $[Cp^*RhCl_2]_2$ and $Cu(OAc)_2{\cdot}H_2O$ through sequential triazole-directed C-H activation followed by C–C, C–N, and C–O bond formation processes in one-pot to access mesoionic triazoloisoquinolium derivatives (Scheme-1).[12] On the other hand, we recently reported a palladium catalyzed double C-H

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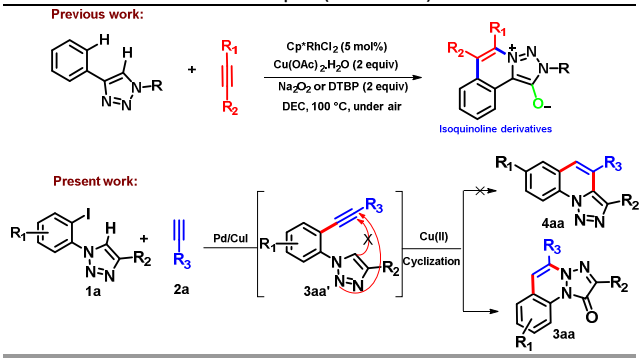
functionalizations of 2-iodophenyl triazoles to afford a variety of triazolo[1,5-f]phenanthridines.[13] As a part of our continued research interest in triazole chemistry, here in we disclose our highly unexpected findings for the synthesis of unknown 1,2,3-triazolo[1,2-a]cinnolin-1-one from 2-iodo-phenyl-triazoles and alkynes through sequential Sonogashira coupling and annulation reactions in one pot (scheme-1).

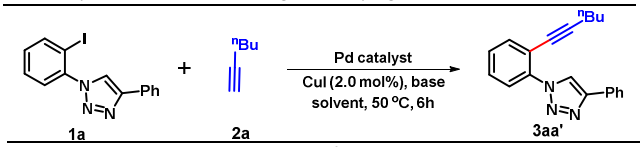


Scheme-1: Previous report along with present study

We started our investigation by optimizing the reaction conditions for both Sonogashira and annulations reactions separately (table-1 & 2), however, at later the stage, both the steps were telescoped in a one-pot.

We have selected 1-(2-iodophenyl)-4-phenyl-1*H*-1,2,3-triazole (**1a**) and 1-hexyne as a model substrate for this one-pot, two steps synthesis of the cinnolinone derivative. In order to optimize the Sonogashira coupling several catalysts, ligands, base, and solvents were screened Table-1. After several optimizations efforts it was found that Sonogashira coupling proceeds smoothly when **1a** (1.0 mmol) and **2a** (2.0 mol%), CuI (2.0 mol%) in Et_3N (3.0 mL) at 50 °C for 6 h (table-1 entry 9). After the standardization of Sonogashira coupling, the product **3aa'** was isolated and subjected to annulations reaction with different conditions. Initially, the hypothesis was based on palladium catalyzed C-H activation of 1,2,3-triazole followed by annulations to obtained **4aa** from **3aa'.** In order to get the desired **4aa** several reactions were tried, unfortunately, all our efforts were found unsuccessful. Interestingly, when we treated **3aa'** (1.0 mmol) with $Cu(OAc)_2$ (1.0 mmol) and Et_3N (2.0 mmol) in toluene (3.0 mmol) at 120 °C for 12 h, we observed trace amount of **3aa** which was confirmed by ESI-MS. This observation was needed to optimize for good yield of **3aa** (Table-2)**.** To our delight, when ligand (L1, 10 mol%) was introduced with $Cu(OAc)_2$ a higher yield (56%) of the desired **3aa** was obtained (entry-2). Among the various bases screened for the annulations reaction, only sodium acetate gave superior yield (61%) than the triethylamine

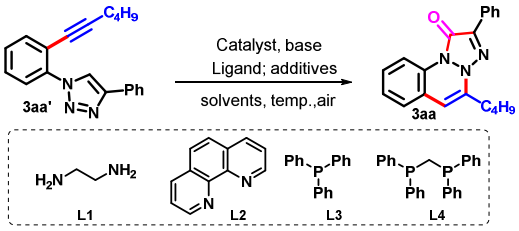
Table 1. Optimization studies for Sonogashira coupling.[a]



S. No.	Pd catalyst (2 mol%)	Base (2 equiv.)	Solvent	Yields % (3aa')[a]
1	$Pd(OAc)_2$	K_2CO_3	toluene	27[b]
2	$Pd(OAc)_2$	Et_3N	toluene	35[b]
3	$PdCl_2$	Et_3N	toluene	21[b]
4	$Pd(PPh_3)_2Cl_2$	Et_3N	THF	78
5	$Pd(PPh_3)_2Cl_2$	Et_3N	MeCN	66
6	$Pd(PPh_3)_2Cl_2$	Et_3N	DMF	57
7	$Pd(PPh_3)_2Cl_2$	DBU	THF	88
8	$Pd(PPh_3)_2Cl_2$	-	Et_3N	92[c]
9	**$Pd(PPh_3)_2Cl_2$**	**-**	**Et_3N**	**96**
10	$Pd(PPh_3)_2Cl_2$	-	Et_3N	78[d]
11	$Pd(PPh_3)_2Cl_2$	-	Et_3N	55[e]
12	$Pd(PPh_3)_2Cl_2$	-	Et_3N	Trace[f]

Reagents and conditions: **1a** (1.0 mmol), **2a** (1.2 mmol), $Pd(PPh_3)_2Cl_2$ (2.0 mol %), CuI (2.0 mol %) and Et_3N (3.0 mL) at 50 °C, for 6 h, under N_2.[(a)] isolated yield; [(b)]when PPh_3 was used; [(c)]when reaction was performed at 25 °C; [(d)] when 4.0 mole% CuI was used; [(e)]when $Cu(OAc)_2$ (2.0 mol%) was used; [(f)]when $Cu(OAc)_2$ (1.0 mmol) was used.

Table 2. Optimization studies for cyclization.[a]



En	Metal	Base (2 eq.)	Solvent	Additives	L (10 mol%)	Yield %[b]
1	$Cu(OAc)_2$	Et_3N	toluene	-	--	Trace
2	$Cu(OAc)_2$	Et_3N	toluene	-	L1	56
3	$Cu(OAc)_2$	$^iPr_3N$	toluene		L1	53
4	$Cu(OAc)_2$	K_2CO_3	toluene		L1	48
5	$Cu(OAc)_2$	NaOAc	toluene		L1	61
6	$Cu(OAc)_2$	NaOAc	toluene	PivOH	L1	66
7	$Cu(OAc)_2$	NaOAc	toluene	PivOH	L2	51
8	$Cu(OAc)_2$	NaOAc	toluene	PivOH	L3	85
9	$Cu(OAc)_2$	NaOAc	toluene	PivOH	L4	92
10	$Cu(OAc)_2$	NaOAc (1.0 eq)	toluene	PivOH	L4	72
11	$Cu(OAc)_2$	NaOAc	DMF	PivOH	L4	Trace
12	$Cu(OAc)_2$	NaOAc	DMSO	PivOH	L4	Trace
13	$Cu(OAc)_2$	NaOAc	NMP	PivOH	L4	Trace
14	$Cu(OAc)_2.H_2O$	NaOAc	toluene	PivOH	L4	66
15	$CuSO_4.5H_2O$	NaOAc	toluene	PivOH	L4	42
16	$Cu(OTf)_2$	NaOAc	toluene	PivOH	L4	48
17	CuI	NaOAc	toluene	PivOH	L4	62
18	AgOAc	NaOAc	toluene	PivOH	L4	trace
19	Pd $(OAc)_2$	NaOAc	toluene	PivOH	L4	trace
20	$Ni(OAc)_2$	NaOAc	toluene	PivOH	L4	trace
21	$Fe(OAc)_3$	NaOAc	toluene	PivOH	L4	trace
22	$(Ph_3P)AuCl$	NaOAc	toulene	PivOH	L4	45
23	$Cu(OAc)_2$	NaOAc	toluene	PivOH	L4	88[c]
24	$Cu(OAc)_2$	NaOAc	toluene	PivOH	L4	60[d]
25	$Cu(OAc)_2$ (10 mol%)	NaOAc	toluene	PivOH	L4	8[e]

Reagents and conditions:[a] **3aa';** (301 mg, 1.0 mmol); $Cu(OAc)_2$ (1.0 mmol), NaOAc (2.0 mmol), Ligand (**L4**; 10.0 mol%), PivOH (10.0 mol%) in toluene (3.0 mL), refluxed at 120 °C, for 12 h under air.[(b)] isolated yield; [(c)]when reaction was performed at 140 °C; [(d)] when reaction was performed at 100 °C; [(e)] when 10 mol% of $Cu(OAc)_2$ was used. Ligands **L1**, **L2**, **L3**, **L4** = ethane-1,2-diamine(en), 1,10-phen, PPh_3, dppm.

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(entries **3-5**). We next examine the effect of additives and found that the addition PivOH (10.0 mol%) in same reaction condition affording **3aa** in 66% yield (entry-**6**). Since the ligand plays an important role in this reaction we next screened the effect of different ligands. Amongst, the different ligands were tested (L2, L3, and L4) only L4 provided the best yield 92% of **3aa,** indicating that phosphine ligands are more effective than amines (entries 7-9). Furthermore, reducing the amount of base from 2.0 equiv. to 1.0 equiv., furnished inferior yields of desired **3aa** (entry-10). Our urge to further improve the reaction conditions resulted in checking the effect of polar solvents such as DMF, DMSO and NMP and surprisingly, all of them furnished **3aa** only in trace amounts (entries 11-13), indicating that toluene is the best choice as a solvent in reaction. Different source copper such as $Cu(OAc)_2.H_2O$, $CuSO_4.5H_2O$ and $Cu(OTf)_2$ were also screened but all of them furnished **3aa** in low yields (entry-14-16). We next screened the role of Cu(I) salt as well as different metals such as AgOAc, $Pd(OAc)_2$, $Ni(OAc)_2$,, $Fe(OAc)_3$, and $(Ph_3P)AuCl$ however most of them were found unsuccessful to induce the annulations reaction except CuI and $(Ph_3P)AuCl$ which furnished **3aa** in 62% and 45% yields respectively (entry-17-22). Increasing or decreasing the reaction temperature from 120 °C, also resulted in a poor yield of **3aa** (entry-23-24). Employing catalytic amount of $Cu(OAc)_2$ (10 mol%) furnished **3aa** only in trace amount indicating that the stoichiometric amount of copper salt is required for this annulation reaction (entry-25). The structure of **3aa** was well characterized by ^1H and ^{13}C NMR, HRMS and X-ray crystallography (fig. 2).

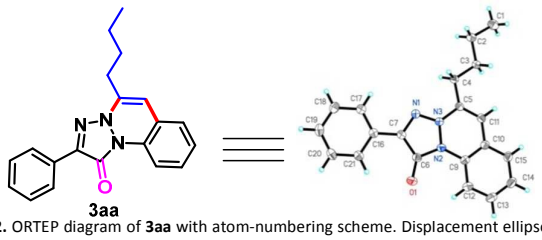
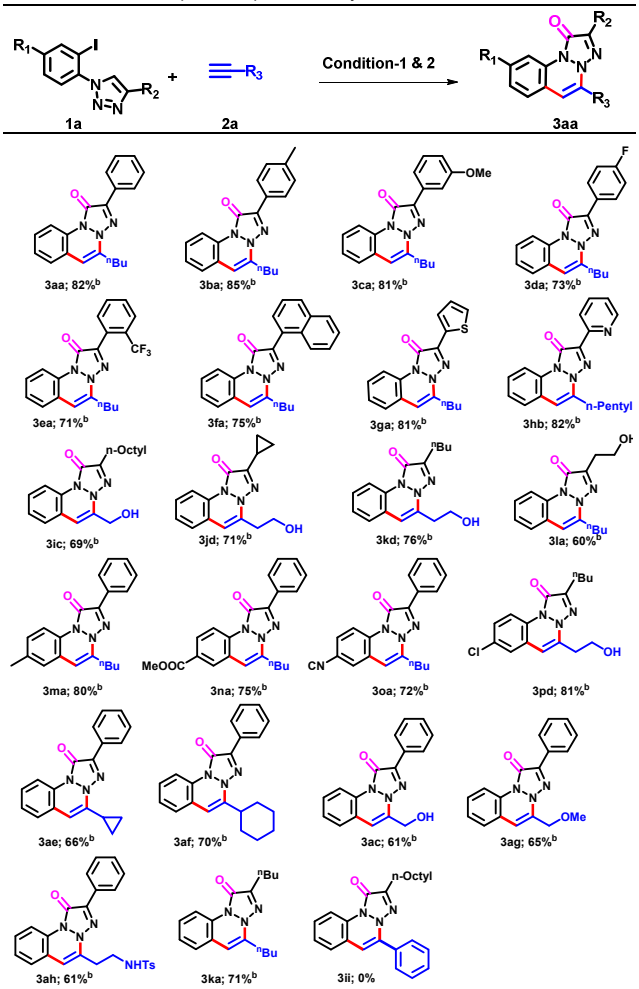


Figure 2. ORTEP diagram of **3aa** with atom-numbering scheme. Displacement ellipsoids are drawn at the 30% probability level

After having standard conditions for both Sonogashira (table-1 entry-9) and annulation (table-2, entry-9) reactions in hand, we turned our attention to cut short these two steps process in same vessel without any workup and purification of intermediate (**3aa'**). Therefore, **1a** (1.0 mmol) and **2a** (2.0 mmol) were treated with $Pd(PPh_3)_2Cl_2$, (2.0 mol%), CuI (2.0 mol%) in Et_3N (3.0 mL) at 50 °C for 6 h. After consumption of starting materials (monitored by TLC), Et_3N was removed under reduced pressure and residue was dissolved in toluene (3.0 mL) and was refluxed with $Cu(OAc)_2$ (1.0 mmol), ligand (**L4**, 10.0 mol%), additive (PivOH, 10.0 mol%) and NaOAc (2.0 mmol) at 120 °C for 12 h, under air furnishing **3aa** in 82% yield in one pot.

The scope of this strategy is exemplified by a diverse range of substrates (table-3). Initially, various 1,4-disubstituted 1,2,3-triazoles (**1a-1p)** containing both electron donating (EDGs) and electron withdrawing groups (EWGs) were employed and delightfully, all of them participated well in the reaction,

Table-3 Substrate scope of the present study[a]



[a]**Regents and conditions**: **conditions-1**: **1a-1p** (1.0 mmol), **2a** (1.2 mmol), $Pd(PPh_3)_2Cl_2$ (2.0 mol %), CuI (2.0 mol %) and Et_3N (3.0 mL) at 50 °C, for 6 h, under N_2; **condition 2:** (after completion of reaction (monitored by TLC) Et_3N was evaporated and crude product was treated with $Cu(OAc)_2$ (1.0 mmol), NaOAc (2.0 mmol), Ligand (**L4**; 10.0 mol%), PivOH (10.0 mol%) in toluene (3.0 mL), refluxed at 120 °C, for 12 h under air. [b]isolated yield; **Condition-1**: applied for Sonogashira coupling and after evaporation of Et_3N; **condition-2** was applied for annulation reaction in the same vessel.

affording good to excellent yields of desired products. It is worth mentioning that triazoles containing electron withdrawing groups (**1d-1e**) furnished slightly lower yields than those containing electron donating groups (**1b-1c**). 1,2,3-trizoles substituted with naphthyl, thiopehenyl, and pyridyl groups were also found to be suitable partner and smoothly reacted with alkynes (**2a-2b**), furnishing required products (**3fa, 3ga** and **3hb**) in very good yields. Furthermore, cyclic and acyclic substitution on 4-position of triazoles (**1i-1l**) were also found equally effective and produced the desired products (**3id-3kd** and **3la**) in good to moderate yields. We next employed various *p*-substituted N-aryl-1,2,3-triazoles into this one pot cascade reaction with aliphatic alkynes under standard reaction conditions delivered the corresponding 1,2,3-triazol-5-ones (**3ma-3oa** & **3pd**) in very good yields. Similarly, the series of alkynes carrying cyclopropyl (**2e**), cyclohexyl (**2f**),

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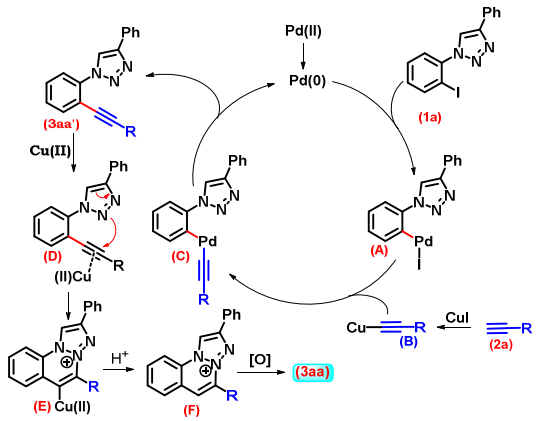
propargyl alcohol (**2c**), 3-methoxyprop-1-yne (**2g**), N-tosyl substituted but-1-yne (**2h**) and hexyne-1 (**2a**) were successfully reacted with **1a** and **1k** under optimized reaction conditions produced corresponding cinnolinones derivatives in identical yields. Aryl alkyne (phenyl acetylene, **1i**) was also employed in this reaction under the standard condition, unfortunately, no cyclized product (**3ii**) was observed. In this case only Sonogashira coupling product (**3ii'**) was recovered after applying optimized reaction conditions.

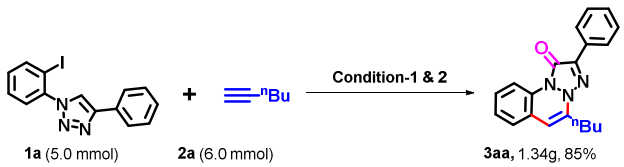
Based on our findings and literature report[14] a plausible reaction mechanism for this one-pot tandem synthesis of 1,2,3-Triazolo-Cinnolinone is depicted in scheme 2. The first step of the reaction proceeds through well recognized Shonogashira coupling reaction. In the initial step, palladium (II) in situ reduced to active form of Pd (0) which on oxidative addition with **1a** furnished palladium (II)



Scheme-2. Plausible reaction mechanism

intermediate **A**. The intermediate **A** undergoes to transmetallation reaction with copper acetylide **B** gives the intermediate **C**. This intermediate **C** undergoes reductive elimination to give the intermediate **3aa'** with regeneration of Pd(0) species. The internal alkyne of **3aa'** gets activated by copper to produce intermediate **D** which is in turn intramolecularly attacked by the lone pair of the nitrogen atom of triazole to furnished **E.** which undergoes to Proto-demetalation to afford intermediate **F.** The intermediate **F** gets oxidized by air to give the desired **3aa.**

After having the optimized reaction conditions, we next performed the large scale synthesis of **3aa** by reacting **1a** (5.0 mmol) with **2a** (6.0 mmol) under optimized reaction conditions and furnished the desired 3aa 85% yield of **3aa** (scheme-3).



Scheme-3: large scale synthesis of **3aa**

In conclusion, we have successfully developed simple and efficient an unprecedented strategy for the synthesis of 1,2,3-Triazolo-Cinnolinone *via* tandem Sonogashira Coupling and intramolecular cyclization in one pot. This one pot process involves one C-C, C–N and C-O bond formations in the presence of palladium/copper catalysts system providing good to moderate yields with both electron withdrawing and releasing groups.

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Experimental

All reagents were purchased from commercial suppliers and used without further purification. The Shonogashira experiment was carried out under nitrogen atmosphere and annulations was carried out under air in one pot. All the solvents used for the reaction were distilled before use. The product purification by column chromatography was accomplished using silica gel 100-200 mesh. Analytical TLC was performed with Merck silica gel 60 F254 plates, and the products were visualized by UV detection. The ^{1}H NMR and 13C NMR spectra were recorded on a Bruker-Avance (300 MHz); Inova (400 MHz) and Avance (500 MHz) spectrophotometer using $CDCl_3$ and TMS as the internal standard. Chemical shifts (δ) are reported in ppm using TMS as an internal standard, and spin -spin coupling constants (J) are given in Hz. Multiplicities in the ^{1}H NMR spectra are described as: s = singlet, d = doublet, t = triplet, q = quartet, qt = quintet, m = multiplet, bs = broad singlet; coupling constants are reported in Hz. Low (MS) and high (HRMS) resolution mass spectra were recorded on a Waters 2695 and Thermo Scientific Exactive spectrometer respectively and mass/charge (m/z) ratios are reported as values in atomic mass units. The melting points of all the compounds are uncorrected.

General procedure for 1,2,3-Triazolo-Cinnolinone:

To a 50ml of round-bottom flask 1-(2-iodophenyl)-4-phenyl-1*H*-1,2,3-triazole (**1a**) (1.0 mmol), $Pd(PPh_3)_2Cl_2$ (2 mol%), CuI (2 mol%) in 3.0 ml of Et_3N were taken under N_2 atmosphere. The reaction mixture was allowed to be stirred at 50 °C for 5 min. To the above solution 1-hexyne (1.2 mmol) was added drop wise over a period of 2 min and the mixture was stirred for another 6h at same temperature. After consumption of starting materials (monitored by TLC) the triethylamine was removed under reduced pressure and the crude product was dissolved in toluene (4 mL). This solution $Cu(OAc)_2$ (1.0 mmol), NaOAc (2.0 mmol), Ligand (L4; 10.0 mol%), PivOH (10.0 mol%) was added and refluxed at 120 °C, for 12 h under air (Condition-B). The reaction mixture was filtered through a pad of celite. The mixture was diluted with ethylacetate (20 mL) and was washed with water (10 ml), brine (10 mL) and sat. sodium bircarbonate solution (10 mL). The organic layer was dried over sodium sulphate and was evaporated under reduced pressure to furnish the crude **3aa** which was purified

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over silica gel column chromatography to afford the pure product **3aa** in 82% yield as a yellowish needles.

Large scale synthesis of 3aa:

To a stirred solution of 1-(2-iodophenyl)-4-phenyl-1*H*-1,2,3-triazole (**1a**) (5.0 mmol), $Pd(PPh_3)_2Cl_2$ (2 mol%), CuI (2 mol%) in 15.0 ml of Et_3N were taken under N_2 atmosphere. To the above reaction mixture 6.0 mmol of 1-hexyne was added dropwise for 8 min and stirred for another 6 h at 50 °C (condition-1). After the completion of reaction (monitored by TLC), Tri ethyl anime was removed by reduced pressure and crude product was further treated with $Cu(OAc)_2$ (1.0 mmol), NaOAc (2.0 mmol), Ligand (L4; 10.0 mol%), PivOH (10.0 mol%) in 10mL of toluene and refluxed at 120 °C, for 12 h under air (Condition-2). the reaction mixture was filtered out on cilite pad and solvent was removed by reduced pressure, washed with brine, organic layer was extracted with EtOH/H2O (1:3). The crude product was set to purification by silica gel column chromatography to afford the pure product **3aa** in 84% (1.34g) yield as a yellowish needles.

5-butyl-2-phenyl-1H-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3aa):
Yield: 82%; Yellow needles, m.p. 196 - 198 °C; ^{1}H NMR (400 MHz, $CDCl_3$):δ 9.24 (d, *J* = 8.3 Hz, 1H), 8.40 – 8.34 (m, 2H), 7.46 (ddd, *J* = 11.3, 8.1, 3.3 Hz, 3H), 7.36 (dd, *J* = 10.7, 5.7 Hz, 3H), 6.21 (s, 1H), 2.90 (t, *J* = 7.64 Hz, 2H), 1.81 (dt, *J* = 15.2, 7.5 Hz, 2H), 1.52 (dq, *J* = 14.7, 7.4 Hz, 2H), 1.02 (t, *J* = 7.4 Hz, 3H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.33, 137.37, 132.85, 131.24, 130.15, 129.78, 128.92, 128.56, 128.42, 128.24, 127.85, 126.97, 125.84, 125.56, 125.41, 121.30, 120.48, 117.62, 115.09, 105.96, 29.38, 28.21, 22.39, 13.88; IR (neat): 3448, 3069, 2953, 2925, 2863, 1645,1594, 1457, 1411, 1353, 1295, 1201, 946, 751; HRMS (ESI, Orbitrap): calcd for $C_{20}H_{20}ON_3$ $[M+H]^+$ is 318.16009 and found is 318.16107.

5-butyl-2-(p-tolyl)-1H-[1,2,3]triazolo[1,2-a]cinnolin-1 one(3ba):
Yield: 85%; Yellow needles, m.p. 162- 164 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.21 (d, *J* = 8.3 Hz, 1H), 8.25 (d, *J* = 8.0 Hz, 2H), 7.40 (dd, *J* = 8.1, 3.3 Hz, 1H), 7.28 (dd, *J* = 15.6, 5.5 Hz, 4H), 6.15 (s, 1H), 2.86 (t, *J* = 7.5 Hz, 2H), 2.39 (s, 3H), 1.82 – 1.73 (m, 2H), 1.56 – 1.44 (m, 2H), 1.01 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 153.34, 138.22, 137.45, 132.89, 129.27, 127.79, 127.31, 126.93, 125.52, 125.34, 121.43, 115.15, 105.57, 29.41, 28.25, 22.38, 21.51, 13.87; IR (neat): 3448, 2954, 2866, 1643, 1526, 1410, 1338, 1306, 1209, 1032, 944; HRMS (ESI, Orbitrap): calcd for $C_{21}H_{22}ON_3$ $[M+H]^+$ is 332.17574 and found is 332.17652.

5-butyl-2-(3-methoxyphenyl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ca):
Yield: 81%; Yellow needles, m.p. 100 - 102 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.23 (dd, *J* = 8.3, 0.6 Hz, 1H), 7.99 (dd, *J* = 2.6, 1.5 Hz, 1H), 7.98 – 7.93 (m, 1H), 7.45 – 7.41 (m, 1H), 7.37 (t, *J* = 8.0 Hz, 1H), 7.34 – 7.32 (m, 2H), 6.92 (ddd, *J* = 8.2, 2.7, 0.9 Hz, 1H), 6.20 (s, 1H), 6.20 (s, 1H), 3.91 (s, 3H), 2.89 (t, J = 7.6 Hz, 2H), 1.83 – 1.76 (m, 2H), 1.51 (dd, *J* = 14.9, 7.4 Hz, 2H), 1.02 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$):δ 159.77, 153.38, 137.42, 132.91, 131.43, 131.14, 129.62, 127.95, 127.03, 125.45, 121.31, 118.06, 115.17, 114.72, 110.30, 106.13, 55.35, 29.41, 28.26, 22.37, 13.85; IR (neat): 3448, 3036, 2992, 2951, 2866, 2831, 1654, 1600, 1458, 1411, 1352, 1297, 1223, 1154, 1093, 1048; HRMS (ESI, Orbitrap): calcd for $C_{21}H_{22}O_2N_3$ $[M+H]^+$ is. 348.17065 and found is 348.16992.

5-butyl-2-(4-fluorophenyl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3da):
Yield: 73%; Yellow needles, m.p. 168 - 170 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.23 – 9.19 (m, 1H), 8.39 – 8.32 (m, 2H), 7.43 (ddd, *J* = 9.6, 6.7, 3.7 Hz, 1H), 7.37 – 7.32 (m, 2H), 7.20 – 7.10 (m, 2H), 6.20 (s, 1H), 2.88 (t, J = 7.4 Hz, 2H), 1.79 (dt, *J* = 15.3, 7.5 Hz, 2H), 1.51 (dq, *J* = 14.6, 7.4 Hz, 2H), 1.02 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 163.96, 161.49, 153.16, 137.36, 132.83, 130.58, 127.92, 127.44, 127.36, 127.05, 126.33, 125.44, 121.30, 115.67, 115.46, 115.10, 105.98, 29.37, 28.22, 22.38, 13.86; ^{19}F NMR (376 MHz, $CDCl_3$) δ: -112.70 (s, 1F); IR (neat): 3448, 3056, 2929, 2865, 1644, 1599, 1525, 1458, 1410, 1337, 1218, 1157, 942; HRMS (ESI, Orbitrap): calcd for $C_{20}H_{19}ON_3F$ $[M+H]^+$ is 336.15067 and found is336.14979.

5-butyl-2-(2-(trifluoromethyl)phenyl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ea):
Yield: 71%; Yellow needles, m.p. 131 - 133 °C; ^{1}H NMR (300 MHz, $CDCl_3$): δ 9.22 (d, *J* = 8.2 Hz, 1H), 8.22 (d, *J* = 7.8 Hz, 1H), 7.84 (d, *J* = 7.9 Hz, 1H), 7.67 (t, *J* = 7.6 Hz, 1H), 7.55 – 7.42 (m, 2H), 7.37 (d, *J* = 4.2 Hz, 2H), 6.27 (s, 1H), 2.86 (t, *J* = 7.7 Hz, 2H), 1.78 (dt, *J* = 15.2, 7.5 Hz, 2H), 1.55 – 1.41 (m, 2H), 0.98 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.59, 137.59, 132.95, 131.71, 131.31, 130.17, 128.47, 128.09, 127.84, 127.13, 125.55, 122.67, 121.24, 120.87, 115.20, 106.72, 29.66, 28.26, 22.39, 13.74; ^{19}F NMR (471 MHz, $CDCl_3$) δ: -58.75 (s, 3F); IR (neat): 3449, 3072, 2959, 2931, 2867, 2092, 1653, 1601, 1494, 1455, 1409, 1313, 1171, 1127, 1032, 954; HRMS (ESI, Orbitrap): calcd for $C_{21}H_{19}ON_3F_3$ $[M+H]^+$ is 386.14747 and found is 386.14855.

5-butyl-2-(naphthalen-1-yl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3fa):
Yield: 75%; Yellow needles, m.p. 158 - 160 °C; ^{1}H NMR (500 MHz, $CDCl_3$):δ 9.29 (d, *J* = 8.3 Hz, 1H), 8.77 (d, *J* = 8.5 Hz, 1H), 8.44 (d, *J* = 7.2 Hz, 1H), 7.91 (d, *J* = 7.7 Hz, 2H), 7.63 – 7.51 (m, 3H), 7.49 – 7.44 (m, 1H), 7.37 (dd, *J* = 4.1, 0.7 Hz, 2H), 6.26 (s, 1H), 2.94 (t, *J* = 7.7 Hz, 2H), 1.90 – 1.81 (m, 2H), 1.54 (dd, *J* = 15.0, 7.5 Hz, 2H), 1.03 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 154.14, 137.41, 134.16, 132.94, 132.45, 130.79, 129.38, 128.69, 127.95, 127.87, 127.07, 126.56, 126.09, 125.95, 125.83, 125.45, 121.44, 115.31, 106.00, 29.66, 28.47, 22.46, 13.89; IR (neat): 3450, 2952, 2865, 1642, 1490, 1456, 1409, 1326, 1298, 1208, 1153; HRMS (ESI, Orbitrap): calcd for $C_{24}H_{22}ON_3$ $[M+H]^+$ is 368.17574 and found is 368.17512.

5-butyl-2-(thiophen-2-yl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ga):
Yield: 81%; Yellow needles, m.p. 152 - 154 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.18 (d, *J* = 0.6 Hz, 1H), 7.99 – 7.96 (m, 1H), 7.45 – 7.41 (m, 1H), 7.38 – 7.35 (m, 1H), 7.35 – 7.31 (m, 3H), 7.15 (dt, *J* = 6.8, 3.4 Hz, 1H), 6.19 (s, 1H), 2.87 (t, *J* = 7.6 Hz, 2H),

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1.78 (dt, *J* = 15.3, 7.5 Hz, 2H), 1.57 – 1.45 (m, 2H), 1.01 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 152.14, 137.48, 127.95, 127.72, 127.15, 125.65, 125.44, 115.21, 108.49, 105.72, 100.23, 29.36, 28.21, 22.34, 13.85; IR (neat):3448, 3086, 2954, 2931, 2867, 1654, 1600, 1407, 1333, 1212, 1154, 1037, 939; HRMS (ESI, Orbitrap): calcd for $C_{18}H_{18}ON_3S$ $[M+H]^+$ is 324.11651 and found is 324.11574.

5-pentyl-2-(pyridin-2-yl)-1H-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3hb):

Yield: 82%; Yellow needles, **m.p.** 168 - 170 °C; **^{1}H NMR (400 MHz, $CDCl_3$):**δ 9.26 (d, *J* = 8.0 Hz, 1H), 8.85 – 8.58 (m, 2H), 7.82 (t, *J* = 7.2 Hz, 1H), 7.47 (t, *J* = 6.8 Hz, 1H), 7.41 – 7.34 (m, 2H), 7.32 – 7.23 (m, 1H), 6.33 (s, 1H), 3.02 (t, *J* = 7.5 Hz, 2H), 1.88 – 1.76 (m, 2H), 1.52 – 1.36 (m, 4H), 0.94 (t, *J* = 7.0 Hz, 3H); **^{13}C NMR (100 MHz, $CDCl_3$):** δ 153.78, 150.10, 149.01, 137.71, 136.69, 132.87, 130.79, 128.21, 127.16, 125.64, 122.81, 122.17, 120.96, 115.09, 107.17, 31.26, 29.07, 25.49, 22.48, 14.00; **IR (neat): 3448**, 2929, 2858, 1655, 1583, 1459, 1402, 1343, 1298, 1149, 944, 788, 761; **HRMS (ESI, Orbitrap):**calcd for $C_{16}H_{20}O_2N_3$ $[M+H]^+$ is 286.15500 and found is 286.15421.

5-(hydroxymethyl)-2-octyl-1H-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ic):

Yield: 69%; Yellow needles, m.p. 130 - 132 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.05 (d, *J* = 8.3 Hz, 1H), 7.45 – 7.39 (m, 1H), 7.35 – 7.29 (m, 2H), 6.26 (s, 1H), 4.74 (d, *J* = 6.0 Hz, 2H), 3.11 (s, 1H), 2.73 (t, *J* = 7.7 Hz, 2H), 1.75 (dt, *J* = 15.4, 7.6 Hz, 2H), 1.37 – 1.22 (m, 12H), 0.88 (td, *J* = 7.0, 2.0 Hz, 5H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 154.02, 137.48, 135.15, 132.77, 128.51, 127.16, 125.98, 121.18, 115.37, 104.59, 59.85, 31.89, 29.73, 29.40, 29.34, 29.25, 27.55, 24.54, 22.68, 14.13; IR (neat): 3450, 3315, 2921, 2852, 1626, 1592, 1457, 1429, 1338, 1279, 1203, 1104, 987; HRMS (ESI, Orbitrap): calcd for $C_{16}H_{20}O_2N_3$ $[M+H]^+$is 328.20195 and found is 328.20260.

2-cyclopropyl-5-(2-hydroxyethyl)-1H-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3jd):

Yield: 71%; Yellow needles, m.p. 164 -166 °C; ^{1}H NMR (400 MHz, $CDCl_3$):δ 8.92 (d, *J* = 7.7 Hz, 1H), 7.33 – 7.28 (m, 1H), 7.23 (t, *J* = 6.9 Hz, 2H), 6.15 (s, 1H), 4.02 (t, *J* = 5.9 Hz, 2H), 3.01 (t, *J* = 5.8 Hz, 2H), 2.03 – 1.97 (m,1H), 1.06 – 0.94 (m, 4H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 153.87, 137.72, 134.23, 132.40, 127.76, 126.99, 125.25, 121.50, 115.09, 105.98, 58.97, 33.65, 7.55, 6.25; IR (neat): 3288, 3077, 2917, 2853, 1623, 1594, 1412, 1326, 1100, 945, 762, 687; HRMS (ESI, Orbitrap): calcd for $C_{15}H_{16}O_2N_3$ $[M+H]^+$is 270.12370 and found is 270.12417.

2-butyl-5-(2-hydroxyethyl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3kd):

Yield: 76%; Yellow needles, m.p. 116 - 118 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 8.93 (d, *J* = 8.1 Hz, 1H), 7.32 – 7.28 (m, 1H), 7.25 (dt, *J* = 7.5, 2.6 Hz, 2H), 6.18 (s, 1H), 4.05 (s, 2H), 3.05 (t, *J* = 5.8 Hz, 2H), 2.66 – 2.57 (t, *J* = 7.6 Hz, 2H), 1.68 (dt, *J* = 15.3, 7.6 Hz, 2H), 1.46 – 1.35 (m, 2H), 0.94 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 154.05, 136.49, 134.31, 132.51, 127.78, 126.95, 125.25, 121.43, 115.01, 106.26, 58.91, 33.77, 29.60, 24.08, 22.45, 13.84; IR (neat): 3331, 2953, 2921, 2857, 1640, 1597, 1457, 1408, 1332, 1305, 1046; HRMS (ESI, Orbitrap): calcd for $C_{16}H_{20}O_2N_3$ $[M+H]^+$ is 286.15500 and found is 286.15419.

5-butyl-2-(2-hydroxyethyl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3la):

Yield: 60%; Yellow needles, m.p. 123 - 125°C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.10 (d, *J* = 8.5 Hz, 1H), 7.45 – 7.40 (m, 1H), 7.38 – 7.32 (m, 2H), 6.16 (s, 1H), 4.51 (t, *J* = 6.3 Hz, 1H), 4.02 (dd, *J*= 11.0, 6.1 Hz, 2H), 3.07 (t,*J* = 5.24 Hz, 2H), 2.83 – 2.79 (m, 2H), 1.78 – 1.70 (m, 2H), 1.49 (dt, *J* = 14.9, 7.4 Hz, 2H), 0.99 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$):δ 155.01, 137.40, 134.71, 132.28, 127.86, 127.28, 125.38, 121.47, 115.38, 105.04, 60.97, 29.75, 29.40, 28.25, 22.34, 13.83; IR (neat): 3325, 2962, 2933, 2868, 1632, 1598, 1459, 1412, 1373, 1333, 1286, 1213, 1161, 1066, 1036; HRMS (ESI, Orbitrap): calcd for $C_{16}H_{20}O_2N_3$ $[M+H]^+$ is286.15500 and found is 286.15421.

5-butyl-8-methyl-2-phenyl-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ma):

Yield: 80%; Yellow needles, m.p. 158 - 160 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.08 (d, *J* = 8.4 Hz, 1H), 8.36 (dd, *J* = 8.3, 1.2 Hz, 2H), 7.49 – 7.42 (m, 2H), 7.37 – 7.31 (m, 1H), 7.21 (dd, *J* = 8.4, 1.3 Hz, 1H), 7.10 (s, 1H), 6.12 (s, 1H), 2.84 (t, *J* = 7.5 Hz, 2H), 2.37 (s, 3H), 1.77 (dt, *J* = 15.3, 7.5 Hz, 2H), 1.56 – 1.41 (m, 2H), 1.00 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.14, 137.23, 136.91, 131.20, 130.73, 130.28, 128.65, 128.54, 128.15, 125.61, 125.54, 121.20, 114.96, 105.98, 29.38, 28.23, 22.38, 21.20, 13.87; IR (neat): 3449, 3055, 2952, 2925, 2864, 1645, 1573, 1489, 1455, 1398, 1352, 1320, 1227, 1153, 944; HRMS (ESI, Orbitrap): calcd for $C_{21}H_{22}ON_3$ $[M+H]^+$ is 332.17574 and found is332.17498.

Methyl 5-butyl-1-oxo-2-phenyl-1H-[1,2,3]triazolo[1,2-a]cinnoline-8-carboxylate(3na):

Yield: 75%; Yellow needles, m.p. 198 - 200 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.23 (d, *J* = 8.7 Hz, 1H), 8.40 – 8.26 (m, 2H), 8.05 (dd, *J* = 8.7, 1.9 Hz, 1H), 7.98 (d, *J* = 1.8 Hz, 1H), 7.49 – 7.43 (m, 2H), 7.39 – 7.33 (m, 1H), 6.20 (s, 1H), 3.93 (s, 3H), 2.87 (t,*J* = 7.45 Hz, 2H), 1.79 (dt, *J* = 15.3, 7.5 Hz, 2H), 1.57 – 1.45 (m, 2H), 1.02 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 165.94, 153.55, 138.29, 135.59, 131.60, 129.76, 129.12, 128.63, 128.55, 128.43, 126.78, 125.64, 121.46, 114.89, 105.36, 52.44, 29.40, 28.18, 22.36, 13.85; IR (neat): 3449, 3068, 2924, 2860, 1714, 1667, 1602, 1438, 1301, 1210, 1108, 985; HRMS (ESI, Orbitrap): calcd for $C_{22}H_{22}O_3N_3$ $[M+H]^+$ is 376.16557 and found is 376.16665.

5-butyl-1-oxo-2-phenyl-1H-[1,2,3]triazolo[1,2-a]cinnoline-8-carbonitrile(3oa):

Yield: 72%; Yellow needles, m.p. 198 - 200 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.28 (d, *J* = 8.6 Hz, 1H), 8.37 – 8.29 (m, 2H), 7.66 (dd, *J* = 8.6, 1.8 Hz, 1H), 7.56 (d, *J* = 1.6 Hz, 1H), 7.47 (t, *J* = 7.6 Hz, 2H), 7.38 (dd, *J* = 10.5, 4.3 Hz, 1H), 6.13 (s, 1H), 2.89 (t, *J* = 7.6 Hz, 2H), 1.84 – 1.75 (m, 2H), 1.56 – 1.47 (m, 2H), 1.03 (t, *J* = 7.4 Hz, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.52, 139.59, 135.21, 132.10, 131.22, 129.36, 128.88, 128.70, 125.73, 117.96, 115.60, 110.65, 103.92, 29.44, 28.17, 22.36, 13.82; IR (neat): 3451, 2926, 2858, 2220, 1660, 1597, 1424, 1348, 1300, 1231, 1148, 927, 888; HRMS (ESI, Orbitrap): calcd for $C_{21}H_{19}ON_4$ $[M+H]^+$ is 343.15534 and found is 343.15644.

2-butyl-8-chloro-5-(2-hydroxyethyl)-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3pd):

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Yield: 81%; Yellow needles, m.p. 140 - 142 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 8.84 – 8.79 (m, 1H), 7.27 – 7.20 (m, 2H), 6.10 (s, 1H), 4.05 (t, *J* = 5.7 Hz, 2H), 3.05 (t, *J* = 5.8 Hz, 2H), 2.90 (s, 1H), 2.66 – 2.61 (m, 2H), 1.69 (dt, *J* = 15.2, 7.6 Hz, 2H), 1.47 – 1.35 (m, 2H), 0.95 (t, *J* = 7.3 Hz, 3H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 153.89, 137.02, 135.55, 132.49, 130.84, 127.52, 124.67, 123.21, 116.24, 105.04, 58.84, 33.77, 29.51, 24.12, 22.45, 13.82; IR (neat): 3409, 3100, 2926, 2934, 2871, 1905, 1633, 1589, 1561, 1436, 1343, 1290, 1206, 1056; HRMS (ESI, Orbitrap): calcd for $C_{16}H_{19}O_2N_3Cl$ $[M+H]^+$ is 320.11603 and found is320.11636.

5-cyclopropyl-2-phenyl-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ae):

Yield: 66%; Yellow needles, m.p. 160 - 162 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.23 (d, *J* = 8.3 Hz, 1H), 8.39 (d, *J* = 7.3 Hz, 2H), 7.47 (t, *J* = 7.7 Hz, 2H), 7.45 – 7.41 (m, 1H), 7.36 (dd, *J* = 11.8, 4.4 Hz, 1H), 7.31 (t, *J* = 8.0 Hz, 2H), 6.03 (s, 1H), 2.40 – 2.31 (m, 1H), 1.21 – 1.13 (m, 2H), 0.92 – 0.86 (m, 2H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.54, 139.13, 132.73, 131.55, 130.19, 128.57, 128.27, 127.92, 126.99, 125.66, 125.46, 121.33, 115.19, 103.37, 10.30, 6.86; IR (neat): 3449, 3066, 2924, 1657, 1597, 1445, 1413, 1335, 1220, 1125, 1103, 1065, 945; HRMS (ESI, Orbitrap): calcd for $C_{19}H_{16}ON_3$ $[M+H]^+$ is 302.12879 and found is 302.12807.

5-cyclohexyl-2-phenyl-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3af):

Yield: 70%; Yellow needles, m.p. 161- 163 °C; ^{1}H NMR (500 MHz, $CDCl_3$): δ 9.23 (d, *J* = 8.3 Hz, 1H), 8.36 (dd, *J* = 8.3, 1.2 Hz, 2H), 7.49 – 7.45 (m, 2H), 7.44 – 7.40 (m, 1H), 7.37 – 7.31 (m, 3H), 6.17 (s, 1H), 3.21 (ddd, *J* = 11.5, 7.4, 3.0 Hz, 1H), 2.17 (d, *J* = 12.9 Hz, 2H), 1.95 – 1.91 (m, 2H), 1.87 – 1.82 (m, 1H), 1.60 – 1.42 (m, 4H), 1.33 (qt, *J* = 13.0, 3.7 Hz, 1H); ^{13}C NMR (125 MHz, $CDCl_3$): δ 153.35, 142.19, 132.77, 131.11, 130.20, 128.57, 128.24, 127.89, 126.96, 125.61, 121.46, 115.14, 104.00, 37.34, 30.79, 26.32, 26.23; IR (neat): 3446, 2924, 2850, 1658, 1596, 1453, 1400, 1349, 1308, 1211, 1153, 1118, 1079, 993; HRMS (ESI, Orbitrap): calcd for $C_{22}H_{22}ON_3$ $[M+H]^+$ is 344.17574 and found is 344.17472.

5-(hydroxymethyl)-2-phenyl-1H-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ac):

Yield: 61%; Yellow needles, m.p. 151- 153 °C; ^{1}H NMR (500 MHz, DMSO) δ 9.07 (d, *J* = 8.2 Hz, 1H), 8.26 (d, *J* = 7.4 Hz, 2H), 7.67 (d, *J* = 7.4 Hz, 1H), 7.49 (tt, *J* = 22.1, 7.3 Hz, 4H), 7.38 (t, *J* = 7.3 Hz, 1H), 6.75 (s, 1H), 5.86 (t, *J* = 5.9 Hz, 1H), 4.71 (d, *J* = 5.5 Hz, 2H); ^{13}C (100 MHz, DMSO + $CDCl_3$) 157.58, 142.09, 137.58, 135.20, 134.95, 133.52, 133.18, 132.98, 132.21, 131.37, 130.23, 126.19, 119.42, 110.03, 84.10, 83.77, 83.44, 62.22, 45.34, 45.13, 44.92, 44.71, 44.50, 44.29, 44.08; HRMS (ESI, Orbitrap): calcd for $C_{17}H_{14}O_2N_3$ $[M+H]^+$ is 292.10805 and found is 292.10730.

5-(methoxymethyl)-2-phenyl-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ag):

Yield: 65%; Yellow needles, m.p. 142 - 144 °C; ^{1}H NMR (400 MHz, $CDCl_3$):δ 9.21 (d, *J* = 8.3 Hz, 1H), 8.35 (dt, *J* = 8.1, 1.6 Hz, 2H), 7.51 – 7.43 (m, 3H), 7.42 – 7.33 (m, 3H), 6.48 (s, 1H), 4.70 (d, *J* = 1.2 Hz, 2H), 3.60 (s, 3H); ^{13}C NMR (100 MHz, $CDCl_3$): δ 153.22, 133.35, 133.13, 131.86, 129.84, 128.59, 128.46, 127.21, 126.14, 125.66, 120.95, 115.30, 105.96, 67.60, 59.59; IR (neat): 3449, 3065, 2929, 1652, 1596, 1491, 1418, 1348, 1218, 1097, 1024, 847, 761; HRMS (ESI, Orbitrap):calcd for $C_{18}H_{16}O_2N_3$ $[M+H]^+$is306.12370 and found is 306.12300.

4-methyl-N-(2-(1-oxo-2-phenyl-1H-[1,2,3]triazolo[1,2-a]cinnolin-5 yl)ethyl)benzenesulfonamide (3ah):

Yield: 61%; Yellow needles, m.p. 154 - 156 °C; ^{1}H NMR (500 MHz, $CDCl_3$) δ 9.07 (d, *J* = 8.2 Hz, 1H), 8.20 (dd, *J* = 5.2, 3.3 Hz, 2H), 7.64 – 7.60 (m, 2H), 7.44 – 7.28 (m, 7H), 7.07 (d, *J* = 7.9 Hz, 2H), 6.17 (s, 1H), 5.11 (t, *J* = 6.2 Hz, 1H), 3.53 (dd, *J* = 12.5, 6.3 Hz, 2H), 3.05 (t, *J* = 6.2 Hz, 2H), 2.31 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$+DMSO): δ 152.97, 142.96, 137.26, 132.95, 129.78, 129.16, 128.43, 128.21, 128.00, 126.99, 126.51, 125.64, 125.37, 121.04, 114.72, 108.69, 30.76, 21.41; IR (neat): 3449, 3184, 2924, 1643, 1597, 1491, 1456, 1330, 1159, 1077, 912, 761; HRMS (ESI, Orbitrap):calcd for $C_{18}H_{16}O_2N_3$ $[M+H]^+$ is 306.12370 and found is 306.12300

2,5-dibutyl-1*H*-[1,2,3]triazolo[1,2-a]cinnolin-1-one(3ka):

Yield: 71%; Yellow needles, m.p. 181 - 183 °C; ^{1}H NMR (400 MHz, $CDCl_3$): δ 9.11 (d, *J* = 8.2 Hz, 1H), 7.41 – 7.35 (m, 1H), 7.32 – 7.25 (m, 2H), 6.05 (s, 1H), 2.82 – 2.72 (m, 4H), 1.80 – 1.69 (m, 4H), 1.53 – 1.40 (m, 4H), 0.98 (dd, *J* = 15.7, 7.4 Hz, 6H). ^{13}C NMR (100 MHz, $CDCl_3$): δ 154.33, 137.51, 136.47, 132.49, 127.42, 126.75, 125.02, 121.60, 115.11, 103.94, 77.45, 77.13, 76.81, 29.75, 29.38, 28.28, 27.24, 24.20, 22.44, 22.31, 14.12, 13.83; IR (neat): 3448, 3069, 2953, 2925, 2863, 1645, 1593, 1457, 1410, 1353, 1295, 1099, 944; HRMS (ESI, Orbitrap): calcd for $C_{18}H_{24}ON_3$ $[M+H]^+$ is 298.19139 and found is 298.19177.

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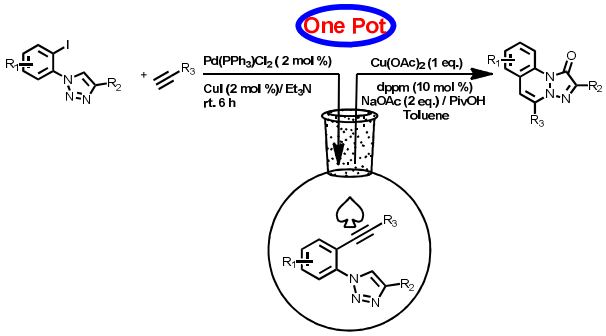

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Unprecedented Synthesis of 1,2,3-Triazolo-Cinnolinone via Sonogashira Coupling and Intramolecular Cyclization

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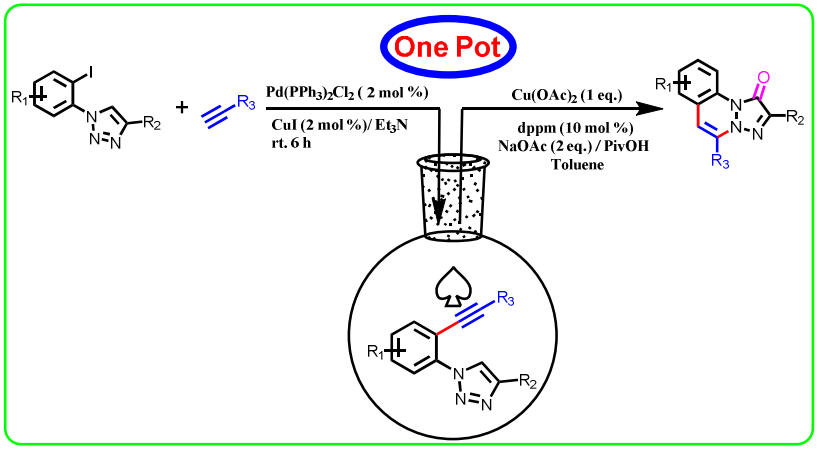

Copper mediated an unprecedented one pot sequential synthesis of 1,2,3-triazolo cinnolinone derivatives from 2-halo-phenyl triazoles and terminal alkynes has been reported. Under optimized reaction conditions, a broad range of substituted triazoles and alkynes were found to participate in this transformation, thus affording unknown 1,2,3-triazolo cinnolinone derivatives in moderate to excellent yield. This method proceeds through sequential C-C coupling followed by annulation cascade sequence in the same vessel under atmospheric air as the sole oxidant, thus representing a simple, efficient and atom economical approach to aza-cinnolinones.