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Research Article

Phosphine-Free Palladium-Catalyzed Direct C-3 Arylation of 2-Phenylimidazo[1,2-*a*]pyridine Using Silver(I) Carboxylate

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Phosphine-free palladium-catalyzed direct arylation of 2-phenyl-imidazo[1,2-*a*]pyridine has been developed with the concept of using silver(I) carboxylate. This protocol efficiently catalyzes the C-H arylation of 2-phenyl-imidazo[1,2-*a*]pyridine with aryl iodides to afford the corresponding 2-phenyl-3-aryl-imidazo[1,2-*a*]pyridines in moderate to-good yields.

1. Introduction

Syntheses of several heterocycles via palladium-catalyzed direct C-H bond activation using aryl halides are of great importance in recent years along with time-honored coupling reactions where expensive and toxic phosphines are widely used [1–6]. Hence, there are significant efforts to perform reactions without using any phosphines for the same reasons. In this aspect, phosphine-free palladium-catalyzed synthesis of free (N-H) as well as substituted indole and pyrroles are reported in the literature [7–9]. In 2008, Igor Larosa reported the intrinsic idea of using the several different types of Ag(I) carboxylate salts (generated in situ by the combination of Ag_2O/differently substituted benzoic acids) along with $Pd(OAc)_2$ to undergo C-H bond activation under very mild conditions to afford C-2 arylated indoles with different functionalities [9]. This paper prompted us to use the same approach for the highly demanding arylation for the C3 position of imidazo[1,2-*a*]pyridine, a heterocycle with outstanding biological activities [10–15]. The most well known drugs like zolimidine (**A**, antiulcer), alpidem (**B**, anxiolytic), and zolpidem (**C**, hypnotic) [14] (Figure 1) also bear this imidazo[1, 2-*a*]pyridine skeleton.

It is to be noted that, in 2007, the research group of Dalibor reported the phosphine-free $Pd(OAc)_2$ catalyzed direct C-arylation of free (–NH) indoles and pyrroles in the presence of CsOAC [8]. Recently there are few reports on the Pd-catalyzed direct C-3 arylation of imidazo[1, 2-*a*]pyridines using phosphines as ligands [16–19] along with the traditional coupling reactions where the starting material should be 3-haloimidazo[1, 2-*a*]pyridines [20–23]. During the preparation of our paper, Fu and collaborators published the phosphine-free Pd-catalyzed direct arylation of imidazo [1,2-*a*]pyridine using KOAc as base [24]. However, prior to the work published by Fu et al. to the best of our knowledge, there was no report on the phosphine-free direct arylation of imidazo[1, 2-*a*]pyridine using palladium as catalyst. In this present work, we describe a new convenient methodology for the phosphine-free direct C3 alkylation of 2-phenylimidazo[1, 2-*a*]pyridine by the reaction of aryl iodides in the presence of $Pd(OAc)_2$ as catalyst with silver(I) carboxylate which is assumed to increase the rate of the palladation step in the catalytic cycle along with its basic nature needed at the reductive elimination step [9]. This methodology also offer a new route for the direct arylation of 2-phenylimidazo[1, 2-*a*]pyridine with aryl iodides.

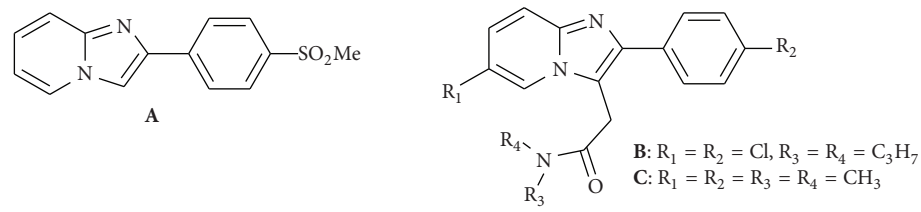


Figure 1: Examples of well-known drugs containing imidazo[1, 2-*a*]pyridine.

2. Experimental

2.1. General. All the chemicals used were purchased from Aldrich Chemical Co. and were used without further purification. Freshly distilled solvents were used. For TLC, aluminum plates coated with silica gel containing F254 indicator were used and the spots were visualized by UV light and/or by exposing to iodine. Column chromatography was performed on silica gel 100–200 mesh, using EtOAc and hexanes mixture as eluent. The ^{1}H and ^{13}C NMR spectra were recorded using 5 mm tubes on a Bruker 500 MHz NMR spectrometer (field strengths: 500 and 125 MHz, resp.,) or 400 MHz NMR spectrometer (field strengths: 400 and 100 MHz resp.,) in $CDCl_3$ solution (unless specified otherwise) with shifts referenced to $SiMe_4$ (^{1}H, ^{13}C: $\delta = 0$). All J values were in Hz. IR spectra were recorded on a JASCO FT/IR 5300 spectrometer. Elemental (C, H, N) analysis was done using Perkin-Elmer 240C CHN FLASH EA analyzer. Melting points were determined by using a SUPERFIT hot-stage melting point apparatus and are uncorrected.

2.2. General Procedure for the Synthesis of 2-Phenylimidazo[1,2-a]pyridine(1). To the solution of 2-aminopyridine (5 mmol) in ethanol (30 mL), 2-bromo acetophenone (5 mmol) was added at room temperature and the reaction mixture was heated under reflux for 3 h. The resulting white solid was filtered off, dried, and used without further purification [25, 26].

2.3. General Procedure for the Direct Arylation of 2-Phenylimidazo[1,2-a]pyridine. A mixture of 2-phenylimidazo[1, 2-*a*]pyridine (194 mg, 1.0 mmol), iodobenzene (224 μL, 2.0 mmol), $Pd(OAc)_2$ (11.2 mg, 5 mol%), Ag_2O (174 mg, 0.75 mmol), and 2-nitrobenzoic acid (251 mg, 1.5 mmol) was stirred at 120°C for 12 h under nitrogen in DMF. The reaction mixture was filtered through a plug of silica gel and then evaporated to dryness under reduced pressure. The crude product was purified by column chromatography (Hexane : EtOAc 80 : 20) to afford 2,3-diphenylimidazo[1, 2-*a*]pyridine. For the synthesis of compounds **3b**-**k**: similar molar quantities of the respective aryl iodides were used with 1.0 mmol of 2-phenylimidazo[1, 2-*a*]pyridine.

2,3-Diphenylimidazo[1, 2-a]pyridine (**3a**). Colorless solid, Yield 82%, 0.22 g, Mp 150–152°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 6.75 (t, ^3J(H-H) = 6.4 Hz, 1H, Ar-*H*), 7.20–7.31 (m, 4H, Ar-*H*), 7.46–7.56 (m, 5H, Ar-*H)*, 7.68–7.71 (m, 3H, Ar-*H)*, 7.97 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 112.4, 117.5, 120.0, 123.3, 124.8, 127.6, 128.1, 128.3, 129.0, 129.6, 129.8, 130.8, 134.0, 137.4, 144.7. IR (ν_{max}, cm^{-1}): 2924, 1506, 1346, 754, 698. LC/MS, *m/z* 271 [M + 1]$^+$; Anal. Calcd. for $C_{19}H_{14}N_2$: C, 84.42; H, 5.22; N, 10.36%. Found: C, 84.31; H, 5.18; N, 10.26%.

2-Phenyl-3-p-tolylimidazo[1, 2-a]pyridine (**3b**). Colorless solid, Yield 81%, 0.23 g, Mp 126–128°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 2.47 (s, 3H, CH_3), 6.72 (t, ^3J(H-H) = 6.0 Hz, 1H, Ar-*H*), 7.17–7.34 (m, 8H, Ar-*H)*, 7.67–7.71 (m, 3H, Ar-*H)*, 7.95 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 21.4, 112.1, 117.5, 121.1, 123.3, 124.5, 126.8, 127.4, 128.1, 128.3, 130.3, 130.5, 134.3, 138.9, 142.2, 144.8. IR (ν_{max}, cm^{-1}): 2924, 1506, 1346, 754, 698. LC/MS, *m/z* 285 [M + 1]$^+$; Anal. Calcd. for $C_{20}H_{16}N_2$: C, 84.48; H, 5.67; N, 9.85%. Found: C, 84.36; H, 5.61; N, 9.96%.

2-Phenyl-3-m-tolylimidazo[1, 2-a]pyridine (**3c**). Colorless solid, Yield 78%, 0.22 g, Mp 156-158°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 2.41 (s, 3H, C*H*$_3$), 6.73 (t, ^3J(H-H) = 6.4 Hz, 1H, Ar-*H*), 7.18–7.44 (m, 8H, Ar-*H)*, 7.67–7.71 (m, 3H, Ar-*H)*, 7.95 (d, ^3J(H-H) = 6.4 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 21.5, 112.2, 117.5, 121.3, 123.4, 124.6, 127.4, 127.9, 128.0, 128.3, 129.5, 129.7, 129.8, 131.2, 134.3, 139.3, 142.2, 144.7. IR (ν_{max}, cm^{-1}): 2924, 1604, 1505, 1385, 1342, 754, 704. LC/MS, *m/z* 285 [M + 1]$^+$; Anal. Calcd. for $C_{20}H_{16}N_2$: C, 84.48; H, 5.67; N, 9.85%. Found: C, 84.38; H, 5.63; N, 9.79%. X-ray analysis was done for this sample.

3-(3-Nitrophenyl)-2-Phenylimidazo[1, 2-a]pyridine (**3d**). Yellow colored solid, Yield 90%, 0.28 g, Mp 158–160°C; ^{1}H NMR (500 MHz, $CDCl_3$): δ_H 6.68 (td, ^3J(H-H) = 7.0 Hz, 1.5 Hz, 1H, Ar-*H*), 7.28–7.33 (m, 4H, Ar-*H)*, 7.60–7.80 (m, 5H, Ar-*H)*, 8.02 (d, ^3J(H-H) = 6.5 Hz, 1H, Ar-*H*), 8.34–8.36 (m, 1H, Ar-*H)*, 8.42 (t, ^3J(H-H) = 2.0 Hz, 1H, Ar-*H*). ^{13}C NMR (125 MHz, $CDCl_3$): δ_C. 112.2, 117.1, 117.8, 121.8, 123.7, 124.6, 127.2, 127.5, 127.6, 130.1, 132.5, 135.8, 143.6, 144.8, 146.5. IR (ν_{max}, cm^{-1}): 2924, 1506, 1346, 754, 698. LC/MS, *m/z* 316 [M + 1]$^+$; Anal. Calcd. for $C_{19}H_{13}N_3O_2$: C, 72.37; H, 4.16; N, 13.33%. Found: C, 72.45; H, 4.08; N, 13.45%.

1-(4-(2-Phenyllimidazo[1, 2-a]pyridine-3-yl)phenyl)ethanone (**3e**). Colorless solid, Yield 85%, 0.26 g, Mp 122–124°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 2.67 (s, 3H, CH_3), 6.79 (t, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*), 7.22–7.30 (m, 4H, Ar-*H)*, 7.56-7.63 (m, 4H, Ar-*H)*, 7.71 (d, ^3J(H-H) = 1.6 Hz, 1H, Ar-*H*), 8.04 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*), 8.09 (d, ^3J(H-H) = 8.0 Hz, 2H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 26.7,

112.7, 117.9, 119.9, 123.1, 125.2, 127.9, 128.4, 129.5, 130.6, 133.8, 134.8, 137.0, 143.6, 145.3. IR (ν_{max}, cm^{-1}): 3053, 1684, 1605, 1267, 958, 698 LC/MS, *m/z* 313 $[M + 1]^+$; Calcd. for $C_{21}H_{16}N_2O$: C, 80.75; H, 5.16; N, 8.97%. Found: C, 80.65; H, 5.21; N, 8.86%.

2-Phenyl-3-(3,4,5-trimethoxyphenyl)imidazo[1, 2-a]pyridine (**3f**). Colorless solid, Yield 86%, 0.31 g, Mp 122–124°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 3.80 (s, 6H, $(OCH_3)_2$), 3.97 (s, 3H, OCH_3),6.66 (s, 2H, Ar-*H*), 6.75–6.78 (m, 1H, Ar-*H*), 7.19–7.34 (m, 4H, Ar-*H*), 7.67–7.75 (m, 3H, Ar-*H*), 7.98 (dd, ^3J(H-H) = 0.8 Hz, 6.8 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 56.3, 61.1, 107.7, 112.3, 117.6, 121.1, 123.5, 124.6, 125.2, 127.5, 127.9, 128.3, 134.1, 138.5, 142.1, 144.7, 154.2. IR (ν_{max}, cm^{-1}): 2930, 1579, 1238, 1120, 736, 698. LC/MS, *m/z* 361 $[M + 1]^+$; Anal. Calcd. for $C_{22}H_{20}N_2O_3$: C, 73.32; H, 5.59; N, 7.77%. Found: C, 73.45; H, 5.52; N, 7.85%.

2-Phenyl-3-o-tolylimidazo[1, 2-a]pyridine (**3g**). Colorless solid, Yield 51%, 0.14 g, Mp 124–126°C; ^{1}H NMR (500 MHz, $CDCl_3$): δ_H 2.48 (s, 3H, CH_3), 6.73 (td, ^3J(H-H) = 7.0 Hz, 1.0 Hz, 1H, Ar-*H*), 7.19–7.36 (m, 8H, Ar-*H*), 7.69–7.72 (m, 3H, Ar-*H*), 7.96 (d, ^3J(H-H) = 7.0 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 21.5, 112.2, 117.5, 121.3, 123.4, 124.7, 127.5, 127.9, 128.0, 128.3, 129.5, 129.7, 131.2, 134.1, 139.3, 142.1, 144.7. IR (ν_{max}, cm^{-1}): 3021, 1523, 1378, 1351, 752, 612. LC/MS, *m/z* 285 $[M + 1]^+$; Anal. Calcd. for $C_{20}H_{16}N_2$: C, 84.48; H, 5.67; N, 9.85%. Found: C, 84.58; H, 5.61; N, 9.75%.

3-(4-Nitrophenyl)-2-phenylimidazo[1, 2-a]pyridine (**3h**). Yellow colored solid, Yield 89%, 0.28 g, Mp 150–152°C; ^{1}H NMR (500 MHz, $CDCl_3$): δ_H 6.86–6.88 (m, 1H, Ar-*H*), 7.28–7.36 (m, 4H, Ar-*H*), 7.59–7.60 (m, 2H, Ar-*H*), 7.68 (d, ^3J(H-H) = 9.0 Hz, 2H, Ar-*H*), 7.75 (d, ^3J(H-H) = 9.0 Hz, 1H, Ar-*H*), 8.11 (d, ^3J(H-H) = 7.0 Hz, 1H, Ar-*H*), 8.38 (d, ^3J(H-H) = 8.5 Hz, 2H, Ar-*H*). ^{13}C NMR (125 MHz, $CDCl_3$): δ_C. 113.2, 118.1, 118.8, 122.8, 124.7, 125.6, 128.2, 128.5, 128.6, 131.1, 133.5, 136.7, 144.5, 145.7, 147.5. IR (ν_{max}, cm^{-1}): 3063, 1599, 1566, 1105, 854, 736. LC/MS, *m/z* 316 $[M + 1]^+$; Anal. Calcd. for $C_{19}H_{13}N_3O_2$: C, 72.37; H, 4.16; N, 13.33%. Found: C, 72.34; H, 4.23; N, 13.21%.

3-(3,5-Dimethylphenyl)-2-diphenylimidazo[1, 2-a]pyridine (**3i**). Colorless solid, Yield 84%, 0.25 g, Mp 158–160°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 2.39 (s, 6H, $CH_3)_2$), 6.74 (td, ^3J(H-H) = 6.4 Hz, 1.2 Hz, 1H, Ar-*H*), 7.08 (s, 2H, Ar-*H*), 7.14 (s, 1H, Ar-*H*), 7.18–7.33 (m, 4H, Ar-*H*), 7.67–7.74 (m, 3H, Ar-*H*), 7.94 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C. 21.4, 112.1, 117.4, 121.4, 123.5, 124.5, 127.4, 127.9, 128.2, 128.3, 129.7, 130.7, 134.3, 139.2, 142.0, 144.7. IR (ν_{max}, cm^{-1}): 2920, 1601, 1444, 1342, 752, 702. LC/MS, *m/z* 299 $[M + 1]^+$; Anal. Calcd. for $C_{21}H_{18}N_2$: C, 84.53; H, 6.08; N, 9.39%. Found: C, 84.45; H, 6.15; N, 9.45%.

3-(2-Nitrophenyl)-2-phenylimidazo[1, 2-a]pyridine (**3j**). Yellow colored solid, Yield 76%, 0.24 g, Mp 154–156°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 6.83–6.87 (m, 1H, Ar-H), 7.27–7.35 (m, 4H, Ar-H), 7.56–7.67 (m, 4H, Ar-H), 7.73(d, ^3J(H-H) = 8.8 Hz, 1H, Ar-H), 8.09 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-H), 8.38 (d, ^3J(H-H) = 8.5 Hz, 2H, Ar-H). ^{13}C NMR (100 MHz, $CDCl_3$): δC. 113.2, 118.1, 118.8, 122.8, 124.7, 125.6, 126.1, 128.2, 128.5, 128.6, 131.0, 133.4, 136.7, 139.4, 145.7, 147.5. IR (ν_{max}, cm^{-1}): 2924, 1528, 1352, 851, 750. LC/MS, m/z 316 $[M + 1]^+$; Anal. Calcd. for $C_{19}H_{13}N_3O_2$: C,72.37; H, 4.16; N, 13.33%. Found: C, 72.41; H, 4.26; N, 13.26%.

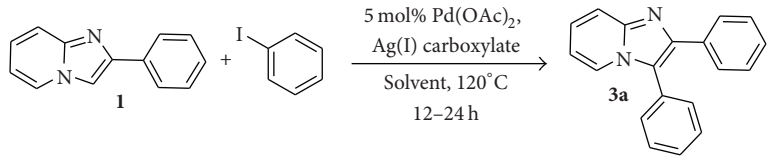
2-Phenyl-3-(thiophen-2-yl)imidazo[1, 2-a]pyridine (**3k**). Yellow colored solid, Yield 66%, 0.18 g, Mp 118–120°C; ^{1}H NMR (400 MHz, $CDCl_3$): δ_H 6.80 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*), 7.23–7.33 (m, 6H, Ar-*H*), 7.60 (d, ^3J(H-H) = 4.8 Hz, 1H, Ar-*H*), 7.68–7.76 (m, 2H, Ar-*H*), 7.83(d, ^3J(H-H) = 7.2 Hz, 1H, Ar-*H*), 8.00 (d, ^3J(H-H) = 6.8 Hz, 1H, Ar-*H*). ^{13}C NMR (100 MHz, $CDCl_3$): δ_C 112.6, 113.4, 117.4, 123.9, 124.3, 125.3, 127.8, 128.0, 128.3, 128.4, 129.9, 130.3, 133.7, 144.4, 145.3. IR (ν_{max}, cm^{-1}): 2957, 2854, 1462, 1377, 1261, 1097, 1020, 804. LC/MS, *m/z* 277 $[M + 1]^+$; Anal. Calcd. for $C_{17}H_{12}N_2S$: C, 73.88; H, 4.38; N, 10.14%. Found: C, 73.80; H, 4.42; N, 10.12.

3. Results and Discussion

Using $Pd(OAc)_2$ as catalyst and several different types of silver(I) acetates or carboxylates, we have begun phosphine-free reactions of 2-phenylimidazo[1,2-*a*]pyridines (**1**) with phenyl iodide to afford the direct C-3 arylated product 2,3-diphenyl imidazo[1,2-*a*]pyridine (**2a**) (Scheme 1). We have taken this reaction as a model to optimize the yield by changing different combinations of Ag(I) carboxylate (generated in situ from Ag_2O and different carboxylic acids) along with other bases and solvents (Table 1). Indeed, compound **1** is a very stable starting material that could be synthesized in a convenient way by the reaction of cheap commercially available 2-aminopyridine and 2-bromoacetophenone. Moreover, 2-phenylimidazo[1, 2-*a*]pyridine derivatives are well established as potent and selective ligands for peripheral benzodiazepine receptor [10].

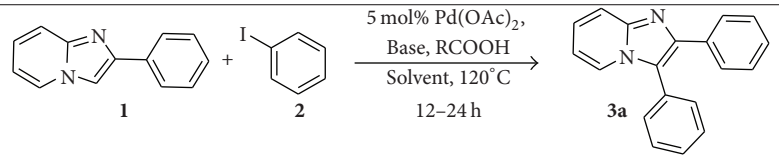
There was no progress of this reaction at room temperature. The highly coordinating dimethylformamide (DMF) was the best choice as a solvent for the different combination of Ag(I) salt. The more acidic *o*-nitro benzoic acid was more effective combination than other acids with Ag_2O for the above reaction to afford compound **2a** with high yield in DMF at 120°C under nitrogen. To find out the extent of this reaction, we have used several aryl iodides substituted with both electron withdrawing and donating groups for this reaction. The products and yields are pointed out in Table 2.

It is experiential that the percentages of yields do not vary considerably (entries 2, 4, 5, and 6) with the type of substiutents present (or absent; entry 1) in the phenyl ring of aryl iodides. Both, electron-withdrawing (entries 4, 5, 8, and 10) and electron-donating substitutents (entries 2, 3, 6, 7, and 9) show the same result. As expected, the more hindered *ortho*-substituted aryl iodides react considerably more slowly than the *meta*- and *para*-counterparts to afford slightly lower yields (entries 7 and 10). Further, we also have checked the reactivity of 2-iodothiophene as a heteroaryl iodide under the same reaction condition which affords the compound **3k** with 66% yield. All the compounds (**3a–k**) were characterized by IR, NMR, mass spectroscopy, and elemental analysis. In the ^{1}H-NMR spectra all aromatic protons resonate in the



Scheme 1: $Pd(OAc)_2$ catalyzed reaction of 2-phenylimidazo[1,2-*a*]pyridine with aryl iodides in the presence of Ag(I) carboxylate salts.

Table 1: Optimization of the coupling between 2-phenylimidazo[1,2-*a*]pyridine**(1)** and phenyl iodide[a].



Entry	Base	Acid	Solvent	Isolated yield (%)
1	K_2CO_3	None	DMF	Trace
2	K_2CO_3	CH_3CO_2H	DMF	Trace
3	K_2CO_3	*o*-O_2N–C_6H_4–CO_2H	DMF	Trace
4	Ag_2O	None	DMF	Trace
5	Ag_2O	CH_3CO_2H	DMF	31
6	Ag_2O	*o*-O_2N–C_6H_4–CO_2H	DMF	82
7	Ag_2O	*o*-O_2N–C_6H_4–CO_2H	Dioxane	80
8	Ag_2O	*o*-O_2N–C_6H_4–CO_2H	Dioxane-EtOH	78
9	Ag_2O	CF_3CO_2H	Dioxane	38

[a] All reactions were carried out using 5 mol% $Pd(OAc)_2$, 1.5 equiv (entries 1–3), or 0.75 equiv (entries 4–8) of base, 1.5 equiv of acid, 1.0 equiv of **1**, and 2.0 equiv of phenyl iodide in a 0.5 M solution, for 12 h at 120°C.

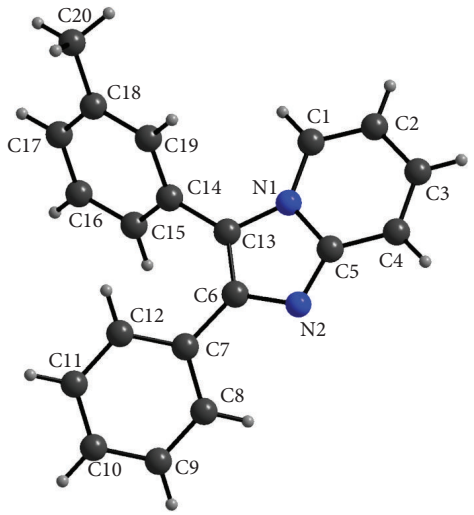


Figure 2: Molecular structure of the compound **3c** (entry 3). (X-ray data was collected on a Bruker AXS-SMART diffractometer using Mo-K_α (λ = 0.71073 Å) radiation. The structure was solved and refined by standard methods. *Crystal data for* **3c**: $C_{20}H_{16}N_2$, M = 284.35, Monoclinic, Space group $P2(1)/n$, a = 7.4312(15), b = 11.708(2), c = 17.611(4) Å, α = 90.00°, β = 95.36(3)°, γ = 90.00°, V = 1525.6(5) Å^3, Z = 4, μ = 0.073 mm^{-1}, data/restraints/parameters: 2677/0/200, R indices ($I > 2(I)$): R1 = 0.0513, *wR*2 (all data) = 0.1208. CCDC no. 885064).

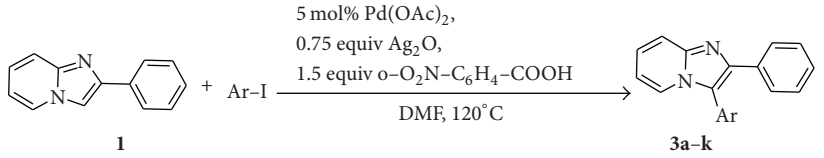
region 6.66–8.42 Hz. Finally the structure for one of these compounds **3c** is proven by X-ray crystallography (Figure 2). (X-ray data was collected on a Bruker AXS-SMART diffractometer using Mo-K_α (λ = 0.71073 Å) radiation. The structure was solved and refined by standard methods. *Crystal data for* **3c**: $C_{20}H_{16}N_2$, M = 284.35, Monoclinic, Space group $P2(1)/n$, a = 7.4312(15), b = 11.708(2), c = 17.611(4) Å, α = 90.00°, β = 95.36(3)°, γ = 90.00°, V = 1525.6(5) Å^3, Z = 4, μ = 0.073 mm^{-1}, data/restraints/parameters: 2677/0/200, R indices ($I > 2(I)$): R1 = 0.0513, *wR*2 (all data) = 0.1208. CCDC no. 885064).

Selected bond lengths (Å) and angles (°): N2-C5 1.323(2); N2-C6 1.369(2); N1 C5 1.395(2); C13 N1 C5 106.90(14); N2 C5 N1 110.93(15).

4. Conclusions

In conclusion, we have applied the catalytic $Pd(OAc)_2$ and Ag(I) carboxylate combination to develop a successful methodology for this challenging direct C-3 arylation of 2-phenylimidazo[1, 2-*a*]pyridine with differently substituted aryl iodides without the presence of phosphines or other ligands to give 3-aryl-2-phenyl imidazo[1, 2-*a*]pyridines with moderate to-high-yield. The structure of one of these compounds has been characterized by X-ray crystallography.

Table 2: Direct arylation of 2-phenylimidazo[1,2-*a*]pyridine**(1)** with differently substituted aryl iodides.



1 **3a–k**

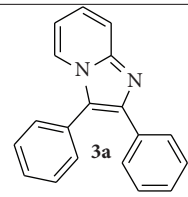
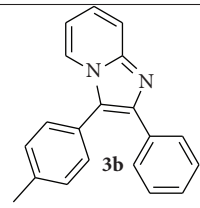
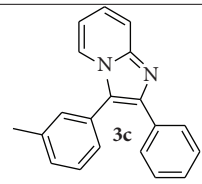
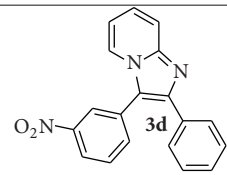
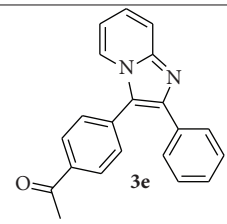
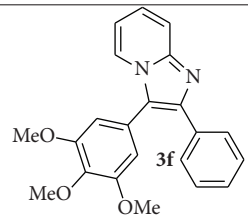
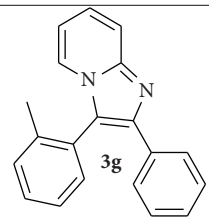
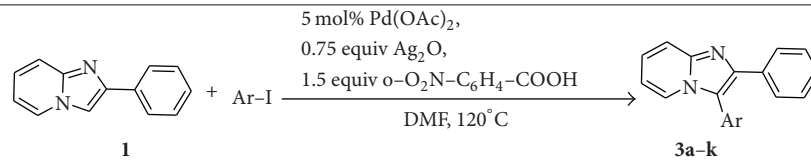
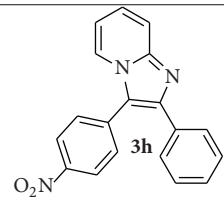
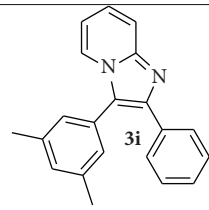
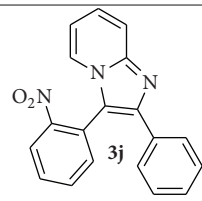
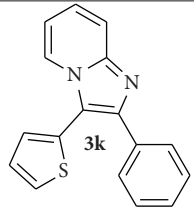
Entry	Products	Yield (isolated, %)
1[a]	 **3a**	82
2[a]	 **3b**	81
3[a]	 **3c**	78
4[a]	 **3d**	90
5[a]	 **3e**	85
6[a]	 **3f**	86
7[b]	 **3g**	51

Table 2: Continued.



1 **3a–k**

8[a]	 **3h**	89
9[a]	 **3i**	84
10[b]	 **3j**	76
11[b]	 **3k**	66

[a] The reaction was carried out for 12 h. [b] The reaction was carried out for 24 h.

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