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Palladium-Catalyzed Reaction of Allyl Halides with α-Diazocarbonyl Compounds

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Contents

1) General ........................................................................................................................................ S2
2) Spectral data for 2a-n ................................................................................................................... S2
3) Spectral data for 4a-k ................................................................................................................... S5
4) References .................................................................................................................................... S8
5) ¹H and ¹³C Spectra ..................................................................................................................... S9

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\begin{align*}
\text{R}^2 & \text{R}^1 \text{X} + \text{Ar} \text{N}_2 \text{Ar} \text{R}^3 & \xrightarrow{\text{Pd(OAc)}_2 \text{ (5\% mol)}} & \text{R}^2 \text{R}^1 \text{O} \text{R}^3 \\
\text{X} = \text{Cl, Br} & \text{Et}_3\text{N, CH}_3\text{CN} & \text{25 °C} & \text{50-77\%} 
\end{align*}
\]
**General** All solvents were distilled prior to use. PhCH$_3$ and THF were distilled over sodium. CH$_3$CN was distilled over calcium hydride. All reactions were carried out under a nitrogen atmosphere and anhydrous conditions unless otherwise noted. Reagents purchased from commercial sources were used without further purification unless otherwise stated. Allylic bromide was distilled prior to use. The substituted allylic chlorides were prepared according to the literature methods. For chromatography, 200-300 mesh silica gel (Qingdao, China) was employed. $^1$H and $^{13}$C NMR spectra were recorded at 300 MHz (or 200 MHz) and 75 MHz (or 50 MHz) with Varian Mercury 300 spectrometer. Chemical shifts are reported in ppm using tetramethylsilane (TMS) as internal standard. IR spectra were recorded with a Nicolet 5MX-S infrared spectrometer.

**(E)-Methyl 2-phenylpenta-2,4-dienoate (2a)**

Yield 77%; $^1$H NMR (300 MHz, CDCl$_3$) δ 3.77 (s, 3H), 5.42 (ddd, $J = 0.6, 1.5, 10.8$ Hz, 1H), 5.66 (ddd, $J = 0.6, 1.5, 16.8$ Hz, 1H), 6.39 (ddd, $J = 10.2, 11.4, 16.8$ Hz, 1H), 7.21–7.26 (m, 2H), 7.32–7.42 (m, 3H), 7.46 (d, $J = 11.4$ Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 52.2, 125.7, 127.7, 127.9, 128.2, 130.1, 133.1, 134.8, 140.7, 167.8.

**(E)-Methyl 2-p-tolylpenta-2,4-dienoate (2b)**

Yield 77%; IR (neat) 1718, 1514, 1435, 1245 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 2.37 (s, 3H), 3.76 (s, 3H), 5.40 (ddd, $J = 0.6, 1.5, 9.9$ Hz, 1H), 5.65 (ddd, $J = 0.6, 1.5, 16.8$ Hz, 1H), 6.41 (ddd, $J = 10.2, 11.4, 16.8$ Hz, 1H), 7.11–7.28 (M, 5H), 7.45 (d, $J = 11.4$ Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 21.2, 52.1, 125.4, 128.7, 130.0, 131.9, 133.2, 133.3, 137.5, 140.4, 168.0; EI-MS (m/z, relative intensity): 202 (M$^+$, 30), 143 (100). HRMS calcd for C$_{13}$H$_{14}$O$_2$: 202.0994. Found: 202.0992.

**(E)-Methyl 2-(4-methoxyphenyl)penta-2,4-dienoate (2c)**

Yield 53%; IR (neat) 1736, 1613, 1513, 1247 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 3.78 (s, 3H), 3.84 (s, 3H), 5.41 (ddd, $J = 0.6, 1.8, 10.2$ Hz, 1H), 5.66 (ddd, $J = 0.6, 1.8, 16.5$ Hz, 1H), 6.43 (ddd, $J = 10.2, 11.4, 16.5$ Hz, 1H), 6.90–6.95 (m, 2H), 7.14–7.19 (m, 2H), 7.43 (d, $J = 11.4$ Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 52.2, 55.2, 113.4, 125.3, 127.0, 131.3, 132.7, 133.3, 140.3, 159.1, 168.1; EI-MS (m/z, relative intensity): 218 (M$^+$, 20), 159 (48), 121(100). HRMS calcd for C$_{13}$H$_{14}$O$_3$: 218.0943. Found: 218.0943.
(E)-Methyl 2-(3-methoxyphenyl)penta-2,4-dienoate (2d)

Yield 71%; IR (neat) 1713, 1601, 1585, 1246 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 3.77 (s, 3H), 3.82 (s, 3H), 5.42 (ddd, J = 1.2, 1.8, 10.2 Hz, 1H), 5.66 (ddd, J = 0.9, 1.8, 16.8 Hz, 1H), 6.40 (ddd, J = 10.2, 11.4, 16.8 Hz, 1H), 6.76~6.82 (m, 2H), 6.88~6.91 (m, 1H), 7.27~7.33 (m, 1H), 7.45 (d, J = 11.4 Hz, 1H); ¹³C NMR (75 MHz, CDCl₃) δ 52.2, 55.2, 113.2, 115.7, 122.5, 125.8, 129.0, 133.0, 133.1, 136.1, 140.8, 159.1, 167.7; EI-MS (m/z, relative intensity): 218 (M⁺, 50), 159(100). HRMS calcd for C₁₃H₁₄O₃: 218.0943. Found: 218.0944.

(E)-Methyl 2-(2-chlorophenyl)penta-2,4-dienoate (2e)

Yield 61%; IR (neat) 1715, 1629, 1434, 1242 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 3.76 (s, 3H), 4.46 (dd, J = 1.5, 9.9 Hz, 1H), 5.70 (dd, J = 1.5, 16.8 Hz, 1H), 6.17 (ddd, J = 10.2, 11.4, 17.1 Hz, 1H), 7.17~7.46 (m, 4H), 7.51 (d, J = 11.4 Hz, 1H); ¹³C NMR (75 MHz, CDCl₃) δ 52.3, 126.5, 126.6, 129.3, 129.4, 131.0, 131.7, 132.5, 134.0, 141.8, 167.0; EI-MS (m/z, relative intensity): 222 (M⁺, 17), 187 (59), 128 (100). HRMS calcd for C₁₂H₁₁O₂Cl: 222.0448. Found: 222.0444.

(E)-Methyl 2-(4-chlorophenyl)penta-2,4-dienoate (2f)

Yield 73%; IR (neat) 1713, 1624, 1493, 1242 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 3.78 (s, 3H), 5.46 (dd, J = 1.2, 10.2 Hz, 1H), 5.69 (dd, J = 0.9, 16.8 Hz, 1H), 6.36 (ddd, J = 10.2, 11.4, 16.8 Hz, 1H), 7.15~7.19 (m, 1H), 7.35~7.38 (m, 2H), 7.47 (d, J = 11.4 Hz, 1H); ¹³C NMR (75 MHz, CDCl₃) δ 52.3, 126.4, 128.2, 131.5, 131.6, 131.9, 132.7, 133.1, 141.2, 167.4; EI-MS (m/z, relative intensity): 222 (M⁺, 28), 128 (100). HRMS calcd for C₁₂H₁₁O₂Cl: 222.0448. Found: 222.0449.

(E)-Methyl 2-(3,4-dichlorophenyl)penta-2,4-dienoate (2g)

Yield 50%; IR (neat) 1714, 1580, 1475, 1244 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 3.79 (s, 3H), 5.52 (d, J = 10.5 Hz, 1H), 5.73 (d, J = 16.8 Hz, 1H), 6.34 (ddd, J = 10.5, 11.4, 16.8 Hz, 1H), 7.07 (dd, J = 1.8, 8.4 Hz, 1H), 7.27~7.34 (m, 1H), 7.45~7.51 (m, 2H); ¹³C NMR (75 MHz, CDCl₃) δ 52.4, 127.3, 128.0, 129.6, 130.0, 130.7, 132.0, 132.2, 132.4, 134.7, 141.8, 167.0; EI-MS (m/z, relative intensity): 256 (M⁺, 23), 162 (100). HRMS calcd for C₁₂H₁₀O₂Cl₂: 256.0058. Found: 256.0065.
(E)-3-phenylhexa-3,5-dien-2-one (2h)

Yield 55%; IR (neat) 1665, 1615, 1226 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 2.33 (s, 3H), 5.45 (d, J = 9.9 Hz, 1H), 5.70 (d, J = 16.8 Hz, 1H), 6.34 (td, J = 10.5, 16.8 Hz, 1H), 7.14~7.43 (m, 6H); ¹³C NMR (75 MHz, CDCl₃) δ 27.6, 126.1, 127.7, 128.2, 129.9, 133.5, 135.5, 139.4, 141.8, 198.8; EI-MS (m/z, relative intensity): 172 (M⁺, 36), 129 (100). HRMS calcd for C₁₂H₁₂O: 172.0888. Found: 172.0884.

(E)-3-(4-chlorophenyl)hexa-3,5-dien-2-one (2i)

Yield 68%; IR (neat) 1668, 1619, 1491, 1250, 1090 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 2.37 (s, 3H), 5.49 (d, J = 10.2 Hz, 1H), 5.73 (d, J = 16.8 Hz, 1H), 6.33 (td, J = 10.2, 16.8 Hz, 1H), 6.33 (td, J = 8.4 Hz, 2H), 7.09 (d, J = 8.4 Hz, 2H), 7.26~7.29 (m, 1H), 7.15 (s, 1H), 7.38 (d, J = 8.4 Hz, 2H); ¹³C NMR (75 MHz, CDCl₃) δ 27.2, 126.8, 128.4, 131.3, 133.2, 133.7, 133.8, 140.3, 140.7, 198.3; EI-MS (m/z, relative intensity): 206 (M⁺, 45), 128 (75), 43 (100). HRMS calcd for C₁₂H₁₁OCl: 206.0498. Found: 206.0496.

(E)-3-(3-chlorophenyl)hexa-3,5-dien-2-one (2j)

Yield 70%; IR (neat) 1668, 1621, 1423, 1250 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 2.36 (s, 3H), 5.51 (d, J = 10.2 Hz, 1H), 5.74 (d, J = 16.8 Hz, 1H), 6.32 (td, J = 10.8, 16.8 Hz, 1H), 7.02~7.05 (m, 1H), 7.15 (s, 1H), 7.15 (s, 1H), 7.26~7.35 (m, 4H); ¹³C NMR (75 MHz, CDCl₃) δ 27.2, 127.0, 127.9, 128.2, 129.5, 129.9, 133.2, 134.1, 137.2, 140.4, 140.5, 198.1; EI-MS (m/z, relative intensity): 206 (M⁺, 22), 128 (49), 43 (100). HRMS calcd for C₁₂H₁₁OCl: 206.0498. Found: 206.0494.

(E)-3-(4-bromophenyl)hexa-3,5-dien-2-one (2k)

Yield 63%; IR (neat) 1667, 1615, 1487, 1250 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 2.36 (s, 3H), 5.49 (d, J = 9.9 Hz, 1H), 5.73 (d, J = 16.8 Hz, 1H), 6.33 (td, J = 10.8, 16.8 Hz, 1H), 7.01 (d, J = 8.4 Hz, 2H), 7.27 (d, J = 11.4 Hz, 1H), 7.53 (d, J = 8.4 Hz, 2H); ¹³C NMR (75 MHz, CDCl₃) δ 27.1, 122.0, 126.8, 131.3, 131.6, 133.2, 134.1, 140.3, 140.7, 198.2; EI-MS (m/z, relative intensity): 252 (M⁺, 19), 128 (75), 43 (100). HRMS calcd for C₁₂H₁₁OBr: 249.9993. Found: 249.9981.

(E)-3-(3,4-dichlorophenyl)hexa-3,5-dien-2-one (2l)

Yield 60%; IR (neat) 1666, 1615, 1473, 1250 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 2.40 (s, 3H), 5.54 (d, J = 10.2 Hz, 1H), 5.77 (d, J = 16.8 Hz, 1H), 6.33 (td, J = 10.8, 16.8 Hz, 1H), 7.00 (d, J = 8.1 Hz, 1H), 7.26~7.31
(m, 2H), 7.48 (d, J = 8.1 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 26.9, 127.5, 129.5, 130.2, 131.8, 132.1, 132.3, 132.9, 135.1, 141.0, 197.8; EI-MS (m/z, relative intensity): 240 (M$^+$, 81), 162 (100). HRMS calcd for C$_{12}$H$_{10}$OCl$_2$: 240.0109. Found: 240.0099.

(E)-2-(Allyloxy)phenyl 2-phenylpenta-2,4-dienoate (2m)

Yield 77%; IR (neat) 1730, 1604, 1498, 1183, 1157 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 4.55 (dt, J = 1.5, 5.1 Hz, 2H), 5.25 (dt, J = 1.5, 10.8 Hz, 1H), 5.40 (ddd, J = 1.8, 3.3, 17.4 Hz, 1H), 5.49 (d, J = 9.9 Hz, 1H), 5.73 (d, J = 16.8 Hz, 1H), 6.01 (m, 1H), 6.51 (m, 1H), 6.96 (d, J = 7.5 Hz, 2H), 7.05~7.19 (m, 2H), 7.30~7.38 (m, 5H), 7.67 (d, J = 11.4 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 69.3, 113.8, 117.3, 121.0, 122.9, 126.4, 126.6, 127.8, 127.9, 130.3, 132.5, 132.9, 133.1, 134.6, 140.4, 141.9, 150.0, 165.5; EI-MS (m/z, relative intensity): 306 (M$^+$, 12), 157 (89), 129 (100). HRMS calcd for C$_{20}$H$_{18}$O$_3$: 306.1256. Found: 306.1265.

(E)-Benzhydryl 2-phenylpenta-2,4-dienoate (2n)

Yield 69%; IR (neat) 1711, 1495, 1232, 1175 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 5.41 (dd, J = 0.6, 10.5 Hz, 1H), 5.66 (d, J = 17.1 Hz, 1H), 6.41 (ddd, J = 10.2, 11.1, 17.1 Hz, 1H), 6.97 (s, 1H), 7.23~7.44 (m, 5H), 7.75 (d, J = 11.1 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 77.3, 125.9, 126.9, 127.1, 127.4, 127.7, 127.9, 128.2, 128.4, 128.6, 129.3, 130.1, 133.1, 134.7, 140.3, 140.9, 166.1; EI-MS (m/z, relative intensity): 340 (M$^+$, 17), 167 (100). HRMS calcd for C$_{24}$H$_{20}$O$_2$: 340.1463. Found: 340.1464.

(2E,4E)-Methyl 2-phenylhexa-2,4-dienoate (4a)$^3$

Yield 63%; IR (neat) 1710, 1637, 1434, 1233 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 1.78 (d, J = 6.6 Hz, 3H), 3.75 (s, 3H), 6.06~6.26 (m, 2H), 7.22~7.26 (m, 2H), 7.32~7.42 (m, 3H), 7.46 (d, J = 10.8 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 18.9, 52.1, 127.4, 127.9, 128.1, 130.1, 135.0, 135.2, 139.9, 141.1, 168.1; EI-MS (m/z, relative intensity): 202 (M$^+$, 23), 143 (100). HRMS calcd for C$_{13}$H$_{14}$O$_2$: 202.0994. Found: 202.0995.

(E)-Methyl 5-methyl-2-phenylhexa-2,4-dienoate (4b)$^4$

Yield 72%; $^1$H NMR (300 MHz, CDCl$_3$) δ 1.79 (s, 3H), 1.95 (s, 3H), 3.76 (s, 3H), 5.87 (d, J = 12.0 Hz, 1H), 7.20~7.23 (m, 2H), 7.29~7.42 (m, 3H),
7.77 (d, J = 12.0 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 19.1, 26.9, 52.0, 121.9, 127.3, 127.9, 129.4, 130.2, 135.5, 136.9, 146.8, 168.5.

**(E)-Methyl 4-cyclohexylidene-2-phenylbut-2-enoate (4c)**

Yield 71 %; IR (neat) 2931, 1710, 1627, 1434, 1242 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 1.59∼1.60 (br, m, 6H), 2.11∼2.13 (br, m, 2H), 2.45∼2.47 (br, m, 2H), 3.75 (s, 3H), 5.83 (d, J = 12.0 Hz, 1H), 7.21~7.27 (m, 2H), 7.33~7.40 (m, 3H), 7.84 (d, J = 12.0 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 26.5, 27.9, 28.5, 29.9, 38.0, 52.0, 118.7, 127.3, 127.9, 129.6, 130.3, 135.5, 136.1, 154.9, 168.5; EI-MS (m/z, relative intensity): 256 (M$^+$, 100), 197 (98). HRMS calcd for C$_{17}$H$_{20}$O$_2$: 256.1463. Found: 256.1459.

**(2E,4E)-Methyl 2,5-diphenylpenta-2,4-dienoate (4d)**

Yield 66%; IR (neat) 1707, 1616, 1434, 1232 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 3.79 (s, 3H), 6.81 (dd, J = 11.4, 15.6 Hz, 1H), 7.48 (d, J = 15.6 Hz, 1H), 7.25~7.44 (m, 10H), 7.66 (d, J = 11.1 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 52.2, 124.7, 127.2, 127.7, 128.0, 128.7, 128.9, 130.3, 132.2, 135.1, 136.2, 140.6, 140.7, 167.9; EI-MS (m/z, relative intensity): 264 (M$^+$, 57), 205 (100). HRMS calcd for C$_{18}$H$_{16}$O$_2$: 264.1150. Found: 264.1142.

**(2E,4E)-Methyl 2-phenyl-5-p-tolylpenta-2,4-dienoate (4e)**

Yield 57%; IR (neat) 1708, 1603, 1434, 1233 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 2.32 (s, 3H), 3.79 (s, 3H), 6.76 (dd, J = 11.4, 15.6 Hz, 1H), 6.95 (d, J = 15.6 Hz, 1H), 7.10 (d, J = 7.8 Hz, 2H), 7.23~7.31 (m, 4H), 7.36~7.45 (m, 3H), 7.63 (d, J = 11.1 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 21.3, 52.1, 123.8, 127.2, 127.7, 128.0, 129.4, 130.4, 131.7, 133.5, 135.2, 140.7, 141.0, 168.0. EI-MS (m/z, relative intensity): 278 (M$^+$, 60), 219 (100). HRMS calcd for C$_{19}$H$_{18}$O$_2$: 278.1307. Found: 278.1305.

**(2E,4E)-Methyl 5-(4-chlorophenyl)-2-phenylpenta-2,4-dienoate (4f)**

Yield 65%; IR (neat) 1708, 1616, 1490, 1233 cm$^{-1}$; $^1$H NMR (300 MHz, CDCl$_3$) δ 3.79 (s, 3H), 6.76 (dd, J = 11.1, 15.6 Hz, 1H), 6.91 (d, J = 15.6 Hz, 1H), 7.26~7.30 (m, 6H), 7.39~7.47 (m, 3H), 7.63 (d, J = 11.1 Hz, 1H); $^{13}$C NMR (75 MHz, CDCl$_3$) δ 52.2, 125.2, 127.8, 128.1, 128.3, 128.9, 130.3, 132.8, 134.5, 134.7, 135.0, 139.0, 140.3, 167.8; EI-MS (m/z, relative intensity): 298 (M$^+$, 64), 204 (100). HRMS calcd for C$_{18}$H$_{15}$O$_2$Cl: 298.0761. Found: 298.0760.
(E)-Methyl 2,5,5-triphenylpenta-2,4-dienoate (4g)

Yield 65%; IR (neat) 1707, 1604, 1434, 1262, 1234 cm\(^{-1}\); \(^1H\) NMR (300 MHz, CDCl\(_3\)) \(\delta\) 3.69 (s, 3H), 6.70 (d, \(J = 11.7\) Hz, 1H), 7.17–7.43 (m, 15H), 7.57 (d, \(J = 11.7\) Hz, 1H); \(^{13}C\) NMR (75 MHz, CDCl\(_3\)) \(\delta\) 52.1, 123.7, 127.7, 128.0, 128.2, 128.3, 128.4, 130.3, 130.5, 133.1, 135.2, 138.1, 138.8, 141.6, 150.8, 168.0; EI-MS (\(m/z\), relative intensity): 340 (M\(^+\), 93), 281 (100). HRMS calcd for C\(_{24}\)H\(_{20}\)O\(_2\): 340.1463. Found: 340.1469.

(2E,4E)-2-(allyloxy)phenyl 2,5-diphenylpenta-2,4-dienoate (4h)

Yield 70%; IR (neat) 1724, 1614, 1497, 1183 cm\(^{-1}\); \(^1H\) NMR (300 MHz, CDCl\(_3\)) \(\delta\) 4.56 (d, \(J = 4.8\) Hz, 2H), 5.26 (dd, \(J = 1.2, 10.5\) Hz, 1H), 5.41 (dd, \(J = 5.4, 10.5, 12.0\) Hz, 1H), 6.02 (ddd, \(J = 5.4, 10.5, 12.0\) Hz, 1H), 6.88–7.45 (m, 16H), 7.86 (d, \(J = 10.8\) Hz, 1H); \(^{13}C\) NMR (75 MHz, CDCl\(_3\)) \(\delta\) 69.3, 113.8, 117.2, 121.0, 123.0, 124.7, 126.5, 127.3, 127.8, 128.0, 128.7, 129.0, 130.5, 131.5, 132.9, 134.9, 136.2, 140.6, 141.3, 142.0, 150.1, 165.6; EI-MS (\(m/z\), relative intensity): 382 (M\(^+\), 6), 233 (100). HRMS calcd for C\(_{26}\)H\(_{22}\)O\(_3\): 382.1569. Found: 382.1558.

(2E,4E)-benzhydryl 2,5-diphenylpenta-2,4-dienoate (4i)

Yield 60%; IR (neat) 1706, 1223 cm\(^{-1}\); \(^1H\) NMR (300 MHz, CDCl\(_3\)) \(\delta\) 6.84 (dd, \(J = 11.4, 15.6\) Hz, 1H), 6.97–7.02 (m, 2H), 7.24–7.44 (m, 20H), 7.73 (d, \(J = 11.1\) Hz, 1H); \(^{13}C\) NMR (75 MHz, CDCl\(_3\)) \(\delta\) 77.3, 124.7, 126.9, 127.2, 127.7, 128.0, 128.4, 128.7, 128.9, 130.4, 132.4, 135.0, 136.2, 140.4, 140.8, 140.9, 166.2; EI-MS (\(m/z\), relative intensity): 416 (M\(^+\), 3), 167 (100). HRMS calcd for C\(_{30}\)H\(_{24}\)O\(_2\): 416.1776. Found: 416.1762.

(2E,4E)-cinnamyl 2,5-diphenylpenta-2,4-dienoate (4j)

Yield 58%; IR (neat) 1703, 1223 cm\(^{-1}\); \(^1H\) NMR (300 MHz, CDCl\(_3\)) \(\delta\) 4.87 (d, \(J = 6.0\) Hz, 2H), 6.34 (td, \(J = 6.0, 15.9\) Hz, 1H), 6.64 (d, \(J = 15.9\) Hz, 1H), 6.83 (dd, \(J = 11.4, 15.6\) Hz, 1H), 6.99 (d, \(J = 15.6\) Hz, 1H), 7.26–7.47 (m, 15H), 7.69 (d, \(J = 11.1\) Hz, 1H); \(^{13}C\) NMR (75 MHz, CDCl\(_3\)) \(\delta\) 65.5, 123.3, 124.7, 126.6, 127.2, 127.8, 128.0, 128.1, 128.6, 128.7, 128.9, 130.4, 132.3, 133.8, 135.0, 136.2, 140.7, 140.8, 167.1; EI-MS (\(m/z\), relative intensity): 366 (M\(^+\), 3), 117 (100). HRMS calcd for C\(_{26}\)H\(_{22}\)O\(_2\): 366.1620. Found: 366.1628.
(2E,4E)-allyl 2,5-diphenylpenta-2,4-dienoate (4k)

Yield 51%; IR (neat) 1707, 1224 cm⁻¹; ¹H NMR (300 MHz, CDCl₃)
δ 4.71 (d, J = 5.4 Hz, 2H), 5.23 (dd, J = 0.9, 10.5 Hz, 1H), 5.30 (dd, J = 1.2, 17.1 Hz, 1H), 5.97 (ddd, J = 5.4, 10.8, 15.9 Hz, 1H), 6.83 (dd, J = 11.4, 15.6 Hz, 1H), 6.99 (d, J = 15.6 Hz, 1H), 7.26–7.46 (m, 10H), 7.68 (d, J = 11.1 Hz, 1H); ¹³C NMR (75 MHz, CDCl₃) δ 65.5, 117.9, 124.7, 127.2, 127.7, 128.0, 128.7, 128.9, 130.4, 132.2, 135.0, 136.2, 140.7, 140.8, 167.0;
EI-MS (m/z, relative intensity): 290 (M⁺, 55), 205 (100). HRMS calcd for C₂₀H₁₈O₂: 290.1307. Found: 290.1318.

References
