**Supporting Information**

**Title:** Palladium Catalyzed Coupling of Allenylphosphonates, Phenylallenes and 1,2-Dialkadienoate Esters: Remarkable Salt Effect and Routes to Novel Benzofurans and Isocoumarins

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**General experimental details and crystal data**

Chemicals were purified when required according to standard procedures. All reactions, unless stated otherwise, were performed in a dry nitrogen atmosphere. $^{1}H$, $^{13}C\{^{1}H\}$ and $^{31}P\{^{1}H\}$ NMR spectra were recorded using a 200 or a 400 MHz spectrometer in CDCl$_3$ (unless stated otherwise) with shifts referenced to SiMe$_4$ ($\delta = 0$) or 85 % H$_3$PO$_4$ ($\delta = 0$). Infrared spectra were recorded neat or by using KBr pellets on an FT/IR spectrometer. Melting points were determined by using a local hot-stage melting point apparatus and are uncorrected. Microanalyses were performed using a CHNS analyzer. For TLC, glass microslides were coated with silica-gel-GF$_{254}$ (mesh size 75µ) and spots were identified using iodine or UV chamber as appropriate. For column chromatography, silica gel of 100-200 mesh size was used. LC-MS or GC-MS equipment were used to record mass spectra for isolated compounds where appropriate. LC-MS data were obtained using electrospray ionization (positive mode) on a C-18 column at a flow rate 0.2 mL/min using MeOH/water (90:10) as eluent. GC-MS data were obtained on EI mode using ZB-1 column. Retention time ($R_t$) values for GC-MS (helium flow rate 4 mL/min) and LC-MS are quoted in min.

**Crystal data:**

**8:** C$_{15}$H$_{19}$O$_3$P, $M = 278.27$, Monoclinic, Space group $C2/c$, $a = 26.850(3)$, $b = 6.2772(8)$, $c = 20.267(3)$ Å, $V = 2991.1(6)$ Å$^3$, $Z = 8$, $\mu = 0.185$ mm$^{-1}$, data/restraints/parameters: 2641 /0/ 174, R indices ($I > 2\sigma(I)$): R1 = 0.0504, wR2 (all data) = 0.1436.

**12:** C$_{16}$H$_{21}$O$_3$P, $M = 292.30$, Monoclinic, Space group $P2_1/c$, $a = 12.9844(15)$, $b = 6.2020(7)$, $c = 20.193(2)$ Å, $V = 1553.9(3)$ Å$^3$, $Z = 4$, $\mu = 0.181$ mm$^{-1}$,
data/restraints/parameters: 2734/0/184, R indices \((I > 2\sigma(I))\): \(R1 = 0.0946, wR2 \) (all data) = 0.1880

16: \(C_{21}H_{23}O_3P\), \(M = 354.36\), Monoclinic, Space group \(P2(1)/c\), \(a = 15.8910(17)\), \(b = 10.2219(11)\), \(c = 12.2745(13) \text{ Å}\), \(V = 1988.2(4) \text{ Å}^3\), \(Z = 4\), \(\mu = 0.154 \text{ mm}^{-1}\),
data/restraints/parameters: 3496/0/228, R indices \((I > 2\sigma(I))\): \(R1 = 0.0554, wR2 \) (all data) = 0.1198.

17: \(C_{22}H_{23}N_2O_7P\), \(M = 458.39\), Orthorhombic, Space group \(Pbc\), \(a = 11.123(3)\), \(b = 14.730(4)\), \(c = 27.784(7) \text{ Å}\), \(V = 4552.2(19) \text{ Å}^3\), \(Z = 8\), \(\mu = 0.166 \text{ mm}^{-1}\),
data/restraints/parameters: 4012/0/292, R indices \((I > 2\sigma(I))\): \(R1 = 0.086, wR2 \) (all data) = 0.1879.

21: \(C_{14}H_{19}O_3P\), \(M = 266.26\), Monoclinic, Space group \(P2_1/n\), \(a = 7.5521(5)\), \(b = 17.6566(10)\), \(c = 10.9664(7) \text{ Å}\), \(V = 1414.15(15) \text{ Å}^3\), \(Z = 4\), \(\mu = 0.192 \text{ mm}^{-1}\),
data/restraints/parameters: 2475/0/166, R indices \((I > 2\sigma(I))\): \(R1 = 0.0478, wR2 \) (all data) = 0.1188.

23: \(C_{14}H_{17}O_4P\), \(M = 280.25\), Monoclinic, Space group \(P2_1/c\), \(a = 14.5201(18)\), \(b = 9.4279(12)\), \(c = 11.1618(14) \text{ Å}\), \(V = 1425.5(3) \text{ Å}^3\), \(Z = 4\), \(\mu = 0.200 \text{ mm}^{-1}\),
data/restraints/parameters: 2514/0/174, R indices \((I > 2\sigma(I))\): \(R1 = 0.0560, wR2 \) (all data) = 0.1367.

24: \(C_{15}H_{19}O_4P\), \(M = 294.27\), Orthorhombic, Space group \(Pna2_1\), \(a = 11.811(3)\), \(b = 6.0445(14)\), \(c = 20.369(5) \text{ Å}\), \(V = 1454.1(6) \text{ Å}^3\), \(Z = 4\), \(\mu = 0.199 \text{ mm}^{-1}\),
data/restraints/parameters: 3334/1/185, R indices \((I > 2\sigma(I))\): \(R1 = 0.0398, wR2 \) (all data) = 0.0919.
25: C_{15}H_{19}O_{4}P, M = 294.27, Orthorhombic, Space group P2_{1}2_{1}2_{1}, a = 8.253(3), b = 9.570(3), c = 18.751(6) Å, V = 1481.1(9) Å^{3}, Z = 4, µ = 0.196 mm^{-1}, data/restraints/parameters: 2577 /0/ 184, R indices (I > 2σ(I)): R1 = 0.0424, wR2 (all data) = 0.0904.

26: C_{16}H_{21}O_{4}P, M = 308.30, Monoclinic, Space group P2_{1}/c, a = 11.5766(14), b = 14.5541(18), c = 10.5240(13) Å, V = 1625.1(3) Å^{3}, Z = 4, µ = 0.181 mm^{-1}, data/restraints/parameters: 2867 /0/ 194, R indices (I > 2σ(I)): R1 = 0.0446, wR2 (all data) = 0.1116.

29: C_{34}H_{32}O_{2}, M = 472.60, Triclinic, Space group P\bar{1}, a = 10.915(12), b = 11.603(3), c = 12.983(2) Å, V = 1325.1(15) Å^{3}, Z = 2, µ = 0.072 mm^{-1}, data/restraints/parameters: 4660/0/ 329, R indices (I > 2σ(I)): R1 = 0.0522, wR2 (all data) = 0.0983.

32: C_{15}H_{17}O_{5}P, M = 308.26, Monoclinic, Space group C2/c, a = 36.090(4), b = 5.9889(6), c = 13.4654(15) Å, V = 2903.6(5) Å^{3}, Z = 8, µ = 0.208 mm^{-1}, data/restraints/parameters: 2539 /0/ 192, R indices (I > 2σ(I)): R1 = 0.0545, wR2 (all data) = 0.1132.

34: C_{17}H_{21}O_{5}P, M = 336.31, Orthorhombic, Space group Pca2_{1}, a = 25.252(2), b = 6.2471(5), c = 10.3606(9) Å, V = 1634.4(2) Å^{3}, Z = 4, µ = 0.191 mm^{-1}, data/restraints/parameters: 2887 /1/ 212, R indices (I > 2σ(I)): R1 = 0.0529, wR2 (all data) = 0.0751.

35: C_{16}H_{12}O_{2}, M = 236.26, Orthorhombic, Space group Pcab, a = 8.4723(18), b = 16.420(4), c = 17.215(4) Å, V = 2394.8(9) Å^{3}, Z = 8, µ = 0.086 mm^{-1}, data/restraints/parameters: 2097/0/ 164, R indices (I > 2σ(I)): R1 = 0.0695, wR2 (all data) = 0.0953.
37: C$_{13}$H$_{12}$O$_4$, $M = 232.23$, Monoclinic, Space group $P2_1/c$, $a = 15.994(5)$, $b = 5.1441(16)$, $c = 14.520(5)$ Å, $V = 1166.5(6)$ Å$^3$, $Z = 4$, $\mu = 0.098$ mm$^{-1}$, data/restraints/parameters: 2270 /0/ 155, R indices ($I > 2\sigma(I)$): R1 = 0.0660, wR2 (all data) = 0.1900.

Figure S1. A PLATON drawing of 8

Figure S2. A PLATON drawing of 12
Figure S3. A PLATON drawing of 16

Figure S4. A PLATON drawing of 17

Figure S5. A PLATON drawing of 21
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Figure S15b. $^{13}$C NMR spectrum of compound 8
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Figure S21a. $^1$H NMR spectrum of compound 14
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Figure S23b. $^{13}$C NMR spectrum for compound 16

Figure S24a. $^1$H NMR spectrum of compound 17
Figure S24b. $^{13}$C NMR spectrum for compound 17

Figure S25a. $^1$H NMR spectrum of compound 18
Figure S25b. $^{13}$C NMR spectrum for compound 18

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Figure S28a. $^1$H NMR spectrum of compound 21
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Figure S29a. $^1$H NMR spectrum of compound 22
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Reference: