Supporting Information

Organocatalyzed [2 + 2] cycloaddition reaction between quinone imine ketals with allenoates

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Table 1. Optimization of the reaction conditions\textsuperscript{a}

<table>
<thead>
<tr>
<th>Entry</th>
<th>Catalyst</th>
<th>Solvent</th>
<th>3a (%)</th>
<th>4 (%)</th>
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<tbody>
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<td>1</td>
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<tr>
<td>2</td>
<td>PhCO₂H</td>
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<tr>
<td>3</td>
<td>4-NO₂-C₆H₄CO₂H</td>
<td>1,4-Dioxane</td>
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<td>4</td>
<td>4-CH₃O-C₆H₄CO₂H</td>
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<tr>
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<td>p-TSA</td>
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<tr>
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<tr>
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<td>1,4-Dioxane</td>
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\textsuperscript{a} The reaction was performed with 1a (0.11 mmol), 2a (0.1 mmol) and catalyst (10 mol\%) in the solvent (1.5 mL).
Copies of $^1$H, $^{13}$C, and $^{19}$F spectra of 2, 3, 5, 6, 7

Figure S1. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3a

Figure S2. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3a
Figure S3. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3b

Figure S4. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3b
Figure S5. $^1$H NMR (400 MHz, CDCl₃) spectra of compound 3c

Figure S6. $^{13}$C NMR (100 MHz, CDCl₃) spectra of compound 3c
Figure S7. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3d

Figure S8. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3d
Figure S9. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3e

Figure S10. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3e
Figure S11. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3f

Figure S12. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3f
**Figure S13.** $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3g

**Figure S14.** $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3g
Figure S15. $^{19}$F NMR (376 MHz, CDCl$_3$) spectra of compound 3g

Figure S16. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3h
Figure S17. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3h

Figure S18. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3i
Figure S19. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3i

Figure S20. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3j
**Figure S21.** $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3j

**Figure S22.** $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3k
Figure S23. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3k

Figure S24. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3l
Figure S25. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3l

Figure S26. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3m
Figure S27. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3m

Figure S28. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3n
Figure S29. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3n

Figure S30. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3o
Figure S31. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3o

Figure S32. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3p
Figure S33. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3p

Figure S34. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3q
Figure S35. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3r

Figure S36. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3r
Figure S37. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3s

Figure S38. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3s
Figure S39. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 3t

Figure S40. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 3t
Figure S41. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 5

Figure S42. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 5
Figure S43. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6a

Figure S44. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6a
Figure S45. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6b

Figure S46. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6b
Figure S47. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6c

Figure S48. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6c
Figure S49. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6d

Figure S50. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6d
Figure S51. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6e

Figure S52. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6e
**Figure S53.** $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6f

**Figure S54.** $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6f
Figure S55. $^{19}$F NMR (376 MHz, CDCl$_3$) spectra of compound 6f

Figure S56. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6g
Figure S57. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6g

Figure S58. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6h
Figure S59. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6h

Figure S60. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6i
Figure S61. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6i

Figure S62. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6j
Figure S63. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6j

Figure S64. $^{19}$F NMR (376 MHz, CDCl$_3$) spectra of compound 6j
Figure S65. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 6k

Figure S66. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 6k
Figure S67. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 61

Figure S68. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 61
Figure S69. $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 2m

Figure S70. $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 2m
**Figure S71.** $^1$H NMR (400 MHz, CDCl$_3$) spectra of compound 2n

**Figure S72.** $^{13}$C NMR (100 MHz, CDCl$_3$) spectra of compound 2n
Figure S73. HRMs spectra of compound 3a