

Journal of Pesticide Science

supplementary materials

DOI:10.1584/jpestics.D16-100

**Synthesis and activities of tolprocarb derivatives against
Pyricularia oryzae: relationships among the activities for
polyketide synthase, melanin biosynthesis, and rice blast**

Shinichi BANBA, Takahiro HAMADA,^{*} Natsuko ARAKI
and Koichi EBIHARA

Pesticide Science Society of Japan

<http://pssj2.jp/eng/>

Table S1. ¹H NMR data of tolprocarb derivatives

Compound No.	¹ H NMR δ
1	7.65-7.63(2H, m), 7.23-7.21(2H, m), 6.62(1H, br-s), 5.26(1H, d, $J = 8.3$ Hz), 4.46-4.35(2H, m), 3.72-3.61(2H, m), 3.51-3.46(1H, m), 2.39(3H, s), 1.91-1.85(1H, m), 1.03-0.96(6H, m).
2	7.69(2H, d, $J = 8.1$ Hz), 7.22(2H, d, $J = 8.1$ Hz), 6.99(1H, br-s), 4.89-4.83(1H, m), 4.75(1H, d, $J = 8.5$ Hz), 3.73-3.67(1H, m), 3.60-3.47(2H, m), 2.38(3H, s), 1.88-1.84(1H, m), 1.21(3H, d, $J = 6.1$ Hz), 1.10(3H, d, $J = 6.1$ Hz), 1.01(3H, d, $J = 7.3$ Hz), 0.99(3H, d, $J = 7.3$ Hz).
3	7.68(2H, d, $J = 8.1$ Hz), 7.23(2H, d, $J = 8.1$ Hz), 6.86(1H, br-s), 4.86(1H, d, $J = 8.5$ Hz), 3.72-3.66(1H, m), 3.63(3H, s), 3.61-3.46(2H, m), 2.39(3H, s), 1.89-1.85(1H, m), 1.00(6H, t, $J = 8.1$ Hz)
4	7.68(2H, d, $J = 7.8$ Hz), 7.22(2H, d, $J = 7.8$ Hz), 6.92(1H, br-s), 4.82(1H, d, $J = 8.8$ Hz), 3.80(2H, d, $J = 6.6$ Hz), 3.74-3.46(3H, m), 2.39(3H, s), 1.89-1.63(2H, m), 1.06(6H, d, $J = 6.8$ Hz), 0.85(3H, d, $J = 6.8$ Hz), 0.84(3H, d, $J = 6.8$ Hz).
5	7.65-7.60(2H, m), 7.22-7.18(2H, m), 6.58(1H, br-s), 5.19-5.12(1H, m), 5.22(1H, br-s), 5.10-5.03(1H, m), 3.70-3.67(1H, m), 3.66-3.42(2H, m), 1.86-1.84(1H, m), 1.36(1/2H, d, $J = 6.8$ Hz), 1.18(1/2H, d, $J = 6.8$ Hz), 1.00(3H, d, $J = 6.8$ Hz), 0.98(3H, d, $J = 6.8$ Hz).
6	7.65(2H, d, $J = 8.1$ Hz), 7.30-7.20(7H, m), 6.86(1H, br-s), 5.06(2H, d, $J = 7.1$ Hz), 4.94(1H, d, $J = 8.8$ Hz), 3.74-3.69(1H, m), 3.62-3.48(2H, m), 2.39(3H, s), 1.90-1.85(1H, m), 1.01(3H, d, $J = 6.8$ Hz), 0.99(3H, d, $J = 6.8$ Hz).
7	7.67(2H, d, $J = 8.1$ Hz), 7.22(2H, d, $J = 8.1$ Hz), 7.04(1H, br-s), 5.81(1H, d, $J = 8.3$ Hz), 4.01-3.98(1H, m), 3.69-3.61(1H, m), 3.44-3.39(1H, m), 2.38(3H, s), 1.97(3H, s), 1.89-1.85(1H, m), 1.01(3H, d, $J = 6.8$ Hz), 1.00(3H, d, $J = 6.8$ Hz).
8	7.59-7.59(2H, m), 7.32(1H, br-d, $J = 7.6$), 7.22(2H, br-d, $J = 8.1$ Hz), 6.50(1H, br-s), 4.00-3.93(1H, m), 3.89-3.81(1H, m), 3.44-3.38(1H, m), 2.39(3H, s), 2.01-1.89(1H, m), 1.03(3H, d, $J = 5.9$), 1.01(3H, d, $J = 6.1$).
9	7.62(2H, d, $J = 8.3$ Hz), 7.21(2H, d, $J = 8.1$ Hz), 6.67(1H, br-s), 6.39(1H, br-d, $J = 9.0$ Hz), 4.06-3.99(1H, m), 3.81-3.72(1H, m), 3.42-3.36(1H, m), 3.08-2.91(2H, m), 2.38(3H, s), 1.95-1.86(1H, m), 1.02(3H, d, $J = 4.2$ Hz), 1.00(3H, d, $J = 4.2$ Hz).
10 [#]	7.64-7.63 (2H, m), 7.23 (2H, d, $J = 8.0$ Hz), 6.73 (1H, s), 5.96 (1H, d, $J = 8.9$ Hz), 4.02-3.96 (1H, m), 3.73 (1H, ddd, $J = 15.9, 8.9, 4.9$ Hz), 3.38 (1H, dt, $J = 13.8, 3.8$ Hz), 2.47-2.28 (7H, m), 1.89-1.86 (1H, m), 1.01 (3H, d, $J = 4.6$ Hz), 0.99 (3H, d, $J = 4.6$ Hz).
11 [#]	7.59-7.57 (2H, m), 7.21-7.19 (2H, m), 7.18-7.15 (2H, m), 7.11-7.08 (2H, m), 6.81 (1H, s), 5.74 (1H, d, $J = 8.9$ Hz), 3.99-3.93 (1H, m), 3.65 (1H, ddd, $J = 15.9, 9.0, 4.7$ Hz), 3.46 (2H, s), 3.35 (1H, dt, $J = 13.8, 3.7$ Hz), 2.40 (3H, s), 1.81 (1H, td, $J = 13.2, 6.6$ Hz), 0.94 (3H, d, $J = 7.0$ Hz), 0.89 (3H, d, $J = 7.0$ Hz).
12	7.67(2H, d, $J = 7.8$ Hz), 7.22(2H, d, $J = 7.8$ Hz), 6.75(1H, br-s), 5.58(1H, d, $J = 7.3$ Hz), 4.02-3.96(1H, m), 3.64-3.58(1H, m), 3.50-3.44(1H, m), 2.92-2.82(2H, m), 2.39(3H, s), 1.91-1.85(1H, m), 1.22(3H, t, $J = 7.3$ Hz), 1.01(6H, t, $J = 6.8$ Hz).
13	7.61(2H, d, $J = 8.3$ Hz), 7.20(2H, d, $J = 8.3$ Hz), 6.67(1H, br-s), 6.18(1H, d, $J = 8.8$ Hz), 4.09-3.93(1H, m), 3.72-3.42(4H, m), 2.38(3H, s), 1.92-1.84(1H, m), 1.00(3H, d, $J = 6.3$ Hz), 0.99(3H, d, $J = 6.3$ Hz).
14	7.66(2H, d, $J = 7.8$ Hz), 7.21(2H, d, $J = 7.8$ Hz), 6.81(1H, br-s), 5.66(1H, d, $J = 8.3$ Hz), 3.96(1H, br-s), 3.63(1H, br-s), 3.46(1H, d, $J = 14$ Hz), 2.84-2.73(2H, m), 2.39(3H, s), 1.93-1.68(2H, m), 1.02-0.99(6H, m), 0.90(3H, d, $J = 5.4$ Hz), 0.88(3H, d, $J = 5.4$ Hz).

- 15 7.69(2H, d, $J = 8.1\text{Hz}$), 7.20(2H, d, $J = 7.8\text{Hz}$), 6.25(1H, t, $J = 6.2\text{Hz}$), 5.88(1H, d, $J = 8.5\text{Hz}$), 3.94-3.75(2H, m), 3.74-3.68(1H, m), 3.47-3.44(2H, m), 2.38(3H, s), 1.89-1.81(1H, m), 1.00(3H, d, $J = 6.8\text{Hz}$), 0.99(3H, d, $J = 6.8\text{Hz}$).
- 16[#] 7.68-7.66 (2H, m), 7.23-7.21 (2H, m), 7.09 (1H, s), 4.89 (1H, d, $J = 8.3\text{ Hz}$), 3.93-3.87 (1H, m), 3.72 (1H, ddd, $J = 16.1, 9.0, 4.7\text{ Hz}$), 3.61-3.53 (4H, m), 3.36-3.32 (1H, m), 3.31-3.26 (4H, m), 2.39 (3H, s), 1.90-1.85 (1H, m), 1.01 (3H, d, $J = 2.8\text{ Hz}$), 1.00 (3H, d, $J = 2.4\text{ Hz}$).
- 17 7.68-7.66(2H, m), 7.26-7.23(2H, m), 6.66(1H, br-s), 5.57(1H, br-s), 4.43(2H, q, $J = 8.5\text{Hz}$), 3.64-3.60(2H, m), 3.50-3.46(2H, m), 2.40(3H, s).
- 18 7.76-7.74(3H, m), 7.25(2H, d, $J = 7.8\text{Hz}$), 4.91-4.85(2H, m), 3.62(2H, d, $J = 5.6\text{Hz}$), 2.40(3H, s), 1.36(6H, s), 1.23(6H, d, $J = 6.3\text{Hz}$).
- 19[#] 7.64 (2H, d, $J = 8.3\text{ Hz}$), 7.23 (2H, d, $J = 7.6\text{ Hz}$), 6.57 (1H, s), 5.18 (1H, d, $J = 8.0\text{ Hz}$), 4.43-4.39 (2H, m), 3.71-3.62 (2H, m), 3.52-3.48 (1H, m), 2.39 (3H, s), 1.91-1.88 (1H, m), 1.02 (3H, d, $J = 6.7\text{ Hz}$), 1.01 (3H, d, $J = 6.7\text{ Hz}$).
- 20[#] 7.70-7.68 (2H, m), 7.23-7.21 (2H, m), 6.98 (1H, s), 4.89-4.84 (1H, m), 4.73 (1H, d, $J = 8.6\text{ Hz}$), 3.73-3.69 (1H, m), 3.59-3.47 (2H, m), 2.39 (3H, s), 1.88-1.85 (1H, m), 1.22 (3H, d, $J = 6.1\text{ Hz}$), 1.10 (3H, d, $J = 6.1\text{ Hz}$), 1.01 (3H, d, $J = 7.0\text{ Hz}$), 0.99 (3H, d, $J = 6.7\text{ Hz}$).
- 21 7.65(2H, d, $J = 8.3\text{Hz}$), 7.23(2H, d, $J = 7.8\text{Hz}$), 6.68(1H, br-s), 5.25(1H, d, $J = 8.5\text{Hz}$), 4.47-4.36(2H, m), 3.87-3.82(1H, m), 3.61-3.48(2H, m), 2.40(3H, s), 1.58-1.37(4H, m), 0.95(3H, t, $J = 7.2\text{Hz}$).
- 22 7.62-7.60(2H, m), 7.19(2H, d, $J = 8.1\text{Hz}$), 6.55(1H, br-s), 5.21(1H, br-d, $J = 8.8\text{Hz}$), 4.42-4.31(2H, m), 3.69-3.65(2H, m), 3.53-3.50(1H, m), 2.38(3H, s), 1.04(9H, s).
- 23 7.65(2H, d, $J = 8.1\text{Hz}$), 7.23(2H, d, $J = 8.3\text{Hz}$), 6.65(1H, br-s), 5.11(1H, d, $J = 8.5\text{Hz}$), 4.46-4.36(2H, m), 3.95-3.90(1H, m), 3.55-3.48(2H, m), 2.39(3H, s), 1.74-1.69(1H, m), 1.47-1.36(2H, m), 0.96(3H, d, $J = 6.6\text{Hz}$), 0.95(3H, d, $J = 6.3\text{Hz}$).
- 24 7.61(2H, d, $J = 7.8\text{Hz}$), 7.18(2H, d, $J = 7.8\text{Hz}$), 6.64(1H, br-s), 5.30(1H, br-d, $J = 8.4$), 4.41-4.32(2H, m), 3.65-3.61(2H, m), 3.49-3.45(1H, m), 2.36 (3H, s), 1.77-1.65(5H, m), 1.25-1.03(6H, m).
- 25 7.64(2H, d, $J = 8.3\text{Hz}$), 7.23(2H, d, $J = 7.8\text{Hz}$), 6.58(1H, br-s), 6.29(1H, br-d, $J = 6.6\text{Hz}$), 4.55-4.39(3H, m), 3.98-3.82(2H, m), 3.80(3H, s), 2.40(3H, s).
- 26 7.67-7.65(2H, m), 7.30-7.24(2H, m), 6.62(1H, br-s), 6.16(1H, d, $J = 7.1\text{Hz}$), 4.46-4.41(2H, m), 3.99-3.98(1H, m), 3.74-3.69(2H, m), 2.80(1H, dd, $J = 13.7\text{Hz}$, 5.6Hz), 2.65(1H, dd, $J = 13.8\text{Hz}$, 7.7Hz), 2.40(3H, s), 2.18(3H, s),
- 27 7.69(2H, d, $J = 8.1\text{Hz}$), 7.24(2H, d, $J = 8.5\text{Hz}$), 6.88(1H, s), 5.46(1H, s), 4.91-4.85(1H, m), 4.02-3.97(1H, m), 3.72-3.65(2H, m), 2.76(1H, dd, $J = 13.5\text{Hz}$, 6.0Hz), 2.67(1H, dd, $J = 13.7\text{Hz}$, 6.8Hz), 2.40(3H, s), 2.18(3H, s), 1.22(3H, d, $J = 6.1\text{Hz}$), 1.18(3H, d, $J = 6.1\text{Hz}$).
- 28 7.78-7.74(2H, m), 7.25-7.22(2H, m), 4.44-4.33(3H, m), 4.01-3.59(3H, m), 3.34-3.10(2H, m), 2.77(1H, s), 2.72(2H, s), 2.40(2H, s), 2.39(1H, s).
- 29 7.81-7.77(2H, m), 7.25-7.23(2H, m), 4.87-4.84(1H, m), 4.29(1H, br-s), 3.97 (1H, br-s), 3.74 (2H, br-s), 3.42-3.14(2H, m), 2.84(1H, s), 2.40(3H, s), 1.22-1.20(6H, m).
- 30[#] 7.70-7.68 (2H, m), 7.23-7.21 (2H, m), 6.98 (1H, s), 4.89-4.84 (1H, m), 4.73 (1H, d, $J = 8.6\text{ Hz}$), 3.73-3.69 (1H, m), 3.59-3.47 (2H, m), 2.39 (3H, s), 1.88-1.85 (1H, m), 1.22 (3H, d, $J = 6.1\text{ Hz}$), 1.10 (3H, d, $J = 6.1\text{ Hz}$), 1.01 (3H, d, $J = 7.0\text{ Hz}$), 0.99 (3H, d, $J = 6.7\text{ Hz}$).
- 31[#] 7.67-7.66 (2H, m), 7.26-7.25 (2H, m), 6.58 (1H, s), 5.20 (1H, d, $J = 8.9\text{ Hz}$), 4.46-4.36 (2H, m), 3.69-3.64 (2H, m), 3.52-3.48 (1H, m), 2.69 (2H, q, $J = 7.6\text{ Hz}$), 1.91-1.88 (1H, m), 1.25 (3H, t, $J = 7.6\text{ Hz}$), 1.02 (3H, d, $J = 7.0\text{ Hz}$), 1.00 (3H, d, $J = 7.0\text{ Hz}$).

- 32[#]** 7.70-7.68 (2H, m), 7.41-7.40 (2H, m), 6.70 (1H, s), 5.13 (1H, d, $J = 8.9$ Hz), 4.45-4.41 (2H, m), 3.72-3.69 (1H, m), 3.64-3.61 (1H, m), 3.53-3.50 (1H, m), 1.91-1.89 (1H, m), 1.03 (3H, d, $J = 7.0$ Hz), 1.01 (3H, d, $J = 6.7$ Hz).
- 33[#]** 7.87 (2H, d, $J = 8.0$ Hz), 7.70 (2H, d, $J = 8.0$ Hz), 6.85 (1H, s), 5.11 (1H, d, $J = 8.9$ Hz), 4.52-4.36 (2H, m), 3.75-3.70 (1H, m), 3.65-3.62 (1H, m), 3.58-3.54 (1H, m), 1.94-1.88 (1H, m), 1.04 (3H, d, $J = 6.7$ Hz), 1.02 (3H, d, $J = 7.0$ Hz).
- 34** 8.11-8.08(2H, m), 7.82-7.80(2H, m), 6.82(1H, br-s), 5.17(1H, d, $J = 8.5$ Hz), 4.50-4.35(2H, m), 3.95(3H, s), 3.76-3.61(2H, m), 3.56-3.52(1H, m), 1.95-1.87(1H, m), 1.04-1.01(6H, m).
- 35[#]** 8.03-8.01 (2H, m), 7.95-7.93 (2H, m), 6.95 (1H, s), 5.10 (1H, d, $J = 8.6$ Hz), 4.52 (1H, ddd, $J = 19.1, 10.5, 6.3$ Hz), 4.38 (1H, ddd, $J = 19.0, 10.6, 6.3$ Hz), 3.74-3.72 (1H, m), 3.65-3.56 (2H, m), 3.08 (3H, s), 1.93-1.91 (1H, m), 1.03 (6H, t, $J = 7.2$ Hz).
- 36^{*}** 8.56 (1H, t, $J = 5.8$ Hz), 8.01-7.99 (2H, m), 7.88 (2H, dd, $J = 6.7, 1.8$ Hz), 7.51 (1H, d, $J = 9.5$ Hz), 4.64-4.59 (2H, m), 3.60-3.57 (1H, m), 3.42-3.29 (3H, m), 1.79-1.76 (1H, m), 0.90 (3H, d, $J = 6.7$ Hz), 0.87 (3H, d, $J = 6.7$ Hz).

No mark : ^1H NMR δ spectrum (JEOL JNM-400 FT-NMR, 400 MHz, CDCl_3)

: ^1H NMR δ spectrum (JEOL JNM-ECA-500, 500 MHz, CDCl_3)

* : ^1H NMR δ spectrum (JEOL JNM-ECA-500, 500 MHz, $\text{DMSO-}d_6$)

Table S2. LC-MS/MS Operating Conditions

Instrument	GL Science LC800 High Performance Liquid Chromatograph (HPLC) coupled with SCIEX API 3200 Mass Spectrometer (MS/MS) operated in the multiple reaction monitoring mode.				
Analytical Column	GL Science / InertSustain ODS-4, 3 µm (100 × 2.1 mm, 3 µm particle size)				
Column Oven Temperature	40°C				
Mobile Phase	A = 0.1 % formic acid in water, B = methanol				
	Compound 1			Compound 34,36	
	<u>Time</u>	<u>Percent A</u>	<u>Percent B</u>	<u>Percent A</u>	<u>Percent B</u>
Mobile Phase ratio	0.00	20.0	80.0	40.0	60.0
	7.00	20.0	80.0	40.0	60.0
Flow Rate	200 µl/minute				
Injection Volume	1 µl				
Ion Source	Turbo Ion Spray®				
