

The dissipation of diflubenzuron in soils and the effect on soil bacterial communities

Yu-ling Hsiao, Wei-hao Ho, and Jui-Hung Yen

Department of Agricultural Chemistry, National Taiwan University, Taipei, Taiwan

The purpose of this study is to investigate the dissipation of diflubenzuron in soils and the effect on the soil bacterial communities. Insecticide was applied into soils in different concentration of 1, 10 and 50 mg/kg. The residue of insecticide in soil was analyzed with high performance liquid chromatography (HPLC). Polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE) was used to monitor the variation of soil bacterial communities. The degradation of diflubenzuron in soils during incubation period generally complied with the first-order kinetics, with correlation coefficients, R^2 values ranging from 0.91 to 0.99. The half-life of diflubenzuron (10 mg/kg) in acidic loamy soil was 10.1 days and in alkaline sandy loamy soil was 23.4 days (Table 1). Degradation rates were slower as the higher concentration of diflubenzuron applied in both two soils (Fig. 1 & 2). The degradation of diflubenzuron in sterilized soils is not obvious (Fig. 3), so the dissipation of the insecticide is mainly by microorganisms. During the incubation period, the bacterial diversities of acidic and alkaline soils were ranged from 24-47% and 18-39% respectively (Fig. 4). According to the results, the soil bacterial communities would be influence by applying diflubenzuron.

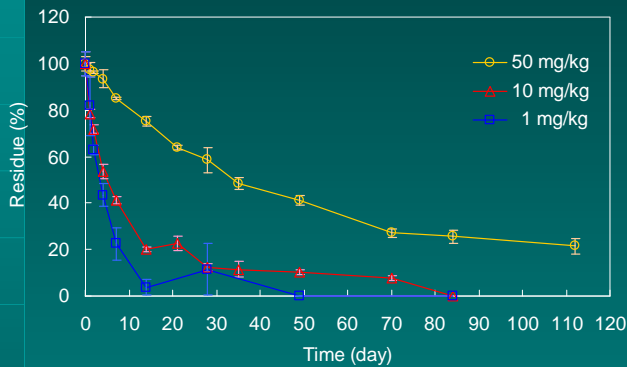


Fig 1. Dissipation of diflubenzuron of different concentrations in Pu soil. The \circ represents 50 mg/kg, \triangle represents 10 mg/kg and \square represents 1 mg/kg.

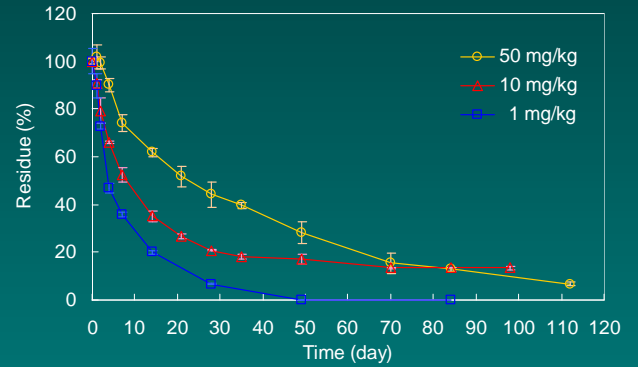


Fig 2. Dissipation of diflubenzuron of different concentrations in WI soil. The \circ represents 50 mg/kg, \triangle represents 10 mg/kg and \square represents 1 mg/kg.

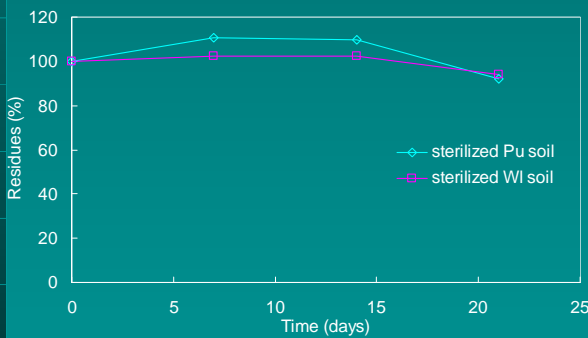


Fig 3. Dissipation of diflubenzuron in sterilized soils. The \diamond represents Pu soil, \square represents WI soil.

Table 1 The first-order degradation rate constant, half-life value, and determination coefficients of diflubenzuron fitting in this study

Soils	Conc. (mg/kg)	K	R^2	$T_{1/2}$ (day)
Acidic (Pu)	1	0.2325	0.9976	3.0
	10	0.0689	0.9182	10.1
	50	0.0151	0.9659	45.9
Alkaline (WI)	1	0.0942	0.9698	7.4
	10	0.0296	0.8400	23.4
	50	0.0244	0.9923	28.4

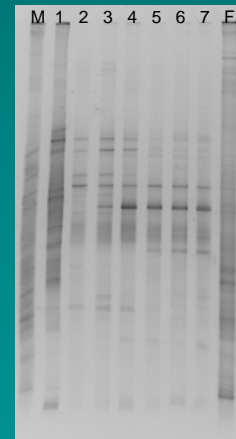


Fig. 4 The PCR-DGGE analysis of 16S rDNA sequence fragments obtained from non-sterilized Pu soil of 50 mg/kg diflubenzuron treatment. Letter M represents marker, and letter F is control in day 0. Number 1 to 7 represent the days 0, 1, 7, 14, 28, 49, 84 and 112 days in this study, respectively.

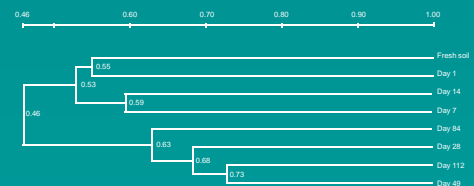


Fig 5. The cluster analysis of bacterial community structures by unweighted pairwise grouping method with mathematical averages (UPGMA) of PCR-DGGE analysis of 16S rDNA sequence fragments obtained from non-sterilized Pu soil of 50 mg/kg diflubenzuron treatment.

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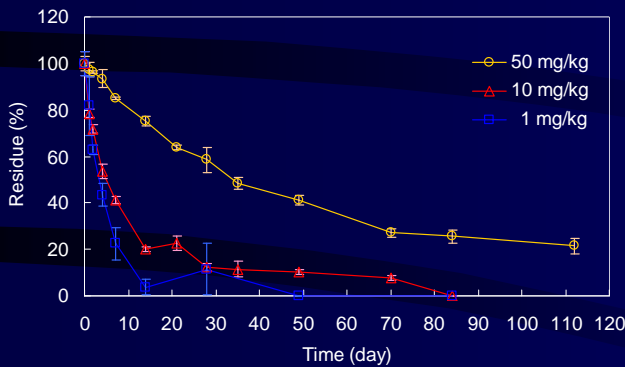


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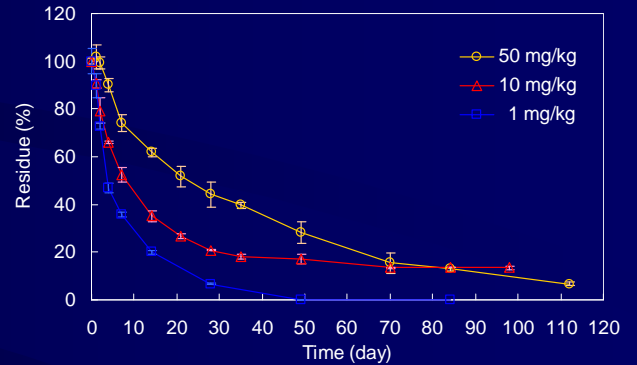


Fig 2. Dissipation of diflubenzuron of different concentrations in W1 soil. The \circ represents 50 mg/kg, \triangle represents 10 mg/kg and \square represents 1 mg/kg.

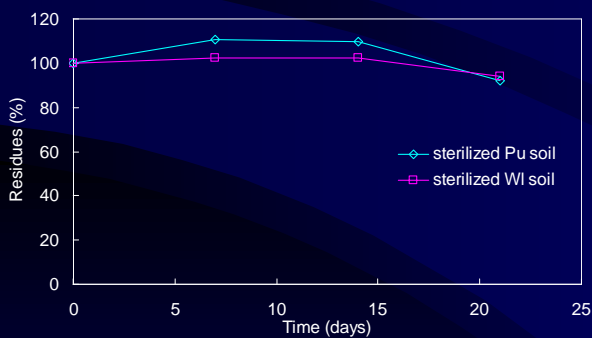


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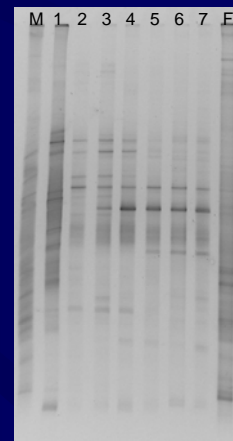


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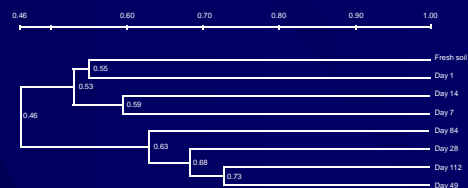


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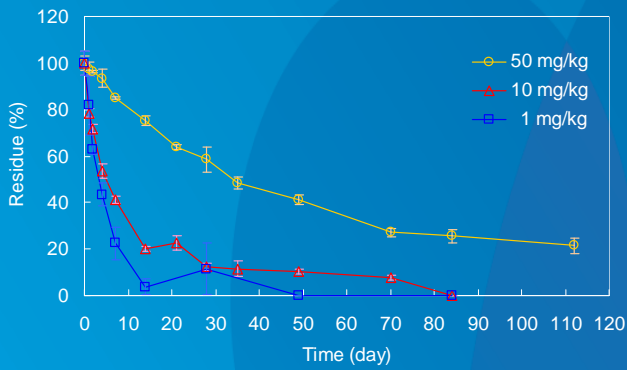


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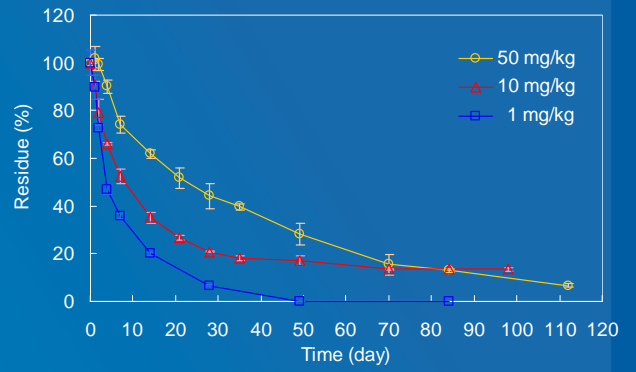


Fig 2. Dissipation of diflubenzuron of different concentrations in WI soil. The \circ represents 50 mg/kg, Δ represents 10 mg/kg and \square represents 1 mg/kg.

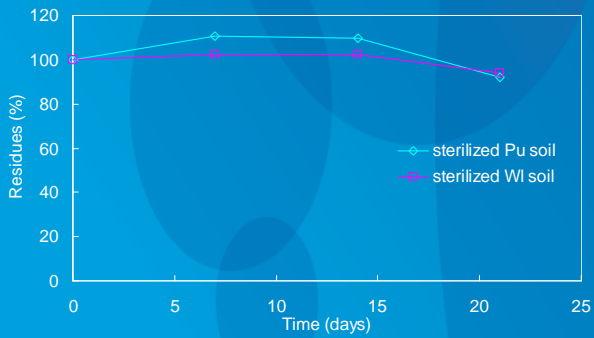


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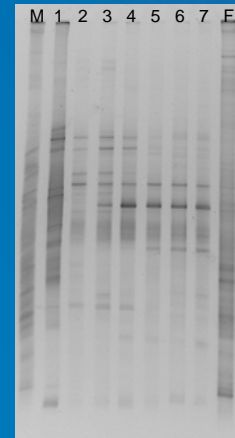


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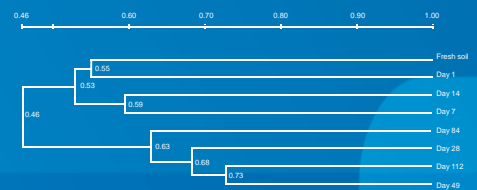


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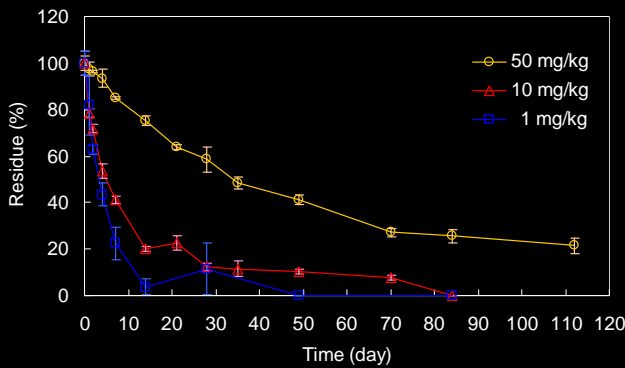


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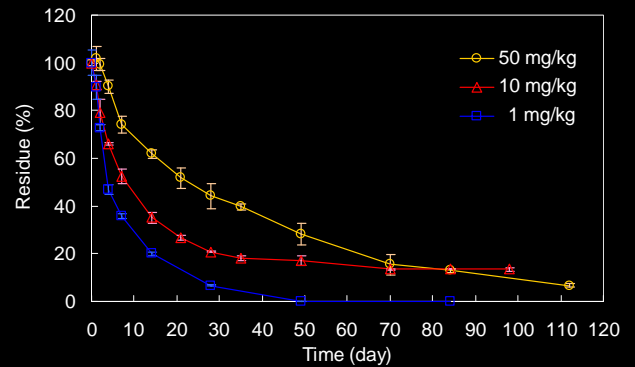


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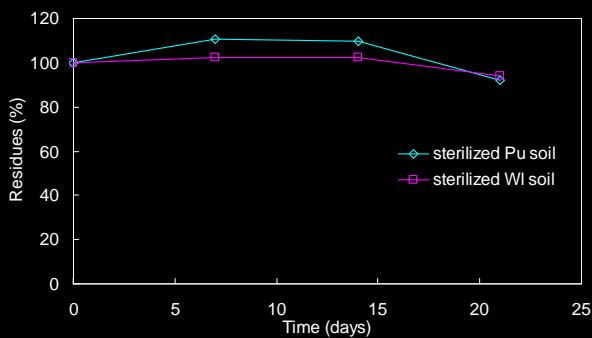


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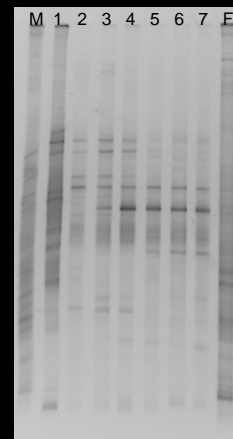


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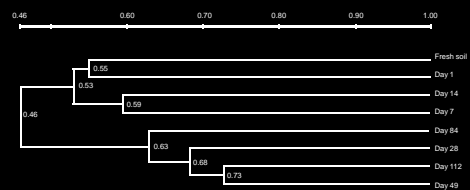


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