

US EPA ARCHIVE DOCUMENT

FORMULATION:			IA	IB	T	FW	EC	R	
% a.i.	SC#	CHEMICAL NAME	Validator:		Date:				
Technical (98.7% a.i.) and 25% Emulsifiable Concentrate JF 5855		Permethrin PP557	R. Balcomb		Oct. 26, 1977				
			Test Type: Acute Toxicity and Reproduction Studies of <u>Daphnia magna</u>						
			Test ID # ES-K						

CITATION: Doma, S. and Evered, P. "PP557: Acute Toxicity and Reproduction Studies on First Instar and Ehippia of Daphnia magna." ICI Plan Protection Division Report No. TMJ1455B (Jan. 1977).

VALIDATION CATEGORY: I. Acute toxicity to first instar Daphnia magna: Core  
II. Acute toxicity to Daphnia ehippia: Supplemental

RESULTS: Summary

I. The EC<sub>50</sub> of Permethrin to first instar Daphnia magna was determined:

	<u>Technical</u>	<u>25% Concentrate</u>
24 hr. EC <sub>50</sub>	2.1 ppb a.i.	0.6 ppb a.i.
48 hr. EC <sub>50</sub>	1.8 ppb a.i.	0.8 ppb a.i.

II. 48-hour EC<sub>50</sub> of Permethrin to the ehippia of Daphnia magna

- a. Ehippia dried prior to exposure to Permethrin: 0.034 mg/L
- b. Ehippia dried after exposure to Permethrin: 0.108 mg/L

VALIDATION CATEGORY/RATIONALE:

- I. The study of the acute toxicity of Permethrin to Daphnia magna was determined core as it generally adhered to guidelines and statistical methods were appropriate and accurate.
- II. The study of the toxicity of Permethrin to Daphnia ehippia was deemed supplemental information as such testing is not required nor was it requested. In addition, this report cannot qualify as a reproduction or life-cycle study as there was not continuous exposure of the organisms to the pesticide.

CATEGORY REPAIRABILITY/RATIONALE:

Part I: NA

Part II: NA

## Details and Discussion

### I. Acute Toxicity of Permethrin to *Daphnia magna*

The acute toxicity of Permethrin (PP557) to first instar *Daphnia magna* was determined. The *Daphnia* were 12 hours old ( $\pm$  12 hr.) and were tested at concentrations ranging from 100 mg/L a.i. down to 0.01 ug/L a.i. plus controls. The *Daphnia* were held at 18°C ( $\pm$  1°), were not aerated or fed during the experiment and were allotted ten organisms per beaker. At each concentration level, three test groups were formed with each group containing six beakers of *Daphnia* (Ref. 1). Survival assessments were made after 24 and 48 hours. This determination was made by gently agitating each beaker and recording the number not free swimming after 5 seconds as affected.

The EC<sub>50</sub> values and their 95% confidence limits were calculated statistically using linear regression on log concentration plotted against a logit transformation of the *Daphnia* response.

		<u>EC<sub>50</sub> ppb a.i.</u>	<u>95% Conf. Limits</u>
Technical	24 hour	2.06	1.65-2.53
	48 hour	0.6	0.53-0.67
Formulated	24 hour	1.82	1.54-2.15
	48 hour	0.76	0.66-0.88

These data were recomputed by this reviewer and a 48 EC<sub>50</sub> value of 0.53 ug/L was determined for the technical material and 0.65 ug/L for the formulated product. These values approximate those of the experimenters.

### II. Acute Toxicity and Reproduction Studies on *Ehippia*

*Ehippia* are the resting eggs of *Daphnia*. The toxicity of PP557 to this life cycle stage of *Daphnia* was investigated by exposing the ehippia to concentrations of technical PP557 ranging from 0.001 mg/L to 100 mg/l plus controls for 48 hours. After exposure, the ehippia were rinsed and stored in dechlorinated tap water (20°C) until hatching 4-5 days later.

The ehippia were stimulated to an early hatch in the laboratory by drying them for 24 hours. This condition was incorporated into the experimental design by having two test series. In test series A the ehippia were exposed to PP557 after drying and in test series B ehippia were exposed to PP557 before drying.

In both tests the EC<sub>50</sub> value was statistically calculated from the number of free swimming first instar Daphnia hatched in the treatment and control groups. The log/logit transformations were used as before.

	<u>EC50 ppm</u>	<u>95% Confidence Limit</u>
Test A:	0.034	0.022-0.047
Test B:	0.108	0.035-0.339

The experimenter did not supply a percent affected for each treatment level. When the reviewer calculated these data from the Table 6 and then computed an EC<sub>50</sub> value, the result obtained was at slight variance with that presented in the paper (i.e., for test A: 0.034 ppm vs. 0.056 ppm (.045 - 0.069 ppm)).

In both cases, with the technical and formulated product, a marked reduction in survival of hatched ephippia occurred: for the technical at 0.1 ppm 85% of the hatched ephippia died, and for the formulated product at 1 ppm the % of hatched ephippia was reduced. The study on formulated product was conducted using ephippia that were exposed to FMC 33297 without being preconditioned by drying. This indicates that under most normal conditions, free swimming Daphnia could be killed before producing ephippia, and any ephippia produced may be killed.

A third portion of this study was conducted comparing toxicity of PP557 (FMC 33297) in a static bioassay and in a bioassay in the presence of soil. The soil type (pear tree soil) had a pH 7. (Chemical 25% a.i.)

Test Soil pH 7	EC <sub>50</sub> = 1.1 ppb (.84-1.45 ppb) 95% C.L.
Test Standard Water	EC <sub>50</sub> = .45 ppb (.35-.61 ppb) 95% C.L.

The researcher concludes from these studies that FMC 33297 will kill most free swimming Daphnia, but ephippia will be unharmed at normal application rates, will hatch and reproduce thus re-establishing the colony.

#### Reviewer Comment

This section takes exception to the researcher's second conclusion. This study has demonstrated that after exposure for 48 hrs., at normal application rates, Daphnia may re-establish their numbers from surviving ephippia. Under field conditions, however, we may well expect exposure to continue for weeks or months. It is impossible, we believe, to make such field predictions from short laboratory exposures. Secondly, the ephippia were hatching into untreated water, whereas under field conditions they may not have this advantage. It is our opinion, therefore, that permethrin poses a strong threat to Daphnia in treated areas and that the ephippia stage does not offer sufficient protection to offset this threat.

#### Reference

Dona, S. and Evered, P., ICI Report No. TIJ 10454. Daphnia magna: Determination of Acute Toxicity of Pesticides. (1976)

103.4.3 Aquatic Invertebrate

FORMULATION:

8 a.i. - Technical (98.7% a.i.) and 25%  
Emulsifiable Concentrate JF 5855

Chemical Name: Permethrin PP557

VALIDATOR: R. Balcomb

DATE: October 26, 1977

TEST TYPE: Acute Toxicity and Reproduction  
Studies of Daphnia Magna

TEST ID NO: ES-K

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CITATION: Doma, S. and Evered, P. "PP557: Acute  
Toxicity and Reproduction Studies on First Instar  
and Ehippia of Daphnia Magna." ICI Plant Protec-  
tion Division Report No. TMJ1455B (Jan. 1977).

VALIDATION CATEGORY:

- I. Acute toxicity to first instar Daphnia  
Magna: Core
- II. Acute toxicity to Daphnia Ehippia:  
Supplemental

RESULTS: Summary

- I. The EC<sub>50</sub> of Permethrin to first instar  
Daphnia Magna was determined:

	<u>Technical</u>	<u>25% Concentrate</u>
24 hr. EC <sub>50</sub>	2.1 ppb a.i.	0.6 ppb a.i.
48 hr. EC <sub>50</sub>	1.8 ppb a.i.	0.8 ppb a.i.

- II. 48-hour EC<sub>50</sub> of Permethrin to the ehippia  
of Daphnia Magna
  - a. Ehippia dried prior to exposure to  
Permethrin: 0.034 mg/L

- b. Ehippia dried after exposure to  
Permethrin: 0.108 mg/L

VALIDATION CATEGORY/RATIONALE:

- I. The study of the acute toxicity of Permethrin to Daphnia Magna was determined core as it generally adhered to guidelines and statistical methods were appropriate and accurate.
- II. The study of the toxicity of Permethrin to Daphnia Ehippia was deemed supplemental as insufficient information was supplied concerning the method of EC<sub>50</sub> calculation. In addition, this report can not qualify as a reproduction or life-cycle study as there was not continuous exposure of the organisms to the pesticide.

CATEGORY REPAIRABILITY/RATIONALE:

Part I: NA

Part II: NA

Details and Discussion

I. Acute Toxicity of Permethrin to Daphnia Magna

The acute toxicity of Permethrin (PP557) to first instar Daphnia Magna was determined. The Daphnia were 12 hours old (+ 12 hr.) and were tested at concentrations ranging from 100 mg/L a.i. down to 0.01 ug/L a.i. plus controls. The Daphnia were held at 18<sup>0</sup>C (+ 1<sup>0</sup>), were not aerated or fed during the experiment and were allotted ten organisms per beaker. At each concentration level, three test groups were formed with each group containing six beakers of Daphnia (Ref. 1). Survival assessments were made after 24 and 48 hours. This determination was made by gently agitating each beaker and recording the number not free swimming after 5 seconds as affected.

The EC<sub>50</sub> values and their 95% confidence limits were calculated statistically using

*Reviewed*  
RB *Jan 9/77*  
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linear regression on log concentration plotted against a logit transformation of the Daphnia response.

		<u>EC<sub>50</sub> ppb a.i.</u>	<u>95% Conf. Limits</u>
Technical	24 hour	2.06	1.65 - 2.58
	48 hour	0.6	0.53 - 0.67
Formulated	24 hour	1.82	1.54 - 2.15
	48 hour	0.76	0.66 - 0.88

These data were recomputed by this reviewer and a 48 EC<sub>50</sub> value of 0.58 ug/L was determined for the technical material and 0.65 ug/L for the formulated product. These values approximate those of the experimenters.

## II. Acute Toxicity and Reproduction Studies on Ehippia

Ehippia are the resting eggs of Daphnia. The toxicity of PP557 to this life cycle stage of Daphnia was investigated by exposing the ehippia to concentrations of technical PP557 ranging from 0.001 mg/L to 100 mg/L plus controls for 48 hours. After exposure the ehippia were rinsed and stored in dechlorinated tap water (20°C) until hatching 4-5 days later.

The ehippia were stimulated to an early hatch in the laboratory by drying them for 24 hours. This condition was incorporated into the experimental design by having two test series. In test series A the ehippia were exposed to PP557 after drying and in test series B ehippia were exposed to PP557 before drying.

In both tests the EC<sub>50</sub> value was statistically calculated from the number of free swimming first instar Daphnia hatched in the treatment and control groups. The log/logit transformations were used as before.

	<u>EC<sub>50</sub> ppm</u>	<u>95% Confidence Limit</u>
Test A:	0.034	0.022 - 0.047
Test B:	0.108	0.035-- 0.339

The experimenter did not supply a percent affected for each treatment level. When the reviewer calculated these data from the Table 6 and then computed an  $EC_{50}$  value the result obtained was at slight variance with that presented in the paper (i.e., for test A: 0.034 ppm vs. 0.056 ppm (.045 - 0.069 ppm)).

REFERENCES:

Doma, S. and Evered, P., ICI Report No. TMJ 1405A. *Daphnia Magna*: Determination of acute toxicity of pesticides (1976).

In both cases ~~for~~ the Technical and Formulated <sup>product</sup> produced a marked reduction in survival of hatched ehippia: ~~occurred~~ for the technical at 0.1 ppm 85% the hatched ehippia died, and for the formulated product at 1 ppm the % of hatched ehippia was reduced. The study on formulated product was conducted using ehippia that were exposed to FMC 33297 without being preconditioned by drying. This indicates that under <sup>the</sup> most normal condition free swimming daphnia could be killed before producing ehippia, and any ehippia produced may be killed. A third portion of this study was conducted comparing toxicity of PP557 (FMC 33297) in a static bioassay and in a bioassay in the presence of soil. The soil type (pear tree soil) had a Ph 7. (Chemical 25% a.i.)

Test Soil ~~Ph~~ <sub>pH</sub> 7 -  $EC_{50}$  = 1.1 ppb (.84 - 1.45 ppb) 95% C.L.

Test standard water -  $EC_{50}$  = .47 ppb (.35 - .61 ppb) 95% C.L.

The researcher concludes from these studies that FMC 33297 will kill most free swimming *Daphnia*, but ehippia will be unharmed at normal application rates, will hatch and reproduce thus re-establishing the colony. This section takes exception to the researchers second conclusion.

EPHÖPPIC EC50  
 ICI Report Series  
 TMS 1955B Jan 1977  
 FMC 33297  
 PP557 Tech

O'Brien

0.001  
 C.  
 117.

0.01  
 2.  
 168.

0.1  
 92.  
 108.

1.  
 88.  
 88.

3.  
 110.  
 118.

10.  
 138.  
 138.

By Finney Prohibit  
 ignore Chi2

2.104	M
7.639	YINT
2.987	LW M
603.411	CHI2

0.056	EC50
0.045	LDCL
0.069	UPCL

0.014	LD10
0.010	LDCL
0.018	UPCL

0.226	LD90
0.161	LDCL
0.318	UPCL