

(TOR038)

DATA EVALUATION RECORD

PAGE 1 OF

CASE G90088

DIMETHOATE

PM

02/05/82

CHEM 035001

dimethoate (O,O-dimethyl S-((methylcar

BRANCH EEB

DISC 40 TOPIC 05103047

FORMULATION 01 - TECHNICAL CHEMICAL

FICHE/MASTER ID 00057053

CONTENT CAT 02

Sanders, H.O. (1969) Toxicity of Pesticides to the Crustacean
"Gammarus locustria". By U.S. Fish and Wildlife Service,
Fish-Pesticide Research Laboratory, Washington, D.C., USFWS.
(Incomplete) technical paper # 25, published study; COL:
228727-AG)

SUBST. CLASS = 8.

DIRECT RVW TIME = 30 min (MH) START-DATE 8/12/82 END DATE 8/25/82

REVIEWED BY:

James D. Felkel

TITLE:

Wildlife Biologist

ORG:

Ecological Effects Branch, Hazard Evaluation Division

LOC/TEL:

Crystal Mall #2/Room 1112, 557-3113

SIGNATURE:

DATE: 9/17/82

APPROVED BY:

TITLE:

ORG:

LOC/TEL:

SIGNATURE:

DATE:

See attached review by C. Laird of EEB, which reviews a complete version of
the above - cited article (MRID # 05009242).

1 duplicate
with 003503 ✓



2004164

CASE GS0018

COUMAPHOS A- (10/16/79)

PM 410 11/16/79

CHEM 036501

O,O-Dietnyl O-(3-chloro-4-methyl-2-oxo-2H-1

BRANCH EEB

DISC 35 TOPIC 05250047

FORMULATION 00 - TECHNICAL (97.0 a.i.)

FICHE/MASTER ID 05009242

CONTENT CAT 01

Sanders, H.D. (1969) Toxicity of Pesticides to the Crustacean Gammarus lacustris. Washington, D.C.: U.S. Bureau of Sport Fisheries and Wildlife. (U.S. Bureau of Sport Fisheries and Wildlife technical paper 25)

SUBST. CLASS = S.

OTHER SUBJECT DESCRIPTORS

PRIM: EEB -40-05054547

SEC: EEB -40-15000047

DIRECT RVM TIME = 40 hrs. (MH)

START-DATE 2/4/80

END DATE 2/25/80

REVIEWED BY: Curtis E. Laird

TITLE: Fishery Biologist

ORG: EEB/HED

LOC/TEL: CM#2, RM 807

SIGNATURE:

DATE: 2/25/80

APPROVED BY:

TITLE:

ORG:

LOC/TEL:

SIGNATURE:

DATE:

CONCLUSIONS

The study is scientifically sound and indicates that Coumaphos is highly toxic to Crustaceans. See Table 1 for additional chemicals. Immature scuds should be used as outlined in the recommended EPA protocol of April 1975. This study does not fulfill registration requirements for an acute aquatic invertebrate.

METHODS AND MATERIALS

Test Type/Test Species - Acute 48-hour LC_{50} for invertebrate/Gammarus lacustris

Test Procedures - For all other chemicals, 0.1 ml of ethanol/L was used as a solvent, according to Dr. H.O. Sanders on February 7, 1980.

Bioassay method - Bioassays in which the toxicant was added to the test medium at the beginning of the test, without aeration, were used to determine pesticide toxicities at various times and temperatures. Assays were conducted in 1-1/2 gallon glass aquariums, each containing 4 liters of test water. The aquariums were submerged in separate water baths with temperatures of 40°, 50°, 60° and 70°, all plus or minus one degree. Upon reaching the test temperature, it was aerated for 10 minutes, then 10 2-month-old (plus or minus 5-days) scuds were placed in each aquarium. The toxicant was introduced into each aquarium 2 hours after adding the test organisms.

The stock solutions were prepared by dissolving either the technical grade pesticide in ethanol or the emulsifiable concentrates and wettable powders in deionized water. The volume of ethanol never exceeded 1 ml per liter of water.

The approximate range of toxicity of the test chemical was determined by preliminary testing, then four or five concentrations of the toxicant were prepared within this range. A control was included with each test.

Statistical Analysis - Deaths in each concentration were recorded for the 24-, 48-, and 96-hour exposure periods and the results plotted on logarithmic probability paper. The toxicity of the pesticide was calculated as the Median Lethal Concentration (LC_{50}) with confidence limits determined by the statistical method of Litchfield and Wilcoxon, 1948 for evaluating dose effect experiments.

Also see attached Finney probit analysis printout for Coumaphos only.

REPORTED RESULTS

Summary - The 48-hour LC_{50} value for Coumaphos was 0.14 micrograms/l. See Table 2 for results of additional active ingredients.

Discussion - The results of exposing scuds to various concentrations of chlorinated hydrocarbon, methylcarbamate, and botanical insecticides are presented in Table 1. The most toxic and least toxic insecticides in this group are of the chlorinated hydrocarbon type. Methoxychlor was the most toxic, producing an LC_{50} value of 2.9 micrograms/l after a 24-hour exposure. The least toxic was Aldrin, which killed half of the scuds at 45,000 micrograms/l in 24 hours. Methylcarbamate insecticides were intermediate in toxicity. The 24-hour LC_{50} values ranged from 39 micrograms/l for Matacil to 86 micrograms/l for Zetran. The 24-hour LC_{50} values of the botanicals ranged from 28 micrograms/l for a pyrethrum formulation to 6,000 micrograms/l for a rotenone formulation.

Scuds are slightly more sensitive to organophosphate insecticides than to chlorinated insecticides (Table 2). Coumaphos was the most toxic of all insecticides tested, having a 24-hour LC_{50} value of 0.32 microgram/l. Bidrin, the least toxic organophosphate insecticide, produced a 24-hour LC_{50} of 2,200 micrograms/l.

The LC_{50} values of a defoliant, some herbicides, and some fungicides are shown in Table 3. DEF, the defoliant, was the most toxic in this group, having a 24-hour LC_{50} of 360 micrograms/l. Herbicides were generally less toxic to scuds than most insecticides. The 24-hour LC_{50} value for Diuron was 700 micrograms/l. No apparent effect was seen after a 96-hour exposure of 100,000 micrograms/l to the dipotassium salt of Endothal and dimethylamine salt of 2,4-D.

The toxicity range was greater in different salts and esters of the same basic structure than in herbicides having dissimilar structures. The 24-hour LC_{50} values for various salts or esters of 2,4-D best illustrate this point. The butoxyethanol ester was the most toxic herbicide (1,400 micrograms/l), followed by the propylene glycolbutyl ether ester (2,100 micrograms/l), and the iso-octyl ester (6,800 micrograms/l). The dimethylamine salt killed no scuds in a 96-hour exposure at 100,000 micrograms/l.

Discussion

Test Procedures - The test procedure generally complies with the recommended EPA Protocol, with the exception of the life stage tested. Adult scuds were used instead of early instar scuds.

Statistical Analysis - The LC_{50} value was determined by using the Litchfield and Wilcoxon method.

Conclusion - Category Supplemental.

Rationale - This study was reviewed for Coumaphos. Since the studies were conducted and published by a government facility, we feel they are scientifically sound. Several assumptions are made in accepting all values reported in this paper: 1) The protocol described were employed for all chemicals 2) Unlike feeding studies, in which food consumption and weight change information is essential to interpreting LC_{50}/LD_{50} values, no organismal response beside death is essential to assess the LC_{50} value. Personal contact with Dr. R. Handerson (National Water Quality Laboratory, Duluth, Minn.) on February 7, 1980 indicated that mature scuds are less sensitive to pesticides than immature scuds. The study is supplemental rather than core.

Repairability - Not repairable.

Table 1. Estimated LC_{50} values and confidence limits (p=.05) for several technical grade insecticides to the scud, Gammarus lacustris, in bioassays conducted at 70°F.

Toxicity Category*	Insecticide	P,p'-DDT reference at 24-Hrs.	LC_{50} micrograms per liter			Fulfill Registration Requirement
			24-Hrs.	48-Hrs.	96-Hrs.	
Vht	<u>Chlorinated</u> Methoxychlor	4.7 Hydrocarbons	2.9(2.2-3.9)	1.3(0.87-1.9)	0.8 (0.56-1.1)	No
Vht	Chlordan		160(120-220)	80(62-102)	26(21- 30)	No
Vht	Azomite (R)	4.7	350(250-500)	100(60-160)	60(43- 84)	No
ht	Tatradifon	5.0	370(280-500)	140(100-200)	110(80-150)	No
ht	Dilan	5.7	800(680-920)	600(520-680)	350(300-400)	No
Vht	<u>Methylcarbamates</u> Matacil (R) Carbaryl Baygon (R) Zectran	4.9	39(30- 51)	29(21-39)	12(8-17)	No
		4.7	40(32- 49)	22(16-30)	16(12-19)	No
		4.9	66(54- 79)	50(40-62)	34(29-39)	No
		4.7	86(61-120)	76(63-91)	46(34-62)	No
Vht	<u>Botanicals</u> Pyrethrus Allethrin Patenons	5.3	28(20-39)	18(14-24)	12(8-17)	No
		5.3	38(30-49)	20(14-28)	11(8-15)	No
		5.0	6,000(5,000-7,000)	3,500(2,900-4,300)	2,600(2,100-3,200)	No

*Vht= Very highly toxic; ht = Highly toxic; Mt = Moderately toxic.

Table 2. Estimated LC_{50} values and confidence limits (p=.05) for several technical grade organophosphate insecticides to the scud, *Gammarus lacustris*, in bioassays conducted at 70°F.

Toxicity Category*	Insecticide	P-P'-DDT references at 24-Hrs.	LC_{50} micrograms per liter			Full Registration Requirement
			24-Hrs.	48-Hrs.	96-Hrs.	
Vht	Coumaphos (R) (Co-Ra) (R)	4.7	0.32 (0.18 - 0.58)	0.14 (0.082 - 0.24)	0.074 (0.059 - 0.092)	No
Vht	Cuthion (R)	6.1	0.56 (0.39 - 0.81)	0.25 (0.19 - 0.35)	0.15 (0.11 - 0.20)	No
Vht	Dursban (R)	4.7	0.76 (0.47 - 1.2)	0.40 (0.32 - 0.49)	0.11 (0.071 - 0.17)	No
Vht	Dichlorvos (DDVP)	4.5	2.0 (1.5 - 2.7)	1.0 (0.66 - 1.5)	0.50 (0.37 - 0.68)	No
Vht	Melathion	4.9	3.8 (3.5 - 4.1)	1.8 (1.3 - 2.4)	1.0 (0.55 - 1.5)	No
Vht	Ethion	6.1	3.6 (3.9 - 8.1)	3.2 (2.3 - 4.5)	1.8 (1.3 - 2.4)	No
Vht	Phosphomidon	4.7	8.4 (6.7 - 11)	3.8 (2.2 - 6.7)	2.8 (1.8 - 4.9)	No
Vht	Endosulfan (R), (Thiodan)	4.2	9.2 (6.8 - 12)	6.4 (5.0 - 8.2)	5.8 (4.1 - 8.1)	No
Vht	Parathion	4.7	12 (7.8 - 18)	6.0 (2.7 - 9.7)	3.5 (2.6 - 4.8)	No
Vht	Panthion	5.2	15 (12 - 20)	11 (8.0 - 15)	8.4 (5.0 - 12)	No
Vht	Phorate (R) (Thimat)	5.7	24 (15 - 38)	14 (9.0 - 21)	9.0 (5.1 - 13)	No
Vht	Shell 4072	5.4	27 (19 - 38)	13 (10 - 16)	9.8 (8.6 - 11)	No
Vht	Carbophenothion (Trithion (R))	5.7	45 (30 - 62)	28 (20 - 36)	5.2 (4.1 - 6.5)	No
Vht	Clodrin	5.7	49 (36 - 67)	29 (21 - 41)	15 (14 - 20)	No
Vht	Methyl Carbo-phenothion	5.7	50 (33 - 75)	32 (22 - 46)	11 (8.0 - 15)	No
Vht	TEPP	5.2	74 (57 - 96)	52 (30 - 90)	39 (27 - 56)	No

*Vht = Very highly toxic.

Table 2. Estimated LC₅₀ values and confidence limits (p=.05) for several technical grade organophosphate insecticides to the scud, Gammarus lacustris, in bioassays conducted at 70 F. (continued)

Toxicity Category*	Insecticide	p-p'-DDT reference at 24-hrs.	LC ₅₀ micrograms per liter			Full Registration Requirement
			24-Hrs.	48-Hrs.	96-Hrs.	
Vht	Trichloro- flea (Dylox (R))	5.2	92(68- 125)	60(39- 91)	40(26- 60)	No
Vht	PPN-Efn	5.7	100(64- 135)	30(26- 50)	15(13- 19)	No
Vht	Disulfoton (R)	5.2	110(81- 148)	70(52- 94)	52(49- 58)	No
ht	Naled (R)	6.7	240(170- 340)	160(110- 230)	110(80-155)	No
Vht	(Dibroa (R)) V-C 13	5.7 (4.7)	430(260- 710)	200(145- 276)	56(40- 78)	No
ht	Phosdrin (R)	4.9	630(460- 920)	310(225- 428)	130(100-170)	No
ht	Oxylometon- methyl (R)	5.4	750(650- 860)	700(610- 800)	190(170-210)	No
ht	Systox	4.5	800(690- 930)	500(400- 620)	200(150-280)	No
ht	Diazinon	5.7	830(500-1,300)	690(390- 1,200)	270(150-513)	No
ht	Dioxathion (R)	4.7	900(670-1,200)	400(250- 630)	200(150-270)	No
Vht	Abate (R)	5.4	960(580-1,600)	640(480- 860)	82(31-110)	No
ht	Bidrin	5.4	2,200(1,500-3,300)	790(500- 1,100)	540(400-730)	No

*Vht = Very highly toxic; ht = Highly toxic.

Table 3. Estimated LC_{50} Values and Confidence Limits ($p=.05$) of several herbicides, fungicides, and a defoliant to the scab, Gammarus lacustris, in bioassays conducted at 70 F.

Pesticide *	P.P.-DDT reference at 24-hrs.	LC ₅₀ micrograms per liter		
		24-Hrs.	48-Hr.	96-Hr.
DEF (R) (Tech. defoliant)	5.8	360(270- 248)	230(210- 250)	100(78- 150)
Diuron (Tech. herbicide)	5.3	700(590- 830)	380(290- 500)	160(130- 190)
2,4-D, (BEZ) (E.C. herbicide)	5.6	1,400(1,100- 1,800)	760(510- 1,100)	440(310- 620)
Hydrothol 131 (Tech. herbicide)	5.6	2,000(1,600- 2,700)	1,000(620- 1,600)	500(370- 670)
2,4-D, (PCBE) (E.C. herbicide)	5.0	2,100(1,700- 2,500)	1,800(1,400- 2,300)	1,600(1,200- 2,100)
Difolitan (W.P. fungicide)	5.6	2,200(1,700- 2,800)	1,300(1,000- 1,600)	800(500- 1,300)
Korax (W.P. fungicide)	5.8	2,800(1,100- 3,800)	1,100(780- 1,500)	640(460- 890)
Dichlorone (W.P. herbicide)	5.4	3,200(1,900- 5,400)	2,300(1,600- 2,800)	1,100(800- 1,500)
2,4-D, (IOE) (W.P. herbicide)	4.9	6,800(4,800- 9,700)	4,600(2,900- 7,300)	2,400(1,900- 4,800)
Dead-X, 95% Naphtha (E.C. herbicide)	5.4	7,000(5,600- 8,800)	3,600(2,600- 5,400)	840(520- 1,300)
Vernolate (E.C. herbicide)	4.9	8,400(7,700- 9,200)	5,000(3,700- 6,800)	1,800(1,100- 2,900)
Trifluralin (E.C. herbicide)	5.3	8,800(6,600- 12,000)	5,600(4,200- 7,400)	2,200(1,400- 3,400)
Molinate (Tech. herbicide)	4.9	9,800(6,900- 14,000)	7,600(6,100- 9,500)	4,500(3,500- 5,800)
Dicamba (W.P. herbicide)	4.7	10,000(6,700- 15,000)	5,800(3,600- 9,300)	3,000(3,100- 4,900)
Sodium azide (Tech. herbicide)	5.6	14,000(13,000- 15,000)	9,000(6,700- 12,000)	5,000(3,700- 6,800)
Potassium azide (Tech. herbicide)	5.6	15,000(11,000- 18,000)	10,000(8,800- 11,000)	6,400(4,600- 8,900)
Dichlorophenyl (W.P. herbicide)	5.3	16,000(14,000- 18,000)	15,000(12,000- 21,000)	11,000(8,000- 15,000)
Dexon (Tech. fungicide)	5.1	18,000(11,000- 29,000)	6,000(4,400- 8,200)	3,700(2,700- 5,000)
12S (Tech. herbicide)	4.9	20,000(18,000- 22,000)	16,000(14,000- 21,000)	10,000(8,500- 12,000)
Fenac (Sod. salt) W.P. herbicide)	5.1	22,000(20,000- 24,000+	18,000(20,000- 24,000)	12,000(9,500- 14,500)
Simazine (W.P. herbicide)	6.1	30,000(26,000- 35,000)	21,000(16,500- 24,000)	13,000(11,400- 15,000)
Paraquat (E.C. herbicide)	5.3	39,000(29,000- 49,000)	18,000(12,000- 26,000)	11,000(8,000- 15,000)
Picloram (E.C. herbicide)	5.1	50,000(35,000- 71,000)	48,000(34,000- 67,000)	27,000(20,000- 37,000)
Dipotassium salt of Endothal (E.C. herbicide)	4.2	No apparent effect	-----	96-Hr. exposure at 100,000
2,4-D (dimethylamine salt) (M.C. herbicide)	5.8	" " "	" "	" "

* Notations following the name of pesticide refer to form and use. Abbreviations Tech., W.P., and E.C. refer to technical, wettable powder, and emulsifiable concentrate, respectively.

FINNEY PROBIT ANALYSIS PRINTOUT
FOR COUMAPHOS ONLY

Not Dimethoate

CONC.	NUMBER EXPOSED	NUMBER DEAD	PERCENT DEAD	BINOMIAL PROB. (PERCENT)
.32	10	10	100	9.76563E-2
.18	10	10	100	9.76563E-2
.1	10	8	80.	5.46875
.056	10	2	20.	5.46875

THE BINOMIAL TEST SHOWS THAT 0 AND .18 CAN BE
USED AS STATISTICALLY SOUND CONSERVATIVE 95 PERCENT
CONFIDENCE LIMITS SINCE THE ACTUAL CONFIDENCE LEVEL
ASSOCIATED WITH THESE LIMITS IS GREATER THAN 95 PERCENT.

AN APPROXIMATE LC50 FOR THIS SET OF DATA IS 7.48331E-2

-----RESULTS CALCULATED USING THE MOVING AVERAGE METHOD

SPAN	G	LC50	95 PERCENT CONFIDENCE LIMITS	
2	.214883	7.48331E-2	5.03839E-2	9.47334E-2

-----RESULTS CALCULATED USING THE PROBIT METHOD

ITERATIONS	G	H	GOODNESS OF FIT PROBABILITY
6	.395534	1	.974169

SLOPE = 6.96779

95 PERCENT CONFIDENCE LIMITS = 2.58564 AND 11.3499

LC50 = 7.45408E-2

95 PERCENT CONFIDENCE LIMITS = 5.59125E-2 AND 9.53083E-2