(TDR03B) DATA EVALUATION RECORD PAGE 1 OF

CASE GS0315 LINDANE PM PM# 04/05/84

CHEM 009001 Lindane (gamma isomer of benzene hexac

BRANCH EEB DISC 40 TOPIC 05054544

FORMULATION 01 - TECHNICAL CHEMICAL

FICHE/MASTER ID 00084757 CONTENT CAT 01

Sanders, H.O. (1970) Pesticide toxicities to tadpoles of the western chorus frog~Pseudacris triseriata~and Fowler's toad~Bufo~‡~woodhousii fowleri~‡. Copeia ?(2):246-251. (Submitter T-2216; also~In~unpublished submission received Oct 8, 1981 under 476-2107; submitted by Stauffer Chemical Co., Richmond, Calif.; CDL:246020-Z)

SUBST. CLASS = S.

DIRECT RVW TIME = 2 (MH) START-DATE 5/10/85 END DATE 5/10/85

REVIEWED BY: Ann Stavola
TITLE: Aquatic Biologist
ORG: HED/EEB
LOC/TEL: CM2-501 557 7560
SIGNATURE: Ann Stavola DATE: 5/10/85

APPROVED BY:
TITLE: Section Head
ORG: EEB
LOC/TEL:
SIGNATURE: Henry T. Craven DATE: 6/6/85

Duplicate of 00003503

DATA EVALUATION RECORD

1. Chemical: Lindane and Other Pesticides

2. Test Material: Technical

3. Study/Action Type: Acute Aquatic Toxicity Test - Amphibians.
Fowler's Toad - Bufo woodhousii fowleri
Western Chorus Frog - Pseudacris triseriata

4. Study ID: Sanders, H.O. (1970) Pesticide Toxicities to Tadpoles of the Western Chorus Frog, Psuedacris triseriata, and Fowler's Toad, Bufo woodhousii fowleri. Copeia ? (2): 246-251. MRID: 00084757.

5. Reviewed By: Ann Stavola
Aquatic Biologist
HED/EEB
Signature: Ann Stavola
Date: June 4, 1985

6. Approved By: Harry Craven
Supervisory Biologist
HED/EEB
Signature: Harry Craven
Date: 6/6/1985

7. Conclusions:

The study is scientifically sound; however, we have no current guideline requirements for acute toxicity testing with amphibians. With TL_{50} values of 4.4 ppm and 2.7 ppm for the toad tadpole and chorus frog tadpole, respectively, lindane is moderately toxic to amphibians.

8. Recommendations:

N/A

9. Background:

This study was part of the data call-in for the Lindane Standard.

10. Materials and Methods:

A. Test Animals: Egg masses from the chorus frog, Pseudacris triseriata and Fowler's toad Bufo woodhousii fowleri were cultured in the lab. The tests were done on week-old chorus frog tadpoles and 5-week old toad tadpoles.

B. Dose: Stock solutions of the technical grades of the pesticides were made in ethanol.

C. Study Design: The bioassays were conducted in 5.7 liter glass aquaria containing four liters of reconstituted soft water. The water temperature was maintained at 15.5 °C and pH 7.1. There were 10 tadpoles in each container. They were acclimated for 2 hours before the toxicants were added.

D. Statistical Analysis: The TL_{50} values were calculated by the Litchfield-Wilcoxon method. The concentrations tested and the observed percent mortalities were converted to logs and probits, respectively, and a linear regression equation was calculated.

11. Reported Results:

The toxicity of pesticides to toad tadpoles varied greatly. Lindane was the least toxic insecticide as it had a 96-hr TL_{50} value of 4.4 (1.8 to 5.6) parts per million.

There was also a wide range of toxicity for the chorus frog tadpoles. Lindane was, as for the toads, the least toxic insecticide as it had a 96-hr TL_{50} value of 2.7 (1.4 to 4.3) parts per million.

The symptoms of pesticide poisoning were essentially the same for both species and all pesticides tested--irritability loss of equilibrium, and then death.

13. Study Author's Conclusions/QA Measures:

Lindane TL_{50} Values (96-hr)

Toad tadpole	4.4 (1.8 - 5.6) ppm
Chorus frog tadpole	2.7 (1.4 - 4.3) ppm

TL_{50} values for the other pesticides are on the attached table.

No QA statement.

14. Reviewer's Discussion:

A. Test Procedures:

The procedures basically follow those recommended by EPA in Methods for Acute Toxicity Tests with Fish Macroinvertebrates and Amphibians, EPA 660/3-75-009. More research is needed before a protocol to study the effects by toxicants on amphibians can be standardized. Some areas of research are: life-stage and age, temperature (which depends on species development), method of exposure, and preferred species.

B. Statistical Analysis:

Without the raw data, the reported TL_{50} values could not be validated.

C. Discussion/Results:

The results indicate that lindane is moderately toxic to 5-week old toad tadpoles and 1-week old chorus frog tadpoles.

D. Adequacy of Study:

1. Category: Supplemental

2. Rationale: No raw data; only one life-stage tested.

3. Repairability: None

TABLE 2. ESTIMATED TL_{50} VALUES AND CONFIDENCE LIMITS (± 2 SE) IN MG/L FOR SEVERAL TECHNICAL GRADE PESTICIDES WITH FOUR AND FIVE-WEEK-OLD TOAD, *Bufo woodhousii* TADPOLES, IN BIOASSAYS CONDUCTED AT 15.5° C.

Pesticide	24 hr DDT TL_{50} mg/l	24 hr TL_{50}	24 hr Confidence limits	48 hr TL_{50}	48 hr Confidence limits	96 hr TL_{50}	96 hr Confidence limits
Trifluralin	2.2	0.18	0.10–0.30	0.17	0.10–0.31	0.10	0.03–0.49
Endrin	2.6	0.57	0.33–1.3	0.46	0.31–0.68	0.12	0.30–0.66
Toxaphene	2.6	0.60	0.30–1.2	0.29	0.20–0.42	0.14	0.06–0.35
Guthion	2.3	0.63	0.45–1.6	0.31	0.17–0.56	0.13	0.05–0.33
TDE	2.6	0.70	0.25–2.0	0.32	0.21–0.45	0.14	0.10–0.21
Methoxychlor	2.3	0.76	0.52–1.1	0.11	0.02–0.60	—	—
Heptachlor	2.3	0.85	0.19–3.8	0.76	0.23–2.7	0.44	0.30–0.65
Dieldrin	2.2	1.1	1.4 –2.2	0.40	0.09–1.2	0.15	0.02–0.47
DEF	2.2	1.2	0.90–2.6	0.76	0.46–0.82	0.42	0.16–1.1
Malathion	2.4	1.9	1.4 –3.5	0.50	0.25–1.3	0.42	0.09–0.98
Aldrin	2.6	2.0	1.6 –3.1	0.68	0.17–2.7	0.15	0.03–0.78
DDT	2.4	2.4	0.73–8.0	1.5	0.04–6.5	1.0	0.02–3.6
Hydrothol 191	2.4	3.2	1.7 –5.5	1.8	0.93–3.2	1.2	0.40–3.4
Benzene hexachloride	2.6	13	4.3 –40	7.1	4.8 –10	3.2	0.30–6.3
Lindane	2.6	14	5.0 –41	5.4	3.1 –9.6	4.4	1.8 –5.6
Silvex 2-(2,4,5-T)	2.6	22	15–32	20	15–28	—	—
Molinate	2.6	33	18–60	28	12–55	14	4.2 –36
Paraquat	2.6	54	30–100	25	9.4 –64	26	11–43

graph paper, the concentrations tested and the observed percent mortalities were converted to logs and probits, respectively, and a linear regression equation was calculated.

RESULTS

The concentrations of some pesticides fatal to 50% of the four to five-week-old toad tadpoles at three time intervals are listed in order of sensitivity on the basis of 24 hr TL_{50} values (Table 2). The toxicity of pesticides varied greatly with toad tadpoles, ranging from a 96 hr TL_{50} value of 0.10 ppm for trifluralin, to 26 ppm for paraquat. The most toxic and the least toxic compounds were herbicides. Endrin was the most toxic of all the insecticides tested to toad tadpoles, producing a 50% mortality at a concentration of 0.12 ppm after a 96 hr exposure. Lindane, the least toxic insecticide, killed 50% of the toad tadpoles at 4.4 ppm in 96 hr.

There was a wide range in the toxicities of the different pesticides to one-week-old chorus frog tadpoles, ranging from the highly toxic carbophenothion (96 hr TL_{50} value of 0.028 ppm), an organophosphate insecticide, to the relative non-toxic dimethylamine salt of 2,4-dichlorophenoxyactic acid (96 hr TL_{50} value greater than 100 ppm), a herbicide (Table 3).

Although there were no significant differences in toxicity of DDT within the one to three-week-old toad tadpoles, the TL_{50} values for four to five-week-old tadpoles after 24 hr indicated that DDT was 2.2 (1.6–3.3) times more toxic to the latter (Table 4). A similar pattern of increased sensitivity with age of tadpole was observed with DDT and six to seven-week-old tadpoles. DDT was 1.7 (0.8–5.1) times more toxic after a 24 hr exposure to six and seven-week-old tadpoles than to four and five-week-old tadpoles.

Toxicity values reported in this study were accumulated from bioassays conducted over a period of several months. To determine possible changes in resistance in tadpoles during holding, reference tests (24 hr TL_{50}) with technical *p,p'*-DDT (99.9%) were conducted periodically during the testing program (Table 2, 3). The *p,p'*-DDT produced consistent results among both species of tadpoles over a four month interval and indicated little change in DDT susceptibility.

General observations of behavior and symptoms of stress prior to death were re-

TABLE 3. ESTIMATED TL_{50} VALUES AND CONFIDENCE LIMITS IN MG/L (±2 SE) FOR SEVERAL TECHNICAL GRADE PESTICIDES TO ONE-WEEK-OLD FROG, *Pseudacris triseriata*, TADPOLES IN BIOASSAYS CONDUCTED AT 15.5° C.

Pesticide	24 hr DDT TL_{50}, mg/l	24 hr TL_{50}	24 hr Confidence limits	48 hr TL_{50}	48 hr Confidence limits	96 hr TL_{50}	96 hr Confidence limits
Carbophenothion	1.8	0.10	0.030–0.20	0.05	0.010–0.25	0.028	0.006–0.09
Dieldrin	1.4	0.23	0.085–0.41	0.22	0.080–0.40	0.10	0.03 –0.23
Endrin	1.8	0.29	0.18 –0.45	0.29	0.018–0.45	0.18	0.09 –0.50
Methoxychlor	1.4	0.44	0.30 –0.65	0.42	0.29 –0.62	0.33	0.19 –0.57
Malathion	1.4	0.56	0.24 –0.94	0.32	0.18 –0.68	0.20	0.09 –0.27
TDE	1.4	0.61	0.41 –0.82	0.50	0.21 –0.75	0.40	0.21 –0.75
DDT	1.4	1.4	0.91 –2.8	0.90	0.40 –1.5	0.80	0.50 –2.3
Parathion	1.8	1.6	0.40 –3.0	1.4	0.91 –2.8	1.0	0.30 –2.0
Toxaphene	1.4	1.7	0.50 –3.2	0.70	0.40 –1.2	0.50	0.10 –1.1
Piperonyl butoxide	1.4	1.8	0.40 –8.2	1.3	0.30 –12	1.0	0.10 –9.0
Naled	1.8	2.2	0.80 –4.0	2.0	0.90 –5.0	1.7	0.50 –3.2
Lindane	1.4	4.0	2.7 –6.1	3.8	2.50 –5.7	2.7	1.4 –4.3
6-Chloro-2-picolinic acid	1.8	18	9.0 –27	12	6.0 –24	6.0	2.0 –10
Silvex (Butyl Ether Ester)	1.6	20	14–32	18	10–31	10	4.0 –18
Paraquat	1.6	43	18–56	37	28–52	28	21–36
Weedar 64 (Amine salt of 2,4-D)	1.8	100				100	

corded. The symptoms of pesticide poisoning followed a predictable pattern (*i.e.*, irritability, followed by loss of equilibrium, and then death) and were essentially the same for both species and all pesticides tested. The tadpoles were irreversibly affected at much lower concentrations than TL_{50} values indicated.

All control animals survived the 96 hr exposure test and exhibited no symptoms of stress.

DISCUSSION

The results indicate a correlation between the toxicity of the same compounds to tadpoles and adult frogs and toads. For example, compounds such as endrin and dieldrin, were among the most toxic organochlorine insecticides to adult cricket frogs (Ferguson and Gilbert, 1968) and adult bullfrogs (Kaplan and Overpeck, 1968). Data presented above indicate that endrin and dieldrin were also the two most toxic insecticides to chorus frog tadpoles. In the present investigation

TABLE 4. ESTIMATED TL_{50} VALUES AND CONFIDENCE LIMITS IN MG/L (±2 SE) FOR DDT AND VARIOUS AGES OF TOAD, *Bufo woodhousii*, TADPOLES IN BIOASSAYS CONDUCTED AT 15.5° C.

Age	$\bar{x}$ wt (mg)	24 hr TL_{50}	24 hr Confidence limits	48 hr TL_{50}	48 hr Confidence limits	96 hr TL_{50}	96 hr Confidence limits
1-week	15	5.3	2.9 –9.9	1.8	0.95–3.3	0.75	0.28 –2.0
2-3-weeks	56	5.4	2.9 –10	1.3	0.32–5.3	—	—
4–5-weeks	74	2.4	0.73–8.0	1.0	0.04–6.5	1.0	0.02 –3.6
6 weeks	350	2.2	0.50–15	0.41	0.28–0.6	0.10	0.02 –0.6
7 weeks	600	1.4	0.90–2.0	0.75	0.61–1.1	0.03	0.006–0.4