

DATA EVALUATION REPORT

- 1. CHEMICAL: Thiobencarb
- 2. FORMULATION: Bolero 8EC (85.2% a.i.)
Shaughnessy Number: 108401
- 3. CITATION: Sanders, Herman O. and Joseph B. Hunn. 1982. Toxicity, Bioconcentration, and Depuration of the Herbicide Bolero 8EC in Freshwater Invertebrates and Fish. In Bulletin of the Japanese Society of Scientific Fisheries. Volume 48(8), 1139-1143).
- 4. REVIEWER: Daniel Rieder
Wildlife Biologist
EEB/HED
- 5. REVIEW DATE: 3/26/84
- 6. TEST TYPE: Acute Toxicity and Bioconcentration

7. RESULTS:

<u>Species (common name)</u>	<u>Test Temp.</u>	<u>96-hr LC50 ppm (95% C.L.)</u>	1)	
			<u>BCF 75 ppm</u>	<u>5 days 28 ppm</u>
2) <u>Daphnia magna</u> (daphnids)	21°C	1.2 (0.4 - 3.1)	16	26
<u>Gammarus pseudolimnaeus</u> (amphipods)	17°C	1.0 (0.6 - 1.7)	76	168
<u>Orconectes nais</u> (crayfish)	21°C	2.0 (1.4 - 3.6)	---	---
<u>Procambarus clarki</u> (red crayfish)	21°C	6.5 (5.7 - 7.1)	18	11 4)
<u>Chironomus plumosus</u> (midge)	---	-----	32	80
<u>Hexagenia bilineata</u> (mayfly)	---	-----	42	85
3) <u>Salmo gairdneri</u> (rainbow trout)	12°C	1.2 (0.7 - 1.6)		
3) <u>Pimephales promelas</u> (fathead minnow)				471
3) <u>Ictalurus punctatus</u> (channel catfish)	20°C	2.3 (1.2 - 4.4)		120
3) <u>Lepomis macrochirus</u> (bluegill)	20°C	1.7 (1.2 - 2.3)		91
<u>Lepomis megalophus</u> (longear sunfish)				297

1) Bioconcentration factor, first value is from water concentration of 75 ppm, the second 28 ppm.

2) 48-hr EC₅₀

3) Meet guideline requirements for acute toxicity test.

4) 60-day bioconcentration test.

8. CONCLUSION: The studies are scientifically sound based on the referenced protocol. The ones which are not marked as fulfilling guideline requirements are done with species not normally used for tests by this branch. They do provide useful information.

METHODS

For the acute studies, the report referenced the April 1975 EPA protocol (EPA-660/3-75-009). The method of Litchfield and Wilcoxon was used to estimate the EC₅₀ and LC₅₀ and 95% C.L.

See the attached study for a description of the methods used to determine bioconcentration and depuration.

RESULTS

See "7 Results" on previous page. Note that chemical exposures are based on the active ingredient.

EVALUATION

These studies substantiate and confirm previously received studies. They show that thiobencarb is moderately toxic to a wide variety of fish and aquatic invertebrates. They also show that thiobencarb bioconcentrate to some extent but also that it depurates rapidly i.e. up to and over 90% of body burden gone in 7 days.

CONCLUSIONS

Category: The list of results indicates which species data are core. The remaining results are supplemental. The bioconcentration studies were not validated.

Rationale: The acute tests are considered supplemental because the species used are not normally acceptable for tests used in pesticide registration hazard assessments.

Repairability: The supplemental acute studies would be upgraded if a particular need for those species arose.

DATA EVALUATION REPORT

1. CHEMICAL: Thiobencarb (plus 14 others)
2. FORMULATION: Technical
Shaughnessy Number: 108401
3. CITATION: Kanazawa, Jun. 1981. Measurement of Bioconcentration Factors of Pesticide by Freshwater Fish and their correlation with Physicochemical Properties or Acute Toxicities. In Pestic. Sci. 1981, 12, 417-424.
4. REVIEWER: Daniel Rieder
Wildlife Biologist
EEB/HED
5. REVIEW DATE: 3/26/84
6. TEST TYPE: Determination of Bioconcentration Factor and Partition Coefficient.
 - A. Species: Topmouth gudgeon (Pseudorasbora parva)
 - B. Material: Thiobencarb and 14 other chemicals
7. RESULTS: The bioconcentration factor was determined to be 170 x. The partition coefficient (octanol/water) was 2650.
8. REVIEWERS CONCLUSION: The study may provide useful information, but EAB has not validated the study. Based on the data reported, thiobencarb does not seem to bioaccumulate. The study does not fulfill any guideline requirements for fish and wildlife safety.

DATA EVALUATION REPORT

1. CHEMICAL: Bolero
2. FORMULATION: 83.3% Thiobencarb
Shaughnessy Number: 108401
3. CITATION: Barrows, Michael E. 1974. Kenetics of 14C-XE-362 in a Model Aquatic Ecosystem. A research report submitted to Chevron.
4. REVIEWER: Daniel Rieder
Wildlife Biologist
EEB/HED
5. REVIEW DATE: 4/13/84
6. TEST TYPE: define behavior of Bolero in model aquatic ecosystem
 - A. Species: Catfish
Crayfish
 - B. Material: Bolero 83.3%
7. RESULTS: Water concentrations of about 0.518 ppm did not seem to cause observeable harmful effects to catfish and crayfish during 49 days exposure. The bioconcentration factors during the study were 167x in catfish and 35x in crayfish.
8. REVIEWERS CONCLUSION: This study was not reviewed by EAB but the results suggest Bolero is persistent when it binds to soil and desorbs into water slowly maintaining a residue level of about 500 ppb. It is not toxic to crayfish or catfish at this level and does not appear to bioaccumulate.

The portions of the test EEB can validate are considered supplemental.

DATA EVALUATION REPORT

1. CHEMICAL: Bolero
2. FORMULATION: 7% granular
Shaughnessy Number: 108401
3. CITATION: Ishikawa, Kanji; Oishi, Toshitaru and Kojima, Kenichi. 1975. Benthocarb: Studies on Residue Level & Behavior in Selected Irrigation Creeks in Agricultural Areas in Saga Pref., Southwestern Japan. Prepared by Life Science Research Inst. Kumia Chemical Industry Co., Ltd. Japan.
4. REVIEWER: Daniel Rieder
Wildlife Biologist
EEB/HED
5. REVIEW DATE: 3/16/84
6. TEST TYPE: Water Residue Monitoring for Benthocarb.
Benthocarb herbicide 7% granules were applied to flooded rice paddies in Central Japan starting from early June to July 2. The water had been pumped into the paddies in May. Sampling for residues in water was conducted from March 4 through November 29, 1974.
7. RESULTS: The highest residue level occurred at station 3 (see map in attached report) and was 0.040 ppm. Levels at all stations declined to low levels (less than 1 ppb) by September 9.
8. REVIEWERS CONCLUSION: This study provides some useful information although it has not been reviewed by EAB. It shows that Benthocarb (or Thiobencarb) can reach levels of 40 ppb in water after direct application of 30 kg granules per hectare (2.1 kg a.i./hectare). The residues decreased by 1/2 in less than a month showing that Benthocarb does not persist extremely long in the environment.

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DATA EVALUATION REPORT

1. CHEMICAL: Thiobencarb
2. FORMULATION: Bolero
Shaughnessy Number: 108401
3. CITATION: Finlayson, B.J. and T.L. Lew, 1983. Rice Herbicide Concentrations in Sacramento River and Associated Agricultural Drains, 1982. Published by the California Department of Fish and Game, Resources Agency. Environmental Services Branch, Administration Report 83-5.
4. REVIEWER: Daniel Rieder
Wildlife Biologist
EEB/HED
5. REVIEW DATE: 3/22/84
6. TEST TYPE: Aquatic Field Residue Monitoring and Fish Bioaccumulation Studies.
 - A. Species: Various species were collected for bioconcentration
 - B. Material: Two herbicide were tested for, Thiobencarb and Molinate
7. RESULTS: Concentrations of thiobencarb were detected in the waters from most of the agricultural drains by May 21, peaked during the first to second week of June, and subsided to less than detectable concentrations by July 7, 1982. Maximum thiobencarb concentrations (ppb) measured were 170 at CBD5, 100 at ND1 and RD108, 30 to 40 at RSl and SBP1, and 10 at BSl. See Figure 1, map. Estimated bioconcentration factors (BCF) for skeletal muscle of fish ranged from 9X to 311X for thiobencarb.
8. REVIEWERS CONCLUSION: This study is scientifically sound and provides useful information on the behavior of thiobencarb in the environment. It shows that thiobencarb does move from rice fields where it was applied to adjacent streams and rivers. But the study does not show bioaccumulation in fish to be a problem. It does not fulfill any guideline requirements at this time.

INTRODUCTION

This study was part of a long-term program being conducted by the California Department of Fish and Game. This program was initiated because of concern over the concentrations of Thiobencarb and Molinate found in California waters downstream from rice fields during independent studies.

The study area included the Sacramento River and its tributaries (see map). The 90-km section of the Sacramento River extending from Colusa to Sacramento receives large volumes of agricultural return irrigation water from rice fields. During low to normal outflow years, agricultural discharge may contribute one-third of the total flow in the Sacramento River above its confluences with the Feather and American rivers. (Hansen, S. 1982) Evaluation of the Role Played by Toxic Substances in the Decline of the Striped Bass Population in the San Francisco Bay-Delta System. California State University Water Resource Control Board, Striped Bass Task Force; September 1982.)

METHODS

The monitoring locations are shown on the map. Both water and fish samples were taken to these locations at least once a week. DO and other water quality parameters were measured.

WATER

200-ml portions of water were collected for chemical analysis for molinate and thiobencarb. Duplicate samples were taken for measurement of copper concentration. Chemical analysis for thiobencarb and molinate was done by the California Department of Fish and Game.

FISH

Fish were collected on May 7 and 8 prior to herbicide applications and again from June 8 through 10 during herbicide treatment. Live fish were collected with gill and hoop nets; dead fish were collected manually. Chemical analysis was done by the California Department of Fish and Game; only skeletal muscle was analyzed.

RESULTS

DO concentrations were near saturation throughout the study. Temperature ranged from 14°C to 21°C in the early part of the study (May) to 22°C to 28°C in the last part of the study (July).

Concentration of molinate and thobencarb were present in agricultural drain waters during the study. Thiobencarb levels up to 110 ppb (RD108, June 4) and 170 ppb (CBD5, May 25) were detected. Residue detection of Thiobencarb began May 21 and lasted until June 30. See Appendix 1-4 study report attached.

Concentrations of thiobencarb were detected in fish. Bioconcentration factors ranged as high as 311 x (SBP1, Carp). See attached study report for detailed results.

REVIEWERS EVALUATION

This study shows that Thiobencarb will move from California rice fields where it is applied and shows up in water and fish samples from adjacent water bodies. The detected levels were in 2 places greater than the 48-hour LC₅₀ for Daphnia magna. The concentrations beginning May 21 and lasting until June 30, exceed the Daphnia magna Chronic MATC.

Based on a comparison of residues detected in this study and the laboratory toxicity data, thiobencarb could be having an adverse acute and chronic effect on aquatic invertebrates.

Apparently no sediment samples were taken or analyzed.

CONCLUSION

This study does not fulfill any guideline requirements at this time.

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DATA EVALUATION RECORD

1. CHEMICAL: Thiobencarb (Bolero)
2. FORMULATION: Technical (94.5% AI) Bolero 8EC
3. CITATION: Studies on the Potential Environmental Impact of the Herbicide Thiobencarb (Bolero). C.H. Schauer, T. Miura, R.J. Stewart, E.F. Dupras, Jr. Mosquito Control Research Laboratory, University of California, Fresno, CA.
4. REVIEWED BY: Ann Stavola
Aquatic Biologist
EEB/HED
5. DATE REVIEWED: 3/23/84
6. TEST TYPE:

Species: Mosquito fish (Gambusia affinis)
7. REPORTED RESULTS: 96-hr LC₅₀=3 ppm (static)
=1.3 ppm (continuous flow)
Residue accumulation -200x in 24 hr.
Field study- no significant effects on mosquito fish, some reaction of plankton and nekton.
8. REVIEWERS CONCLUSION: The lab toxicity study and the field study are not scientifically sound and cannot be used in risk assessment. The bioaccumulation study was not validated.

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Materials/Methods

Test Procedures - Lab Toxicity Studies

Mosquitofish (*Gambusia affinis*) were tested under both static and flow-through conditions. The fish underwent a 2-week acclimation period prior to testing. The fish that were tested were mixed in terms of sex and size. Four tests were conducted: two static tests with technical grade thiobencarb (94.5% AI) in which an acetone solvent was used; a static test and continuous flow-through test in which the EC formulation was used. Thiobencarb concentration were measured at the beginning and end of each test. The sample size was 10 fish/chamber. Each Chamber held 4 liters of water, and the loading rate was ≤ 0.8 gm fish/L.

Statistical Analysis

The LC₅₀ values were calculated by probit analysis and the confidence limits were calculated by the Litchfield - Wilcoxon Method.

Test Procedures-Field Study

Bolero 8EC was applied at the label rate of 4 lb/a. Applications were made with a fixed wing aircraft to ricefields. Before Bolero was applied, 1 cu. ft. cages containing 20 mosquitofish each were placed in the test plots. Water and hydrosol samples were taken pre-application and 2 hr, and 1, 2, 3, 5, 7, 13 and 21 days post-application. Other aquatic organisms were sampled both prior to and after treatment by dipping, trapping with minnow traps and area sampling. There were 4 test plots, ranging from size 5.1 to 20.6 acres, for the controls, EC-treatment and 10 G-treatment (12 plots total).

Results and Discussion

In the static toxicity tests, the 96-hr LC₅₀ was 3.1 ppm for the technical grade and 2.6 ppm formulation. In the continuous flow-through study the LC₅₀ was 1.3 ppm for the formulation.

In the field studies the concentration of thiobencarb averaged 0.9, 0.6 and 0.5 ppm at 24, 48 and 72 hours in the plots treated with EC formulation and 0.3, 0.4 and 0.5 ppm of 24, 48 and 72 hours in the plots treated with the 10 G formulation. The cumulative mortality of mosquitofish was 5% at 24 hr, 25% at 48 hr., 25% at 72 hr, for the EC formulation and 0% at 24 hr, 2% at 48 hr and 10% at 72 hr for the 10 G formulation. One week following treatment additional cages of fish were placed in these plots and no mortality occurred.

The plankton was generally reduced 31-75% during a two-week period post-treatment, but then populations began increasing. In the benthic community chironomid larvae were reduced 65% but oligochaetes were not reduced. The nekton community did not appear to be affected.

Reviewer's Evaluation

Materials/Methods

Test Procedures-Lab Toxicity Studies

The test procedures did not follow many of the testing requirements set forth in EPA's guidelines Methods for Acute Toxicity Test with Fish, Macro-

Invertebrates and Amphibians. EPA-660/3-75-009. The test species, Gambusia affinis, is not a recommended species. Other problems are: failure to indicate mean size (weight and length) of fish; low test volume (4 L instead of 15 L); type of water (soft or hard). Temperature, D.O. content and pH. of the water during the test were not reported; failure to indicate if controls were used; and failure to report the mortality data.

Statistical Analysis

The LC₅₀ could not be verified since the raw data were not included.

Test Procedures - Field Study

The description given of the methods used for the field study is very sketchy. Were the measurements made in the fields and/or drainage ditches around the fields? Are the plots contiguous and do they all have the same pattern and drainage area? Also the type of body of water is not indicated. Other important features that were not mentioned include frequency of rainfall and runoff; acclimation period of fish to the cages; sizes of cages; sizes of fish; the placement of the cages in relationship to the plots; use of control cages and mortality data.

Results and Discussion

Lab Studies

Since the test procedures did not follow the protocol recommended by the EPA, the results are not reliable and cannot be used in a risk assessment.

Field Studies

They reported mean residues values at 24, 48 and 72 hours of 0.9, 0.6 and 0.5 ppm with the EC formulation and 0.3, 0.4 and 0.5 ppm with the 10G formulation. Using the residue data for water and hydrosol from table 7, I calculated the near residues for both formulations at the various sampling intervals to be:

	<u>8EC (ppm)</u>	<u>10G (ppm)</u>
<u>2 hr</u>		
water	0.85	0.13
soil	0.20	0.20
<u>1 day</u>		
water	0.29	0.93
soil	0.05	0.12
<u>2 day</u>		
water	0.20	0.48
soil	0.18	0.15
<u>3 day</u>		
water	0.33	0.70
soil	0.70	0.68
<u>7 day</u>		
water	0.07	0.15
soil	0.20	0.20
<u>13 day</u>		
water	0.01	0.03
soil	0.28	0.32
<u>21 day</u>		
water	ND	ND
soil	0.20	0.20

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Without knowing where the measurements were taken in relationship to the areas of application it is unclear how applicable these data are to our requirements.

Mosquitofish feed near the top of the water column and are not as sensitive to the presence of toxic chemicals that are dispersed throughout the water column. Therefore, the mortality values are not totally applicable to more sensitive fish species.

The test plots were treated either concurrently or earlier with other pesticides, and these treatments could be masking any effects due solely to thiobencarb.

Conclusions

1. Category: Invalid for both studies
2. Rationale: Improper test procedures for the lab toxicity study, failure to provide clearer details for the field study.
3. Repairability: None for the lab study.
If more details are provided for the field study, and they are found to be acceptable, the category can be upgraded to supplemental.

NOTE: A fish bioaccumulation study was also included in this report, but it has not been validated by EAB.