



Department of Pesticide Regulation



Paul E. Helliker
Director

MEMORANDUM

Gray Davis
Governor
Winston H. Hickox
Secretary, California
Environmental
Protection Agency

TO: John S. Sanders, Ph.D.
Branch Chief
Environmental Monitoring and
Pest Management Branch

FROM: Johanna Walters, Environmental Research Scientist
Dave Kim, Associate Environmental Research Scientist
Roger Sava, Associate Environmental Research Scientist
Kean S. Goh, Agriculture Program Supervisor IV
Environmental Monitoring and
Pest Management Branch
(916) 324-4340

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SUBJECT: PRELIMINARY RESULTS OF PESTICIDE ANALYSIS AND ACUTE TOXICITY TESTING OF MONTHLY SURFACE WATER MONITORING FOR THE RED IMPORTED FIRE ANT PROJECT IN ORANGE COUNTY, MARCH 2000 (STUDY 183)

SUMMARY OF RED IMPORTED FIRE ANT (RIFA) COMPOUNDS

During March 2000, surface water samples collected from eight sites in Orange County, California, showed no detects of hydramethylnon and pyriproxyfen. There were two detections of bifenthrin with concentrations of 0.433 and 2.3 parts per billion (ppb) at two nursery sites and one detection of fenoxycarb with a concentration of 0.485 ppb at a nursery site. There were no detections of chlorpyrifos. Three sites had significant mortality (above 80%) to *Ceriodaphnia dubia* in the water collected. These toxic sites drained two nurseries and one integrated site. The toxicity could be attributed to diazinon and bifenthrin.

SCOPE OF THIS MEMORANDUM

This memorandum reports results of water sampling conducted by the Department of Pesticide Regulation (DPR), under interagency agreement with the California Department of Food and Agriculture (CDFA), for the RIFA control project. Data included here are from the March 27 and 28, 2000 monitoring, and encompass results from both chemical analyses and aquatic biotoxicity testing. This memorandum summarizes results for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and eight organophosphorus insecticides: chlorpyrifos, diazinon, dimethoate, fonofos, malathion, methidathion, methyl parathion, and phosmet. Only bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, and chlorpyrifos are used in the RIFA control program. The other seven organophosphates are in our multiresidue analytical method and are included in this report to assist in the interpretation of the toxicity results. Acute toxicity results



using *Ceriodaphnia dubia* are also included. An in-depth interpretation of data is not included here, but will be provided in the final report when the 2000 pesticide use report becomes available.

Reports of the monthly surface water sampling events will continue through the conclusion of the study. This memo is the eighth in the monthly sampling series. You can request previous sampling results memos by calling the number above or you may view or download them from DPR's website at <www.cdpr.ca.gov> under Programs and Services then Red Imported Fire Ant Project.

MATERIALS AND METHODS

Sample and Data Collection

On March 27 and 28, 2000, surface water samples were collected at eight creeks within the Orange County treatment area (Table 1 and Figure 1) and one rinse blank. Sites A, B, I, and J were sampled on March 27 and sites D, E, F, and G were sampled on March 28; sites C and H were not sampled because of insufficient water. This sampling event did not coincide with measurable rainfall.

Table 1. Sampling site descriptions in Orange County, California

Site #	Description	Coordinates
A	Bolsa Chica Channel at Westminster Ave.	N 33°45'35", W 118°02'36"
B	East Garden Grove Channel at Gothard St.	N 33°43'03", W 117°59'59"
C	Westcliff Park	N 33°37'25", W 117°54'02"
D	Bonita Creek at San Diego Creek	N 33°39'00", W 117°51'48"
E	San Diego Creek at Campus Dr.	N 33°39'23", W 117°50'43"
F	Hines Channel	N 33°42'04", W 117°45'24"
G	Drain at Bee Canyon and Portola Parkway	N 33°42'37", W 117°44'13"
H	Marshburn Slough at Irvine Blvd.	N 33°41'45", W 117°44'02"
I	San Juan Creek at Stonehill Dr.	N 33°28'31", W 117°40'43"
J	Arroyo Trabuco at Oso Parkway	N 33°35'06", W 117°38'09"

All water samples were collected at center channel using a 10-liter stainless steel bucket and divided into one-liter amber sample bottles using a Geotech® 10-port splitter. Samples designated for organophosphate chemical analysis were preserved by acidification with 3N hydrochloric acid to a pH between 3.0 and 3.5. Because diazinon rapidly degrades under acidic conditions, it was analyzed from a separate, un-acidified sample. Samples designated for

toxicity testing were delivered to the testing laboratory within 36 hours of collection. All samples were stored on wet ice or in a 4° C refrigerator until transported to the appropriate laboratory for analysis.

Toxicity Tests

Acute toxicity testing was conducted by the Department of Fish and Game (DFG) Aquatic Toxicity Laboratory following current U.S. Environmental Protection Agency (U.S. EPA) procedures using a cladoceran, *Ceriodaphnia dubia*, (U.S. EPA, 1993). Acute toxicity was determined using a 96-hour, static-renewal bioassay in undiluted sample water. Data were reported as percent mortality.

Environmental Measurements

Water quality parameters measured *in situ* included temperature, pH, electrical conductivity (EC), and dissolved oxygen (DO). Water pH was measured using an IQ Scientific Instruments® (model IQ 150) pH meter. EC, water temperature, and DO were measured using a YSI® multi parameter meter (model 85). Additionally, the DFG Aquatic Toxicity Laboratory measured alkalinity, hardness, and ammonia on the samples to be tested for toxicity. Totals of alkalinity and hardness were measured with a Hach7 titration kit. Ammonia was determined using an Orion® 95-12 ammonia selective electrode attached to an Orion® specific ion meter (model 290A).

Insecticide Analyses

All water samples were analyzed for bifenthrin, fenoxycarb, hydramethylnon, pyriproxyfen, chlorpyrifos, diazinon, dimethoate, fonofos, malathion, methidathion, methyl parathion, and phosmet. The CDFA Center for Analytical Chemistry performed all analysis using gas chromatography and a flame photometric detector for the eight organophosphorus insecticides; a high performance liquid chromatography and a ultra violet detector for fenoxycarb, hydramethylnon, and pyriproxyfen; and gas chromatography with an electron capture detector confirmed with a mass selective detector for bifenthrin. The reporting limit (reliable detection levels) for chlorpyrifos and diazinon is 0.04 ppb, 0.1 ppb for fenoxycarb and pyriproxyfen, 0.2 ppb for hydramethylnon, and 0.05 ppb for the other insecticides.

RESULTS and DISCUSSIONS

Insecticide Concentrations

Table 2 shows chemical analysis results. A total of nine samples were analyzed for the eight organophosphorus insecticides, bifenthrin and the three RIFA insecticide baits. Diazinon was detected in seven samples and ranged from 0.047 to 0.257 ppb. Fonofos and malathion were detected in one sample each with concentrations of 0.053 to 0.422 ppb, respectively. Bifenthrin was detected in two samples with concentrations of 0.433 and 2.3 ppb. Fenoxycarb was detected in one sample with a concentration of 0.485 ppb. There were no detections of hydramethylnon, pyriproxyfen, chlorpyrifos, dimethoate, methidathion, methyl parathion, or phosmet. Bifenthrin, fenoxycarb, and diazinon detections recorded at site F were collected from commercial nursery runoff, as were the bifenthrin and diazinon detections recorded at site G. Samples collected at site E in a creek downstream from sites F and G showed detections of diazinon only. Sites A and B, which mainly drain urban areas, had detections of diazinon and fonofos and diazinon and malathion, respectively. Of the twelve insecticides tested, only chlorpyrifos, bifenthrin, fenoxycarb, hydramethylnon, and pyriproxyfen were allowed use in nurseries for treatment of fire ants to comply with U.S. Department of Agriculture quarantine requirements. All of the organophosphorus insecticides listed are registered for uses in commercial agriculture, nurseries, golf courses or parks for the control of other insect pests. Malathion, diazinon, and chlorpyrifos are widely available for homeowner use.

Table 2. Insecticide concentrations and acute toxicity in surface water samples, March 27 and 28, 2000, Orange County, California.

Site	Concentration in pbb												% Acute Mortality ¹
	bifenthrin	fenoxycarb	hydramethylnon	pyriproxyfen	chlorpyrifos	diazinon	dimethoate	fonofos	malathion	methidathion	m. parathion	phosmet	<i>C. dubia</i>
A	ND ²	ND	ND	ND	ND	0.144	ND	ND	0.422	ND	ND	ND	20/5
B	ND	ND	ND	ND	ND	0.257	ND	0.053	ND	ND	ND	ND	0/5
C	NS ⁴	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
D	ND	ND	ND	ND	ND	0.053	ND	ND	ND	ND	ND	ND	15/5
E	ND	ND	ND	ND	ND	0.168	ND	ND	ND	ND	ND	ND	95/5 ³
F	2.3	0.485	ND	ND	ND	0.062	ND	ND	ND	ND	ND	ND	100/5 ³
G	0.433	ND	ND	ND	ND	0.131	ND	ND	ND	ND	ND	ND	100/5 ³
H	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
I	ND	ND	ND	ND	ND	0.047	ND	ND	ND	ND	ND	ND	5/5
J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	10/5
RB ⁵	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS

¹ Two numbers are reported for each toxicity test. The first number is the result from the sample; the second from the corresponding control.

² ND = none detected at the reporting limit for that chemical.

³ The difference in mortality between the sample and the corresponding control are significant using Wilcoxon two-sample test.

⁴ NS = not sampled

⁵ RB = rinse blank

Toxicity Data

Samples from sites F and G were acutely toxic to *C. dubia* causing 100% mortality, and sample from site E caused 95% mortality (Table 2). The five sites (A, B, D, I, and J) that showed non-significant toxicity to *C. dubia* drain both residential areas and integrated sites. Two of the toxic sites (F and G) drain commercial nurseries and one other toxic site (E) drains both residential areas and integrated waters. The toxicities were attributable mostly to bifenthrin and diazinon. All detections of diazinon were below the LC₅₀ for *C. dubia*; the detections of bifenthrin at sites F and G were above the LC₅₀ for *D. magna* (Table 3).

Table 3. LC₅₀'s of insecticides (ppb) for three aquatic species and U.S. EPA fresh water quality criteria.

Pesticide	Rainbow trout ¹	<i>D. magna</i> ¹	<i>C. dubia</i>	Fresh Water Quality Criteria (Acute)
Bifenthrin	0.15	0.16	ND ²	ND
Chlorpyrifos	3	1.7	0.13 ³	0.083 ⁴
Diazinon	2600	0.96	0.51 ⁵	0.090 ⁶
Dimethoate	6200	4700	ND	ND
Fenoxycarb	1600	400	ND	ND
Fonofos	50	1	ND	ND
Hydramethylnon	160	1140	ND	ND
Malathion	170	1.8	1.14 ⁷ - 2.12 ⁸	ND
Methidathion	10	3	2.2 ⁹	ND
Methyl parathion	2700	7.3	ND	ND
Phosmet	230	8.5	ND	ND
Pyriproxyfen	>325 ¹⁰	400 ¹¹	ND	ND

¹ Data from Tomlin, C.D.S., 1997

² ND= No Data

³ Data from Menconi and Paul, 1994

⁴ Data from U.S. EPA, 1994

⁵ Data from Menconi and Cox, 1994

⁶ Proposed U.S. EPA data

⁷ Data from Nelson and Roline, 1998.

⁸ Data from Ankley et al., 1991

⁹ Data from Menconi and Siepmann, 1994

¹⁰ Data from Bowman, Jane H., 1989

¹¹ Data from Burgess, David, 1989

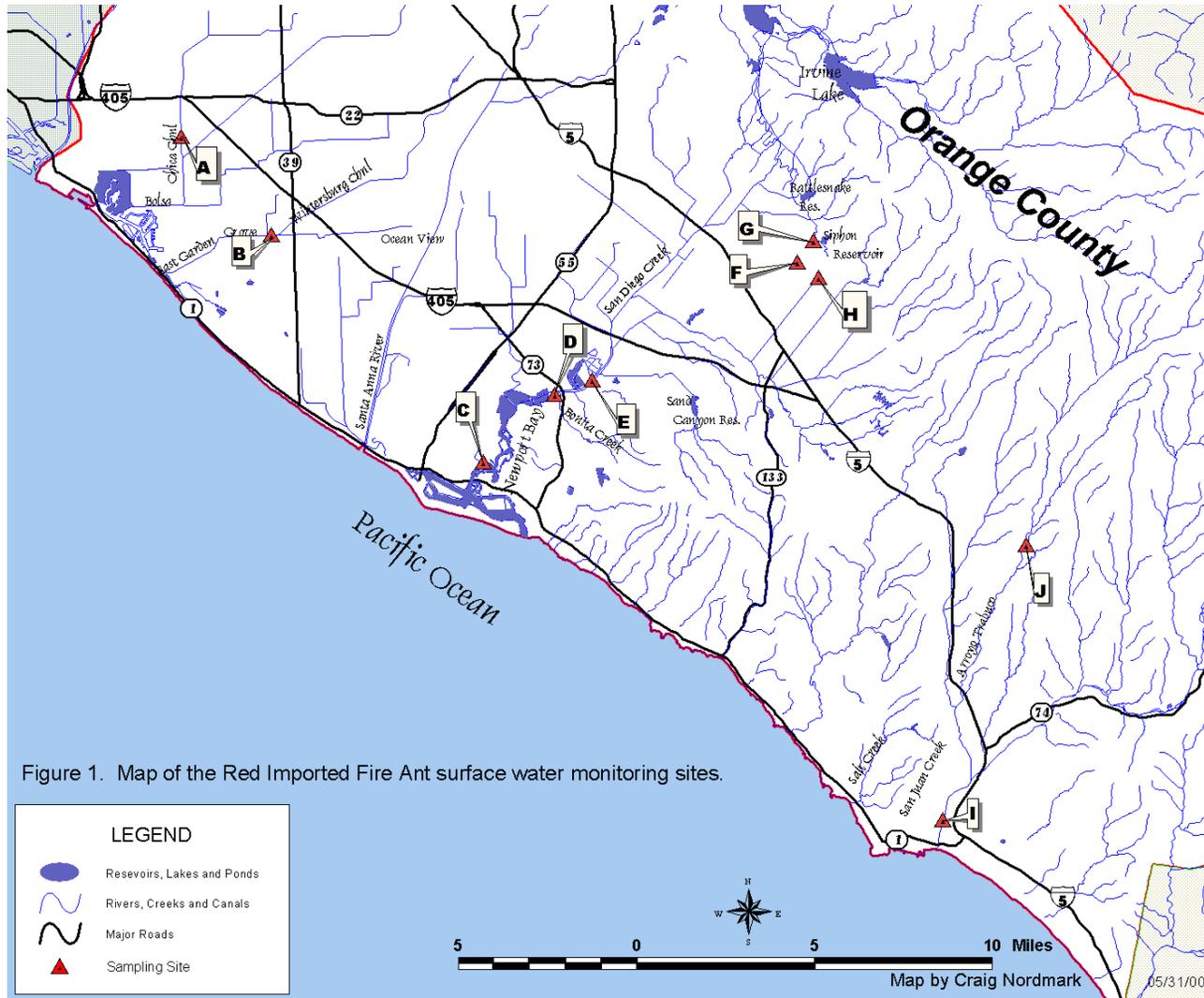
Environmental Measurements

Table 4 presents the data for DO, temperature, pH, EC, ammonia, alkalinity, and hardness. Water temperature ranged from 13.3 to 21.1° C; DO ranged from 7.35 to 18.61 mg/L; pH ranged between 7.53 and 9.13; EC ranged from 902 to 3058 µS/cm; ammonia was between <1 and 19.2 ppb NH₃; alkalinity ranged from 92 to 354 mg/L CaCO₃; and hardness ranged from 314 to 846 mg/L CaCO₃. The California Regional Water Quality Control Board, Water Quality Control Plan, Santa Ana River Basin (1995), and the Water Quality Control Plan, San Diego Basin (1994), list the following water quality guidelines as acceptable: DO above 5.0 mg/L, pH between 6.5 and 8.5, and water temperature no higher than 78°F (25.5°C). The Santa Ana River Basin plan determines ammonia levels to be dependent upon water temperature and pH, while

the San Diego Basin plan states that ammonia levels shall not exceed 0.025 mg/L. The plans do not provide an acceptable range for EC, alkalinity, or hardness. The pH at sites A, B, G, and J were above the maximum guideline pH. The one site with ammonia above <1 ppb is in the Santa Ana River Basin.

Table 4. Water quality measurements at sampling sites, March 2000, Orange County, California.

Site	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Electroconductivity (µS/cm)	Ammonia ppb NH ₃	Alkalinity mg/L CaCO ₃	Hardness mg/L CaCO ₃
A	21.1	8.81	13.03	2519	<1	354	450
B	20.1	9.13	18.61	1482	19.2	300	408
C	NT	NT	NT	NT	NT	NT	NT
D	13.3	8.20	9.16	3058	<1	326	820
E	19.1	8.48	10.68	2389	<1	168	574
F	14.2	7.53	7.35	2595	<1	70	846
G	14.5	8.52	11.07	2417	<1	130	718
H	NT	NT	NT	NT	NT	NT	NT
I	19.4	8.43	14.84	2126	<1	92	780
J	17.3	8.62	10.60	902	<1	148	314



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John S. Sanders, Ph.D.
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Precipitation data obtained from The University of California Statewide Integrated Pest Management Project, California Weather Databases. www.ipm.ucdavis.edu/WEATHER/