

US EPA ARCHIVE DOCUMENT

2.3 AUG 1988

MEMORANDUM

SUBJECT: Registration Standard for Methoxychlor -  
Nontarget Insect Studies

FROM: Allen W. Vaughan, Entomologist  
Ecological Effects Branch  
Hazard Evaluation Division (TS-769-C)

THRU: Henry T. Craven, Head - Section 4  
Ecological Effects Branch  
Hazard Evaluation Division (TS-769-C)

THRU: James W. Akerman, Chief  
Ecological Effects Branch  
Hazard Evaluation Division (TS-769-C)

TO: Edward Allen, PMT-12  
Insecticide/Rodenticide Branch  
Registration Division (TS-767-C)

The Ecological Effects Branch has reviewed the nontarget insect data received under the Registration Standard for methoxychlor. Attached material includes DER, Topical Summary, Disciplinary Review, and Data Table.

Attachments

cc: B. Lowery (SPSM/HED)  
K. Barbehenn (SIPS/HED)

Methoxychlor Registration Standard - Nontarget Insects

Effects on Beneficial Insects

The following study received full review under this topic:

<u>Author</u>	<u>ID #</u>
Atkins et al.	00036935

Study is outlined in Table 1.

Table 1. Toxicity study on beneficial insects with ~~24-D~~ <sup>METHOXYCHLOR</sup>

<u>Species</u>	<u>Formulation</u>	<u>Results</u>	<u>Author</u>	<u>Date</u>	<u>MRID #</u>
Honey bee ( <u>Apis mellifera</u> )	Technical	LD <sub>50</sub> = 23.57 micrograms per bee (relatively nontoxic)	Atkins et al.	1975	00036935

There is sufficient information to characterize methoxychlor as relatively nontoxic to honey bees, when bees are exposed to direct treatment. This study fulfills the guideline requirement for an acute contact toxicity test with honey bees.

Statement for Disciplinary Review

Effects of Methoxychlor on beneficial insects

Methoxychlor was shown to be nontoxic to honey bees in a laboratory acute contact study (Atkins et al. 1975).

Reference (for Disciplinary Review)

Atkins, E.L., E.A. Greywood, and R.L. Macdonald. 1975. Toxicity of pesticides and other agricultural chemicals to honey bees. Laboratory studies. University of California, Div. Agric. Sci., Leaflet 2287. 38 pp. MRID# 00036935.

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TABLE A  
GENERIC DATA REQUIREMENTS FOR METHOXYCHLOR

Data Requirement	Composition	Use Pattern	Does EPA Have Data To Satisfy This Requirement? (Yes, No, or Partially).	Bibliographic Citation	Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B)?
§158.155 Nontarget Insect					
<u>NONTARGET INSECT TESTING - POLLINATORS:</u>					
141-1 - Honey bee acute contact LD50	TGAI	A,B,G	YES	00036935	NO
141-2 - Honey bee - Toxicity of residues on foliage	TEP	A,B,G	NO		NO <sup>1/</sup>
141-4 - Honey bee subacute feeding study	[Reserved] <sup>2/</sup>				
141-5 - Field testing for pollinators	TEP	A,B,G	NO		NO <sup>1/</sup>
<u>NONTARGET INSECT TESTING - AQUATIC INSECTS</u>					
142-1 - Acute toxicity to aquatic insects	[Reserved] <sup>3/</sup>				
142-2 - Aquatic insect life-cycle study	[Reserved] <sup>3/</sup>				
142-3 - Simulated or actual field testing for aquatic insects	[Reserved] <sup>3/</sup>				
143-1 <u>NONTARGET INSECT</u> thru <u>TESTING-PREDATORS</u> 143-3 <u>AND PARASITES</u>	[Reserved] <sup>3/</sup>				

Composition: TGAI = Technical grade of the active ingredient; TEP = Typical end-use product.

The use patterns are coded as follows: A = Terrestrial, Food Crop; B = Terrestrial, Non-Food; C = Aquatic, Food Crop; D = Aquatic, Non-Food; E = Greenhouse, Food Crop; F = Greenhouse, Non-Food; G = Forestry; H = Domestic Outdoor; I = Indoor.

- 1/ As data from the acute contact test indicate low toxicity, no further testing is required.
- 2/ Reserved pending development of test methodology.
- 3/ Reserved pending Agency decision as to whether the data requirement should be established.

CASE GS0108 METHOXYCHLOR

PM 200 09/16/82

CHEM 034001

BRANCH EEB DISC 40 TOPIC 05050045

FORMULATION 00 -

FICHE/MASTER ID 00036935 CONTENT CAT 11

Atkins, E.L.; Greywood, E.A.; Macdonald, R.L. (1975) Toxicity of Pesticides and Other Agricultural Chemicals to Honey Bees: Laboratory Studies. By University of California, Dept. of Entomology. ?; UC, Cooperative Extension. (Leaflet 2287; published study.)

SUBST. CLASS = S.

DIRECT RVW TIME = (MH) START-DATE 8/22/88 END DATE 8/22/88

REVIEWED BY: Allen W. Vaughan  
TITLE: Entomologist  
ORG: EEB/HED  
LOC/TEL: Crystal Mall #2 / 557-0783

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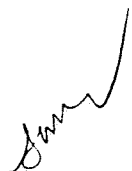
DATE: 8-22-88

APPROVED BY:  
TITLE:  
ORG:  
LOC/TEL:

SIGNATURE:

DATE:

1. CHEMICAL: Multiple chemicals. See tables
2. FORMULATION: Technical
3. CITATION: Atkins, E.L., E.A. Greywood, and R.L. Macdonald. 1975. Toxicity of pesticides and other agricultural chemicals to honey bees. Laboratory studies. Univ. of Calif., Div. Agric. Sci. Leaflet 2287. 38pp.  
*FICHE/MASTER ID 00036935*
4. REVIEWER: Allen W. Vaughan  
Entomologist  
EEB/HED
5. DATE REVIEWED: December 2, 1981
6. TEST TYPE: Toxicity to honey bee
  - A. Test Species: Honey bee (Apis mellifera)
7. REPORTED RESULTS: Methoxychlor (#154) was determined to be relatively nontoxic to honey bees in laboratory acute contact toxicity tests. When test bees were exposed to direct treatment, LD<sub>50</sub> was determined to be 23.57 micrograms per bee.
8. REVIEWER'S CONCLUSIONS: This study is scientifically sound, and shows methoxychlor to be relatively nontoxic to honey bees. This study fulfills the guideline requirement for an acute contact toxicity test on honey bees.



## Materials and Methods

### Test Procedures

A bell-jar vacuum duster is used to apply the pesticide, mixed with a pyrolite dust diluent, to the test bees. Dosages of dust are weighed, bees are aspirated into dusting cages and treated, and bees are then transferred into holding cages. Observations are recorded at 12, 24, 48, 72, and 96 hours.

### Statistical Analysis

Analysis of the data was performed to enable the authors to determine LD50 values of pesticides from either dosage-mortality curves or from LC50 values. The slope value was also obtained from the dosage-mortality curve.

## Discussion/Results

See tables for LD50 values, slope values, and toxicity categories.

## Reviewer's Evaluation

### A. Test Procedure

Procedures were sound.

### B. Statistical Analysis

Analysis as performed by the authors was assumed to be valid. No validation was performed by EEB.

### C. Discussion/Results

This study is scientifically sound.

by the other factors (0.5, 0.75, 1.25 and 1.5) to obtain the proper range of field dosages in pounds per acre. Then, using the slope value closest to the known slope value for the particular pesticide, the anticipated percent mortalities will be valid for that chemical.

We wish to emphasize that there are a few exceptions to the above rule of thumb method--those pesticides which are less hazardous as well as more hazardous than one can anticipate from the laboratory data.

It is our desire that, by presenting this data and these methods, decisions can be made (to select a pesticide, determine the dosage, and apply the chemical in the safest way and at the most appropriate time of day) maximizing the control of pest species while minimizing the adverse effects upon beneficial species in the treated area.

A list of the LD<sub>50</sub> and slope values determined at 48 hours after treatment at 80F (26.7C) and 65 percent relative humidity in the laboratory is given for 203 pesticides in table 1. A list of pesticides not toxic in the laboratory at dosages below 11 µg per honey bee is given for 196 pesticides in table 2. Other commonly used pesticide names or name designations appear together in tables 1 and 2. The pesticide names or other designations appearing in table 1 or 2 are arranged in alphabetical order in table 3 preceded with a numerical reference to their position in table 1 or 2 and giving the chemical definition.

\*LC50 is the lethal concentration of a chemical giving a bee mortality of 50 percent; LD50 is the lethal dosage in micrograms per bee of a chemical giving 50 percent mortality.

TABLE 1. LD<sub>50</sub> and Slope Values Showing the Comparative Toxicity to Honey Bees in the Laboratory at 48 Hours at 80°F (26.7°C) and 65-Percent Relative Humidity.

Reference No.	Pesticide	LD <sub>50</sub> in µg/Bee	Slope Value
Group I - Highly Toxic to Honey Bees			
1	tepp	0.001	0.64
2	thionazin; Zinophos <sup>®</sup> ; Nemaphos <sup>®</sup> ; AC-18133; ENT 25580	0.042	9.08
3	chlorpyrifos; Dursban <sup>®</sup> ; Dowco 179	0.114	7.80
4	dieldrin	0.139	4.65
5	carbofuran; Furadan <sup>®</sup> ; MIA-10242; ENT 27164	0.160	4.31
6	parathion	0.175	7.66
7	GC-6506	0.178	8.19
8	dimethoate; Cygon <sup>®</sup> ; DE-FEMO <sup>®</sup> ; ENT 24650	0.188	5.94
9	methidathion; Supracide <sup>®</sup> ; GS-13005; ENT 27197	0.236	9.06
10	EPN; EPN-300	0.245	5.08
11	HOE-2960; ENT 27764	0.268	9.39
12	C-2307; ENT 27625	0.283	6.11
13	aldicarb; Temik <sup>®</sup> ; UC-21149; ENT 27093	0.285	5.64
14	methyl parathion	0.291	6.24
15	dicrotophos; Bidrin <sup>®</sup> ; SD-3562; ENT 24482	0.300	16.50

16	phoxin; Valenon <sup>®</sup> ; Beythion <sup>®</sup> ; BAY-77488; ENT 27448	0.305	6.80
17	phenthoate; CIDLAL <sup>®</sup> ; Paphion <sup>®</sup> ; BAY-33051; ENT 27386	0.306	4.95
18	fenthion; Baytex <sup>®</sup> ; BAY-29493; ENT 25540	0.308	7.20
19	Zectran <sup>®</sup> ; Dowco 139 <sup>®</sup> ; ENT 25766; mexicarbamate	0.308	4.92
20	monocrotophos; Azodrin <sup>®</sup> ; SD-9129; ENT 27129	0.350	7.77
21	fensulfotion; Dasanit <sup>®</sup> ; BAY-25141; ENT 24945	0.350	5.44
22	aldrin	0.353	4.98
23	mevinphos; Phosdrin <sup>®</sup> ; OS-2046; ENT 22374	0.360	7.96
24	diazinon; DIAZINON <sup>®</sup> ; G-24480	0.372	8.97
25	Mesuro <sup>®</sup> ; BAY-9026; BAY-37364; ENT 25726	0.375	3.20
26	Methyl Dursban; Dowco 214	0.383	10.23
27	fenitrothion; Accothion <sup>®</sup> ; Polichion <sup>®</sup> ; Sumthion <sup>®</sup> ; BAY-41831; CP-47114; ENT 25715	0.383	4.94
28	MIA-10586	0.408	4.26
29	famphur; Famophos <sup>®</sup> ; CL-38023	0.417	4.85
30	Hobam <sup>®</sup> ; MC-A-600; ENT 27041	0.423	8.69
31	azinphosmethyl; Guthion <sup>®</sup> ; BAY-17147	0.423	6.84
32	Isolan <sup>®</sup> ; G-23611	0.471	8.70
33	naled; Dibrom <sup>®</sup> ; RE-4355	0.480	18.18



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34	dichlorvos; Vapona <sup>2</sup> ; DDVP	0.495	8.97
35	BAY-93820; ENT 27659	0.519	12.80
36	heptachlor; Velicol 104 <sup>2</sup> ; Heptamul <sup>2</sup> ; Drinox <sup>2</sup> H-34	0.526	5.16
37	GS-12968	0.550	8.91
38	lindane; gamma BHC	0.562	5.07
39	Hercules 18526	0.574	8.40
40	Hercules 17413; ENT 27615	0.581	3.90
41	NIA-11637	0.609	3.53
42	pirimiphos-ethyl; PP-211	0.614	15.11
43	NIA-10559	0.624	4.50
44	UC-8305	0.628	2.68
45	pirimiphos-methyl; PP-511	0.639	13.89
46	malathion; Cythion <sup>2</sup>	0.709	8.04
47	Bowyl <sup>2</sup> ; GC-3707	0.743	9.09
48	Hercules 13462; ENT 27405	0.829	3.90
49	UC-30045; ENT 27393	0.880	4.02
50	Hercules 5727; UC-10854	0.937	4.34
51	Methyl Iso-Systox	0.937	3.48
52	azinphosethyl; Ethyl Guthion <sup>2</sup> ; BAY-16259; ENT 22014	0.981	7.32
53	Sevin 4-011	1.02	4.37
54	C-9473; ENT 27564	1.04	8.76
55	Imidan <sup>2</sup> ; Prolate <sup>2</sup> ; R-1504	1.06	4.77
56	RP-11783	1.08	7.11
57	Carbamult <sup>2</sup> ; promecarb; Schering 34615; EP-316; SM-316	1.13	2.22
58	Metacil <sup>2</sup> ; BAY-44646; ENT 25784	1.16	3.72

59	Orthene <sup>2</sup> ; Ortho 12420; ENT 27822	1.20	8.26
60	carbaryl; Sevin <sup>2</sup> ; Compd. 7744	1.34	2.45
61	Sevin 805	1.34	4.22
62	propoxur; aprocarb; Baygon <sup>2</sup> ; Uden <sup>2</sup> ; BAY-39007; OMS-33; ENT 25671	1.35	3.30
63	monitor; Tameron <sup>2</sup> ; BAY-71628; RE-9006	1.37	10.32
64	Gardona <sup>2</sup> ; Rabon <sup>2</sup> ; SD-8447	1.37	21.45
65	AC-12008	1.38	3.60
66	phosphamidon; Dimcron <sup>2</sup>	1.46	14.28
67	Methyl Trithion <sup>2</sup>	1.46	6.64
68	C-8874; ENT 27409	1.46	3.93
69	Iso-Systox	1.49	1.45
70	methowyl; Lannate <sup>2</sup> ; IH-1179; Nudrin <sup>2</sup>	1.51	3.03
71	Abate <sup>2</sup> ; Biothion <sup>2</sup> ; AC-52160; EI-52160; ENT 27165	1.55	2.85
72	Isodrin; Compd. 711	1.61	2.63
73	ER-6624; ENT 27760	1.66	16.86
74	BUX <sup>2</sup> ; Ortho 5353; RE-5353; ENT 27127	1.66	5.12
75	Hercules 9007; ENT 27334	1.66	3.30
76	Dow ET-15	1.83	6.12
77	Nemacur P <sup>2</sup> ; BAY-68138	1.87	5.25
78	Sevimon <sup>2</sup> 4	1.88	3.82
79	I-1642	1.90	3.00

Group II - Moderately Toxic to Honey Bees

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80	endrin; Compd. 269	2.02	4.20
81	RE-5030	2.08	5.28
82	leptophos; Aber <sup>2</sup> ; PHOSVEL <sup>2</sup> ; VCS-506; ENT 27378	2.19	5.80
83	Elocron <sup>2</sup> ; diazocarb; C-8353	2.21	2.98
84	Hercules 3895 G	2.25	2.84
85	Ciodrin <sup>2</sup> ; SD-4294; crotoxyphos	2.26	17.10
86	AC-12009	2.28	3.48
87	trichloronate; Agritor <sup>2</sup> ; BAY-37289; ENT 25712	2.33	3.26
88	Banol <sup>2</sup> ; SOK <sup>2</sup> ; U-12927; carbamate	2.36	5.91
89	N-4543	2.48	2.76
90	Ortho 11775; PP-9; RE-11	2.51	4.55
91	demeton; Syston <sup>2</sup> ; BAY-8169	2.60	1.85
92	EI-43064	2.62	4.55
93	AKTON <sup>2</sup> ; SD-9098	2.66	4.07
94	G-30494	2.70	4.06
95	Pyramat ; G-23330	2.95	4.07
96	oxydemetonmethyl; Meta Systox-R <sup>2</sup> ; BAY-21097	3.00	2.32
97	C-10015; ENT 27410	3.14	2.70
98	chlordanes, α & isomers; MCS-3260	3.14	2.45
99	Cyrolane <sup>2</sup> ; EI-47470	3.51	6.28
100	TD-72	3.58	4.32
101	BAY-38156; ENT 25713	3.60	2.10

102	BAY-30911; ENT 25635	3.75	3.68
103	GS-10128	3.84	6.21
104	UC-6812	3.94	3.75
105	Iodofamphos; Alfacron <sup>2</sup> ; C-9491; ENT 27408	3.99	3.12
106	GC-9160; ENT 27154	4.09	3.98
107	GC-10284	4.19	3.21
108	Cyolane <sup>2</sup> ; EI-47031	4.23	7.32
109	TD-73	4.29	5.64
110	carboophenothion; Trithion <sup>2</sup> ; R-1303	4.47	8.39
111	Perthane <sup>2</sup> ; Q-137	4.47	4.05
112	GC-9879	4.90	4.14
113	SD-7438	5.08	6.09
114	Nissol <sup>2</sup> ; MPTA	5.14	3.87
115	disulfoton; Di-Syston <sup>2</sup> ; BAY-19639	5.14	1.14
116	chlordanes	5.23	3.24
117	UC-270748; UC-34096; ENT 27473	5.35	2.75
118	DDT, p,p' isomer	5.36	4.43
119	SD-8448	5.74	8.72
120	ronnel; Korlan <sup>2</sup> ; Trolene <sup>2</sup> ; Dow ET-14; Dow ET-57	5.74	2.10
121	Banomite <sup>2</sup> ; U-27415; ENT 27646	5.75	4.13
122	GC-10101	5.78	8.58
	Dimetilan; Dimettlan <sup>2</sup> ; GS-13332	5.84	4.08
	DT; ENT 1506	5.95	4.89
	isopropyl parathion; OXY-2168	6.41	6.86

126	fenoxaflor; fenoflurazole; Lovozal <sup>®</sup> ; NC-5016; EMT 27438	7.10	5.12
127	DDT	7.12	4.43
128	mirax; GC-1283	7.15	3.23
129	GC-3583; SD-8210	7.74	3.57
130	endosulfan (ex WP50); Thiodan <sup>®</sup>	7.81	3.15
131	endothion; NIA-5767; AC-18737	8.00	7.02
132	Tranic <sup>®</sup> ; UC-20047A; EMT 25962	8.10	3.27
133	chlordan	8.80	2.34
134	phosalone; Zolone <sup>®</sup> ; EP-11974	8.94	3.83
135	HRS-1422	9.55	3.20
136	phorate; Thimer <sup>®</sup> ; AC-3911	10.07	1.34
137	Vydate <sup>®</sup> ; IN-1410	10.32	6.43
138	chlordanone; Kapone <sup>®</sup> ; Compd. 1189	10.39	4.83

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Group III - Relatively Nontoxic to Honey Bees

139	CP-10502	11.00	3.62
140	menazon; Saphor <sup>®</sup> ; PF-175	11.06	2.03
141	binapacryl; Morocide <sup>®</sup> ; NIA-9044	11.60	9.97
142	SD-17250	12.00	5.71
143	sabadilla	12.33	6.20
144	formetanate; Carzol SP <sup>®</sup> ; EP-332; EMT 27566	14.27	3.97
145	CP-10516	14.50	3.20
146	endosulfan (ex.tech.);	16.14	2.34
147	fluenechyl; Lambrol <sup>®</sup> ; Mytrol <sup>®</sup> ; M-2060; TH-367-I	16.62	3.60
148	α endosulfan	17.42	3.02
149	ASPO <sup>®</sup> ; NFD	17.43	3.79
150	pirimicarb; Pirimor <sup>®</sup> ; PF-062	18.72	2.88
151	ethion; Nialate <sup>®</sup>	20.55	0.95
152	dioxathion; Deloav <sup>®</sup> ; Hercules AC-528; EMT 22897	21.27	5.05
153	β endosulfan	21.79	3.31
154	methoxychlor; Marlate <sup>®</sup> ; DMDT	23.57	1.55
155	Endane <sup>®</sup>	25.68	4.00
156	BAY-39731	26.59	1.27
157	dinocap; Karathene <sup>®</sup> ; EMT 27727	33.39	2.87
158	Torak <sup>®</sup> ; Hercules 14503; EMT 27320; dialifor	34.45	1.30
159	dinoseb; Sinox <sup>®</sup> PE; DNEP; alkanolemine salt	36.26	4.93

160	Plictran <sup>®</sup> ; Dowco 213; EMT 27395; M-3180	38.19	4.92
161	Dilan <sup>®</sup> ; CS-708	40.49	1.70
162	R-23233	40.59	4.23
163	siram; Zerlate <sup>®</sup>	46.65	2.12
164	EP-334-HCl	46.75	1.98
165	dinobuton; Acrex <sup>®</sup> ; Dessin <sup>®</sup> ; UC-19786; EMT 27244	48.42	5.90
166	toxaphene	50.40	1.87
167	EP-417	51.46	3.18
168	EP-418	52.82	3.46
169	trichlorfon; Dylor <sup>®</sup> ; Dipterax <sup>®</sup> ; EMT 19763	59.83	2.81
170	GC-3582	60.43	4.92
171	GC-10435	62.80	9.45
172	PPG-124	65.87	2.40
173	oxythioquinox; Morestan <sup>®</sup> ; BAY-36205; EMT 25606	66.47	1.36
174	SYLOID <sup>®</sup> 244 - Grade 68; SC-68	67.08	2.18
175	thiram; Arasan <sup>®</sup> ; Teraan <sup>®</sup> 75; Thylate <sup>®</sup>	73.72	1.18
176	calcium arsenate	78.56	4.10
177	Dri-Die <sup>®</sup> ; SYLOID <sup>®</sup> 255-Grade 255; SC-67	96.69	4.40
178	GC-8993; EMT 25207	96.69	1.37
179	RH-2300	97.89	1.90
180	GC-9832; 4FK	98.00	2.68
181	SYLOID <sup>®</sup> 378-Grade 78; SC-78	108	3.18

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182	monuron; OMU; Telvar <sup>®</sup>	110	0.78
183	Erader <sup>®</sup> ; BAY-30686; chinochionat	121	1.14
184	dicofol; Kelthane <sup>®</sup> ; FW-293	145	1.52
185	Rhothane <sup>®</sup> ; DDD; TDE; EMT 4225	161	0.98
186	SYLOID <sup>®</sup> 308-Grade 77; SC-77	163	2.65
187	Q-128	179	0.75
188	BAY-58733; EMT 27323	198	2.18
189	nitrofen; TOK <sup>®</sup> ; FW-925	275	3.08
190	propachlor; Ramrod <sup>®</sup> ; CP-31393	311	2.81
191	Polyram <sup>®</sup> ; EMT 26711	437	1.53
192	fenosan; Murvesaco <sup>®</sup> ; TriFenson <sup>®</sup> ; GC-928	483	0.07
193	molasses (feed grade)	494	4.79
194	propham; Chem-Hoe <sup>®</sup> ; IPC	604	0.96
195	HI-811-233	616	2.47
196	SYLOID <sup>®</sup> 74-Grade 74; SC-74	880	0.99
197	ryania	977	1.26
198	sulfur	1,051	1.38
199	chlorobenzilate; Acaraben <sup>®</sup> ; Geigy 338; G-23992	1,849	1.01
200	dinitrocyclohexylbenzol; Diner <sup>®</sup> ; DN-111; DNOCHP	2,175	0.45
201	SYLOID <sup>®</sup> 63-Grade 63; SC-63	3,625	0.91
202	SD-14114; Vender; Miticide; EMT 27738	3,982	0.57
203	GC-6936	10,031	0.63

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TABLE 2. Pesticides Not Toxic at 11 Micrograms per Honey Bee (or highest dosage tested) in the Laboratory at 48 Hours at 80°F (26.7°C) and 65 Percent Relative Humidity. Group III - Relatively Nontoxic to Honey Bees

Reference No.	Pesticide	% Mortality	ug/bee
204	allethrin; pyrethrins, synthetic; ENT 17510	6.00	0.314
205	Bacticid <sup>®</sup>	6.79	0.336 0.338
206	pyrethrum	11.00	0.63
207	rotenone; cube; darris	12.00	2.42
208	parinol; Farnon <sup>®</sup>	2.90	2.42
209	paraquat	2.74	6.04
210	dichloro; Phygou <sup>®</sup>	7.04	7.25
211	nicotine	3.00	8.70
212	dichlofluanid; Euparen <sup>®</sup> ; BAY-67531	3.91	9.06
213	Alamine 21, primary amine; AL-21	2.38	9.06
214	Armeen L-15; ARL-15	2.38	9.06
215	Alamine 11, primary amine; AL-11	0	9.06
216	Alamine 15, primary amine; AL-15; Tall oil	0	9.06
217	Alequat 221, tertiary amine; ALQ-221	0	9.06
218	Duomeen L-15; DL-15	0	9.06
219	methyl chlorobenzilate	1.09	9.67
220	Aramite <sup>®</sup>	26.00	12.00
221	ferbam; Fermate <sup>®</sup>	10.61	12.09
222	Vegedex <sup>®</sup> ; CDEC	10.03	12.09
223	folpet; Phaltan <sup>®</sup>	8.97	12.09
224	DDT antiresistant; WARF antiresistant for DDT; GC-6768	7.79	12.09

225	ethphon; Ethrel <sup>®</sup> ; Compd. 68-240	7.00	12.09
226	marphos; Folax <sup>®</sup>	6.14	12.09
227	Eptam <sup>®</sup> ; EPTC	5.91	12.09
228	TD-71	5.85	12.09
229	nabam; Parzate <sup>®</sup>	5.71	12.09
230	glyodin; Glyoxide <sup>®</sup>	5.08	12.09
231	Randox <sup>®</sup> ; CDAA	4.73	12.09
232	Triton X-100 <sup>®</sup>	4.51	12.09
233	Benzac <sup>®</sup> ; Trysben <sup>®</sup> ; 2,3,6-TBA	4.36	12.09
234	amitrole; Weedazol <sup>®</sup> ; Cytrol <sup>®</sup> ; ATA	4.10	12.09
235	cuprous oxide	3.52	12.09
236	maneb; Manzate <sup>®</sup>	2.98	12.09
237	Triton B-1956	2.80	12.09
238	dodine; Cyprex <sup>®</sup>	2.45	12.09
239	BIO-908; Compd. 908A; NLA-908	2.17	12.09
240	pictoram; Tordon <sup>®</sup> 22K	7.40	14.50
241	benefin; Balan <sup>®</sup>	7.10	14.50
242	copper oxychloride sulfate; C-O-C-S	7.00	14.50
243	BAY-28589	6.83	14.50
244	barban; Carbyne <sup>®</sup>	5.60	14.50
245	2,4-DB (dimethylamine salt); Bacysa <sup>®</sup> -118; 4-(2,4-DB)	3.97	14.50
246	cyproimid; Clobbat <sup>®</sup> ; S-6000	2.90	14.50
247	amiben (ammonium salt); Amiben <sup>®</sup> ; chloramben	2.80	14.50
248	benzadon; Topcide <sup>®</sup> ; S-6173	2.40	14.50
249	bromoxynil; Brominil <sup>®</sup> ; Bucril <sup>®</sup>	2.00	14.50
250	D-6	3.33	16.92

251	erbon; Baron <sup>®</sup> ; Movou <sup>®</sup>	6.60	18.13
252	2,4-D (low volatile oil soluble form); Decamine <sup>®</sup>	6.44	18.13
253	AC-94556	6.20	18.13
254	chlorbenside; Chloroperacide <sup>®</sup> ; Mitox <sup>®</sup> ; ENT 20696	2.00	18.13
255	Omite <sup>®</sup> ; Comite <sup>®</sup> ; DO-14; ENT 27226	1.85	18.13
256	mecoprop; MCPP; CHPP; 2-MCPP	1.67	18.13
257	D-048 (analogue of Aramite <sup>®</sup> )	0	18.13
258	U-36059; ENT 27967	9.94	21.15
259	EP-2929	1.28	21.70
260	ozadiazon; Ronstar <sup>®</sup> ; EP-17623	1.28	21.70
261	Acarol <sup>®</sup> ; GS-19851; ENT 27552	5.50	24.00
262	Dimite <sup>®</sup> ; DMC; chlorfenethol	4.95	24.03
263	GC-2066	22.87	24.17
264	GC-2131	13.66	24.17
265	trifluralin; Treflan <sup>®</sup>	12.85	24.17
266	seasin; Sasin <sup>®</sup> ; 2,4-DEB	7.46	24.17
267	Nylone <sup>®</sup> ; DNTT	6.25	24.17
268	Ansar <sup>®</sup> 170; Deaconate <sup>®</sup> ; NSMA	6.17	24.17
269	dalapon; Doupon <sup>®</sup> ; Radapon <sup>®</sup>	4.58	24.17
270	2,4-D (sodium salt)	3.70	24.17
271	Indopol <sup>®</sup> Polybutene M-300	3.70	24.17
272	propanil; DPA; Rogue <sup>®</sup> ; Stam <sup>®</sup> F-34; BAY 30130	3.69	24.17
273	Weedar <sup>®</sup> ; MCPA; Dow MCP amine weed killer	3.62	24.17
274	DEP <sup>®</sup>	2.99	24.17

275	sesone; Seson <sup>®</sup> ; SES	2.00	24.17
276	2,4,5-T	1.93	24.17
277	C-940; UHI-C940	1.62	24.17
278	bensulide; Betasam <sup>®</sup> ; Prufar <sup>®</sup> ; R-4461	1.60	24.17
279	chloropropylate; Acaralate <sup>®</sup> ; G-24163; ENT 26999	1.60	24.17
280	Glytar <sup>®</sup>	0.85	24.17
281	GS-13798	0.79	24.17
282	stilikil	0	24.17
283	butylate; Sutar <sup>®</sup> ; R-1910	14.95	26.01
284	DOE, E,E' isomer	16.81	26.59
285	DOT, E,E' isomer	16.43	26.59
286	DOE, E,E' isomer	15.00	26.59
287	pabulate; PEBC; Tillam <sup>®</sup> ; R 2061	13.18	29.01
288	NLA-10656	11.97	29.01
289	vernolate; Vernam <sup>®</sup> ; R-1607	10.89	29.01
290	molinate; Ordram <sup>®</sup> ; R-4572	10.32	29.01
291	cycloate; Ro-Beet <sup>®</sup> ; R-2063	7.04	29.01
292	UC-21426	8.58	30.22
293	UC-21427	5.70	30.22
294	Aroclor <sup>®</sup> 1221	2.50	30.22
295	Aroclor <sup>®</sup> 1248; ENT 8078	1.24	30.22
296	Aroclor <sup>®</sup> 1254	1.24	30.22
297	Aroclor <sup>®</sup> 1260	1.20	30.22
298	Aroclor <sup>®</sup> 1232	0	30.22
299	Aroclor <sup>®</sup> 1242	0	30.22
300	IPC + PFC - 124 @ 4:1	11.30	32.26 9.10

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301	chlorpropham; CIPC; Chloro IPC; FURLOC <sup>®</sup>	4.90	36.26	325	BAY-78175	6.04	60.43
302	CIPC + PFG - 124 @ 4:1	4.50	<u>36.26</u> 9.10	326	naphtha; Espesol 300 <sup>®</sup> ; Herbitox <sup>®</sup>	4.53	60.43
303	maleic hydrazide; MH-30 <sup>®</sup>	4.32	36.26	327	NaTCA (inhibited); Sodium TCA	3.70	60.43
304	HCCPT	2.59	36.26	328	ethyl formate	2.59	60.43
305	dimethyl sulfoxide; DMSO	2.47	36.26	329	Amate <sup>®</sup> X; AMS	2.90	60.43
306	methan; SMDC; VPH <sup>®</sup> ; Vapan <sup>®</sup>	2.40	36.26	330	Frucote <sup>®</sup> ; Tutane <sup>®</sup>	2.50	60.43
307	Kuron <sup>®</sup> ; 2(2,4,5-TP); silvax acid, PGSE ester	2.10	36.26	331	Sencor <sup>®</sup> ; BAY-94337	2.82	60.00
308	diallate; Avader <sup>®</sup> ; DATC; CP-15366	2.00	36.26	332	dicamba; Banvel D <sup>®</sup>	2.58	90.65
309	Pipron <sup>®</sup>	2.00	36.26	333	prometryne; Caporal <sup>®</sup> ; G-34161	10.36	96.69
310	triallate; Avader M <sup>®</sup> ; DATC-MW	1.82	36.26	334	captafol; folcid; Difolatan <sup>®</sup> ; RE-5865	8.91	96.69
311	asulam; Asulox <sup>®</sup> 60; M&B 9057	1.28	36.26	335	slmazine; Princep <sup>®</sup>	6.52	96.69
312	Polysorbate 80 <sup>®</sup> ; Tween 80 <sup>®</sup>	0.86	36.26	336	ametryne; atrametryne; Ametryne <sup>®</sup> ; Evik <sup>®</sup> GS-34162	6.49	96.69
313	alachlor; Lasso <sup>®</sup> ; CP-50144	0.41	36.26	337	atrazine; AAttrax <sup>®</sup> ; Atracol <sup>®</sup> ; G-30027	4.79	96.69
314	UNI-K840	2.56	45.30	338	SUNITOL <sup>®</sup> ; GS-14254	4.55	96.69
315	SN-38107; EP-475	9.68	48.34	339	nores; Herban <sup>®</sup>	3.09	96.69
316	FLIT <sup>®</sup> MLO; BPRL-3855-2	9.52	48.34	340	propazine; Milogard <sup>®</sup>	2.47	96.69
317	MBC	8.34	48.34	341	Hexagon <sup>®</sup> ; Fumazone <sup>®</sup>	13.00	100.00
318	BPRL-5337-2	7.61	48.34	342	Dezon <sup>®</sup> ; BAY-22555	40.46	102.00
319	polyisobutylene	7.34	48.34	343	naptalam; Alanap <sup>®</sup> ; NPA	0.41	113.20
320	polyisobutylene; Polytrap <sup>®</sup>	5.60	48.34	344	fentin hydroxide; TPTH; DuTe <sup>®</sup>	12.70	114.82
321	TCA, acid	4.18	48.34	345	chlordimeform; chlorphenamidine; Fundal <sup>®</sup> ; Galecro <sup>®</sup> ; EMT 27567; EMT 27335; EP-333; C-8514	8.49	114.82
322	pentachlorophenol; PCP; Dowcide <sup>®</sup> 7 Flake tech Dowcide <sup>®</sup> C sodium salt	2.55 2.16	48.34 48.34	346	PREP <sup>®</sup> ; UC-20299	3.80	114.82
323	NIA-10637	0.85	48.34	347	Dyrone <sup>®</sup> ; Kamate <sup>®</sup> ; B-622	4.27	117.23
324	dichloropropene; Telone <sup>®</sup>	6.58	60.43	348	benzoyl; Benlate <sup>®</sup> ; F-1991	8.16	120.86
				349	Maloran <sup>®</sup> ; C-6313	7.25	120.86
				350	limuron; Lorox <sup>®</sup>	6.47	120.86

351	metobromuron; Factoran <sup>®</sup> ; C-3126	5.59	120.86	377	bromacil; Hyvat <sup>®</sup> X	1.20	193.38
352	fluorodifen; Proforan <sup>®</sup> ; C-6989	5.40	120.86	378	Alar <sup>®</sup>	5.80	205.46
353	siduron; Tupersan <sup>®</sup>	5.30	120.86	379	captan; Merpan <sup>®</sup> ; Orthocida <sup>®</sup> 406; EMT 26538	9.86	215.00
354	GC-10379	4.58	120.86	380	methar; DEMA; Anaar <sup>®</sup> 184	9.80	217.55
355	chloroxuron; Tenoran <sup>®</sup>	4.50	120.86	381	tetradifon; Tedion <sup>®</sup>	4.33	217.55
356	ovax; Ovatan <sup>®</sup> ; K-6451	3.17	120.86	382	cryolite	1.45	217.55
357	dichlobenil; Casaron <sup>®</sup>	3.09	120.86	383	Decthal <sup>®</sup> -T; DAC 893; DCPA	3.18	229.63
358	Treflan <sup>®</sup> (-trifluralin, 50% + diphenamid, 3.12)	2.70	120.86	384	GS-16068; Sancap <sup>®</sup>	6.20	235.68
359	diuron; Karmax <sup>®</sup>	2.77	145.03	385	terbutryn; Igram <sup>®</sup> ; GS-14260	2.90	236.40
360	cacodylic acid; Phycar <sup>®</sup> 138	5.60	157.12	386	Can-Trol <sup>®</sup> ; Thistrol <sup>®</sup> ; MCPB (sodium salt)	4.00	237.37
361	Dikar <sup>®</sup> (-Dithane <sup>®</sup> M-45, 74% + Karthane <sup>®</sup> , 6%)	14.59	<u>178.87</u> 14.50	387	diatomaceous earth	18.33	241.72
362	chlorothalonil; Daconil <sup>®</sup> 2787; Bravo <sup>®</sup>	14.28	181.29	388	Friamite MX	12.11	241.72
363	nitralin; Planavin <sup>®</sup> ; SD-11831	6.80	181.29	389	calcium carbonate	8.22	241.72
364	Plantvax <sup>®</sup> ; F-441	5.90	181.29	390	diphenamid; Dymid <sup>®</sup> ; Enide <sup>®</sup>	7.29	241.72
365	dicloran; Botran <sup>®</sup> ; DCMA; ditranil; Allisan <sup>®</sup>	5.52	181.29	391	phemedipham; Betanai <sup>®</sup> ; EP-452; S-4075	2.95	241.72
366	Kerb <sup>®</sup> ; RH-315	4.90	181.29	392	olancha clay	2.02	241.72
367	methazole; Probe <sup>®</sup> ; VCS-438	3.79	181.29	393	VIRROW/ <sup>®</sup> ; Heliothis virus	0.58	241.72
368	dithlanon; Thynon <sup>®</sup> ; Delan <sup>®</sup>	3.09	181.29	394	silkkil (heavy)	0.49	241.72
369	carboxin; Vitavax <sup>®</sup> ; D-735	2.00	181.29	395	Attaclay <sup>®</sup>	0.43	241.72
370	karbutylate; Tandex <sup>®</sup> ; NIA-11092	8.50	193.38	396	fenoprop; silvax acid(tech.); 2(2,4,5-TP)	0.41	241.72
371	fluometuron; Cotoran <sup>®</sup>	3.80	193.38	397	cycloheximide; ACTI-AID <sup>®</sup> ; Actidione <sup>®</sup>	0	241.72
372	Dithane <sup>®</sup> M-45	3.70	193.38	398	pyrophyllite, Pyrol <sup>®</sup>	1.28	362.60
373	pyrazon; Pyramin <sup>®</sup> ; PCA	3.30	193.38	399	<u>Bacillus thuringiensis</u> Berliner; Thuricide <sup>®</sup> ; Biotrol <sup>®</sup> non-toxic @ 726,000 spores/bee		
374	terbacil; Sinbar <sup>®</sup>	2.40	193.38				
375	cyanazine; Bladex <sup>®</sup> ; SD-15418	2.11	193.38				
376	terbutol; AZAR <sup>®</sup> ; Hercules 9573	1.66	193.38				