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The Acute Oral Toxicity of 369 Pesticidal, Pharmaceutical and Other Chemicals to Wild Birds

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The Acute Oral Toxicity of 369 Pesticidal, Pharmaceutical and Other Chemicals to Wild Birds. SCHAFER, EDWARD W. (1972). *Toxicol. Appl. Pharmacol.* **21**, 315–330. The acute po toxicity of 369 chemicals was determined for 1 or more species of wild birds, always including either red-winged blackbirds or starlings. Of these, 180 chemicals were toxic to 1 or more species at 100 mg/kg or less. Statistical comparison of redwing, starling and rat data indicated that redwings were more sensitive to chemicals than starlings, and both were more sensitive than rats.

Since 1960 personnel of the Wildlife Research Center at Denver, Colorado, have tested 369 chemicals for acute po toxicity to 1 or more species of wild birds in a program designed to evaluate chemicals as potential avian toxicants, stupefacients or repellents. The purpose of this paper is to make these data available.

METHODS

The chemicals tested included pesticidal, pharmaceutical and other commercial or experimental compounds that were either purchased or solicited from cooperating firms. They have been alphabetically arranged in the tables according to commonly accepted trade, coined, product or chemical nomenclature.

Wild-trapped birds preconditioned to captivity for 2–6 wk were usually dosed by gavage with solutions or suspensions of the test chemical in propylene glycol, according to methods described by DeCino *et al.* (1966) and Shafer *et al.* (1967). Other dosing methods occasionally used are noted in the tables. LD50 values were calculated by the method of Thompson (1948), Thompson and Weil (1952) and Weil (1952). If LD50 values for rats (*Rattus norvegicus*) were available, they were provided by the cooperators.

RESULTS AND DISCUSSION

Of the 369 chemicals tested, 180 were toxic to red-winged blackbirds (*Agelaius phoeniceus*) or starlings (*Sturnus vulgaris*) at doses of 100 mg/kg or less (Table 1). The other 189 compounds were not toxic to either species at this dose (Table 2). An analysis was made of the comparative toxicity to rats, redwings and starlings of the 61 chemicals for which all 3 LD50 values were available (none of these compounds was solicited for

TABLE 1

ACUTE PO LD50 VALUES OF CHEMICAL COMPOUNDS TOXIC TO RED-WINGED BLACKBIRDS OR STARLINGS AT 100 MG/KG OR LESS

Chemical No.	American Chemical Society Name (common or other identification[a])	Starling LD50 (mg/kg)	Starling 95% CL (mg/kg)	Redwing LD50 (mg/kg)	Redwing 95% CL (mg/kg)	Rat LD50 (mg/kg)
1.	Acetanilide, 4′-(3,3-dimethyl-1-triazeno) Abate)	75	32–178	56	32–100	510
2.	Acetimidothioic acid, methyl-, *N*-(methylcarbamoyl) ester (Lannate)	42	—	10	5.6–18	20
3.	*p*-Acetotoluidide, 3-chloro	1.3	—	1.8	1.0–3.2	—
4.	Aniline, 4-chloro	1000	562–1870	100	56–178	—
5.	Aniline, 4-chloro-2,5-dimethoxy	>100	—	100	56–178	—
6.	Aniline, 4-chloro-3-nitro	>100	—	100	56–178	—
7.	Aniline, 2,5-dimethoxy	100	56–178	>100	—	—
8.	Aniline, 3-fluoro	>100	—	56	32–100	—
9.	Aniline, 4-fluoro	>100	—	100	56–178	—
10.	Aniline, 4-iodo	>100	—	100	56–178	—
11.	Aniline, 4-nitro	>100	—	75	—	—
12.	Barbituric acid, 5-allyl-5-*sec*-butyl (Talbutal)	>100	—	75	—	57.5
13.	Barbituric acid, 5-allyl-5-isobutyl (Sandoptal)	>100	—	100	56–178	—
14.	Barbituric acid, 5-allyl-5-(1-methylbutyl) sodium salt (Secobarbital)	>100	—	75	—	125
15.	Barbituric acid, 5-ethyl-5-isopropyl- (Probarbital)	100	56–178	42	—	—
16.	Barbituric acid, 5-ethyl-5-(methylbutyl) sodium salt (Pentobarbital)	>100	—	75	56–100	118
17.	Benzene, 5-chloro-nitro-2,4-dimethoxy	>100	—	100	56–178	—
18.	Benzenediazosulfonic acid, *p*-(dimethylamino) sodium salt (Dexon)	18[b]	10–32	18[b]	10–32	60
19.	Benzene, 1,3-dinitro	>100	—	42	—	—
20.	Benzene, sulfonic acid	75	42–133	>100	—	—
21.	Benzenethiol (Thiophenol)	32	18–56	24	—	—
22.	Benzene, 1,2,4-trichloro-5-nitro	>100[b]	—	100[b]	56–178	—
23.	2,5-Benzodiazocine, 1-(*p*-chlorophenyl)-1,2,3,4,5,6-hexahydro dihydrochloride (WY 5244)	>100	—	100	—	—
24.	1,4-Benzodioxan, 2-(butylaminomethyl)-8-ethoxy (Ethoxomane)	>100	—	100	—	348
25.	2,4-Benzodioxepin, 6,7,8,9,10,10-hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-3-methyl- (Bay 38920)	50[b]	28–89	>28[c]	—	—

26. Benzoic acid, *p*-amino, ethyl ester (Benzocaine)	>316	—	56	—	—
27. Benzoic acid, 4-chloro-3-nitro	>100	—	75	—	—
28. 2*H*-Benzo[*a*]quinolizine-3-carboximide, *N*,*N*-diethyl-1,3,4,6,7,11b-hexahydro-2-hydroxy-9,10-dimethoxy-, acetate (ester) (Benzquinamide)	>100	—	100	56-178	—
29. Benzyl alcohol	>100	—	100	56-178	3100
30. *o*,*o*-Biphenol, 3,3′-dichloro-5,5′dinitro- (Bay 9015)	13	5.6-32	13	5.6-32	10
31. 2,3-Butanediol, 2-(*p*-chlorophenyl)-3-methyl- (Phenaglycodol)	>100	—	32	—	832
32. Carbamic acid, 2-*sec*-butyl-, 2-methyltrimethylene ester (Mebutamate)	>100	—	100	56-178	—
33. Carbamic acid, dimethyl-, 1-isopropyl-3-methylpyrazol-5-yl ester (Isolan)	8.6[c]	—	—	—	54
34. Carbamic acid, dimethyl, 3-methyl-1-phenylpyrazole-5-yl ester (Pyrolan)	39	—	—	—	62
35. Carbamic acid, dipropylthio,- 5-ethyl ester (Eptam)	>100	—	100	56-178	1630
36. Carbamic acid, ethyl-, 4-nitrophenyl ester	>100	—	75	—	—
37. Carbamic acid, methyl-, 1-(butylcarbamoyl)-2-benzimidazole ester (Fungicide 1991)	>100	—	100	56-178	>9590
38. Carbamic acid, methyl-, 3-*sec*-butyl-6-chloro phenyl ester (RE 5655)	5.6	3.2-10	2.4	—	100
39. Carbamic acid, methyl-, *m*-*sec*-butylphenyl ester (RE 5305)	5.6	—	4.6	—	20
40. Carbamic acid, methyl-, 2-chloro-5-*tert*-pentyl phenyl ester (RE 5454)	16	9–28	9.0	—	75
41. Carbamic acid, methyl-, 2-chloro-4,5-xylyl ester (Banol)	11.5	8.5–15.5	2.4	—	56
42. Carbamic acid, methyl-, *m*-cumenyl ester (AC 5727)	17	—	3.2	—	29
43. Carbamic acid, methyl-, 4-(diallylamino)-3,5-xylyl ester (Bay 50282)	13	5.6-32	13	10–18	89
44. Carbamic acid, methyl-, 2,4-dichloro-5-ethyl-*m*-tolyl ester (U 17556)	>100	—	13	—	>210
45. Carbamic acid, methyl-, 3,5-diisopropyl phenyl ester (HRS 1422)	>100	—	10	5.6-18	562
46. Carbamic acid, methyl-, 4-dimethylamino-*m*-tolyl ester (Matacil)	212	—	50	28–89	30
47. Carbamic acid, methyl-, 4-dimethylamino-3,5-xylyl ester (Zectran)	32	18–56	10	3.2–32	39
48. Carbamic acid, methyl-, *o*-isopropoxy phenyl ester (Aprocarb)	15[d]	—	3.8	1.7–5.2	99
49. Carbamic acid, methyl-, 4-(methylsulfinyl)-3,5-xylyl ester (Bay 41791)	—	—	42	—	—
50. Carbamic acid, methyl-, 4-(methylsulfonyl)-3,5-xylyl ester (Bay 41790)	—	—	1.8	1.0–3.2	—
51. Carbamic acid, methyl-, 4-methylthio-*m*-cumenyl ester (ACD 7029)	100	—	32	18–56	—

TABLE 1—*continued*

Chemical No.	American Chemical Society Name (common or other identification[a])	Starling LD50 (mg/kg)	Starling 95% CL (mg/kg)	Redwing LD50 (mg/kg)	Redwing 95% CL (mg/kg)	Rat LD50 (mg/kg)
52.	Carbamic acid, methyl-, 4-methylthio-*m*-tolyl ester (Bay 32651)	57[b]	28–100	67[b]	50–90	50
53.	Carbamic acid, methyl-, 4-(methylthio)-3,5-xylyl ester (Methiocarb)	13[d]	—	4.6	2.7–6.9	132
54.	Carbamic acid, methyl-, 1-naphthyl ester (Sevin)	—	—	56	32–100	600
55.	Carbamic acid, methyl-, *m*-(2-propynyloxy)phenyl ester (Hercules 8717)	150	47–470	15	4.7–47	150
56.	Carbamic acid, methyl-, *o*-(2-propynyloxy)phenyl ester (Hercules 9699)	45	—	45	—	80
57.	Carbamic acid, methyl-, 3-tolyl ester	>100	—	100	56–178	—
58.	Carbamic acid, methyl-, 2,3,4-trimethylphenyl ester (SD 8786)	>100	—	42	—	318
59.	Carbamic acid, methyl-, 3,4,5-trimethylphenyl ester (SD 8530)	>100	—	10	5.6–18	178
60.	Carbamic acid, methyl-, 3,5-xylyl ester	>100	—	75	—	—
61.	Cinchoninamide, 2-butoxy *N*-[2-(diethylamino)ethyl] hydrochloride (Dibucaine)	100	56–178	42	—	—
62.	Coumarin, 3-chloro-7-hydroxy-4-methyl, *O*-ester with *O,O*-diethyl phosphorothioate (Coumaphos)	32[b]	—	3.5[b]	—	125
63.	Crotonic acid, 3-hydroxy-, methyl ester dimethyl phosphate (Phosdrin)	3.9[c]	—	—	—	4
64.	Cyclohexane, 1,2,3,4,5,6-hexachloro (Lindane)	100	—	75	—	170
65.	Cyclopentane, 1,3-disulfonyl fluoride (Phillips 2133)	1.3	—	2.1	1.2–4.0	7.9
66.	Diethylaminoethyl chloride hydrochloride	100	56–178	42	24–75	—
67.	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-endo,endo- (Endrin)	2.4	—	2.4	—	10–12
68.	1,4:5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro- (Aldrin)	7.2	—	—	—	67
69.	1,4,5,8-Dimethanophthalazine, 5,6,7,8,9,9a-hexachloro-1,4,4a,5,8,8a-hexahydro-, 2 oxide (SD 3450)	—	—	<25	—	2.8
70.	Dipyrrolidine, 1,1′-(2-butynylene) (Tremorine)	>100	—	100	56–178	—
71.	α-*D*-Glucochloralose (α-Chloralose)	75	—	32	18–56	400

72. 3-Hydroxyglutaconic acid, dimethyl ester dimethyl phosphate (Bomyl)	9.5	3.0–30	0.95	0.30–3.0	32
73. Imidizole, 5-carboxylic acid-, 1-(α-methylbenzyl)-, methyl ester (Metomidate)	>100	—	56	32–100	—
74. Imidizole, 5-carboxylic acid-, 1-(α-methylbenzyl)-, methyl ester hydrochloride (Metomidate HCl)	178	—	100	56–178	—
75. 1-Indanamine, *N,N*-dimethyl-3-phenyl (Dimefadane)	>100	—	75	32–178	176
76. Ketone, 10-{3-[4-(2-hydroxyethyl)-1-piperazinyl]-propyl} phenothiazin-2-yl methyl dimaleate (Acetophenazine)	100	—	75	32–178	433
77. Lysergamide, *N,N*-diethyl- (Lysergide)	>32	—	1.8	—	—
78. Methyl sulfoxide	100	—	100	—	200
79. Micoluteina destacina	2.4	—	2.4	—	—
80. Naphthalimide, *N*-hydroxy-, *O,O*-diethyl phosphorothioate (Bay 22408)	500[b]	—	24	10–56	500
81. Norbornene-2,3-dimethanol, 1,4,5,6,7,7-hexachlorocyclic sulfite (Endosulfan)	35[c]	11–110	—	—	100
82. 4-Oxazolidinone, 2-imino-5-phenyl- (Pemoline)	>100	—	100	56–178	500
83. 1-Penten-4-yn-3-ol, 1-chloro-3-ethyl (Ethchlorovynol)	—	—	42	—	—
84. Phenethylamine, 3,4-dichloro, α-methyl (Lilly 21784)	>100	—	75	—	—
85. Phenol, 2-*sec*-butyl-4,6-dinitro (Dinoseb)	7.1[d]	—	—	—	37–60
86. Phenol, 2,4-dinitro	46	21–107	13	—	30
87. Phenothiazine-2-carbonitrile, 10-[3-(4-hydroxypiperidino)propyl] (Pericyazine)	1000	562–1780	100	56–178	395
88. Phenothiazine, (1)10-(3-dimethylamino-2-methylpropyl)-2-methoxy (Levopromazine)	>100	—	100	56–178	—
89. Phenoxyarsine, 10-chloro (DID 95)	—	—	100	56–178	>94
90. Phenoxyarsine, 10,10′-oxy bis (DID 47)	—	—	24	—	>94
91. Phosphonic acid, (2,2,2-trichloro-1-hydroxyethyl) dimethyl ester (Trichlorfon)	47[c]	—	40[c]	—	400
92. Phosphonodithioic acid, ethyl-, *O*-methyl *S*-(*p*-tolyl) (Bay 42903)	32	—	5.6	—	>75
93. Phosphonodithioic acid, ethyl-, 5-phenyl ester (Dyfonate)	42	—	10	5.6–18	—
94. Phosphonothioic acid, methyl-, *O*-ethyl *O*-naphthyloxime (Bay 39197)	500	—	18	10–32	250
95. Phosphonothioic acid, phenyl-, *O*-ethyl *O*-*p*-nitrophenyl ester (EPN)	7.5	—	3.2	1.8–5.6	50
96. Phosphoramidic acid, *sec*-butyl-, ethyl 2,4,5-trichlorophenyl ester (Dowco 211)	>100	—	75	32–178	—
97. Phosphoramidic acid, ethyl-, 2,4-dichlorophenyl ester (Dowco 161)	13	5.6–32	24	—	—

TABLE 1—*continued*

Chemical No.	American Chemical Society Name (common or other identification[a])	Starling LD50 (mg/kg)	Starling 95% CL (mgkg/)	Redwing LD50 (mg/kg)	Redwing 95% CL (mg/kg)	Rat LD50 (mg/kg)
98.	Phosphoramidic acid, ethyl-, ethyl 2,4,5-trichlorophenyl ester (Dowco 210)	>100	—	24	—	—
99.	Phosphoramidic acid, ethyl-, methyl 2,4,5-trichlorophenyl ester (Dowco 159)	>100	—	56	32–100	—
100.	Phosphoramidic acid, ethyl-, 2,4,5-trichlorophenyl ester (Dowco 160)	18	10–32	10	5.6–18	—
101.	Phosphoramidic acid, methyl-, 4-*tert*-butyl-2-chlorophenyl methyl ester (Ruelene)	>100	—	100	56–178	950
102.	Phosphoramidothioic acid, acetimidoyl-, *O,O*-bis(*p*-chlorophenyl) ester (Gophacide)	18	—	4.2	—	13
103.	Phosphoramidothioic acid, isopropyl-, *O*-2,4-dichlorophenyl *O*-methyl ester (Zytron)	>100	—	100	—	270–360
104.	Phosphoramidothioic acid, isopropyl, 2,4,5-trichlorophenyl ester (Dowco 133)	>100	—	7.5	3.2–18	31–63
105.	Phosphoramidothioic acid, methyl-, *O*-(*tert*-butyl-2-chlorophenyl) ester (Narlene)	—	—	75	50–112	820
106.	Phosphoramidothioic acid, methyl-, *O*-ethyl *O*(4-methylthio-*m*-tolyl ester (Bay 34042)	1.8	—	<0.32	—	5
107.	Phosphoramidothioic acid, methyl-, isopropyl ester (Dowco 177)	>100	—	100	—	800
108.	Phosphoric acid, 2-chloro-1-(2,4-dichlorophenyl) vinyl ester (GS 4072)	3.2	—	10	—	13
109.	Phosphoric acid, 2-chloro-1-(2,4,5-trichlorophenyl) vinyl dimethyl ester (SD 8447)	>100	—	100	56–178	5000
110.	Phosphoric acid, 2,2-dichlorovinyl dimethyl ester (DDVP)	12	—	17	—	70
111.	Phosphoric acid, diethyl-, 2-ethylthio-1-*p*-chlorophenyl vinyl ester (GC 4276)	178	100–316	10	3.2–32	—
112.	Phosphoric acid, diethyl-, 5(or 3)-methylpyrazole-3(or 5)-yl ester (Pyrazoxone)	40	—	—	—	—
113.	Phosphoric acid, dimethyl-, ester with 2-chloro-*N,N*-diethyl-3-hydroxycrotonamide (Phosphamidon)	5.6	—	1.8	—	17

114. Phosphoric acid, dimethyl ester with 3-hydro-*N*-methyl crotonimide (E-) (Azodrin)	3.3[c]	1.9–6.0	1.0	0.56–1 8	23
115. Phosphoric acid, dimethyl ester with *cis*-3-hydroxy-*N*,*N*-dimethyl crotonamide (Bidrin)	2.7[c]	0.85–8.5	1.6[c]	0.5–5.0	22
116. Phosphoric acid, dimethyl ester with *N*-hydroxynaphthalimide (Bay 9002)	>100	—	2.4	1.3–4.2	70–75
117. Phosphoric acid, dimethyl-, methyl thiophenyl ester (GC 6506)	0.56	—	0.56	—	7
118. Phosphoric acid, dimethyl-, 2,4,5-trichlorophenyl ester (Dowco 101)	>100	—	18	10–32	—
119. Phosphorodiamidic acid, *N*,*N*-dimethyl phenyl ester (Dowco 169)	75	—	13	5.6–32	—
120. Phosphorodithioic acid, *S*-{[(*p*-chlorophenyl)thio]methyl} *O*,*O*-diethyl ester (Carbophenothion)	5.6	3.2–10	7.5	—	24
121. Phosphorodithioic acid, *S*-{[(*p*-chlorophenyl)thio]methyl} *O*,*O*-dimethyl ester (Methyl trithion)	> 78	—	18	5.6–56	200
122. Phosphorodithioic acid, *O*,*O*-diethyl *S*-[2-(ethylthio)ethyl] ester (Disulfoton)	>32	—	3.2	1.8–5 6	10
123. Phosphorodithioic acid, *O*,*O*-diethyl *S*-[(ethylthio)methyl] ester (Phorate)	7.5	—	1.0	0.56–1 8	3.7
124. Phosphorodithioic acid, *O*,*O*-diethyl *S*-9-thiabicyclo[3.3.1]non-6-en-2-yl ester (HRS 1635)	>100	—	75	—	140
125. Phosphorodithioic acid, *O*,*O*-dimethyl ester, *S* ester with *N*-methyl acetamide (Dimethoate)	32	25–41	6.6	3.6–12	250
126. Phosphorodithioic acid, *O*,*O*-dimethyl-, *S*-ester with 3-(mercapto-methyl)-1,2,3-benzotriazin-4(3*H*)-one (Guthion)	27	15–48	8.5	—	13
127. Phosphorodithioic acid, *O*,*O*-dimethyl-, *S*-ester with *N*-(mercapto-methyl)phthalimide (Imidan)	>100	—	18	10–32	216
128. Phosphorodithioic acid, *O*,*O*,*O*′,*O*′-tetraethyl-, *S*,*S*′-methylene ester (Ethion)	>304	—	45	—	96
129. Phosphorothioic acid, *O*-2,4-dichlorophenyl *O*,*O*-diethyl ester (VC 13)	80	25–250	14	—	270
130. Phosphorothioic acid, *O*,*O*-diethyl *O*-[2-(ethylthio)ethyl]ester mixture with *O*,*O*-diethyl *S*-[2-(ethylthio)ethyl] ester (Demeton)	22[b]	—	—	—	1.7–7.5
131. Phosphorothioic acid, *O*,*O*-diethyl *O*-(2-isopropyl-6-methyl 4-pyrimidinyl) ester (Diazinon)	110	60–200	2.0	—	150–220
132. Phosphorothioic acid, *O*,*O*-diethyl *O*-[*p*-(methylsulfinyl)phenyl] ester (Bay 25141)	0.56	0.32–1.0	0.24	—	5

TABLE 1—*continued*

Chemical No.	American Chemical Society Name (common or other identification[a])	Starling LD50 (mg/kg)	Starling 95% CL (mg/kg)	Redwing LD50 (mg/kg)	Redwing 95% CL (mg/kg)	Rat LD50 (mg/kg)
133.	Phosphorothioic acid, *O,O*-diethyl *O*-[4-(methylthio)3,5-xylyl] ester (Bay 9017)	>100	—	4.2	—	375
134.	Phosphorothioic acid, *O,O*-diethyl *O*-*p*-nitrophenyl ester (Parathion)	5.6	0.76–40	2.4	—	5
135.	Phosphorothioic acid, *O,O*-diethyl *S*-phenylglyoxylonitrile, oxime (Bay 79808)	—	—	3.2	1.0–10	>1000
136.	Phosphorothioic acid, *O,O*-diethyl *O*-(3,5,6-trichloro-2-pyridyl) ester (Dursban)	5.0	—	13	—	145
137.	Phosphorothioic acid, *O,O*-dimethyl-, *O*-ester with *p*-hydroxy-*N,N*-dimethylbenzenesulfonamide (Famphos)	4.2	1.9–9.5	1.8	1.0–3.2	35
138.	Phosphorothioic acid, *O,O*-dimethyl-, *O*-[4-methylthio)-*m*-tolyl] ester (Fenthion)	5.3[d]	3.0–9.5	1.8	1.0–3.2	215–245
139.	Phosphorothioic acid, *O,O*-dimethyl *O*-[4-(methylthio)-3,5-xylyl] ester (Bay 37342)	>500	—	10	3.2–32	1000
140.	Phosphorothioic acid, *O,O*-dimethyl *O*-*p*-nitrophenyl ester (Methylparathion)	7.5	—	10	5.6–18	15
141.	Phosphorothioic acid, *O,O*-dimethyl *O*-4-nitro-*m*-tolyl ester (Sumithion)	—	—	25	8–80	250
142.	Phosphorothioic acid, *O,O*-dimethyl *O*(2,4,5-trichlorophenyl) ester (Ronnel)	375[d]	158–890	80	65–103	1740
143.	Phosphorothioic acid, *O,O*-dimethyl *O*-(3,5,6-trichloro-2-pyridyl) ester (Dowco 217)	56	32–100	13	—	—
144.	Phosphorothioic acid, ethyl-, *O*-ethyl *O*-(2,4,5-trichlorophenyl) ester (Bay 37289)	110	35–350	1.6	—	35
145.	Phosphorothioic acid, *O*-ethyl *S*-*p*-tolyl ester (Bay 38156)	5.0	—	1.6	—	50
146.	Phosphorothioic acid, *O,O′*-(sulfonyldi-*p*-phenylene) *O,O,O′,O′*-tetramethyl ester (Abate)	>100	—	42	—	2000
147.	3-Picoline, 4-amino- (Phillips 1908)	3.2	1.8–5.6	2.4	—	446

148. 1-Piperazineethanol, 4-[3-(2-chlorophenothiazin-10-yl)propyl]- (Perphenazine)	100	—	32	—	318
149. Piperidine, 1-(1-phenylcyclohexyl) hydrochloride (Phencyclidine)	237	—	42	—	—
150. 1,3-Propanediol, 2,2-bis(chloromethyl) sulfate (Phillips 2605)	18	10–32	2.4	—	20
151. 1,Propanol, 3-(dibutylamino)-*p*-aminobenzoate sulfate (Butacaine)	>100	—	100	56–178	—
152. Pyridine, 4-acetamido (Phillips 2038)	13	—	42	—	446
153. Pyridine, 4-amino (Phillips 1861)	4.9	3.6–6.6	2.4	1.5–3.8	21
154. Pyridine, 4-amino *N*-oxide (Phillips 1863)	—	—	85[c]	—	75
155. Pyridine, 4-benzyl	>100	—	18	3.2–100	—
156. Pyridine, 2-*p*-chloro-α-[2-(dimethylamino)ethyl] benzyl maleate (Chlorpheniramine)	>100	—	75	42–133	—
157. 2-Pyrimidinephosphorothioic acid, 3-bromo-5,7-dimethyl pyrazolyl-, *O*,*O*-diethyl ester (Bay 75546)	>100	—	2.4	—	>2000
158. 2-Pyrimidinephosphorothioic acid, 3-chloro-5,7-dimethyl pyrazolyl-, *O*,*O*-diethyl ester (Bay 79845)	7.5	—	3.2	1.8–5.6	>2500
159. Pyrophosphoramide, octamethyl (OMPA)	11[c]	—	—	—	25
160. Pyrroldine, 1-methyl-2-(3-pyridyl)-SO_4 (Nicotine)	>100	—	75	—	55
161. Pyrophosphoric acid, tetraethyl ester	1.3	—	—	—	1.12
162. Pyrophosphorodithioic acid, tetraethyl ester	100	—	<100	—	—
163. 2-Quinolinecarboxylic acid (Quinaldic acid)	>100	—	100	56–178	—
164. Reserpine	—	—	100	56–178	—
165. Strychnine sulfate	<5.0	—	—	—	5
166. Tallow, 1,5-propylene diamine derivative (GC 5942)	100	—	>100	—	1500
167. Thallium sulfate	35[c]	—	—	—	25
168. Thiosemicarbazide	9.1[c]	—	—	—	19
169. *p*-Toluene sulfonamide	75	32–180	75	—	—
170. *p*-Toluidine	42	24–75	57	22–157	—
171. *p*-Toluidine, 3-bromo-	7.5[b]	—	1.9	—	>1000
172. *p*-Toluidine, 3-chloro-	3.2	—	2.4	—	1500
173. *p*-Toluidine, 3-chloro-, hydrochloride	3.76	3.10–4.55	2.4	—	1500
174. *p*-Toluidine, 2-fluoro-	100	—	>100	—	—
175. *p*-Toluidine, 3-fluoro-	1.3	—	1.8	1.0–3.2	—
176. *p*-Toluidine, 3-iodo-	24	10–56	2.4	1.0–5.6	>1000
177. *p*-Toluidine, 3-nitro	32	18–56	3.2	1.8–5.6	—
178. 3,4-Xylidine	10	5.6–18	5.6	3.2–10	—
179. Zinc bis(dimethyldithiocarbamate) (Ziram)	—	—	100	56–178	1400
180. Zinc bis (dimethyldithiocarbamate)cyclohexylamine complex (Ziram cyclohexylamine complex)	—	—	32	18–56	1400

[a] Reference to trade names does not imply endorsement of commercial products by the Federal Government.
[b] Administered in a prepared pellet.
[c] Administered as an aqueous solution
[d] Administered as an ethyl alcohol–water solution.
[e] Administered as a corn oil suspension.

TABLE 2

COMPOUNDS NOT TOXIC ORALLY TO RED-WINGED BLACKBIRDS OR STARLINGS AT 100 MG/KG

Chemical No.	American Chemical Society Name (common or other identification)
181.	Acetamide, 2,2′-[(2-hydroxyethyl)imino]bis[*N*-(α,α-dimethylphenethyl)-*N*-methyl] (Oxethazaine)
182.	Acetic acid, phenoxythio-, *s*-10-phenarsinyl ester (DID 100)
183.	Acetophenone, 4′-amino
184.	Acetylsalicylic acid (Aspirin)
185.	*m*-Aminobenzoate, ethyl-, methane sulfonate (Tricaine)
186.	*p*-Aminobenzoic acid, *n*-butyl ester (Butamben)
187.	Aniline
188.	Aniline, 2-chloro
189.	Aniline, 2-chloro-5-trifluoromethyl
190.	Aniline, 3-chloro
191.	Aniline, 3,4-dichloro
192.	Aniline, 2,4-dimethoxy-5-chloro
193.	Aniline, 3-iodo
194.	Aniline, 4-methylthio
195.	Aniline, 3-nitro
196.	*o*-Anisidine, *N*-*n*-butyl-5-sulfonamide
197.	*o*-Anisidine, 5-chloro
198.	*o*-Anisidine, 5-nitro
199.	*p*-Anisidine
200.	*p*-Anisidine, 2-nitro
201.	1,8,9-Anthracenetriol (Dithranol)
202.	Anthraquinone
203.	3-Azoniabicyclo[3,2,1]octane, 3-[3-(dimethylamino)propyl]-1,3,8,8-tetramethyl methyl sulfate methosulfate (Trimethidinium methosulfate)
204.	Barbituric acid, 5-butyl-5-ethyl (Butethal)
205.	Barbituric acid, 5-(1-cyclohexen-1-yl)-1,5-dimethyl, sodium salt (Hexobarbital)
206.	Barbituric acid, 5-(cyclohexen-1-yl)-5-ethyl (Cyclobarbital)
207.	Barbituric acid, 5,5-diallyl (Allobarbital)
208.	Barbituric acid, 5,5-diethyl, sodium salt (Barbital)
209.	Barbituric acid, 5,5-diethyl-1-methyl (Methabarbital)
210.	Barbituric acid, 5-ethyl-1-methyl-5-phenyl (Mephobarbital)
211.	Barbituric acid, 5-ethyl-5-phenyl, sodium salt (Phenobarbital sodium)
212.	Benzanilide, 3-amino-4-methoxy
213.	Benzene, 1-chloro-2,5-dimethoxy
214.	Benzene, 1,4-dichloro-2,5-dimethoxy (Chlorneb)
215.	Benzene, 1-nitro-2,5-dimethoxy
216.	Benzene, 1,2,3-trichloro-4,6-dinitro (Chemagro 2635)
217.	Benzene sulfonic acid, 2,4-dinitro
218.	2-Benzimidazolinone, 1-{1-[3-(*p*-fluorobenzoyl)propyl]-4-piperidyl}- (Benperidol)
219.	2-Benzimidazolinone, 1-{1-[3-(*p*-fluorobenzoyl)propyl]-1,2,3,6-tetrahydro-4-pyridyl}- (Droperidol)
220.	3*H*-1,4-Benzodiazepam-4-oxide, 7-chloro-2-[(cyclopropylmethyl)amino]-5-phenyl- (W-3623)
221.	3*H*-1,4-Benzodiazepine, 7-chloro-2-methylamino-5-phenyl-, 4-oxide (Chlordiazepoxide)
222.	2*H*-1,4-Benzodiazepin-2-one, 7-chloro-1,3-dihydro-3-hydroxy-5-phenyl (Oxazepam)
223.	2*H*-1,4-Benzodiazepin-2-one, 7-chloro-1,3-dihydro-1-methyl-5-phenyl- (Diazepam)
224.	2*H*-1,4-Benzodiazepin-2-thione, 7-chloro-1,3-dihydro-1-methyl-5-phenyl (W-3676)
225.	Benzoic acid

226. Benzoic acid, 4-amino-2-chloro, 2-(diethylamino)ethyl ester hydrochloride (Chloroprocaine HCl)
227. Benzoic acid, *p*-amino-, 2-(diethylamino)ethyl ester hydrochloride (Procaine HCl)
228. Benzoic acid, 3-amino-4-methyl
229. Benzoic acid, 2-chloro-4-propanone
230. Benzoic acid, 3,4-diamino
231. Benzonitrile
232. 2*H*-1,2,4-Benzothiazine, 6-chloro-3,4-dihydro-3(3-oxo-*n*-propyl)-7-sulfamyl-1-, 1-dioxide phthalazone-azine (EX 5004)
233. 1,2,3-Benzothiazine, 4-hydrazino-, 1,1,dioxide hydrochloride (EX 4211A)
234. *p*-Butylamino benzoic acid, 2-(dimethylamino)ethyl ester hydrochloride (Tetracaine HCl)
235. Butylcarbamic acid, 2-(hydroxymethyl)-2-methylpentyl ester (Tybamate)
236. Butyric acid, ester with *O,O*-dimethyl-(2,2,2-trichloro-1-hydroxy ethyl) phosphonate (Butonate)
237. Butyrophenone, 4′-fluoro-4-[4-hydroxy-4-(α,α,α-trifluoro-*m*-tolyl)piperidino]- (Trifluperidol)
238. Carbamic acid, *N*-benzylcyclopropane, ethyl ester (Encyprate)
239. Carbamic acid, *n*-butyl
240. Carbamic acid, butylethylthio-, *S*-propyl ester (Tilliam)
241. Carbamic acid, *n*-butyl, 3′-hydroxypropionanilide ester (R 11914)
242. Carbamic acid, 3-(*p*-chlorophenoxy)-2-hydroxypropyl ester (Chlorphenesin)
243. Carbamic acid, 4-chlorophenyl-, ethyl ester
244. Carbamic acid, cyclohexylethylthio-, *S*-ethyl ester (Ro-Neet)
245. Carbamic acid, *N,N*-di-*n*-butyl-, ethyl ester
246. Carbamic acid, diisobutylthio-, *S*-ethyl ester (Sultan)
247. Carbamic acid, dimethyl-, ester with 3-hydroxy-*N,N*-5-primethylpyrazole-1-carboxamide, mixt. with 5(or 3)-methylpyrazol-3(or 5)-yl ester (Dimetilan)
248. Carbamic acid, dimethyl-, 6-methyl-2-propyl-4-pyridinyl ester (Pyramat)
249. Carbamic acid, *N,N*-diphenyl-, ethyl ester
250. Carbamic acid, ethyl- (Urethan)
251. Carbamic acid, ethyl-, acetamidophenyl-2,2,2-trichloro ester (Fenchlorethate)
252. Carbamic acid, ethyl-, ethyl ester
253. Carbamic acid, 1-ethynylcyclohexyl ester (Ethinamate)
254. Carbamic acid, 1-(hydroxymethyl)propyl-, ethyl ester
255. Carbamic acid, isopropyl, 3′-hydroxypropionanilide ester (R 11913)
256. Carbamic acid, 2-mercaptoacetanilide
257. Carbamic acid, methyl-, 4-chlorophenyl ester
258. Carbamic acid, methyl-, 4-chloro-3-tolyl ester
259. Carbamic acid, methyl-, 4-chloro-3,5-xylyl ester
260. Carbamic acid, methyl-, 2,4-dichloro-3,5-xylyl ester (U 14540)
261. Carbamic acid, methyl-, ethyl ester
262. Carbamic acid, methyl-, phenyl ester
263. Carbamic acid, 2-methyl-2-propyltrimethylene ester (Meprobamate)
264. Carbamic acid, *tert*-octyl-, ethyl ester
265. Carbamic acid, oleyl ester
266. Carbamic acid, phenyl ester
267. Carbamic acid, bis(2,2,2-trichloroethyl) ester (Chlorethate)
268. Carbanilic acid, *m*-chloro-, isopropyl ester (CIPC)
269. Chloral
270. *p*-Chlorophenyl phenyl sulfone (Sulphenone)
271. 8-Chlorotheophyllinate, 2-(benzhydryloxy)-*N,N*-dimethyl-ethylamine- (Dimenhydrinate)
272. Coumarin, 3-[1′-(*p*-chlorophenyl)propyl], 4-oxo (Enticide)
273. Cyclohexanecarbamic acid, ethyl ester
274. 4-Cyclohexene-1,2-dicarboximide, *N*-[(trichloromethyl)thio]- (Captan)
275. *Bis*(dialcylphosphinothioyl) disulfide (Phostex)
276. Diethyl ammonium chloride, [oxalylbis(iminoethylene)]-bis-(*o*-chlorobenzyl) (Ambenonium)

TABLE 2—*continued*

Chemical No.	American Chemical Society Name (common or other identification)
277.	Disulfide, bis(dimethylthiocarbamoyl) (Thiram)
278.	Dithiocarbamic acid, *S,S'*-bis(2,4-dichlorobenzoyl) hexamethylene (Niagara 2309)
279.	1,2-Dithiol-3-one, 5-chloro-4-phenyl- (Hercules 3944)
280.	Ethanol, 2{2-[4-(chloro-α-phenylbenzyl)-1-piperazinyl]ethoxy} (Hydroxyzine)
281.	Ethylene bis(tetrahydrothiophenonium) dibromide (HRS 1591A)
282.	Fluoaluminate, sodium salt (Cryolite)
283.	Fluoride, sodium
284.	Glutarimide, 2-ethyl-2-phenyl (Glutethimide)
285.	Guanidine, 1,3-diphenyl
286.	Guanidine, 1,2,3-triphenyl
287.	Hydrocupreine, isopentyl ether (Isopentylhydrocapreine)
288.	Iron, bis(dimethyldithiocarbamato) (dimethylthiocarbamoyl sulfinato) (Vancide F 4004)
289.	Mandelic acid, α-cyclopentyl-, 1-ethyl-3-piperidyl ester (Ditran)
290.	Metaldehyde
291.	2,6-Methano-3-benzazocin-8-ol, 1,2,3,4,5,6-hexahydro-6,11-dimethyl-3-(3-methyl-2-butenyl)- (Pentazocine)
292.	1,3,4-Methano-1*H*-cyclobuta[*cd*]pentalene, 1,1a,2,2,3,3a,4,5,5a,5b,6-dodecachlorooctahydro- (Mirex)
293.	Methyl reserpate, 3,4,5-trimethoxy cinnamic acid ester (Rescinnamine)
294.	3-Methylvaleramide, 2-ethyl (Valnoctamide)
295.	Methylxanthene, 9(3-dimethylaminopropyl)-2-trifluoro hydrochloride (SKF 10810-A)
296.	Morpholine, 4-[3-(*p*-butoxy phenoxy)propyl (Pramoxine)
297.	Morpholine, 4-(3,4,5-trimethoxybenzoyl) (Trimetozine)
298.	1,2-Naphthaquinone, 3-naphthoic acid, 2,8-dihydroxy
299.	Nickel pentachlorophenolate
300.	2-Norbornanamine, *N*-ethyl-3-phenyl (Fencamfamine)
301.	5-Norbornene-2,3-dicarboximide, 5-(α-hydroxy-α-2-pyridylbenzyl)-7-(α-2-pyridylbenzylidene)- (Norbormide)
302.	2-Oxazolidione, 5-(3,5-dimethylphenoxymethyl)- (Metaxalone)
303.	2-Oxazolidione, 5-[(*o*-methoxyphenoxy)methyl]- (Mephenoxalone)
304.	Paraldehyde
305.	Phenothiazine, 2-chloro-10-(3-aminopropyl) (EX 4422)
306.	Phenothiazine, 2-chloro-10-[3-(dimethylamino)propyl] (Chlorpromazine)
307.	Phenothiazine, 3-chloro-10-[-3-(dimethylamino)propyl] 5-oxide (Opromazine)
308.	Phenothiazine, 10-(3-dimethylaminopropyl) (Promazine)
309.	Phenothiazine, 10-[3-(dimethylamino)propyl]-2-trifluoromethyl (Triflupromazine)
310.	Phenothiazine, 10-[3-(4-methylpiperazin-1-yl)propyl]-2-trifluoromethyl dihydrochloride (Trifluoperazine diHCl)
311.	Phenothiazine, 10-[2-(1-methyl-2-piperidyl)ethyl]-2-(methylsulfinyl) (Mesoridazine)
312.	Phenothiazine, 10-[1-methyl-3-piperidyl)methyl (Mepazine)
313.	Phenyl sulfoxide
314.	Phosphonodithioic acid, chloromethyl, *S,S*-diethyl ester (Chemagro 5461)
315.	Phosphoramidic acid, *O*-methyl *O*(2,4,5-trichlorophenyl) ester (Dowco 208)
316.	Phosphoramidothioic acid, ethyl-, *O*-methyl *O*-4-*tert*-butyl-2-chlorophenyl ester (Dowco 105)
317.	Phosphoramidothioic acid, *O*-methyl *O*-(2,4,5-trichlorophenyl) ester (Dow Et-15)

318. **Phosphorodithioic acid, *O,O*-diethyl, *S*-(2,5-dichlorophenylthiomethyl) ester (Phencapton)**
319. Phosphorodithioic acid, 2-ethylisobutyrate-, *O,O*-diethyl *S*-(3-ethylthio) **(Bay 56194)**
320. Phosphorothioic acid, *O*-(3-chloro-4-nitrophenyl) *O,O*-dimethyl ester (Chlorthion)
321. Piperidine, 4-benzyl-1-(dimethylaminoethyl) (IN-379)
322. Piperazine, 1-(*p*-*tert*-butylbenzyl)-4-(*p*-chloro-α-phenylbenzyl) (Buclizine)
323. 1-Piperazineethanol, 4-{3-[2-(trifluoromethyl)phenothiazin-10-yl]propyl}dihydrochloride (Fluphenazine)
324. 1-Piperazinepropanol, 4-[3-(2-chlorothioxanthen-9-yl)propyl]-(Xanthiol)
325. 1-Piperazinepropionamide, 4-[3-(2-chlorothioxanthen-9-ylidene)propyl] *N*-methyl-, dimaleate (Clothizamide)
326. Polyhalodithiotetrahydrophthalimide (RE 5729)
327. 5βPregnane-3,20-dione, 21-hydroxy sodium hemisuccinate (Hydroxydione)
328. 1,2-Propanediol, 3-(*o*-methoxyphenoxy)-, 1-carbamate (Methocarbamol)
329. 1,2-Propanediol, 3-piperidino-, dicarbanilate (ester) hydrochloride (Diperodon HCl)
330. 2-Propanol, 1,1,1-trichloro-2-methyl- (Chlorobutanol)
331. 2-Propenal (Acrolein)
332. *o*-Propionotoluidide, 2-(propylamino)- (Prilocaine)
333. 3-Pyrazolin-5-one, 4-amino-2,3-dimethyl-1-phenyl (Ampyrone)
334. 2,4(1*H*,3*H*)Quinazolinedione, 3-[3-(4-*m*-chlorophenyl-1-piperazyl)propyl]-, hydrochloride (MA 1337)
335. 4(3*H*)-Quinazolinone, 3-(*o*-chlorophenyl)-2-methyl-(Mecloqualone)
336. Quinoxaline, 6-methyl-2-oxo-1,3-dithio(4,5,6) (Oxythioquinox)
337. Rhodanine, 3-(*p*-chlorophenyl)-5-methyl (N-244)
338. Rhodanine, 5[*p*-(dimethylamino)benzylidene]
339. Salicylic acid, 5-chloro
340. Succinic acid, mercapto-, diethyl ester *S*-ester with *O,O*-dimethyl phosphorodithioate (Malathion)
341. Succinylcholine chloride
342. Sulfamide, *N'*-(dichlorofluoromethylthio) *N',N'*-dimethyl *N*-phenyl (Bay 47531)
343. 4*H*-1,3-Thiazin-4-one, 2-(*p*-chlorophenyl)tetrahydro-3-methyl-, 1,1-dioxide (Chlormezanone)
344. Thiazole, 2-[(dimethylaminoethyl) (*p*-methoxybenzyl)amino] (Zolamine)
345. 2-Thiobarbituric acid, 5-allyl-5-(1-methylbutyl)- (Thiamylal)
346. 2-Thiobarbituric acid, 5-ethyl-5-(1-methylbutyl), sodium salt (Thiopental Sodium)
347. Thiocarbamic acid, *S*-propyl-, diisopropyl ester (Vernam)
348. Thiocarbonic acid, cyclic ester with 2,3-quinoxalinedithiol (Thioquinox)
349. Thiocyanic acid, 2-(2-butoxyethoxy)ethyl ester (Lethane 384)
350. Thiocyanic acid, 1-dodecyl
351. Thiopyrophosphoric acid, tetrapropyl ester (NPD)
352. Thiosemicarbazone, *N*-ethyl isatin
353. Thiosemicarbazone, methylglyoxal bis (N^4-methyl)
354. Thioxanthene, *trans*-9-(3-diethylaminopropylidene)-2-trifluoromethyl hydrochloride (SKF 10812)
355. Thioxathene, 2-dimethylsulfamyl-[9-(4-methyl-1-piperazinyl)-propylidine] (P-4657B)
356. Thioxanthene-Δ^9, α-propylamine, 2-chloro-*N,N*-dimethyl (Chlorprothixene)
357. Toluene, α-[2-(2-butoxyethoxy)ethoxy[-4,5-(methylenedioxy)-2-propyl (Piperonyl butoxide)
358. *m*-Toluidine
359. *m*-Toluidine, 2-chloro-
360. *m*-Toluidine, 2-methoxy-4-nitro-
361. *o*-Toluidine
362. *o*-Toluidine, 3-chloro-
363. *o*-Toluidine, 5-chloro-
364. *o*-Toluidine, 5-nitro-
365. 3,5,7-Triaza-1-azoniaadamantane, 1-(3-chloroallyl) chloride (Dowicil 100)
366. Tribromoethanol
367. Tributyltin chloride
368. Urea, 2-ethyl-3-methylvaleryl (Capuride)
369. Zinc, [ethylene bis(dithiocarbamate)] (Zineb)

TABLE 3

ACUTE PO TOXICITY OF CHEMICAL COMPOUNDS TO 20 AVIAN SPECIES

Chemical No.	Common grackle (*Quiscalus quiscula*) LD50 (mg/kg)	(95% CL)	Common pigeon (*Columba livia*) LD50 (mg/kg)	(95% CL)	House finch (*Carpodacus mexicanus*) LD50 (mg/kg)	(95% CL)	House sparrow (*Passer domesticus*) LD50 (mg/kg)	(95% CL)	Mallard duck (*Anas platyrhynchos*) LD50 (mg/kg)	(95% CL)	Ring-necked pheasant (*Phasianus colchicus*) LD50 (mg/kg)	(95% CL)	Yellow-headed blackbird (*Xanthocephalus xanthocephalus*) LD50 (mg/kg)	(95% CL)	Others LD50 (mg/kg)	(95% CL)
12.	—		56	(32–100)	100	(56–178)	133		100	(56–178)	>100		100	(56–178)	—	
13.	—		75		133		100	(56–178)	237		>100		75		—	
14.	—		133		56	(32–100)	56	(32–100)	75	(56–100)	>100		100	(56–178)	—	
15.	—		>100		24		42		>100		>100		178	(100–316)	—	
16.	178	(100–316)	133	(56–136)	100	(56–178)	75		75		>100		100	(56–178)	—	
															Common crow	
41.	1.8	(1.0–3.2)	4.2		2.0	(1.2–3.3)	4.2		2.4		10	(5.6–18)	1.3		7.5	
48.	13	(5.6–32)	7.5		7.5		13		18	(10–32)	13		7.5		[a]	
															Robin (*Turdus migratorius*)	
51.	100	(56–178)	13		1.8	(1.0–3.2)	32	(18–56)	7.5		>100		13		>18	
53.	10	(5.6–18)	13		2.4		18	(10–32)	13		1000	(562–1780)	3.2	(1.8–5.6)	[b]	
															Common crow	
64.	>100		—		—		56	(32–100)	—		—		—		>100	
65.	—		—		—		—		—		4.2		—		[c]	
67.	5.6	(3.2–10)	5.6	(3.2–10)	—		1.8	(1.0–3.2)	—		—		—		—	
71.	75		178	(100–316)	56	(32–100)	42		42		>100		133		[d]	
73.	—		56	(32–100)	42	(18–100)	32	(18–56)	56	(32–100)	100	(56–178)	56	(32–100)	—	
74.	56	(32–100)	42		56	(32–100)	32	(18–56)	133		>100		75		[e]	
89.	—		—		—		100	(56–178)	—		—		—		—	
90.	—		—		—		100	(56–178)	—		—		—		—	
97.	7.5		75	(32–178)	42		7.5		13		13	(5.6–32)	10	(5.6–10)	—	
98.	56	(32–100)	>100		75		56	(32–100)	75		>100		>100		—	
100.	—		—		—		5.6	(3.2–10)	—		—		—		—	
102.	—		15		—		—		—		—		—		—	
122.	2.4		—		—		—		—		—		—		—	
123.	1.3		—		—		—		—		—		—		—	
															Common crow	
136.	13		—		—		10	(5.6–18)	—		—		—		>32	
138.	—		1.8	(1.0–3.2)	—		5.6	(3.2–10)	—		—		—		[f]	

149.	133	237		75		133		75	133		24	(10–56)	[g]
150.	—	—		—		—		—	16		—		[h] Mourning dove
152.	—	—		—		—		—	—		—		24 Boat-tailed grackle
153.	—	—		—		4.0		4.2	7.5		—		18 (10–32) [i]
160.	>100	75		100	(56–178)	>100		75	>100		42		[j] Robin
165.	—	—		5.6	(2.9–12.3)	—		—	—		—		>10 Robin
172.	—	13		—		316	(178–562)	—	—		—		>3.2 Sparrow hawk (*Falco sparverius*)
173.	—	18	(10–32)	>225		366		18	(3.5–90) 10	(5.6–18)	—		421 See DeCino *et al.* (1966)

[a] Brown-headed cowbird (*Molothrus ater*) 10 (5.6–18)
Common crow (*Corvus brachyrhynchos*) 13
Mourning dove (*Zenaidura macroura*) 18 (10–32)
Boat-tailed grackle (*Cassidix mexicanus*) 5.6
[b] Bobwhite quail (*Colinus virginianus*) 24
Mourning dove 10 (5.6–18)
Brown-headed cowbird 7.5 (4.2–13)
Ring-billed gull (*Larus delawarensis*) 7.5
Inca dove (*Scardafella inca*) 4.2
Boat-tailed grackle 4.2
White-winged dove (*Zenaida asiatica*) 10 (5.6–18)
Common crow 7.5
[c] Bobwhite quail 3.2 (1.8–5.6)
Mourning dove 1.8 (1.0–3.2)
Common crow 4.2
[d] Mourning dove 42
White-crowned sparrow (*Zonotrichia leucophrys*) 56
Common crow 42
[e] Mourning dove 133
White-crowned sparrow 56
Common crow >100

[f] Black-billed magpie (*Pica pica*) 5.6 (3.2–10)
Sparrow hawk 1.3
Mourning dove 2.3 (0.95–9.5)
[g] White-winged dove 133
Mourning dove 56
Common crow >100
Boat-tailed grackle 5.6 (3.2–10)
Canada goose (*Branta canadensis*) >56
[h] Boat-tailed grackle 10 (5.6–18)
White-fronted dove (*Leptotila verreauxi*) 4.2
Mourning dove 7.5
[i] Brown-headed cowbird 4.2
White-crowned sparrow 5.6
Boat-tailed grackle 3.2 (1.8–5.6)
Common crow 2.4
Mourning dove 8.1 (7.5–10)
White-winged dove 13
Bronzed cowbird (*Tangavius aeneus*) 3.2 (1.8–5.6)
[j] Common crow 42
Brown-headed cowbird 32 (18–56)
White-crowned sparrow 56 (32–100)

known differences in rat and avian toxicity). A standard analysis of variance showed that redwings and starlings were significantly more susceptible to poisoning with these chemicals than rats ($\alpha < 0.1\%$). A Student t test showed that redwings were much more easily poisoned than starlings ($\alpha < 0.005\%$). The mean LD50 of the 61 compounds was 110 mg/kg for rats, 48 mg/kg for starlings and 15 mg/kg for redwings. Table 3 presents data gathered on other species of birds when at least 1 species was killed with 100 mg/kg or less.

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