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PASA-RA(ID) 1-67
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TOXICOLOGY AND APPLIED PHARMACOLOGY 26, 154–157 (1973)

SHORT COMMUNICATIONS

Comparative Toxicity of Seventeen Pesticides to the Quelea, House Sparrow, and Red-Winged Blackbird[1]

Comparative Toxicity of Seventeen Pesticides to the Quelea, House Sparrow, and Red-Winged Blackbird. SCHAFER, E. W., JR., BRUNTON, R. B., LOCKYER, N. F. AND DI GRAZIA, J. W. (1973). *Toxicol. Appl. Pharmacol.* **26**, 154–157. The acute po LD_{50} values of 17 commercial or experimental pesticides were determined for quelea (*Quelea quelea*), house sparrows (*Passer domesticus*), and red-winged blackbirds (*Agelaius phoeniceus*), and the acute dermal LD_{50} values for quelea and house sparrows. Close correlations suggested that po toxicity data for red-winged blackbirds and dermal toxicity data for house sparrows can be used as preliminary indicators of po and dermal toxicity to quelea, respectively.

A sparrow-sized African finch known as the red-billed weaver, black-faced dioch, or simply quelea (*Quelea quelea*) has the distinction of being one of the most numerous and destructive birds in the world. Quelea range over 20% of Africa's land area and affect the economy of 25 African nations. Crops affected include millett, grain sorghum, rice, and wheat (Crook and Ward, 1968). Since 1950, many methods of controlling quelea have been tried; currently the most widely used are explosives and aerial sprays of insecticides (primarily parathion and fenthion) in communcal roosting and nesting sites. Quelea are so numerous, however, that killing hundreds of millions each year has apparently not resulted in any appreciable decrease in either populations or damage, except in a few local areas (Crook and Ward, 1968).

As developing African nations intensify and increase their agricultural production, more selective and efficient methods will be needed to control bird damage. For effectiveness, economy, and safety, the trend in the United States is away from mass reduction of bird populations and toward use of chemicals and application techniques to protect directly the crops suffering damage. A number of chemicals and techniques have recently been developed for bird species native to the United States, but little is known about their applicability to quelea.

The following series of acute toxicity tests was conducted with 17 commercial and experimental pesticides to provide data on the susceptibility patterns of quelea, and to determine whether two native species, the house sparrow (*Passer domesticus*) and the red-winged blackbird (*Angelaius phoeniceus*), have similar enough patterns to "represent" the responses of quelea.

METHODS

Seventeen commercial or experimental pesticides, primarily organophosphates, found highly toxic to house sparrows or red-winged blackbirds, were selected for testing

[1] Conducted in part with funds provided by the Agency for International Development under PASA RA(ID) 1-67 "Control of Vertebrate Pests: Rats, Bats and Noxious Birds."

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on quelea at the United Nations Development Programme, Food and Agriculture Organization, Quelea Project headquarters in Fort Lamy, Chad, Africa. The LD_{50} values for seven of these chemicals in the red-winged blackbird have been reported previously (Schafer, 1972). The materials used were technical grade of 90–99% purity.

Oral toxicity was determined by po administration of propylene glycol solutions from a microsyringe with a length of polyethylene tubing attached to the needle point. To ensure that the dose was introduced at approximately the same location in the gastrointestinal tract of each species, the tubing length corresponded with the distance from the back of the oral cavity to the esophageal opening of the proventriculus. For quelea (average weight 18 g), the syringe held 50 µl, the needle was 18 ga, 2.5 cm, and the tubing was 4 cm long and measured 1.14 mm id and 1.57 mm od. For sparrows (average weight 26 g), the syringe held 100 µl and the needle and tubing were the same as for quelea. For redwings (average weight 65 g), the syringe held 250 µl, the needle was 15 ga, 2.5 cm, and the tubing was 5 cm long and measured 1.68 mm id and 2.41 mm od.

Dermal toxicity was determined by applying acetone solutions with a syringe of the same capacity used for each species in the oral tests and a 21-ga, 2.5-cm needle whose tip was squared and polished to avoid abrading the skin. The solution was slowly applied to an area 1 cm^2 in the sparsely feathered skin area covering the pectoralis muscles under the wing joint, and the acetone was evaporated by a current of air.

For both oral and dermal tests, solutions were prepared so that the total amount administered (in µl) equaled two times the bird's weight (in g). Doses were administered at 1/4-log intervals, and two birds were used at each level. After dosing, quelea were held individually for 2 hr in a nylon net bag for observation. Surviving birds were banded and released into communal 7-m^3 wire cages, where there was ample food, water, and shade, and observed for 4 days. Ambient temperatures varied from 18 to 38°C and averaged 27°C. Sparrows and redwings were placed in individual 15 × 22 × 15-cm wire mesh cages and observed for 4 days. Ambient temperature averaged 24°C. LD_{50} values were calculated by the moving-point interpolation method described by Thompson (1948), Thompson and Weil (1952), and Weil (1952).

RESULTS AND DISCUSSION

The results of these tests are summarized in Table 1. The average oral LD_{50} for the 17 pesticides was 2.3 mg/kg for quelea, 4.4 for house sparrows, and 1.9 for redwings. Six of the chemicals (Bay 75546, Bay 93820, Bay COE 3664, Bay COE 3675, Bay HOL 0574, and fenthion) had been selected for testing on quelea because they showed considerably higher toxicity to birds than to mammals (> 100×). The average oral LD_{50} of these six chemicals was 2.5 mg/kg for quelea, 5.4 for sparrows, and 2.2 for redwings. The toxicity of the remaining 11 chemicals averaged 2.1 mg/kg for quelea, 3.7 for sparrows, and 1.8 for redwings. The three species did not differ in their response to chemicals selected for differential toxicity.

Ratios between the quelea LD_{50} and the LD_{50} of the other two species indicated that the quelea were approximately as sensitive as redwings, twice as sensitive as house sparrows to oral administration, and about three times as sensitive as sparrows to dermal administration of the 17 pesticides. Quelea LD_{50} values were compared with those of the other species by regression analysis. Two comparisons had correlation

TABLE 1

ACUTE ORAL AND DERMAL TOXICITY OF 17 CHEMICALS TO THE QUELEA, HOUSE SPARROW, AND RED-WINGED BLACKBIRD

Chemical	Acute LD_{50} (mg/kg)				
	Quelea		House sparrow		Red-winged blackbird
	Oral	Dermal	Oral	Dermal	Oral
4-Aminopyridine (Avitrol Corp, Tulsa, OK)	5.6	>100	7.5	>100	2.4
Azodrin (Shell Chemical Co., New York, NY)	1.3	4.2	1.3	18	1.0
Bay 50519[a] (Bay Chem. Corp., Kansas City, MO)	4.2	5.6	2.4	3.2	2.4
Bay 75546[b] (Bay Chem)	2.4	>100	3.2	>100	2.4
Optunal (Bay Chem)	0.75	1.3	1.0	3.2	0.56
Bay COE 3668[c] (Bay Chem)	2.4	2.4	5.6	7.5	2.4
Bay COE 3675[c] (Bay Chem)	0.75	2.4	1.8	7.5	1.3
Bay HOL 0574[d] (Bay Chem)	5.6	75	3.2	>100	2.4
Bidrin (Shell)	1.3	1.3	4.2	1.8	1.0
Carbofuran (FMC Corp., Middleport, NY)	0.42	100	1.3	100	0.42
Counaphos (Bay Chem)	3.2	7.5	10	75	3.2
Cyolane (American Cyanamid, Princeton, NJ)	1.8	10	2.4	18	2.4
Dasanit (Bay Chem)	0.24	0.42	0.32	1.0	0.32
Demeton (Bay Chem)	1.3	1.8	5.6	13	2.4
Fenthion (Bay Chem)	1.3	1.8	5.6	2.4	1.8
Methiocarb (Bay Chem)	4.2	100	18	>100	4.6
Parathion (Monsanto Chemical Co., St. Louis, MO)	1.8	1.8	1.3	1.8	2.4

[a] Phosphonothioic acid, ethyl-, (2-diethylaminomethyl)-4,6-dichlorophenylester.
[b] 2-Pyrimidine phosphorothioic acid, 3-bromo-5,7-dimethyl pyrazolyl-*O,O*-diethyl ester.
[c] Unidentified organophosphate.
[d] Phosphoramidothioic acid, ethyl-, 4-(methylthio)-*m*-tolyl ester.

coefficients significantly different from zero ($p < 0.01$): quelea po with redwing po, and quelea dermal with house sparrow dermal. For both relationships, the correlation coefficient was 0.98. The relative sensitivity among house sparrows and redwings in this study, correlated well with a previously published paper in which redwings were twice as sensitive as sparrows to the action of 22 immobilizing agents (Schafer and Cunningham, 1972).

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Received December 7, 1972; accepted March 2, 1973