Effect of SKF-525A on Brain Acetylcholinesterase Inhibition by Parathion in Fishes[1]

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Many compounds have been shown to alter the metabolism and subsequently to either synergize or antagonize the effects of certain pesticides. The N-alkyl compound SKF-525A inhibits a variety of microsomally catalyzed biotransformations, including the desulfuration of parathion to the potent anticholinesterase paraoxon (1,2). Although parathion activation is antagonized in mouse-liver slices, no protection against parathion toxicity is afforded the intact mouse since SKF-525A competitively inhibits enzymes effecting the hydrolysis of paraoxon (2).

Here, we report the effect of SKF-525A pretreatment upon the activation of parathion - as reflected by brain AChE inhibition - in 3 species of freshwater fishes.

Materials and Methods

Golden shiners (Notemigonus chrysoleucas), green sunfish (Lepomis cyanellus) and bluegill sunfish (Lepomis macrochirus) seined from ponds having no known insecticidal contamination were acclimated to laboratory conditions prior to testing.

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Fish were exposed to 1 ppm SKF-525A (diluted from a 1% (v/v) solution in acetone) for 24 hr in stainless steel aquaria (1 fish/liter of test solution). Control fishes were held in 40 liters of water containing an equivalent amount of acetone.

After 24 hr 20 fishes from the SKF-252A pretreatment and control solutions were placed separately into 200 ppb parathion. Ten hr later both groups were sacrificed and assayed for brain AChE activity. AChE assays were performed on pooled samples of 2 brains at 30°C. The Ellman method (3) for AChE assay was employed; using a Beckman Model B spectrophotometer.

Results and Discussion

Exposure of non-pretreated fish to 200 ppb parathion for 10 hr produced 58.6, 83.7 and 80.1% inhibition of AChE activity in brains of shiners, green sunfish and bluegills respectively (Table 1).

Fish pretreated for 24 hr in 1 ppm SKF-525A solution prior to exposure to 200 ppb parathion for 10 hr showed depressions in brain AChE activities of 52.0, 70.2, and 82.0% respectively for shiners, green sunfish and bluegills (Table 1). SKF-525A alone did not alter AChE activity. The level of protection afforded by SKF-525A pretreatment is significant ($p = .05$) for shiners and green sunfish, as determined by ANOV and DNMRT. SKF-525A pretreatment did not protect bluegill sunfish AChE (Table 1). The observed differences among control AChE activities have been previously discussed (4,5,6).

SKF-525A pretreatment affords significant protection against parathion inhibition of brain AChE in the golden shiner and green sunfish, but not in bluegill sunfish. Our data indicate that SKF-525A acts to antagonize parathion activation in fishes as it does in terristrial vertebrates. These data do not preclude the competitive inhibition of paraoxon hydrolysis or reduction or parathion uptake by SKF-525A. We are presently investigating the effects of SKF-525A and other mixed-function oxidase inhibitors on the toxicity and metabolism of parathion in these three species.

TABLE 1.

Mean brain AChE activity and % AChE inhibition in 3 species of fishes treated with 1 ppm SKF-525A and 200 ppb parathion or parathion alone.

Treatment	Species	Mean Activity[a] + SD	% Inhibition
None	Shiners	30.2±1.7	-
	Green sunfish	17.5±2.1	-
	Bluegill	16.0±1.7	-
Parathion	Shiners	12.5±1.0	58.6
	Green sunfish	2.9±0.5	83.7
	Bluegill	3.2±1.0	80.1
SKF-525A + Parathion	Shiners	14.5±0.2*	52.0
	Green sunfish	5.2±0.4*	70.2
	Bluegill	2.9±0.4*	82.0

[a] Micromoles substrate hydrolyzed/min/g of tissue.

* Differs significantly from "parathion" value as determined by ANOV and DNMRT ($p = .05$).

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