Possible Metabolites of Dieldrin in the Sailfin Mollie *(Poecilia latipinna)*[1] (34693)

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Kunze and Laug (1) suggested that dieldrin might be destroyed by metabolic processes in the rat. However, 9 years elapsed before Cueto and Hayes (2) identified metabolites of dieldrin in human urine by colorimetric analysis, column and paper chromatography, and microcoulometric gas chromatography. These compounds were hydrophilic, neutral, heat stable, resistant to alkaline hydrolysis, and more polar than dieldrin. Cueto and Hayes also described a variable ratio between these compounds in the urine. Oonnithan and Miskus (3) reported that resistant female mosquitoes (*Culex pipiens quinquefasciatus*) metabolize ^{14}C dieldrin to a more polar compound. Ludwig *et al.* (4) reported that daily doses of 4.3 μg of ^{14}C aldrin did not accumulate in male rats because the aldrin was converted to dieldrin and hydrophilic metabolites that they detected in the urine. Korte and Arent (5) described six hydrophilic metabolites of dieldrin from the urine of treated rabbits. The principal metabolite (86% of total radioactivity administered) was a 6,7-*trans*-dihydroxydihydro-aldrin. Datta *et al.* (6) found two metabolites in the urine of treated rats that were more polar than dieldrin. These compounds were destroyed when the urine was treated with alcoholic KOH. Some of the dieldrin administered appeared to be converted to aldrin in the rat. Tu *et al.* (7) reported that microorganisms in soil degrade aldrin to dieldrin. After a variable adaptation period they found that dieldrin was further degraded by certain fungi, actinomycetes, and bacteria to products not detected by their methods. Wedemeyer (8) suggested that the intestinal microflora of the rainbow trout, *Salmogairdneri*, were of major importance in the degradation of DDT to TDE. On the other hand, Ottoboni and Ferguson (9) found that DDT is almost quantitatively converted to TDE in the rat liver.

This paper reports our tests with the sailfin mollie, *Poecilia latipinna,* maintained in sea water containing 12 ppb dieldrin for various periods. Two substances that may be metabolites were detected in various tissues by gas chromatography. These substances were not found among the diluted excretory products in the aquaria.

Materials and Methods. The sailfin mollies (*P. latipinna*) used in this study were reared in the laboratory under carefully controlled conditions. They were third generation descendants of fishes collected in the Florida Keys and maintained in 1000 liter concrete tanks in flowing sea water. Rigid control of diet and water has limited the tissue concentration of pesticides (chiefly DDT and its metabolites) to < 0.01 ppm. Our rearing methods minimize pesticide synergism (10) and largely avoid acquired resistance to insecticides while shielding the fishes from unnatural environmental stress.

Bioassays were performed in a continuous flow pesticide dilutor system described by Lane and Livingston (11). The apparatus permits continuous control of pH, temperature, salinity, flow rate, and dieldrin concentration. Fishes weighing between 1 and 2 g were exposed to 0.012 ppm dieldrin at pH 8.2, 30 $^{0}/_{00}$ salinity and 25°, from 1 to 6 hr. A subsequent test exposed *P. latipinna* of the same size range to 0.012 ppm dieldrin for 120 hr.

At various times fishes were killed by tran-

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secting the spinal cord and tissue samples weighing between 0.1 and 100 mg were quickly removed. Samples were hydrolyzed in alcoholic KOH, extracted into hexane, and assayed by gas chromatography. Details of our procedure for small tissue samples have been given elsewhere (12). Aquarium water samples were extracted by hexane for gas chromatographic analysis. Separation was by 3% SE-30 on a 42/60 Chromosorb G column at 200° with an He flow of 40 ml/min. Dieldrin and two different compounds associated with dieldrin in all fish tissues examined were detected in a Beckman GC-5 gas chromatograph equipped with an electron capture detector. Compared with dieldrin the retention times of these compounds averaged 0.893 and 0.780.

Results and Discussion. The chromatogram of the liver extract from a fish exposed for 1 hr to 0.012 ppm dieldrin (Fig. 1) shows two different compounds that only appear in extracts of tissues from treated fish. Figure 2 is a chromatogram of the liver extract from a fish that had been exposed to the same concentration of pesticide for 6 hr. These two compounds did not appear in the water of the aquaria in detectable quantities, so we assume that they are not excreted. If they appeared in extracts of other tissues it was always in smaller amounts than in the liver. These substances were resistant to alkaline hydrolysis, more polar than dieldrin, and stable to at least 230°. They separated clearly on the Chromosorb G, SE-30 column to yield sharp peaks and appeared in the liver extract simultaneously with dieldrin. No aldrin was detected in any sample.

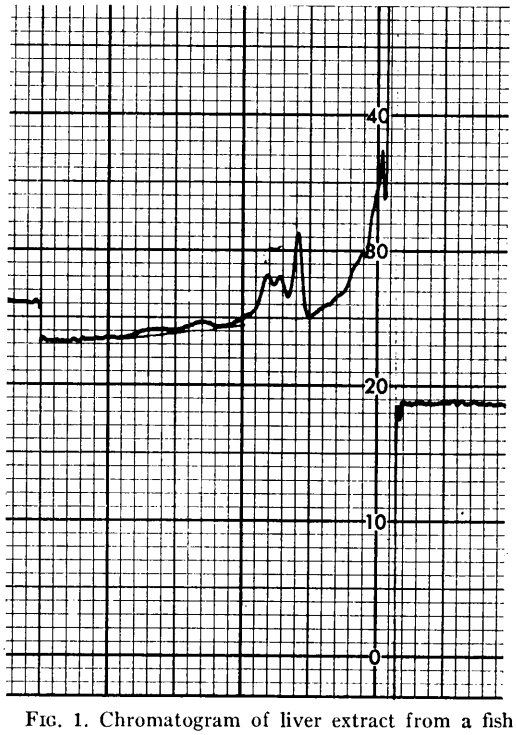

FIG. 1. Chromatogram of liver extract from a fish exposed to 0.012 ppm dieldrin for 1 hr. The peak on the left of the central three is dieldrin.

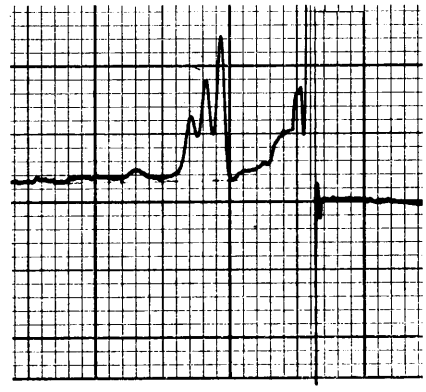

FIG. 2. Chromatogram of liver extract from a fish exposed to 0.012 ppm dieldrin for 6 hr.

Thus, the properties of these compounds resemble those substances described (2, 3, 6) as metabolites of dieldrin. Their increased polarity suggests that these compounds may have been partially dechlorinated. This suggestion is consistent with the mechanism by which fishes are thought to metabolize DDT to DDE and DDD (8).

Since these substances appear first, and in greatest concentration, in extracts of the liver, we assume that they are produced in that organ. Their low level in extracts of the gut suggests that intestinal symbionts are probably not important in the conversion of dieldrin.

Conclusions. Two products, thought to be metabolites of dieldrin, have been detected in extracts of the liver and of various organs

of the sailfin mollie *P. latipinna,* after the fish had been exposed to dilute solutions of dieldrin in sea water for 1 hr. Some properties of these substances are different from those described for dieldrin metabolites in other animals. We suggest that they may be partially dechlorinated cyclo-diene fragments of the dieldrin originally administered.

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