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Patterns of Current Pesticide Use in Mexico

Eduardo E. Iñigo & R. W. Risebrough

As pointed out elsewhere in this symposium, pesticide use has been both extensive and intensive in Mexico (Albert *et al.*, this volume). Although restrictions on the uses of those biocides which are particularly harmful to birds of prey and other wildlife species have been implemented in a number of the more industrialized countries, many of these uses continue in Mexico and other countries of the Third World. Determination of the effects upon local and migratory wildlife of these biocide uses has become a priority of conversation biologists.

We point out that there are two complementary approaches to the problem of determining environmental effects of biocide use in a country such as Mexico. One, adopted by Albert *et al.* (this volume), consists of sampling of species considered to be particularly vulnerable, and analysis for the compounds considered to be potentially dangerous. In this paper we adopt the other approach - to determine as far as is possible the levels and kinds of use, and on the basis of documented effects elsewhere, predict the kinds of effects that might be expected, and the areas where they might occur, as a guide to follow-up investigations in the field.

Two surveys of pesticide use in Latin America over the 1970s and 1980s have been undertaken. Maltby (1980) prepared for the United Nations Industrial Development Organization a report that presented on a country by country basis the estimated use and production figures in 1978 and the use and production that might be expected in 1988. Although prepared primarily from an economic perspective to assist in the development of a number of individual Latin American countries and to provide information that might benefit trading practices, the information provided constitutes a data base for estimating and predicting environmental effects. Burton and Philogene (1986) consulted a number of additional documents, not widely available, to produce the report "An Overview of Pesticide Usage in Latin America" for the Canadian Wildlife Service.

In addition, we make particular use of a document compiled by one of the largest manufacturers and formulators of biocidal chemicals in Mexico, Fertilizantes Mexicanos, that is a guide to the industry for the production and sales of pesticides in Mexico. It provides data on the manufacture and importation of pesticides used in Mexico, as well as on some of the principal uses (FERTIMEX 1981). Coming from the industry, this document must be considered generally more reliable than data compiled by national and international agencies. We have found, however, that the generalizations made by Maltby (1980) and by Burton and Philogene (1986) are supported by the industry data.

With Brazil, Mexico differs from other Latin American countries in that domestic production accounts for the major portion of the pesticides used. Over the period 1969-1979 imports

amounted to only 15% of the total use of the chlorinated hydrocarbon insecticides. Products produced domestically were principally BHC (HCH, about 1,600 tonnes/year), DDT (3,900 tonnes/year) toxaphene (2,000 tonnes/year), and endrin (300 tonnes/year) (FERTIMEX 1981). These are the average production figures over the period 1969-1979.

Over the period 1969-79, use of all chlorinated hydrocarbon insecticides averaged about 9,000 tonnes per year (FERTIMEX 1981). DDT was produced by two companies, FERTIMEX with a capacity of 4,100 tonnes, and Diamond Chemical Shamrock with a capacity of 1,000 tonnes. Production, at a mean level of 3,900 tonnes, was therefore somewhat less than 80% of capacity over the decade. Production was lower during the second half of the decade, and virtually no DDT was imported.

As the principal reference point, we take the level of peak DDT use in the USA, obtained from the annual reports of the U. S. Tarriff Commission. This was in the order of 160 million pounds, or about 73,000 tonnes, in the mid-1960s. If we assume that about half of this was exported, domestic use at that time was in the order of 35,000 tonnes. Since Mexico has a land area about 1/5 of that of the contiguous 48 states, annual uses of DDT in Mexico in the order of 5-10,000 tonnes would be expected to cause a level of damage to wildlife equivalent to that experienced in the mid-1960s in the United States.

Actual use appears therefore to be lower, about one-half, of the level associated with severe damage in the United States. Locally, however, DDT-related problems might be expected in areas of intensive use, and in the vicinity of manufacturing sites.

In 1978, over half of the total DDT produced by FERTIMEX, 1,650 of 2,700 tonnes, was sold to the health ministry in Mexico City (Secretaria de Salubridad y Asistencia), presumably for use throughout the country. A total of 224 tonnes was sold in Michoacan for uses not documented. Otherwise, major sales were in cotton-producing states: Sonora, 138 tonnes; Baja California, 125 tonnes; Chiapas, 90 tonnes (FERTIMEX 1981). Figures for Durango, the major cotton-producing state, were not included in those portions of the document available to us. Although cotton production has accounted for 60% of insecticide use in Mexico, decreasing world prices have prompted the conversion of cottton acreage to food crops (Burton & Philogene 1986).

Discharges into local environments of wastes generated by pesticide manufacturing plants have accounted for some of the worst cases of environmental contamination. In the early 1960s there were a number of major fish kills in the Mississippi River (reviewed by Risebrough, 1971); the Brown Pelican, *Pelecanus occidentalis*, the State Bird of Louisiana, disappeared from the Gulf Coast during those years (Schreiber & Risebrough 1972). Very high residues of endrin and of a compound produced in the manufacture of endrin were recorded in sediments of the Mississippi River below an endrin manufacturing plant (Barthel *et al.* 1969). Some of the pelicans re-introduced into the Mississippi Delta area as young birds from breeding colonies in Florida later succumbed to endrin poisoning (Blus *et al.* 1979). Although cause-and-effect relationships could not be established long after the event, it appears that endrin residues discharged by the plant were responsible both for the fish kills and for the local disappearance of the Brown Pelicans. Discharges of wastes containing telodrin and dieldrin from a factory manufacturing these biocides in the Netherlands led to deaths and local population declines of Sandwich Terns, *Sterna sandvicensis*, and Eider Ducks, *Somateria mollissima*, in the 1960s (Koeman & van Genderen 1970; Koeman *et al.* 1972; Rooth & Jonkers 1972; Swennen 1972). In California, the effects of wastes discharged from a DDT manufacturing plant into the local coastal environment have been abundantly documented. Local populations of Peregrine Falcons, *Falco peregrinus*, and Bald Eagles, *Haliaeetus leucocephalus*, disappeared; reproduction of Brown Pelicans and other fish-eating birds was reduced almost to zero. The wastes produced by another DDT-manufacturing plant, in Alabama, continue to contaminate local environments (Fleming & O'Shea 1980; Fleming & Cromartie 1981). Factories manufacturing DDT and endrin in Mexico might therefore be expected to be sources of high local contamination by these compounds.

The import data indicate that some of the more dangerous biocides are no longer imported into Mexico, or that records are no longer kept. The last year for which records are available and the mean amounts previously imported per year are: aldrin: 1975, 190 tonnes; heptachlor: 1977, 430 tonnes; dieldrin: 1975, 30 tonnes. If the restrictions on uses of these compounds are effectively in force, environmental damage in Mexico has been correspondingly reduced. Kelthane was imported throughout the period, averaging 17 tonnes/year. Between 1969 and 1974, a total of 19 tonnes of mirex were imported.

CONCLUSIONS

Environmental contamination in Mexico by persistent biocides may not be as severe as initially assumed. Investigations should be carried out, however, in the vicinity of the factories manufacturing DDT and endrin, and in the vicinity of the areas of the most intensive uses of DDT and endrin. The latter include the cotton-producing areas of Durango, Sinaloa, Baja California, Sonora and Chiapas; other areas remain to be identified. Determination of the status of rare and endangered species that are potentially vulnerable to the effects of the continuing uses of DDT and endrin, and of other biocides in use, is a high priority for field investigations.

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Eduardo E. Iñigo Elias*
Programa Fauna de Mexico
Instituto Nacional de Investigaciones sobre Recursos Bioticos, Chiapas
Calle Real de Guadalupe No. 50
29200 San Cristobal de las Casas, Chiapas, Mexico
*(Present address:
Department of Wildlife and Range Studies
University of Florida
Gainesville, Florida 32611 USA)

Robert W. Risebrough
Institute of Marine Sciences
University of California
Santa Cruz, CA 95064, USA