

# Tests Show 40 Species

By George J. Wallace and Richard F. Bernard

Editor's Note: In Dr. Wallace's previous articles in Audubon Magazine on DDT in birds (see footnote) he wrote: "Only for the robin are the full details known. . . I have no data on dead or dying leaf-gleaning birds. . . We have even less data on birds that forage on the trunks and branches. . . The extent to which other species share in this [insecticide] dilemma is less known."

Dr. Wallace and Dr. Bernard have

now completed analyses of 47 other species, 26 of which probably contained lethal doses of DDT—if lethal levels determined for robins and sparrows apply to other species. New analyses now being made by other workers on additional species are not included. In this article the authors report on the effects of DDT on these many other species as well as providing additional findings on their robin studies.

During the past eight years, aided by graduate students, staff members and others, we have been accumulating and trying to evaluate data on the effects on birds of the DDT used in local spraying operations.

For the past four years, mainly through the work of Dr. Bernard, we have supplemented field observations with chemical analyses of avian tissues and by feeding tests with caged birds. Some of our earlier observations have been published in *Audubon Magazine*\* or other journals.

The results of many analyses on robins and of feeding tests on sparrows have now been documented in detail. Since these reports\*\* are primarily in biological and statistical terms, we are presenting them in less technical form in this article.

We shall discuss our field observations, chemical analyses, feeding tests, current progress on studies of the food chains responsible for toxicity in birds and DDT effects on reproduction.

The first phase of our studies necessarily was restricted to observations of dead and dying birds found on or around the Michigan State University campus in East Lansing. Each spring, usually following the spraying of the elms for protection from Dutch elm disease, we get 50 to 100 or more specimens turned in or reported from the campus and vicinity, many of them exhibiting the symptoms com-

monly associated with hydrocarbon poisoning.

During the past four years we have carried out detailed spring censuses on the North Campus, usually once a week, so that we have been able to measure the decline from week to week and to compare the number of survivors with the accumulative dead.

Our conclusion from these surveys is that the elimination of robins and some other species on the campus in spring is virtually complete. Any robins remaining in mid-June or later are usually due to replacements and were not a part of the original April population.

Usually our recovery of dead robins, even though incomplete, equals or exceeds the maximum April figures. When peripheral populations are high, as in 1961 and 1962, this influx is great. We estimate that the number of robins dying on our census area in the past two springs has been about four times the maximum April population.

This portrays a dismal picture for our campus. However, the die-off of robins is probably less severe in off-campus areas, where there are fewer or more scattered elms. Also, the die-off seems to be largely limited to the spring months.

Factors responsible for the apparent lack of summer mortality might be change in diet from toxic earthworms to fruit, the greater mobility of summer robins, which range widely, or temporary storage of

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\* See "Insecticides and Birds" and "Another Year of Robin Losses on a University Campus," by George J. Wallace, *Audubon Magazine*, January-February 1959 and March-April 1960, respectively.

\*\* Michigan State University Museum Publications (Biological Series, Vol 2, No. 3, 1963); Bulletin 41, Cranbrook Institute of Science, Bloomfield Hills, Michigan, 1961.



# Birds Poisoned by DDT

DDT in nonlethal tissue areas from which it might be transferred to lethal centers during periods of stress, such as during migration or in times of critical food supplies.

The second phase of our studies involves chemical analyses of tissues from suspected victims. From 1959 through 1961 Dr. Bernard made nearly 1,000 tests on avian tissues, measuring the levels of DDT in the brains, hearts, breast muscles, livers and sometimes kidneys and gonads of more than 200 birds of nearly 50 different species. Smaller samples of soil, leaves, bark, earthworms, eggs, embryos and nestlings were also analyzed.

These tests by Dr. Bernard showed that every one of the 69 East Lansing-Lansing robins analyzed had DDT in its tissues or organs.\* About 90 per cent of the robin brains analyzed had levels of DDT comparable to levels found in those dying of experimental DDT poisoning.

Three robins taken in May on an unsprayed wildlife sanctuary and several other species from TV towers in fall were free from DDT in all the tissues examined. Three summer robins caught in nets on a small area sprayed only for mosquitoes (from the ground) had intermediate (sublethal) levels of DDT, but three of four found dead in an area reportedly sprayed only for gypsy moths (from the air at one pound per acre) had lethal levels.

About 40 of the other species analyzed so far have contained DDT, though not necessarily in lethal amounts in all cases. Only aerial feeders (swifts, swallows and a night-hawk, in areas where elms are sprayed from the ground) and some transients, chiefly fall, have been consistently free of DDT. However, a trembling grasshopper sparrow picked up on Point Pelee on May 7, presumably after a flight across Lake Erie, had 17 parts per million of DDT—probably a sublethal dose for a normal bird.

Species in which laboratory tests on birds found dead or dying showed

DDT in amounts probably fatal include the following:\*

Mallard	Cedar waxwing
Red-shouldered hawk	Starling
Screech owl (?)	Black-throated green warbler
Yellow-shafted flicker	House sparrow
Horned lark	Eastern meadowlark
Blue jay	Red-winged blackbird
Black-capped chickadee	Baltimore oriole
White-breasted nuthatch	Common grackle
House wren	Cardinal
Brown thrasher	Rose-breasted grosbeak
Robin	Pine siskin
Blue-gray gnatcatcher	American goldfinch
Ruby-crowned kinglet	Rufous-sided towhee

Species containing amounts of DDT presumed to be sublethal were:

Marsh hawk, pigeon hawk, mourning dove, belted kingfisher, downy woodpecker, hermit thrush, wood thrush, brown-headed cowbird, grasshopper sparrow, slate-colored junco and chipping sparrow.

Dead or dying species (most with DDT symptoms) but not analyzed:

Goshawk, sharp-shinned hawk, Cooper's hawk, red-tailed hawk, rough-legged hawk, sparrow hawk, rock dove, yellow-billed cuckoo, great horned owl, ruby-throated hummingbird, hairy woodpecker, yellow-bellied sapsucker, red-bellied woodpecker, kingbird, Eastern phoebe, Traill's flycatcher, common crow, tufted titmouse, brown creeper, catbird, Swainson's thrush, Eastern bluebird, golden-crowned kinglet, red-eyed vireo, 14 warblers (black-and-white, Nashville, yellow, magnolia, Cape May,

\* This and three subsequent lists are from Bulletin 41, Cranbrook Institute of Science, 1961.

\* For precise readings (micrograms per gram of tissue) see Michigan State University Museum Publications (Biological Series, Vol. 2, No. 3, 1963).