THE EFFECT OF CERTAIN INSECTICIDES ON THE BOBWHITE QUAIL AND MOURNING DOVE

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In the relatively few years since the end of the second World War, the insecticide manufacturing industry in the United States has undergone a great expansion. Since the introduction of DDT to the public at the close of the war, many new and increasingly potent insecticides have been put on the market faster than research workers have been able to evaluate them. Those which received the most attention are the organic phosphates, such as parathion, HETP (hexaethyl tetraphosphate) and TEPP (Tetraethyl pyrophosphate), and the chlorinated hydrocarbons. Four of these commercial poisons of the chlorinated hydrocarbon group, toxaphene, lindane (the gamma isomer of benzene hexachloride), dieldrin and aldrin are included in my research studies with bobwhite quail and mourning dove. Although Cottam and Linduska of the Fish and Wildlife Service and numerous other workers have made extensive studies on DDT in relation to songbirds, fish, and wildlife in general, little has been undertaken to secure similar information for the newer compounds. To my knowledge, no experiments utilizing the mourning dove as a test species for toxicity studies have previously been made. Therefore I feel that, though incomplete, the information available at the present time will be of some interest, especially to those of you who will live in regions where considerable cotton and peanut dusting is done annually.

METHODS

The intial portion of my program was necessarily concerned with the provision of adequate facilities for holding the experimental birds, and for this purpose we utilized the holding pens for which constructional details are given in the Fish and Wildlife Service Conservation Bulletin No. 10 by Nestler and Bailey "Bobwhite Quail Propagation." Our first supply of fifty quail were obtained in October of 1950 at eight weeks of age from a private source at $3.50 per pair. These birds plus an additional 90 donated by the Patuxent Refuge in Laurel, Maryland were utilized for exploratory doses of the four poisons. A second shipment of birds purchased in 1951 are at present being used to add significance to the data already obtained.

In the early portion of this past summer dove trapping was begun, as there is no commercial source for these birds. Little success was had at first, but in late July a large concentration was located, and sufficient birds were obtained to begin work. The covey type quail trap seemed to produce the best results, and was used in the latter portion of the trapping in preference to the Potter-type treadle traps. To date a total of 85 doves have been trapped and used in exploratory dosing. The feeds used for the birds are given in Table 1.

The procedure of handling the birds for dosing is relatively simple, yet might merit mentioning. The birds are caught by hand from the pens and placed in a bag

Table 1. Nitritive values of foods fed to bobwhite quail and mourning dove during LD_{50} studies.

	%	
	Quail[a]	Doves[b]
Crude protein	> 26.00	> 9.50
Crude fat	> 3.50	> 2.00
Crude fiber	< 7.00	< 5.00
Nitrogen free extract	> 45.00	> 65.00

[a] Security 26% protein turkey growing mash.
[b] Wheat and corn starch.

where they remain until prepared for dosage. Each bird is removed and placed in a paper cone with the head projecting from the small end. In this position most of the birds remain sufficiently quiet to allow weighing. From the weight of the bird and the dosage level in mg/kg the amount of poison to be administered is calculated for each individual. An analytical balance is used to weigh out the dose of poison while the birds remain in the cone. The weighed portion is then placed in a Number 1 gelatin capsule and the bird is picked up, holding the cone sufficiently tight to prevent it from backing out and escaping. The cone is next pressed against the table top with the left forearm, while the birds' head is held slightly extended with the left thumb and forefinger, generally at the base of the mandibles. A small portion of water is administered to the bird with an eye dropper or pipette to assure a well lubricated esophagus. To prevent adhering, the capsule is then moistened, as are the fingers of the operator, and it is slid down the throat of the bird. Once past the base of the tongue the bird will usually swallow the capsule without difficulty. Another small portion of water is then administered, and the bird is placed in a container to await its return to the holding pen. Since the birds are all banded, no attempt is made to segregate those poisoned with one poison from those dosed with another, nor from the untreated birds. The sexes are segregated, however, to prevent rival cocks from fighting over the hens. Several cases of cannibalism have occurred, but the addition of small amounts of salt to the diet of the birds generally curbed this in short order.

Wild doves present a problem when caged, as they injure themselves seriously on the wire or hardware cloth interior of even small cages, often striking the wire with the anterior edge of the wing and top of head until extremely bloody. To prevent this we found a cheesecloth lining tacked a short distance inside the cage wire was quite effective. Attempts to induce wild adult doves to breed in cages in a North Carolina life history study (Quay 1951) were unsuccessful primarily because the birds injured or killed themselves on the sides and top of their enclosure. For that reason we feel quite fortunate in being able to eliminate this as a factor to complicate our results.

RESULTS

To date all work has been concerned with the location of the acute toxicity level, or more specificially the LD_{50}. This merely means that level of dosage at which fifty per cent of the treated birds die.

On the basis of experiments conducted to date, which are not extensive enough to draw definite conclusions, the LD_{50} for the four poisons are given in Table 2.

Table 2. LD_{50} values for bobwhite quail and mourning doves fed four commercial poisons.

	LD_{50} (mg/kg)	
	Quail	Doves
Aldrin	4.0 - 4.5	14.0 - 15.0
Dieldrin		
Males	13.0 - 15.0	
Females	10.00 - 12.0	
Toxaphene	85.0 - 90.00	200.0
Lindane		> 300.00
Males	135.0 - 137.0	
Females	200.0 - 225.0	

DISCUSSION

To those of you unfamiliar with the term mg/kg, it refers to milligrams of toxicant per kilogram of body weight of the test animal, in other words parts per million. If we then look at the amount of aldrin required to kill quail, which seldom weigh over 200 grams, we see that one milligram of pure poison will kill birds. This amount of poison could easily be held on the head of a common pin. The redeeming factor, or course, may be the low percentage of active insecticide present in the commonly used sprays and dusts, seldom over 5%. It would certainly seem though, that such small amounts of the toxic material could conceivably be picked up by a bird in an area in which aldrin has been used. No authentic cases have been recorded where such is the case, but many second or third hand reports of dead birds in and around dusted fields might lead to such an assumption. Unfortunately, all of these poisons are highly chlorinated compounds which are very difficult to isolate and distinguish except by colorimetric or spectrographic procedures which are tedious and complicated and require much specialized laboratory equipment. Therefore autopsies of birds found in such cases would probably not yield conclusive evidence as to the cause of their death, even if it were due to the insecticide.

All autopsies have been performed or supervised by staff members of the A.P.I. Poultry Department, to whom I am gratefully indebted. Other than an excess of urates in the kidneys, frequent dilation of the auricles and their veins, occasional regurgitation of food into the anterior larynx, and slight hemmorhages in the pleural cavities and other body areas no gross pathological changes have been noted for either species. In all cases a marked loss of weight preceded death. This has been demonstrated (Anderson et al. 1951) to be due to a loss of appetite induced by the poison rather than a direct effect on the metabolic rate of the victim.

The general symptoms of poisoning with these compounds are very similar to those described for dieldrin (Hayes et al. 1951), convulsions, loss of appetite, weight loss, hyperexcitability and muscle twitching. The chlorinated hydrocarbons are convulsant poisons and the above disorders of the central nervous system are typical. The autopsy of a convulsed animal will show slight hemmorhages and congestion of the viscera and central nervous system even when the causative factor is something other than an insecticide, so they are nonspecific for the poisons.

Dosages which were sublethal in amount apparently had no effect on the breeding condition of the birds, since several of the quail which were paired up late in the spring produced fertile eggs and healthy young. Most of the birds which recovered were marked with a plastic bowtie and released on areas which could be censused by Unit Personnel to determine the per cent survival under natural conditions.

Further work must be done on these species to add significance to the data already obtained on acute toxicity. Following the completion of this portion of the project, plans are to inaugurate work on the chronic toxicity of aldrin and dieldrin to the same species. The third step will be to carry out studies of toxicity of the various poisons under field conditions.

Linduska and Springer (1951) recently did considerable work with some of the insecticides to determine chronic toxicity. Toxaphene was 100% fatal at 0.1% in the diet in 16 days, and 90% fatal at 0.05% in 32 days. Benzene hexachloride was 95% fatal at 0.1% in 37 days, but only 10% fatal at 0.05% in the same length of time. Studies by Anderson et al. (1951) in Canada with aldrin on turkeys in chronic doses produced 100% mortality at all dosages down to 12.5 ppm. in 25 days. As the dosage increased the amount of food decreased, and subsequently the birds lost considerable weight.

LITERATURE CITED

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