DDE Thins Screech Owl Eggshells

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Eggshell thinning has been found to occur widely and is well documented especially in the United States and England. In the U.S., natural populations of at least 22 species representing seven orders have been affected. In seven of eight species where shell thinning exceeded 20 percent, there was an associated population decline (1). The thinning began to occur in the U.S. and England in the mid-forties at the time DDT and other organochlorine insecticides were first available for widespread use (1, 2). The possible relationship of shell thinning to the use of DDT led to a series of studies to test the effects of DDT and its metabolites on shell thinning and reproduction of birds.

Controlled experiments on species of two major bird groups, the Order Anseriformes (mallard ducks, *Anas platyrhynchos* and black ducks, *Anas rubripes*) (3, 4) and the Order Falconiformes *(Falco sparverius)* (5) show a direct causal relationship between DDE and eggshell thinning.

An experimental study has been made concerning the effectiveness of DDE in thinning eggshells of screech owls (*Otus asio*), which are members of a third major bird group, the Order Strigiformes The results of this study are reported below.

The group of screech owls involved in the study consisted of 14 pairs. The birds were drawn from the colony at Patuxent Wildlife Research Center where they had lived for at least a year before the study began. They were kept outdoors in 20x50x6-foot wire enclosures with one nest box and one 3-sided shelter. The owls were fed a ground diet of hamsters, mice, rats, chicken necks and heads, and vitamin and calcium supplements. They had a constant supply of water.

The study began on February 19, 1970, and extended through two breeding seasons. The birds received an untreated diet from the beginning of the study until September of the same year. At that time, seven pairs were randomly selected to receive a dietary

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dosage of 2.8 ppm of DDE (equivalent to 10 ppm dry weight) mixed with cottonseed oil. These birds were the dosed group. The remaining seven pairs were fed the same diet, including the cottonseed oil, but without the DDE dosage. These birds were the control group. Dosage began September 21, 1970, and continued through the second breeding season.

In each breeding season, the eggs were numbered as they were laid, and all were removed from the nest 5 days after the last egg was laid. The egg contents were removed, the shells rinsed with water, and dried for 2 weeks at room temperature before measuring. A dial gauge micrometer, calibrated in 0.01 mm units, was used to measure the eggshell and shell membranes at the equator of the egg.

The basic unit for comparisons, made among control and treated groups, was the average shell thickness of eggs laid by each female. Data were analysed by means of Student's t-distribution with and without paired observations (6).

The results are shown in Table 1. Birds fed untreated food in both 1970 and 1971 laid eggs of the same average thickness each year. Birds fed untreated food in 1970 and DDE dosage in 1971 laid eggs with shells that were 12 percent thinner than in 1970 ($P<0.01$, paired comparisons).

In 1971, the dosed birds laid eggs with shells 13 percent thinner than did birds fed untreated food both years ($P<0.05$).

The results of this study are similar to those of Heath, et al. (3), in which mallard ducks received 10 ppm in the diet with the results of 13 percent shell thinning. The owl study showed less shell thinning than Longcore's black duck study where eggs thinned by 17.6 percent after one year on 10 ppm DDE (4). Screech owls seem to show greater shell thinning than the American Kestrels, which showed 10 percent shell thinning on a diet of 10 ppm DDE (5).

Screech owls prey not only on mice and other small rodents, but also on arthropods, insect-eating birds, reptiles and fish (7-9). Screech owls seem to eat what is readily available in their habitat. These owls are, therefore, in a position in the food chain to accumulate DDE. This study has shown that DDE produces shell thinning of screech owl eggs, and so has shown the potential that DDE has for impairing reproduction of this species.

TABLE

Table 1. Changes in thickness of screech owl eggshells[1/]

Treatment group[2/]	No. of females[3/]	No. of eggshells measured	Shell thickness (mm) Average	Range
Control				
1970	7	29	0.218	0.185-0.256
1971	7	37	0.218	0.180-0.253
Experimental				
1970	6	25	0.214	0.175-0.237
1971	6	28	0.189**	0.170-0.205

** Significantly different from shell thickness of eggs laid by the same bird in 1970 ($P<0.01$) and from shell thickness of eggs laid by control birds in 1971 and 1970 ($P<0.05$).

1/ The basic unit for comparisons was the average shell thickness of eggs laid by each female.

2/ Control birds received untreated food in both 1970 and 1971. Experimental birds received untreated food in 1970 and DDE-dosed food in 1971.

3/ One female of the experimental group was injured near breeding season and did not lay in 1971 and therefore could not be compared in both years.

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