Methyl Mercury: Its Effect on Eggshell Thickness

by DAVID B. PEAKALL and JEFFREY L. LINCER
Section of Ecology and Systematics
Cornell University, Ithaca, N.Y. 14850

The eggshell thinning phenomena, discovered by Ratcliffe (1), has now been widely noted (2,3). There is conclusive evidence, both from field (3,4) and laboratory studies (5,6), that DDT and its metabolites can cause shell thinning. A more difficult question to answer is whether it is the only agent. Any material that is widely dispersed in appreciable concentration and capable of biological magnification is a possibility. Polychlorinated biphenyls, chemical similar to DDT, do not appear to thin eggshells (7,8). Another possible candidate is mercury.

We have examined the effect of mono- and di-methyl mercury on the shell thickness of two species, the Ring Dove (Streptopelia risoria) and American Kestrel (Falco sparverius). Two clutches (two eggs each) were collected from each pair of doves before the administration of mercury. The volatile dimethyl mercury was given by i.m. injection (10 mg/kg dissolved in semane oil) and then two more clutches were collected. Monomethyl mercury chloride was studied both by the oral and injected route. The smaller number of eggs in the experimental groups for this compound is due to marked inhibition of egg-laying. The length and breadth of each egg was measured before the shell was ashed overnight at 1000°. Ashed weight was considered to be a more accurate assay of calcium content than thickness for a species laying small eggs. The results for the Ring Doves are given in Table 1 and it is clear that no effect was observed.

The kestrels' diet consisted of one day old dead chicks. The dead chicks were injected with dimethyl mercury dissolved in semane oil in the breast region immediately before being fed to the hawk. Amounts injected were calculated to give 10 ppm in the total diet. Control birds were fed chicks injected with semane oil only. The kestrels were on diet for about three months before egg-laying commenced. The thickness of the shells remained exactly constant at 0.172 mm and the Ratcliffe Index (1) was 1.00 ± 0.03 (10) for controls and 0.95 ± 0.04 (x12) for those fed mercury. Figures are, respectively, mean, standard error and sample size. This change was not statistically significant at the 5% level.

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TABLE 1.

Treatment		Ashed shell weight mg. Control	Expt.	Ratcliffe Index[1] wt(mg)/ l.x b.(mm) Control	Expt.
$(CH_3)_2Hg$	10mg/kg i.m.	227±3.2 (24)	225±3.5 (24)	342±4.0 (24)	334±7.9 (24)
CH_3HgCl	10mg/kg i.m.	226±2.2 (24)	222±4.5 (16)	341±5.7 (24)	339±6.3 (16)
	10mg/kg oral	239±6.4 (24)	240±4.5 (14)	351±5.5 (24)	360±3.0 (14)
Semane oil, i.m.		234±3.7 (16)	230±2.5 (16)	348±3.6 (16)	346±5.0 (16)

Figures are means, standard error, and sample size.

It is of interest that Stoewsand et. al. (9) found a definite dose-dependent shell thinning when Quail (C. coturnix) were fed 1 to 8 ppm mercury chloride in their diet. While it is possible that a species difference is involved it is more likely that the form of mercury is critical. Since methylation of mercury occurs in biological systems (10,11) it is likely that top predators will receive most of their mercury in the form of methyl mercury. Our finding suggest that the effects of mercury do not include eggshell thinning.

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