Effect of Polychlorinated Biphenyls (PCB's) on the Eggshells of Ring Doves

by David B. Peakall

Section of Ecology and Systematics
Division of Biological Sciences
Cornell University
Ithaca, New York

Since their discovery in the ecosystem by Jensen in 1966(1) the polychlorinated biphenyls(PCB's) have been found to be widely distributed, often in considerable amounts. These data have been recently reviewed(2). Since the formulae of PCB's are similar to that of DDT it has been suggested that their actions may be similar. The outstanding effect of DDT and its metabolites on avian reproduction is to cause the thinning of egg-shells. This phenomenon has been recently reviewed by Ratcliffe(3), and it physiological basis discussed by Peakall(4).

One group of Ring Doves (Streptopelia risoria) were fed a diet containing 10 ppm PCB's (Arochlor 1254, kindly supplied by the Monsanto Chemical Company) for six months and the ashed (16 hrs, 1000° C) egg-shell weights compared to those from a group of control birds. No consistent changes in egg-shell weights were noted over this period, nor did the first and second egg of the clutch differ significantly. The conditions for maintaining birds has been given previously(5). In order to overcome the effect of individual variation, a second experiment was performed in which eggs were collected from the individual birds under study both before and after being put on a diet containing 10 ppm PCB's. In the third experiment 25mg PCB's (equivalent to 160mg/kg) were injected intraperitoneally one to four days before egg-laying and ashed egg-shell weights compared to those of eggs laid by the same individual before injection. Previous experiments had shown that injection of the carrier alone was without effect. The results are summarised in table 1 and it is clear no effect was observed.

TABLE 1

	Ashed shell weight in mg	
	Experimental	Control
Diet 10 ppm PCB's Separate controls	229.8 ± 4.5 (24)	231.8 ± 2.8 (26)
Diet 10 ppm PCB's Individuals acting as own controls	230.2 ± 3.2 (14)	232.0 ± 3.9 (14)
Injection experiment 25mg ip PCB's	224.1 ± 8.6 (9)	228.3 ± 3.7 (10)

Figures are means, standard error, and sample size.

Bulletin of Environmental Contamination & Toxicology, Vol. 6, No. 2, 1971, published by Springer-Verlag New York Inc.

DSW 332472

STLCOPCB4079048

In the case of the doves injected with PCB's, the carbonic anhydrase levels in the oviduct were determined by a method previously described(5). No difference from control values was observed. Residue analyses were carried out on egg contents and at the end of the experiment brains were taken for analysis. The average residue level in the eggs from the first experiment in which the birds were on diet for approximately 35 days was 4.81 ppm with a standard error of 1.08. Fuller details of this work will be reported elsewhere.

Although experimental studies have not previously been reported some attempt has been made to determine the effect of PCB's on egg-shell thinning by regression analysis from field samples(6,7). These studies are complicated by the presence of considerable amounts of DDE and lesser amounts of other pesticides. Anderson and co-workers(6) concluded that DDE has a greater effect on shell thickness than PCB's based in their studies on Double-crested Cormorants (Phalacrocorax auritus) and White Pelicans (Pelecanus erythrorhynchos) in western Canada. Vermeer and Reynolds(7) found no significant correlation between shell thickness and PCB's residues for the Great Blue Heron (Ardea herodias), but their range of concentrations of PCB's were too small for this regression analysis to be convincing. Risebrough (private communication) has come to the same conclusion based on his data for the Brown Pelican (Pelecanus occidentalis) in California. In this case the range of PCB's concentrations was large.

It is concluded that PCB's do not play a significant role in the phenomena of egg-shell thinning.

Acknowledgements

This work was supported by N.I.H. grant ES00306; Dr. T. J. Cade, principal investigator. Research was carried out while the author was an Established Investigator, American Heart Association.

References

1. ANONYMOUS. New Sci. 32,612 (1966).
2. PEAKALL, D.B. and LINCER, J.L. Biosci. 20,958 (1970).
3. RATCLIFFE, D.A. J. Appl. Ecol. 7,67 (1970).
4. PEAKALL, D.B. Sci. Amer. 222,72 (1970).
5. PEAKALL, D.B. Science 168,592 (1970).
6. ANDERSON, D.W., HICKEY, J.J., RISEBROUGH, R.W., HUGHES, D.F. and CHRISTENSEN, R.E. Can. Field Natur. 83,89 (1969).
7. VERMEER, K. and REYNOLDS, L.M. Can. Field Natur. 84,117, (1970).

DSW 332473

STLCOPCB4079049