POLYCHLORINATED BIPHENYLS: THEIR EFFECTS ON PENNED PHEASANTS[1]

by

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ABSTRACT

In 1970 and 1971, game-farm cock pheasants (Phasianus colchicus) were given single capsules weekly containing 0 and 25 mg polychlorinated biphenyls (PCB), Aroclor 1254, and hens were given 0, 12.5, and 50 mg weekly for 17 and 16 weeks, respectively. Egg production was reduced ($P < 0.01$) in the hens given 50 mg PCB both years. Fertility, determined by visual inspection of incubated eggs, was unaffected by PCB. Hatchability was lowest in the group of hens given 50 mg in both years, but significantly lower ($P < 0.01$) only in 1971. PCB adversely affected the viability of the embryo both years, as the number of eggs pipped but not hatched in PCB groups was higher ($P < 0.05$). PCB did not affect eggshell thickness. PCB-treated birds had fewer feathers than controls.

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[1]Funds for the study were supplied by the Bureau of Sport Fisheries and Wildlife through the South Dakota Cooperative Wildlife Research Unit, supported jointly by the South Dakota Department of Game, Fish and Parks; the Bureau of Sport Fisheries and Wildlife; the South Dakota State University; and the Wildlife Management Institute. Tissue analyses were made by the Denver Wildlife Research Center, and by Dr. Yvonne A. Greichus, Experiment Station Biochemistry Department. Dr. Robert J. Bury, Veterinary Science Department, conducted necropsies and histopathologic studies. Dr. W. L. Tucker, Experiment Station Statistician, gave statistical advice. This work is from a doctoral dissertation in the Animal Science Department by the senior author.

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Behavior on the visual cliff shortly after hatching was affected in that offspring of hens given 50 mg PCB in 1970 ($P < 0.01$) chose the visually-deep side of the cliff. No difference in behavior on the visual cliff between groups was evident in 1971. Response to hand catching of offspring was affected in 1970 ($P < 0.01$); the ability of penned pheasants to avoid hand capture was least where both parents received PCB, followed by those where hens only, cocks only, and neither parent received PCB. No difference in response to hand capture among groups was found in 1971. Weights of chicks from hens on 50 mg PCB were lower ($P < 0.01$) than those of chicks from hens given 0 or 12.5 mg at 6 weeks of age in 1970; this effect was not seen in 1971. Survival of chicks in brooders to 6 weeks of age was lower ($P < 0.01$) in offspring of hens given 50 mg PCB weekly in 1970; no difference was found among offspring of treatment groups in 1971. Survival of young from 6 weeks of age to the fall was similar in all groups. Overall survival from hatching to the fall was less ($P < 0.05$) in offspring of hens given 50 mg weekly in both years combined. No differential effect on survival was found between sexes.

PCB caused hyperexcitability, weakness, tremoring, lack of appetite, and comatose death. Birds 11-weeks old given 10 or 20 mg PCB daily, birds 6-9 months old given 50 or 100 mg each 3.5 days, and adult hens given up to 50 mg once a week continued to eat; 11-week old birds given 210 mg daily stopped eating. Of those given 210 mg daily, the heaviest birds lived longest and lost the greatest percentage of their weight (15-31 percent) before death (1.3-4.3 days). Birds not given PCB, but starved, lost a greater percentage of weight (27-51 percent)

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before death and took longer to die (2.3-8.6 days). Of 10 birds given 10 mg daily, one died as early as 30.6 days after the first capsule while one bird of the group lived 8 months and was sacrificed. The ninth bird in this 10-mg group died in 179.3 days, while the other seven birds died between 50.3 and 60.6 days. Of 10 birds given 20 mg PCB daily, one died as early as 39.6 days, and the last bird died 54.1 days after the initial capsule was given. The average number of days to death in the 20-mg group was 46.1 ± 5.3 days standard deviation. Four of 22 birds of both sexes, 6-9 months old, died after 10 single capsules containing 50 mg PCB were given at 3.5 day intervals; 9 of 22 were killed by 10 capsules each containing 100 mg administered similarly. Analysis of brain, liver, and muscle tissues from dead and surviving birds showed that brain residue levels from 300-400 ppm wet weight were indicative of death from PCB toxicosis; liver and muscle levels were too variable to be useful in assessing cause of death.

Adult hens were given a single 50-mg capsule, and samples of whole-body, brain, liver, muscle, eggs, and feces were analyzed. Residue levels of PCB were highest 12 hours after capsule administration; residues were highest in liver, followed by brain and muscle for 28 days after dosage. At least 94 percent of the administered dose was absorbed and 40.5 mg of the 50 mg was in the body after 28 days. Hens were in a state of low egg production, and excreted 4.2 mg in the eggs and 4.0 mg in the feces over 28 days. Excretion in the egg could be an important means of ridding the body of PCB. Eggs from hens given a single capsule containing 50 mg PCB had from 25 to 49 ppm wet weight in their eggs; a single egg laid between the first and second week after treatment contained 1.5 mg PCB. Hens from the 1970 breeding

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experiment given 17 capsules weekly and killed 1 week following the last capsule had, for four hens given 12.5 mg per week, from 37 to 56 percent of the administered dose in their body, and, for four hens on the 50-mg level, from 60 to 82 percent of the dose given.

Administration of PCB decreased weights of hearts and spleens ($P < 0.01$) at all levels given and increased weights of kidneys and livers in birds given 10- and 20-mg doses daily ($P < 0.01$), but not in birds given 210 mg daily. Splenic atrophy was characteristic of birds given PCB. Such small spleens were pale-tan color and had wrinkled capsules resulting from depletion of lymphatic nodules.

PCB and dieldrin were given singly and jointly, and only additive, not synergistic, effects were noted. Among the 22 pheasants in each test group given capsules each 3.5 days 10 times, three died from 4 mg dieldrin per capsule, six died from 8 mg dieldrin, four died from 50 mg PCB, nine died from 100 mg PCB, and nine died from 4 mg dieldrin jointly given with 50 mg PCB.

After alternately starving and feeding birds which had PCB stored in their bodies, it was found that PCB levels increased in the brain tissue. This work is presently being prepared for publication.