

Effects of Dietary Carbofuran on Bobwhite Activity Patterns

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Early pesticidal research focused primarily on the determination of LD₅₀ concentrations and measuring changes in reproductive performance and/or number and survival of offspring (BROWN 1978). More recently, research has evaluated effects of pesticides on aggression, motor activity, stress, growth response, susceptibility to disease, and other nonlethal impacts. Because of the complexity of natural ecosystems and strong selective forces operating within them, slight pesticide-induced behavioral changes could be extremely important to the survival of certain organisms. Physiological and behavioral rhythms are part of the phylogenetic make-up of an organism and have obvious ecological and biological significance (PITTENDRIGH 1961, ASCHOFF 1964). Earlier we reported on the effects of carbaryl and carbofuran on bobwhite (*Colinus virginianus*) food intake, body weight, and locomotor activity (ROBEL et al. 1982). Herein we report on the effect of sublethal levels of carbofuran (2,3-dihydro-2,2-dimethyl-7-benzofuranyl methylcarbamate) on activity patterns of bobwhites.

MATERIALS AND METHODS

Bobwhites were adult males obtained from a game farm operated by the Kansas Fish and Game Commission. Prior to the experiment, the birds were confined individually in 48 x 24 x 13-cm polypropylene cages with wire bottoms and tops, in environmental chambers at 20°C, 65% relative humidity, and under a 14 h light - 10 h dark photoperiod. Bobwhites were provided food and water ad libitum, the food was a pelleted mash consisting of 20.5% protein, 2.7% fat, and 3.6% crude fiber, plus vitamins and minerals.

During experiments, randomly selected bobwhites were confined individually in the environmental chambers in 76 x 35 x 30-cm plywood cages with wire tops. The cage floors were spring supported 0.63-cm mesh hardware cloth platforms balanced on fulcrums. A pressure sensitive microswitch under the floor made contact each time a bird walked across the cage floor. The contacts were recorded on an Esterline-Angus event recorder and used as a measure of activity. A quantitative expression of locomotor activity was determined by converting the number of pen deflections on the chart paper into minutes. A value of four

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seconds was assigned for every pen deflection.

Pesticide-treated feed was prepared by mixing the powdered form of technical grade carbofuran into dry mash, tumbling the mixture for 30 min, then pelleting the homogenous mixture. The feed provided a dietary concentration of 131 ppm of carbofuran. Pesticide-treated feed was stored in dark at -16°C .

The experimental design included 2 separate blocks of 4 randomly selected birds. The first experiment consisted of 2 periods: a 35-day pretreatment period and a 14-day treatment period. The second experiment included 3 periods: a 35-day pretreatment period, a 14-day treatment period, and a 14-day posttreatment period. Birds were provided carbofuran-treated feed only during the 14-day treatment periods.

RESULTS AND DISCUSSION

During the pretreatment period of the first experiment, all birds exhibited a bimodal activity pattern with major morning and evening peaks coinciding with light-on and light-off stimuli (Fig. 1). The pattern and timing of major activity peaks during treatment remained unchanged from that during pretreatment, however, reduction in activity was found for all birds during treatment. Activity reduction ranged from a 10% decrease for bird No. 4 to a 25% decrease for bird No. 2.

As in the first experiment, all birds in the second experiment exhibited a bimodal activity pattern during the pretreatment period (Fig. 2). The general pattern and timing of major activity peaks for birds during treatment remained unchanged from pretreatment, but the level of activity was reduced. Reduction in activity ranged from 29% for bird No. 3 to 50% for bird No. 4. During the 14-day posttreatment period, general pattern and timing of major activity peaks for birds coincided with that during the 35-day pretreatment period. The posttreatment activity of birds No. 3 and 4 was almost identical to their pretreatment levels whereas bird No. 1 exhibited a 27% decrease and bird No. 2 a 17% increase.

The bimodal activity pattern exhibited by our confined bobwhites is typical of free-ranging bobwhites (FATORA AND DUEVER 1968). The first peak of activity may be in response to light-on stimuli, but there is no such proximate light stimulus for the second peak of activity. It may be that the second peak of activity is a latent response of several hours to the light stimulus (ASCHOFF 1966), but this research was not designed to examine that issue.

The general depressing effects of carbofuran on activity of bobwhites was equally spread throughout the photoperiod, i. e., not concentrated in the beginning, middle, or end of the 14-hour photoperiod. The ecological impact of this reduced activity could not be evaluated in this laboratory study, however, if such reduced activity occurred in the wild, it could result in reduced food intake and altered breeding behavior. The depressing effects of carbofuran on activity is temporary. Data from our second experiment disclosed complete recovery of activity levels within 14 days after birds were taken off the carbofuran-contaminated

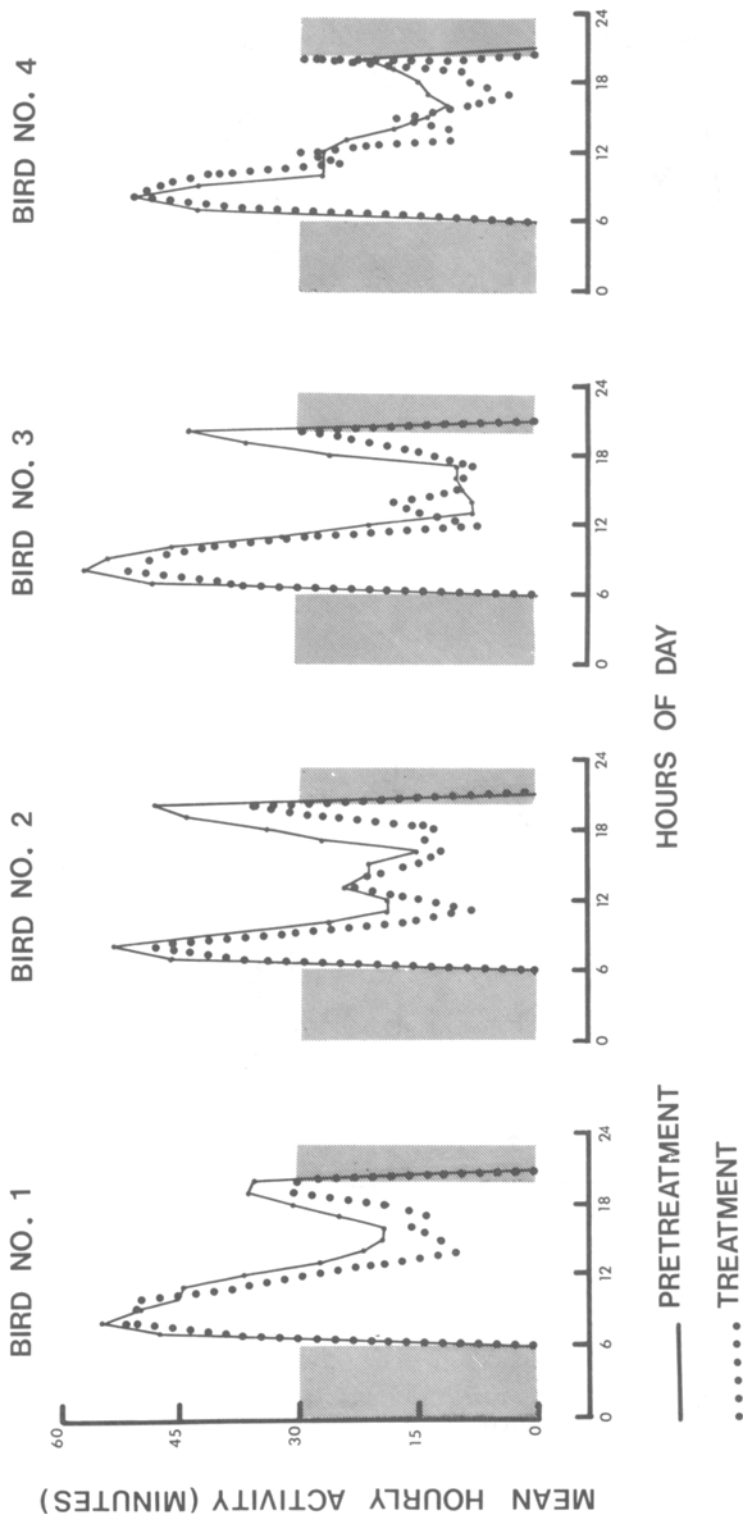


Figure 1. Activity patterns of four bobwhites during 35 days on uncontaminated feed (pretreatment) and 14 days on feed contaminated with 131 ppm of carbofuran (treatment). Shaded areas represent dark periods of the 14L:10D photoperiod.

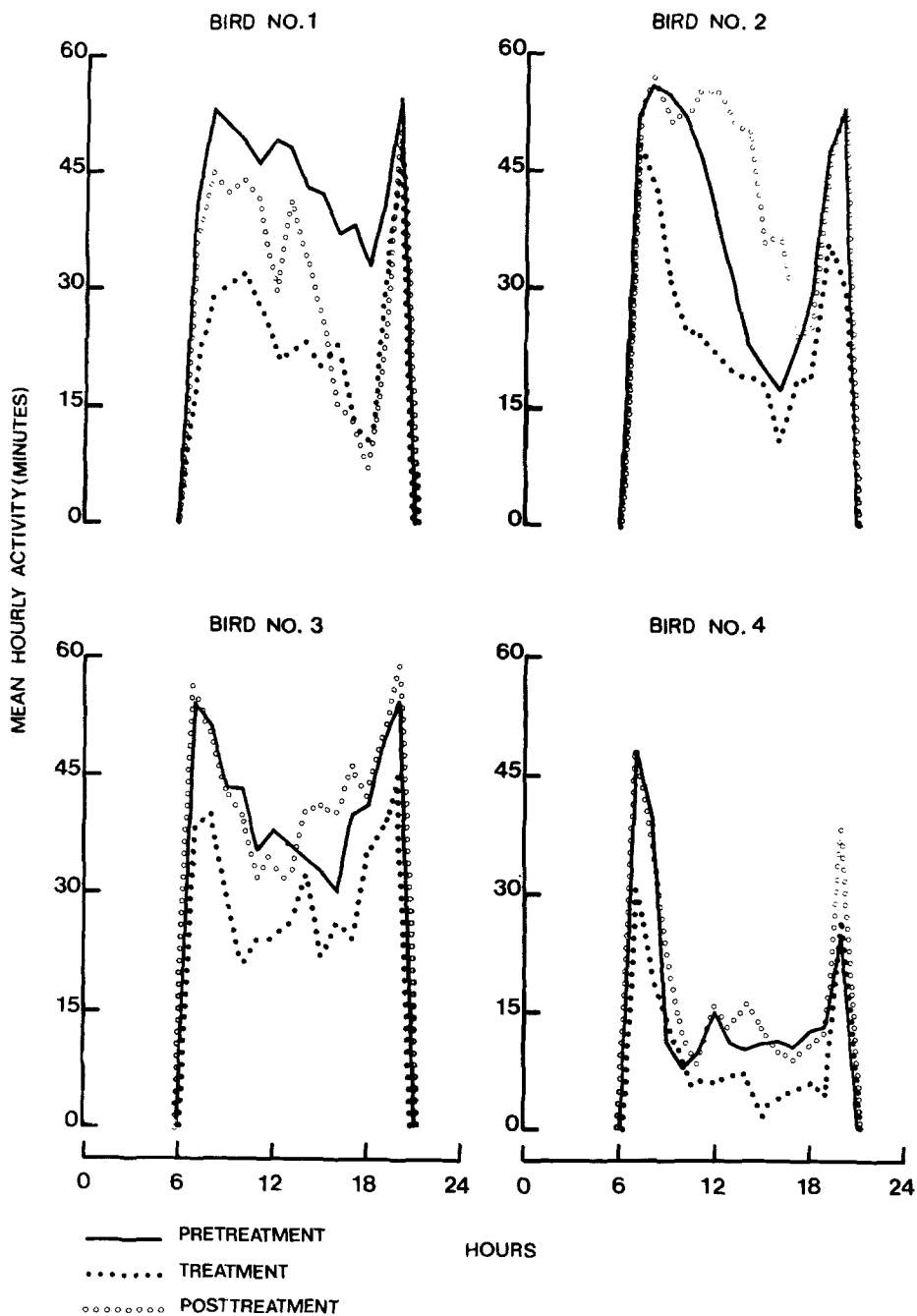


Figure 2. Activity patterns of four bobwhites during 35 days on uncontaminated feed (pretreatment), 14 days on feed contaminated with 131 ppm of carbofuran (treatment), and 14 days on uncontaminated feed (posttreatment). Shaded areas represent dark periods of the 14L:10D photoperiod.

feed. The temporary nature of reduced activity probably is due to the rapid breakdown of carbofuran in the body (HICKS et al. 1970).

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