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Source: Journal of Wildlife Diseases, 36(1) : 180-183

Published By: Wildlife Disease Association

URL: <https://doi.org/10.7589/0090-3558-36.1.180>

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Lead Poisoning in a Northern Bobwhite in Georgia

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ABSTRACT: A northern bobwhite (*Colinus virginianus*) was observed with partial paralysis on 3 March 1997 and found dead on 8 March 1997 on Di-Lane Plantation Wildlife Management Area (Burke County, Georgia, USA). The juvenile male was necropsied by the Southeastern Cooperative Wildlife Disease Study (Athens, Georgia) and diagnosed with lead toxicosis. The bobwhite had liver tissue lead levels of 399 parts per million wet weight and two worn 1-mm diameter lead shot pellets were found in the gizzard.

Key words: Case report, *Colinus virginianus*, dove fields, lead shot, lead toxicosis, northern bobwhite.

Lead poisoning was documented in waterfowl as early as 1874 (Phillips and Lincoln, 1930) and more recently many studies have focused on waterfowl lead exposure (Bellrose, 1951; Kendall and Driver, 1982; Sanderson and Bellrose, 1986), but reports of plumbism in wild upland game birds are relatively rare (Campbell, 1950; Hunter and Rosen, 1965; Locke and Bagley, 1967; Stone and Butkas, 1978; Butler, 1996). There are even fewer reports involving lead poisoning in wild northern bobwhite (*Colinus virginianus*) (Stoddard, 1931; Westemeier, 1966; Best et al., 1992a).

Lead poisoning in any bird often goes unnoticed for several reasons. Lead poisoning is often fatal within 2 to 3 days (Pain, 1992) to 2 to 3 wk after ingestion of lead (Butler, 1996), depending on amounts of lead ingested, consumption of other food types and the species involved, leaving a limited time-period to observe sick or dead birds. Also, sick birds often seek refuge in dense vegetation, where they are depredated or carcasses are consumed by scavengers (Carrington and Mirarchi, 1989).

Few studies have been conducted to determine dose-response mortality of north-

ern bobwhite that ingest lead shot pellets. Stoddard (1931) reported lead poisoning in a wild northern bobwhite that was exhibiting partial paralysis and had two lead shot pellets in the gizzard. However, Best et al. (1992a) described several northern bobwhite in New Mexico that exhibited no lead toxicosis symptoms, but had liver tissue lead levels greater than birds with symptoms. McConnell (1967) reported northern bobwhite that displayed lead toxicosis symptoms within 4 days after ingestion of 15 to 100 lead shot pellets, but most recovered. A wild northern bobwhite in Illinois which died of lead toxicosis had four lead shot pellets in its gizzard (Westemeier, 1966). Lead poisoning, in addition to causing direct mortality in upland birds, also may affect reproduction. Upland birds that ingest lead and recover, may experience reproductive problems. Buerger et al. (1986) reported a reduction in egg hatchability in mourning doves (*Zenaidra macroura*) when force fed one, number 8 lead shot pellet. McConnell (1967) detected a reduction in northern bobwhite egg fertility and hatchability when hens were force fed 1 to 100, number 7½, lead shot pellets. Edens et al. (1976) also saw reproduction reductions in Japanese quail (*Coturnix coturnix japonica*) after ingestion of 1 to 1,000 parts per million (ppm) lead levels in their feed. However, Kendall and Scanlon (1981) documented no disruption in egg production or fertility in ring-necked doves (*Streptopelia risoria*) fed water with 100 µg/ml of lead.

Mourning dove hunting is a common practice in the United States and many private landowners, as well as state and federal agencies manage areas for dove and dove hunting (i.e., dove fields). The increasing popularity of dove hunting and

dove field management is resulting in high concentrations of lead shot in upland areas available for consumption by upland birds (Lewis and Legler, 1968; Best et al., 1992b). These dove hunting areas, especially after many years of hunting, carry amounts of lead shot ranging from 3,228 shot/ha (Castrale, 1989) pre-hunting season levels to 108,900 shot/ha (Lewis and Legler, 1968) and 860,185 shot/ha (Best et al., 1992b) post-hunting season levels. Many of these dove hunting areas also are attractive to northern bobwhite because of maintained early successional habitat. Any lead shot on these areas is available for both species to consume, but more so to the rasorial bobwhite.

On 3 March 1997, we observed one of our radio-marked wild northern bobwhite, a juvenile, male, was unable to fly and was apparently afflicted by partial paralysis. This radio-marked bobwhite was one of 52 involved in an ongoing habitat use study conducted by the University of Georgia (Warnell School of Forest Resources, Athens, Georgia, USA) on Di-Lane Plantation Wildlife Management Area (WMA) (32E56'N, 82E04'E) in Burke County (Georgia). This bobwhite had been fitted with a 5.5 g, necklace-harness radio-transmitter on 25 February 1997, as were the other bobwhite captured from January to April 1997. The partially paralyzed bobwhite was captured by hand, examined for external injury and kept in a wire cage over-night for observation. The bobwhite had no obvious injuries, behaved normally the next day, and was released at the capture site. The bird was still unable to fly, but rejoined its original covey by the second day after release. During daily locations of radio-marked bobwhites, we found that the afflicted individual continued to exhibit partial paralysis until it was found dead on 8 March 1997. The carcass was in good condition and was immediately frozen and taken to the Southeastern Cooperative Wildlife Disease Study (SCWDS, University of Georgia, Athens) for diagnosis (SCWDS case #76-97). Other indi-

viduals captured for radio-marking on Di-Lane Plantation WMA were not tested for tissue lead levels and exhibited no lead poisoning symptoms.

SCWDS found the bird in poor physical condition with no subcutaneous or internal body fat and it weighed 120 g. Hunter-killed male bobwhite from Di-Lane Plantation WMA average 170 g (Lewis, 1999). There were no external lesions. The proventriculus was enlarged, 4.5 cm × 2 cm, and filled with impacted feed material (mainly grain and plant material). The gizzard contained similar ingesta, as well as two, 1-mm diameter, dull gray, worn, spherical, lead shot pellets. The gizzard mucosa was thickened, stained dark green/brown, and contained several small erosion lesions. No other gross or microscopic lesions were noted. Liver samples were analyzed for heavy metals. Lead was detected at 399 ppm tissue wet weight. Lead toxicosis was diagnosed as the cause of death.

This bobwhite and 10 others were captured on and frequently used one of the two managed dove fields on Di-Lane Plantation WMA. This particular dove field is open to public hunting at certain times during the statewide dove hunting season (September through December) and receives moderate to heavy hunting use. There are no records of hunter numbers or amounts of lead shot deposited on the 40-ha area used for dove hunting. This dove field is planted annually with agricultural crops (e.g., corn, millets, grain sorghum, and sunflowers) which are available to bobwhite and dove in late summer through fall. Late winter discing is practiced to encourage legume growth and create insect rich areas for bobwhite chicks to feed. Soil tillage reduced the amount of available lead shot by 79% in Missouri (Fredrickson et al., 1977) and 85% in Illinois (Esslinger and Klimstra, 1983); however, after a long history of lead deposition, tillage may no longer effectively reduce lead availability (Castrale, 1989).

No studies could be found that docu-

ment normal liver tissue lead levels in northern bobwhite. However, Bagley and Locke (1967) reported normal liver tissue lead levels in mourning doves as 0.4 to 7.0 ppm. Best et al. (1992a) reported two northern bobwhite, each had one to two lead shot pellets in the gizzard, with liver tissue lead levels of 5 ppm wet weight, and six individuals, with no symptoms of lead toxicosis, had tissue lead levels of 10 to 32 ppm wet weight.

Reports of lead poisoning in northern bobwhite are rare. This rarity may be due to the difficulty of observing and recovering sick and dead birds. Also, there may be a relatively small portion of local bobwhite populations which inhabit dove fields with high available lead shot levels. However, with lead shot levels likely increasing on these areas because of increasing hunting pressure, and the continued decline in northern bobwhite populations, lead poisoning may become a greater problem. More research is needed to document baseline lead levels in northern bobwhite, the potential of lead ingestion from dove fields by northern bobwhite, and the effects of lead exposure on northern bobwhite reproduction.

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Received for publication 24 October 1998.