Prevalence and Identity of Coccidia in Pen-Raised Wild Turkeys

Authors: Ruff, M. D., Schorr, L., Davidson, W. R., and Nettles, V. F.

Source: Journal of Wildlife Diseases, 24(4) : 711-714

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-24.4.711

Journal of Wildlife Diseases, 24(4), 1988, pp. 711–714

Prevalence and Identity of Coccidia in Pen-Raised Wild Turkeys

M. D. Ruff,[1] L. Schorr,[2,4] W. R. Davidson,[2,3] and V. F. Nettles,[2] [1] Protozoan Diseases Laboratory, Livestock and Poultry Sciences Institute, Agricultural Research Service, USDA, BARC-East, Beltsville, Maryland 20705, USA; [2] Southeastern Cooperative Wildlife Disease Study, Department of Parasitology, College of Veterinary Medicine, University of Georgia, Athens, Georgia 30602, USA; [3] School of Forest Resources, The University of Georgia, Athens, Georgia 30602, USA. [4] Present address: National Wildlife Health Center, 6006 Schroeder Road, Madison, Wisconsin 53771, USA

ABSTRACT: One hundred nineteen pen-raised wild turkeys (*Meleagris gallopavo*) from 12 locations in nine states in the United States were examined for coccidia by sugar flotation of intestinal contents and mucosa or by subinoculating the contents into uninfected domestic turkeys. Seventy-eight (66%) of the turkeys were positive for coccidia. There were no differences in the frequency of coccidia among adult, subadult or juvenile turkeys. More females (75%) were infected than males (48%). The species of coccidia from 30 of the turkeys were identified based on microscopic examination of oocysts, fresh scrapings, stained sections and inoculations of bobwhites (*Colinus virginianus*). The frequency of each species was *Eimeria meleagrimitis* (97%), *E. gallopavonis* (47%), *E. meleagridis* (27%), *E. dispersa* (17%), *E. innocua–E. subrotunda* (13%), *E. adenoeides* (7%) and an undescribed species (3%). Of the 30 turkeys in which the species of coccidia was determined, 30% had a single species infection, 40% had two species, 20% had three species and 10% had four species.

Key words: *Eimeria* spp., coccidia, distribution, infection, prevalence, wild turkey, *Meleagris gallopavo*.

Coccidia have been reported from a significant percentage of native wild turkeys (*Meleagris gallopavo*) (Kozicky, 1948; Prestwood et al., 1971) although there are few such surveys. Coccidia are often overlooked, or not searched for, when surveys are conducted for internal parasites in wild turkeys. As a result, some checklists of parasites of the wild turkey include coccidia (Prestwood et al., 1973), whereas others do not (Prestwood et al., 1975; Davidson et al., 1985). Information on coccidiosis in pen-raised wild turkeys is lacking other than brief general mention of the disease in lay or semitechnical publications.

The occurrence of pathogens, such as coccidia, in pen-raised wild turkeys is important because many wildlife biologists consider released pen-raised turkeys to be a potential source of disease problems in native wild turkey populations. However, data to substantiate this contention are sparse and circumstantial. This report concerns the prevalence and identity of coccidia isolated from 119 pen-raised wild turkeys from 12 locations in the United States.

Samples of the intestinal contents and mucosa were collected from 119 pen-raised wild turkeys from 12 locations in nine states (Table 1). These birds were designated as juvenile (5 to 6 mo old), sub-adult (7 mo to 1½ yr old) or adult (>1½ yr old). Domestic turkeys were not present at the same locations although other game birds or poultry were present in some cases. The samples included approximately one-half the contents of the large intestines. The samples were preserved in approximately 20 ml 2.5% potassium dichromate and sporulated for 72 hr at room temperature. They were then refrigerated at 4 C until used.

Two methods were used to identify samples positive for oocysts. In the first, approximately 3 ml of the sample was centrifuged at 600 *g* and the sediment mixed with 1 M sucrose. After a second centrifugation at 225 *g*, the top layer of the sugar solution was examined microscopically for oocysts. This procedure was repeated for samples that were negative the first time.

In the second method, approximately 3 ml of sediment were given orally to each of three 2- to 4-wk-old domestic turkeys.

TABLE 1. Comparison of flotation/microscopy and experimental inoculation for the detection of coccidia infections in wild turkeys.

Location*	Number positive (flotation)	Number positive (inoculation)	Total positive (%)
Keokuk County, Iowa (41°2'N, 92°12'W)	9	1	90
Shelby County, Missouri (39°47'N, 92°2'W)	10	6	100
Baltimore County, Maryland (39°18'N, 76°27'W)	10	1	100
Crawford County, Pennsylvania (41°37'N, 79°40'W)	8	3	80
Juniata County, Pennsylvania (40°41'N, 77°7'W)	8	1	80
Winona County, Minnesota (44°3'N, 91°38'W)	3	1	27
Monroe County, Alabama (31°31'N, 87°20'W)	1	1	10
Blue Earth County, Minnesota (44°12'N, 93°59'W)	3	1	30
Moore County, North Carolina (35°26'N, 79°34'W)	4	3	50
Early County, Georgia (31°23'N, 84°57'W)	7	7	80
Winona County, Minnesota (44°2'N, 91°46'W)	4	1	62
York County, South Carolina (35°7'N, 81°12'W)	7	8	80
Total	74	34	78
% Positive	62	29	66

* A sample from each of 10 pen-raised wild turkeys was examined for each location except for the two Winona County, Minnesota collections which were taken from 11 and 8 turkeys, respectively.

Feces from each inoculated turkey were collected 5 to 7 days postinoculation (PI) and examined by sugar flotation to identify positive samples. In addition, experimentally inoculated turkeys were killed at 7 days PI and scrapings of the intestine were examined microscopically. The prevalence of coccidia was analyzed based on age (75 juveniles, 11 sub-adults, and 33 adults) and sex (42 males and 77 females) using Chi Square analysis with each location as a separate group.

A portion of each positive sample was used to inoculate three domestic turkeys to harvest oocysts for species identification. Feces were collected 5 to 9 days PI. Oocysts were sporulated, cleaned by sugar flotation, and counted in a McMaster Chamber (Weber Scientific International Ltd., 32 Ingleside Crescent, Lancing, Sussex, England BN15 8EN). Harvests yielding at least 2,000 sporulated oocysts/ml were used for species identification.

Preliminary species identifications were based on oocyst measurements, shape index, and other characteristics such as a refractile body or polar granules. Oocysts were tentatively classified as (1) *Eimeria meleagrimitis*, (2) *E. adenoeides–E. gallopavonis* type, (3) *E. meleagridis*, (4) *E. innocua–E. subrotunda* type, or (5) other (*E. dispersa* or unidentified species). At least 100 oocysts were examined in each sample. The relative frequency of each type also was estimated based on counts of each oocyst type.

Domestic turkeys (one for each sample) were inoculated per os with 2,000 to 100,000 sporulated oocysts of each harvest. These turkeys were killed 6 days PI. Scrapings were examined from the duodenum, jejunum, ileum and ceca, and the relative frequency (light, moderate, or heavy infections) of parasites noted. In addition, tissue samples from the same regions were fixed in 10% buffered formalin, sectioned, stained with hematoxylin and eosin and examined microscopically. The relative frequency, intestinal region and location in the mucosa were used to further differentiate species.

In addition, three northern bobwhites (*Colinus virginianus*) were inoculated with each harvest. The droppings and intestinal scrapings from these bobwhites were examined 6 days later to detect *E. dispersa*.

Oocysts were found in 74 of the 119 pen-raised wild turkeys using sugar flotation of feces (Table 1). When experimental domestic turkeys were inoculated with the samples, infections were detected in only 34 of the 119 pen-raised wild turkeys. Four of the 34 positive turkeys had not been detected by sugar flotation. The preva-

lence of infection in pen-raised wild turkeys within a location ranged from 10% to 100% and over 50% of the locations (7/12) had a prevalence of ≥80% (Table 1).

There were no significant differences ($P \geq 0.05$) in the prevalence of infection among different ages of pen-raised wild turkeys (67, 73, and 61% for juvenile, subadult and adult turkeys, respectively). There were significant differences between the prevalence in females (75%) and males (48%).

Thirty of the samples produced sufficient oocysts from the harvest for speciation experiments. The most frequent species found was *E. meleagrimitis* (97% of the positive samples) and the least frequent was *E. adenoeides* (7%) (Table 2). Only *E. meleagrimitis*, *E. meleagridis* and *E. gallopavonis* were found in older birds. As many as four species were identified in any one sample. *Eimeria meleagrimitis* was the most numerous oocyst in 14 of the 21 mixed species samples. *Eimeria meleagridis* was numerous in only one sample and *E. dispersa* was never numerous. There were no apparent differences in the distribution of species based on location or sex.

The coccidial species found in these pen-raised wild turkeys also are readily found in domestic turkeys (Edgar, 1986) and wild turkeys (Prestwood et al., 1971, 1973). Therefore, it appears that cross transmission among pen-raised wild turkeys, wild turkeys and domestic turkeys could be expected wherever proper environmental conditions are present. Pen-raised wild turkeys and domestic turkeys are raised in confinement often by similar husbandry techniques during the first few weeks of life. This similarity of early rearing suggests that both domestic and pen-raised wild turkeys could have the same status concerning coccidia even though pen-raised wild turkeys are often moved later to outside, dirt-floored pens to become weather conditioned before release. Indeed, there are several accounts of clinical coccidiosis in artificially propagated wild turkeys (Blakey, 1932; Mosby and Handley, 1943; Kozicky, 1948; Burget, 1957). Such clinical disease problems in pen-raised wild turkeys can be explained by the same epizootiologic factors that are found in coccidia-infected domestic turkey flocks, including crowded conditions, moist litter with heavy fecal contamination and warm, humid microclimate.

TABLE 2. Prevalence of species of *Eimeria* identified from 30 pen-raised wild turkeys.

Variable	Number positive	Prevalence (%)
Species		
Eimeria meleagrimitis	29	97
E. gallopavonis	14	47
E. meleagridis	8	27
E. dispersa	5	17
E. innocua/E. subrotunda	4	13
E. adenoeides	2	7
Eimeria sp.	1	3
Multiple infections		
One species	9	30
Two species	12	40
Three species	6	20
Four species	3	10

The high prevalence of coccidial infection (66%) in this study suggested that coccidiosis could be a health problem in pen-raised wild turkeys. Furthermore, the large percentage of positive adult pen-raised turkeys was somewhat surprising and indicates that a protective immunity, especially to *E. meleagrimitis*, is not developing. The continued presence of coccidia in older pen-raised birds would allow resident breeders to serve as a continuing reservoir for infection of newly hatched poults. No explanation can be given for the difference in prevalence between sexes.

The relative frequencies of individual species in our study were somewhat different from those found by Prestwood et al. (1971) in wild turkeys. Two of the three most frequent species in their study, *E. dispersa* and *E. adenoeides*, were seen only infrequently in the present study. The most frequently found species in our study, *E.*

meleagrimitis, also was found frequently in the Prestwood et al. (1971) study and was the most frequently found species in domestic turkeys by Jeffers and Bentley (1980) and Edgar (1986). However, the second most common species in the latter two studies, *E. adenoeides*, was only infrequently found in the pen-raised wild turkeys in the present study.

Although available information suggests that coccidiosis is not a significant mortality factor, the significance of coccidiosis to native wild turkey populations is not fully understood. Prestwood et al. (1971) studied 321 wild turkeys and found only subclinical coccidial infections. Similarly, Davidson et al. (1985) did not report coccidiosis among the diseases found in 139 wild turkeys submitted for diagnostic examinations. Thus, because native wild turkey populations commonly are infected with the same species of coccidia found in pen-raised wild turkeys and because these infections are often subclinical, release of infected pen-raised wild turkeys does not appear to present a significant disease threat. However, this conclusion should be tempered by the realization that unforeseen epidemiologic factors could lead to clinical disease in certain situations and that species of coccidia could be introduced into wild turkey populations where they did not occur previously. Accordingly, care should be taken to follow the Wildlife Disease Association's recommendation on a disease monitoring protocol to be used before release of pen-raised wild turkeys (Prestwood, 1984).

This study was supported in part by a donation from the National Wild Turkey Federation to The University of Georgia College of Veterinary Medicine's Comparative Medical Research Fund; in part by the Federal Aid in Wildlife Restoration Act (50 Stat. 917); and in part by Contract Numbers 14-16-0004-84-005 and 14-16-0004-85-007, Fish and Wildlife Servce, U.S. Department of the Interior. The authors gratefully acknowledge Gary C. Wilkins, Emma Harrison, and Kellene Lockwood for their assistance in these studies.

LITERATURE CITED

BLAKEY, H. L. 1932. Biological problems confronting the artificial propagation of wild turkeys in Missouri. Transactions of the 19th North American Game Conference 19: 337–343.

BURGET, M. L. 1957. The wild turkey in Colorado. Progress Report, Federal Aid for Wildlife Restoration, Project W-39-R, U.S. Government Printing Office, Washington, D.C., 55 pp.

DAVIDSON, W. R., V. F. NETTLES, C. E. COUVILLION, AND E. W. HOWERTH. 1985. Diseases diagnosed in wild turkeys (*Meleagridis gallopavo*) of the southeastern United States. Journal of Wildlife Diseases 21: 386–390.

EDGAR, S. A. 1986. Coccidiosis in turkeys: Biology and incidence. *In* Research in avian coccidiosis: Proceedings of the Georgia coccidiosis conference, L. R. McDougald, L. P. Joyner, and P. L. Long (eds.). University of Georgia, Athens, Georgia, pp. 116–123.

JEFFERS, T. K., AND E. J. BENTLEY. 1980. Monensin sensitivity of recent field isolates of turkey coccidia. Poultry Science 59: 1722–1730.

KOZICKY, E. L. 1948. Some protozoan parasites of the eastern wild turkey in Pennsylvania. The Journal of Wildlife Management 12: 263–266.

MOSBY, H. S., AND C. O HANDLEY. 1943. The wild turkey in Virginia. Cited in A. W. Schorger. 1966. The wild turkey, its history and domestication. University of Oklahoma Press, Norman, Oklahoma, 341 pp.

PRESTWOOD, A. K. 1984. Wildlife Disease Association advisory statement on disease monitoring in wild turkeys. Wildlife Disease Association, Ames, Iowa, 14 pp.

———, F. E. KELLOGG, AND G. L. DOSTER. 1973. Parasitism and disease among southeastern wild turkeys. *In* Wild turkey management. Current problems and programs, G. C. Sanderson and H. C. Schultz (eds.). University of Missouri Press, Columbia, Missouri, pp. 159–167.

———, ———, AND ———. 1975. Parasitism among wild turkeys in the Southeast. *In* Proceedings Third National Wild Turkey Symposium, L. K. Halls (ed.). Texas Chapter of the Wildlife Society, San Antonio, Texas, pp. 27–32.

———, ———, ———, AND S. A. EDGAR. 1971. Coccidia in eastern wild turkeys of the southeastern United States. The Journal of Parasitology 57: 189–190.

Received for publication 11 February 1988.