



2012

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### Recommended Citation

Villarreal, Stacie M.; Fedynich, Alan M.; Brennan, Leonard A.; and Rollins, Dale (2012) "Parasitic Eyeworm (*Oxyspirura Petrowi*) in Northern Bobwhites from the Rolling Plains of Texas, 2007–2011," *National Quail Symposium Proceedings*: Vol. 7 , Article 95.  
Available at: <http://trace.tennessee.edu/nqsp/vol7/iss1/95>

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# PARASITIC EYEWORM (*OXYSPIRURA PETROWI*) IN NORTHERN BOBWHITES FROM THE ROLLING PLAINS OF TEXAS, 2007–2011

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## ABSTRACT

The eyeworm *Oxyspirura petrowi* is an indirect life cycle nematode that occurs under the nictitating membrane on the eye surface of certain bird species. Previous studies from western or northwestern regions of Texas reported *O. petrowi* from northern bobwhites (*Colinus virginianus*), scaled quail (*Callipepla squamata*), and Montezuma quail (*Cyrtonyx montezumae*). We examined 173 bobwhites from the Rolling Plains of Texas collected during the 2007–2008 ( $n = 33$ ), 2009–2010 ( $n = 86$ ), and 2010–2011 ( $n = 54$ ) hunting seasons, respectively. Overall, 99 (57%) bobwhites were infected with 596 individual *O. petrowi*; the mean ( $\pm$  SD) eyeworm intensity was  $6.0 \pm 6.4$  (range = 1–40) and mean abundance was  $3.4 \pm 5.7$ . Thus, this eyeworm is a commonly occurring parasite of bobwhites in the Rolling Plains of Texas. Additional surveys are needed to learn more about the geographic distribution of *O. petrowi* and to assess the possible negative effects on individual bobwhites and their populations.

**Citation:** Villarreal, S. M., A. M. Fedynich, L. A. Brennan, and D. Rollins. 2012. Parasitic eyeworm (*Oxyspirura petrowi*) in northern bobwhites from the Rolling Plains of Texas, 2007–2011. *Proceedings of the National Quail Symposium* 7:241–243.

**Key words:** *Colinus virginianus*, eyeworm, helminth, northern bobwhite, *Oxyspirura petrowi*, Texas

## INTRODUCTION

There have been concerns about the decline in abundance of northern bobwhites throughout their range, including Texas. Thus, there is keen interest in understanding factors that negatively affect bobwhite populations. One factor needing more thorough examination is the influence of parasites on bobwhite life history (Peterson 2007).

One parasite that has generated concern about potential negative effects on quail is the eyeworm *Oxyspirura petrowi*. It is unclear what, if any, pathological effect *O. petrowi* has on host individuals due to the lack of detailed studies, but Ruff (1984) suggested pathological effects would likely be similar to that of the poultry eyeworm (*O. mansoni*). Additionally, non-pathological consequences of infection may be important. One potential consequence could be visual obstruction by the parasites that could obscure vision and make infected birds less aware of environmental hazards and predators, thereby reducing their fitness.

A review conducted by Peterson (2007) indicated *O. petrowi* has been found in northern bobwhites, scaled

quail, and Montezuma quail in Texas. Only one published study has reported *O. petrowi* in bobwhites from Texas, specifically the Rolling Plains (Jackson 1969). This study reported eyeworms in 49.5% of bobwhites and to be relatively common in West Texas. Only the life cycle of *O. mansoni* of the 84 species of oxyspiruids has been sufficiently examined (Anderson 2000), and it is uncertain which species of intermediate hosts are used by *O. petrowi* (Pence 1972). Intermediate hosts of *Oxyspirura* spp. include cockroaches (*Pycnocelus surinamensis*) (Fielding 1926, Sanders 1928) and grasshoppers (*Melanoplus* spp.) (Cram et al. 1931). Experimental studies by Fielding (1926, 1927) using *O. mansoni* (= *O. parvovum*), demonstrated the larval eyeworm exits the intermediate host in the definitive host's crop within minutes, likely governed by the temperature difference between the host's crop and the insect. The larvae, upon exiting the insect, migrate up the esophagus into the mouth and through the infra-ocular sinus cavity or nasolachrymal duct to the eyes where they develop into adults (Ruff 1984).

Our objective was to document the prevalence, intensity of infection, and abundance of *O. petrowi* in northern bobwhites by hunting season, host age, and host

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Table 1. Prevalence, intensity, and abundance ( $\pm$  SD) of *Oxyuris petrowi* in northern bobwhites by age, gender, and hunting season in the Rolling Plains of Texas during 2007–2008, 2009–2010, and 2010–2011.

	Overall	Adult	Juvenile	Male	Female	2007–2008	2009–2010	2010–2011
Number of hosts	173	85	88	94	79	33	86	54
Prevalence No. infected (%)	99 (57%)	57 (67%)	42 (48%)	53 (56%)	46 (58%)	19 (58%)	54 (63%)	26 (48%)
Intensity	6.0 $\pm$ 6.4	6.9 $\pm$ 7.3	4.8 $\pm$ 4.7	5.8 $\pm$ 5.2	6.3 $\pm$ 7.6	8.3 $\pm$ 10.1	5.0 $\pm$ 4.2	6.5 $\pm$ 6.6
Abundance	3.4 $\pm$ 5.7	4.6 $\pm$ 6.8	2.3 $\pm$ 4.0	3.3 $\pm$ 4.8	3.7 $\pm$ 6.6	4.8 $\pm$ 8.6	3.1 $\pm$ 4.1	3.1 $\pm$ 5.6

gender on a ranch within the Rolling Plains ecoregion of Texas.

## STUDY AREA

Our study sites were the Rolling Plains Quail Research Ranch (RPQRR) and the Melton Ranch near Roby in Fisher County, Texas, USA. The RPQRR is  $\sim$  1,902 ha in size, where the main research focus is to sustain Texas' wild quail hunting heritage for this and future generations. This area is mostly rangeland with ranching and farming the major land uses. Common plants are mesquite (*Prosopis glandulosa*), prickly pear (*Opuntia* spp.), lotebush (*Ziziphus obtusifolia*), and sand shinnery oak (*Quercus havardii*), all of which are important woody plants for quail (Rollins 2007).

## METHODS

Bobwhites donated by hunters were obtained during the 2007–2008, 2009–2010, and 2010–2011 hunting seasons, respectively. Each bird was classified to age (juvenile or adult) based on presence or absence of buffy tips on the primary wing coverts; gender was assigned based on coloration of the feathers on the head (Dimmick and Pelton 1996). Bobwhites were placed in individually numbered plastic freezer bags within 5 min to retain any parasites that could exit the bird post-mortem. Bobwhites were placed in a cooler on ice to slow and stop movement of helminths still alive and limit decomposition of dead helminths. The bobwhites were placed in a freezer upon returning from the field until they were transported to the

necropsy laboratory at the Caesar Kleberg Wildlife Research Institute in Kingsville, Texas, USA.

Each bag containing a frozen carcass was placed in the refrigerator for thawing the night before necropsy. The head was removed once the carcass was thawed and examined for eyeworms on the eye surface, underneath the eyelids, and nictitating membrane; examinations were conducted using a variable power (1–40x) dissection microscope. Eyeworms were removed, fixed in glacial acetic acid for several minutes, and preserved in 70% alcohol and 8% glycerin in individually-marked vials corresponding to each bird.

We conducted Chi-square analyses to compare the prevalence of eyeworms for the main effects' variables of hunting season, host age, and host gender. We used analysis of variance (ANOVA) to examine whether mean abundance of eyeworms varied by the main and interaction effects' variables. Non-significant interaction effects' variables were eliminated from the model and the ANOVA rerun for final interpretation. Most parasite abundance data are not normally distributed, (i.e., overdispersed or aggregated) and abundance data were rank transformed prior to ANOVA (Landgrebe et al. 2007).

## RESULTS

Eyes of 173 northern bobwhites (85 adults, 88 juveniles; 94 males, and 79 females) were examined for *O. petrowi*. We found 99 (57%) infected with 596 worms. Intensity of infection averaged ( $\pm$  SD) 6.0  $\pm$  6.4 (range = 1–40) and mean abundance was 3.4  $\pm$  5.7 eyeworms.

Prevalence was 19% higher ( $\chi^2_1 = 5.82$ ,  $P = 0.016$ ) in adults (67%) than in juveniles (48%) (Table 1). Prevalence was similar ( $\chi^2_1 = 0.06$ ,  $P = 0.807$ ) in males (56%) and females (58%) (Table 1) as well as by hunting season 2007–2008, (58%), 2009–2010 (63%), and 2010–2011 (48%) ( $\chi^2_2 = 2.91$ ,  $P = 0.234$ ) (Table 1, Fig. 1). None of the ANOVA interaction effects variables was significant ( $P > 0.087$ ). The ranked abundance model using the main effects variables was significant ( $F_{4,166} = 2.77$ ,  $P = 0.029$ ); only host age was significant ( $F_{1,166} = 8.11$ ,  $P = 0.005$ ) and adult bobwhites had 50% higher rank mean abundance of *O. petrowi* than juveniles (Table 1).

## DISCUSSION

There have been 5 published articles on eyeworms in species of quail in Texas (Wallmo 1956, Jackson 1969, Pence 1975, Dancak et al. 1982, Landgrebe et al. 2007) and only Jackson (1969) examined bobwhites. Jackson's

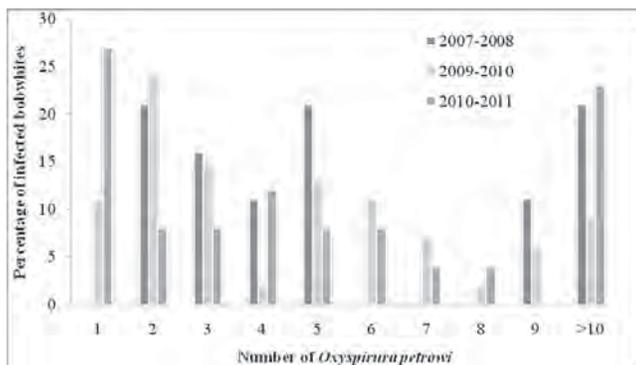


Fig. 1. *Oxyuris petrowi* (%) in 99 infected northern bobwhites collected from the Rolling Plains of Texas during 2007–2008, 2009–2010, and 2010–2011.

(1969) findings on eyeworm prevalence (49.5%) were comparable to our results (57%) over 40 years later. However, we found the second highest recorded number (40) of *O. petrowi* in any wild galliform host individual reported in the literature. Robel et al. (2003) found a male lesser prairie-chicken (*Tympanuchus pallidicinctus*) with 81 *O. petrowi*. Jackson (1969) reported finding *O. sygmoidea* in bobwhites from the Rolling Plains; however, the parasite may have been misidentified and was likely *O. petrowi*, as *O. sygmoidea* is found primarily in Austria (Peterson 2007).

*Oxyspirura mansoni* is the eyeworm found most commonly in poultry (Ruff 1984, Anderson 2000). Based on Ruff (1984: 640–641), infected hosts may appear restless and continue to scratch their eyes; eyes may appear watery and inflamed with observation of swelling of the nictitating membrane; left untreated, eyelids can become stuck together, causing severe ophthalmia. However, descriptions of pathological effects caused by *O. petrowi* are lacking. Non-pathological consequences to infection may be important, such as difficulty in seeing caused by these large worms or distractions that could make infected birds less attentive to environmental hazards and predators. Jackson (1969) reported that erratic and peculiar (i.e., not flushing) behavior of some bobwhites lead to speculation that vision of bobwhites may have been impaired by eyeworms.

Prevalence and mean ranked abundance of *O. petrowi* were significantly higher in adult bobwhites than juveniles, suggesting infections increase through time, which is likely the result of adult bobwhites feeding on infected arthropods for longer periods (multiple seasons/years) than juveniles (only several months). It also suggests the immune system of adult bobwhite is not effectively eliminating infections of *O. petrowi*. Prevalence and ranked abundance of eyeworms were not significant between males and females, suggesting similar exposure probabilities to infected intermediate hosts. This would be expected in host species where males and females regularly co-occur in social groups, feed together, and share similar dietary preferences.

More data on the life history of *O. petrowi* including their intermediate hosts in Texas and the geographic distribution of *O. petrowi* across the range of the northern bobwhite are needed. Future research should also assess the possible negative effects of *O. petrowi* on bobwhites including pathological responses and non-pathological consequences of infection in regard to host survival.

## ACKNOWLEDGMENTS

We thank the Rolling Plains Quail Research Foundation for generous financial support. We thank the Rolling Plains Quail Research Ranch and Paul Melton for providing collection sites and recognize the Caesar Kleberg Wildlife Research Institute for providing nec-

ropsy laboratory access. Specimens of *O. petrowi* were confirmed by Mike Kinsella, Ph.D., Missoula, Montana USA. This is manuscript number 12–123 of the Caesar Kleberg Wildlife Research Institute.

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