Parasite and Infectious Disease Survey of Lesser Prairie-Chickens

K. Bondo, A. Smith-Herron, S. Allen, M. Whitson, C. Boal, C. Hagen, M. Peterson, B. Simpson, and B. Grisham

Background

- Populations of Lesser Prairie-chickens have declined substantially across range due to habitat loss (Haukos and Boal 2016).
- Many small isolated populations exist.
- Impact of parasites and infectious diseases is unknown.

Impacts of Parasites and Infectious Diseases

- Parasite, *Trichostrongylus tenuis*, plays a role in Red Grouse population cycles and regulation in the UK (Hudson et al. 1986; 1998).

- West Nile virus causes high mortality in Sage Grouse (Walker and Naugle 2011) and suspected to contribute to population declines of Ruffed Grouse (Stauffer et al. 2017) .

- Blackhead disease may have played a role in the extinction of the “Heath Hen”.

Lesser Prairie Chicken Parasite and Disease Studies

- Most parasitological surveys are outdated (1970's).

- The last infectious disease survey of TX birds was conducted in the 1990's by Peterson et al. (2002).

Objectives

1) Conduct an updated parasitological and infectious disease survey of Lesser Prairie-Chickens to establish new baselines for this species in the Sand Shinnery Oak Prairie ecoregion.

2) Determine if any new pathogens have emerged since the last surveys were conducted.

2) Make future recommendations for continued surveillance of pathogens of concern to Lesser Prairie-Chickens.

Key Pathogens (Peterson 2004)

Bacteria

Salmonella pullorum and *gallinarum*

Mycoplasma gallisepticum and *synovia*

Chlamydia spp.

Pasteurella multicoda

***Cryptosporidium* spp.**

Parasitic Worms (Helminths)

Cestodes (tapeworms)

Nematodes (roundworms)

Viruses

Avian Influenza

Infectious bronchitis strains MA, AZ, and CT

Newcastle Disease

West Nile virus

Reticuloendotheliosis

Blood Parasites

Hemoparasites (*Plasmodium* spp., *Leucocytozoon* spp., and *Haemoproteus* spp.)

Methods – Capture of Birds

- Live-captured male birds from March-May 2018-2019 at leks in sand-shinnery oak prairies of TX and NM.
- Used funnel traps and drop nets

Blood

Choanal swab

Cloacal swab

Samples Collected from Birds

Mosquitoes

Samples collected from leks

Fecal and cecal droppings

Diagnostic Tests – Bacteria and Viruses

Infection

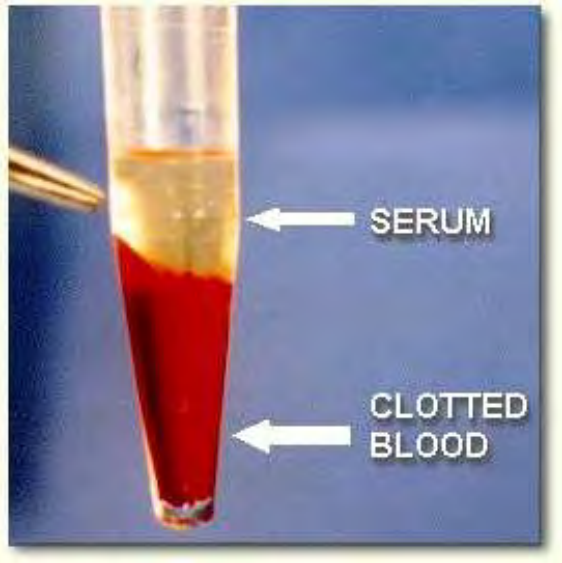
- Test swabs, blood, or feces using PCR

(Limitation: animal might be infected but pathogen might not be detected.)

Exposure:

- Detection of antibodies in the blood

(Limitation: Time of exposure is unknown. Exposed does not indicate animal is currently infected).



Diagnostic Tests – Blood Parasites

- Examine blood smear for hemoparasites
- Confirm species using PCR

Diagnostic Tests – Cestodes and Nematodes

- Necropsied intact deceased birds stored frozen in Texas and Kansas from 2012-2019 and examined for parasites at Sam Houston State University.
- Extracted eggs from female worms, photographed, and made reference library.
- Tested feces from leks for parasites using PCR.

Bacteriological Results

Bacteria	Serological Results (2018-2019)	PCR - Swabs (2018-2019)	PCR – Feces (2019)
Salmonella pullorum	0/9	-	
Salmonella gallinarum	0/9	-	
Mycoplasma gallisepticum	0/5		
Mycoplasma synovia	0/7		
Cryptosporidium spp.	-	0/9	0/15
Chlamydia spp.	-	0/9	
Pasteurella multicoda	-	0/9	

M. gallisepticum samples initially tested positive, but were considered **false positives** after following up with more sensitive testing.

Virology Results

Viruses	Serological Results (2018-2019)	rtPCR - Blood (2018)
Newcastle Disease (Avian paramyxovirus type I)	0/10	-
Avian Influenza	0/9	-
Infectious bronchitis CT	0/9	-
Infectious bronchitis AZ	0/9	-
Infectious bronchitis MA	0/10	-
Reticuloendotheliosis		0/4

6 archived blood samples from 2008-2012 tested negative for Newcastle Disease.

West Nile Virus Results

Mosquito species	No. Mosquitoes Tested/Pool	Result (Oct. 2019)
Culex quinquefasciatus	5	Negative
Culex unknown species	1	Negative
Aedes vexans	1	Negative
Aedes unknown species	1	Negative
Aedes nigromaculis	29	Negative

Blood Parasite Results

Bacteria	Prevalence (2018) (n=15)	Prevalence (2019) (n=16)	Intensity (2018) (n=3)	Intensity (2019) (n=3)
Plasmodium pedioecetae	20% (95% CI, 4-48)	19% (95% CI, 3-46)	40/2000 erythrocytes range (34-48)	18/2000 erythrocytes range (15-24)

Prevalence did not differ between TX and NM.

Intensity appeared twice as high in 2018 than 2019.

Necropsy Results

- Three parasites detected through necropsy
  - Eyeworm (*Oxyspirura petrowi)*
  - Cecal worm (*Aulonocephalus pennula)*
  - Proventricular worm (*Dispharynx nasuta)*
- 5/5 birds infected with at least one nematode species in TX.
- 2/5 birds infected with at least one nematode species in KS.

Necropsy Parasitology Results

Bird ID	Location	Date	*Oxyspirura petrowi*	*Aulonocephalus pennula*	*Dispharynx nasuta*
1	TX	2008-2012	0	29	0
2	TX	2008-2012	0	25	0
3	TX	2008-2012	0	45	0
4	TX	2016	4	6	0
5	TX	2016	3	6	0
6	**TX**	**2018**	**41**	**121**	**1**
7	KS	Unknown	0	0	0
8	KS	2013-2014	0	0	0
9	KS	2014	0	0	0
10	**KS**	**2018**	**1**	**11**	**0**
11	**KS**	**2018**	**19**	**10**	**1**

Cecal Dropping Parasitology Results Using PCR

	Oxyspirura petrowi	*Aulonocephalus pennula*	*Dispharynx nasuta*
Texas (n=6)	83% 95% CI, 36–100	50% 95% CI, 12–88	0
New Mexico (n=27)	15% 95% CI, 4–34	4% 95% CI, 1–19	0

Discussion

- Bacterial and viral results are consistent with that of previous surveys.

- From 1997-2001, Peterson et al. (2002) also did not detect antibodies to the following pathogens in 24 Lesser Prairie Chickens sampled from TX:
  - *Mycoplasma gallisepticum*
  - *M. synoviae*
  - *Salmonella pullorum*
  - Avian Influenza
  - New Castle disease
  - Reticuloendotheliosis

Other Pathogens

- *Chlamydia* spp. and *Cryptosporidum* spp. not previously detected in wild Lesser Prairie-Chickens.

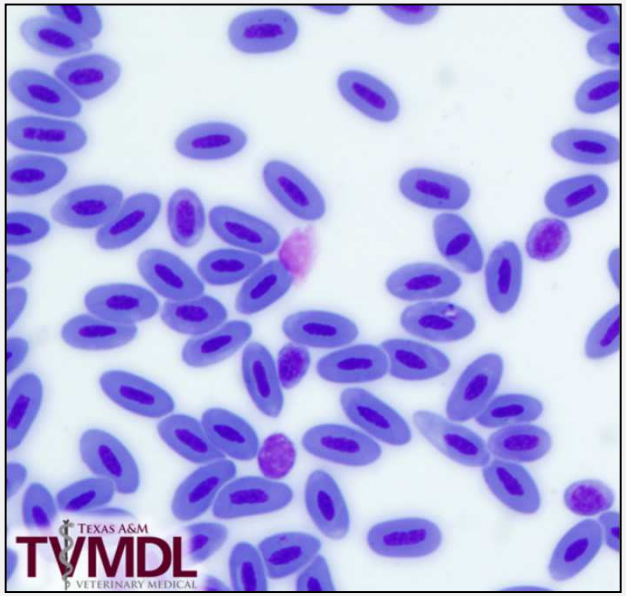
- Seroprevelance of *Pasteurella multicoda* (2/45) and West Nile virus (1/98) was low in a previous unpublished study from TX.

Infectious Bronchitis

- Peterson et al. (2002) detected antibodies to infectious bronchitis in 17-18 birds in TX :
  - strain AZ (48%)
  - strain MA (11%)
- 5/8 birds that tested positive were juvenile birds.
- Possible this virus does not regularly circulate in the population or juveniles or more susceptible.

Avian Malaria

- Prevalence of *Plasmodium pedioecetii* was within range of previous studies:
  - 11% (95% CI; 3–25) in 1978 (Stabler 1978)
  - 13% (95% CI; 4–29) in 2003 (Smith et al. 2003).
- Indicative of chronic low-level infections.
- Intensity of infections differed between years, suggesting that stressors such as drought may play a role.



Parasitology – *Aulanocephalus pennula*

- First report of *Aulanocephalus pennula* in grouse.
- Commonly found in Bobwhite Quail and Scaled Quail.
- Unknown if it is expanding its range.
  - Not detected in any hunter-killed Lesser Prairie-Chickens from Kansas examined by Robel et al. (2003).
  - Of the birds we submitted for post-mortem examination, this parasite was only detected in birds from Kansas that died in 2018.

Parasitology – *Dispharynx nasuta*

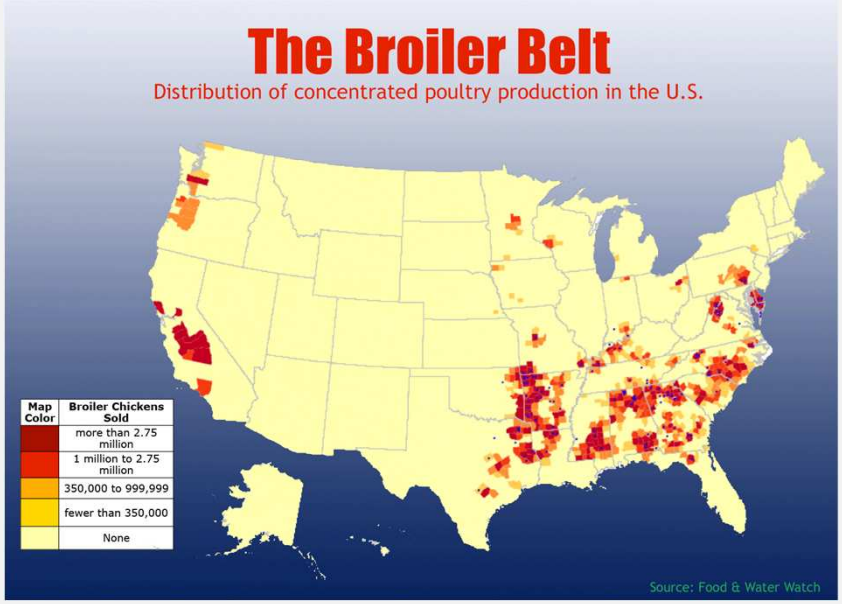
- First report of *Dispharynx nasuta* in Lesser Prairie-Chickens
- Suspected cause of “grouse disease in North America”
- Previously reported in Attwater’s Prairie-Chickens, Greater Prairie-Chickens in Kansas, and Sharp-tailed Grouse in Wisconsin
- Primarily causes disease in young birds.
- Unclear if this is an emerging parasite in Lesser Prairie-Chickens.

Parasitology – *Oxyspirura petrowi*

- Prevalence of eyeworm in TX was reported to range from 42-53% (Pence and Sell 1979 and 1983).
- In general, intensity of eyeworm from most Lesser Prairie-Chickens we examined was low (0-4).
- The highest intensities consisting of 19 and 41 eyeworms were still within range of what was previously reported in Kansas (range, 1-61 worms; Robel et al. 2003).

Overall Conclusions

- The prevalence of most bacterial and viral pathogens of concern appears to be low in this ecoregions.
- The parasitological communities may have changed from what they were historically.
- Recommend continued surveillance of some pathogens (e.g., West Nile virus and infectious bronchitis)
- Necropsy any dead birds found dead in the field be necropsied and examined for parasites.
- Important to establish baseline information.



Future Work

- Continue one more field season with Lesser Prairie-Chickens.
- Work with KDWPT to selectively sample and necropsy LEPCs across different habitat types.
- Applied for a postdoctoral fellowship to work with state agencies and biologists to obtain hunter harvested and archived prairie grouse across North America
  - Examine tissues and heads for parasites and test for West Nile virus across their range.

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Questions?