Toxocara vitulorum (roundworms) in Bison Calves

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Toxocara vitulorum

- Large roundworm of cattle & water buffalo
- Found in tropical & subtropical regions
- Responsible for high morbidity & mortality in 15-50 day old water buffalo calves
- Up to 80% of water buffalo herds affected in endemic areas
- Recently found in cattle herds (and bison) in temperate climates like the UK, Belgium, USA
Natural host - Asian Water Buffalo
Distribution of T. vitulorum

Tropical & sub tropical regions: India, Philippines, Indonesia
T. vitulorum adults (cattle)
T. vitulorum inside intestines
The life cycle of *Taenia vitulorum* involves a complex set of stages where infected bison calves serve as intermediate hosts. Here's a breakdown of the process:

1. **Adult bison infected**: The first stage begins with an adult bison that is infected. **Hypobiotic larvae** migrate to the mammary gland at birth.

2. **Eggs contaminate pasture vegetation**: After birth, the bison begins to pass the infected **T. vitulorum egg** that contains larvae, which subsequently contaminate the vegetation on the pasture.

3. **Eggs are passed with feces**: As the bison ingests the infected plants, the eggs pass through its digestive tract and are excreted in its feces.

4. **Infected calf**: These eggs are then ingested by a suckling calf, initiating the infection process in the new host.

5. **Larvae migrate into lungs**: Once ingested, the larvae migrate into the lungs of the calf. They are then coughed up, swallowed, and mature in the small intestine.

6. **Worms lay eggs within 2-3 wks.**: In this mature stage, the worms lay eggs within a period of 2-3 weeks.

7. **Infected calf**: The infected calf then passes these eggs with its feces, contaminating the pasture once again.

8. **No adults or eggs in mature host**: Despite passing the eggs, the mature host (in this case, the bison) does not harbor adults or eggs, completing the cycle.

The diagram illustrates this cycle, starting with the adult bison, moving through the infected calf stage, and ending with the cycle reverting back to the adult bison, emphasizing the need for proper pasture management and hygiene practices to control this parasite.
Life cycle in the mother

- Mom is an intermediate host
- Consumes an infective egg
- Egg hatches into larva
- Larva migrates and resides in the liver (hypobiotic)
- Possibly other organs too
- No further development: no eggs
Life cycle in the calf

- Calf is the definitive (final) host
- At parturition larvae move from liver to mammary gland and then into the colostrum
- Larvae are swallowed and grow to adults (18-25 days)
- Adult worms shed eggs (100,000s per day) into the calf feces
Hypobiotic larvae

Trichinella spiralis
Necropsy findings

- Major organs normal
- Small intestine distended
- Large intestine completely empty
- Blockage with dozens of white worms
Treatment strategies

- Hypobiotic larva in an infected dam are not treatable
- Target calves at 10-14 days of age with a de-wormer
  - Topical (pour on de-wormer)
  - Darts (injectable de-wormer)
- De-wormer to the herd ??? x/ year
Control plan

- Dart or pour-on dewormer to calves at 10-14 days of age (prevent egg shedding)
- Herd dewormer administered by feed or water May 15; 2nd de-worming July 1
- Rotational gazing
- Where possible harrow manure pats down when hot (July - August)
Control Challenges

- Long survival of eggs in environment (2 yrs)
- Long survival of larva in maternal host
- Transmission via the colostrum
- Large number of eggs produced in short period of time
- Intensity of production more important than climate
- Natural elimination of any remaining adults by 6 months of age (Can’t diagnose)
Points to remember

- Small calves 3-6 wks of age are affected
- Lifecycle can be interrupted by deworming the calf at 10 to 14 days of age
- No adult worms found in calves over 4-5 mos of age
- Bulls and non lactating females are dead end hosts
- Pregnant females are the “Trojan Horse”
- Adult bison cannot be tested for infection
- Diagnosis is made by periodic fecal testing of calf feces for eggs
A survey to detect *Toxocara vitulorum*: an emerging parasite in Canadian bison

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US Distribution of T. vitulorum

- Pa. 1
- Del. 1
- Indiana 1
- Wisc. 3
- Mn. 3
- Ia. 1
- Neb. 1
- So. Carolina 1
Objectives of the survey

• To detect and estimate the prevalence of *T. vitulorum* in commercial bison herds in MB and SK.

• To perform a survey of other gastrointestinal parasites in adult bison in MB and SK.
Methods

- Producers registered with the Canadian Bison Association in Saskatchewan and Manitoba were contacted and asked to collect fecal samples.
- Quantitative fecal flotations were performed at the Western College of Veterinary Medicine. All gastrointestinal parasite eggs and oocysts were recorded.
- Known amount of feces (5gm)
- Known dilution of flotation solution
- Counted in a known volume in chamber (eggs/gm of feces)
- Microscope and ID source
- Flotation solution
- Special counting slide with grid
T. vitulorum eggs
Parasite eggs

Trichostrongyloides

Ostertagia
Parasite eggs

Eimeria (coccidiosis)
Parasite eggs

Nematodirus
Parasite eggs

Monezia (tapeworm)
Parasite eggs

Capillaria
## Results

Table 1. Prevalence of *T. vitulorum* in MB and SK bison herds

<table>
<thead>
<tr>
<th></th>
<th><em>T. vitulorum</em> positive herds</th>
<th>Calves sampled per herd</th>
<th>Prevalence (95% C.I.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manitoba (n = 34)</td>
<td>4</td>
<td>12.0</td>
<td>12% (3.3 - 27.5%)</td>
</tr>
<tr>
<td>Saskatchewan (n = 64)</td>
<td>0</td>
<td>13.0</td>
<td>0% (0 - 5.6%)</td>
</tr>
</tbody>
</table>
## Results

Table 2. Survey of gastrointestinal parasites of adult bison (eggs and oocysts/gram of feces ± SE).

<table>
<thead>
<tr>
<th></th>
<th>Trichostrongyles</th>
<th>Eimeria</th>
<th>Nematodirus</th>
<th>Trichuris</th>
<th>Monezia</th>
<th>Capillaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manitoba (n = 309)</td>
<td>23 ± 2.5</td>
<td>28 ± 3.2</td>
<td>0.2 ± 0.02</td>
<td>0.02 ± 0.01</td>
<td>5.3 ± 1.3</td>
<td>0.13 ± 0.09</td>
</tr>
<tr>
<td>Saskatchewan (n = 800)</td>
<td>26 ± 2.8</td>
<td>16 ± 1.7</td>
<td>0.1 ± 0.07</td>
<td>.007 ± .005</td>
<td>4.0 ± 0.7</td>
<td>.009 ± .005</td>
</tr>
</tbody>
</table>
Conclusion

- Toxocara vitulorum was detected in 4 herds in MB prevalence of 12% (C.I. 3.3 - 27.5%), but not in SK bison.
- The producers were contacted and an anthelmintic control plan for calves was recommended.
- Survey of adults confirmed existing information regarding parasite infection prevalence and intensity.
- Results from the survey will be used to suggest baseline parasite loads for western Canada.
Conclusions

- Parasites were unevenly dispersed in adult bison
  - 77% of the Trichostrongyle eggs and 88% of the Eimeria spp. oocysts were shed by 20% of the adults in the herd.
- Further studies will be needed to evaluate the threat that the roundworm may pose to cattle, wild cervids, as well as its potential zoonotic risk.