Sheep Parasites in Alberta

Problem and Solutions

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Grazing lambs and Parasite Plans
Saturday April 5th 2014

Introduction

- **Discussion points today**
  - **What are the important parasites**
  - **Anthelmintic resistance (AR)?**
  - **Is there a problem with parasites in AB sheep flocks?**
  - **Anthelmintic resistance: Present in AB?**
  - **On going and future project at the University of Calgary Veterinary Medicine**

Parasites of importance

- Abomasum
  - Teladorsagia
  - Haemonchus
  - Trichostrongylus
- Small intestine
  - Trichostrongylus
  - Cooperia
  - Nematodirus
  - Strongyloides
- Large intestine
  - Oesphagostomum
  - Chabertia
  - Trichuris

Haemonchus Contortus

- "Barber pole" worm
- Blood sucker
- Prolific egg producer
  - 5000-10,000 eggs/day
- Pasture contamination

Haemonchus Contortus: Signs

- Young sheep
  - Sudden death
  - Weak and anemic
  - End of summer
- Ewes
  - Weak and anemic
  - Bottle jaw: low protein in blood
  - Reduced production: most common form

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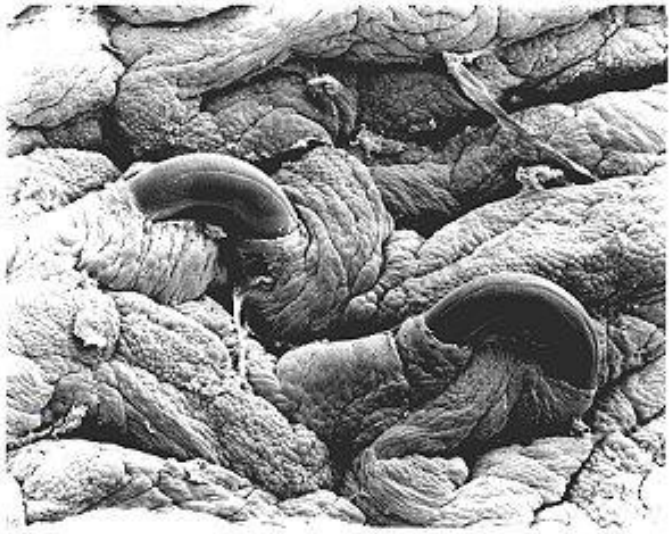
Haemonchus Contortus: Signs

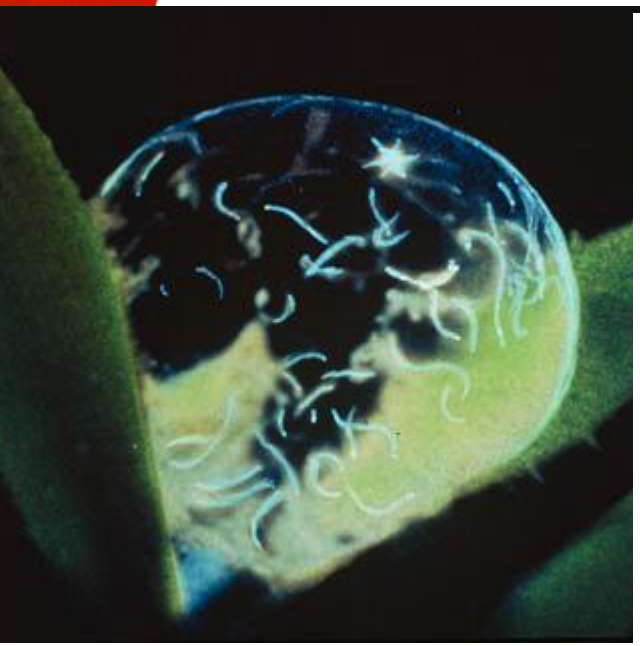
Teladorsagia circumcincta

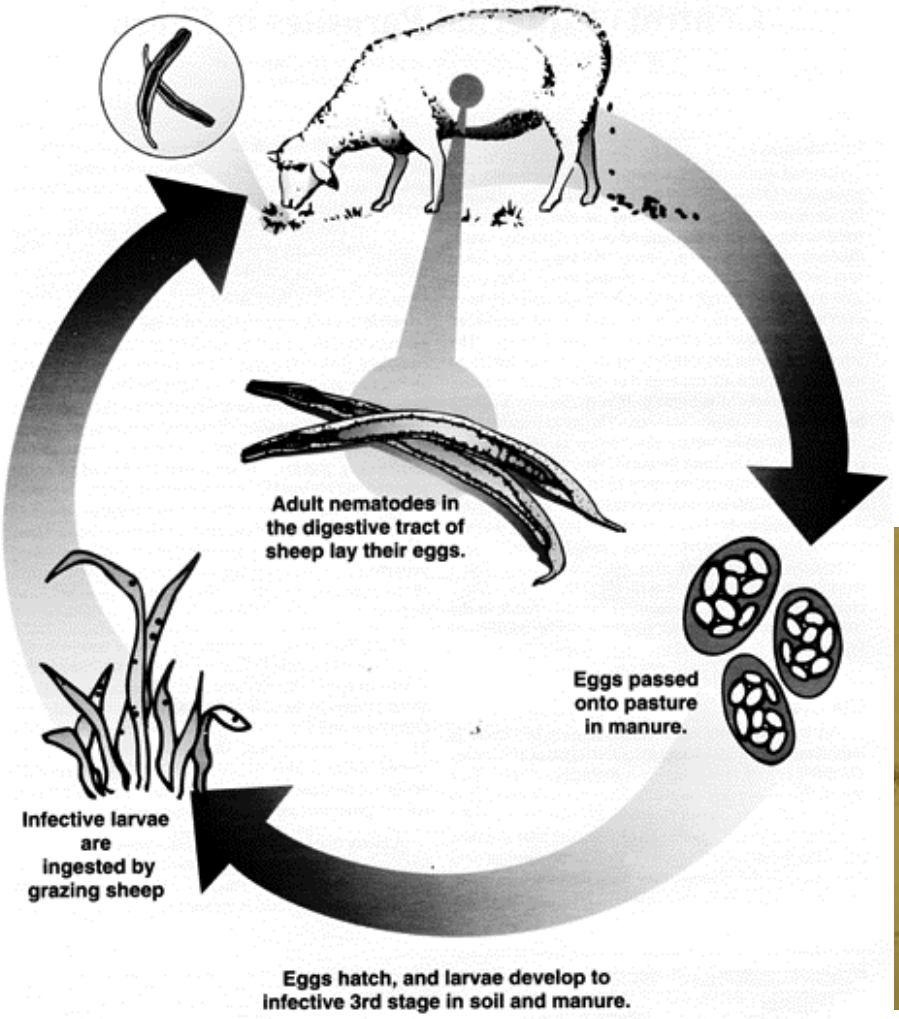
- Puncture wall of the glands of the abomasum
- Prevent proper digestion
- Suck proteins from the sheep

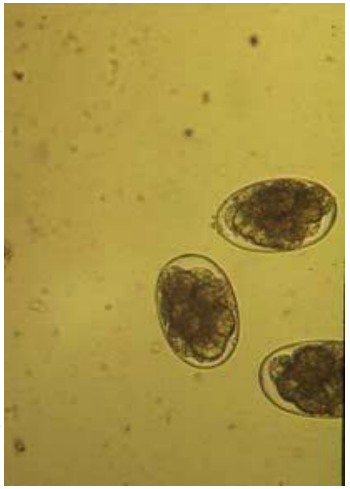
- Cause
  - Bottle jaw
  - Diarrhea
  - Poor growth



Cycle of the parasites







Typically:
70% on pasture
30% in the sheep

Parasite adaptation

- Hypobiosis /Arrested development
  - Development arrested at the L4 stage
  - No adult-> no eggs-> no disease
  - Fall (cold climate)
  - Dry season (hot climate)
  - Re-emerge in the Spring
    - Contaminate pastures

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Parasite adaptation

- Periparturient rise
  - Around lambing time
  - 2-4 weeks before up to 8 weeks after lambing
  - Lowering of immunity
  - Major increase in egg production and pasture contamination

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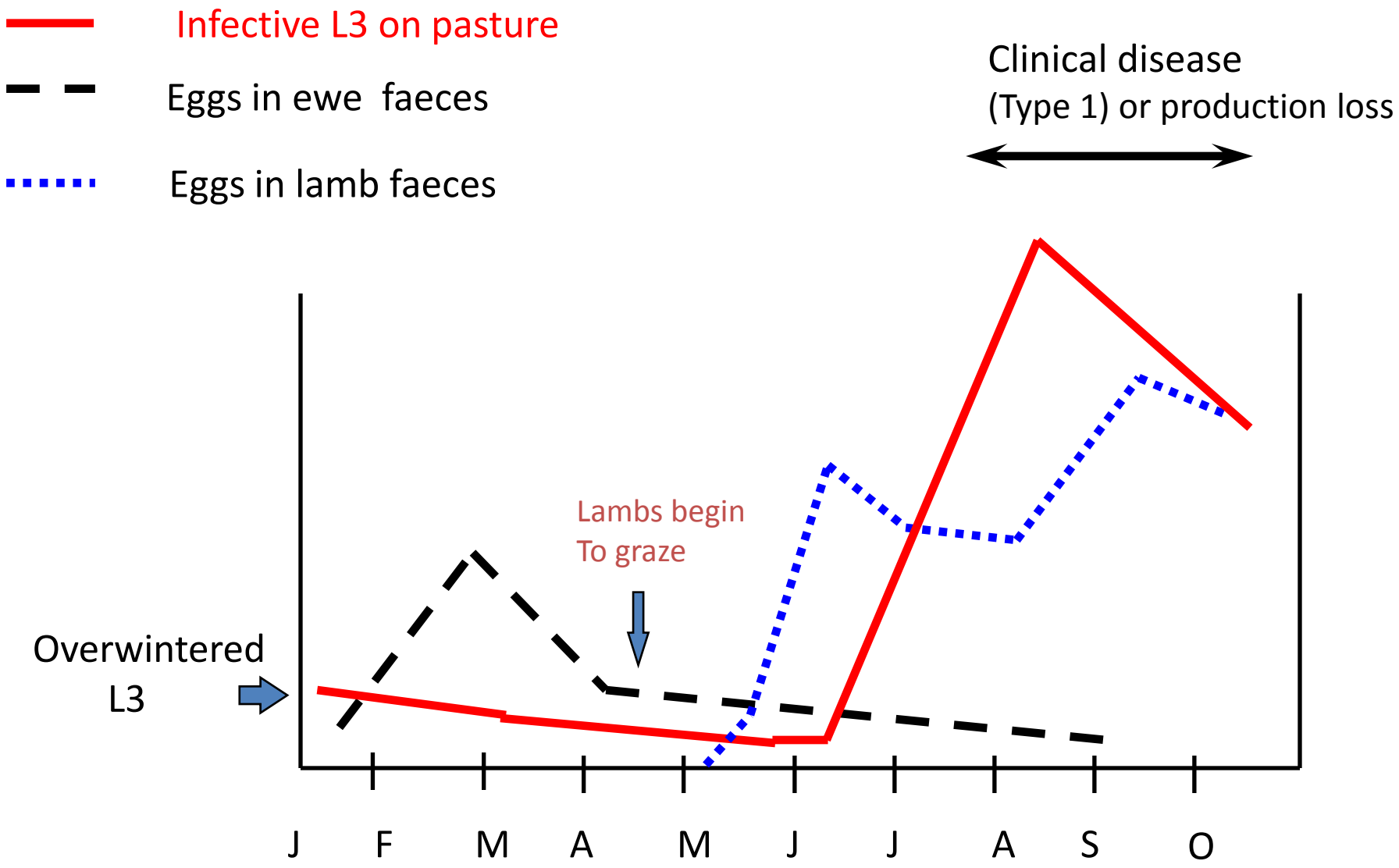
Survival in pasture

- Over-Wintering of larvae on pasture
  - Teladorsagia well adapted to cold and snow
  - Haemonchus less adapted
- Survival during grazing season
  - Depends on temperature and humidity
  - Hot temperature shorten survival
  - Cool temperature prolong survival of L3

Epidemiology of Ovine GI nematodes (N. Hemisphere)



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Diagnosing Parasitism

Clinical signs + Fecal egg count

Diagnosing Parasitism

Clinical signs+ Fecal egg count

How to get "poop" samples

- ✓Sheep in corner of pasture/from rectum
- ✓Collection in "Ziplock bags"
- ✓In a cooler right away
- ✓Kept cool (not frozen) -> lab
- ✓Pooled sample vs individual samples

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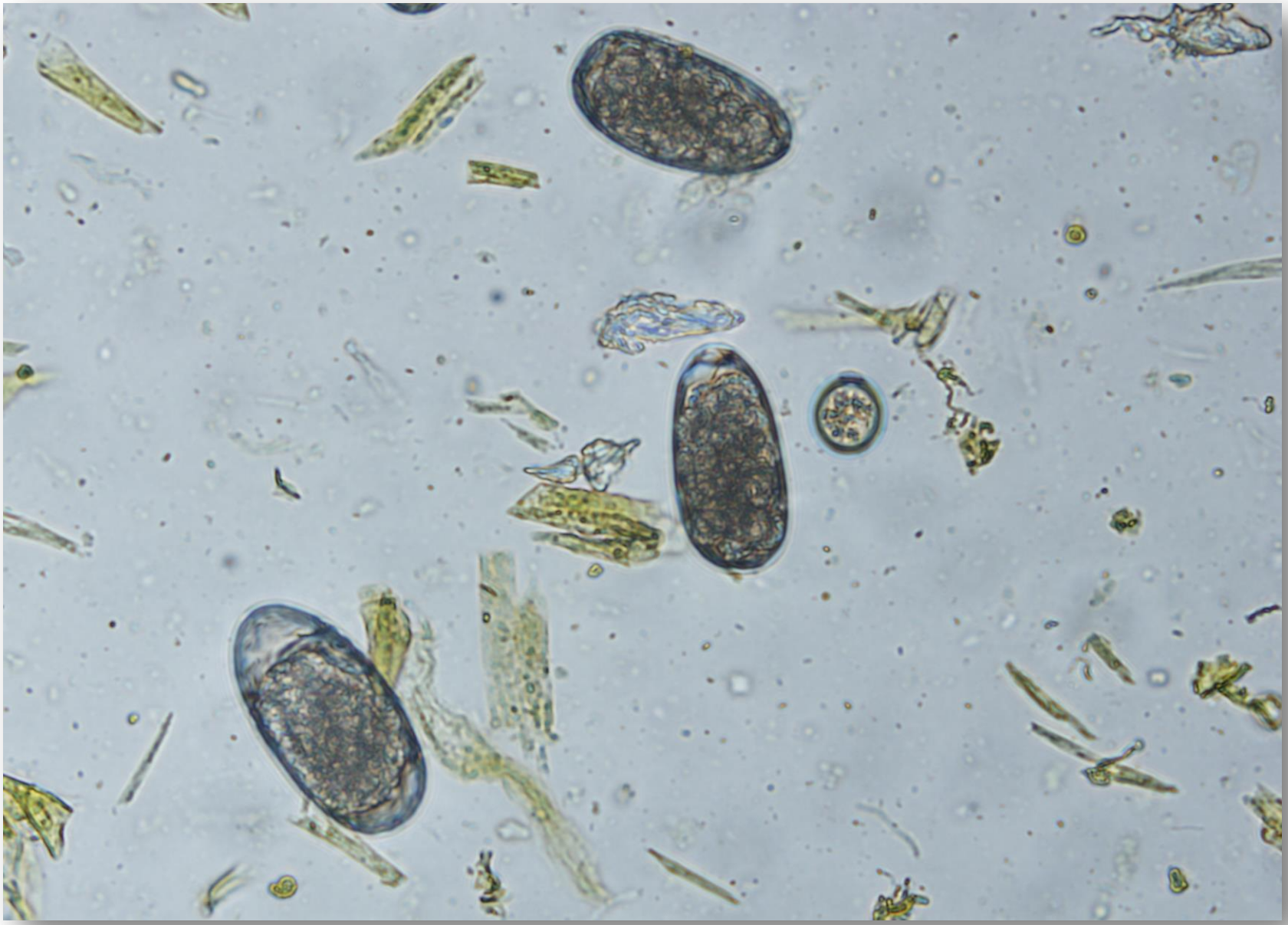
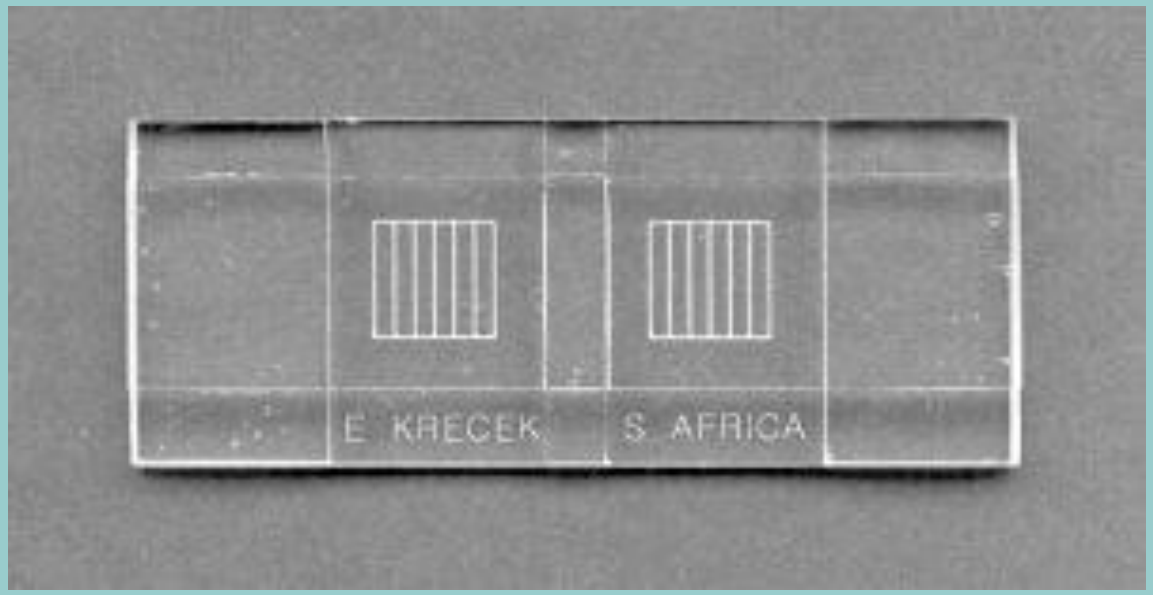
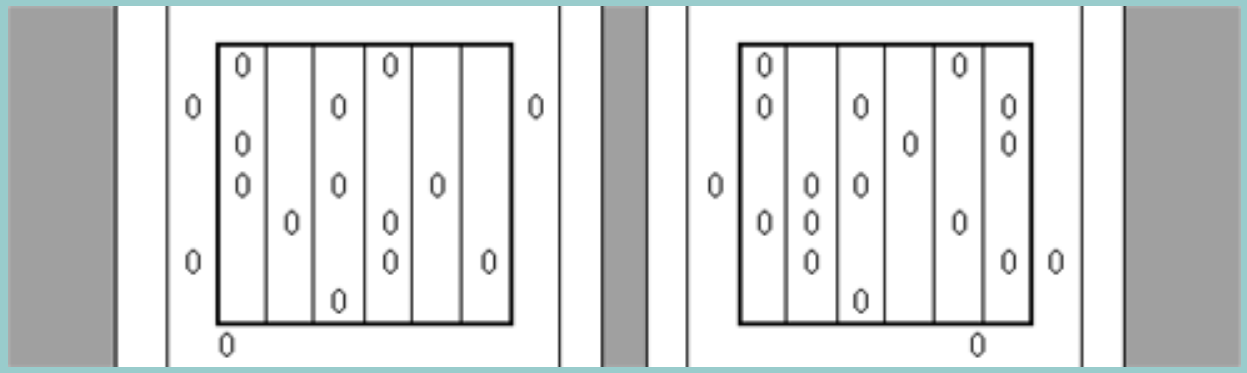
Diagnosing parasitism



Fecal egg count





Diagnosing *Haemonchus*

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Diagnosing *Haemonchus*

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Control of parasites

- Dewormers/ Anthelmintics
- Environment/Pastures

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Anthelmintics

Doses given per 100 lbs

Dewormer	Sheep dose	Goat dose
Ivermectin 1%	0.9 mls	1.8 mls
Albendazole 11.36%	4 mls	8 mls
Fenbendazole 10%	4.5 mls	9 mls
Levamisole 11.7 g packet	Treats 21 animals	Treats 21 animals
Oxfendazole 10%	4.5 mls	4.5 mls
Pyrantel 5%	22.5 mls	22.5 mls
Moxidectin 0.5%	1.8 mls	1.8 mls ?

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Anthelmintics

- 2 new Drugs- not yet available in Canada

- Monepantel: Zolvix, Novartis
- Derquantel: Startect, Pfizer/Zoetis

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Treatment Efficacy

- Ewes and lamb look better
- Fecal Egg Count (FEC)
  - Time of sampling is important
    - 10-14 days BZ
    - 7 days levamisole
    - 14-16 days Macrocyclic lactones

Treatment failure

- Insufficient dose
  - Underestimation of animal weight
  - Faulty equipment
  - Poor administration technique
- Inactive medication
  - Out of date
  - Incorrect storage
  - Poor quality products (Generics)

Treatment failure

- Inappropriate drug for target parasite
- Rapid re-infection on heavily contaminated pasture

- ***Resistance to anthelmintic***

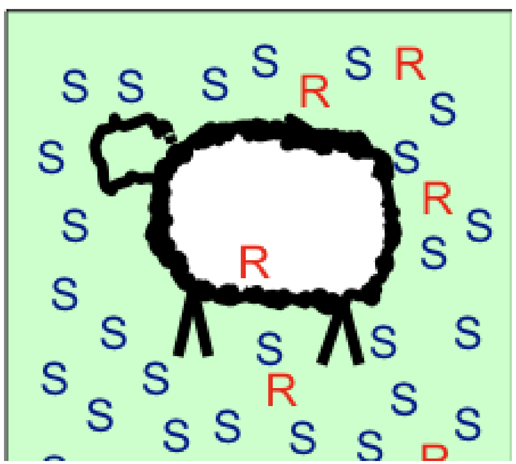
Anthelmintic Resistance (AR)

Defined as a heritable reduction in sensitivity of a parasite population to the action of a drug.

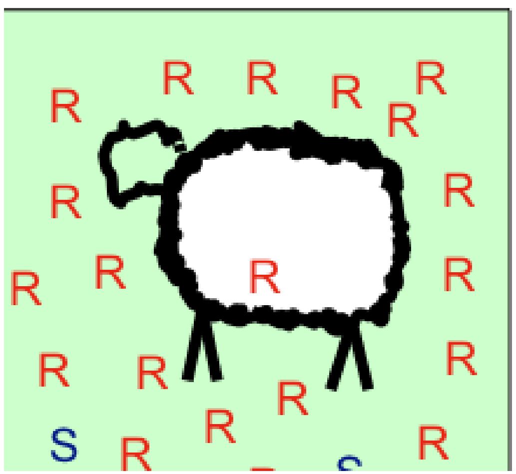
- Prevalence
  - **Worldwide**: 86% of 77 member countries (OIE June 1999 Bulletin)
  - **AR in the United States**
    - First documented in 1957
    - Reported primarily in the Southeastern US
    - Significant problem in the US and worldwide since 1990's
  - **AR in Canada**: reported Quebec and Ontario
- Economic losses
  - 1995: AUS$ 222 million/year to the sheep industry

Diagnosis of AR

- Suspected when poor response to anthelmintic treatment
- Unsuspected in early phases



Difficult to diagnose in early stages



Easy to diagnose later but too late

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Diagnosis of AR

- Simple response to dosing
- FEC from 10 animals after dosing
  - Time of sampling is important
- Fecal Egg Reduction Test
  - 2 groups (10-15 animals /groups): treated and control
  - FEC before-Treatment-FEC 7-14 days later
  - **Resistance if <95% reduction and 95% CI <90%**
  - Reliable when at least 25% population resistant
  - Species ID, minimal acceptable egg count

Fecal Egg Count Reduction Test (FECRT)

No Control Group

10 Tx animals

A. Pre-Tx FEC

↓

Treat animals

↓

B. Post Tx FEC

$$\% \text{ reduction} = \frac{(A-B) \times 100}{A}$$

With Control Group

10 Tx animals

A. Pre-Tx FEC

↓

Treat animals

↓

B. Post Tx FEC

10 Untreated animals

C. Pre-Tx FEC

↓

Untreated animals

↓

D. FEC

$$\% \text{ reduction} = \frac{(D-B) \times 100}{D}$$

Why a control group?

FECs Impacted by variables other than anthelmintic drug many of which change over time : (time of year, immune status, nutritional management/stress, faecal dry matter)

Fecal Egg Count Reduction Test (FECRT)

No Control Group

10 Tx animals

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10 Untreated animals

C. Pre-Tx FEC

↓

Untreated animals

↓

D. FEC

$$\%\ \text{reduction} = \frac{(D-B) \times 100}{D}$$

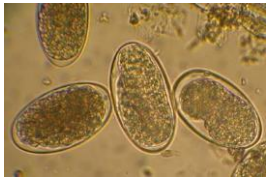
But which Parasite?

Why a control group?

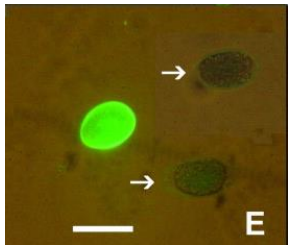
FECs Impacted by variables other than anthelmintic drug many of which change over time : (time of year, immune status, nutritional management/stress, faecal dry matter)

Species identification

Multiple species have similar eggs



Staining to identify Haemonchus eggs

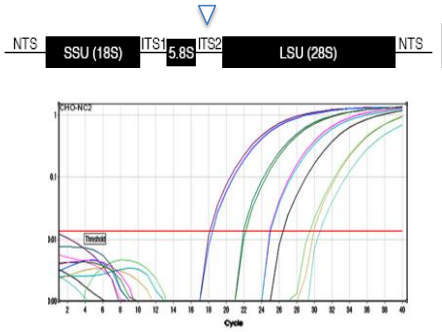


Only Haemonchus eggs stain with fluoroscein labelled peanut agglutinin

Culture eggs to L3 followed by morphological identification

Time consuming specialist task

Real-time PCR assays based on species-specific SNPs in the ITS-2 rDNA sequence



Changes in species present can help confirm resistance profile and identifies resistance species

In vitro tests for anthelmintic efficacy

- Bioassays (Phenotyping assays)
  - **E**gg **H**atch **A**ssay
  - **L**arval **D**evelopment **T**est
  - **L**arval **M**igration **I**nhibition **A**ssay

- Molecular Genotyping assays
  - SNPs in gene encoding β-tubulin target
  - Predominantly research tools at present

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Control of parasites

- Dewormers/ Anthelmintics
- Environment/Pastures

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Pasture Management

- Safe pastures
- Pasture management
- Animal Management
- Don’t buy resistant worms
- Selective treatment (FAMACHA)

Pasture Management

- Safe pastures include:
  - Tilled fields or burned pastures
  - harvested hay fields
  - not grazed yet or left idle for 90 days in summer or 180 days in fall/winter
  - Seasonal forages or browse

Pasture Management

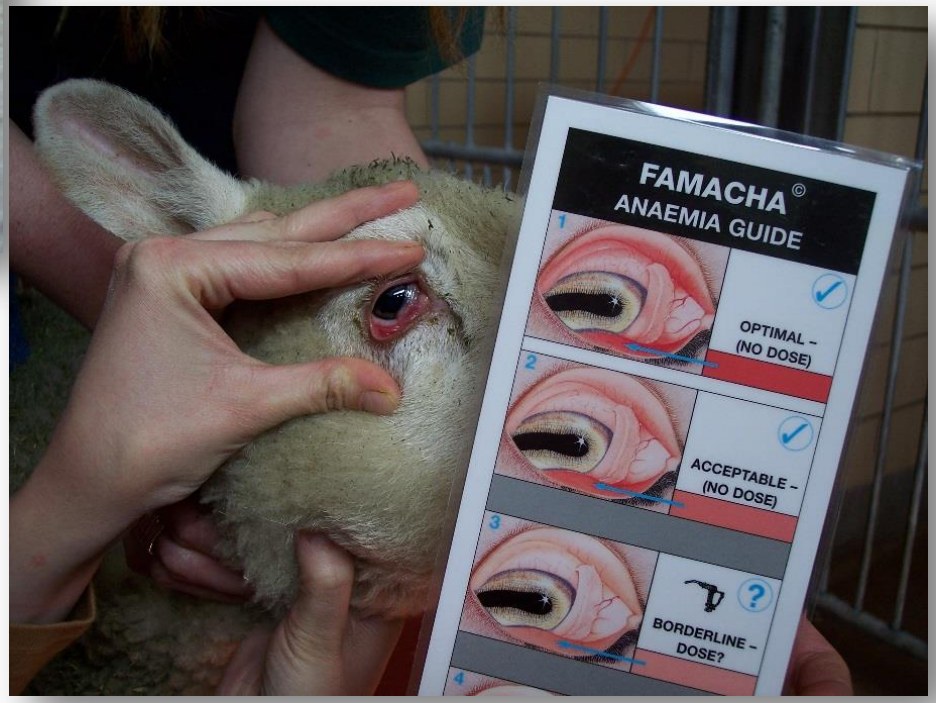
- Reduce stocking rates
- Use rotation through pastures
- Don’t graze too close
- Leave a pasture vacant as long as practical
- Co-graze with cattle or horses or rotate species

Animal Management

- Animal susceptibility:
  - Lambs
  - Late Gestation ewes
  - Lactating ewes
- Graze susceptible animals on safer pastures

Animal Management

Do not treat every animal



FAMACHA

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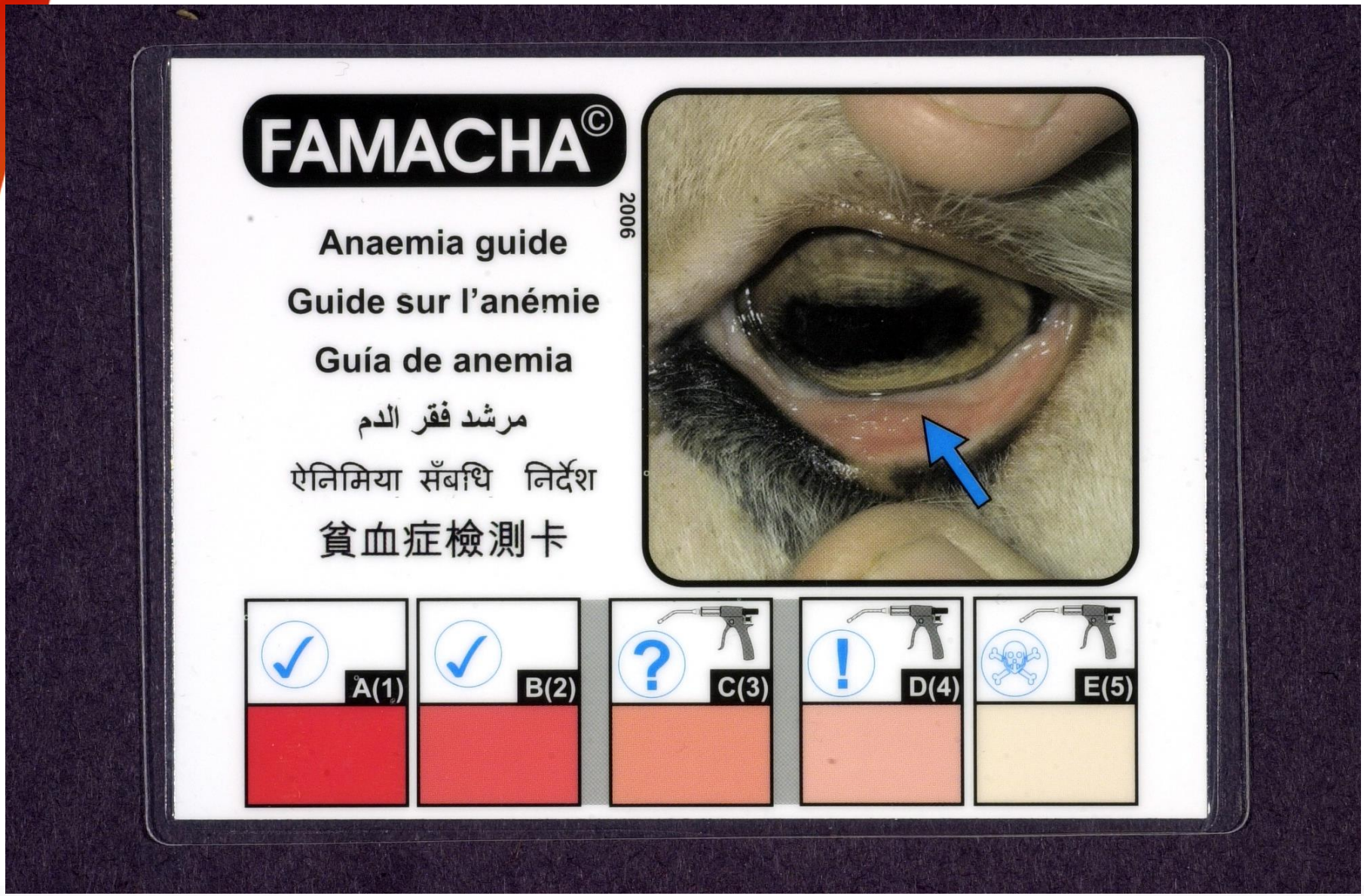

Animal Management

- Do not treat categories 1-3 in sheep
- Treat categories 4-5 in sheep
- It is only a guide, not 100% accurate
- Together with record,FAMACHA can help make culling decisions

Animal Management

Don’t buy resistant worms

- All new additions should be quarantined and aggressively dewormed upon arrival
- Should remain in quarantine for 10 - 14 days
- Perform FEC to confirm that no eggs are shed

UCVM Study 2013

Randi Stead, Michel Lévy

John Gilleard

UCVM Study: Objective of the study

- Summer 2013
- Summer research student
- Question: Is there AR of sheep parasites in Alberta?

UCVM Study: Method

- 4 farms selected, north of Calgary
- Survey
- 2 visits at 10-14 days interval
- 3 groups of 15 ewes: 1 control and 2 treated with IVM or FB

UCVM Study: Method

- Fecal egg count on first and second visit in ewes of each group
- FECRT: comparing FEC control at 2nd visit with FEC of each treated group on 2nd visit

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UCVM Study: Method

- Culture the feces to identify the type of parasites
- Develop high throughput methods for determination of the identity of the parasite
- Determine high throughput methods for determination of AR

UCVM Study

Determination of Anthelmintic Resistance

- If FECRT $\geq$ 95% -> effective drug
- If <95% but > 90% -> suspect AR
- If < 90% then AR

UCVM Study: Results

	Fenbendazole		Ivermectin	
	%reduction FECRT	95% CI	%reduction FECRT	95% CI
Farm # 1	77%	42%-91%	93%	77%-98%
Farm # 2	0%	0%-57%	85%	0%-98%
Farm # 4	-718%	-24%-0%	29%	0%-91%

UCVM Study: Results

	Fenbendazole	Ivermectin
Farm # 1	Resistance	Suspect Resistance
Farm # 2	Resistance*	Resistance
Farm # 4	Resistance**	Resistance

UCVM Study: Conclusion

- Not enough data to make firm conclusions but:
- Results on 3 farms + information from the field suggest that Haemonchosis is an emerging disease in the province and that AR is present in Alberta flocks

UCVM Study: Follow up study

- Summer of 2014
- Summer research student
- Similar but improved methodology
- + prevalence of *Haemonchus contortus*

UCVM Study: Overall goal

- To evaluate a number of Farms in Alberta and determine:
  - ✓What kind of GI parasites, specifically *H. contortus*
  - ✓The level of AR in the province
  - ✓Determine methods to minimize the problem

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UCVM Study: our Goal

- 2 summers of gathering preliminary data
- Successfully submit a proposal for more extensive evaluation of this issue to ALMA with the support of the Sheep industry

UCVM Study: Follow up study

We are looking for volunteer flocks

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Thank you for your attention

We'll be back to share results

In the meantime:

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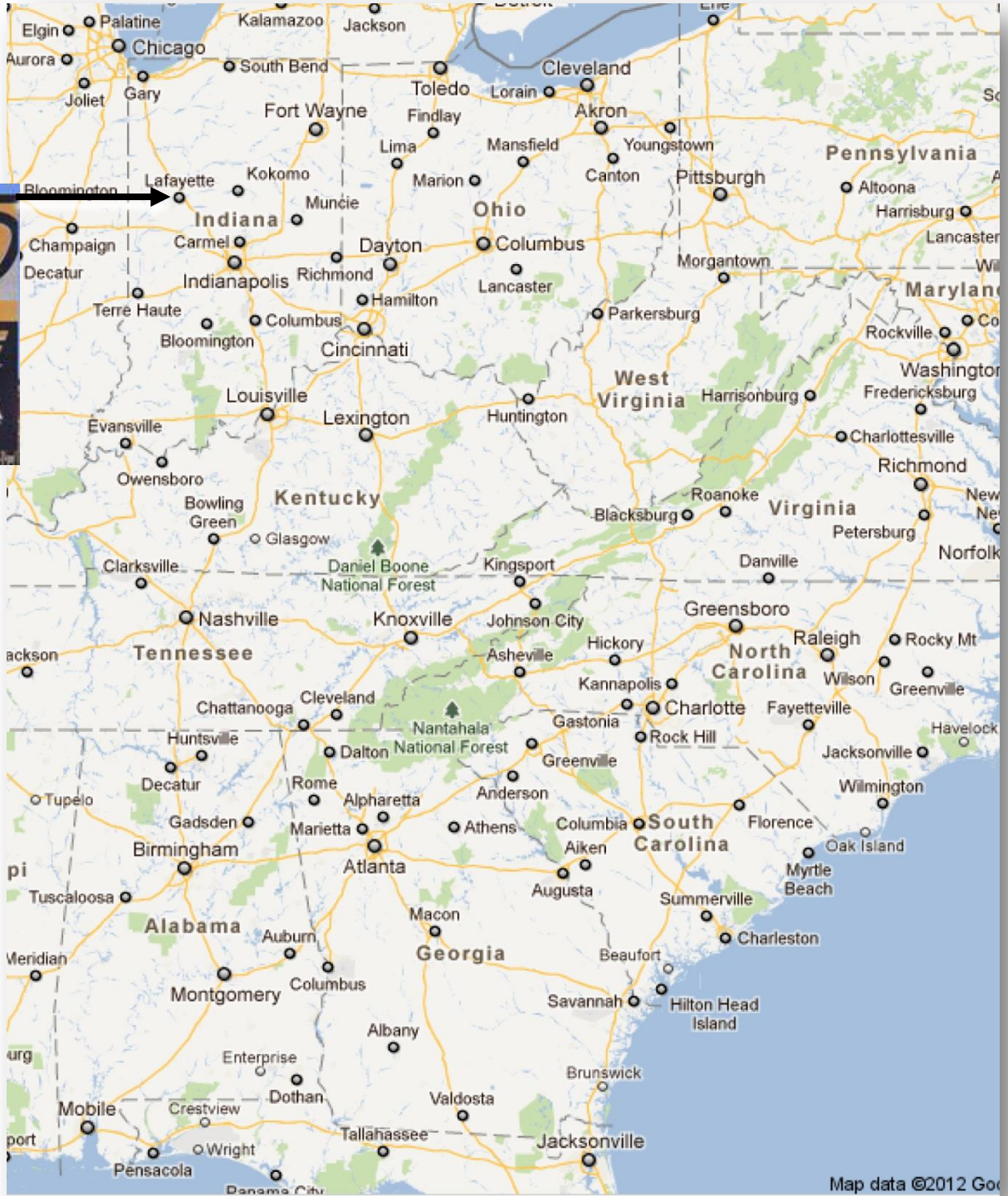
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Mansfield
Youngstown
Pennsylvania
Canton
Pittsburgh
Altoona
Harrisburg
Lancaster
Bloomington
Lafayette
Kokomo
Muncie
Marion
Ohio
Indiana
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Comparison of anthelmintic resistance