

# Modern Understanding of Cattle Parasitism

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# What Are The Primary Helminth Parasites of Concern ???

Major pathogens:

*Ostertagia ostertagi*

*Cooperia* spp.

*Haemonchus placei*

*Trichostrongylus axei*

*Fasciola hepatica*

Less important:

*Oesophagostomum*

*Nematodirus*

*Trichuris*

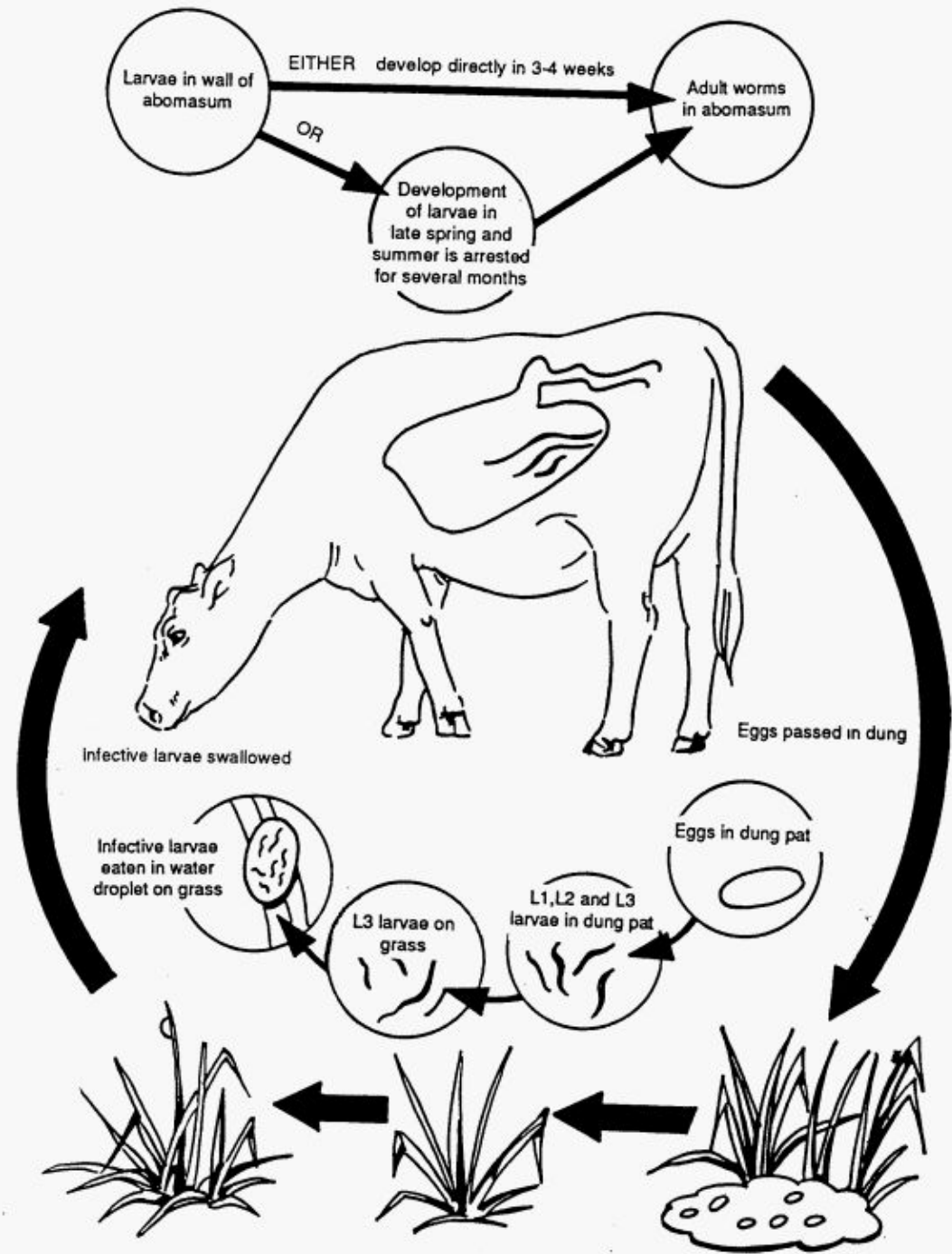
*Bunostomum*

# *Ostertagia / Teladorsagia*



**brown stomach worm**

# Ostertagia Life Cycle



# *Ostertagia* / *Teladorsagia*

- *O. ostertagi* (cattle)
  - most important parasite of cattle
  - worldwide distribution (except for tropics)
  - cool-climate adapted worm
- *Teladorsagia circumcincta* (sheep, goats)
  - important pathogen of sheep worldwide
    - NZ, Scotland, S. Australia = most imp't parasite
  - uncommon in Georgia - if see it will be in winter/spring
- Appearance - slender, reddish-brown, < 1 cm
  - only visible on close inspection

# *Ostertagia / Teladorsagia*

## Biology - Epidemiology

- **Prepatent period = 3 weeks**
- **Short lived**
  - most adult worms survive < 2-3 months in host
    - **Rapid turnover**
- **Life - cycle (3 weeks to complete)**
  - **L3 penetrate into gastric glands of abomasum**
  - late L4 emerge from gastric glands
  - molt to L5, mature to adults, produce eggs

# *Ostertagia* / *Teladorsagia*

## Hypobiosis

- **Worms survive adverse environmental conditions within the host in an arrested state of development**
  - always arrest in the early 4th stage
  - Stay in arrested state for 3-4 months
- **Cool temperate (northern U.S., Europe)**
  - stimulated by cool autumn temperatures – worms overwinter in host
- **Warm temperate, (southern U.S.)**
  - stimulated by warm spring temperatures – worms survive summer in host

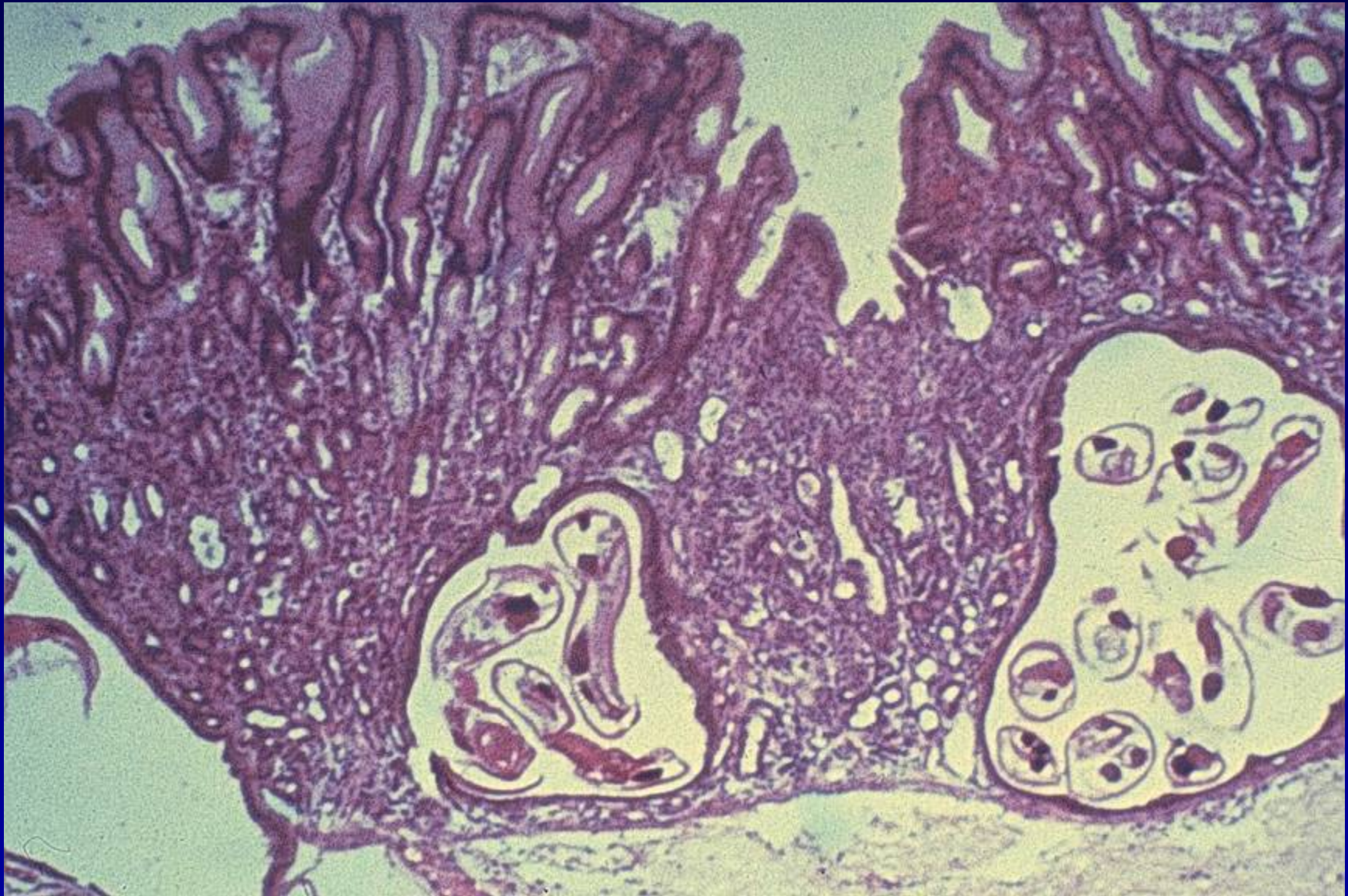
# Seasonal Transmission of *Ostertagia* / *Teladorsagia*

- **In cool temperate climates**
  - seasonal grazing
  - Highest transmission in summer - fall
  - larvae acquired in late fall become hypobiotic
- **In warm temperate climates**
  - frequently grazing all-year
  - Highest transmission in winter - spring
  - larvae acquired in late spring become hypobiotic

# *Ostertagia* - Pathogenesis

- **Primary pathology**
  - **disruption of abomasal mucosa by developing larvae -- gastric glands destroyed**
    - destruction of zymogen cells - decreased pepsinogen
    - destruction of parietal cells - decreased HCl
  - both direct effect and immune-pathology
- **Post Mortem**
  - abomasum has putrid smell - bacterial overgrowth, high pH
  - mucosa has nodular appearance - so called “Moroccan Leather”

# Ostertagia L<sub>4</sub> in Gastric Glands



# Abomasal Lesions From *Ostertagia*



# Abomasal Lesions From *Ostertagia* “Moroccan Leather”



# *Ostertagia*

## Clinical Syndromes

- **Type I** ostertagiasis
  - disease resulting from worms acquired from pastures being **currently grazed**
- **Type II** ostertagiasis
  - disease resulting from hypobiotic worms acquired during **previous grazing season**
  - **synchronous emergence of late L4 larvae coming out of arrest**

# Ostertagiasis

## Type I Vs. Type II

- **With both types pathophysiology is the same**
  - 1° pathology is due to larvae
- **Epidemiology of the 2 types of disease are very different**

# Parasitic Gastroenteritis (PGE)

- Important disease syndrome
- Caused by nematode infection of the abomasum and intestine
  - primarily of the family Trichostrongylidae
  - usually caused by **multiple parasite species**
  - ***Ostertagia* most important species (cattle)**
- Clinical Manifestations
  - **Anorexia - hallmark of disease**
  - Anemia, Hypoproteinemia
  - **Diarrhea - most common clinical sign**
  - Decreased resistance to other infections, decreased “well-being”

# Clinical Symptoms of PGE

- Weight loss
- Pale mucous membranes
- Rough, feces-soiled hair coats
- Diarrhea
- Dehydration
- Submandibular edema
  - bottle jaw
- “Poor doers”





# Clinical Disease Is Not The Primary Concern

## ■ Subclinical disease

- GI Nematodes can have a dramatic impact on production without causing any signs of Dz

## ■ Decrease in appetite is most important

## ■ Also decrease in nutrient utilization

## ■ Effect of moderate levels of parasites can be totally unapparent if animals are not weighed

- 0.2 – 0.4 lb/day in gain can be lost to parasites



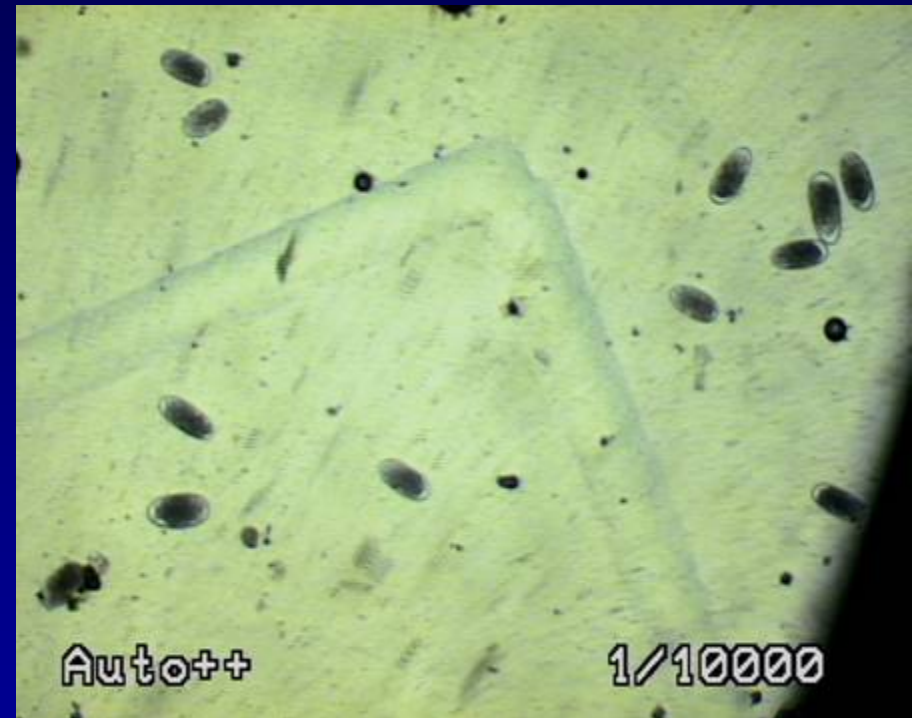
**Image courtesy of Dr. A Loyacano**



**Image courtesy of Dr. R. Rew**

# Diagnosis of Parasitic Gastroenteritis

- History
- Clinical Signs
- Fecal Egg Counts (FEC)
  - fecal cultures
- Clinical Pathology
  - anemia
  - hypoproteinemia
  - serum pepsinogen
- Necropsy – will not see worms



# *Cooperia* spp.

- Hosts – cattle, sheep, goats
- Identification
  - small < 1 cm (similar in size to *Ostertagia*)
- Quite a few different species
  - Both cool- and warm-climate adapted species
- **Very common -- frequently is predominant contributor to FEC in young cattle**
- **“Dose-Limiting” parasites for AM drugs**

**copulatory bursa &  
spicules**



**cephalic vesicle;  
longitudinal ridges with  
transverse striations  
(railroad tracks)**



# Strategic Control: A New Idea?

'It would seem that a new approach is being made in the control of nematode parasites. The emphasis is now on pasture hygiene, achieved by combining the intelligent use of anthelmintics with controlled grazing....**As better anthelmintics become available and more knowledge of life cycles and bionomics of various parasites are acquired**, there is every reason to hope that the tremendous losses due to parasitism of farm livestock will be greatly reduced'.

**A. Russell (1949)**  
**Vet Rec 61:238-239**

# 1st Published Research Paper on Strategic Control

- JF Michel (1969) J Helminthol
  - “The results of these observations suggest a simple and widely applicable means of controlling parasitic gastro-enteritis in calves.”
    - Leads to treat and move strategy

# Strategic Control

## What Exactly Does This Mean ???

- Term often used but means different things to different people
- **Strategic control** of parasites involves the judicious use of anthelmintics based on knowledge of the host, parasite, environment and the properties of the drug being used

# Strategic Treatment

## The Bottom Line

- Anthelmintics are most effective in controlling parasites when treatments are **strategically** timed so as to prevent the contamination of pastures with infective stages of parasites

# Strategic Treatment

## The Bottom Line

- The best and most cost-effective anthelmintic treatment is prophylactic in nature and is given to seemingly healthy animals
  - Treatment may only remove small numbers of parasites
  - Used to prevent future infections
  - Animals can grow to their potential by minimizing the establishment of parasites

# Strategic Control is a Dynamic System

- Optimal program will differ based on:
  - Specifics of production system
  - Production goals
  - Season – length of grazing period
  - Available pasture – type and amount
    - perennial or newly sown ?
    - safe or contaminated ?
  - Species of parasites likely to be present
  - Labor availability and cost
  - Quality of handling facilities
  - Properties of drugs, cost of drugs
  - Drug resistance

# Impact of Strategic Parasite Control on Weight Gain

- Some studies have showed no significant differences in gain
  - These studies typically performed under very low worm challenge conditions
- But most studies have demonstrated an increase in gain of about 0.2 – 0.4 lb/day
  - 12 - 24 lb gain advantage over 60 days
  - 24 - 48 lb gain advantage over 120 days

# The Term "Strategic Control" is Often Overused

- What is convenient or what yields maximal production is not necessarily strategic
- True strategic control uses anthelmintic treatment at carefully timed intervals based on a working knowledge of the host-parasite relationship, the epidemiology of parasite transmission and the properties of the drug being used

# Do Most Cattle Operations Really Use Strategic Control ???



# Common Parasite Control Program Used In Stocker Cattle Operations In Georgia

- Deworm one time at initial processing with a pour-on macrocyclic lactone
  - Also vaccinated
- Grazed on winter pasture that likely has had several groups of cattle on it over the previous year
- Grazed for 30 – 120 days and sent to feedlot

# Strategic Control Works !!!

- Parasitological and animal production data from trials investigating the impact of strategic parasite control tells us that the decision of *which ML product to use* is less important than *when to use it*
  - There are differences between products that can impact decision of which to use

# What About Resistance ???

- Frequent, near suppressive treatment will promote drug resistance
- Strategic control by design will promote resistance to some degree because it is fundamentally based on minimizing refugia
  - Strategic control programs aim to minimize environmental contamination of pastures with infective stages of parasites
  - All cattle are treated

# Anthelmintic Resistance in Nematodes of Cattle

- Certainly less of a problem than with small ruminants or horses
- In Brazil, Argentina, and New Zealand
  - ML resistance is reaching levels that justify concern
- In other areas of the world too little data to know extent of problem
  - Numbers of reports increasing around the world

# Drug Resistance In Cattle Nematodes In The US ???

- Multiple-drug resistant *Haemonchus* and *Cooperia* are reported in US
  - No prevalence studies have been conducted
  - May be more common than is currently recognized ???
  - Is it a problem ???

# Resistance May Not Be Noticed Until Reaching High Levels

- In cattle, resistance is only first noticed as reduced weight gains
  - By the time resistance reaches this level, it is a significant problem and is irreversible
  - With *Cooperia* and *Haemonchus* clinical Dz following failed treatments is not noticed until resistance reaches very high levels
- BUT – the most important parasite of cattle "*Ostertagia*" has not been reported to be resistant anywhere in the world

# Is There Anything To Do About It?

- Short-term profit concerns always are most important to cattlemen
- Increased labor and handling costs will make any alternative system more expensive than cheap chemical control
- Any measures used in an attempt to decrease the chances of resistance developing will most likely cause some decrease in short-term profitability

# Strategies to Slow The Development of Resistance

- Leave the heaviest 5 - 10% of cattle untreated
  - These are most likely the animals with highest resilience and immune resistance to parasites
  - These animals will likely grow well whether they have small numbers of parasites or not
  - Low numbers of parasites infecting these animals will contaminate pastures with a relatively small -- but drug-susceptible refugia of infective stages

# Strategies to Slow The Development of Resistance

- Treat simultaneously with 2 drugs from different anthelmintic classes
  - e.g. use albendazole or levamisole at same time that the ML is used
    - Levamisole tends to have good efficacy against *Cooperia*
  - Once resistance to develops, it usually renders that drug “narrow spectrum” and therefore more than 1 drug must be used to kill full spectrum of parasites

# Questions ???

