

A photograph of a rider on a brown horse jumping a wooden obstacle with red and white striped poles. The rider is wearing a dark shirt, light-colored pants, and a helmet. The horse is in mid-air, clearing the jump. In the background, there is a green field and a person sitting in a chair. The text is overlaid on the image.

# Current Concepts in Equine Parasite Control: The Good, The Bad, & The UGLY!

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Misty Gray, DVM

Lauren Baldwin, DVM

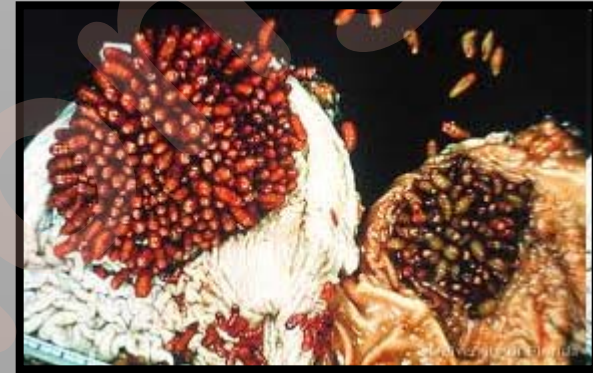
# Overview

- ▶ Life Cycle of a Parasite
- ▶ The Players
- ▶ Diagnostics
- ▶ DeWormers Demystified
- ▶ To Treat, or Not to Treat?
- ▶ Manage It!!!

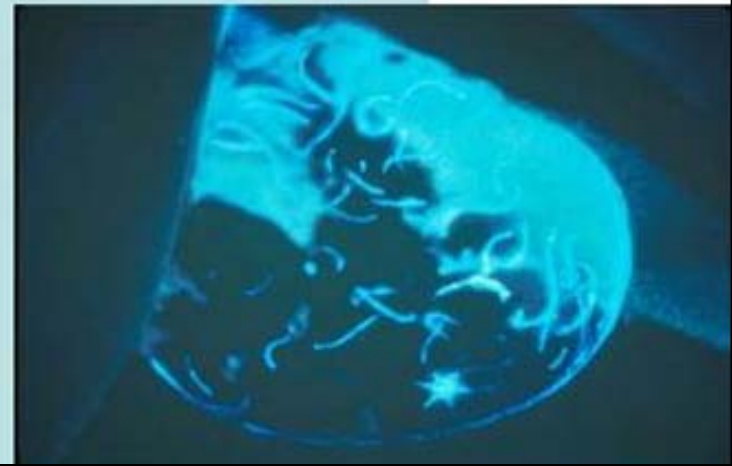


# Life & Times of a Parasite:

- ▶ Internal parasites can:
  - Lower the horse's resistance to infection
  - Rob the horse of valuable nutrients
  - Cause permanent damage to internal organs



*Water droplet on blade of grass containing parasites that will be consumed by a grazing horse.*



# Life & Times of a Parasite: Life Cycle at a Glance...

- ▶ Adults within intestinal lumen produce eggs
- ▶ Eggs pass into environment via manure
- ▶ Eggs hatch, releasing L1 larvae
- ▶ L1 → L2 → L3 (infective)
- ▶ L3 ingested via grazing
- ▶ Mature to fertile adult worm within intestine → eggs



# The Players: The Good

## ▶ Parasite **Refugia**:

- Definition:
  - Parasites which have not encountered anthelmintics
- Sources
  - Eggs/larvae on pasture
  - Parasitic stages within host unexposed to drug
  - Untreated horses
- Importance
  - Provides a gene pool susceptible to anthelmintics
    - Dilute the frequency of resistant genes
- Maintain
  - Via strategic deworming



# The Players: The Bad

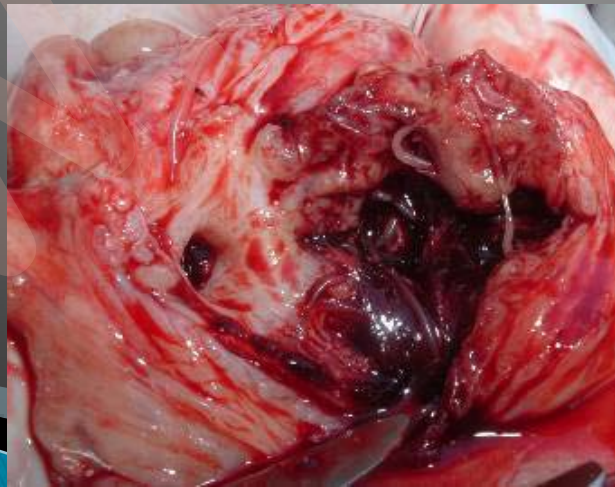
## ▶ Parasites of Concern in the **Adult Horse**:

- Large Strongyles (Bloodworms)
- **\*\*Small Strongyles** (Cyathostomes)
- Tapeworms (*A. perfoliata*)
- Bots (*Gasterophilus spp*)
- Others...



# Large Strongyles

- ▶ *S. vulgaris*
  - Historically the most important equine parasite
  - 90% of colics due to *S. vulgaris*
  - Most pathogenic helminth of horses
  - Now very uncommon



# Small Strongyles / Cyathostomes

- ▶ Chief concern in adult horses today
  - Primary target of worm control program
  - Ubiquitous (Prevalence = 100%)
- ▶ Stages:
  - Luminal
  - Encysted
    - Larval Cyathostomosis
  - Signs:
    - Colic
    - Weight loss
    - Diarrhea



Encapsulated small strongyle larvae  
in the cecal wall

# What Kills Larval Strongyles?

## ANTHELMINTICS CURRENTLY APPROVED FOR TREATMENT AND CONTROL OF LARVAL STRONGYLE INFECTIONS OF HORSES

Dewormer	Brand Names	Dosage/Regimen	EFFECTIVE AGAINST:		
			Migrating Large Strongyles	Encysted cyathostomes EL3	LL3/L4
Fenbendazole	Panacur, Safe-Guard	10 mg/kg/day; 5 days	Yes	Yes	Yes
Ivermectin	Equell; EquiMax; Eqvalan; Ivercare; Phoenectin; Rotation 1; Zimecterin; Zimecterin Gold; various generics	0.2 mg/kg/once	Yes	No	No
Moxidectin	Quest; Quest Plus; ComboCare	0.4 mg/kg/once	Yes	No	Yes

SOURCE: CRAIG REINEMEYER, DVM, PHD

## Anthelmintics with Adulticidal or Larvicidal Activity Against Cyathostomes

DRUG ACTIVITY	CHEMICAL NAME
Adulticidal	Benzimidazoles, fenbendazole (5 mg/kg), oxfendazole (10 mg/kg), oxibendazole (10 mg/kg), macrocyclic lactones, ivermectin (0.2 mg/kg), moxidectin (0.4 mg/kg), tetrahydropyrimidines, pyrantel pamoate, pyrantel tartrate
Larvicidal	Moxidectin (0.4 mg/kg), fenbendazole (10 mg/kg daily for 5 days)

# Tapeworms: an underrated threat

## ▶ *Anoplocephala perfoliata*

- Cestode
- Indirect life cycle
  - Orbatid mites
- Secondary target of worm control program
  - 50–60% infected
  - colic
- FEC inconclusive
- Spring/Autumn
- Praziquantel



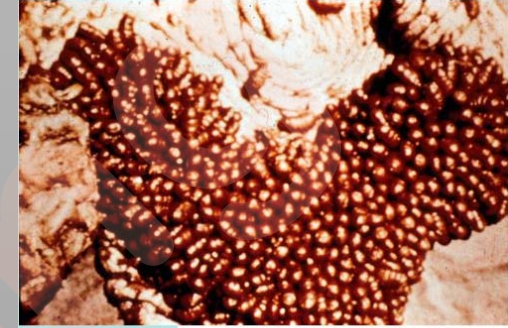
## WHAT WORKS AGAINST TAPEWORMS?

PRODUCT (MANUFACTURER)	INGREDIENTS			LABEL CLAIMS	
	FORMULATION	NEMATOCIDE DOSAGE	PRAZIQUANTEL DOSAGE	PREGNANT MARES	MINIMUM AGE
Equimax (Pfizer)	Paste	Ivermectin (0.2 mg/kg)	1.5 mg/kg	Yes	1 month
Quest Plus (Fort Dodge)	Gel	Moxidectin (0.4 mg/kg)	2.5 mg/kg	No	6 months
Zimecterin Gold (Merial)	Paste	Ivermectin (0.2 mg/kg)	1.0 mg/kg	No	5 months
ComboCare (Farnam)	Gel	Moxidectin (0.4 mg/kg)	2.5 mg/kg	No	6 months

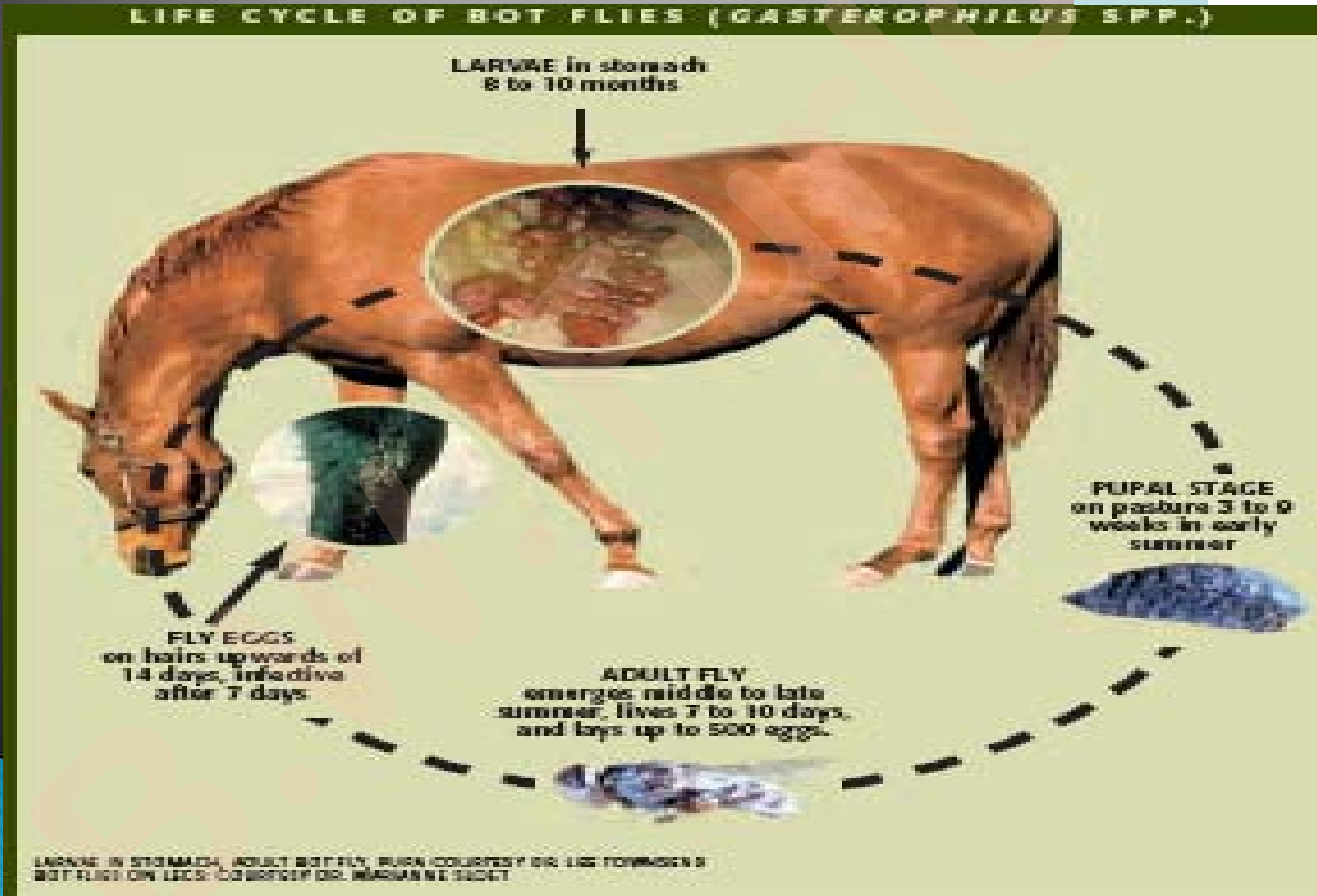
*Comparison of combination anthelmintics currently approved for treatment and control of tapeworm infections in horses*

# Bots

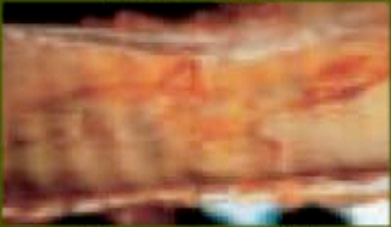



## ▶ *Gasterophilus* spp



Bots



## LESS-KNOWN INTERNAL PARASITES OF EQUIDS

PARASITE	AGE AFFECTED	SIGNS	TREATMENT
<p><b>LUNGWORMS</b></p>  <p><i>(Dictyocaulus immitis)</i></p>	Any age group (more common in donkeys)	Coughing, lung irritation	Ivermectin
<p><b>STOMACH WORMS</b></p>  <p><i>(Trichostrongylus axei; Habronema muscae; O. circumcincta; Haemonchus contortus)</i></p>	4 months and up	Loss of appetite, weight loss, poor growth, itchy, persistent sores	Ivermectin
<p><b>PINWORMS</b></p>  <p><i>(Oxyuris equi)</i></p>	6 months and up	Tail rubbing, rat-tailed appearance, weight loss	Broad-spectrum anthelmintics*
<p><b>THREADWORMS</b></p>  <p><i>(Strongylus edentatus)</i></p>	1 to 5 months	Diarrhea	Ivermectin Oxibendazole at 1.5 x label dose

\* BROAD-SPECTRUM ANTHELMINTICS—ANY COMPOUND THAT DEMONSTRATES EFFICACY AGAINST FOUR DISTINCT GROUPS OF WORMS: SMALL STRONGYLUS, LARGE STRONGYLUS, ASCARIDS, AND PINWORMS.

# The Players: The Bad

- ▶ Parasites of Concern in the Foal:
  - **Ascarids** (Roundworms)
  - Large Strongyles (Bloodworms)
  - Small Strongyles (Cyathostomes)
  - Tapeworms (*Anaplocephala*)
  - Threadworms (*Strongyloides*)
  - Others...

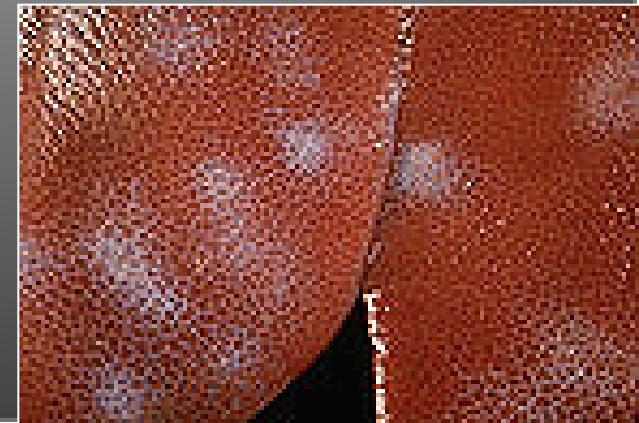
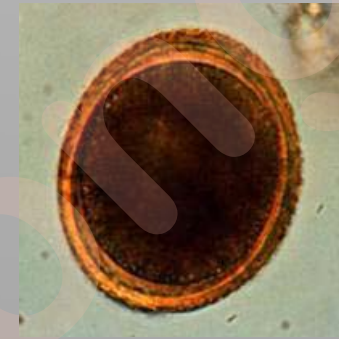


Parasites Affecting Juvenile Horses	
COMMON NAME	SCIENTIFIC NAME
Pinworms	<i>Oxyuris equi</i>
Roundworms (ascarids)	<i>Parascaris equorum</i>
Large strongyles	<i>Strongylus spp.</i>
Small strongyles (cyathostomes)	<i>Numerous species</i>
Tapeworms	<i>Anoplocephala perfoliata</i>
Threadworms	<i>Strongyloides westeri</i>

# Ascarids

## ▶ *Parascaris equorum*

- Chief concern in foals
- Primary target of worm control program
- Impaction colic
- Environmental persistence
- Acquired immunity



# WHAT WORKS AGAINST ASCARIDS?

CHEMICAL DEWORMER CLASSES	BRAND NAMES	ACTIVE INGREDIENT	DOSAGE
Benzimidazoles	Panacur, Safe-Guard	Fenbendazole	10 mg/kg*
	Benzelmin	Oxfendazole	10 mg/kg
	Anthelcide E.Q.	Oxibendazole	10 mg/kg
Tetrahydro-pyrimidines	Strongid-P, Strongid suspension; Exodus; Pyrantel Pamoate Paste; various generics	Pyrantel pamoate	6.6 mg/kg
	Continuex; Strongid-C; Strongid-C 2X; various generics	Pyrantel tartrate	2.64 mg/kg daily
Macrocyclic Lactones	Equell; EquiMax; Eqvalan; Ivercare; Phoenectin; Rotation 1; Zimecterin; Zimecterin Gold; various generics	Ivermectin	0.2 mg/kg **
	Quest; Quest Plus, ComboCare	Moxidectin	0.4 mg/kg***

\* The 10 mg/kg dosage is for foals that might harbor *Parascaris*; older horses presumably immune to ascarids are dosed at 5 mg/kg.

\*\* Zimecterin® Gold is not approved for use in foals younger than five months of age.

\*\*\* Quest, Quest Plus, and ComboCare are not approved for use in foals younger than six months of age.

# Threadworms

- ▶ *Strongyloides westeri*
  - Transmitted via nursing
    - Migrate from mare's tissues
  - CS: unthriftiness, scours
  - Immunity



# Foal Deworming Timeline

1-2 weeks

**ANTHELMINTIC**

Ivermectin

**PARASITES OF CONCERN**

Threadworms

2 months

**ANTHELMINTIC**

Pyrantel pamoate  
or benzimidazole

**PARASITES OF CONCERN**

Ascarids and Pinworms

(subsequent treatments with rotational  
deworming every 60 days until 15-18 months old)

5 months

**ANTHELMINTIC**

Macrocydic lactone  
(ivermectin, moxidectin)

**PARASITES OF CONCERN**

Strongyles

(and every 5 months thereafter)

after weaning

**ANTHELMINTIC**

Praziquantel

**PARASITES OF CONCERN**

Tapeworms

# The Players: The UGLY

## ▶ Resistant Worms

- Present against each major class of anthelmintics
- No reversal
- No new drugs on the market



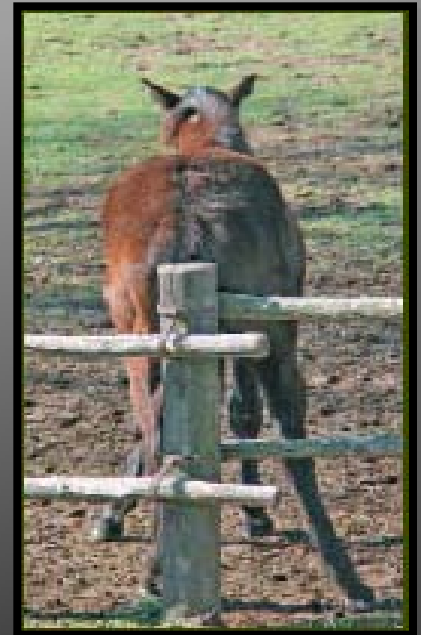
# Overview

- ▶ The Players:
- ▶ **Diagnostics**
  - Clinical Signs
  - FEC
  - FECRT
- ▶ DeWormers Demystified
- ▶ To Treat, or Not to Treat?
- ▶ Management Changes



# What to Look For: Signs of Parasitism

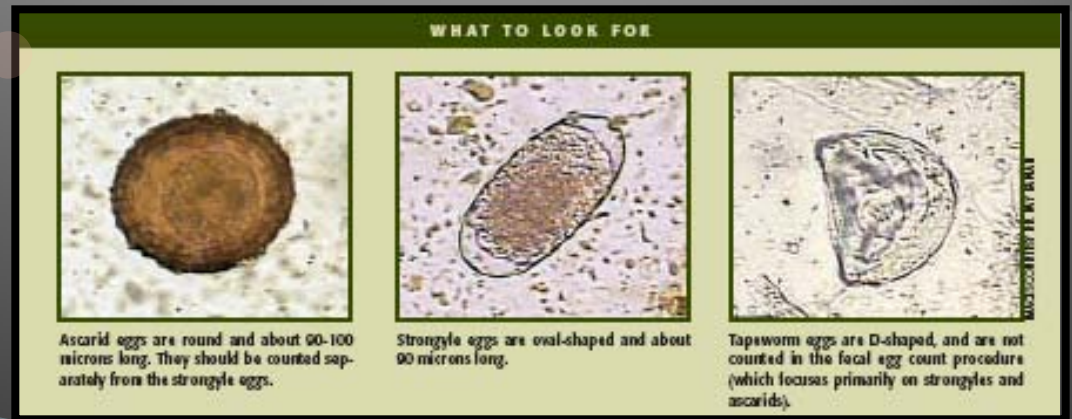
- ▶ Unthriftiness/loss of condition
- ▶ Decreased stamina/lethargy
- ▶ Dull, rough hair coat
- ▶ Slowed growth (young horses)
- ▶ Pot belly (especially in young)
- ▶ Colic
- ▶ Diarrhea



# Diagnostics

## ▶ Fecal Egg Count (FEC)

- McMasters Technique
- Imperative to successful parasite control
- Horses are categorized in Low, Moderate, & High Egg Shedders
- Monitor program effectiveness over time
- Evaluate an individual's drug resistance



# Fecal Egg Count

What your vet needs:

- 1 gram (fecal ball) of FRESH manure
  - Fresh = still steamy when you pick it up
  - Place in air tight container
  - Refrigerate until submitted to your veterinarian
  - Submit within 24 hours for most accurate results



# Examining the Evidence:

- ▶ The Fecal Egg Count Reduction Test
  - Tests the resistance of a horse's parasite population to an individual dewormer
  - Procedure
    - FEC day 1
    - Deworm
    - FEC day 14
    - Categorize:
      - Effective
      - Moderate
      - Resistance



# Overview

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  - Ugly
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# The Drugs...

- ▶ Benzimidazoles
- ▶ Tetrahydropyrimidines
- ▶ Macrocyclic Lactones
- ▶ Isoquinoline–Pyroazines



## DEWORMERS AVAILABLE IN THE U.S.

DRUG CLASS	GENERIC ANTHELMINTICS	BRAND NAMES
Benzimidazoles	Fenbendazole	Panacur; Safeguard; Panacur PowerPac
	Oxfendazole	Benzelmin
	Oxibendazole	Anthelcide E.Q.
Heterocyclic compounds	Piperazine	Piperazine
Macrocyclic lactones	Ivermectin	Zimecterin, Rotation 1, Ivercare, Equell
	Moxidectin	Quest, Quest Plus, ComboCare
Tetrahydropyrimidines	Pyrantel pamoate	Exodus; Pyrantel Pamoate Paste; PSI's suspension; Strongid-T; Strongid Paste
	Pyrantel tartrate	Strongid-C; Strongid-C 2X; Continuex; Continuex 2X
Isoquinoline-pyrazines	Praziquantel	Equimax; Quest Plus; Zimecterin Gold

# Interval After Deworming with Various Anthelmintics To Perform Fecal Egg Counts for Determining the Strongyle Contaminative Potential of Individual Horses

## ANTHELMINTIC

## EXPECTED EGG REAPPEARANCE PERIOD

## STRONGYLE CONTAMINATIVE PERIOD

Benzimidazoles  
(fenbendazole, oxfendazole, oxibendazole)

4 weeks

8 weeks

Pyrantel salts

4 weeks

8 weeks

Ivermectin

8 weeks

12 weeks

Moxidectin

12 weeks

16 weeks

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- ▶ Management Changes



# To Treat or Not to Treat: The Traditional Approach

## ▶ Interval Dose Program

- Drudge and Lyons (Kentucky, USA) **1966**
- Tx with different anthelmintic every 6 – 8 weeks
- Designed to control *S. vulgaris* as cyathostomes considered little more than nuisance at that time

**Pro:** *Very Effective* in controlling parasites within an individual

**Con:** Increases incidence of resistance over time

# Welcome to the 21st Century!

- ▶ **Strategic Deworming**
  - Evidence based medicine
  - Designed in the face of resistance
- ▶ Parasitism is a natural state
  - All animals co-evolved with their parasites
- ▶ Important for horses to develop immunity
  - Frequent movement of horses virtually ensures exposure to parasites
  - Horses without good immunity are at significant risk for severe disease

# Sample Deworming Program For Northern Horses

- ▶ **MAR:** IVM/PRZ -- Treat & Perform **FEC all horses**
  - Start of yearly cyathostome control cycle
  - Treat to prevent egg shedding at time of year when conditions for transmission are gearing up
  - Clean out tapes before oribatid mites start to increase
  - Identify high, moderate and low egg shedders
- ▶ **MAY:** Treat all **moderate** and **high egg shedders**
  - Use OBZ or PP if effective (or both together)
  - Do FECRT on these horses to determine if effective
- ▶ **JUN:** IVM for **high egg shedders**
- ▶ **AUG:** OBZ/PP for **moderate** and **high egg shedders**
- ▶ **SEP:** MOX/PRZ -- Treat & Perform **FEC all horses**
  - Treat to prevent egg shedding at time of year when conditions for transmission are gearing up
  - Check to see how you are doing in keeping FEC down
- ▶ **DEC, JAN, FEB**
  - NOTHING – TOO COLD FOR TRANSMISSION
  - Worm eggs will not survive and develop to L3

# Recommendations for New (or Temporary) Additions

- ▶ Rational approach only possible if have knowledge of resistance profile of resident worm population
- ▶ Goals:
  - Keep out resistant worms
  - Keep out *S. vulgaris*
  - Keep out tapeworms
- ▶ Strategy used also depends on length of stay and age of horse



# Recommendations for New or Temporary Additions (Adults)

- ▶ Use a macrocyclic lactone drug combined with praziquantel because of broad spectrum
- ▶ If long-term addition
  - Treat with moxidectin/praziquantel
  - Repeat in 12 weeks
    - efficacy against EL3 stages is only low – moderate
- ▶ If short-term addition (< 6 weeks)
  - can use ivermectin/praziquantel because mucosal worms are not a concern



# Recommendations for New or Temporary Additions (Foals)

- ▶ Foals (less than 1 year old)
  - Treat with ivermectin/praziquantel or moxidectin/praziquantel
    - For all the same reasons as for adults
  - **AND** either oxibendazole or pyrantel
    - To keep out ML-resistant *P. equorum*
    - Re-treat in 8 weeks



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# Non-pharmaceutical Control

## ▶ Pastures:

- Keep stocking rates low
- Avoid overgrazing
- Dispose of manure regularly
  - Compost rather than spread on grazed pastures!!!
- Use a feeder for hay/grain.
  - Avoid feeding from the ground.
- Remove Bot eggs regularly.
- Rotate pastures with other livestock



# Harrowing Pastures



- ▶ Helps to break up manure and spread across pasture
  - Good for pasture health
  - Good **or bad** for parasite control depending on timing
- ▶ Want to do this in hot/dry periods
  - Late spring or summer
- ▶ Leave pasture ungrazed by horses for 4 weeks
- ▶ Picking manure from pasture a better option

# Questions?

