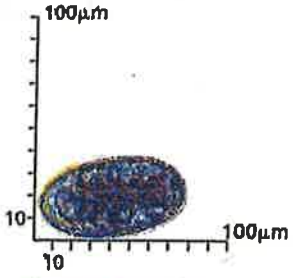
Guide to Internal Parasites of Ruminants

Sponsored by Intervet—providers of Panacur®/Safe-Guard® to the livestock industry.



Ostertagia
(brown stomach worm)

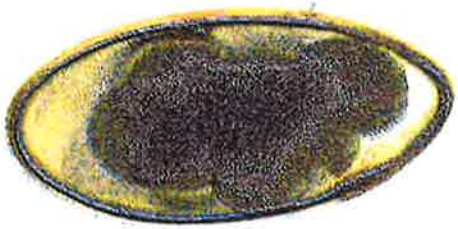
Cooperia
(small intestinal worm)

Moniezia
(tapeworm - sheep)

Moniezia
(tapeworm - cattle)

Bunostomum
(hookworm)

Haemonchus
(barberpole worm)



Nematodirus
(threadneck worm)

Trichostrongylus
(bankrupt worm)

Oesophagostomum
(nodular worm)

Trichuris
(whipworm)

Strongyloides
(threadworm)

Coccidia
(a protozoan that causes coccidiosis)

Dictyocaulus
(lungworm)

Mite Egg - 1/4 actual size
(contaminant - often mistaken for worm eggs)

D.H Slike and W.D. Kvasnicka; the compendium, April 1997

Why Do Sheep and Goat Fecal Egg Counts

Quantitative fecal egg counting is a procedure that determines the number of eggs per gram (EPG) of strongylid eggs, including barber pole worm (*Haemonchus contortus*), in a fecal sample. Quantitative fecal egg counts can be used along with other information, to design and evaluate a parasite control program. It can also help a producer make breeding decisions and determine the effectiveness of a dewormer.

Modified McMaster Test

The most common and efficient way to obtain fecal egg counts for sheep, goats, young cattle and horses is to use the Modified McMaster Test. This is a flotation test based on density; the eggs float to the surface of the counting chamber.

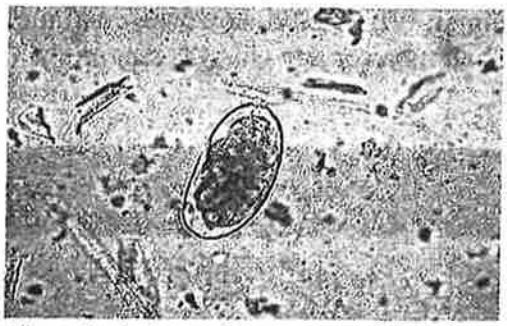


Figure 1. A photo of a microscope slide showing a strongylid egg.

This test uses a special microscope slide with a grid which makes counting easier. Manure and flotation fluid is measured and mixed and only a small portion of the total mixture is counted. A calculation is performed to determine the number of eggs/gram in the manure. The counting techniques for ruminants are designed to count strongylids or gastrointestinal nematode worms including the barber pole worm (*H. contortus*), but can be used for other parasites as well.

For more information view our information sheet, *How To Do The Modified McMaster Fecal Egg Counting Procedure*; and our demonstration video on fecal egg counting available on our website, ***http://web.uri.edu/sheepngoat.***

This information sheet will provide guidance on:

1) Interpreting FEC results
2) The Fecal Egg Count Reduction Test (FECRT)
3) Improving drug efficacy

Interpreting Fecal Egg Count Results?

Using the McMaster procedure described in our information sheet, *How To Do The Modified McMaster Fecal Egg Counting Procedure*, each strongylid egg counted represents 50 eggs/gram of feces; therefore, a FEC result of "0" means that there were fewer than 50 eggs/g in the sample analyzed, not that the animal is free of worms.

All grazing sheep and goats will have some worms. If one animal in the flock/herd is infected with parasites, all of the remaining animals are exposed.

Major Strongylid Nematodes in the U.S.

Haemonchus (barber pole worm)
Lives in abomasum
Dominant in summer
Spends winter as arrested larvae

Teladorsagia Ostertagia (brown stomach worm)
Lives in abomasum
Prefers cooler weather
Spends winter as arrested larvae

Trichostongylus
Lives in small intestine
Very common
Most likely to over-winter as an adult

Performing fecal egg count test:

1. Label two cups with animal ID as well as farm ID (if needed).

2. Tare one labeled cup on scale.

3. If manure is pelleted, crush the pellets in the glove and knead the manure in glove to mix. Cut off fingertip of glove containing feces to access fecal pellets, making sure to leave label intact.

Step 3. Kneading manure in glove to mix fecal sample.

4. Measure two grams of fecal pellets into cup on scale.

5. Dispense 28 ml flotation solution into the cup, mix and let soak for approximately 5 minutes. *See following notes on flotation solution for how to make up your own saturated salt solution.

6. Once you are confident in the procedure you can weigh out multiple samples, add flotation solution and mix until 6-10 samples are set up.

7. Return to the first sample and mix again. Place tea or fabric strainer on top of the second cup (don't stretch fabric tight across the cup). Pour the mixture of feces and flotation solution through, pressing fluid through with the tongue depressor.

13. Always start at the same point on the McMaster slide (for example, top left or bottom right). That way, you won't lose track of whether you have counted only one or both chambers.

14. Count only strongylid eggs (oval shaped, ~80-90 microns long). Quantify *Nematodirus* eggs separately as they can be clearly distinguished. Other parasites present should be recorded and may be counted if desired, but numbers are often difficult to interpret. *See the parasite egg identification section of this fact sheet for photos (pages 7 and 8).

15. Count both chambers. Total egg count:
    (chamber 1 + chamber 2) * 50 = eggs per gram (EPG)

This multiplication factor of 50 is specific to the ratio of feces (2 grams) to flotation solution (28 ml) described in this procedure. Each egg observed represents 50 eggs/gram therefore, this procedure will not detect fewer than 50 eggs/gram, which is equivalent to seeing one strongylid egg on the McMaster slide.

Be consistent:
Many laboratories perform this test and you may see slight variations in the procedure described. **The important thing is to always perform the test the same way each time—consistency is critical in order to monitor your animals over time or test the efficacy of drug treatment.**

Additional notes on procedure:

Flotation solution:
The following commercial solutions are commonly used by labs and can be obtained through your veterinarian:

Fecasol® - Vetoquinol, **www.vetoquinolusa.com**; Phone: 800-267-5707
Feca Med - Vedco Inc., Saint Joseph, MO, **www.vedco.com**; Phone: 816-238-8840

You can make up your own saturated salt solution using regular salt (sodium chloride) or Epsom salts (Magnesium Sulfate). A sugar solution is also available, but it is very viscous and sticky and results in difficult clean-up.

The approximate amounts of salt and water needed are provided on page 6. Add more salt as needed to fully saturate the solution. Add and mix the salt to lukewarm tap water until some of the salt no longer dissolves (the solution is saturated). Let it sit overnight. The amount of salt it takes to saturate the solution is affected by temperature, so the final test is to be sure you always see some un-dissolved salt at the bottom of your container. Pickling salt works better than table salt for making this solution because table salt contains anti-caking agent that doesn't dissolve and may mislead you into thinking that the mixture is saturated.

Parasite Egg Identification: Common Parasites in Small Ruminant Fecal Samples

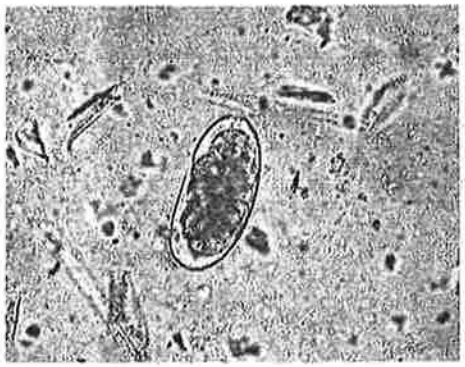


Figure 1. Strongylid egg

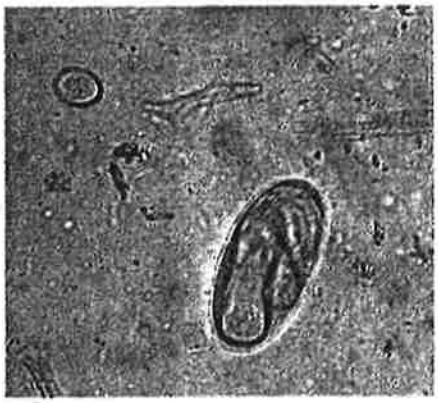


Figure 2. Larvated strongylid egg. These may be seen in old fecal samples

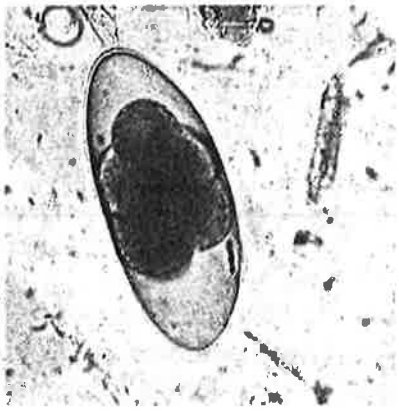


Figure 3. *Nematodirus* egg

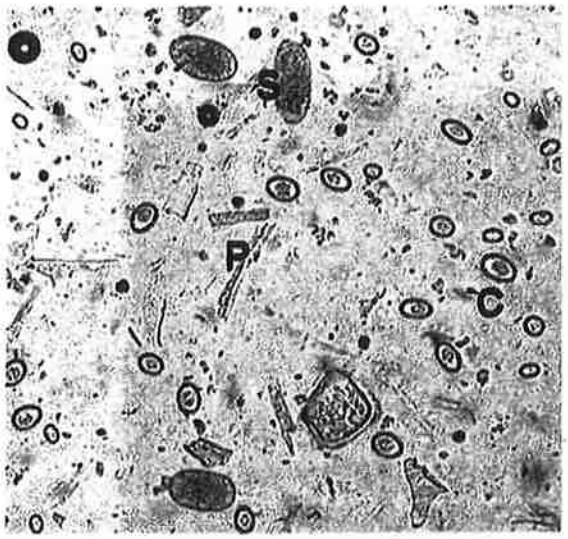


Figure 4. Strongylid egg (S), coccidia oocysts (C) and plant debris (P). Note size differences between eggs and oocysts.

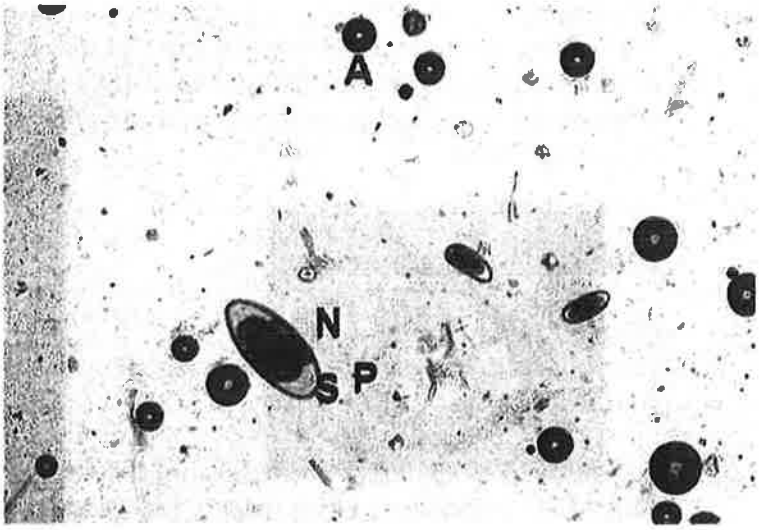


Figure 5. *Nematodirus* (N) and strongylid (S) eggs. Note size difference between eggs. Also note the presence of air bubbles (A).

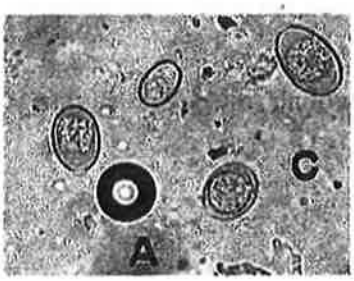


Figure 6. Coccidia oocysts (C) and air bubble (A). Small ruminants are infected with several different species of coccidia that vary in size.

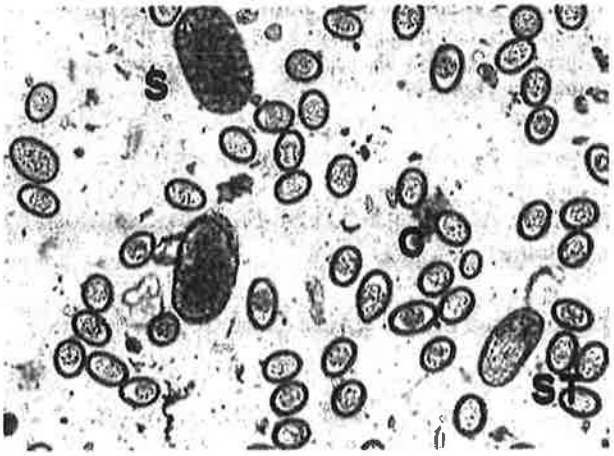


Figure 7. Strongylid (S) eggs and *Strongyloides* (ST) egg and coccidia (C) oocysts. Note size difference between eggs. *Strongyloides* eggs are larvated in fresh feces, strongylid eggs are not.

Improving Drug Efficacy

What do I do when testing shows that a dewormer may no longer be fully effective? Always:

- **Consult with your veterinarian**
- **Consider the whole parasite control program and how principles of integrated parasite control can be utilized and optimized to reduce the need for deworming.**

Whether or not to continue using a drug once a FECRT indicates that a substantial population of resistant worms may be present depends on the situation. Always use an effective treatment for animals with parasitic disease or especially vulnerable animals. Treatment for these animals should also be accompanied by removal from a heavily infected pasture. However, a drug that produces a less than optimum fecal egg count reduction might still have some use. For example, a producer might use a drug that produced a 75% fecal egg count reduction to treat some clinically normal animals to reduce fecal egg counts. Under these circumstances, use of the drug will continue to select for resistant worms, but using the drug in only a portion of the animals will slow the rate of increase in the resistant population.

Even in the face of reduced drug efficacy, the anthelmintic activity of benzimidazoles (BZD i.e. albendazole, fenbendazole) and macrolides (ivermectin, moxidectin) can be restored for a variable period by the following practices:

a. For both BZDs and macrolides, take animals off feed for 12 hours before treatment. This practice slows down movement of the drug through the rumen and enhances absorption. Do not remove water and do not take sick animals or those in late pregnancy or lactating off feed.

b. For BZDs, continue to leave animals off feed and treat again in 12 hours—so you are giving 2 treatments in a 24 hour period, during which the animals are off feed. In one goat herd the activity of fenbendazole was restored for a year with this strategy, even though there was a 0% reduction in fecal egg counts after a single treatment. However, the increase in activity and its duration will vary from farm to farm and should be monitored.

c. If using oral ivermectin, a second treatment as described for BZDs may be of some value. Increasing the dose may also temporarily improve efficacy.

NOTE OF CAUTION TO GOAT PRODUCERS!!!
Morantel and fenbendazole, at the 5 mg/kg dose, are the only drugs approved by the Food and Drug Administration (FDA) for use in goats. **All other drugs** and **fenbendazole at 10 mg/kg** are considered extra-label use by the FDA. The FDA regards extra-label use of drugs an exclusive privilege of the veterinary profession and is only permitted when a bona fide veterinarian-client-patient relationship exists and an appropriate medical diagnosis has been made.

Dewormer Chart for Goats

Dewormer chart for goats; Ray Kaplan, DVM, PhD, University of Georgia

Important --Please read notes below before using this chart

1 ml = 1cc	Valbazen (albendazole) ORALLY	SafeGuard (fenbendazole) ORALLY	Ivomec Sheep Drench (ivermectin) ORALLY	Prohibit (levamisole) ORALLY	Cydectin Sheep Drench (moxidectin) ORALLY	Rumatel (morantel) Feed Pre-mix ORALLY
Weight Pounds (lbs)	20 mg/kg 2 ml/ 25 lb	10 mg/kg 1.1 ml/ 25 lb	0.4 mg/kg 6 ml/ 25 lb	12 mg/kg 2.7 ml/ 25 lb	0.4 mg/kg 4.5 ml/25 lb	10 mg/kg 45 gm/100 lb BW (Durvet)
20	1.6	0.9	4.8	2.2	3.6	
25	2.0	1.1	6.0	2.7	4.5	11 grams
30	2.4	1.4	7.2	3.3	5.4	
35	2.8	1.6	8.4	3.8	6.5	
40	3.2	1.8	9.6	4.4	7.3	
45	3.6	2.1	10.8	4.9	8.2	
50	4.0	2.3	12.0	5.5	9.0	23 grams
55	4.4	2.5	13.2	6.0	10	
60	4.8	2.7	14.4	6.6	11	
65	5.2	3.0	15.6	7.1	12	
70	5.6	3.2	16.8	7.7	12.7	
75	6.0	3.4	18.0	8.2	13.6	34 grams
80	6.4	3.6	19.2	8.8	14.6	
85	6.8	3.9	20.4	9.3	15.4	
90	7.2	4.1	21.6	9.9	16.4	
95	7.6	4.3	22.8	10.4	17.3	
100	8.0	4.6	24.0	11.0	18	45 grams
105	8.4	4.8	25.2	11.5	19	
110	8.8	5.0	26.4	12.1	20	
115	9.2	5.2	27.6	12.6	21	
120	9.6	5.5	28.8	13.2	22	
125	10.0	5.7	30.0	13.7	22.7	56 grams
130	10.4	5.9	31.2	14.3	23.6	
140	11.2	6.4	33.6	15.4	25.4	
150	12.0	6.8	36.0	16.5	27.3	68 grams

Valbazen Suspension (11.36 % or 113.6 mg/ml): 20 mg/kg orally; withdrawal time is 9 days for meat and 7 days for milk Do NOT use in pregnant does in the first trimester of pregnancy

Safe-Guard/ Panacur Suspension (10% or 100 mg/ml): the label dose in goats is 5 mg/kg, but a 10 mg/kg dosage is recommended. At 10 mg/kg, withdrawal time is 16 days meat and 4 days for milk. Add 1 day for each additional day the drug is used (e.g. if administered 2 days in a row then withhold milk for 5 days after 2nd dose).

Ivomec Sheep Drench (0.08% or 0.8 mg/ml): 0.4 mg/kg orally; meat withdrawal time is 14 days and milk withdrawal is 9 days.

Prohibit Soluble Drench Powder (Sheep): (Note that this drug is also sold as Levasol and Tramsiol) 12 mg/kg oral dose with meat withdrawal of 4 days and milk withdrawal of 3 days. Solution prepared by dissolving a 52 gram packet in 1 quart (943 ml) of water. This yields a solution with 49.6 mg/ml. If dosing kids, it is safer to dilute further (1 packet in 2 quarts of water), and then administer twice the amount listed on the chart. The larger volume administered will then provide a wider margin for safety if there are small errors in dosing.

SHEEP Dewormer Chart

Important --Please read notes below before using this chart

1 ml = 1cc	Valbazen (albendazole) ORALLY	SafeGuard (fenbendazole) ORALLY	Ivomec Sheep Drench (ivermectin) ORALLY	Prohibit (levamisole) ORALLY	Cydectin Sheep Drench (moxidectin) ORALLY
Weight Pounds (lbs)	7.5 mg/kg 0.75 ml/ 25 lb	5 mg/kg 0.6 ml/ 25 lb	0.2 mg/kg 2.9 ml/ 25 lb	8 mg/kg 2 ml/ 25 lb	0.2 mg/kg 2.3 ml/25 lb
20	0.6	0.5	2.3	1.5	1.8
25	0.75	0.6	2.9	1.8	2.3
30	0.9	0.7	3.4	2.2	2.7
35	1.1	0.8	4.0	2.6	3.2
40	1.2	0.9	4.5	2.9	3.6
45	1.4	1.0	5.1	3.3	4.1
50	1.5	1.1	5.7	3.7	4.5
55	1.7	1.3	6.2	4.0	5.0
60	1.8	1.4	6.8	4.4	5.4
65	2.0	1.5	7.4	4.7	5.9
70	2.1	1.6	8.0	5.1	6.3
75	2.3	1.7	8.5	5.5	6.8
80	2.4	1.8	9.1	5.8	7.2
85	2.6	1.9	9.7	6.2	7.7
90	2.7	2.0	10.2	6.6	8.1
95	2.9	2.1	10.8	6.9	8.6
100	3.0	2.2	11.4	7.3	9.1
105	3.2	2.3	1.02	7.7	9.5
110	3.3	2.5	12.5	8.0	10
115	3.5	2.6	13.1	8.4	10.5
120	3.6	2.7	13.7	8.8	10.9
125	3.8	2.8	14.2	9.1	11.4
130	3.9	2.9	14.8	9.5	11.8
140	4.2	3.0	15.4	10.2	12.7
150	4.5	3.1	16.0	11.0	13.6

Valbazen Suspension (11.36 % or 113.6 mg/ml): 7.5 mg/kg orally; approved in sheep with meat withdrawal time of 7 days. Do NOT use in pregnant ewes in the first trimester of pregnancy.

Safe-Guard/ Panacur Suspension (10% or 100 mg/ml): Note that SafeGard is not approved for use in sheep. Sheep dose is 5 mg/kg orally; meat withdrawal time of 6 days.

Ivomec Drench for Sheep (0.08% or 0.8 mg/ml): 0.2 mg/kg orally; approved in sheep with meat withdrawal time of 11 days. Protect from light.

Prohibit Soluble Drench Powder (Sheep): (Note that this drug is also sold as Levasol and Tramsiol) 8 mg/kg ORAL dose. Approved for use in sheep with meat withdrawal of 3 days. Solution prepared by dissolving a 52 gram packet in 1 quart (943 ml) of water. This yields a solution with 49.6 mg/ml. Always make sure to follow directions on packet when preparing.

If dosing lambs, it is safer to dilute further (1 packet in 2 quarts of water), and then administer twice the amount listed on the chart. The larger volume administered will provide a wider margin for safety if there are small errors in dosing.

Cydectin Sheep drench (1 mg/ml): 0.2 mg/kg orally; approved in sheep with meat withdrawal time of 14 days.

Check Point	Observation	Possibilities
1. EYE	Anemia 1-5 (FAMACHA© card)	**Barber pole worm (*Haemonchus*)** Liver fluke Hook worms Other worms and causes
2. BACK	Body condition score 1-5 (BCS card)	**Brown stomach worm (*Teladorsagia*)** **Bankrupt worm (*Trichostrongylus*)** Nodular worm Other worms and causes
3. TAIL	Fecal soiling (1-5) Dag score card	**Brown stomach worm (*Teladorsagia*)** **Bankrupt worm (*Trichostrongylus*)** **Coccidia (*Eimeria*)** Nodular worm (Oesophagostomum) Other worms and causes
4. JAW	Soft swelling "Bottle jaw" 1-5	**Barber pole worm (*Haemonchus*)** **Coccidia (*Eimeria*)** Liver fluke Hook worms Other worms and causes
5. NOSE	Discharge 1-5	Nasal botfly Lungworms Pneumonia Other causes
5. COAT	Coat condition 1-3	**Barber pole worm (*Haemonchus*)** **Brown stomach worm (*Teladorsagia*)** **Bankrupt worm (*Trichostrongylus*)** **Coccidia (*Eimeria*)** External parasites Other causes