

*Guide*  
to  
*Parasites*  
in  
**Sheep**

# **PARASITE MANUAL for SHEEP PRODUCERS**

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## **Introduction**

Parasites can be a major cause of production loss in sheep flocks in Western Canada. Fortunately for producers and their sheep, the harsh winter climate gives a much needed helping hand with control. There are two main classifications of important parasites in this area: internal parasites (endoparasites) and external parasites (ectoparasites). In addition *Cysticercus ovis*, or “sheep measles”, has recently become an economic problem in Western Canada.

Parasites of any type can cause major production losses to sheep producers if they are not diagnosed and managed properly. The most common and most economically important losses are due to subclinical or unapparent parasitism. These lambs will not have clinical signs of illness, but they will not be performing up to their potential. Growth rates will be depressed, wool growth decreased, and milk production may be decreased in ewes. This is an economic loss to the producer as it will cost more per pound of lamb produced.

It is important to work in conjunction with the flock veterinarian to accurately assess the problem, and develop a specific treatment plan. The vet will be able to advise which dewormer or feed additive is most appropriate based on fecal exam results. In some cases post mortem exams will also be useful.

Parasites have either an indirect or direct life cycle. Knowing the difference will be important to developing a treatment strategy.

*Direct lifecycle:* The adult parasite lives in/on the host animal and eggs are shed into the environment. The eggs will develop through several stages to become infective to the host, usually as a 3<sup>rd</sup> stage larva. When the host animal ingests the larva the parasite continues development into an adult and the lifecycle is completed.

*Indirect lifecycle:* A parasite with an indirect lifecycle must infect a second, or intermediate host to become infective to the definitive host animal. This is a typical lifecycle for tapeworms.

Worms affecting sheep can be divided into 3 categories: *nematodes*, or roundworms; *cestodes*, or tapeworms; and *trematodes*, or flukes. These categories are based on the physical and structural characteristics of the worms.

## INTERNAL PARASITES (Endoparasites)

1. **Gastrointestinal worms (Nematodes)**
2. **Lungworms (Nematodes)**
3. **Coccidia**
4. **Cysticercus spp.**
5. **Tapeworms (Cestodes)**
6. **Liver Flukes (Trematodes)**

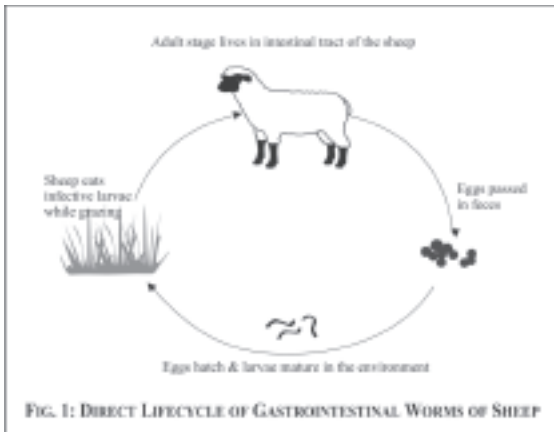
### 1. Gastrointestinal worms

There are several species of worms that can infect the gastrointestinal tract of sheep, the most important of which are *Haemonchus*, *Ostertagia*, *Trichostrongylus* and *Nematodirus*. *Haemonchus* likes relatively warm, humid conditions and so is more of a problem in BC and Ont. *Trichostrongylus* and *Nematodirus* on the other hand can survive cold, dry weather and are therefore believed to be of more concern on the prairies. A recent study of the prevalence of gastrointestinal worms in Alberta slaughter lambs identified *Trichostrongylus* and *Nematodirus spp.* as the most common species in central Alberta lambs (Colwell, Goater, Jacobson. CVJ Volume 43, 2002).

Gastrointestinal worms are the most economically important to the sheep industry.

Life for internal parasites is not often easy in Western Canada. Winter kills approximately 90% of larvae left on the pasture in the fall. The freeze/thaw cycles of winter here are especially hard on them. Once the spring thaw arrives the larvae only have 3-5 weeks to be ingested by a sheep before their energy resources will be depleted and they die.

The reason that there is still a substantial parasite problem here is the ability of the larvae to overwinter, or “hibernate” in the host (termed *hypobiotic larvae*). Springtime triggers the larvae to “wake up” and continue their development into adult worms (Diagram 1). Part of the stimulus for worms to develop at this time is associated with a decrease in the immune status of the ewe during the lambing period, which extends from 2 weeks prior to 8 weeks post lambing. This phenomenon is called the “periparturient rise” in fecal egg counts. This means that when ewes and lambs are turned out to pasture in the spring the adult worms are ready to produce 2,000 - 10,000 eggs daily! The potential for lambs to become heavily infected during a grazing season is tremendous. It only takes an average of 3-4 weeks after ingestion of eggs for them to develop into reproductive adult worms (Fig.1) capable of passing eggs of their own onto the pasture (termed the *prepatent period*).



*Figure 1. Direct lifecycle of gastrointestinal worms of sheep.*

Climatic conditions are very important for optimal survival of eggs and larvae on pasture. Therefore eggs passed early in the prairie grazing season will probably not become infective until June.

- < 14 C eggs will not hatch
- > 32 C eggs hatch, but larvae do not survive
- ↑ humidity = ↑ larvae survival

When conditions of humidity and temperature are adequate for development, the eggs will hatch into larvae which crawl up blades of grass and wait to be eaten by a grazing sheep. Sheep housed in drylot without access to grazing will not ingest larvae, and therefore are not at high risk of becoming infected with these gastrointestinal worms.

### ***Diagnosis and Control of Gastrointestinal Parasites***

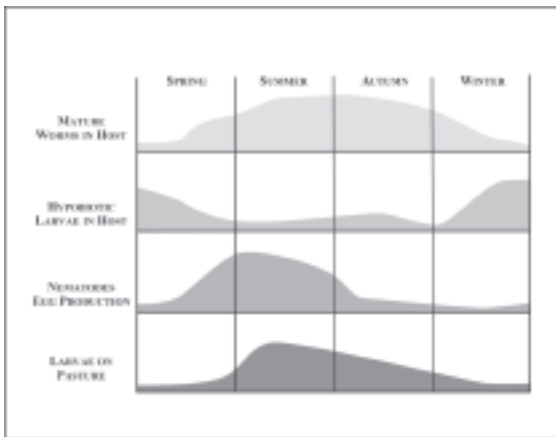
Clinical signs of gastrointestinal parasitism will vary depending on the number of worms and the general health and nutrition of the animals. Lambs may show signs of diarrhea, poor growth rates, poor body condition and increased susceptibility to secondary infections such as pneumonia. Heavily affected animals may have swelling under the jaw (bottle jaw) due to loss of proteins, and death may occur.



Photo courtesy of Tracy Hagedorn, AAFRD

### *Lamb on pasture showing clinical signs of gastrointestinal parasitism*

By the end of the summer grazing season 95% of the farm's parasite load is on the pasture rather than in the sheep. Therefore, producers should think of adequate control as monitoring and treating the parasites of the pasture rather than individual sheep. The ultimate goal of deworming protocols should be to keep pasture contamination to a minimum.



*Diagram 1. Parasite burden in sheep and on pasture relative to the season.*

Understanding the lifecycle and transmission patterns of gastrointestinal worms is essential to developing an effective *and* economical deworming program for a flock. Diagnosis is best done with routine fecal analysis, and consultation with the flock veterinarian will provide the best strategic deworming protocol for each individual situation. Regardless of the specific deworming strategy used, routine fecals on a percentage of the flock are important to monitor the effectiveness of the program.

- sample 15-20% of the flock (min. 5 animals)
- samples should be as fresh as possible (refrigerate, but do not freeze)

- individual samples are preferred to pooled samples
- best time to test is the last 2 weeks of July
- request a Modified Wisconsin Technique from your veterinarian rather than routine fecal flotation

It is important to utilize a combination of strategically timed, effective dewormers (anthelmintics) and appropriate management practices to control parasites. Using as few drugs as possible will decrease the chance of resistance developing on a farm, as well as saving money. An effective program must be tailored to each specific farm situation, based on fecal samples and veterinary recommendations.

### *Deworming Strategies*

The following strategies can be selected and combined to create an effective deworming program for individual flocks. Use in conjunction with fecal exam results and in consultation with the flock veterinarian. Individual farm management practices for breeding and lambing will also affect the choice of drug, and timing of administration.

- deworm in the fall with a larvicidal product
  - Eliminates the overwintering hypobiotic larvae and allows the sheep to make the most efficient use of winter feed.
- Deworming of the ewes prior to lambing
  - Minimizes the periparturient rise in parasites. This will ensure that the ewes are at their healthiest at lambing, and help maximize milk production
  - Helps prevent contamination of the pasture when lambs graze with the ewes
- deworm after 3-4 weeks of grazing in the spring
  - eliminates worms that have developed from ingestion of larvae that have survived the winter on the pasture
  - helps to minimize worm burdens on the pasture
- reduce exposure to larvae on pasture
  - rotation of pastures at strategic times to prevent ingestion of larvae
  - utilization of alternate species such as horses or cattle to “vacuum” the pasture of sheep parasite larvae
  - mechanical harvesting of excess forage in rotation with grazing
- fecal exams during last 2 weeks of July
  - peak pasture parasite loads occur in July – fecal exams will give an indication of the efficacy of the parasite control program
- hold sheep off feed in drylot for 12-18 hours prior to deworming
  - allows for better absorption of the drug and a more effective parasite kill

The Ontario Sheep Marketing Agency has printed an excellent article describing a multi-year deworming strategy for the ewe flock. It is available online at the OSMA website [www.ontariosheep.org](http://www.ontariosheep.org).

Reasons for a poor response to deworming

- incorrect drug selection for the specific parasite
- incorrect dosage/route of administration – it is a good idea to weigh a sample group of the sheep to be treated and dose for the heaviest animals
- incorrect timing with respect to the parasites lifecycle
- rapid reinfection from pasture
- drug resistance by parasite

Parasite resistance to dewormers has not yet become a problem in Western Canada. However in warm, humid areas where sheep are routinely dewormed many times per year resistance is becoming a very serious problem. In some areas of the world, including the southern United States, none of the currently available dewormers are effective against the parasites, and there are no new drugs ready to be released for use in the near future. It behooves all producers to use the drugs responsibly and be cautious of importing new animals from these problem areas.

Veterinarians in South Africa have developed a strategic deworming program called FAMACHA. It works on the premise of only treating the ewes that are heavily infected, and in this way the producer will be selecting for sheep that are genetically resistant to parasite infection, as well as reducing the chance of drug resistance developing. This system particularly targets *Haemonchus* as this is the species that can cause severe blood loss in heavily infected animals. In areas of the world where drug resistance is common, genetic selection is one of the primary tools available for parasite control in sheep. More information about FAMACHA is available by searching the internet, or try [www.scsrpc.org](http://www.scsrpc.org).

## 2. Lungworms

Lungworms are not a widespread economic problem in western Canadian sheep, however there are isolated areas and flocks that will have a heavy lungworm infection.

The adult lungworm lives in the airways of the lungs (Fig.2). They lay eggs, which hatch to larvae, and are then coughed up and swallowed. The larvae are passed in the feces onto pasture. The larvae survive well in low lying damp areas of the pasture and therefore lungworms will be more of a problem in very wet years, in animals grazing low ground. Larvae pass through a developmental stage on pasture, and the infective stage 3 larvae are then consumed by the next sheep while grazing. They penetrate the gut wall, and travel to the lungs via the bloodstream to complete the lifecycle.

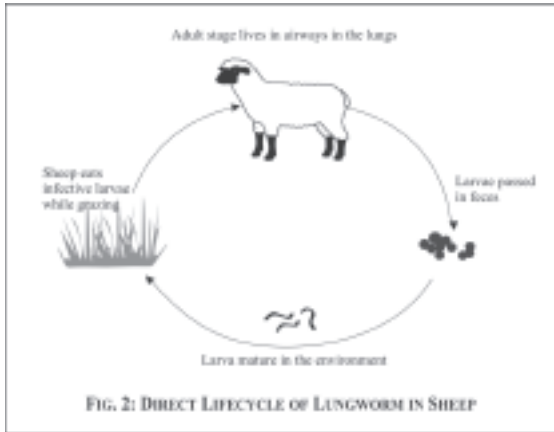


Figure 2. Direct lifecycle of lungworms in sheep.

Lambs will exhibit a chronic, wet cough and may develop secondary bacterial pneumonia. Heavily infected lambs will be poor doing with rough coats and low growth rates. Death will occur in severe cases.

Diagnosis of lung worms cannot be made with routine fecal analysis, but rather will require a specific technique (called the Baermann) to detect the larvae in the feces. A post mortem exam may reveal the adult worms in the lungs. Discuss this with your veterinarian if you have concerns about lungworms in your flock.

### 3. Coccidia

Coccidia (*Eimeria sp.*) are microscopic protozoa that live and reproduce in the lining of the intestine. Adult sheep rarely show clinical signs but coccidiosis in lambs can be severe and even fatal. Clinical signs range from “poor doers” to straining, bloody diarrhea, dehydration and death. Subclinical production losses are probably the most important economic aspect of this disease. Lambs will be thin, with poor growth rates. Heavy burdens of coccidia in lambs may cause permanent damage to the lining of the gut. A sudden stressful event such as weaning or a major nutritional change may trigger an outbreak of coccidiosis in a group of lambs.

Infected sheep will develop natural immunity, or resistance, with age but continue to shed oocysts (eggs) in their feces as adults and become a source of infection for the lambs (Fig.3). Transmission occurs by ingestion of the oocysts which require moisture to become infective. Therefore dirty, wet pens and contaminated feed and water containers are often associated with outbreaks in lambs. It becomes obvious that good hygiene and management can play a key role in the control of coccidiosis. Coccidial oocysts can be detected in fecal samples from affected lambs. The flock veterinarian will be able to make the diagnosis for you.



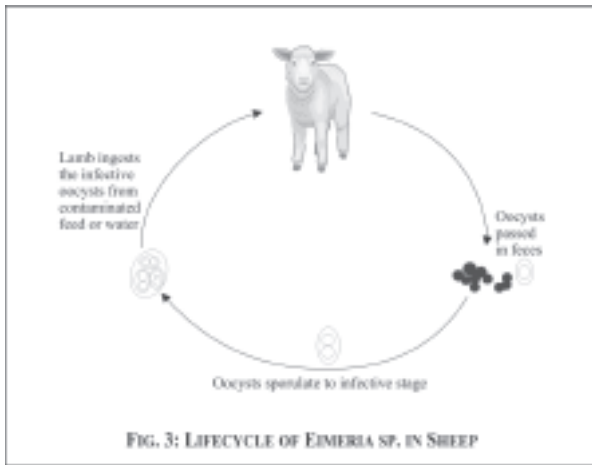


Figure3. Lifecycle of *Eimeria* spp. in sheep

Outbreaks of the disease can be treated with individual doses or medications in the feed or water supply. However, it is most efficient to use anticoccidial drugs such as decoquinate (Decox<sup>®</sup>) or monensin (Rumensin<sup>®</sup>) in creep feed to prevent the disease rather than treat lambs in the face of an outbreak. In some situations the use of specific drugs (is the only way to control the disease. Very few products are licensed for use in sheep, but several effective products, such as decoquinate are available with a veterinary prescription as a feed additive. These can be added to creep rations or feeder pellets by the feed mill. Drugs used to deworm sheep are not effective against coccidia.

The most important thing you can do to control coccidiosis in your lambs is to provide them with clean, dry, well drained pens, and eliminate fecal contamination of feed and water containers. Treating the ewes with anticoccidials to decrease shedding of oocysts has not proven to be a consistently effective means of controlling the disease in lambs, but may be beneficial under certain circumstances.

#### 4. *Cysticercus* (“sheep measles”)

*Cysticercus ovis* has been seen in increasing numbers in Alberta slaughter lambs over the past few years. This parasite in sheep is the intermediate or larval stage of a dog tapeworm, *Taenia ovis*. The adult stage of the tapeworm lives in the small intestine of dogs, coyotes, and other wild canids. The dog (definitive host) becomes infected by ingesting live cysts from uncooked sheep meat (intermediate host), most commonly when allowed access to sheep or lamb carcasses (Fig.4). As the tapeworm matures, eggs are passed in the feces of the dog, and shed onto pastures or feeding areas of the sheep. The eggs are contained in tapeworm segments that look like a cucumber seed, or grain of rice often stuck to the fur under the dog’s tail. Each segment can contain thousands of eggs, which can remain viable in the environment for months.

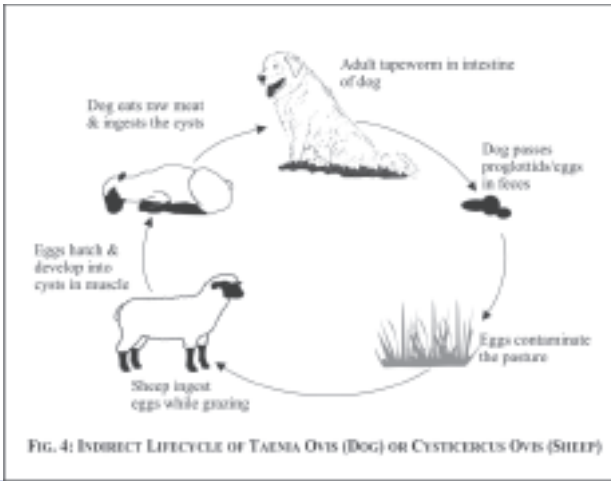


Figure 4. Indirect lifecycle of *Cysticercus ovis* in sheep.

These eggs are then ingested by grazing sheep, hatch in the sheep’s intestinal tract, and the larvae migrate throughout the body of the sheep. They localize in muscle tissue and develop into small whitish cysts approximately 9mm x 5mm in size. It takes 7 to 10 weeks for the cysts to fully develop after the eggs are ingested by the sheep. The most common locations to find the cysts at slaughter inspection are the cheek muscles, diaphragm, heart and skeletal muscles. The cysts will then begin to degenerate and are often seen in carcasses as small calcified or caseous (“cheesy”) nodules in the muscle tissues. Carcasses that are only lightly infected can be trimmed and passed for human consumption. Animals that are heavily infected with cysts will be condemned at the slaughterhouse.



Photo courtesy of Sunterra Meats, Innisfail, AB

*Photo of Cysticercus ovis “sheep Measles” in a lamb carcass*

Treatment of the cysts once the sheep is infected is very difficult, and control of the problem must be focused on the adult stage of the tapeworm in the dog. There are several dewormers for dogs that are very effective at controlling tapeworms, and the appropriate drug to use should be discussed with your veterinarian. Not all dewormers available for dogs will kill tapeworms and products available from pet stores and feed suppliers are generally not effective. Culled sheep that may be infected with *Cysticercus ovis* can be safely fed to dogs, **but** the meat must be cooked thoroughly, or frozen to -18°C for a minimum of 10 days prior to feeding.

There is another *Cysticercus* species of less economic importance, but with a similar lifecycle. *Cysticercus tenuicollis* cysts are found attached to the abdominal wall and the surface of the liver of sheep. Infection will lead to condemnation of livers at the slaughterhouse due to scarring from the migration of the parasite. The adult stage of the tapeworm (called *Taenia hydatigena*) lives in the dog's intestine, and can be controlled with adequate dewormers specifically formulated to kill tapeworms.

Routine deworming, every 2-3 months, of all dogs with access to your sheep flock is important to control these parasites. In infected flocks dogs should be dewormed as often as once every 30 days. Do not feed raw sheep meat back to your dogs, and do not allow scavenging of sheep carcasses by wild canids such as coyotes. Wild deer are also susceptible to developing the cysts, which will seriously hamper control efforts in a flock. If the local coyote population becomes infected with the adult tapeworms, control is extremely difficult and limiting or eliminating grazing of lambs in affected areas may be required.

## 5. Tapeworms

It is important not to confuse the sheep tapeworms, *Monezia* and *Thysanosoma* with the dog tapeworm that causes “sheep measles” (see previous section). The sheep is the definitive host, and a free-living mite is the intermediate host for these species. In most cases sheep tapeworms do not cause a significant problem to the sheep. However in severe infections there can be loss of body condition, or a physical blockage of the gut with worms.

The adult tapeworm lives in the sheep's intestine and passes out eggs in the feces(Fig.5). The eggs are consumed by the insect, and develop into the infective stage. The cycle is completed when a sheep inadvertently eats the mite while grazing.

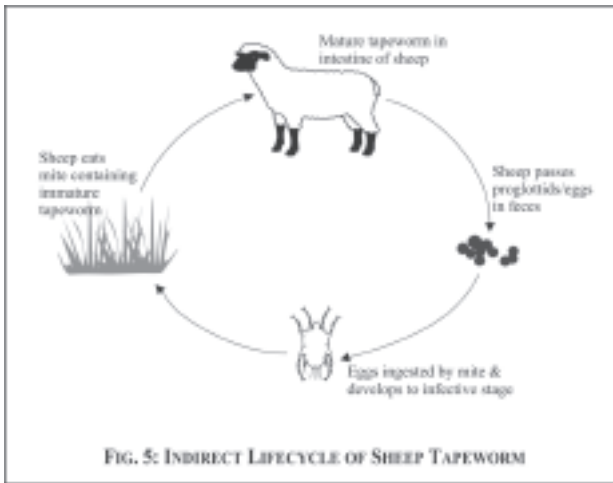


Figure 5. Indirect lifecycle of the sheep tapeworm

Tapeworms are not a widespread problem in Western Canada, but can cause losses in localized cases. Tapeworm infections are easily diagnosed with routine fecal examinations. Not all dewormers will be effective against tapeworms.

## 6. Liver Flukes

The sheep liver fluke, *Fasciola hepatica*, is uncommon in Western Canada although localized outbreaks have been documented. This species of fluke is also found in cattle, and potentially humans. The adult parasite lives in the bile ducts within the liver of the host (Fig.6). Eggs are passed with the bile into the intestine and out in the feces. The eggs hatch and the miracidium enters the intermediate host, a snail. Development occurs in the snail and the next stage, a cercaria leaves the snail to encyst on surrounding vegetation. The sheep is infected when it grazes the contaminated vegetation. Damage is caused when the immature forms migrate through the liver.

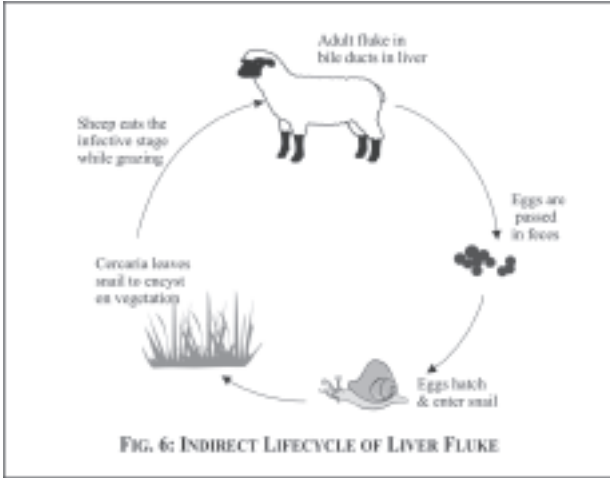


Figure 6. Indirect lifecycle of sheep liver fluke.

Scarring of the liver leads to condemnations at slaughter, and in heavy infections death occurs. Diagnosis can be made with fecal exams, postmortem examination or slaughterhouse inspections. Not all dewormers are effective against liver flukes.

### EXTERNAL PARASITES (Ectoparasites)

1. Sheep Keds
2. Lice
3. Flystrike
4. Mites
5. Sheep nasal bot
6. Ringworm

External parasites on sheep are common in Western Canada despite effective methods of eradication. If treated properly and completely they can be totally eliminated from a flock. But be careful not to buy new ones in on purchased sheep. External parasites transmit from sheep to sheep very easily, either by direct contact or on people or equipment.

#### 1. Sheep Keds (*Melophagus ovinus*)

Sheep keds, or “ticks” are the most common external parasite in sheep flocks in western Canada. They are actually not a true tick at all, but rather a blood-sucking wingless fly that has evolved to spend its entire life cycle on the host sheep. They are relatively large insects (adults are 4 – 7mm) that are readily seen in the fleece of affected animals (Diagram 2). Brown pupae (3 –4mm) may also be noticed in the fleece. Many producers

are unaware of a mild infestation until the shearer sees them during shearing. In severe cases they cause intense itching, rubbing and damage to the fleece. Often the animals are tormented and rub on fences or chew at their fleece. Heavy or chronic infestations can lead to anemia and poor body condition. The insect feces contaminate the wool and are difficult for processors to scour out.



*Photo courtesy of Tracy Hagedorn, AAFRD*

*Ewe showing typical signs of external parasite infestation; rubbing and chewing at wool, wool break.*

Keds will spread easily between animals, and can even be inadvertently carried between flocks by visitors or equipment. Adults can survive 4 – 8 days off the host. Keds move very quickly from newly shorn ewes to lambs at foot. The most common route of introduction into a flock is via a newly purchased animal. Be careful where you buy sheep from, and quarantine new additions prior to introduction to the flock.



*Diagram 3. Sheep ked*

Treatment of keds is relatively cheap and easy, and is very effective when done properly. Understanding the lifecycle of the insect is important for control. The ked spends its entire life on the sheep. Female keds do not lay eggs, but rather deposit larva on the host. The larvae pupate within a few hours, and then remain at this stage for 19 – 36 days. Adults are capable of mating within only a few hours of hatching from the pupa, and the

cycle begins again. Adults travel around the body of the sheep in a circular fashion while feeding.

The safest, most effective treatment is Ectiban 25® (pyrethroid insecticide) which is readily available from veterinary clinics and livestock supply stores. It is even licensed for the control of keds in sheep in Canada.

### Directions for use of Ectiban

## 2. Lice

Lice also occasionally infest sheep, but are not considered a major problem in most areas of Western Canada. Clinical signs are similar to ked infestation: itching, wool damage, and anemia in severe cases. The entire 4-5 week lifecycle of the louse takes place on the sheep. The lice can only survive for about 7 days off of the host. Eggs, or *nits*, are laid on the host, and “glued” to the hair.



Diagram 2. Sheep louse

Lice are more difficult to detect than keds as they are much smaller in size. An adult louse is only 2mm long, and brownish in colour (Diagram 3). Consult a veterinarian for help with a definitive diagnosis. Since Ectiban 25® has become licensed for sheep and

ked s have been eliminated from many flocks, lice have made a comeback where they were previously controlled by annual ked spraying. Lice can also be eliminated with the use of the above Ectiban 25® .

### 3. Flystrike

Sheep that have open wounds, infected areas of skin, or heavy fecal and urine contamination of the fleece are very prone to flystrike. Adult flies are attracted to the smell of the affected area, and lay their eggs in the fleece or skin. When the eggs hatch the maggots eat the debris and tissue in the surrounding area. In many cases they progress to attacking otherwise healthy tissue and cause severe distress to the sheep. Death may occur in severe cases due to secondary bacterial infections.



*Photo courtesy of Tracy Hagedorn, AAFRD*

*Sheep with fecal and urine contamination of hind end that may lead to flystrike.*

Flystrike can be difficult to treat if very severe, and animals may die from the resulting infection and damage to tissue. Treatment must be to thoroughly clean the affected area and remove all maggots. Antibiotics will usually be required. The best method to control flystrike is to prevent it from occurring. Adequate internal parasite control is one of the most important methods of prevention, to keep lambs from developing diarrhea and heavy fecal contamination of the hind end. Docking of tails on lambs is a common management tool for the prevention of flystrike.

### 4. Mites

Parasitic, or mange mites are relatively uncommon in sheep. The entire lifecycle of the mite is on the sheep, and they are easily transmitted by direct contact between sheep. Most mites are microscopic and are diagnosed by a skin scraping taken by a veterinarian. Clinical signs include severe itching, loss of hair/wool, crusting and thickening of the skin. Treatment varies with the species of mite diagnosed.



## 5. Sheep nasal bot

The sheep nasal bot is the larval stage of the fly *Oestrus ovis*. The female fly deposits her larvae around the nostrils of the sheep, and they crawl into the nasal cavity to develop. The larvae can take from 2 weeks to 9 months to develop, and then they crawl out to pupate on the ground.

The presence of the adult flies causes restlessness, poor appetite and decreased weight gains. The larvae in the nasal passages cause irritation, nasal discharge and sneezing. In rare cases a larvae will migrate through the skull. Diagnosis is generally made based on clinical signs and behaviour of the sheep. If a postmortem exam is done larvae may be found in the nasal cavity.

The most effective treatment is to kill the larvae with systemic insecticides. Some of the common dewormers used for internal parasite control will also be effective against nose bots.

## 6. Ringworm

Ringworm is generally only a problem in show sheep that are sheared and washed frequently as this removes the protective coating of lanolin in the wool. Most cases in sheep are caused by the fungus *Trichophyton sp.* It will appear as areas of hair/wool loss, and a grayish scabby surface to the skin. It is very important to remember that ringworm of animals is also contagious to humans, so extra precautions need to be taken.

Ringworm is highly contagious between sheep, and can easily be transmitted by direct contact or grooming equipment or contaminated pens. Fungal spores may survive long periods of time off the host, so thorough disinfection with a fungicide is required.

## Selecting a Dewormer

It is very difficult to make overall recommendations for choosing a specific dewormer to use in a flock. There are several factors which must be taken into account when deciding which dewormer is appropriate to use.

### Type of Parasite

- Not all dewormers are effective against all species of parasite
- Routine dewormers such as ivermectin do not kill tapeworms or flukes
- treatment of coccidiosis requires a feed prescription from your veterinarian e.g. Decoquinat, monensic acid (lasalocid sodium)

### Stage of the Parasites Lifecycle

- The hypobiotic larvae are more difficult to kill and not all drugs are effective against this stage

### Production stage of the flock

- Choose a dewormer that is safe for the production stage of the sheep e.g. Albendazole can cause birth defects if given in early pregnancy
- Will the sheep be grazed or kept in a drylot?
- Do the ewes have lambs at foot?

### Age and weight of the animal

- Be cautious of withdrawal times as lambs get close to market weight
- Dewormers with larger dose volumes will be easier to dose accurately for smaller lambs

### Timing of Administration of the Dewormer

- Choose the most strategic times to deworm
- Will depend on when the flock lambs, weans, and goes to grass
- It is advisable to withhold food for 12-24 hours prior to deworming
- Season of the year: spring vs. summer vs. fall

## Extra Label Drug Use – a prescription from a veterinarian is always required

There are very few drugs available that are labeled for use in sheep. “*ELDU is the use of an animal health product such as an antibiotic, in a manner other than what is specified on the label. It includes using a product for a different species, weight or age of animal, and for diseases or other conditions not listed on the label: administering a product at a different dosage, route, frequency, duration or timing of treatment or failing to observe the stated withdrawal period*”. (Canadian Sheep & Lamb Food Safe Farm Practices) It is beneficial to the shepherd and their sheep to work with the flock veterinarian to develop a strategic plan for parasite control that is specifically tailored for each farm. This plan should be based on knowledge of the parasite burden (based on fecal exams), the shepherd’s knowledge of the management and production cycle of the flock, and the veterinarian’s knowledge of available drugs for use.

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# Disclaimer

The primary purpose of this handbook is to assist producers, to make production decisions with consideration to responsible animal care.

The authors and editors of this handbook have made every effort to ensure the accuracy and integrity of the materials presented within. All information (including descriptions of or references to products, persons, web sites, services or publications) is provided entirely "as is" and the authors make no representations, warranties or conditions, either express or implied, in connection with the accuracy, use of or reliance upon this information. All information is provided to the recipient entirely at the risk of the recipient and, because the recipient assumes full responsibility, the authors shall not be held liable for any claims, damages or losses of any kind based on any theory of liability arising out of the use or reliance upon this information (including omissions inaccuracies, typographical errors and infringement of third party rights).

Expert professional legal and veterinary advice should be referenced by the reader on a case-by-case basis.

This handbook is considered to be a living document and therefore is subject to updates, revisions and modifications at any time.



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