**The Liver Fluke (Fasciola hepatica): Life Cycle, Epidemiology, Pathology, Clinical Signs, Effect on Productivity, Treatment and Control**

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**Introduction**

The common liver fluke, *Fasciola hepatica*, is a parasite of increasing concern to the cattle industry. Fluke associated liver condemnation numbers have risen from reported rates of 5% in 1973, to 17.24% in 1989-90, and 19.2% in 1994. (1,2,3) Condemnation rates, in some areas, have been much higher. Due to the nationwide presence of the lymnaeid snail, the intermediate host of the liver fluke, and increased movement of cattle, *F. hepatica* infection has been spreading in the United States as naturally infected cattle have been discovered in previously non-infected areas.(4,5) Affected cattle show decreased weight gains, rough hair coats and unthriftiness.

**Biology and Life Cycle**

**Adult.** Adult liver flukes are about 20-30 mm long and 7-14 mm wide. They are leaf-shaped, broader anteriorly than posteriorly, with an anterior cone-shaped projection that bears the anterior ventral sucker and mouth. The entire cuticle is covered with sharp spines. Flukes are hermaphroditic, containing both male and female sexual organs, and capable of self-fertilization.

**Eggs.** Liver flukes are prolific egg layers, producing an average of 19,000 eggs per day. The eggs are oval in shape, operculated at one end and yellow-brown in color. The eggs are deposited in the bile ducts of the host, pass through the gall bladder to the small intestine and are voided with the feces. Due to sporadic emptying of the gall bladder, fluke egg counts on any given day can be a poor indicator of the actual level of infection. Once eggs are deposited with the fecal pat, they can remain viable for up to one year without hatching. When an egg comes in contact with water, and with proper environmental temperatures, each egg will produce a larva, called a miracidium in 4-15 days.

**Miracidium.** The miracidium can gain access to the intermediate host, the lymnaeid snail, in one of two ways: 1.) The snail may eat the egg, and the miracidium will hatch out and begin its development within the snail. 2.) The egg will hatch in water or a moist environment, and the miracidium would actively...
swim and seek out a snail, actually penetrating the skin of the snail. Once in the snail, the miracidium develops into a bag-like cocoon called a sporocyst.

**Sporocyst / Rediae / Cercariae.** The sporocyst is essentially a bag of germinal (egg-type) balls that develop into 5-8 rediae. When the rediae are fully developed, they escape from the sporocyst. The redia, utilizing a simple mouth, feeds and actively migrates through the tissue of the snail. Some rediae reproduce asexually (basically splitting in two), creating two daughter rediae, further increasing the number of rediae in the snail. Each redia also contains germinal tissue and produces large numbers of offspring which are called cercariae. The cercariae, in turn, migrate out of the snail when the snail is in an aquatic environment.

Under optimal conditions the phases within the snail occur in 3-7 weeks. During dry periods, the duration of the snail phase can be much longer with the cercaria remaining in the snail for several months.

**Metacercariae.** The cercariae actively swim using their tadpole-like tail and attach themselves to vegetation near the surface of the water. They shed their tail and encyst on vegetation near the surface of the water as infective metacercariae. If conditions aren’t too hot and dry, the encysted metacercaria can remain infective for up to 6 months. When the metacercariae are ingested by a suitable host each metacercaria will develop into an individual fluke. *Infection of a snail with one miracidium can produce over 600 infective metacercariae.*

**Juvenile Fluke.** When metacercariae are ingested by a bovine, they excyst in the small intestine, penetrate the wall and migrate through the peritoneum to the liver. The young fluke will migrate through the liver tissue before entering the bile ducts and developing to a reproductively capable adult. The prepatent period within the bovine is 8-10 weeks.(6)

**Selling Application.** One fluke will produce 19,000 eggs per day. Each egg potentially produces more than 600 metacercariae. One fluke can potentially produce 11,400,000 flukes from one day of egg production.

Flukes are extremely prolific, which means even a single fluke in an individual animal in the herd could potentially result in widespread infection. Regular treatments are appropriate to prevent economically significant losses.

**Epidemiology**

Several factors are necessary for infection with liver fluke (fascioliasis) to occur. Seasonally, these factors can all be present in most areas of the United States, with very few areas exempt. The simple representation of conditions needed for liver fluke infections to develop are: Fluke-Infected Animal, Lymnaeid Snail, Environmental Conditions

**Fluke-Infected Animal.** Presence of an infected animal in the area is necessary. It should be noted that the liver fluke is capable of infecting and reproducing in...
It should be noted that the liver fluke is capable of infecting and reproducing in several animal species other than cattle. *Fasciola hepatica* has also been found to occur in the bile ducts of sheep, goat, and other ruminants; hare; rabbit; beaver; dog; cat and man. This broad potential host base, plus the increase in mobility of the livestock population, makes most grazing areas of the United States potentially infected.

**Lymnaeid Snail.** Numerous lymnaeid snail species which are distributed across the United States and worldwide can act as the intermediate host of *Fasciola hepatica*. The snails are amphibious, easily capable of surviving out of water when the relative humidity is high. They are capable of withstanding summer drought or winter freezing for several months by aestivating, which means hibernating deep in the mud. Permanent habitats include banks of ditches and streams, and the edges of ponds. Following periods of rainfall, temporary habitats can include hoof-prints and tire ruts. Lymnaeid snails are hermaphroditic and very prolific. In a three-month period a single snail is capable of producing up to 100,000 descendants.

**Proper Environmental Conditions.** Several environmental conditions are necessary for propagation and development of both the lymnaeid snail and the developing larval forms of the fluke. Moisture is necessary for the amphibious snail, and also for the swimming cercariae. The ideal temperature range for optimal development of both snail and fluke larvae is 84.6 - 93.6 °F (15 - 20 °C). Development can occur at temperatures between 75.6 - 84.6 °F (10 - 15 °C) but it will be slightly slower in a cooler environment. The snails also prefer a slightly acid pH. During certain times of the year, almost all pasture land in the United States falls into these parameters.

**Selling Application.** Nearly the entire United States provides conditions suitable for fluke existence. Different locales will have differing seasonal patterns. It is important to develop treatment schedules appropriate for a specific area based on the temperature and moisture requirements of the snail and fluke (remembering that they are basically identical).

**Pathology**

Eight to ten weeks after cattle ingest metacercariae, adult flukes will be present in the bile ducts of the liver. Individual adult flukes will attach at various sites to the walls of the bile duct and feed on blood. The multi-site feeding pattern in combination with the irritation from the spines on the fluke’s cuticle irritate the bile ducts, which cause thickening of the bile duct walls and impairment of liver function. Chronic irritation can actually lead to calcification of the bile duct walls. The presence of a single fluke can lead to pathology of the liver and condemnation. If sufficient numbers of flukes are present, they can cause a primary anemia from their blood feeding. Proline, an amino acid produced in large amounts by adult flukes, also intensifies the thickening of the bile duct walls, and there is evidence that proline may also directly cause anemia by destroying red blood cells.
**Selling Application.** Ideally, treatment should be administered approximately 10 weeks after "ideal environmental conditions" for a given area are no longer present.

**Clinical Signs**
Adult liver flukes in the bile ducts lead to very classical clinical signs: there is gradual loss of condition, progressive weakness, anemia and hypoproteinemia with development of edematous subcutaneous swellings, especially in the intermandibular space and over the abdomen.(9) The main effects are low weight gains in young cattle, decreased milk production and condemnation of infected livers.(6) Overall, the clinical signs of fascioliasis in the live animal could easily be confused with nematode infections. Like nematode infections, obvious clinical signs of fascioliasis do not need to be present for productivity to be affected.

**Selling Application.** Observing the animal, clinical signs of fluke infection are indistinguishable from clinical signs caused by gastrointestinal parasites (i.e. rough hair coats, depressed appetite, etc.).

**Effect on Productivity**
Liver condemnation due to fascioliasis causes an economic loss to the packer that is passed on to the cattle finishing unit; this economic loss is becoming a more important concern in the cattle industry due to increased liver condemnation rates. It should be noted that feeding an animal is still the primary cost concern. Since fascioliasis affects feed utilization, the economic impact is much greater than liver condemnation alone. Clinical studies have shown reduction of the rate of gain by 8-28% in feeder calves experimentally infected with 40-140 *Fasciola hepatica*. (10) Comparative productivity studies of cattle treated with IVOMEC® (ivermectin) 1% Injection and IVOMEC® Plus (ivermectin/clorsulon) upon introduction to the feedlot show statistical advantages to average daily gain and total gain by specifically controlling adult liver flukes. (11,12) These parameters are more easily measured in the feedlot situation, but the effect of fascioliasis would also extend to feed utilization and other production parameters of calves, stockers and cows on affected pastures.

**Selling Application.** Both clinical and sub-clinical fluke infections cause significant economic damage in cattle. Liver condemnation, of course, is also a significant loss.

**Treatment and Control**
The economic impact of *Fasciola hepatica* on both liver condemnation and productivity has been well documented in numerous studies and publications. Consideration of the cow's role as a source of fluke infection for their calves is also necessary. Cows infected with liver flukes can be a continuous source of contamination for the pasture. Fluke control in all cattle can aid in the control of egg shedding and pasture contamination.

**Cows** can be treated with IVOMEC Plus at any time of year, since they may
have had acquired liver flukes over several seasons.

**Northern calves** should be treated for flukes with IVOMEC Plus as late in the fall as possible. This allows time for infections acquired in summer and early fall to mature to adults, which are most easily killed.

**Southern calves** should be treated in September with IVOMEC Plus. The usual dry summers limit fluke transmission during summer months, allowing for maturation of the flukes to adults.

**Feedlot animals** should be treated with IVOMEC Plus at receiving. This provides the best insurance against economic losses from flukes as well as endoparasites and ectoparasites in animals with an unknown status.

IVOMEC Plus Injection provides a convenient formulation to control a wide range of internal and external parasites, including sucking lice, mange mites, grubs and nematode parasites plus mature liver flukes. This product provides unsurpassed broad-spectrum control of cattle parasites, including the added insurance of adult liver fluke control.

**Selling Application.** IVOMEC Plus should be used on the entire herd to control liver flukes and other parasites which may increase profits for the producer.

**References**


7. Soulsby EJL. *Helminths, Arthropods & Protozoa of Domesticated*


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