Internal Parasites of Swine: Natural History and Control – Pork Industry Handbook
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pork industry handbook

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Internal Parasites

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Even though excellent deworming programs are available, it is estimated that internal parasites cost the pork industry an astonishing 250 million dollars or $3.00 per pig produced annually. Forty-three million pounds of liver were condemned by USDA inspections from 90 million hogs slaughtered in 1980. Nearly all of these livers were condemned because of "white spots" which are tissue wound scars left from the migration of immature worms (larvae).

Worm infections reduce growth rate and feed efficiency directly by competition for food and damage from larval migration through various organs. In addition, the tissue injury enhances the deleterious effects of other disease-producing microorganisms such as *Mycoplasma hyopneumoniae* or *Treponema hyodysenteriae*.

Some degree of worm infection occurs on most swine farms. Studies indicate that 80-90% of U.S. swine herds are infected with one or more species of worms. Efficacious swine dewormers are available and a magazine survey indicated that 74% of the producers deworm their hogs an average of 1.8 times during a production cycle. If such deworming practices really exist, it is difficult to ascertain why worm prevalence is so high in U.S. swine. To effectively lower the worm population in a swine herd, several management practices must be used. Proper selection of dewormers and proper timing of the deworming are important. Additional management tools include manure removal and good sanitation practices during the production cycle. A knowledge of the life cycle and the tremendous reproductive capabilities of the various swine worms will aid one in understanding how best to break the life cycles of different parasites.

Characteristics of the Common Worms

Roundworms

The large roundworm (*Ascaris suum*) is the most common and largest worm that infects young swine. The roundworm (Fig. 1) may be 10-15 in. long and is often observed in feces or hanging from the rectum of a pig. The large roundworm normally lies in the anterior small intestine, but will occasionally migrate into the stomach. When this happens, the pig may vomit material containing the worms. The female adult roundworm can produce up to 1,000,000 eggs per day. Roundworm eggs are remarkably resistant to adverse climate conditions and disinfectants.

Worm eggs must embryonate before they become infective. Under optimal conditions of high humidity and warm temperature, eggs embryonate and become infective about 10-14 days after they are passed. Therefore, fresh manure is not infective and, if ingested by pigs, the eggs will pass on through undigested and unhatched. Cold exposure delays or completely halts embryonation.

Once the embryonated infective eggs are swallowed, they hatch and the larvae penetrate through the intes-

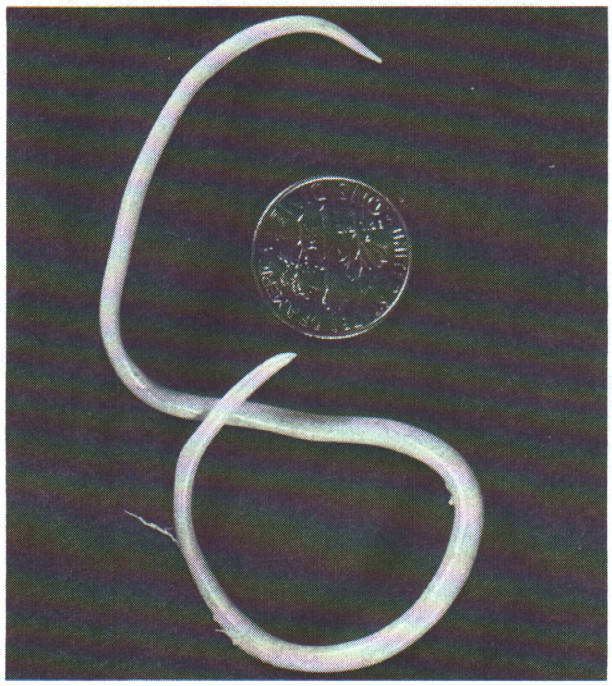

Figure 1. Roundworm (*Ascaris suum*).

Figure 2. Damaged liver.

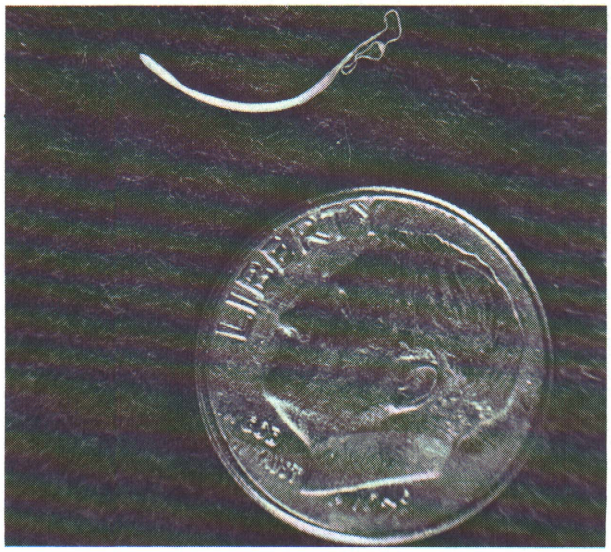

Figure 3. Adult whipworm (*Trichuris suis*).

Figure 4. Nodular worm (*Oesophagostomum sp.*).

tine wall into the bloodstream and are taken to the liver. The larvae migrate through the liver back into the bloodstream and end up in the lungs. They migrate from the lung tissue into the airways, travel up the trachea to the mouth, are swallowed, and develop into egg-laying adults in the small intestine. Since the entire life cycle from ingestion of the egg to egg laying requires about nine weeks, 8-week-old pigs may harbor immature worms but test negative on fecal examination.

When the roundworm (ascarid) larvae migrate through the liver, the body's defense mechanism produces an inflammatory reaction. A white spot is formed that can be readily seen. If several are present at slaughter, condemnation of the liver results (Fig. 2).

White spots reach maximum size 10-14 days following infection, but will regress with complete tissue repair 35-42 days following infection. Therefore, white spots observed at slaughter are the results of an infection within the last six weeks. Evidence indicates that an acquired resistance develops following the initial roundworm infection. Succeeding exposures to roundworm eggs result in most of the larvae being trapped and destroyed in the liver. Larvae from secondary exposures that escape the liver entrapment will be engulfed and destroyed during larval migration through lung tissue. But a very few will escape both liver and lung engulfment and end up in the intestine as egg-laying adults. These few that survive the attack of the liver and lungs remain as the perpetuators of the species and keep the swine facilities contaminated with eggs.

Following the initial infection, the migration of larvae through the lungs may cause a nonproductive cough. During this migration phase, the pig also will be more

susceptible to respiratory infections such as influenza and mycoplasma pneumonia.

Whipworms

Whipworms (*Trichuris suis*) are common throughout the United States and are more common in hogs raised on pasture. The adult whipworm (Fig. 3) is 2 to 3 in. long and resembles a buggy whip. The life cycle of the whipworm is direct in which larvae penetrate only the inside lining of the large intestine and cecum where they develop into adults. A large infestation of worms can cause sufficient damage to the intestine, resulting in diarrhea and death. Diarrhea often occurs two to three weeks after pigs have been moved from a nursery to an old pasture or contaminated area. It may resemble bloody dysentery and be unresponsive to antibiotic therapy.

Nodular worms

Nodular worms (*Oesophagostomum spp.*) are the most common worms found in adult swine, although they also often infect young pigs. The adult worm (Fig. 4) is 1 in. long and thick. It lies in the large intestine and probably causes little harm, but during the life cycle, the larvae encyst in the intestinal wall and cause a nodule about the size of a pea. Mild infections produce few clinical signs, but severe infections can result in excessive weight loss and contribute to the "thin sow syndrome" during lactation.

Threadworms

Intestinal threadworms (*Strongyloides ransomi*) are small worms that may infect the sow. She can transmit the living larvae through her colostrum to nursing pigs. Pigs nursing the infected milk develop a severe diarrhea at about 10-14 days of age with mortality occasionally reaching 75% of the infected animals. Surviving pigs may be stunted and feed efficiency will be poor. Threadworms are more prevalent on southern and southeastern United States swine farms and are seldom diagnosed in swine raised in the north central states.

Stomach worms

Red stomach worms (*Hyostrongylus rubidus*) are distributed throughout the United States and are more prevalent in pasture-raised swine. The increase in confinement nationwide has lowered the incidence of the red stomach worm. Clinically, this worm usually has little effect on the pig.

Kidney worms

The kidney worm (*Stephanurus dentatus*) is approximately 1 to 1 ½ in. long and is located in or around the kidney or along the tubes leading from the kidney to the bladder. The adult females produce eggs that are passed into the ureters and excreted in the urine. Swine are infected either through ingestion of the infective egg or by penetration of the skin or mucous membrane by the infective larvae. Fetuses may become infected via the blood supply to the uterus.

Oral infections reach the liver in 10 to 32 days. Then they may migrate in the liver for two to nine months. This prolonged migration period is responsible for a large percentage of the liver condemnations, especially in the southeastern states where the parasite is most commonly found.

Eventually, the larvae break through the liver capsule and reach the kidney area and develop into egg-laying adults some 9 to 16 months after initial ingestion. During the wandering migration, "lost" larvae that reach the spinal column have been blamed for posterior paralysis in sows.

Lungworms

Lungworms (*Metastrongylus spp.*) are found in the central and Atlantic states when swine are partially or totally raised on pasture. Since the life cycle of the lungworm requires contact with the common earthworm, hogs raised in total confinement are not infected with lungworms.

Mild lungworm infections will magnify the symptoms of respiratory disease, mycoplasma, influenza, and bacterial pneumonia. More severe infestations of the parasite can cause respiratory signs of coughing and labored breathing on their own.

Diagnosis of Internal Parasites

Internal parasites can be diagnosed by clinical signs, necropsy, and examination of feces for eggs. Clinical signs include poor feed efficiency, unthrifty appearance, coughing, pneumonia, diarrhea, and death. However, many hogs may be heavily worm-infected that appear normal.

Depending on the worm species, adult worms can be observed in the intestinal tract, lungs, or kidney at postmortem. Migrating larvae of roundworms (ascarids) and kidney worms cause scars or white spots on the liver. These can be observed during necropsy of young pigs or at the time market hogs are slaughtered.

The white spots from ascarid larvae disappear approximately six weeks after formation. Therefore, spots at slaughter associated with ascarid larvae indicate the finishing hogs have been infected or reinfected during the last six weeks of feeding. Scars incurred at weaning will clear up by slaughter age.

To determine the parasite status of a farm, fecal samples should be obtained from at least five pigs that are more than 9 weeks old. At the same time, five samples should be collected from 4 to 5-month-old pigs and from the breeding herd.

Mix each set of five samples together so that a composite sample representing each group is available. These three composite samples should be taken to a veterinarian for a fecal test for worm eggs.

The species of eggs observed at microscopic examination will determine treatment and control methods. Occasionally, no eggs will be observed and treatment is unnecessary. Pigs from dewormed sows that have been farrowed on clean slotted or mesh floors and placed in slotted floor nurseries commonly are worm free. Nevertheless, severe worm infections have been observed in confinement operations that allowed a break in sanitation. Annual or twice-a- year fecal examination to monitor the effectiveness of the parasite control program is important.

Dewormers

No individual dewormer is effective against all species of worms (Table 1). Piperazine, administered properly, is fairly effective against the adult roundworm. But all too often, when producers administer piperazine via drinking water, an adequate dosage is not consumed in a 24-hour period because of the drug's bitter taste.

Dichlorvos (Atgard) has broad deworming activity and is given as a one- or two-day dewormer in the

feed. Dichlorvos is usually considered a drug of choice against whipworms when the two-day type treatment is administered.

Levamisole (Tramisol, Ripercol) is also effective against several species of worms and can be mixed with feed or in the drinking water.

Pyrantel tartrate (Banminth) is effective against roundworms and nodular worms. Pyrantel tartrate is administered in the feed and can be given as a one-day dewormer or fed continuously. Continuous feeding of pyrantel tartrate prevents the migration of the hatched larva through the intestinal wall into the liver. Thus, pigs fed pyrantel tartrate from weaning to 12 weeks will not have white scars on the liver at the end of drug feeding period. If, at this time, pigs are placed on clean pastures or on clean floors, no ascarid liver scars will be present at slaughter. However, if they are placed on an egg-contaminated lot, liver spots will form quickly.

Fenbendazole (Safe-Guard) is effective against roundworms, nodular worms, stomach worms, whipworms, kidney worms (immature and mature forms), and lungworms. This broad spectrum dewormer is mixed with the feed and fed for three consecutive days. Fenbendazole is a drug of choice against kidney worms, lungworms, and whipworms.

Hygromycin B (Hygromix) is a continuously fed dewormer that is effective against roundworms, nodular worms, and whipworms. When Hygromycin B is fed for longer than six weeks, a hearing impairment may develop. Therefore, its use is not recommended in animals that may be saved for breeding stock.

Thiabendazole paste is used to treat 5 and 10-day-old pigs for intestinal threadworms.

Parasite Control Program

Parasite control programs vary with the individual farm, but in general farms are separated into confinement or pasture operations. Pigs raised on pasture or in dirt lots where reinfection is inevitable will need a more rigorous control program than pigs raised on slotted floors. Confinement systems with dirty solid concrete floors are no different from a pasture lot and should be considered contaminated with worm eggs.

Before initiating a worm treatment and control program, an accurate diagnosis of the species of worm present should be made. At this point, choose the drug most effective against the worms diagnosed. Deworm sows one week before breeding and again one week before farrowing with either dichlorvos, levamisole, pyrantel tartrate, or fenbendazole. Wash the sows with soap and water, especially along the udder, to remove worm eggs before sows are placed in a clean farrowing crate or pen.

Pigs should be dewormed at 6 to 8 weeks and again 30 days later, or treatment with continuous pyrantel tartrate or Hygromycin B can be initiated at weaning. If threadworms are a problem, treat baby pigs with thiabendazole paste at 5 and 10 days of age. Levamisole or fenbendazole treatment is recommended if kidney worms or lungworms have been diagnosed.

Since the kidney worm requires one year to reach maturity, the use of a gilts-only program for farrowing for four years is reported to eliminate kidney worms from the herd.

For economic reasons, the four-times-a-year deworming of sows and twice-a-year deworming of pigs is often not advisable in complete confinement systems with clean slotted or mesh floors. Although deworming may be unnecessary, twice-a-year monitoring of feces for worm eggs should still be continued.

Modern dewormers and husbandry practices make it possible to raise swine practically worm free. Proper diagnosis and timing of the worm treatment can alleviate this costly menace of the swine producer.

Reference to products in this publication is not intended to be an endorsement to the exclusion of others which may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer.

Table 1. Percent removal of common swine parasites by recommended drugs.*

Parasite	Piperazine	Pyrantel[1] Tartrate	Thiabendazole[2]	Hygromycin B[3]	Dichlorvos[4]	Levamisole[5]	Fenbendazole[6]
Roundworms	75-100%	96-100%	--	95-100%	99-100%	99-100%	92-100%
Nodular worms	50%	88-100%	--	95-100%	95-100%	80-100%	100%
Whipworms	0	0	--	85-100%	90-100%	70-80 %	94-100%
Lungworms	0	0	--	0	0	90-100%	97-100%
Small stomach worms	--	--	--	--	--	--	99-100%
Threadworms	0	0	99-100%	--	60-80 %	80-95 %	--
Mature kidney worms	0	0	0	0	0	83 %	100%
Immature kidney worms	0	0	0	0	0	0	100%

[1]Trade name Banminth--Pfizer, Inc.
[2]Trade name Thibenzole--Merck and Co., Inc.
[3]Trade name Hygromix--Elanco Products Company
[4]Trade name Atgard--SDS Biotech Corporation
[5]Trade name Tramisol--American Cyanamid Company
[6]Trade name Safe-Guard--American Hoechst Corporation

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