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Common Parasites of Swine

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CONTENTS

	Page
Importance of Parasite Control.....	3
Parasites of the Stomach.....	4
Thin Stomach Worm.....	4
Thick Stomach Worm.....	4
Parasites of the Small Intestine.....	5
Large Roundworm.....	5
Thorny Head Worm.....	7
Parasites of the Large Intestine.....	8
Nodular Worm.....	8
Coccidia.....	9
Whipworm.....	10
Parasites of the Lungs.....	10
Lungworm and Other Species.....	10
Parasites of the Kidney Region.....	11
Kidney Worm.....	11
Parasites of the Muscles.....	12
Tapeworm.....	12
Pork Bladder Worm.....	13
Long Necked Bladder Worm.....	13
Hydatid Cysts.....	13
Trichina.....	14
Swine Sanitation System.....	15
Other Factors in Parasite Control.....	16
External Parasites of Swine.....	16
Hog Louse.....	16
Swine Mange.....	17

Common Parasites of Swine

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Farmers, stockmen and even veterinarians and animal disease workers have tended to underestimate the significance of parasites to animal health. This is understandable because the damage wrought by parasites is not spectacular and ordinarily is not severely pronounced. Parasitism is usually a slow insidious process which gradually robs the animal of proper growth and weight gains. Parasites might well be compared to hidden taxes. We are not aware of the total tax we pay and therefore are inclined to complain much less about the matter.

IMPORTANCE OF PARASITE CONTROL

It is difficult to overemphasize the importance of controlling or preventing swine parasites. Certainly we can go on raising hogs and ignore the problem of parasites, but it will continue to cost us dearly. Perhaps we can best explain the value of prevention by examining the value of treatments for swine parasites.

In the first place, there are only three or possibly four common parasites of swine for which we have effective treatments. This leaves many more for which we have absolutely no means of effective removal.

The second consideration concerns the benefit we may expect from the treatment of hogs for worms. All drugs are effective for removing the adult parasite only. The larvae, or pre-adult parasites, have already invaded the body tissues, migrated through vital body organs and in many instances caused much of the damage they would ultimately produce.

This does not imply, however, that treatment for some swine parasites is not worthwhile or beneficial. Fortunately, we do have a practical and efficient treatment for the large roundworm, which is by far the most detrimental parasite of young hogs. We can treat for nodular worms and stomach worms with fair success. Certainly treatment relieves the gross load on the animal and gives the natural body defenses time to overcome the infection. Treatment may also serve as a method of control. By removing most of the adult female worms we remove the source of most of the worm eggs thereby greatly reducing contamination of hog lots and premises.

Any good parasite control program must utilize two principles: (1)

the practice of reasonable sanitation and cleanliness, and (2) the use of temporary pastures. We cannot expect to feed, water and house swine in surroundings of mud and filth and still raise them relatively free of parasites and other diseases. Neither can we expect to raise hogs in the same old lots year after year without paying the price of parasites. The old adage that "Permanent pastures perpetuate parasites" aptly applies to swine.

In Missouri we have two distinctly different problems with respect to parasites of swine. Northern Missouri with the colder winter climate and heavy swine feeding program has to contend primarily with the large roundworm or ascarid. In southeast Missouri where there is more low swampy land, a milder climate and less emphasis upon swine husbandry, we see conditions paralleling the swine parasite problems of the South. Here we note the lungworm and the kidney worm as more significant parasites.

PARASITES OF THE STOMACH

Two different types of worms are found in the stomach of swine. They will be considered separately.

Thin Stomach Worm (*Hyostrogylus rubidus*)

These worms are slender pink or red roundworms that average about $\frac{1}{2}$ inch in length. They are usually burrowed into the mucus of the stomach and are easily overlooked.

Life History—The eggs of these worms pass out in the droppings, hatch and develop into infective larvae (young worms) in a period of a week or longer. These larvae are consumed by hogs either in the food or water. They pass directly to the stomach of the hog where they develop to mature worms.

Damage—Irregular ulcerated areas may be developed in the stomach. Occasionally considerable blood is lost from these raw ulcers.

Symptoms—Usually no symptoms will be noted, but with extreme infections there may be a diarrhea, general unthriftiness, and poor weight gains. The droppings sometimes are dark and discolored due to the blood from the stomach.

Thick Stomach Worm—(*Ascarops strongylina* and *Physocephalus sexalutus*)

These worms are relatively stout and yellowish white. They vary from $\frac{1}{2}$ to 1 inch in length.

Life History—The worm eggs are passed in the droppings where they are eaten by various species of dung beetles. Here the larvae develop to an infective state. The hog in turn eats the beetle, thereby releasing the larvae in the stomach where they develop into mature worms.

Damage—Usually nothing more than a mild inflammation is produced in the stomach.

Symptoms—Similar to those produced by the thin stomach worm. There will be little or no blood loss due to these worms.

Diagnosis—Stomach worms can be diagnosed by a careful examination for the adult worms in the stomach of an affected hog or by a microscopic examination of a sample of manure.

Treatment and Control—Carbon disulfide is fairly effective for removal of these parasites. A good swine sanitation program usually limits these parasites to a rather mild infection, and treatment is rarely necessary. Avoiding prolonged use of old hog lots, and using temporary hog pastures and the practice of feeding on concrete floors usually control stomach worms.

PARASITES OF THE SMALL INTESTINE

Large Roundworm (*Ascaris lumbricoides*)

The adult worms vary in length from 5 to 15 inches and vary from yellow to pink in color. Their normal location is the small intestine but they are often found in the bile ducts, pancreatic ducts, and other abnormal locations.

Life History—The mature female ascarid is a very prolific egg layer and lay thousands of eggs daily for long periods of time. The eggs pass in the droppings and go through a period of incubation on the ground. If all conditions are favorable the eggs can become infective in a period of about 3 weeks. If it is extremely cold or dry the eggs may lie on the ground for months or years before the incubation process takes place. The eggs do not hatch on the ground, but young larvae develop within the eggs which are released in the stomach of the hog when consumed with food or water. These young larvae pass into the small intestine, migrate through the intestinal wall and are carried by the blood to the liver. From the liver they go by the right side of the heart to the lungs. In the lungs the young worms remain for some time, molt into a more advanced stage, and eventually break out of the blood vessels and into the air passages of the lungs. They migrate up the air passages, through the windpipe and into the back of the mouth or pharynx. From this point the young worms are again swallowed by the hog and carried back to the small intestine where they develop to maturity in 2 to 3 months.

Damage—Much of the damage is done during the early larval stages in the liver and the lungs. Often much scar tissue is left in the liver; the lobe surface being covered with small white scarred depressions. Varying degrees of pneumonia develop in the lungs as a result of the larval migrations. Roundworm larvae are believed to be one of the main causes of thumps in pigs. In the small intestine large numbers of ascarids may cause intestinal or more likely bile duct obstruction. Bile duct obstruction causes

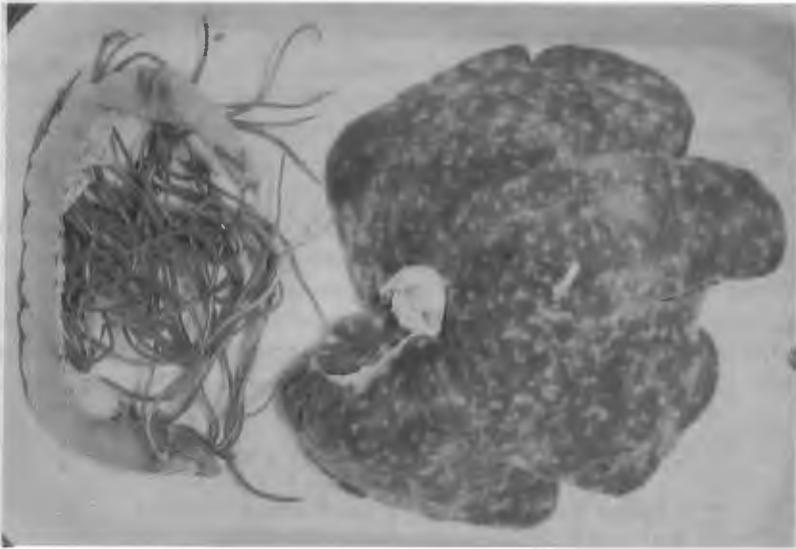


Fig. 1.—A portion of swine intestine showing the large roundworms removed. Note the white scarred depressions of the liver which resulted from the passage of the young worms through the organ.

the liver to be jaundiced and results in condemnation of the liver or the entire carcass in the packing house.

Symptoms—Thumps, unthriftiness, and failure to grow and gain properly during the first two or three months after weaning are good indications of heavy roundworm infections. Recent experiments by Bureau of Animal Industry workers indicate that pigs with heavy roundworm infections consume an average of .8 lb. more grain feed per lb. of body weight gained than did comparable pigs with few or no roundworms.

Treatment—At this time sodium fluoride appears to be the treatment of choice. This drug should be administered at the rate of 1 percent of a dry ground feed. Swine should not be fasted but should be slightly underfed the day prior to treatment. Make a fair estimate of the average daily feed consumed and than feed slightly less of the medicated feed. Sodium fluoride is poisonous but when used with the proper safeguards is probably as safe as many other drugs. The medicinal grade of sodium fluoride has been tinted to avoid confusion with foods which exist in white powder form.

PRECAUTIONS FOR USE OF SODIUM FLUORIDE

1. Label all containers of sodium fluoride and keep them out of reach of children and pets.
2. Do not feed in the form of slop or wet mash..
3. Do not increase the dose percentage and do not feed longer than 1 day.

4. Do not feed to hogs with severe gastrointestinal infections or hogs already showing signs of some infectious disease, such as hog cholera.

Prevention—The McLean County System which was developed by the Bureau of Animal Industry, and farmers of McLean County, Illinois, incorporates the ideal principles of control. This plan, with certain modifications, is outlined at the end of the discussion of internal parasites. The plan, though developed for the control of roundworms, controls most other parasites of swine effectively. The main objective of this program is to maintain environmental conditions so that hogs can never pick up large numbers of infective parasite larvae or eggs.

NOTE: See page 20 for additional information on treatment for roundworms.

Thorny Head Worm (*Macrocanthorhynchus hirudinaceus*)

This is a cylindrical roundworm, several inches in length, which may resemble the common roundworm. However, it is usually almost milk white in color and has a small projecting cone-like apparatus at the front end, armed with many small hooks. These hooks are deeply embedded into the intestinal wall and often cause the formation of nodules or swellings at the point of attachment.

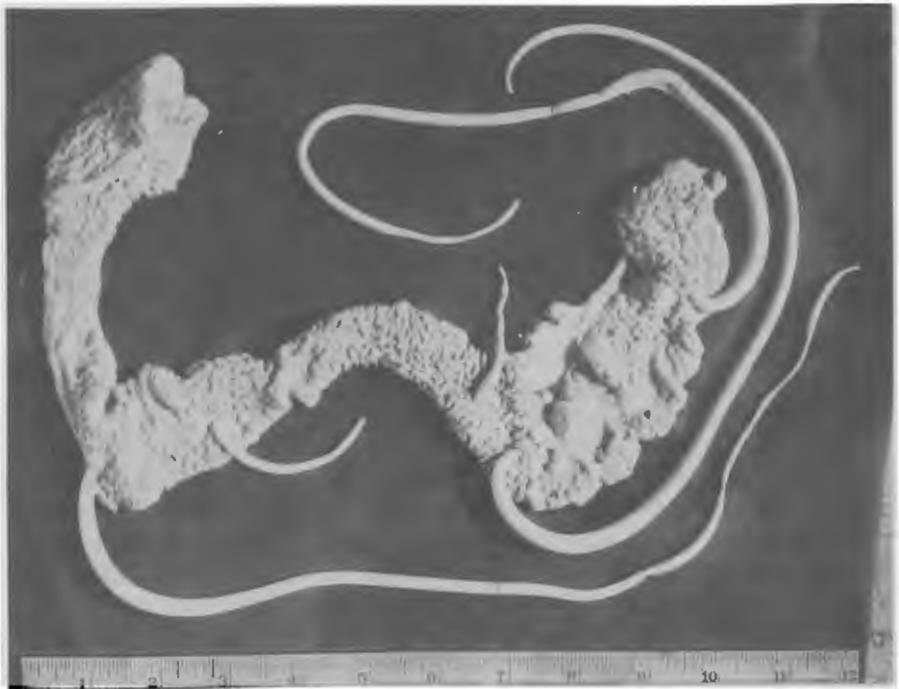


Fig. 2.—Thorny-headed worms embedded in the intestinal wall of the hog.

Life History—Eggs are passed from the female worms and eliminated in the droppings. The eggs hatch when they are eaten by the grub of the May or June beetle. The hog is infected by eating the grub or adult beetle which contains the infective stage of the worm larva.

Damage—Usually the damage done by “Thorny Heads” is minor, but when large numbers are present they will cause unthrifty hogs. They may also cause the death of the hog by puncturing a hole through the intestine at the site of the nodule formation. This usually causes peritonitis, an acute inflammation of the abdominal cavity which can lead to death.

Treatment and Prevention—No treatment of value is known. Avoiding use of old hog lots and other areas harboring large numbers of white grubs usually controls this parasite. If necessary, rings can be used in the nose to prevent rooting for infective grubs.

PARASITES OF THE LARGE INTESTINE

Nodular Worms (*Oesophagostomum dentatum*) and Other Species

The mature stages are slender white or brownish white roundworms from $\frac{1}{3}$ to $\frac{1}{2}$ inch in length. They are found free in the large intestine.

Life History—Eggs are passed in the droppings which hatch into tiny larvae and develop into the infective stage in the soil. The time required for this process is usually about 1 week. Swine usually get the infective larvae with their food. The larvae pass through the stomach and small intestine and invade the wall of the large intestine. Here they produce pin point nodules. Following a period of growth and development the young worms emerge from the nodules and develop to maturity. The entire cycle requires about 2 months.

Damage—The common nodular worm which is most prevalent in Missouri ordinarily does not cause pronounced lesions in the intestine and usually no clear cut symptoms are seen in hogs with moderate infections. Occasionally nodular worms may cause large nodules which become infected with bacteria, producing considerable damage to the large intestine. In such cases when there are large numbers of worms present diarrhea may be observed during the early stages of the infection. Pigs show very limited weight gains during this period.

Treatment—It is not often necessary to treat swine for nodular worms under Missouri conditions. However, in some instances these parasites may be a serious problem. Phenothiazine is effective against the adults but has little or no effect on the larval stages in the intestinal wall. Complications may follow the use of phenothiazine in hogs. It can cause photosensitization if swine are permitted in the sun for long periods following treatment. Such hogs may be temporarily blind and show various swellings and abnormalities of the skin. Pigs under three months of age and sows in late stages of pregnancy should not be treated with phenothiazine. Due to the difficulty involved in diagnosing nodular disease in hogs and the complications

which can develop following the use of phenothiazine, the services of a veterinarian should be obtained when this condition is suspected.

Prevention—The swine-sanitation program developed for the common roundworm usually controls the nodular worm. Best control can be effected if there is no part of the pasture in continuous shade. The larvae are susceptible to the effects of direct sunlight. When portable hog houses are used they should be moved at intervals of one month or less.

Balantidium coli

This is a protozoan (one celled organism) found in the large intestines of swine which is similar to or identical with the same protozoan found in man. The organism is common in swine, being found in 50 percent or more of the hogs examined. However, little is known about its ability to produce disease in swine. In man it can result in a severe dysentery and cause ulcers in the colon. Because it is a possible source of infection for man, persons coming in contact with swine should be very careful of their personal hygiene.

Coccidia (Eimeria spp.)

Coccidia are tiny one celled organisms which can be seen only with the aid of a microscope. Coccidiosis in hogs is caused by these tiny microbes attacking the cells that line the large intestine.

Life History—In the intestine resistant stages called oocysts are developed and eliminated in the droppings. After a period of incubation these cysts become infective and are consumed by the hog in its food and water. In the stomach or intestine several tiny bodies are released and each makes its way into an intestinal cell. Each of these bodies continues to grow until it finally ruptures the intestinal cell and releases hundreds of similar bodies. Each of these in turn invades other cells and repeats the process. Eventually after a limited number of cycles the resistant stages are again developed and passed in the droppings.

Damage—Under conditions of extreme infections the large intestine is greatly thickened and highly inflamed. Hogs will develop a diarrhea of several days duration and will fail to show any gains during the period. Occasionally an animal may become very thin and die. Many cases of coccidiosis in swine are rather mild and are never positively diagnosed.

Treatment—There is no specific drug for treatment. Several drugs, such as copper sulfate and the sulfonamides, are of some value. Both the diagnosis and treatment of coccidiosis in swine is often difficult and will usually require the aid of a veterinarian.

Prevention—Coccidiosis in swine is usually a disease of young animals. Older animals are resistant to the infection but remain carriers. Therefore, young pigs should be separated from older stock as soon as possible.

Old, unsanitary hog lots should be avoided. Hogs should be fed in troughs, preferably on concrete floors, to avoid contamination of the feed by the droppings.

Whipworms (*Trichuris suis*)

The mature whipworm is from 1 ½ to 2 inches long, the front two-thirds being much smaller in diameter than the remainder of the worm. This slender front end is attached to the lining of the colon and cecum.

Life History—The stage of this parasite outside the animal body is almost identical to that of the common roundworm or ascarid. However, as far as is known there is no blood migration stage of the larvae in the hog. After the infective egg is eaten the larvae hatch and pass back to the cecum or large colon where all stages, including the adult, develop.

Damage—There is little evidence that whipworms are significantly detrimental to swine under most Missouri conditions. However, they do in some instances contribute to the general condition of gross parasitism.

Treatment and Prevention—There is no treatment and control is identical with that given for the common roundworm.

PARASITES OF THE LUNGS

Lungworms (*Metastrongylus apri* and Other Species)

The mature lungworm is a creamy white round worm from 1 to 3 inches in length which is found in the small air passages of the lungs.

Life History—The female lungworm lays her eggs in the lung passages. The eggs are coughed up and swallowed then eliminated in the droppings. The eggs are eaten by the earthworm. Here they hatch and the lungworm larvae grow to an infective state. The hog is in turn infected with the lungworm by eating the earthworm. In the stomach and intestine the lungworm larvae are released and then migrate through the intestinal wall. From here they are carried via the blood and lymph to the lungs where the worms develop to maturity.

Damage—Considerable inflammation and irritation are produced in the lung. Bronchial pneumonia may sometimes develop when there are complicating bacterial infections. A chronic cough is one of the most common symptoms. Pigs with heavy lungworm infections are usually stunted and unthrifty. Pigs with mild infections show little or no symptoms of disease.

Lungworms are capable of harboring and carrying the virus of swine influenza. Many authorities believe that the lungworm offers one of the main means by which swine flu survives for years on hog farms.

Treatment and Prevention—At the present time there is no drug known to be effective for the removal of lungworms. Removing swine from their main source of earthworms, and good feeding and care are the best means of handling infected hogs. Control measures include the use of well drained, temporary pastures which are cultivated and planted to a good for-



Fig. 3.—Swine lungworms. The tip of each lung has been severed to reveal the lungworms which are released from the air passages.

age crop. Every effort should be made to avoid raising swine in old hog lots, low swampy areas, or on soil extremely high in organic matter. Such soil usually harbors large numbers of earthworms. The practice of ringing the noses of hogs is sometimes used to prevent rooting for earthworms. However, this measure alone should not be expected to control lungworms.

PARASITES OF THE KIDNEY REGION

Kidney Worm (*Stephanurus dentatus*).

The adult kidney worm is a thick, stout round worm from 1 to 2 inches long that is usually found in the fat surrounding the kidney. It is also commonly found under the capsule of the liver and in the muscles in the region of the kidney.

Life History—The female kidney worm perforates the wall of the ureters (tube-like structures extending from the kidney to the urinary bladder) and lays her eggs inside. The eggs are carried to the bladder and eliminated with the urine. The egg hatches and the larvae develop to an infective stage in the soil in a few days. These larvae may enter the hog through the skin or through the mouth. By either course they eventually make their way to the liver where they migrate for weeks or months. The female finally makes her way from the liver across the abdominal cavity to the area of the kidney. She is then ready to lay her eggs and complete the life cycle. The entire cycle requires from 6 to 9 months.



Fig. 4—The swine kidney worm. The worms are embedded in the fat in the region of the kidney.

Damage—Considerable damage is done to the liver which usually must be condemned at the packing house. Frequently much of the loin must be trimmed away or the entire carcass may be found unfit for human consumption. Usually no symptoms other than poor growth and gains are noted in infected hogs. Death due to kidney worms is rare.

Treatment and Prevention—There is no medicinal treatment for this parasite at the present time. Kidney worms are not uncommon in southeast Missouri but do not seem to be creating any special problems there. It remains to be seen if the transfer of swine through community sales may ultimately result in the spread and establishment of this worm as an important parasite of swine in south Missouri.

The kidney worm can be effectively controlled by a special swine-sanitation plan outlined by the Bureau of Animal Industry. Details of this plan of control may be obtained from U. S. D. A. Leaflet 108 or from U. S. D. A. Farmers Bulletin No. 1787.

PARASITES OF THE MUSCLES

Tapeworms (Larval or Bladder Stages)

Several tapeworms have their intermediate stages in the muscles or other organs and tissues of swine. The adult tapeworm in each case is found in the intestine of either man or dog. The hog becomes infected with bladder worms by eating the tapeworm eggs released in human or dog stools. The hog harbors no adult tapeworms in the intestine.

Pork Bladder Worm

Slender white bladder like structures about $\frac{1}{2}$ inch or less long and $\frac{1}{4}$ inch or less wide are found throughout the muscles and in the heart. Man may become infected with the adult tapeworm by eating improperly cooked pork containing these cysts. The pork bladder worm has become very rare in Missouri.

Long Necked Bladder Worm

This is a large bladder worm usually found in sheep but it may be found adhering to the liver or other organs and structures of the abdominal cavity of swine. The dog harbors the adult stage of this tapeworm and becomes infected by feeding on the abdominal contents of swine.

Hydatid Cysts

A cyst or bladder stage usually not more than 1 inch in diameter which is ordinarily found in the liver or lungs, but may be in other parts of the body. This cyst, unlike the previously mentioned forms, has a thick heavy wall and is capable of developing into many thousand small tapeworms in the intestine of the dog. The same type cysts may develop in the liver or lungs of man; however man does not get the infection directly from the hog. Man is accidentally infected from indirectly consuming a few of the tapeworm eggs voided by the primary animal hosts—the dog, wolf and coyote.

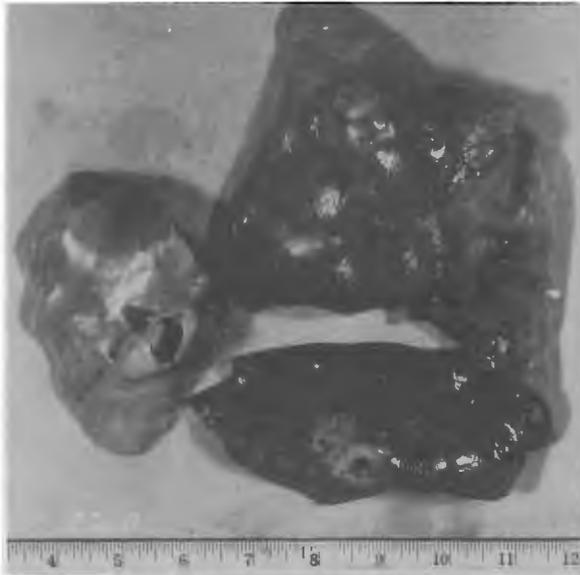


Fig. 5—Hydatid cysts shown here as they appear in both the liver and the lungs of swine, sheep and cattle. These cysts represent the intermediate stages of tapeworms which are found as adults in the small intestine of the dog.

CONTROL AND PREVENTIVE MEASURES—

1. Dogs should never be permitted to eat the carcass or offal of animals which have died or been slaughtered on the farm.
2. Farm or ranch dogs having an opportunity to eat such material should be regularly treated for adult tapeworms.
3. Man should never eat improperly or incompletely cooked pork.

Trichina (Trichinella spiralis)

Trichinae are tiny roundworms which are capable of completing their entire life cycle (both adult and larval stage) in one animal. They are found in swine, rats, man, and other meat eating animals, including dogs. The adult male and female trichinae found in the intestine are tiny parasites never more than 1/6 of an inch long. They never live more than a few weeks. The females burrow deep into the intestine to give birth to tiny larvae which enter the blood and lymph and are carried to all parts of the animal body. These larvae invade muscle cells and are soon to be found closely coiled inside a thin membrane. After a period of 3 weeks or longer these larvae in the muscle reach an infective stage. If the uncooked or improperly cooked muscle is eaten by a man, hog, rat, or other host, larvae will be released in the stomach. Soon they pass back to the intestine where mature male and female parasites can be formed in a period of 3 or 4 days.



Fig. 6—Highly magnified picture to show the tiny trichina larvae embedded in the muscle cells of the hog. These tiny worms may also enter the muscles of man if he carelessly eats raw or improperly cooked pork which is infected with this parasite.

Damage—Trichina infection is seldom diagnosed in living swine. Usually the infection is gradual and the hog will not show any symptoms. Occasionally a hog may show listlessness, muscular soreness and other symptoms with trichinosis, but these are also symptoms of many other diseases and conditions. One of the main symptoms in animal or man is muscular soreness due to larvae in the muscle tissue.

Prevention and Control—Swine usually get the infection from raw pork scraps in garbage. Dead rats may also be a source of infection to hogs. Man contracts the worms by eating improperly cooked pork containing tiny microscopic trichina larvae embedded in the muscle. Garbage fed hogs constitute the majority of trichina infected swine in the United States.

Most authorities agree that trichinosis infections could be greatly reduced in both man and swine if the following control measures were carefully and strictly applied.

1. All garbage containing raw pork or meat scraps should be well cooked before it is fed to hogs.
2. Dead rats and swine should either be burned or buried deeply and covered with lime. They should never be left to decay on farm premises.
3. All pork and pork products should be thoroughly cooked before being used for human consumption.

SWINE SANITATION SYSTEM

Any sanitation system for the control of swine parasites and diseases must be flexible and subject to modifications, depending on the needs of a given farm or area. The type of soil, the amount of rainfall, the mean winter temperature, and other natural and man made factors will determine to a great extent the measures needed for a control program.

The McLean County System remains the best method for handling early spring pigs where permanent farrowing houses are used.

The steps of this system are given as follows:

1. Carefully clean farrowing pens a few days before placing sows in them. All dirt and litter should be removed and the floors, walls and rails thoroughly scrubbed with hot lye water.
2. Prior to placing sows in farrowing pens, wash the udders, feet, and legs to remove all caked mud and filth which may contain thousands of worm eggs, disease germs, etc.
3. Within 10 to 14 days after farrowing haul the sow and pigs to a clean pasture. Where possible the pasture should have been free of swine the preceding year. At any rate, the pasture should have been cultivated and seeded to some suitable forage crop. Such hog pastures should always be on well drained soil.
4. Pigs raised under this system should be kept on clean pasture until they are three or four months old. Even at this age it is not advisable to place them in small muddy pens that have been used as permanent hog lots.

When the portable farrowing house is used certain parts of the McLean County System can be omitted. If the sows are not muddy it probably will not be necessary to wash the udder and feet prior to placing them directly into the pasture a few days before farrowing.

This system saves much time and effort and is readily applicable to fall farrowed pigs. In areas where temperatures are not sufficiently low to require artificial heat in the farrowing pens the system also can be used for spring pigs.

OTHER IMPORTANT FACTORS IN PARASITE CONTROL

Feeding Methods—Swine pick up the majority of their internal parasites through feed and water. For this reason care should be taken to see that the system of feeding and watering is clean and sanitary. Feeding pens with concrete floors can be kept clean of mud and filth.

Nutrition—A good, well balanced ration is vital to the control of swine parasites. Hogs on good rations usually are capable of developing a high degree of resistance to parasites. Under conditions of fair sanitation, where only moderate numbers of parasites are encountered, well fed hogs will throw off most worms before much damage is done.

Milk for Control of Swine Parasites—Hogs should be kept off solid feed from 3 to 5 days and fed a diet of skim milk. Most swine will develop a loose diarrhea and flush out a large per cent of the large roundworms and nodular worms present in the intestines.

EXTERNAL PARASITES OF SWINE

The hog is not plagued with many different types of external parasites. One species of lice, two species of mites and one or two species of fleas are the only external parasites that are commonly found on hogs. However, two of these species (the hog louse and Sarcoptic mange mite) are often serious parasites of hogs and capable of causing much economic loss to the raiser.

Hog louse (*Hematopinus suis*)

The hog louse is relatively large, from 1/5 to 1/4 inch long, and has sharp pointed mouth parts especially adapted for sucking blood. Usually they are concentrated on the areas of tender skin along the flank and lower abdominal regions, on the insides of the legs, and in and around the ears. Although found at any time, they are more prevalent in winter and early spring.

Life History—The female louse lays her eggs or "nits" on the hair near the skin. After about 12 days the eggs hatch into nymphs which are smaller but almost identical to the adult lice. These nymphs feed by sucking blood from the skin and develop to maturity within 10 to 15 days. The en-



Fig. 7.—The adult hog louse. At the right is an egg or "nit" shown attached to a hair.

tire life span is spent on the hog. Lice are spread from one hog to another by direct contact in most instances. Hog lice do not adapt themselves to other animal hosts and are capable of living only a short time off the hog.

Damage—Lice puncture the skin each time they feed and in this manner cause the animal much irritation. In an attempt to relieve the irritation the animal rubs against any solid structure in the house or pen. Such rubbing and scratching may remove the hair and cause wounds or thickened areas on the skin. Hogs infested to this extent show poor gains and are generally unthrifty.

Hog lice may carry swine influenza, swine pox, and possibly other infectious diseases of swine.

Swine Mange (*Sarcoptes scabie var suis* and *Demodex folliculorum*)

Sarcoptic mange is by far the most common form seen in swine. It is caused by a tiny mite which is microscopic in size.

Life History—The Sarcoptic mange mite burrows into the skin and excavates short tunnels beneath the surface. The females lay their eggs (usually from 10 to 20) in these tunnels. The eggs hatch in 4 or 5 days and the larvae, after several molts, develop to mature mites in 10 to 15 days. The young larval or nymphal stages are spread over the body readily, due to the rubbing and scratching habits of hogs. This mite is relatively specific for the hog and is spread from one hog to another by direct contact.

Damage—The burrowing and feeding of the mites cause intense



Fig. 8—Advanced stage of Sarcoptic mange showing the thickened skin and dry, scaly crusts and scabs. Insert: The Sarcoptic mange mite of swine magnified to 120 times its actual size.

swelling and itching of the affected areas. Small vesicles appear over the burrows which rupture and permit serum to ooze over the area. The serum soon crusts and forms dirty yellowish scabs. The animal may in turn rub off many of these scabs, leaving raw, bleeding areas. If the infection is permitted to persist the skin will soon become greatly thickened, cracked and encrusted with thick, dry, scaly scabs. Such swine will not grow or gain properly and some may actually die of the condition. Lesions are first noted around the eyes, ears, nose or tail, but spread rapidly to other parts of the body. Young pigs and shoats seem much more susceptible to mange.

Treatment and Control—Recommendations for treatment of lice and mange have been changed somewhat in recent years. The relatively new

chlorinated hydrocarbons have replaced to some extent the use of lime-sulfur dips and crude petroleum and coal tar products. Insecticides for external parasites of hogs may be applied by hand application or as sprays, dips or dusts. They may be used in hog wallows or applied by the various types of automatic hog oilers.

Dipping is the best means of application but is not so widely used because of the lack of dipping vats on many farms. Spraying is probably the next best mode of application and is effective if care is exercised to see that all parts of the body are covered. High pressure sprayers are usually advocated for spraying animals, because of the force needed to drive the spray through the hair or wool. However, hogs may be effectively sprayed with the small knapsack sprayer if only a few animals are to be treated.

Most of the new insecticides are available as commercial preparations and should be used as directed by the manufacturer. Also, they may be purchased in bulk form as wettable powders or emulsifiable concentrates. The chlorinated hydrocarbons are not readily soluble in water.

The following insecticides are generally recommended for hog lice: Lindane or Gamma Isomer of BHC as a spray or dip at .05 to .06% strength, DDT as a spray or dip at .5 to .75% strength, Toxaphene and Chlordane as sprays only at .5% strength.

These same insecticides are generally effective against mange with some variations as to strength applied. Lindane or BHC is probably the preferred insecticide against Sarcoptic mange in hogs. The concentration recommended is from .10 to .13% Lindane or the pure gamma isomer of BHC. This is far below the usual toxic level for swine. Because young animals are much more susceptible to Lindane poisoning, the insecticide should be used with care on very young pigs. DDT is not generally recommended for swine mange. Chlordane and Toxaphene as recommended for lice are effective as treatments for swine mange. In most instances one treatment for either lice or mange is sufficient with most of the new chlorinated hydrocarbons. However, a second treatment from 7 to 10 days later may be desired for complete eradication of the parasites.

Swine should **never** be treated with any insecticides, such as DDT, BHC, Chlordane or Toxaphene within thirty days prior to slaughter.

Crude petroleum, used crank case oil, and kerosene and lard mixed in equal proportions are all remedies that have been effectively used to control hog lice and hog mange. These products may be applied by hand application or by the use of hog oilers. Care must be taken to see that the oil covers the entire body surface, including the inner surface of the external ear.

The various type hog oilers, whether home made or commercially made, do not insure complete body coverage with the oil. They help to control or limit lice and mange infestations but will not eradicate either type parasite. In instances of severe outbreaks a better means of medication

should be used. Crude petroleum, various coal tar derivatives, and lime-sulfur all have been used effectively, either in the form of a dip or in hog wallows, for control of lice and mange. However, at least two and often more treatments are needed for eradication. For this reason these products are gradually being replaced by the chlorinated insecticides.

NEW DRUGS FOR REMOVING SWINE ROUNDWORMS

Cadmium Compounds—These products are more commonly sold as cadmium oxide or cadmium anthranilate and may be marketed under various trade names. Cadmium compounds seem to be about as efficient as sodium fluoride and much less likely to poison swine. It is fed as one percent of the feed for 3 days and can be used in a wet feed if so desired. Cadmium is not fast acting and worms are not passed for 4 or 5 days after treatment is started.

The main disadvantage to the cadmium compounds is that they are taken into the tissues of the animal body and stored there for some time. Because such meat could be poisonous to man, it is recommended that cadmium compounds never be used less than 30 days before swine are slaughtered.

Piperazine—Very recently a new group of compounds called the Piperazine derivatives have been placed on the market as swine wormers. There is some evidence to indicate that these drugs, which are being marketed under a variety of trade names, may be the best products available for removing swine roundworms. However, they are new products and complications may yet develop from their use. Most of the experimental work on these products has been done by British workers. Recently, scientists of the U. S. Department of Agriculture began studies concerning this group of drugs, but much of their findings are not yet available. Keep in mind that your local veterinarian is best informed concerning the use of new drugs and remedies and should be consulted before they are used.