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THE COMMON ANIMAL PARASITES  
OF SWINE

BY ROBERT GRAHAM AND I. B. BOUGHTON



Roundworm (*Ascaris lumbricoides*) infestation is a frequent cause of unthriftiness and death.

## **Are your Premises Infested?**

Premises on which swine are raised each year eventually become infested with the more common pig parasites. Pigs farrowed in unclean houses or pastured in permanent hog lots which harbor the eggs of parasites may become infested while nursing, even tho symptoms may not be noted until after weaning. Dirty hog wallows and unclean farrowing houses commonly harbor parasitic larvae or their eggs. Permanent pastures and feed lots, as a result of long usage or overstocking, may also be infested.

## **Are Parasites the Cause of Unthriftiness in Your Pigs?**

The fatal effects of parasites in swine are commonly noted in young pigs, but animals weighing over one hundred pounds, including mature animals, may also be chronically infested. Death of sucking pigs, or unthriftiness of an obscure character following weaning, not traceable to a specific infection, such as hog cholera, for example, may be caused by parasites. Chronically infested animals not only fail to make a normal gain in weight but prove more susceptible to other diseases than do healthy pigs free from parasites. Large numbers of pigs in infested herds have died as a result of internal and external parasites.

## **Hygienic Measures Are More Valuable than Medicine**

Hygienic measures prevent the development of parasitic diseases and reduce the frequency of fatal secondary bacterial infections. Plow, rotate, crop, or rest the hog lots in alternate years, or provide free range. Clean and disinfect the hog houses before farrowing time. Keep pigs out of filth and mud, and provide pure drinking water. Avoid dirty feeding places by using concrete feeding floors. See that pigs are farrowed in clean, disinfected houses and that while nursing the sow they are placed on fresh ground. At weaning time they should be separated from older hogs and kept on uncontaminated ground.

These preventive measures are imperative in the successful raising of swine. Pigs that become infested with internal or external parasites should be treated without delay.

# THE COMMON ANIMAL PARASITES OF SWINE

By ROBERT GRAHAM, CHIEF IN ANIMAL PATHOLOGY AND HYGIENE, AND  
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Losses from parasitic diseases of swine in Illinois are largely traceable to improper rotation of pastures and failure to clean and disinfect hog houses. The history of badly infected animals received at this Station for examination invariably shows that it is a common practise for pigs to be farrowed in the same houses, and later fattened in the same lots, year after year, with little regard for sanitary measures. As a result, the common swine parasites capable of surviving Illinois winters have become implanted on many premises. Some breeders fear this source of loss more than cholera.

While the majority of deaths traceable to parasitism occur in young pigs, older and more resistant animals may be chronically infested. The common symptom of parasitism in pigs is unthriftiness. Unfortunately, the owner too often attributes this manifestation to other diseases. According to our experience, if improper feeding and housing and faulty breeding may be excluded, parasitism is to be suspected in practically all cases of unthrifty pigs. It is the purpose of this circular to describe the common animal parasites in swine, together with the symptoms which they induce and the approved measures of holding them in check. These measures, based upon the life cycle of the parasite, justify the hope of successfully raising pigs free from parasites and of ultimately clearing the premises of worm, egg, and larva infestation.

## IMPORTANCE OF PREVENTIVE MEASURES

The medicinal treatment of infested animals, tho necessary, is secondary in importance to the general scheme of management which prevents infestation. Because little is known relative to the treatment of some internal parasites of swine, it is imperative that parasitic infestations be destroyed on the premises before they gain entrance to the host.

The general thought conveyed in the placard which is reproduced on the back cover page of this circular is fundamental in the control of parasitic diseases in pigs. Clean, disinfected houses, together with fresh pastures uncontaminated with parasites, eggs, and larvae, are more effective than medicine. The major effort, then, in the control of parasitism should be directed to the eradication of these infestations on

the premises by rotating pastures and by properly disinfecting the houses and feeding places. Sanitary measures judiciously practised from the time litters are farrowed until the pigs are four months old constitute the most effective and economical procedure in the control of parasitic diseases of swine.

Effective sanitary measures for the prevention of parasitic and bacterial diseases of swine in connection with crop rotation have been outlined by the Federal Bureau of Animal Industry in cooperation with certain farmers in McLean county, Illinois. This system has become known as the "McLean county system of swine sanitation." While it cannot be said that the McLean county system completely solves the problems of preventing parasitic diseases of swine, yet it is a step in the right direction and to date has proved a most valuable aid. The application of this method has made possible the profitable raising of pigs on premises that previously were heavily infested with parasites. Inasmuch as this system was originally developed to combat the common roundworm of swine, a description of it is given under the discussion of that parasite on page 14. The value of the McLean county system is not limited to the control of the common intestinal roundworm; in fact it is recognized as a most practical procedure for the protection of the swine industry against secondary bacterial diseases.

## EXTERNAL PARASITES—LICE AND MITES

Pigs badly infested with lice become unthrifty from loss of blood and irritation of the affected parts. In mature animals the effects are usually not very noticeable; but in young pigs the normal growth and development may be arrested, or in the case of a heavy infestation death may result. The effects of mange are more pronounced and serious than those of lice. Aside from the intense itching, injury to the skin causes an impairment of the normal functions, while absorption of poisonous material through the skin abrasions is likely to occur.

### HOG LICE

(*Haematopinus suis*, Fig. 1)

The hog louse is the largest species of lice affecting domesticated animals. This parasite is characterized by a round, segmented abdomen, a blood-sucking apparatus, and feet having claw-like structures for clasping hairs. The lice are hatched in 12 to 20 days from small oval-shaped eggs, or "nits," that are glued to the hairs. The young lice seek the part of the hog most protected from cold, where the skin is tender. Ten to twelve days after hatching, the young louse is ready to lay eggs. A single female deposits an average of about 90 eggs. Hog lice do not propagate on animals other than hogs and are seldom found

on them. The quarters of lousy hogs may become infested, necessitating a thoro cleaning and disinfection of the houses if reinfestation of the pigs is to be prevented.

### SARCOPTIC MANGE MITE

(*Sarcoptes scabiei suis*, Fig. 2)

The most common form of mange in pigs is caused by an eight-legged mite too small to be seen without the aid of a magnifying

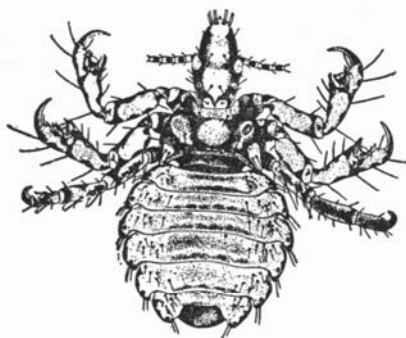


FIG. 1

FIG. 1.—THE HOG LOUSE (*Haematopinus suis*). Notice the claw-like structures for clasping the hair. Enlarged. (U. S. D. A.)

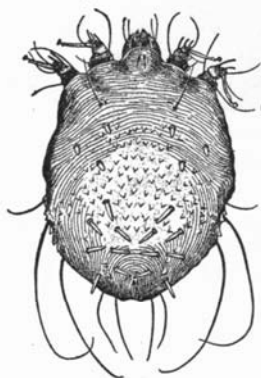


FIG. 2

FIG. 2.—SARCOPTIC MANGE MITE (*Sarcoptes scabiei suis*). In the natural position two pairs only of legs are seen from the dorsal view. Enlarged. (U. S. D. A.)

glass. Sarcoptic mange mites burrow or tunnel into the deeper layers of the skin, where the eggs are deposited and hatched. Inflammation induced by the presence of mites in the deep layers of the skin is accompanied by the formation of small exudative blisters, which soon dry, forming a scab. The pigs rub and scratch the irritated areas until most of the hair is worn off. Often raw, granular sores result; at other times the skin is thickened in rough, irregular folds. In badly affected animals, the scab which appears first about the eyes, nose, ears, and the root of the tail, eventually extends over the entire body (see Fig. 3).

The mites and eggs are readily transmitted from one hog to another in crowded sleeping quarters or indirectly from contaminated rubbing posts and bedding. The mites live for several weeks in pens and bedding not exposed to direct sunlight. Care must be exercised

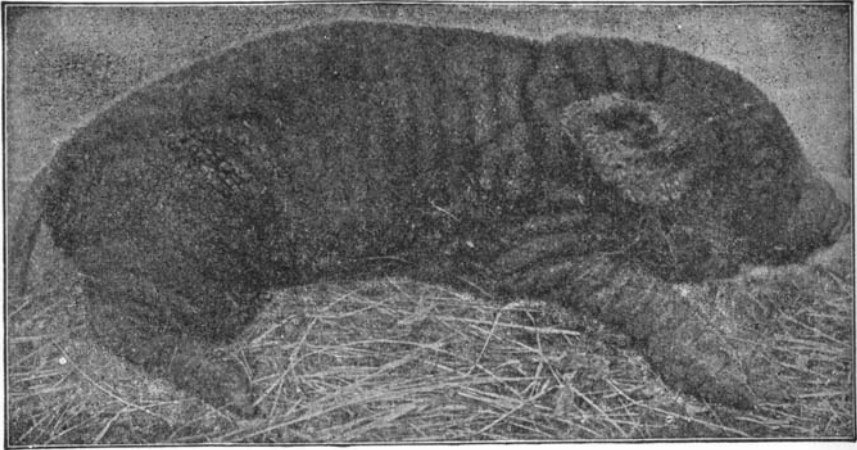


FIG. 3.—A SEVERE CASE OF SARCOPTIC MANGE

From *Special Pathology and Therapeutics of the Diseases of Domestic Animals*.  
(By permission of the publisher.)

in handling sarcoptic mange in swine, as this parasite attacks other farm animals, and also man.

### RED OR DEMODECTIC MANGE MITE

(*Demodex folliculorum suis*, Fig. 4)

Demodectic mange is occasionally encountered in hogs. The causative agent is a very small, slender mite which penetrates the hair follicles and oil glands of the skin, usually appearing first in the region of the snout and spreading over the parts of the body where the skin is thin, especially along the belly. The thick-skinned areas, such as the back, are seldom affected. This mite produces mild inflammatory pustules ranging in size from that of a pinhead to that of a hazelnut. These pustules may break and discharge pus or a caseous substance.

*Diagnosis.*—A positive diagnosis of either type of mange cannot be made with the naked eye. The presence of small blisters, crusts, or scabs around the eyes and root of the tail, accompanied by rubbing and scratching, is suggestive of the presence of mange mites. By the aid of a good magnifying glass, the sarcoptic mange mites may sometimes be seen as tiny moving specks if skin scrapings from the affected areas are placed on dark paper and slowly warmed. Definite diagnosis can be made by a microscopic examination of the scrapings. Deep scrapings (down to



FIG. 4.—Red mange mite (*Demodex folliculorum*). These mites burrow into the hair follicles. Enlarged. (U. S. D. A.)

the "quick") from the parts recently affected are most satisfactory for laboratory diagnosis.

#### HOW TO PREVENT INFESTATION

- (1) Inspect all newly purchased animals to determine their freedom from lice or the skin lesions of mange before they are allowed to come in contact with other hogs.
- (2) Watch the pigs closely in order to detect the presence of lice and mites, and isolate and treat affected animals without delay.
- (3) Avoid overcrowding the hog houses.
- (4) Clean and disinfect the houses.

#### TREATMENT FOR LICE

There are several practical and effective methods of treating hogs infested with lice. Crude petroleum oil, crank-case oil, and kerosene emulsion, if properly applied, are all efficacious. Kerosene emulsion is prepared by adding 2 gallons of kerosene to 1 gallon of warm water, in which has been dissolved  $\frac{1}{2}$  pound of castile soap. The oils are used undiluted.

In addition to crude petroleum oil, which is the natural, unprocessed oil, there are many brands of partly processed oils on the market. The thinner oils are preferable to the thicker ones. Fuel oil is commonly used. The effectiveness of this oil may be increased by the addition of 1 quart of kerosene to 5 gallons of oil. Many of the commercial dips consist of the crude oils with various ingredients added to command a higher price. It is unnecessary, however, to pay exorbitant prices for such dips, which have little, if any, advantage over crude petroleum for destroying lice.

The method of applying treatment will be determined by the number of hogs involved and the facilities available for the work. The quarters occupied by lousy hogs may become infested, necessitating the burning of old bedding and the disinfection of hog houses at the same time the pigs are treated for lice, so as to prevent reinfestation. To avoid the danger of pneumonia, lousy animals should not be dipped or sprayed in cold weather.

Since oil does not destroy the eggs of the lice, it is advisable in using any of the following methods, to re-treat in seven to ten days.

(1) *Hand Application.*—Applying crude oil by means of a cloth or brush is a practical measure when only a few animals are to be treated.

(2) *Spraying or Sprinkling.*—Hogs may be sprayed with crude petroleum oil, the ordinary spray pump or hand sprinkler being used for the purpose. They should then be confined in a small pen until by rubbing against each other each hog is thoroly oiled. This method is commonly used even on farms where dipping tanks are available. It is

economical, quickly executed, and the results are satisfactory. Crude petroleum oil is probably the best and cheapest remedy. A mixture of equal parts of cottonseed oil and kerosene is also recommended.

(3) *Dipping*.—An effective method of treatment is dipping. Vats for this purpose may be built of wood or concrete. The vat should be 54 inches deep, 24 inches wide at the top, and 12 or 16 inches at the bottom. The length at the bottom should be about 10 feet, and the ends slanting so as to give a measurement of about 20 feet at the top. A dripping pen should be provided at one end and a forcing chute at the other. The dipping vat should be filled with water to a depth of 40 to 44 inches, which will allow for a two- to four-inch covering of oil on the surface.

(4) *Medicated Hog Wallows*.—A simple method of treatment is that of placing crude oil in the hog wallows. A cement wallow six or eight inches deep is ideal for this purpose. Creolin or other coal-tar products may be mixed with the water in sufficient amounts to make a 1-percent solution. The best and safest procedure is to add enough crude oil to the water in the wallow to form a layer of oil about two inches deep. The oil should be added in the evening, as the heat of the sun during the day may cause the oil-covered water to become very hot. If added in the evening, most of the oil will be smeared over the pigs and carried away before noon of the next day. The wallow should be provided with a drain as it is important that it be kept clean and sanitary to avoid serving as a breeding place for vermin.

(5) *Other Methods of Treatment*.—Other methods of treatment, such as the use of mechanical oilers, may be employed. Mechanical oilers, however, often clog up and therefore cannot be relied upon in the treatment of lice. Rubbing posts wound with ropes or sacks soaked in crude oil are often used. This simple method helps to keep the parasites in check but is insufficient for handling badly infested herds.

Lice powders, tho very convenient to apply, especially in cold weather, are usually not entirely satisfactory in the eradication of lice.

#### TREATMENT FOR MANGE

The most satisfactory treatment for mange in pigs is lime and sulfur. This is prepared by mixing in the following manner 12 pounds of unslaked lime, 24 pounds of sulfur, and sufficient water to make 100 gallons. Slake the lime with enough water to make a thin paste and add the sulfur. Then add the lime and sulfur paste to 30 gallons of boiling water and boil the mixture for one and one-half to two hours, or until the sulfur disappears from the surface, when the solution becomes a dark amber color. Stir the mixture frequently while boiling. Allow the solution to stand until all the solids have settled to the bottom; then



draw off the clear fluid and add sufficient water to make 100 gallons. The sediment in the bottom of the container should be discarded, as it is caustic in character and dangerous to apply.

The clear lime and sulfur dip should be applied to the entire body of the pig with a stiff brush after the dirt, scabs, and dried secretions have been removed.

## INTERNAL PARASITES

The more important internal parasites of swine are lungworms, roundworms, thorn-headed worms, trichinae, and kidney worms.

### LUNGWORMS

(*Metastrongylus apri*, Fig. 5)

These are fine, threadlike, white or brownish worms found in the bronchi, or air passages, of the lungs. Unless they are present in sufficient numbers to obstruct the bronchi, they are likely to be overlooked. The life history of the lungworm is not known. By some means the eggs containing living embryos are deposited in the lungs. The young worms ascend the windpipe and are probably swallowed, eventually reaching the ground in the manure. The stages of development beyond that of the newly hatched larva have not been observed. In moist soil the young worms remain alive for long periods of time without further development.

The method by which they gain access to the lungs and the changes they undergo have not yet been fully determined.

A heavy infestation of lung worms causes inflammatory changes in the air passages, which may terminate in bronchial pneumonia. In badly affected herds the resultant pneumonia may cause either death in a large number of animals, or general unthriftiness accompanied by a chronic cough. A mild infestation of lung worms uncomplicated with other conditions causes no apparent ill effects in older hogs altho intermittent attacks of coughing frequently accompanied by a nasal discharge may be noted.

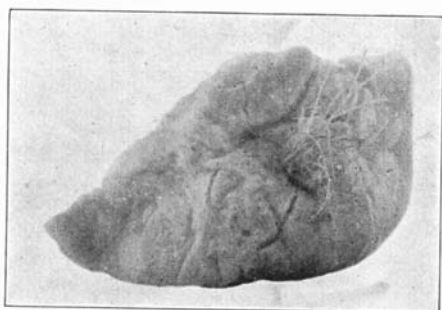


FIG. 5.—Lungworms (*Metastrongylus apri*) as observed in a cross-section of infested lung. These parasites irritate the lung passages, inducing unthriftiness and death from bronchial pneumonia.

*Prevention.*—In securing new stock, if possible avoid hogs having a chronic cough. If such hogs are purchased, do not allow them to come in contact with the other hogs or to contaminate the premises until the possibility of the presence of lungworms is eliminated. Avoid the use of low, damp lots or pastures, as the young worms apparently develop in such places. Clean up all pens and houses. Burn all litter and manure from infested hogs. Avoid dusty quarters.

*Treatment.*—Treatment of affected animals is not very successful. It is difficult to obtain a drug so selective in its action that it will kill the worms without destroying also the delicate lung tissues. Aside from providing wholesome feed and healthful surroundings, little can be prescribed in the way of treatment. Affected animals should be marketed, and the premises should be cleaned and disinfected, as outlined on page 17.

### ROUNDWORMS

(*Ascaris lumbricoides*, Fig. 6)

The mature common intestinal roundworm is found as a rule in the small intestines, but occasionally in the stomach. Sometimes these worms migrate into the bile ducts of the liver. The mature worm

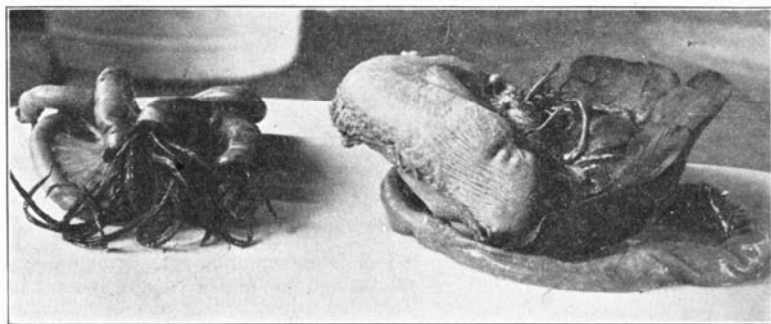


FIG. 6.—ROUNDWORMS (*Ascaris lumbricoides*)

This parasite is found in the intestines and may migrate into the bile ducts of the liver.

measures from 6 to 12 inches or more in length and about one-eighth of an inch in diameter. It is believed at present that the ascaris of man and that of swine are the same species; but most cases of roundworms in human beings probably trace back to other persons harboring worms, rather than to pigs. In rural districts, however, the danger to children from eating food contaminated with swine ascaris eggs is not to be overlooked. The eggs may develop to the larval stage in the intestines of the child and be carried to the lungs, where they may work serious injury.

*Life History.*—The life history of the ascaris, or roundworm, has in recent years been worked out by Stewart, of England; Ransom and Foster, of the Federal Bureau of Animal Industry; Yoshida, of Japan; and others. According to their findings, the eggs are liberated by the mature worm while in the intestinal tract and pass out with the fecal excrement. If exposed to direct sunlight in a dry place, the eggs may live only a short time. In cool, shady places, however, the eggs may remain dormant for many months. In moist surroundings protected from sunlight, the embryo worm develops in the egg in a few weeks (see Fig. 7). After a period varying from two weeks to several months, depending upon the amount of warmth and moisture present, the embryos in the eggs reach what is called the infective stage. If eggs in the infective stage are swallowed by pigs, the embryos escape from within the shell after the eggs reach the small intestine. The larvae then penetrate the walls of the small intestine and are carried by the blood stream through the liver to the heart and lungs. In the lungs, the larvae migrate through the blood vessels into the lung tissues and so gain access to the air spaces. The injuries caused by the migration of the larvae through the lungs may result in pneumonia, difficult breathing, so-called "thumps," and other pulmonary disturbances. From the air spaces, the larvae pass up the windpipe into the back of the mouth and are swallowed. In the intestine the small worm grows to maturity. A period of two or three months is required to complete the life cycle, that is, the period from the time the infective egg enters the host until the worm reaches the mature stage in the intestine and begins egg production. (See Fig. 8.)

*Symptoms.*—Pigs harboring the common intestinal roundworm frequently become unthrifty. Young pigs are much more susceptible to an invasion of ascarids than are pigs half-grown or older. Suckling pigs often swallow eggs in the infective stage which have adhered to the teats and udder of the sow. The swallowing of eggs in large numbers by young pigs may be followed by difficult breathing, or "thumps." Many pigs die of a heavy lung infestation, while others survive but remain unthrifty. The larvae from a few eggs may pass through the lungs gradually without causing symptoms of pulmonary ascariasis. In the small intestines, however, they may develop in numbers sufficient to cause obstruction. Even a few worms in the intestine may injuriously affect young pigs, especially if the gall bladder and ducts of

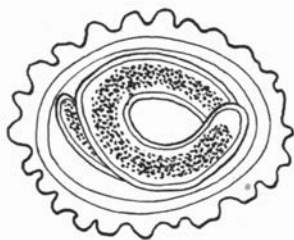
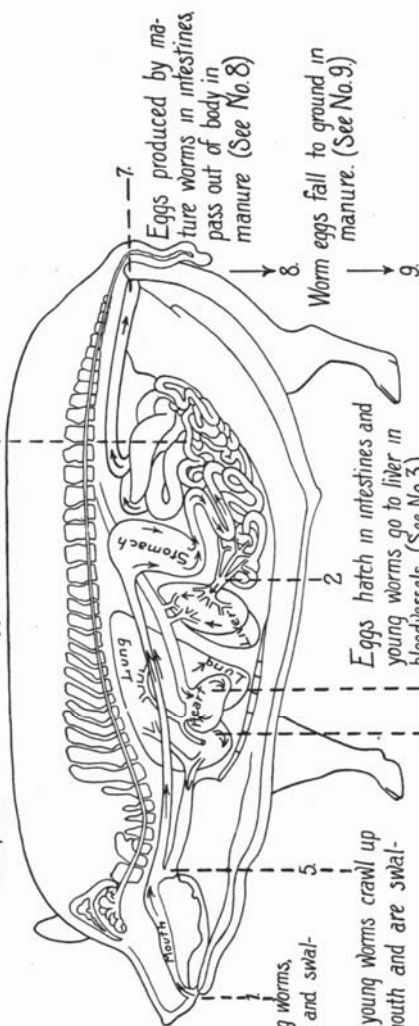


FIG. 7.—Egg of roundworm in the infective stage. The embryo is coiled within the egg shell. Diagrammatic.

## The Roundworm's Journey Thru The Pig

6. Young worms that have passed thru lungs and are swallowed, grow to maturity in about 2 months. They continue to live in intestines and produce millions of eggs. (See No.7)



1. Worm eggs containing young worms, are picked up from ground and swallowed. (See No.2.)

2. After a few days in lungs, young worms crawl up windpipe into back of mouth and are swallowed. (See No.6.)

3. From heart, young worms go to lungs in bloodvessels and grow several times larger. (See No.5.)

4. From liver, young worms go to heart in bloodvessels. (See No.4)

5. Eggs hatch in intestines and young worms go to liver in bloodvessels. (See No.3.)

8. Worm eggs fall to ground in manure. (See No.9)

9. In a few weeks young worms form inside the eggs on the ground.

7. Eggs produced by mature worms in intestines pass out of body in manure. (See No.8)

FIG. 8

the liver are invaded. The common intestinal roundworm has been found a few times in the mesentery, having perforated the wall of the intestine.

*Treatment.*—No successful treatment for young pigs suffering from ascaris pneumonia has been devised. An intestinal roundworm infestation, however, may be treated successfully. Reliable vermifuges include oil of chenopodium and santonin. According to Hall's experience, chenopodium gives better results than santonin. The dose of santonin is 5 grains for a 50-pound pig. It is generally given in a capsule with 2 grains of calomel. Oil of chenopodium should be used in doses of 2 cubic centimeters to each 50 pounds of live weight, and should be given in capsules or mixed with one ounce of castor oil and given with a dose syringe. If a large number of pigs are to be treated, mix one-half pound of oil of chenopodium with sufficient castor oil to make one gallon, and give one ounce of this mixture to each 50-pound pig. If chenopodium is given in capsule form, it should be followed two or three hours later by a quick-acting purgative in the feed. Epsom salts can be used for this latter purpose with good results, in amounts of one ounce per 100 pounds live weight.

Drugs possessing vermicide or vermifuge properties, if properly administered, may kill or stupefy the worms so that they are readily expelled. Regardless of the remedy used, the best results are obtained only when the treatment is carefully administered in every detail. This begins with the preparation of the pig by fasting for 24 to 36 hours before the treatment. Care must also be taken in administering capsules to avoid a fatal blood poisoning induced by lodgment of the capsule in the throat. The administration of purgatives, such as castor oil, in addition to the vermifuge, aids in expelling dead or stupefied worms and in protecting animals from the poisonous effects of the worm remedies. Pigs should be confined in a small place during the treatment, in order that the expelled worms may be collected and destroyed.

Various vermifuge powders and liquids in the form of stock tonics and worm medicines are advertised as effective in the treatment of worms when mixed with feed or water. Many of these so-called remedies have very little value. Moreover, the mixing of any medicine in the feed does not insure a proper dosage to each individual. Some animals may not eat enough of the feed to include the necessary amount of the drug and some may take an overdose. Cases of medicinal gastritis are often traceable to the consumption of irritant drugs in excessive amounts. In the roundworm treatment, the giving of the drug in the feed would partially nullify the value of fasting, as well as dilute the drug, thereby rendering the treatment less effective. The individual administration of the proper dose of an effective vermifuge is as yet the most satisfactory procedure in treating pigs for roundworms. As worm remedies are potent drugs intended to destroy worms, but likely, unless

properly given, to injure the animal seriously, it is advisable to have drugs administered by a competent veterinarian whenever possible. The diagnosis and treatment require training and skill.

*Prevention and Control (McLean County System of Swine Sanitation).*—As treatment is essentially the province of the veterinarian, so is prevention essentially the province of the farmer and stockman. The prevention of ascaris infestation consists mainly in keeping young pigs away from infested places. Ransom and Raffensberger, of the Federal Bureau of Animal Industry, in cooperation with farmers of McLean county, Illinois, have demonstrated the practicability of raising pigs free from parasites. Before farrowing time, the sows are scrubbed thoroly to remove dirt with its content of ascarid eggs from the udder and body so that the young pigs will not be subject to immediate infestation. The farrowing pen is thoroly cleaned with hot lye water (1 pound of lye to 40 gallons of boiling water). Since ordinary germicides do not penetrate the thick covering of the ascarid egg to reach the embryo, dependence must be placed upon cleanliness and the killing effects of scalding water.

Within two weeks following farrowing in a clean, uncontaminated house, the sow and litter are placed in a pasture that has not been used for hogs since cultivation. Legume pastures available in the normal course of crop rotation in Illinois may be utilized, a different field each year being devoted to this purpose. Clean colony houses may be placed in the pasture for shade during the summer. The pigs remain on pasture until they are at least four months old and during this time are not allowed to return to the hog house nor allowed access to old pens recently occupied by hogs. Pigs raised in this manner can be kept free, or practically free, not only from roundworms but from necrotic enteritis, bullnose, and various other bacterial diseases that develop in pigs fed in permanent hog yards. While the McLean county system of swine sanitation may, under certain conditions, seem superfluous and complicated, the fact remains that "an ounce of prevention is worth a pound of cure."

Various mixtures of medicines, consisting of copperas, lime, sulfur, and charcoal, added to the drinking water or kept in self-feeders, have been said to aid in reducing worm infestations. Tests of some of these mixtures have not confirmed this supposition. Mineral mixtures must not be relied upon to prevent losses from worms in young pigs, until further evidence is obtained of their value for this purpose.

#### THORN-HEADED WORMS

(*Macracanthorhynchus hirudinaceus* or *Echinorhynchus gigas*, Fig. 9)

The thorn-headed worms are long, round, white worms somewhat resembling the common intestinal roundworm. These worms are equip-

ped with several rows of hooks which firmly attach the head to the intestinal wall of the host; in this respect they differ from the common intestinal roundworm. The eggs of the thorn-headed worm pass out in the feces and are eaten by the white grubs, the larvae of the May-beetle. In the May-beetle larvae the eggs are hatched, and the young

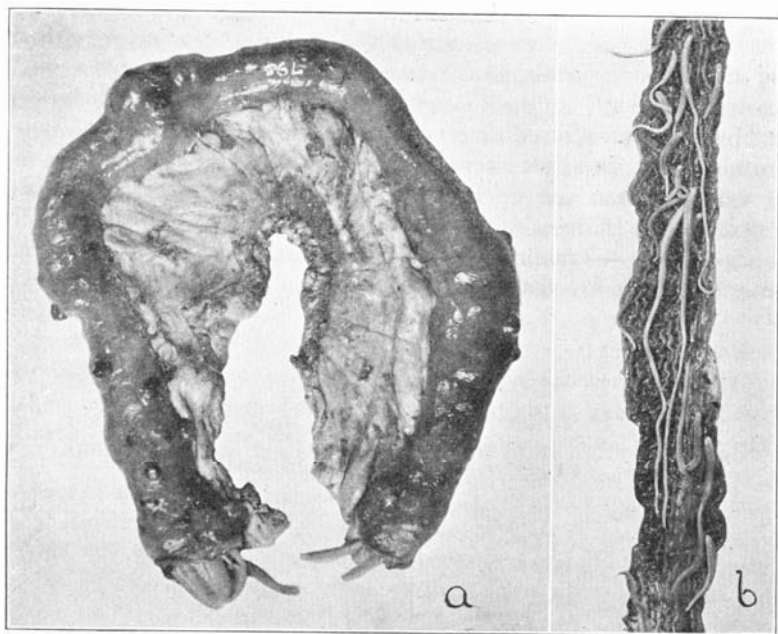


FIG. 9.—THORN-HEADED WORMS (*Echinorhynchus gigas*)

(a) Showing nodules on the outer wall of the intestine indicating the points of attachment of the worms. (b) Intestine, showing how the parasite is attached to the inner lining.

embryo undergoes development and becomes enclosed in a sac called a cyst. The cysts of the thorn-headed worm enter the digestive tracts of pigs with the ingestion of the infested grub. The cyst wall is dissolved, and the young worm attaches itself permanently to the inner wall of the intestine (see Fig. 9).

*Treatment.*—As yet, no satisfactory treatment for thorn-headed worms has been found, altho some of these worms may be removed by the treatment that is used for ascarids. Bacchus recommends one teaspoonful of powdered copper sulfate (bluestone) per hundred pounds live weight. This should be given in a bran mash morning and evening, after the animals have been fasted for 24 hours. Rotation of pastures and the plowing of infested lots are very helpful measures in

the control of this parasite. Since swine become infested by rooting up and eating white grubs, nose-ringing to check rooting will assist in preventing infestation.

### KIDNEY WORMS

(*Stephanurus dentatus*)

The kidney worm is a small, mottled, white, red, and black worm often found imbedded in the fat in the region of the kidneys tho seldom in the kidney itself, as the name might suggest. These worms are occasionally found in the liver. The larvae may enter the intestinal tract by being swallowed or may penetrate the skin. If the kidney fat is reached, the parasites survive and grow to maturity. These worms, tho very common in the southern states, have been observed only occasionally in Illinois.

*Treatment.*—Treatment is of questionable value, owing to the location of these parasites in the host.

### TRICHINAE

(*Trichinella spiralis*)

Trichinosis in swine is caused by a microscopic parasite, which lives during its adult stage in the small intestines of the hog and the rat. The young of this parasite form cysts which become imbedded in the voluntary muscles of the animal harboring the adult (see Fig. 10). When meat which has been infested in this way is eaten by a hog or other animal, the live larval worms are set free in the intestinal tract. In the intestine they grow to sexual maturity within a few days. The female burrows into the intestinal wall and there deposits 1500 to 2000 young worms. These larval worms are then carried to all parts of the body by means of the blood and lymph streams. The muscle fibers are penetrated and worms become encysted.

*Prevalence.*—The Federal government at one time maintained a trichinae inspection of all hog carcasses exported to certain foreign countries. According to Ransom, of the Zoological Division of the

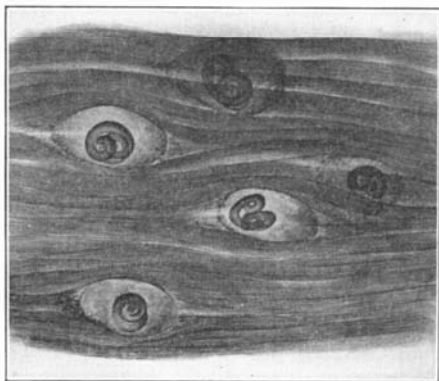


FIG. 10.—Muscle trichinae (*Trichinella spiralis*)  
After Raffensperger



Bureau of Animal Industry, eight million hog carcasses were inspected microscopically during the period of nine years, 1898-1906. It was found that active trichinae occurred in only one out of every seventy-one hogs, a percentage of approximately 1.41. An examination of the literature on this subject, however, shows that trichinosis is by no means an unusual disease in the human family. During the period of seventy-two years which terminated in 1914, ninety cases of human trichinosis and twenty-four deaths from this disease were reported in Illinois.

*Sources of Infestation.*—Hogs become infested as the result of eating the carcasses or slaughter-house offal of infested hogs, infested rats, or garbage containing scraps of infested pork. The possibility of the propagation of trichinae through the ingestion of feces of infested animals is not acknowledged by most writers. While certain birds may harbor the adult parasite in the intestine, the larval form produced do not become encysted in the muscle tissues of birds. Trichinae are transmitted from swine to man only through the consumption of improperly cooked pork.

In a majority of cases human trichinosis is traceable to homemade sausage or sausage prepared in small meat shops. Each year many samples of homemade sausage are submitted to the Laboratory of Animal Pathology and Hygiene of this Station for microscopic examination. Even when such examinations are negative, the necessity of proper cooking must not be overlooked. The Bureau of Animal Industry recommends a minimum temperature of 137° F. as necessary for the destruction of trichinae. Altho experiments conducted by this bureau show that salt and certain pickling and curing processes are of some value in the destruction of trichinae, no agency is as reliable as cooking in rendering trichinous meat harmless. It must be remembered that trichinae may remain alive in meats for a long period of time, altho drying and freezing reduce the vitality and often kill the parasites.

*Prevention.*—The most important point in the prevention of trichinosis in swine consists in the proper destruction of the carcasses of hogs and rats which die on the farm. The feeding of unsterilized slaughter-house offal or garbage containing pork scraps should also be guarded against.

The prevention of the disease in man can be largely accomplished by discouraging the dangerous practise of eating raw or insufficiently cooked pork.

## METHODS OF DISINFECTING HOG HOUSES AND PENS

In cleaning and disinfecting hog houses, remove all coarse litter, dirt, and manure with fork, shovel, and broom. Hot lye water or live steam should be liberally applied so as to penetrate all cracks and crevices. Remove the dirt with a broom as it becomes loosened. After

this has been done thoroly, a coat of whitewash, or paint, or a coal tar disinfectant may be applied. Sprinkling lye water or disinfectants, such as cresol compound, on surfaces not thoroly cleansed does very little good. The parasite eggs underneath the dirt remain unharmed and capable of infesting a susceptible host.

Infested ground is best handled by plowing and seeding to forage crops. Pens that cannot be plowed may be sprinkled with unslaked lime. Litter and manure should be hauled into fields far removed from hog pens or burned immediately upon removal. Carcasses of dead pigs and other animals should be burned or buried deeply.

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CLEAN UP  
HOG LOTS  
ROTATE PASTURES

BETTER THAN  
MEDICINE FOR MANY  
SWINE DISEASES

AGRICULTURAL EXTENSION SERVICE  
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