Common Parasites of Horses

Before treatment for intestinal parasites

Six months later

UNIVERSITY OF ILLINOIS
COLLEGE OF AGRICULTURE AND AGRICULTURAL EXPERIMENT STATION

Circular 397
PARASITES sap the energy and lower the efficiency of horses on Illinois farms. In addition to general unthriftiness, catarrh, indigestion, and colic often are associated with parasitic infestation. Intestinal parasites not only injure the host, but also waste valuable feed. Grain and hay are too expensive to feed to worms.

Farmers have often consulted veterinarians for relief from parasites in their horses. Upon veterinary advice a few farmers have used parasite control measures for many years. However, a more logical way to cope with this widespread parasitic menace is to make a systematic community effort. The advantages of area control have been demonstrated in 66 Illinois counties since January, 1931, when a systematic effort was started in Logan county.

In 1931, 8,461 horses and mules belonging to 1,090 farmers were treated for bots and roundworms by local veterinarians in eight Illinois counties cooperating under the Area-Control plan outlined in Project 1080 of the Agricultural Extension Service, University of Illinois. In 1932, 129,109 horses and mules belonging to 20,851 farmers in 66 Illinois counties were treated for bots and roundworms.

Simple procedures by which these parasites can be suppressed and controlled are described in this circular. Further information about the Area-Control plan can be obtained by writing the Laboratory of Animal Pathology and Hygiene, University of Illinois, Urbana.

Cover Illustration. The horse shown on the cover was about to be discarded when it was treated for bots and other intestinal parasites. The picture taken six months later tells its own story. The improvement noted in this animal has been duplicated in varying degrees by thousands of other treated horses in Illinois.
The Common Parasites of Horses

By FRANK THORP, JR., and ROBERT GRAHAM

FEW HORSES are entirely free from parasites of one kind or another. Altho the injury often is unnoticed, the loss in feed bills and work may be more costly over a period of years than an attack of some contagious disease. Farmers can avoid these losses by using simple preventive measures. This has been demonstrated in the project on horse-parasite control now being carried on throughout Illinois by cooperating licensed veterinarians, farm advisers, and farmers under the direction of the Extension Service of the College of Agriculture, University of Illinois.

The common parasites of horses on Illinois farms include the nose, throat, and ordinary botflies (Gastrophillus spp.), the stomach worms (Habronema spp. and Trichostrongylus axei), the large intestinal roundworm (Ascaris), palisade worms (Strongylus spp.), the pinworms (Oxyuris), the thread worms (Setaria), and tapeworms (Anoplocephala spp.). These and other internal parasites cause indigestion, colic, and loss of vitality. External parasites such as lice and mites irritate the skin and, like internal parasites, cause unthriftiness. Colts are more susceptible than mature horses, altho chronic or longstanding parasitic infestations of mature animals lead to unthriftiness and general ill health.

Injury by Parasites May Escape Notice

Despite the widespread parasitic diseases of horses on Illinois farms, these troubles have attracted less attention than contagious diseases. This is largely because of the vague symptoms of parasitism. The injury or immediate loss is not so striking as in contagious diseases, such as distemper, influenza, or moon blindness. Neither are symptoms of parasitism definite, as in lameness, poll evil, fistulae, and side bones.

In the early stages of parasitism there is a slow and often scarcely noticeable slump in the condition of infested horses. Such gradual inroads fail to attract owners promptly, and some farmers may not appreciate the difference between horses that are bothered with parasites and those that are not—they commonly speak of their horses as being "a little off condition" or as "hard keepers." Since the cause is not suspected, proper preventive and control measures may not be taken for many months. Obscure or indefinite symptoms of unthriftiness in horses should be taken as a warning. A careful diagnosis by a veterinarian may reveal some type of parasitic infestation.

1FRANK THORP, JR., Associate in Animal Pathology; ROBERT GRAHAM, Chief in Animal Pathology and Hygiene. For detail drawings of the different stages of several of the parasites described herein the authors are indebted to C. O. MOHR, of the Illinois Natural History Survey.

A parasite is a living organism which, during all or part of its life, lives on or in another living organism and is dependent on it for nourishment. Parasitism means infestation with parasites; a parasitized animal is one infested with parasites. An external parasite is an organism which spends all or part of its existence on the outside of the host. An internal parasite is an organism which spends all or part of its existence inside the host's body.

Injury Manifested in Many Ways

Injury caused by parasites may be in proportion to their numbers, as well as to the length of time the animals are infested. The common horse parasites cause irritation and discomfort, loss of nourishment, greater susceptibility of the animal to bacterial diseases, absorption of poisons, and destruction of tissue in varying degrees.

Parasites Pester and Irritate.—Botflies are a dangerous pest in the summer months when they are laying eggs on the nose, throat, or legs of the horse. Horses at work often become unmanageable when attacked by these pests. Animals on pasture spend the time fighting botflies when they should be grazing. The bots attached to the stomach walls produce irritation and interfere with digestion. A bot infestation of long standing thickens the lining of the stomach, and in severe cases causes many small tumors in the stomach. Palisade worms (strongyles) with their heads deeply imbedded in the walls of the intestine cause intense irritation. Larvae of certain parasites invade the blood vessels of the intestine and cause painful colic or even death. Parasites that are unattached in the intestinal tract of horses, such as the common roundworm (ascarid), cause irritation by their movement. Furthermore, it is not uncommon for ascarids to become so massed together that they interfere with the normal passage of food or even cause stoppage of the bowels. Animals heavily infested may even suffer illness and die from obstruction of the intestines. Pinworms produce intense irritation and cause the infested animal to rub its posterior parts on

Fig. 1.—Nursing Colts May Become Infested With Parasites

An infested colt shows paleness in mucous membranes, a rough coat, and general unthriftiness and loss of weight accompanied by a chronic cough, marked languor, and fatigue. Parasitized colts develop slowly and frequently have a habit of eating dirt or droppings. Prevention of worm infestation in young foals is dependent upon clean stalls for the mare at foaling time and pastures free from worm infestation. Worm infested colts should be treated early in the fall to avoid chronic unthriftiness during the winter.
(A) Bots attached to inner wall of a horse's stomach. Note nodules and tumors caused by these parasites. The tumors are the result of bots of several years standing. Chronic thickening of the stomach wall interferes with normal digestion. (B) Palisade worms of the Strongylus species. These and other palisade worms bury their heads in the lining of the intestines and cause extensive inflammation. (C) Large intestinal roundworms (ascarids) live unattached in the intestines and cause intestinal catarrh, indigestion, and unthriftiness. (D) Large intestinal roundworms and bots expelled by the same treatment. These were passed by one horse a few hours after treatment. Many more were passed on successive days.

Hard objects. Threadworms, in the larval stage, may penetrate the eye, causing irritation and in time possibly blindness. The tapeworm interferes with the passage of food and causes digestive disturbances. Lice and mites irritate by their continual movements and destruction of tissue.

Parasites Waste Feed.—Horses that harbor parasites must feed them. Infested animals, therefore, require more nourishment than animals free from parasites. At the same time the infested animal must prepare the food for the parasite. The energy required by the animal to do this is lost for work or for normal development in colts. Some parasites of horses nourish themselves by sucking the blood of the host. This may be more injurious than the direct absorption of nutrients from the intestine. Parasites in the intestinal tract also affect digestion by interfering with the function of the intestinal glands and the normal absorption of food.

Parasites Increase Susceptibility to Bacterial Disease.—Parasitized animals are particularly susceptible to bacterial diseases. Bots attached to the walls of the stomach and the intestine weaken the natural defense of the
FIG. 3.—Covers on Water Tanks Keep Dirt, Manure, Leaves, Barnyard Fowls, Pigeons, and Sparrows from Contaminating the Water

FIG. 4.—Fenced-Off Manure Pits Keep Animals Away from Dangerous Sources of Infestation

FIG. 5.—Daily Cleaning of Stalls and Proper Storing of Manure Aid in Suppressing Parasites
body against disease. By breaking and irritating the lining wall of the intestine, or invading tissues during migration, other parasites may also serve as inoculating agencies, opening the way for the entrance and development of bacteria and their toxins.

**Parasites Secrete Poison.**—Parasites may secrete toxins or poisons that injure the host. Strongyles as well as ascarids produce primary toxins. Some parasites produce poisons which attack and destroy the red blood cells of the host, causing an anemia or impoverished blood. Poisons produced by parasites may cause weakness and even death of horses in some instances.

**Parasites Destroy Tissue.**—Parasites destroy tissue at the point where they are attached. Chronic inflammation of the intestine is not uncommon in horses as the result of an infestation of palisade worms. Flies often bite the skin, causing it to become raw and bleed. Constant stamping of the feet in fighting flies may break the hoof wall. Irritation and thickened skin caused by lice and mites lowers the quality of hides.

### Waste and Injury Easily Prevented

Simple control measures will save all this injury and waste. On farms where systematic treatment of horses for intestinal parasites has been adopted, there are fewer cases of colic; and colts protected from parasite infestation by treatment and thru sanitary management are thriftier than they otherwise would be. Horses free from parasites breed better, work better, are easier to handle, and require less feed to keep them in good condition.

Evidence of this has already developed in the College's state-wide extension service project on horse-parasite control which had its beginning in January, 1931. At that time nose-fly control was discussed by a representative of the College of Agriculture, University of Illinois, at a series of five meetings in central Illinois. The first conference was held with approximately 20 farmers at the Logan county farm bureau, Lincoln, Illinois. The increasing losses caused by parasitic diseases in horses, as described by farmers at this meeting, seemed to warrant the application of area methods of control. Headed by Mr. Ray Staats of Beason, Illinois, a staunch advocate of nose-fly control, a tentative community plan was put under way for treating all horses and mules in the Beason district. The general interest of farmers favored the undertaking in this locality, while cooperation of the farm adviser and local veterinarians also was obtained. The favorable results following the treatment of several hundred horses in the Beason neighborhood promptly attracted the attention of the farmers in surrounding counties. A conference with local veterinarians followed, and as a result 8,461 horses belonging to 1,090 farmers in eight counties were treated for bots. Practically half the horses and mules, or 4,258, in Ford county were treated; 2,082 in McLean county; 1,284 in Logan county; 253 in Iroquois county; 236 in Tazewell county; 209 in Champaign county; 95 in DeWitt county; and 44 in Livingston county.

The idea of systematic state-wide area-control of botflies and common intestinal parasites of horses took definite form in the minds of farmers, farm advisers, and veterinarians at a meeting held at the College of Agriculture in May, 1931, when Dr. E. M. Nighbert, Extension Veterinarian in Animal Parasite Control, U. S. Department of Agriculture, discussed plans
for suppressing parasites of horses. Horse-parasite control was given further impetus by the improvement noted in treated horses. On some farms an improved condition of horses was noticed by owners within thirty days after treatment.

### Nose Botfly Not Common in Illinois

One of the valuable findings made in carrying out the area-control plan in the first eight counties was that, contrary to common opinion, the nose fly is not the most common of the botflies in Illinois. Arrangements were made with local veterinarians and farmers to submit samples of bots from treated horses for identification. A total of 575 bots from forty-six farms in five central Illinois counties showed that 258 were throat or chin bots, 315 common bots, and only 2 nose bots. Thus the throat and common botflies, and not the nose botfly, became the target of control measures. There is something to be gained at this time in preventing nose botflies from becoming established in Illinois.

### Bot Treatment Effective for Large Roundworms

The remedy used by veterinarians in the preliminary treatment of horses for bots also expelled roundworms. Many horses treated for bots proved to be infested with large intestinal roundworms. Thus the significance of roundworm infestation on many farms was brought to the owners' attention.

### Studies Reveal Best Treatments

In connection with the routine treatment employed by veterinarians in the field, the value of different bot and worm remedies has been studied at the Illinois Experiment Station. Thru courtesy of Chappel Brothers, Rockford, Ill., approximately 80 head of horses were treated and the stomachs examined from one to three weeks after treatment. The efficiency of the different treatments, based on the number of attached bots in the stomachs of treated horses compared with untreated horses, is shown below:

<table>
<thead>
<tr>
<th>Number of horses</th>
<th>Treatment</th>
<th>Average number of bots in stomach</th>
<th>Efficiency index perct.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Liquid carbon disulfid..........</td>
<td>Less than one</td>
<td>99.33</td>
</tr>
<tr>
<td>6</td>
<td>Chlorinated carbon tetrachlorid</td>
<td>7</td>
<td>92.00</td>
</tr>
<tr>
<td>6</td>
<td>Mass powder carbon disulfid....</td>
<td>9</td>
<td>91.1</td>
</tr>
<tr>
<td>6</td>
<td>Chloroform......................</td>
<td>75</td>
<td>25.00</td>
</tr>
<tr>
<td>4</td>
<td>No treatment...................</td>
<td>207</td>
<td></td>
</tr>
</tbody>
</table>

In other tests the administering of two remedies in combination, each of which is effective for a specific type of intestinal parasite when given alone, proved ineffective. Several remedies of suggested value proved

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1. Identifications were made by W. B. Hayes, Associate Professor of Entomology, University of Illinois; and Dr. Maurice Hall, Chief of the Zoological Division, Bureau of Animal Industry, Washington, D. C.

worthless. Veterinarians and farmers are therefore warned against the claims of nostrum peddlers with a "shot-gun" combination of worm remedies for expelling all worms from horses. Parasite remedies of merit are poisonous and must be carefully selected. The basis of their efficiency must be established in critical tests properly controlled.

Critical tests on the dissolution time of hard gelatine capsules containing carbon disulfid showed that the capsules rupture very quickly and allow the carbon disulfid to escape. Such capsules ruptured within fifteen minutes in the stomach of a living horse. It would therefore appear that the administration of carbon disulfid in hard gelatine capsules is efficient and effective.

**Effective Treatment Must Be Properly Administered**

The importance of fasting horses for twenty-four hours before treatment and withholding feed and water for at least five to six hours after treatment has been shown by this work. Proper administration of an effective remedy also is important. Faulty treatment makes it necessary to re-treat the animal immediately to avoid underdosing. Professional skill is needed in administering volatile remedies since improper dosing may produce death. The cooperation and advice of local veterinarians is needed, since successful treatment depends on proper administration of effective remedies.

**Sanitation Must Not Be Neglected**

Treatment should be followed by sanitary measures to prevent reinfection. Sanitation is the responsibility of the owner. Intestinal parasites are commonly perpetuated by contaminated feces of infested animals getting into feed and water. Simple sanitary measures together with systematic manure disposal therefore are valuable in suppressing intestinal parasites of horses.

![FIG. 6.—Simple, Inexpensive Racks Help Prevent Contamination of Feed](image-url)
Intestinal-parasite eggs that pass out in the manure develop to the infective stage in the surface soil. Poorly drained barnyards and swampy pastures favor the accumulation of manure and the development of parasite eggs and larvae. Low pastures, stagnant surface pools of water, or slews may perpetuate intestinal parasitic diseases of horses. Parasite-infested pastures or yards should not be used for grazing purposes until properly drained. Protection of the water supply also is important. Covered water tanks located near barns will give proper protection. Spreading horse manure on pastures keeps the cycle of infestation going. The continuous feeding of horses on the same ground or in dirty feed boxes or mangers, together with overstocking of pastures year after year, may increase intestinal parasites in horses.

**THE COMMON INTERNAL PARASITES**

A description of the common parasites of horses in Illinois will be helpful to owners in detecting infested animals. The veterinarian, thru his professional skill, can give valuable assistance to owners in the final diagnosis of different parasitic infestations. Likewise, treatment of infested animals should be under veterinary supervision.

**BOTFLIES**

*Gastrophilus spp.*

There are three species of horse botflies in Illinois: the chin or throat fly, the common botfly, and the nose fly. The latter is uncommon, but throat and common botflies are widely distributed in the state.

*Life History.*—All three species lay their eggs on the hair of horses from July to September. The eggs are glued to the hair on parts of the body indicated by the common names of the different species. The three
Botflies are separate and distinct species, yet all have the same life cycle. From the eggs laid on the hair the larvae or bots find their way to the stomach, where they are attached during the fall and winter months. It is not unusual to find 200 to 600 bots firmly attached to the stomach lining. The throat and common bots leave the body directly with manure, while the nose bot reattaches to the rectum and the anus before it finally passes out. The bots pupate in the ground and finally emerge as adult flies during the summer months to lay their eggs on the hair of the horse. For diagram of life cycle see Fig. 9.

**Symptoms and Lesions.**—Horses that harbor large numbers of bots in the stomach may suffer from intestinal disturbances such as colic. The hooks of the bots imbedded in the wall of the stomach, as well as their spines on the body surface, cause irritation. Large numbers of bots also cause unthriftiness, as well as colic, and may even obstruct the opening at the junction of the stomach and small intestine. During the time nose bots are attached to the rectum, horses may show signs of pain and itching and rub their posterior parts against the stall partitions in an effort to dislocate the parasites.

**Treatment.**—Animals to be treated may be allowed water but no hay, grain, bedding, straw, or food of any kind for twenty-four hours. Water as well as feed should be withheld for five hours after treatment.

Carbon disulfid has proved the best treatment. It is inflammable and must be handled cautiously. Powdered carbon disulfid is sometimes recommended, but the results indicate that it is somewhat less effective than the liquid form. Chlorinated carbon tetrachlorid often will remove more than 90 percent of the bots from the stomach in a single dose. Since bots

![Fig. 8.—INJURY TO WALL OF STOMACH FROM BOTS](image-url)
(1) Flies pester horses from July to frost, laying their eggs on the hairs of the nose, throat, and legs. (2) In the eggs larvae develop in two weeks or less and enter the digestive tract. (3) Larvae spend the winter months in the stomach, where they are a drain on the animal; in the spring they pass out in the manure. (4) In the ground pupae develop from the larvae. During July to September these pupae become flies, which start the life cycle all over again.

(Fig. 9)
attached to the rectum are difficult to remove, the treatment should be administered during December and January, before migration from the stomach starts.

The proper dose of carbon disulfid is 6 fluid drams (24 cc.) for each 1,000 pounds live weight. Caution is necessary in administering carbon disulfid, as it causes a local inflammation where it comes in contact with mucous membranes. The breaking of a carbon disulfid capsule in the laryngeal region may result in the drug entering the lungs, and causing mechanical pneumonia. There were, however, relatively few fatalities reported among more than 137,000 horses treated in Illinois by veterinarians. Horses pass bots for 24 hours to 17 days or longer following treatment. Purgatives are dangerous and should not be given following the administration of carbon disulfid.

**ROUNDWORMS**

Roundworms, or threadworms, are by far the most prevalent parasites of horses. These worms are elongated, cylindrical in shape, and usually taper at both ends. They vary greatly in color and size. The majority of the roundworms are yellowish in color, but some are white or grayish white while others are pinkish or blood red.

The large intestinal roundworm, or ascarid, is the longest, varying from 6 inches to over a foot in length. The *Strongylus* species (palisade worms) vary from 2 inches to a little over half an inch in length. The smallest of the roundworms, the small stomach worm, may be less than an inch long.

Roundworms reproduce by eggs deposited by the female worm. These eggs are usually deposited in the intestinal tract of the horse and are elimi-
nated in the manure. While some species of roundworms must be taken up by an intermediate host, in which they undergo part of their development, most of the roundworms which occur in the horse are transmitted directly by the eggs and larvae.

Stomach Worms

*(Hebronema spp. and Trichostrongylus axei)*

Large stomach worms (*Hebronema spp.*) are slender, whitish in color, and vary in length from 1/2 to 1 inch. They occur either free in the stomach, covered by mucous, or attached to the stomach wall or in tumors of the stomach wall. The small stomach worm (*Trichostrongylus axei*) is very slender and about 1/2 inch in length.

*Life History.*—The eggs of large stomach worms are deposited by the female in the stomach of the horse and pass out of the body with the manure (Fig. 11). The eggs are swallowed by the maggots of house flies, stable flies or other flies, which breed in horse manure, and additional development of the eggs takes place which keeps pace with the physical development of the maggots. Horses become infested with stomach worms by swallowing live infested flies or infested flies that have been dead for a short time. Possibly a more common way in which horses become infested is as follows: as the infested flies suck moisture from the nose and lips of the horse the larvae present in the mouth parts of the flies escape and are readily swallowed by the horse, thus reaching the stomach of the horse. The life history of the small stomach worm has not been definitely worked out.

*Symptoms and Lesions.*—These worms attach themselves to and penetrate into the stomach wall, allowing bacteria to invade the tissues. Worms which become embedded in the stomach wall produce tumorous growths. Digestion is impaired and the tumors may mechanically affect the passage of food. The symptoms and lesions for the small stomach worms are similar to those of the large stomach worms.

*Treatment.*—The treatment for large stomach worms consists of the same amounts of carbon disulfid as used for bots and ascarids (pages 11 and 13). After fasting the horse, it is desirable, previous to treatment, to wash the stomach by means of a stomach tube with a warm, weak solution of sodium bicarbonate. The treatment for the small stomach worm is similar to that outlined for large stomach worms.

*Prevention.*—The practice of general sanitary measures, together with the storage of manure in closed containers away from flies, is the only way to prevent stomach worm infestation. Any measures that prevent flies from breeding aid in the control of stomach worms. Prevention of small stomach worms is similar to that of the strongyles (pages 21 and 23).

Large Intestinal Roundworms or Ascarids

*(Ascaris equorum)*

Large intestinal roundworms are more common and cause more damage in young animals than in older ones. The mature ascarids are yellowish white, cylindrical in shape, 6 to 12 inches long, and taper toward both ends. A single horse may harbor hundreds of large intestinal roundworms.
LIFE HISTORY OF LARGE STOMACH WORMS OF HORSES

Habronema muscae, H. microstoma, H. megastoma

The adult worms lay eggs in the stomach. The eggs are deposited in the stomach and are eliminated from the horse's body with the manure.

The horse is infected by swallowing infested flies or the young worms that escape from the flies while the flies are sucking the moisture on the horse's lips and nostrils.

Young Worms

The eggs are swallowed by maggots of stable flies, houseflies or other flies that breed in horse manure; the young worms further develop in the pupa and are infective when the adult fly emerges.

Eggs

The eggs are passed out in the manure of infested horses and are swallowed by maggots of stable flies, houseflies and other flies and mature in the pupa to the infective stage of the adult fly.

Stomach Worms

Stomach worms cause chronic gastritis and indigestion. The mature stomach worms (A) develop from eggs (B) that gain entrance to the digestive tract by way of the mouth and nose. Sometimes the young larvae are deposited on the lips and nostrils of horses by infested flies. The eggs that pass out in the manure of infested horses are swallowed by maggots (A) of stable flies, house flies and other flies and mature in the pupa (B) to the infective stage of the adult fly (C).

(Fig. 11)

The ascarid of the horse does not infest other animals. In infested horses the parasite is found chiefly in the upper part of the small intestine and less frequently in the stomach and other parts of the intestinal tract.

Life History.—The female ascarid lays large numbers of eggs in the intestine of the host. These eggs, which cannot be seen with the naked eye, pass out in the manure. Each egg is covered with a thick shell which protects it (Fig. 12). Under favorable conditions of temperature and moisture,
the eggs on the ground or in the manure undergo certain changes before they become infective. The eggs must spend two weeks or more outside the host before they become infective to susceptible animals. The appearance of the embryo or tiny worm in the eggs marks the infective stage. The infective egg remains dormant until swallowed by the host. When noninfective eggs are swallowed they do not hatch but pass in the manure.

![Fig. 12.—Eggs of the Large Intestinal Roundworm](image)

The eggs of the ascarid are laid in the intestine of the horse. After passing from the body in the manure, they become infective in about two weeks. (Enlarged 157 times.)

as newly laid ascarid eggs and later reach the infective stage. The infective eggs hatch in the intestinal tract and the live embryos leave the shells. The young worms then burrow into the walls of the intestines to enter the blood stream and migrate to the liver, the heart, and the lungs where they undergo further changes. About one week elapses from the time the young worms are liberated in the intestinal tract until they are present in the lungs in great numbers. The young worms move up the windpipe and are swallowed. Upon reaching the intestine for the second time the young worms develop into mature worms in about two to three months. For diagram of life cycle, see Fig. 13.

**Symptoms and Lesions.**—Ascarids in the intestinal tract of foals and horses may cause digestive disturbances manifested by colicky symptoms. As a result of irritation to the walls of the intestine, a catarrh accompanied by diarrhea alternates with the passage of hard, dry feces coated with mucus. Heavily parasitized colts, as well as horses, may become "pot bellied." Heavy infestations of ascarids may produce illness and even death owing to the horses' absorption of the toxins or poisons produced by the worms. In mild infestations no symptoms are observed other than the occasional passing of a parasite. Heavily parasitized horses have harsh, dry hair and lack vitality. Their expression is dull, and they are listless. Infested colts fail to make normal growth. Roundworms in great numbers may partially obstruct the intestine. Impaction, torsion, and rupture of the intestine may be followed by death. Great numbers of ascarid larvae passing thru the lungs at one time may cause attacks of coughing, bronchitis, and possibly pneumonia.

**Treatment.**—The treatment for ascarids is the same as that for bots (pages 11 and 13).

**Prevention.**—The adoption of strict sanitary measures with horses and foals seems to be about the only way to prevent ascarid infestation. Prevention requires special care of the young animals, inasmuch as they must not have access to the infective eggs of the adult worm. Pregnant mares may be treated with carbon disulfid with little risk or danger of serious
CONSEQUENCES TO THE FOAL, BUT TREATMENT IS PREFERRED BEFORE THE LAST TWO MONTHS OF THE GESTATION PERIOD.

The foaling pen or box stall should be thoroughly cleaned and disinfected before the mare is placed in it. This may be done cheaply and efficiently by scrubbing with a hot lye water solution (1 pound of lye to 40 gallons of
boiling water). Stalls and paddocks should be repeatedly cleaned for the best results. After foaling, the mare and colt should be placed on a pasture to which horses have not had access for at least one year or longer. In the control of ascarids and other intestinal parasites, horse manure should not be spread on horse pastures. However, horses can safely graze on pastures fertilized with cow or sheep manure, or they may even be pastured with these animals, since the danger of roundworms being transmitted from one species of animal to another is very slight.

**Palisade Worms or Large Strongyles**

*(Strongylus spp.)*

Palisade worms (strongyles) of horses and mules are small roundworms, commonly called red worms, blood worms, palisades, or sclerostomes.

Different species of strongyles are widely distributed in Illinois horses (Fig. 14). Colts are more susceptible to strongyles than are adult animals. These parasites are much smaller than the large roundworms, varying in length from one-third to two and one-half inches. They also differ from the former in that the adult worms are usually attached to the mucous membrane lining the intestine by means of a mouth (supplied with suckers and sometimes with teeth), which is connected to the body of the parasite by a thread-like neck. Some are free, however, in the fecal contents.

*Life History.*—Eggs of the strongyle are laid in the intestinal tract of the host and pass out with the manure (Fig. 15). When conditions are favorable, the eggs hatch in a day or so in the manure on the ground. The liberated larvae feed on the manure to which they have access, undergo two changes, and reach the infective stage in a short time. It takes about a week for the young worms to reach the infective stage under favorable conditions, while a much longer period is necessary during the cold months or during weather which is not conducive to their development. Moisture must be present for development and enough ordinarily is found in horse manure. Direct sunlight is injurious to the hatching larvae. In the infective stage the young worms are resistant to adverse weather conditions, such as cold, heat, and dryness, and can remain viable in pastures for a long time.

After reaching the infective stage the larvae, when there is enough moisture supplied by dew or rain, migrate up the stems of grasses, where they remain. Grazing horses pick them up, and they pass into the large intestine, where they may develop into mature parasites. This point in the life cycle is not definitely known, as many of the larvae are known to migrate thru the internal organs and tissues and have been found in practically every organ of the body. It is an established fact, however, that in the mature, or adult, stage they are found attached to the mucous membrane lining the large intestine of horses, mules, and foals, where they lay eggs and begin their life cycle over again.

*Symptoms and Lesions.*—Animals mildly affected with strongyles may show no diagnostic symptoms (Fig. 16). Weakness, emaciation, anemia, and general unthriftiness mark advanced cases. In heavy infestations animals may suffer intermittent or persistent diarrhea or constipation, the
hard, dry feces being covered with slimy mucus. The diarrhea is a result of the chronic irritation of the intestine. In the early stages diarrhea is scarcely noticeable, but constipation may be frequent. The appetite may

be very good at first, but soon falls off. This leads to further emaciation and loss of vitality and strength. A pronounced change follows in the organs and systems of the affected animals. A heavy infestation of strongyles also leads to symptoms of secondary anemia and its accompanying dangers.

Strongyles injure the walls of the intestine to which they are firmly attached, sucking blood and tissue juices (Fig. 17). They attach themselves

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**FIG. 14.—PALSADe WORMS AND EGGS (Strongylus spp.)**

Different species of palisade worms are widely distributed in Illinois horses. Three are shown in the above illustration (3/4 natural size): (A) S. equinus, S. edentatus; (B) S. vulgaris, S. equinus, S. edentatus; (C) S. vulgaris. The eggs (D) are laid in the intestinal tract of the horse and pass out in the manure; they are here shown enlarged 224 times. Under favorable conditions the eggs hatch in a few days and the infective larvae are taken up with food and water.
by sucking a portion of the intestine into their mouth and holding it securely in this position. The injured intestinal wall is often inflamed and contains pus. The inflamed portions of the bowel may even rupture, causing death. The strongyles do not remain attached long at one point on the intestines, but release their hold and move to a new field, thus extending their injury. The damage is reflected in the condition of infested horses, as the injury at the point of attachment makes an opening for toxins and bacteria. Like ascarids, strongyles also produce primary toxins or poisons.
Horses suffering from palisade worms may show varying symptoms of un-thriftiness. Emaciation, lack of condition, and lowered vitality are the predominating symptoms.

Migration of strongyles to body tissues also brings about serious conditions. It is not uncommon for the larvae of one type of strongyle (*S. vulgaris*) to lodge in the mesenteric arteries, causing stoppage (Fig. 18), which may result in death. The tissues supplied by such plugged vessels are not properly nourished. Small particles of the clot may become separated from the main mass and plug smaller arteries, causing serious circulatory disturbances which often result in recurring colics and lameness.

After a variable time the larvae leave the tissues and the arteries and return to the caecum, where they become embedded in the submucosa. The larvae embedded in the intestinal wall (Fig. 17, right) cause destruction of tissue accompanied by minute nodular formations and abscesses.

**Treatment.**—Oil of chenopodium, given in doses of 4 fluid drams (16 cc.) for each 1,000 pounds live weight, is very effective in removing strongyles from the intestines of horses. The animals to be treated should be fasted for 36 hours before treatment to insure the drug coming in contact with the parasites. Following treatment the animal should receive a liberal dose of a purgative such as raw linseed oil or an aloes bolus to prevent absorption of the drug. Food and water may be allowed six hours following treatment.

Wright and coworkers (1931) suggest the administration of N-butyldene chlorid for the removal of strongyles, especially where oil of chenopodium or carbon disulfid has failed to yield results. The anthelmintic efficiency of this drug, against *Strongylus spp.*, was found to be 50 percent, 90 percent, 100 percent, and 100 percent in four animals treated. Best results were obtained with a dose rate of 0.207 to 0.333 cubic centimeters of
FIG. 17.—GROSS LESIONS IN WALL OF INTESTINE RESULTING FROM INFESTATION WITH PALISADE WORMS

The larvae embed themselves in the walls of the intestine. The arrow points to the larger lesion (⅔ natural size). Numerous small lesions, appearing as pin point dots, indicate the location of encysted larvae. At the right is shown a larva coiled in the submucosa of the intestine (enlarged 22 times). Note extensive tissue destruction. Heavy larval infestation of the wall of the intestine may weaken it and cause it to rupture.

FIG. 18.—THROMBOSIS IN MESENTERIC ARTERY RESULTING FROM STRONGYLE INFESTATION

Such plugs, caused by strongyles, may cause stoppage of the mesenteric artery. Small particles of the clot may become separated from the main mass and plug smaller arteries, causing serious circulatory disturbances which often result in recurring colics. (⅔ natural size)
N-butylidene chlorid per kilogram (2.2 pounds) of body weight, followed in 5 hours by 960 cubic centimeters of raw linseed oil for a 1,000-pound animal. The efficiency for strongyles appeared much lower when the drug was administered in raw linseed oil or when it was followed by aloes or by a castor-oil mineral-oil mixture.

N-butylidene chlorid proved relatively ineffective against bots and was relatively ineffective against ascarids when administered in raw linseed oil. Without oil, however, the drug was apparently effective for the removal of this species of parasites.

PINWORMS
\[\text{(Oxyuris equi)}\]

Pinworms are whitish worms, relatively long with a very long, slender tail (Fig. 19). They occur in the large intestine of the horse. The males are very small and are seldom found. The female may attain a length of 3 to 6 inches.

Life History.—The adult worm passes from the horse in the manure and deposits the eggs or becomes attached near the anal opening and deposits the eggs in this region. The eggs are seen as a yellowish external incrustation. In either case the eggs develop outside the body and become infective, under favorable conditions in 1 to 3 days. Eggs are capable of producing infection from 1 to 4 months after development. Infective eggs may be taken into the body of the horse thru infected water, pastures, grain, or hay. The young worms reach the large intestine and become adults in 3 to 4 months.

Symptoms and Lesions.—The attachment of the pinworms in the region of the anus and the egg incrustation produce an intense itching that causes the infected animal to rub its posterior parts on hard objects. This may cause an eczematous inflammation. Pinworms may cause digestive disturbances, emaciation, and anemia in rare cases.

Treatment.—Oil of chenopodium, administered as for strongyles, is effective in ridding horses of pinworms. Oil of turpentine, 1 to 2 fluid ounces (30 to 60 cc.) per 1,000 pounds of live weight, given with 1 quart of raw linseed oil is also effective. Tartar emetic may be given in 2-gram doses daily for 5 days in the feed.

Prevention.—Preventive measures are the same as those recommended for the large intestinal roundworms and strongyles.

THREADWORMS OR FILARIDS
\[\text{(Setaria equina)}\]

The threadworms of the body cavity of the horse are slender, whitish in color, and from 2 to 5 inches long (Fig. 20). They usually occur in the abdominal cavity of the horse but have been found in other parts of the body. Immature forms sometimes occur in the eyes of horses as the so-called eye worm or “snake in the eye.”

Life History.—Nothing definite is known of the life history of the horse filarids. Evidence, however, points to the transmission of the parasite by biting and blood-sucking insects.
The female worms are found in the large intestine of the horse. Passing out with the manure they deposit their eggs with the manure or on the ground. Under favorable conditions the eggs become infective in a few days. Females attached to the anus may deposit eggs around the external anal region, causing intense pruritis. (Enlargements same as in Fig. 20.)

Symptoms and Lesions.—No definite symptoms are connected with filarids in horses. The worms appear to do little damage. The young worms in the eye produce irritation and may in time cause blindness.

Treatment.—Since infestation by filarids is seldom diagnosed during the life of the animal, no treatment is known. The worm, if present in the eye, may be removed surgically under local anesthesia.

Prevention.—No definite control measures can be recommended. Measures to prevent attacks by biting flies and the prevention of fly breeding are indicated to be of possible value.

TAPEWORMS

Horses are known to harbor three species of tapeworms. They are elongated, flat, ribbon-like in structure, and consist of a head and a series of segments (Fig. 21). The head of the tapeworm has four prominent suckers, which have little hooklets for attachment to the gut. The segments vary greatly in size and number. Those near the head are small
and immature, while those farther from the head are larger in size, mature, and contain ripe eggs. In infested horses the parasite is found most frequently attached to the wall of the small intestine but may be found occasionally in the caecum.

**Life History.**—Each segment of the tapeworm contains both male and female reproductive organs, and the large, mature segments are filled with eggs. It is impossible to see these eggs with the naked eye. The ripe or gravid segments filled with eggs break from the chain of segments and pass from the body of the horse in the feces. It is believed that all tapeworms have an intermediate host but from this point nothing definite is known regarding further development of the tapeworm of the horse.

![Fig. 21. Tapeworm of Horse (Anoplocephala magna or Taenia plicata) and Eggs](image)

These parasites are found in the small intestine. Heavy infestations cause intestinal catarrh, indigestion, and unthriftiness and, in severe cases, anemia and emaciation. The eggs, shown in the lower part of the picture (enlarged 185 times) are found in the ripe posterior body segments of the adult worm. These ripe segments break away and pass out in the manure. (The mature worm is shown 3/4 natural size.)

**Symptoms and Lesions.**—Infestations of tapeworm in the intestines seldom produce clinical symptoms. Heavily infested horses may show intestinal catarrh, chronic digestive disturbances, and general unthrift and in very severe infestation the horse may become emaciated and anemic. If the intestine contains many tapeworms, the walls bulge out. The bulges may later rupture. Inflammation may be produced by these parasites and the attachment of the perfoliate tapeworm to the wall of the caecum produces small ulcers.

**Treatment.**—The following treatments have been recommended but have not had critical test to determine their precise value.

Oil of turpentine is said to be an effective remedy. The animal to be treated is removed from work and fasted for 24 hours; then 2 to 4 fluid ounces (60 to 120 cc.) of oil of turpentine and 1 dram of oleoresin of aspidium in a pint of linseed oil is given. Oil of turpentine is also recommended in a dose of 2 fluid ounces (60 cc.) in capsules, followed every second day by 1 ounce (30 cc.) in a capsule until 5 or 6 doses have been given. The last dose is immediately preceded or followed by 1 quart of raw linseed oil.

Tartar emetic is quite effective given in 2 doses of 3 drams each at intervals of 12 hours. It should be mixed with a gruel of linseed meal.

Areca nut, kamala, and oleoresin of male fern may be of value in the removal of tapeworms but must be used with caution. The animals to be
treated are fasted 24 to 36 hours. Areca nut, freshly ground, may be given in doses of 1 to 1.5 ounces (30 to 45 grams) in capsules to adult horses. If the bowels do not move in 4 to 5 hours, 1 to 2 pints of raw linseed oil should be given. Areca nut should not be given to very old or very young animals or to those in a weakened condition. Kamala may be given in doses of 1 ounce (30 grams) in capsule to adult horses. This drug seldom needs to be followed by a purgative. It should not be given to very young or very old animals, to those in a weakened condition, or to those suffering from febrile diseases. Oleoresin of male fern is given adult horses in doses of 3 to 6 drams (10 to 20 grams) and is immediately preceded or followed by 1 quart of raw linseed oil.

Prevention.—No definite control measures can be recommended, but since the eggs expelled in the ripe segments produce reinfection, sanitation and systematic disposal of manure are recommended.

EXTERNAL PARASITES

Horse lice and mites spend their entire life on the host. Horse lice will not live on animals other than horses, mules, and asses. Different types of lice and mites infest horses.

LICE
(Haematopinus and Trichodectes)

There are two kinds of lice infesting horses, sucking lice (Haematopinus) and biting lice (Trichodectes) (Fig. 22). Sucking lice probably do more harm and are harder to eradicate. The life cycles of the two kinds of lice are similar.

FIG. 22.—TWO SPECIES OF LICE THAT INFEST HORSES

Left—biting louse. Right—sucking type. Lice do their greatest damage to horses and colts in winter, when the animals are confined in close quarters and the parasites can spread easily.

Life History.—Lice can live only a few days when removed from their natural host. Their eggs, more commonly referred to as nits, are laid on the hair, to which they are firmly attached. From 10 to 20 days is required before the nits hatch. The newly hatched nits reach sexual maturity and lay eggs at about eleven or twelve days of age. Long hair, commonly found on horses in winter, favors the development and spread of lice. Direct contact is the greatest means of spread. Hair carried on
grooming instruments gives lice and mites a chance for spreading in a stable. Tufts of infested hair removed while rubbing or grooming animals, as well as harness, blankets, and other stable equipment, can, thru contact, infest horses free from lice.

*Symptoms and Lesions.*—Biting lice live by feeding on the external layers of the skin, hair, and exudates. Sucking lice actually puncture the skin of the host and suck blood. When not feeding, lice move about on the skin and annoy the host. The itching sensation causes lousy animals to rub, bite, and kick in an endeavor to dislodge the pests. If lice are present in great numbers, the hair coat becomes rough, and patches of skin are stripped of hair by frequent rubbing.

Lice can be detected with little difficulty by pulling a tuft of hair and holding it against direct sunlight. The regions of the horse's body usually inhabited by lice are the side of the neck, croup, flanks, and under the jaws. When heavily infested, however, horses may have lice on all parts of their bodies.

*Treatment.*—One treatment will kill all lice on an animal, but the eggs are not destroyed. Therefore, for permanent relief a second treatment should be given seven to fourteen days later.

In suitable weather dipping in a special tank is the best means of control. A coal-tar product is effective, as are also nicotine or tobacco solutions. Dry treatments or dusting powders hold lice in check, but are not so effective as dipping. Sodium fluorid dusted into infested areas will control the spread of biting lice, but is of no value for treating sucking lice. This drug is highly poisonous and should be used only under the instruction of a veterinarian.

Oils and greases which are commonly used as insecticides on hogs and other animals destroy horse lice, but are not recommended, as they remove hair and injure the skin.

**MITES**

*(Sarcoptes, Psoroptes, and Chorioptes)*

Mange, or scabies, of horses is a specific skin disease caused by small mites which live on or in the skin. Three species of mites cause mange or scabies: Sarcoptes, Psoroptes, and Chorioptes. The mites are about $\frac{1}{40}$ inch in diameter, and a microscope must be used to identify the species. The general contour of the body is oval, and the mature parasite has four pairs of legs (Fig. 23). Mites spend their entire life on the host. They differ from lice in that they are communicable to other species, as well as to human beings.

*Life History.*—The life cycles of the three types of mites are virtually alike, varying only in detail. The female sarcoptic mite lays her eggs in the channel she makes in the skin. From ten to twenty-five eggs are laid in approximately two weeks. Soon after this the female mite dies. Incubation of the eggs takes from three to ten days, and the young mites develop to maturity in about ten to twelve days. Psoroptic mites differ from the sarcoptic form in that each female lays 15 to 24 eggs on the surface of the body. These take from 3 to 4 days to hatch and reach sexual maturity. Development of the chorioptic mite is similar to that of the psoroptic mite.
Symptoms and Lesions.—The sarcoptic mite is the one most commonly encountered in horses. This parasite burrows into the upper layer of the skin and forms channels in which mating and reproduction are carried out. In the early stage of sarcoptic mange the only symptoms noticeable are areas of irritation or inflammation. The withers, sides of the neck and shoulders, and the head are most commonly affected. However, any portion of the body may become affected. The burrowing of the mites causes an intense pruritis, or itching, of the skin. Infested horses try to relieve this by rubbing against objects, by biting the involved areas, or by constant movements of the skin. The affected areas are swollen and sensitive and often are injured further by attempts of the animal to gain relief. It is not uncommon for an animal to have large scabs form over infested areas. In advanced stages of the disease the entire surface of the body may become involved.

Psoroptic mange mites are found mostly on areas covered with long thick hair, such as the mane, foretop, tail, and fetlocks. From the first point of infestation, mange caused by this mite may spread slowly to all parts of the body. In the early stages of the disease it is often overlooked, as there is only a slight swelling caused by the mite pricking the skin and depositing an irritating substance. This is accompanied by an intense pruritis which the animal tries to relieve by rubbing or biting. However, other skin diseases may cause similar symptoms. The lesions are at first papules, or small pimples, with many mites as inhabitants. As the mange progresses, these initial lesions become larger owing to the parasites moving to healthy tissue around the edges of the lesion. This mite does not burrow into the skin as does the sarcoptic mite, but feeds on the surface layers. In advanced stages psoroptic mange is hard to tell from sarcoptic mange, as large areas may be involved. Positive diagnosis requires identification of the mite, which can be done with a microscope. Psoroptic mange is not transmissible to any other animals than horses, mules, and

![Sarcoptic Mange Mite](image1.png)
asses, but it is more highly contagious to these animals than is the sarcoptic variety.

Chorioptic mange is more commonly spoken of as foot mange, since it is caused by a mite which attacks the skin of thickly haired portions of the legs. This form of mange very rarely extends above the hocks or knees of horses. Chorioptic mange mites, like the psoroptic variety, live on the surface of the skin. This type of mange consequently is commonly confused with the nonparasitic skin disease referred to as scratches. The symptoms and lesions are virtually the same as those of sarcoptic mange and psoroptic mange, although less extensive and more localized in character.

Treatment.—Treatment of all three types of horse mange is essentially the same. The object is to put some noxious agent on the offending parasite. Dips, such as lime sulfur, nicotine, and coal-tar products, are recommended. Frequent, thorough applications are necessary. In generalized cases dipping in an especially constructed tank is necessary. Four to six dippings at intervals of one week usually eradicate moderate infestations. Repeated treatments are necessary in chronic cases.

In chorioptic scabies and in mild infestations of psoroptic and sarcoptic scabies, the solution may be efficiently applied with a sponge or swab. To give best results the solution should be held in contact with the body for two or three minutes. Crude oil and sulfur dioxide fumigation are other agents of reported value in the treatment of scabies.
Parasite-free horses mean more horse power, fewer cases of colic, better use of feed, and greater safety of horses in harness. This is a big return for a small investment.
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