

PARASITES OF HORSES

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DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
BULLETIN No. 152—NEW SERIES

Published by direction of Honourable Robert Weir, Minister of Agriculture
Ottawa, 1931

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PARASITES OF HORSES

Parasites and the diseases caused by them are always of considerable importance and as the young animals are more susceptible and less resistant to the ravages of these pests their constitution and growth may be permanently affected before they reach the age of usefulness. Practically all organs and tissues of the horse may be invaded by mature parasites or their larvæ. The adult parasite usually has a fairly definite location but the young larval forms may travel either directly through the tissues or be carried by the blood stream to their selective location. Horses are liable to infestation with not only many different kinds of parasites both internal and external but with enormous numbers of these tenants obtaining free board and lodging at the expense of their hosts. Hundreds of bots may be present in the horse's stomach. The intestines may be teeming with thousands of worms both large and small while on the surface of the body lice or mange mites may number hundreds of thousands or even exceed a million if left uncontrolled. A large variety of parasites of horses both internal and external exist in or may be introduced into Canada and consequently it behooves the horseman to be constantly on the watch to prevent the serious damage which follows heavy infestation with these pests.

SYMPTOMS

The symptoms caused by the various internal parasites are the result of any one or a combination of the following conditions: absorption of toxins or poisons, actual damage to the tissues, loss of blood in some cases, consumption of nourishment meant for the horse, mechanical obstruction in the stomach or intestines, interference with digestion and assimilation of food, and even severe damage to the arteries.

External parasites also produce poisons which may be absorbed and the constant irritation and itching cause loss of sleep and interfere with feeding, besides, many of them are potential carriers of disease.

The symptoms develop slowly and progressively and they may be overlooked by the owner until loss of flesh and inability to do a day's work without distress clearly show that something is wrong. Worm infestation causes debility, unthriftiness, tucked up flanks, distended abdomen, rough coat, paleness of the mucous membranes of the mouth and eyes from anemia, and in some cases frequent attacks of colic and diarrhœa. The temperature remains normal and the animal usually retains a good appetite. The death rate is not high but the economic loss caused by parasites is very large.

The growth and development of foals may be permanently affected and the working power of horses is reduced by general debility and sometimes from repeated attacks of colic while the cost of food and maintenance may be increased.

CONTROL

Comparatively few of the internal parasites complete their life-cycle entirely within the horse and some even require another host of different type such as a fly, a beetle or a snail in which to pass a portion of their life. The eggs are usually swallowed by the second host and develop to the stage at which they are capable of infesting domestic animals. It is evident therefore that a knowledge of the life-history of parasites is necessary if this problem is to be intelligently dealt with and the parasites attacked at the most vulnerable stage.

The eggs of parasites are generally passed out with the manure and undergo various stages of development, then the infective larvæ or eggs are again swallowed by the horse by means of contaminated food or water. It is evident,

therefore, that the proper disposal of manure is an important factor in the prevention of parasitism. Manure should be piled in an inclosure packed so that it will heat and turned in order that the outer layers are also subjected to heat. This procedure if carefully carried out will destroy the eggs and larvæ of parasites. Stables and pasture lands should be kept as free from manure as possible. Tight floors which are easily kept clean and grain boxes and feed racks raised above the ground assist in preventing contamination of the food. Water troughs should be of concrete or metal and raised to prevent contamination of drinking water. Permanent pastures eventually become polluted with the eggs or parasites and when possible they should be cultivated. When cultivation is not practicable the different domestic animals should be pastured in rotation. The parasites of cattle and sheep are rarely transmissible to horses, and vice versa. If pastures are used on alternate years for horses and then for cattle or sheep a considerable reduction in worm infestation would take place. Horse manure should never be spread on pastures intended for horses.

MEDICINAL TREATMENT

The horse owner can in all cases take some sanitary measures, but it is not always practicable to carry out the measures necessary to effectively control parasites and medicinal treatment becomes necessary. As many different parasites require specific treatment it is often necessary to examine faeces to identify the eggs and as the drugs used to kill parasites are poisons the diagnosis and treatment should be carried out by a veterinary surgeon.

The administration of drugs which are volatile and poisonous for the treatment of parasites should be by stomach tube. If this is not practicable capsules may be used. It should be remembered that if capsules containing such drugs break in the horse's mouth serious results may follow if any of the drug is drawn into the windpipe. The dose of drugs for the treatment of internal parasites must be calculated according to the weight of the animal. Many of these drugs are dangerous if used in unfavourable conditions and as a knowledge of their action is necessary the employment of a veterinarian for the treatment of parasites in horses is recommended.

Horses infested with worms should be treated in the spring and fall, while the best time for the treatment of bots is at the beginning and end of winter. They may of course be treated at any time definite symptoms of parasitism are evident.

Before treatment is given food should be withheld for about eighteen hours but water may be given. After treatment the horse should not be fed for about four hours. When food is withheld the contents of the stomach and intestines are less bulky and the drug is more likely to come in contact with the worms.

WORMS

Worm parasites of horses are of three kinds: flukes, tapeworms, and round worms. The round worms are by far the commonest and most serious.

FLUKES OR TREMATODES

Flukes are flat and leaf shaped parasites which occur in various organs of the body, usually in the digestive tract or the organs communicating with it, especially the liver.

Flukes are rarely encountered in horses in Canada but should they be found, treatment with carbon tetrachloride would probably be effective as this drug has been successfully used in the treatment of liver flukes of sheep. Liver flukes pass their larval life in snails and are associated with low lying swampy pastures. As these conditions favour worm parasites in general, horses should be kept on dry pasture land when possible.

The dose of carbon tetrachloride is 6-12 fluid drams an adult horse.

TAPEWORMS OR CESTODES

A tapeworm, as the name implies, is an elongated, flat, band shaped worm consisting of a head and a series of segments. The head has suckers by which it attaches itself usually to the wall of the intestine. The segments are wider than they are long and each segment is sexually complete, having both male and female organs. The segments as they mature are impregnated and get larger and those farthest from the head contain the eggs. These become detached and pass out with the manure. The portion of the life-cycle of tapeworms after the eggs leave the horse is not known.

Three species of tape worms may be found in horses. They generally remain unperceived during life unless present in large numbers.

Anoplocephala mamillana, the small tapeworm of horses, inhabits the small intestine. It is from one-quarter of an inch to two inches in length and has a very small head with suckers on the side. The segments usually number thirty to forty or even more.

Anoplocephala perfoliata usually occurs in the caecum and rarely in the colon or small intestine. It is from about three-quarters of an inch to over three inches in length and the segments become wider to about half the length of the body. The suckers are somewhat cup shaped and in front of the head. Behind the head there are two flaps on the upper and lower sides.

Anoplocephala magna, the large tapeworm of the horse, inhabits the small intestine and exceptionally the stomach. It is usually from about $3\frac{1}{2}$ inches to 10 inches in length. The head is comparatively large, two-fifths of an inch wide. There are four suckers.



FIG. 1.—*Anoplocephala mamillana*; natural size.—Railliet.



FIG. 2.—*Anoplocephala perfoliata*; natural size but not complete.—Railliet.

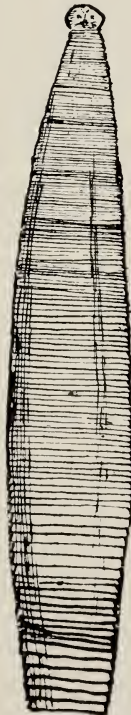


FIG. 3.—*Anoplocephala magna*; natural size.—Railliet

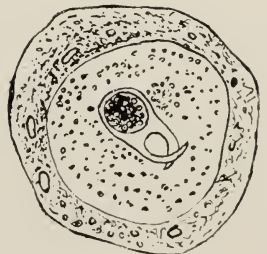


FIG. 4.—*Anoplocephala perfoliata*. Egg magnified 360 times.—Yorke & Southwell.

SYMPTOMS.—Unless a horse is heavily infested no symptoms are present. If the manure were carefully examined segments of tapeworms might be found. When tapeworms are very numerous the horse might become anaemic and emaciated.

TREATMENT: There is little definite knowledge as to the efficacy of the various drugs for the treatment of tapeworms in horses, but the following drugs are commonly used. For an adult horse—*Oil of turpentine*, in doses of 2 fluid ounces in capsules followed by 1 ounce in capsules every second day until four doses have been given. Immediately after the last dose give one quart of raw linseed oil. *Areca nut*, in doses of 1 to 2 ounces in capsules may be given after the horse has been fasted for twenty-four hours. If the bowels do not move in a few hours a pint of raw linseed oil should be given. *Areca nut* is not a suitable drug for animals in a weak condition or for very old horses or foals.

Other drugs such as Kamala or Oil of Malefern have been used in the treatment of tapeworms in other animals and might be effective for horses in appropriate doses. Ordinary purgatives, such as aloes 6 to 8 drams, and Calomel 1 dram, sometimes expel tapeworms.

PREVENTION.—Tapeworms generally pass a cystic stage in another animal but as nothing is known of this stage of horse tapeworms proper disposal of manure is the only measure likely to prevent new infestations.

ROUND WORMS OR NEMATODES

Round worms are by far the commonest parasites of horses. Their shape is that commonly associated with the name worm, long and cylindrical. They usually taper at both ends and are white, yellowish or greyish white and some of those which consume blood are pinkish to red. The different round worms in the horse range from about one-quarter of an inch to over a foot in length. They reproduce themselves by means of eggs which are usually deposited in the digestive tract and pass out with the manure. Outside the body the eggs undergo a certain development before they are capable of continuing their life in the horse. There are several species which require an intermediate host to continue their development before they are ready to again infest the horse.

STOMACH ROUNDWORMS

The stomach worms of the horse are all relatively small worms, long and slender, and they are easily overlooked unless a careful search is made. One very small worm *Trichostrongylus axei* occurs in the lining of the stomach. It is only about one-fifth of an inch in length. Little is known concerning this parasite but it is believed that infestation is direct by means of the larvæ swallowed with food and water. This worm causes injury to the stomach wall and sometimes small rough tumors in circumscribed areas.

Three other species are transmitted by flies. *Habronema megastoma*, the smallest, is usually less than one-half an inch in length. These worms form tumors in the stomach wall some of which may occasionally reach a size of four or five inches in diameter.

H. Microstoma, slightly larger than the former, is from about one-third of an inch to nearly an inch long. This worm may be found free in the stomach; it may also penetrate the stomach wall and cause ulcers.

H. Muscae, about the same size as the former, is found free in the stomach or attached to the lining of that organ.

The eggs of these three larger stomach worms pass out with the dung and are taken up by the maggots of flies; house flies, stable flies and others which breed in horse manure. As the fly maggots pass into the pupal stage the worm larvæ continue their development and reach their full growth when the fly emerges from its pupa.



FIG. 5.—*Habronema muscae*. Eggs. Highly magnified. Showing development of embryo.—Ransom.



FIG. 5A.—Stomach worms of horses.

The worm larvæ are present in the mouth parts of the flies and the horse may become infested when flies congregate around the mouth and nostrils, the heat and moisture enticing the worm larvæ to leave their temporary host. The worm larvæ on the horse's lips or those which enter the nostrils can wriggle their way into the mouth or to the pharynx and be swallowed. Once they reach the stomach they develop to maturity and continue their existence as parasites of the horse.

SYMPTOMS.—No special symptoms are associated with these parasites. They cause damage to the stomach lining and the large tumors may cause mechanical obstruction and interfere with digestion. In addition to injury to the stomach they no doubt add to the general debility and weakness associated with parasitism of horses. When flies containing the larvæ of the large stomach worms come in contact with slight wounds or broken skin on horses the larvæ invade the tissue and cause a skin disease known as *summer sores* (see below).

TREATMENT.—It is unlikely that the drugs used will reach the worms in the lining of the stomach and in the tumors but those free in the stomach can be removed. The animals should be fasted for about 18 to 24 hours before treatment with the following drugs. Carbon disulphide in doses of 6 fluid drams, Carbon tetrachloride in doses of 6 to 12 fluid drams for a 1,000-pound horse. No purgative is required after either of those treatments.

PREVENTION.—Measures to prevent flies from breeding are important in controlling stomach worm infestation. When only small quantities of manure are dealt with closed containers are useful. When large manure piles are maintained these should be kept covered with a few inches of earth and the manure turned over so that the outer layers are subjected to heating.

SUMMER SORES

Summer sores are a skin disease caused by flies containing the larvæ of stomach worms feeding on small wounds or abrasions in the skin of horses. The larvæ escape from the mouth parts of the fly and live in the wound causing irritation and itching. The lesion persists as a chronic sore until the onset of the cold weather. The larvæ are not known to penetrate the unbroken skin.

TREATMENT.—The following treatments have been recommended: One per cent picric acid in glycerine. Ether, chloroform or iodoform applied to the wound every day. Astringent powders containing quinine keep the animal from biting the sores and permit healing. Good results are reported from the following: Plaster of Paris 100 parts, alum 20 parts, naphthalene 10 parts, and quinine 10 parts.

PREVENTION.—Harness abrasions and other skin injuries should be protected from flies by the use of repellents such as oil of tar.

LARGE INTESTINAL ROUNDWORMS

Ascaris equorum.—The large intestinal roundworms or ascarids of horses are yellowish white and are from about six inches to over a foot long. The head is distinct and has three lips. These worms usually inhabit the small intestine but are occasionally found in the caecum and stomach. They have also been found blocking the bile duct. They may be present in large numbers and are especially detrimental to foals and young horses.

The eggs are produced in large numbers in the intestine and eliminated with the manure. With warmth and moisture the eggs develop to the infective stage in about two weeks but this development is retarded in cold weather or from lack of moisture. Rapid drying destroys the eggs but there is usually enough moisture in the manure to ensure development of the embryo within the egg. The embryo remains within the egg and is protected by the thick egg covering until it is swallowed with contaminated food or water and reaches the horse's intestine where it is liberated. It then penetrates the intestinal wall and is carried in the blood stream to the liver. From the liver it passes with the blood through the heart to the lungs. When large numbers of larvæ reach the lungs together they may cause considerable damage and produce pneumonia. From the lungs the young worms crawl up the windpipe or are coughed up and are swallowed. On reaching the intestine a second time they remain there. This migration to the lungs may occupy about a week while their development to sexual maturity in the intestine takes about eight to ten weeks.

SYMPTOMS.—In severe infestations there may be very large numbers which become entangled into masses and obstruct the passage of the ingesta. Such cases occur in foals and yearlings and death may even occur from rupture of the gut following obstruction and pressure. Besides the damage caused by the passage of the larvæ through the liver and lungs the absorption of the poisonous products from large numbers of these worms causes severe illness and debility and may even cause the death of the animal.

TREATMENT.—Carbon disulphide and Carbon tetrachloride are effective in removing these ascarids. These drugs should be administered in capsules or by a stomach tube. Food should be withheld for eighteen hours before these drugs are given. The dose of Carbon disulphide is at the rate of $1\frac{1}{2}$ fluid drams for each 250 pounds of weight. No purgative should be given with Carbon disulphide. The

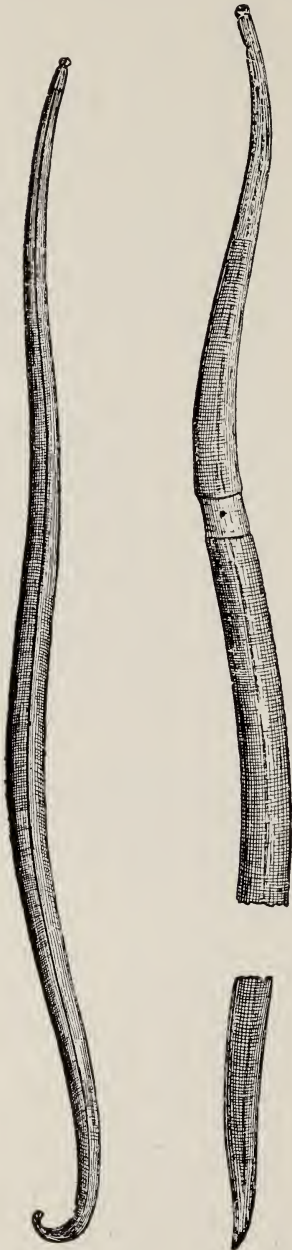


FIG. 6.—*Ascaris equorum*, left male, right female, natural size.—Railliet.

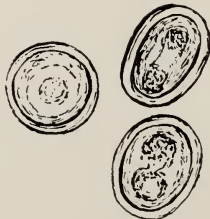


FIG. 7.—*Ascaris equorum*. Eggs magnified 130 times.—Railliet.

dose of Carbon tetrachloride is 6 to 12 drams for a 1,000-pound horse. A purgative of Glauber salts will assist in eliminating the worms.

PREVENTION.—The young animals are most vulnerable to the effects of these parasites. Before foaling the mare should be kept in sanitary surroundings which have been scrubbed clean and a small pasture should be reserved adjacent to the barn so that the manure may be removed every few days. If possible the pasture should be one which has not been used by horses for a year. This procedure will tide the foal over the period when it has least resistance to support a heavy infestation. When special pastures are not available the use of fields in which cattle or sheep only have grazed are best as the parasites of cattle and sheep are not generally transmissible to horses, and vice versa. Stables in which manure is allowed to accumulate are likely to produce heavy infestations of worms as the eggs are protected and develop under favourable conditions. Horses undoubtedly become infested with ascarids at pasture but are unlikely to suffer such severe infestation as the eggs are likely to be exposed to more adverse conditions in the open. If sanitary watering troughs are provided in the open and raised feed boxes and hay racks in the stable the risk from contaminated food and water is reduced.

STRONGYLES

The large strongyles commonly known as blood worms or sclerostomes are red in colour and are usually found in the caecum and large colon. They have a cup shaped mouth into which they suck the mucous membrane of the bowel and abstract blood. Three species are commonly found in horses:—

Strongylus equinus, about $1\frac{1}{4}$ to 2 inches in length, has three teeth in the cup shaped mouth. *Strongylus edentatus*, somewhat similar in appearance but slightly smaller, about $1\frac{1}{2}$ inches in length, has no teeth in the mouth cup. *Strongylus vulgaris* is only from about half an inch to one inch in length and is the smallest of three species mentioned. It has a single tooth which has two rounded projections.



FIG. 8.—*Strongylus vulgaris*. Egg. Enlarged.
—Winchester.

The females discharge their eggs in the intestine and they pass out with the manure. The eggs hatch out under favourable conditions of warmth and moisture in a day or two and live in the manure on the ground, further development takes place, and in about a week the larvæ are infective. In cold weather the process of hatching and development is delayed. After the larvæ reach the infective stage they are very resistant to adverse conditions and when grass is moist with rain or dew they make their way up the blades of grass where they can be readily swallowed by horses grazing. Other food and water which has become contaminated with the larvæ no doubt cause infestation also. There is a possibility that the larvæ may penetrate the skin and enter the animal body in that way but this is not known to occur. It is doubtful if the larvæ go directly to their final location. Some travel through different tissues and organs and when they eventually reach the gut they continue their development to maturity and the eggs are again eliminated.

SYMPTOMS.—The common symptoms are occasional diarrhœa, weakness and emaciation. When large numbers of these blood sucking strongyles are present the loss of blood may result in anaemia and weakness while the injuries to the

intestinal wall expose the animal to invasions of bacteria. Anaemia produces paleness of the mucous membranes and edema or swellings usually of the legs and belly.

The immature forms of these worms cause injuries in different organs and tissues during their wanderings. One strongyle causes particular damage to the arteries especially the anterior mesenteric artery through which the blood supply of the large intestine passes. The presence of the worms cause thickening and stretching of the artery wall and pockets (aneurisms) are formed with deposits of fibrin. The artery may be almost closed up so that the blood supply to the intestine is partially shut off and severe colic becomes common as the functions of the gut are deranged. Small portions of the fibrin clots may also become detached and block an artery entirely and result in death.

When horses are heavily infested with these and other parasites the working power is greatly reduced and the growth of foals may be permanently retarded. Infestation with its resulting anaemia is sometimes mistaken for Swamp Fever but removal of the worms by medicinal treatment cause the symptoms to disappear and the animal to gain in weight.



FIG. 9.—Ulcer in intestine showing small strongyles which cause it. Photo by Hadwen.

TREATMENT.—Carbon tetrachloride in doses of 6 to 12 fluid drams for a 1,000-pound horse is usually effective. Food should be withheld for at least eighteen hours before treatment. If necessary this treatment may be repeated in a month.

Oil of chenopodium is effective for the removal of large strongyles but should not be used for pregnant mares. The dose is 1 fluid dram for each 250 pounds weight. A purgative such as an aloes ball or a quart of raw linseed oil should be given immediately before or after oil of chenopodium.

Prevention consists in removal of manure and cleansing stables thoroughly so that the larvæ are kept from contaminating food and water. Low, wet pastures should be avoided and frequent rotation of pastures practised when possible. In special cases where valuable horses are concerned removal of manure every few days from pasture fields would be of considerable benefit. In ordinary circumstances treatment must be relied upon.

SMALL STRONGYLES

In addition to the blood worms horses are commonly hosts of numerous smaller greyish white strongyles which inhabit the colon and caecum. Some of the smaller species known as cylicostomes are about half an inch in length. They may be seen attached to the mucous membrane of the gut or free in the contents of the intestine. The immature forms of some of these worms live in nodules on the wall of the gut.

These small strongyles when in large numbers and combined with the blood worms contribute to the general weakness, emaciation and anaemia associated with parasitism.

The same control measures and treatment as for the large strongyles are effective against the small strongyles. Oil of *Chenopodium* is said to be especially effective in removing these worms.

STRONGYLOIDES

A very small slender threadworm, *Strongyloides westeri*, which inhabits the small intestine commonly infests foals. These threadworms are whitish in colour about one-third of an inch long and less than one-two hundred and fiftieth of an inch wide. Those found in the intestine are all females.

The eggs of these threadworms are of course microscopic in size and are deposited in large numbers in the intestine. The eggs are eliminated with the manure and develop on the ground very rapidly into infective larvæ which may infest other foals or they may develop on the ground into mature males and females. These females on the ground deposit eggs which under favourable conditions hatch and the larvæ are capable of infesting horses.

The larvæ whether from eggs voided by the horse or from the eggs deposited by females on the ground may be taken in with the food but they are also capable of penetrating through the horse's skin. Within about two weeks of having been taken up by the horse the females are again depositing eggs which pass out with the manure.

SYMPTOMS.—These parasites are usually found in foals earlier than other parasites and may cause a heavy infestation as reinfestations may occur rapidly and often. The foal may also become infested when lying down due to the fact that the larvæ may penetrate the skin.

There are no definite symptoms attributed to these threadworms but they are probably the cause of diarrhœa in foals. The parasites are usually embedded in the lining of the intestine and no doubt cause an irritation.

TREATMENT.—A simple purgative of 4 to 6 ounces of castor oil followed by carbon tetrachloride at the rate of 2½ fluid drams per 220 pounds weight would probably be beneficial against these worms but no controlled test has been carried out with this drug and little is definitely known of its efficiency against these threadworms.

Prevention requires special care of foals with clean bedding, changed daily, and the usual stable sanitation and measures recommended for other roundworms.

PINWORMS

Oxyuris equi.—These worms commonly called pinworms are familiar to most horsemen. They inhabit the large bowel but are frequently seen in the manure. The worms seen in the horse are the females and are from 3 to 6 inches in length with a long thin tail. The females are passed out with the manure and lay their eggs outside the horse's body. Masses of eggs are often seen around the horse's anus as yellowish deposits; these are eggs from females

which adhered to the anal opening. These eggs are also developed outside the body but the larva does not leave the egg. Infestation with pinworms occurs when the horses swallow infective eggs with contaminated food or water.



FIG. 10.—Pinworms, *Oxyuris equi* (females) natural size.

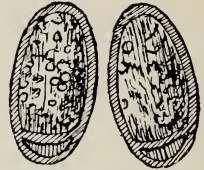


FIG. 11.—*Oxyuris equi*. Eggs. Magnified 200 times.—Railliet.

SYMPTOMS.—The pinworms may be seen in the manure and the eggs as yellow crusts on the anus. Practically the only symptom produced by pinworms is the irritation of the anus which causes the horse to rub its tail and hind-quarters against posts or other objects. It is believed the itching is caused by some irritant property of the eggs. When present in very large numbers pinworms are credited with causing digestive disturbances and anaemia.

TREATMENT.—Oil of turpentine is effective in removing pinworms in doses of 2 fluid ounces for a 1,000-pound horse. This treatment should be immediately preceded or followed by a quart of raw linseed oil.

Prevention is the same as for large intestinal roundworms.

LUNG WORMS

Lung worms of the horse, *Dictyocaulus arnfieldi*, are slender whitish worms from about 1 inch to over 2 inches in length. They inhabit the bronchial tubes.

The female deposits her eggs in the lungs and it is believed the larvæ are coughed up and swallowed and passed out with the manure. The larvæ are probably expelled from the mouth and nose with mucous also. When on the ground the larvæ develop to the infective stage in a few days.

The life-history of horse lung worms is not known but closely related lung worms occur in other animals and it is probable horses become infected in the same way by swallowing the larvæ on contaminated food and water.

SYMPTOMS.—In heavy infestations these parasites produce bronchitis with a persistent coughing which weakens the animal and may have serious results.

When few worms are present probably no definite symptoms are noticed. These worms are not commonly encountered in Canada.

TREATMENT.—It is doubtful if medicinal treatment is of any value against lung worms. Various injections into the windpipe have been tried but it is doubtful if the drugs used destroy the worms and damage to the delicate membranes may result. Better results will follow if care is taken that the animal

gets uncontaminated food and water so that no more larvæ are taken up to increase infestation. If young horses are kept from contaminated pastures and only receive clean food and water they will be protected until they are more resistant to the effects of infestation.

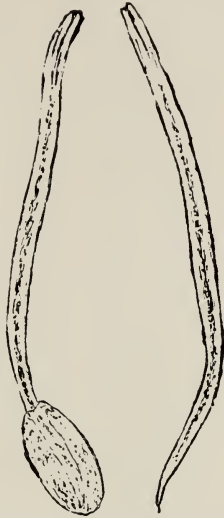


FIG 12.—*Dictyocaulus arnfieldi*. Larvæ. One in process of leaving egg shell. Magnified 150 times.—Raill:et.

Prevention is best accomplished by careful disposal of manure so that infective larvæ are kept away from horses. The procedure is the same as for intestinal worms.

THREAD WORMS

Setaria equina are long slender worms which inhabit the abdominal cavity outside the bowels. Immature forms are sometimes seen in the horse's eye. Little is known concerning the life-history of these worms and no symptoms have been recognized excepting when the parasite is in the eye. The life-history of similar worms in other animals suggests that these worms are probably transmitted by biting insects.

TREATMENT.—When the worm is detected in the eye it may be surgically removed under a local anaesthetic.

Onchocerca cervicalis, another threadworm, is sometimes encountered in the elastic ligament which supports the horse's head. They have been associated with poll evil and fistulous withers. They weaken the tissue and may make it more susceptible to disease. It is also possible they may transmit disease producing bacteria to this ligament which is affected in cases of poll evil and fistulous withers.

The life-history is not known and there is no treatment. If fistulous withers or poll evil should occur surgical treatment can be carried out.

BOTS

Bots are the larvæ or maggots of bot flies, three species of which are widely distributed. In Western Canada a post-mortem on a horse is rarely performed without finding these parasites in the stomach.

The life-history of bot flies is an interesting one. The adult flies deposit their eggs and glue them to the hairs in selective locations. The eggs hatch on the skin. It is not known if the maggots are swallowed or whether they

reach the stomach through the tissues. Neither is it known certainly if the larvæ of the throat bot even gain entrance to the mouth but all three species eventually find their way to the horse's stomach where they remain until they are passed out with the manure. The nose bot attaches itself to the rectum and to the anus and may be seen for three or four days before it drops to the ground. Many of the fully developed bots pass out in the fall while the younger forms pass the winter in the horse and are evacuated in the spring. The bots find a suitable location in the ground and finally the winged botfly emerges from the pupa, mates and again lays eggs to continue the same life-cycle.

The three species of botflies are named *Gastrophilus intestinalis*, *Gastrophilus nasalis* and *Gastrophilus hæmorrhoidalis*.



FIG. 13.—(A) *G. hæmorrhoidalis*, (B) *G. nasalis*, (C) *G. intestinalis*.
After Hadwen and Cameron.

The common bot fly, *G. intestinalis*, is brownish-grey with mottled wings and a whitish face. The eggs are deposited on the hairs of the legs, shoulder and mane of the horse and these are readily seen as yellowish specks most commonly inside and below the knee. They are attached for slightly more than half of their length around the hair and at an angle and only hatch after they have been rubbed or licked by the horse. The bots are reddish in colour and attach themselves in the left or white part of the horse's stomach.

The throat bot fly, *G. nasalis*, has a red coloured thorax, a prominent black band across the abdomen and clear wings. It attaches its eggs to the hair between the jaws of the horse in front of the throat. This fly may be seen hovering alongside the flank of the horse and then suddenly darting between the horse's fore-legs up under the jaws where it deposits its eggs. When flying around they cause the horse to become nervous and continually nod its head. The eggs are easily seen attached to the hair. They are yellowish in colour and glued on parallel to the hair for practically the whole length of the egg. These eggs hatch without rubbing and the larvæ may possibly burrow through the skin. These bots have been found attached to the pharynx but their natural habitat is near the exit of the stomach and in the duodenum or first part of the intestine.

The nose fly, *G. hæmorrhoidalis*, is the smallest of the three bot flies. It has a dark coloured body, reddish tail and clear wings. It attaches its eggs at the base of the fine hairs near the edges of the lips. These flies terrify horses and are dangerous as they may cause a runaway. They do not sting but cause great annoyance. The eggs have a long corkscrew appearance at one end, are black in colour and are not readily seen unless looked for carefully. These bots may be found in any part of the stomach but most around the pyloric end or exit of the stomach.

The common bot fly and the throat fly lay a large number of eggs—from 300 to 500. The nose fly deposits fewer—probably not more than 150 eggs. In the stomach the bots undoubtedly cause some damage but their food is not certainly known although the pinkish colour of many bots suggests that they

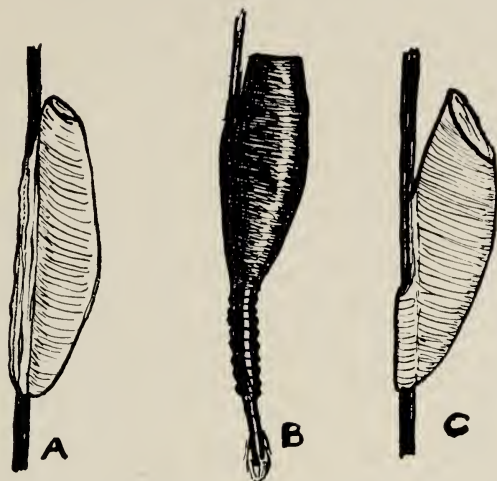


FIG. 14.—Eggs of botflies attached to the hair.
A. Throat fly egg. B. Nosefly egg.
C. Common botfly egg.

consume some blood. It is not uncommon to find hundreds of bots in the stomach of a horse at a post-mortem examination and as many as a thousand have been counted. In such cases besides the damage to the stomach, the bots must interfere with the digestion and cause obstruction to the passage of the food.

When the bots pass from the horse they cover themselves near the surface of the ground and the outer covering becomes hard. Eventually after a varying period according to weather conditions and warmth the bot fly emerges in from four to seven weeks.

The sole purpose of the bot flies is reproduction. They do not require food and have no mouth parts. They are short lived—the average life is probably about one week. Bot flies do not travel far and although it has not been definitely determined they probably do not extend their activities much beyond half a mile. This is an important point if an organized effort at control is made.

CONTROL MEASURES

Horses can be protected from the nose fly and the throat fly. For horses in harness a broad band of stiff oil cloth or leather attached to the rings at the side of the bridle so that the mouth is entirely covered but the nostrils left clear prevents the nose fly from depositing its eggs. A fringe of leather cut in strips attached all around the mouth on a leather band is effective provided a piece of leather is attached so that it projects over the nostrils and admits of the fringe hanging down in front. Without this the fringe has a tendency to part in the middle and leave part of the mouth exposed. Canvas or sacking can be used to protect the under part of the jaws and prevent the throat fly depositing its eggs on the hair on that part. No satisfactory protection against the common bot fly has been discovered. Clipping the hair short inside and below the knee and applying a non-irritating grease makes it difficult for the fly to attach its eggs, while light cotton blankets and net covers are of some use as preventive measures on the body. The eggs may be removed by scraping them off with a knife, or a very fine steel comb.

For horses at pasture shelter should be provided, a dark shed with sacking for a curtain will prevent fly worry.

Repellents of different kinds have been tried but the constant repetition necessary makes them rather impracticable for horses at pasture. A two per cent emulsion of standard coal tar creosote dips applied with a rag at intervals of a week will probably destroy most of the larvæ and young embryos in the eggs. These disinfectants should be applied lightly and not rubbed in otherwise injury to the hair and skin may follow.

TREATMENT.—Destruction of the bots in the stomach can be accomplished by giving carbon disulphide in capsules. It must be kept in mind that this is a dangerous drug and should preferably be administered by a veterinary surgeon. If a capsule should break and the carbon disulphide get into the lungs the horse might die.

The dose is one and a half fluid drams (six cubic centimetres) per 250 pounds weight and is given in a capsule after fasting the horse for eighteen hours. A single dose of carbon disulphide is most effective but in old debilitated horses there is some risk. For these and young foals the treatment may be given in two or even three half doses with an interval of an hour between doses. This admits of the treatment being suspended if any ill-effects are observed.

Food and water should be withheld for three hours after treatment. No purgative should be given after the carbon disulphide. The bots will come away for several days after the treatment. One treatment is usually sufficient and it has the advantage of being effective against large round worms of the horse.

EXTERNAL PARASITES

LICE

Lice are usually noticed on horses during the cold weather when the coat is long and they increase very rapidly, especially on ill-kept animals. They apparently disappear when the animals shed their hair in the spring but some of the lice usually remain and increase again under winter conditions. Lice are easily detected when numerous. Horses are commonly infested with a species of blood sucking lice (*Hæmatopinus asini*) and two species of biting lice (*Trichodectes pilosus* and *Trichodectes parumpilosis*).

The blood-sucking louse is much the larger species and has a long pointed head while the biting lice have short rounded heads.

These lice complete their life cycle on the horse. The blood-sucking lice will only live about three days and the biting lice not longer than ten days when off the horse.

The eggs of the blood-sucking lice hatch in about two weeks; the extreme range is probably from ten to twenty days according to conditions. When hatched young lice mature and the female commences to lay eggs in eleven or twelve days. The period of incubation for eggs of the biting lice is approximately eight to ten days.

The blood-sucking lice pierce the skin and thus obtain their food supply by sucking blood. The biting lice feed on the exudations and debris of the skin. They do not suck blood. When heavily infested horses manifest great irritation biting and rubbing themselves and the itching causes them to kick and stamp. The coat becomes rough, the hair is destroyed by rubbing and bare patches become evident while the skin is also bruised and wounds or abrasions may appear.

METHOD OF SPREADING.—Direct contact with a lousy horse is the most common method of infestation, but lice may be transported from one animal to another on blankets, curry combs, brushes and harness. Some cases no doubt become infested by lice which have become separated from their host and eggs attached to hair which falls out or is brushed out may hatch under favourable conditions. The young lice will live for a few days and may find another host.

All litter and manure should be removed to a safe distance and the stalls sprayed with a disinfectant. If lousy horses are clipped the hair should be burned.

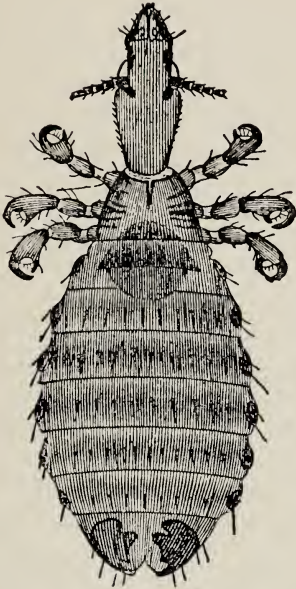


FIG. 15.—*Haematopinus asini* female blood sucking louse of the horse magnified 20 times.



FIG. 16.—*Trichodectes pilosus*, female biting louse of the horse magnified 20 diameters.—Railliet.

TREATMENT.—It is necessary to treat horses twice at an interval of fourteen to sixteen days as the dip which kills lice will not kill all the eggs. The second treatment kills the young lice which hatch from the eggs before they have time to reach sexual maturity and lay more eggs. Any of the coal tar creosote preparations are usually effective in killing lice provided they are used in the strength indicated.

Stock dips containing arsenic in solution are very effective but care must be exercised as these are poisonous.

Nicotine solution used in a strength of five one hundreds of one per cent will kill lice and is safe for use at that strength.

HORSE MANGE

Mange, scabies or itch are the names given to a group of serious contagious diseases of the skin which may affect horses, mules and asses of all classes and ages.

Mange is scheduled under the Animal Contagious Diseases Act. This Act and the regulations made thereunder require that every owner, breeder, dealer or veterinary surgeon suspecting the existence of this disease in horses shall immediately notify the Minister of Agriculture or the nearest veterinary inspector.

This action is essential in order that prompt measures may be taken to control and eradicate the disease with a view to protecting the interest of horse owners throughout the country.

The cause of mange is a minute parasite or mite about one-fiftieth of an inch in length which lives on or in the skin and reproduces itself by means of eggs.



FIG. 17.—Horse showing extensive Mange. Photo by Hadwen.

Under favourable conditions the eggs hatch in from three to seven days but this may be delayed to ten days. The incubation of the eggs varies according to the weather, the activity of the circulation and the thickness of the coat. The young mites after passing through several stages reach maturity and begin laying eggs in ten to twelve days.

Under average conditions the eggs hatch in about four days and the female mite begins to lay eggs in about eleven days so that the reproduction of a new generation may take place in fifteen days. A single pair of mites are capable of producing a million and a half (1,500,000) descendants in about three months.

Mange mites belong to a large order of parasites which is divided into many families. Those affecting horses are classified zoologically into three different genera: *Sarcoptes*, *Psorptes*, and *Chorioptes*.

A great deal has been discovered concerning the life-history of these mites, but it is evident that some of their habits are still unknown. It is, however, known that the mites will not remain on a dead animal as they have been observed to swarm off the carcass directly after death. It has been suggested that the mites may be carried by small animals and birds or even insects and in this way spread the disease mechanically. The mites may live for long

periods in favourable surroundings and they naturally remain in the suitable places until they can gain access to another animal. Many do get on to other horses and as soon as they are in their natural habitat they multiply rapidly under favourable conditions and may soon produce symptoms of the disease. Great care, therefore, should be taken in burning or burying the carcass of any mangy animal and litter which has been in contact with it.

Certain specific mange parasites produce mange on the different animals but the disease is not transferable from one species of domestic animals to another although a temporary irritation may follow transfer of mites from one species to another.

The activities of these innumerable mites and the poisonous secretions produced by them produce intense itching accompanied by loss of hair, effusion, thickening of the skin and the formation of scabs and crusts and even corrugations of the skin.

All cases of mange result from contagion from an existing or pre-existing case.



FIG. 18.—Horse showing Mange lesions particularly on the withers. Photo by Hadwen.

The disease spreads by contact of mangy horses with healthy ones and as mites live for some time off the animal body healthy animals may also become infected by coming in contact with places or things contaminated by mangy animals such as stables, stockyards, stock cars, chutes, fences, trees, ropes, halters, harness, saddles, blankets, stable utensils, curry combs and brushes, in fact anything which has been in contact with a mangy animal which has not been disinfected subsequently.

Each of the three varieties of mange commonly affect horses—Sarcoptes, Psoroptes, and Chorioptes. Each has characteristic habits and in the early stages of the disease the appearance and location of the lesions are fairly typical.

SARCOPTIC MANGE

Mange caused by sarcoptes spreads slowly but it is the most serious and most difficult to cure as the mites burrow into the skin and the females deposit their eggs in the galleries thus formed.

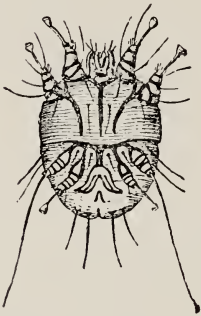


FIG. 19.—Sarcoptes of horse, male, ventral surface magnified 100 times.
From Neumann

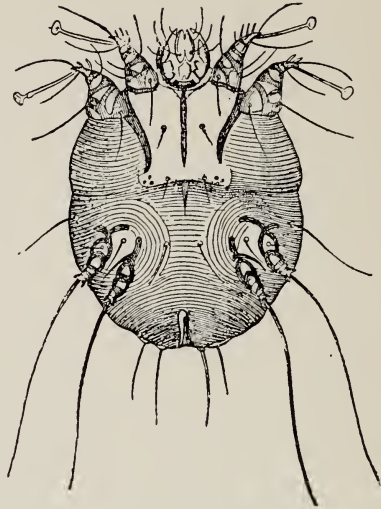


FIG. 20.—Sarcoptes of the horse, female, ventral surface magnified 100 times.
From Neumann

The female mites are about one-fiftieth of an inch in length and the males about one-sixtieth of an inch. When scrapings from a lesion on an infected horse are placed on black paper it is possible to see the mites with the naked eye as small white or yellowish specks. When moving they are more readily detected. It is, however, usually necessary to examine the scrapings under the microscope.

The disease develops slowly at first and is seldom noticed for three or four weeks after infection. It is generally detected on the withers, or as small spots devoid of hair under the ears if infection has been conveyed on a head collar used by an infected horse. It generally spreads in an irregular manner until large portions of the neck and body are affected but the extremities are usually left untouched. If neglected the animal soon becomes debilitated from the constant irritation preventing rest and feeding and the constitutional disturbance produced may lead to a fatal termination.

The skin becomes inflamed and small nodules and vesicles are formed over the burrows. The latter break and discharge serum and small scabs form. The rubbing and biting of the animal results in larger scabs and the skin soon becomes bare in patches and thickened and wrinkled or corrugated in appearance. Cases of long standing are difficult to treat successfully, the disease reappearing in animals apparently cured.

Sarcoptic mange is usually transmitted by direct contact but may be transmitted by stable utensils or harness which have been used on mangy horses.

Horses showing symptoms of mange should be immediately isolated and the case reported. Treatment of all horses on the premises and also contact horses

is carried out under supervision and all stables, utensils, vehicles or other articles the horses may have come in contact with are disinfected.

TREATMENT.—As mange is a reportable disease its suspected existence must be promptly reported to the nearest veterinary inspector and treatment is carried out under quarantine until the animals are cured.

As the symptoms and skin lesions are the result of the activities of the mange mites treatment must ensure their destruction both on the animal body and all contact material. With this object in view a mixture which will destroy the mites is applied to the animal's body and all places and material with which affected animals have been in contact must be thoroughly disinfected.

Dips or mixtures which destroy the parasites do not always destroy the eggs and consequently it is essential to apply treatment at definite intervals in order to kill the mites before they are capable of laying eggs. To meet these conditions treatment must be carried out at intervals of not less than ten days and not more than fifteen days. When practicable all horses should be clipped before treatment and all contact matter should be carefully disinfected immediately after each treatment.

Treatment consists of hand applications or the immersion of the animals in a suitable dipping vat. The first method may be employed when dealing with a limited number of tractable animals. To obtain the best result the animals should first be clipped and then washed with hot water and castile soap to remove all crusts and scabs. As soon as the coat is dry the remedy is applied.

The following mixture is used officially for hand treatment of horses and must be applied under the supervision of an inspector:—

Sulphur	2 pounds
Oil of tar	8 ounces
Raw linseed oil	1 gallon

These ingredients should be gradually heated together, but not allowed to boil as the sulphur and tar will cake on the bottom of the vessel. If the container with the mixture is placed in a large vessel containing hot water and constantly stirred it can be maintained at the necessary temperature after it is heated.

This dressing should be thoroughly applied over the whole body and extremities of the animal including the ears and tail at a temperature of not less than 110 degrees F. and not more than 120 degrees F.

At least two dressings are necessary. Two days before the second application the first dressing should be washed off with hot water and castile soap. The second dressing may be washed off after eight days has elapsed.

In severe cases it may be necessary to apply the treatment several times.

Upon completion of the first treatment all refuse and litter must be promptly burned and all places and material with which infected animals have been in contact must be thoroughly disinfected with an approved disinfectant.

In outbreaks comprising large numbers of animals dipping in the official lime, sulphur mixture has given satisfactory results.

This mixture consists of:—

Flowers of sulphur	24 pounds
Fresh unslaked lime.....	10 "
Water	100 "

The preparation of this mixture is of the greatest importance. The lime should be carefully slaked, made into a paste and sulphur then added and thoroughly incorporated with the paste; the whole is then added to sufficient water, preferably boiling water, and thoroughly boiled for at least two hours and while boiling must be frequently stirred. The mixture should then be of a rich brown or chocolate colour. Allow mixture to stand for a few hours, better still over night, then drain off liquid but do not disturb sediment, and add suffi-

cient water to make one hundred gallons. The vat is filled with the mixture in the above proportions, and heated to not less than 110 degrees F. nor more than 115 degrees F.

This temperature must be maintained while the animals are held in the vat for at least two minutes. During this period all crusts and scabs must be loosened with a stiff brush. This procedure is most important, in order to enable the mixture to come in contact with the mites under these scabs and crusts. Upon completion of the first dipping all refuse must be promptly burned, and all infected places and materials thoroughly disinfected.

The second dipping must be undertaken between the tenth and fifteenth day after the first dip, in order to destroy the new generation of mites before they mature.

There are two varieties of dipping vats, the cage vat and the swimming vat. The cage vat gives excellent results and is preferable to the swimming vat, but its use is not practicable when a large number of animals are to be dipped.

Under proper treatment and strict sanitation the disease is curable but if neglected may necessitate the slaughter of badly diseased animals.

PSOROPTIC MANGE

Mange caused by psoroptes while not so intractable as sarcoptic mange is, nevertheless, a serious malady, causing great suffering and loss of condition to the affected animals.

The mite is somewhat longer than the sarcoptic mite, female measuring about one-fortieth of an inch and the male about one-fiftieth of an inch in length.

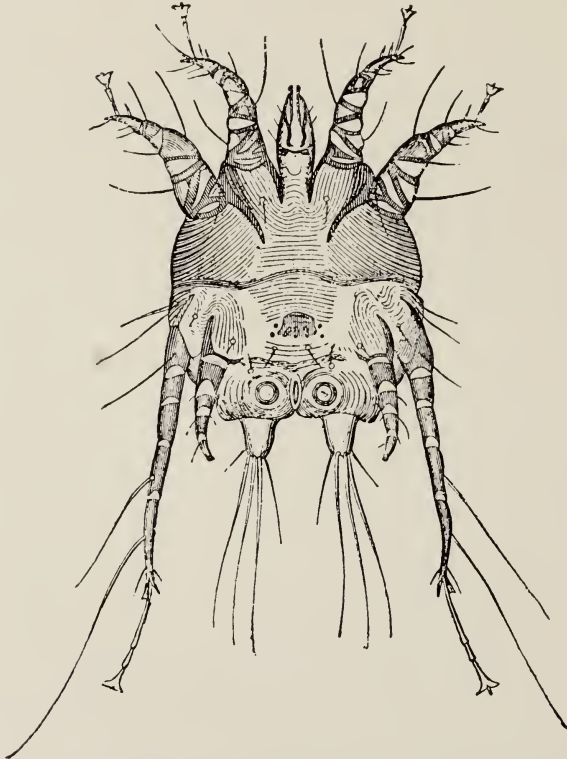


FIG 21.—Psoroptes of the horse, male, ventral surface magnified 100 times.

From Neumann

The female may lay from fifteen to twenty-four eggs and these may hatch in from three to four days. The young mites become sexually mature and the females may deposit eggs for the next generation in from ten to twelve days.

The disease generally makes its appearance at the roots of the mane or tail. The irritation causes the horse to rub these parts and soon the broken appear-

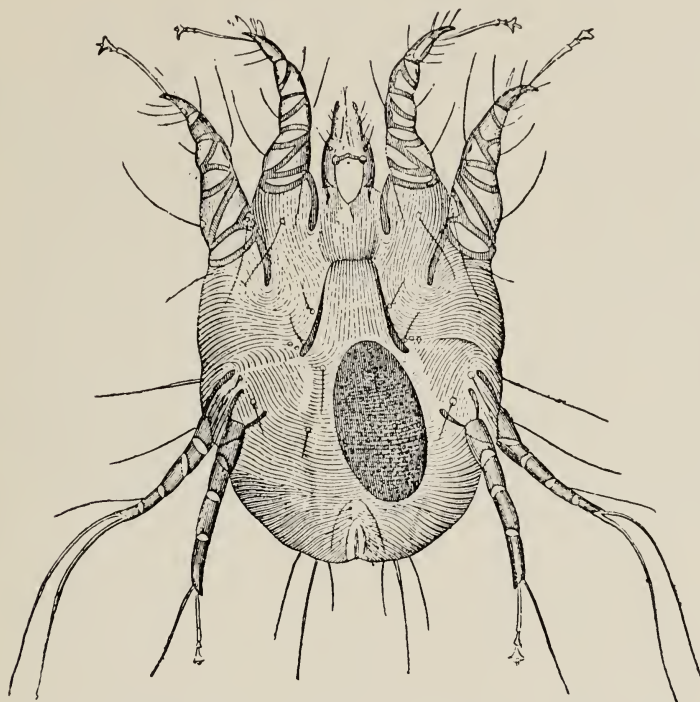


FIG. 22.—*Psoroptes* of the horse, ovigerous, female, ventral surface magnified 100 times.

From Neumann

ance of the long hairs calls attention to the trouble. These mites do not burrow but live on the surface of the skin under protection of the scales and scabs resulting from their activities. Examination reveals small pimples which exude serum and eventually crusts and scabs are formed. The mites prick the skin and it is believed introduce a poisonous secretion which causes an inflammation and intense itching. In this form of mange the affected parts remain moist and in this respect differ from sarcoptic mange in which the surface of the skin remains drier and more scaly. As the mites increase the lesions spread and large areas become inflamed, thickened and wrinkled while the hair either falls out or is rubbed off. This form of mange is even more contagious than sarcoptic mange and is readily transmissible to other equines by direct contact or indirectly by means of infected stables or utensils with which infested horses have come in contact.

Treatment is the same as for sarcoptic mange and must be carried out under supervision of an inspector of the Health of Animals Branch.

CHORIOPTIC MANGE

Chorioptic or symbiotic mange in horses is generally confined to the legs, more especially the hind legs, and is most frequently seen in horses with hairy legs. The chorioptes are somewhat similar to other mange mites but rarely extend their operations above the hocks.

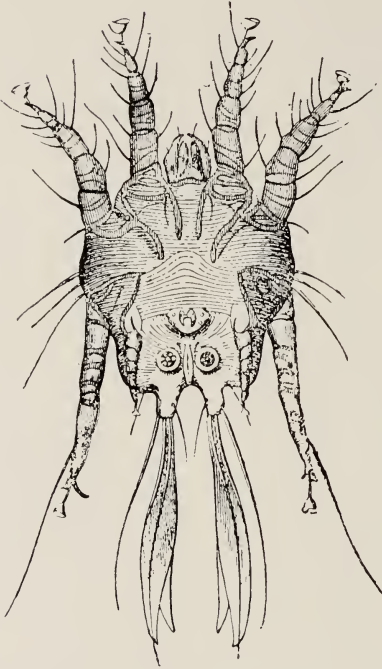


FIG. 23.—Chorioptes of horse, male, ventral surface magnified 100 times.
From Neumann

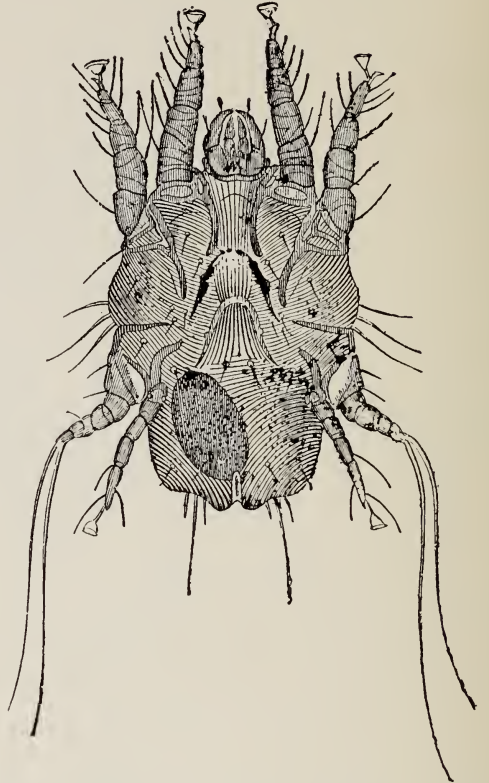


FIG. 24.—Chorioptes of horse, ovigerous, female, ventral surface magnified 100 times.
From Neumann

This disease spreads slowly and yields readily to treatment. Affected horses show their discomfort by pawing and kicking and rub the affected parts with the other foot.

The treatment recommended for sarcoptic mange is effective in eradicating leg mange. Leading or driving horses through a shallow trough or tank filled with the lime-sulphur solution at a ten-day interval is an easy and quick method of treatment. Individual animals may be treated by soaking the legs with dip.

It is rarely necessary to insist on control or quarantine measures for chorioptic mange.

