

HABRONEMIASIS SERIOUSLY AFFECTING IMPROVED TYPES OF HORSES IN THAILAND

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INTRODUCTION

According to various investigators, habronemiasis in horses occurs in certain countries of Europe, Asia, and North America; it occurs in Australia and possibly also in other countries where the causative nematode parasites (*Spiruridae*) are found. Due to favorable climatic conditions, this disease is known to be more prevalent and with higher incidence in tropical countries than in temperate countries.

Cases of cutaneous habronemiasis, otherwise known as "summer sores", "summer wounds", or "bursatti", and cases of gastric habronemiasis have been observed among improved types of horses in two vicinities of Bangkok and in the provinces of Saraburi and Choburi in connection with the veterinary ambulatory clinic for practical field training of senior and junior students of the Faculty of Veterinary Science. Observations so far made have shown that the imported horses are seriously affected by cutaneous habronemiasis and by gastric habronemiasis.

Since the cutaneous and gastric types of this disease are destructive to horses and certain cases are not easily amenable to treatment, this report is presented with special reference to the transmission and pathogenicity of the causative worms and the control of the disease. It may be useful not only to veterinarians engaged in equine practice but also to those in-charge of horse stables and horse farms.

The observations on habronemiasis in Thailand for this report could not have been made within a short period of about five months had it not been for the encouragement of the ambulatory clinic by Dean Luang Chai Asvarakra of the Faculty of Veterinary Science; for the cooperation of Dr. Jit Waramontri, Head of the Department of Veterinary Parasitology, in the early acquisition of the necessary equipment and materials through the Office of the Dean; and for the diligence and interest of Mr. Prakai Chitrakorn, senior student assistant, in helping the writer in laboratory diagnosis and collecting the necessary specimens.

CAUSATIVE NEMATODES AND TRANSMISSION

The equine stomach worms causing habronemiasis are three species of small spirurids, namely:

- (1) *Habronema megastoma* (Rudolphi, 1819)
Synonym: *Draschia megastoma* (Benbrook, 1952);
- (2) *Habronema muscae* Carter, 1861; and
- (3) *Habronema microstoma* (Schneider, 1866)
Synonym: *Habronema majus* (Benbrook, 1952)

In popular terms, *H. megastoma* is known as the large-mouthed stomach worm; *H. muscae*, the Carter's stomach worm which has medium-sized mouth; and *H. microstoma*, the small-mouthed stomach worm.

Distribution.— The occurrence of these three species have been reported in Europe by van Saceghem (1918) and others; in Africa by Monnig (1934); in the Philippines by de Jesus and Uichanco (1939) and by Tubangui (1947); in North America by Benbrook (1952) and others; and in Australia by Bull (1919) and others. But in Australia, only *H. muscae* and *H. microstoma* are recorded by Seddon (1947) in his check list of animal parasites in that country; and in India, only *H. muscae* is mentioned by Datta (1933). However, it is probable that all the three species of these spirurids occur in most tropical countries.

Identification.— The three species of *Habronema* are differentiated mainly by the relative sizes and morphological characteristics of their respective mouths and partly by the characteristic papillae and spicules at the tail of the males. These distinguishing features are clearly presented by Morgan and Hawkins (1951) and by Monnig and Lapage (1956) in their respective books of veterinary helminthology. To clearly see the characteristics of each species, male and female specimens are mounted in lacto-phenol on a microslide with cover slip and the preparation is examined microscopically under the 4-mm. objective at a magnification of about 400 x.

LIFE - HISTORY

As reported by various investigators, the intermediate host of *H. megastoma* and *H. muscae* is the common housefly (*Musca domestica* Linnaeus); that of *H. microstoma*, the common stablefly (*Stomoxys calcitrans* Geoffroy). However, it is highly probable that the subspecies of *M. domestica* and possibly also the other species of *Musca* in the tropics can also serve as intermediate hosts of *H. megastoma* and *H. muscae*.

In the Philippines, Cabrera and Rozeboom (1957) have definitely identified the common houseflies as *Musca domestica vicina* Macquart and *Musca sorbens*

Wiedemann; and those commonly found among farm animals, which are known to be hematophagous in their feeding habits, as *Musca domestica* (?) *nebulo* Fabricius, *Musca vetustissima* Walker, *Musca conducens* Walker, *Musca ventrosa* Wiedemann, *Musca planiceps* Wiedemann, *Musca crassirostris* Stein, *Musca craggi* Patton, *Musca senior-whitei* Patton, *Musca bakeri* Patton, and *Musca gibsoni* Patton and Cragg. Even in the complete absence of *Musca domestica* Linnaeus in that country, *Habronema megastoma* and *H. muscae* are quite prevalent. Hence, as to which of these common houseflies and/or of these common hematophagous *Musca* spp. serve as intermediate hosts of these two species of *Habronema* are yet to be determined. This condition in the Philippines may be identical with that in the neighboring Asian countries.

Since *H. megastoma* and *H. microstoma* are known to be viviparous and *H. muscae* to be ovoviviparous, only the non-infective larvae are passed in the feces of horses suffering from gastric habronemiasis. Fresh horse manure is the most favorable breeding place for *Musca* spp.; and the old fermenting manure mixed with bran and hay, for the stableflies. Because of positive chemotaxis, the *Habronema* larvae are attracted by the fly larvae or maggots, so that at least some of the worm larvae are ingested by the maggots with some particles of fecal matter.

The *Habronema* larvae reach their infective stage by the time the maggots are becoming pupae and they are found in the haemocoel of the pupae and of the adult flies where they remain viable for the duration of the life of the flies.

MODES OF INFECTION

Heretofore, it was believed that the infective larvae leave the fly body by breaking through the intersegmental membrane. Recently, it had been demonstrated that these larvae migrate to the proboscis of the fly intermediate host (Monnig and Lapage, 1957).

Cutaneous Infection.— Whenever the infected *Musca* spp. is feeding on skin breaches, such as exposed operation and accidental wounds as well as abrasions, scratches and rope burns, the infective larvae of *H. megastoma* and *H. muscae* in the fly proboscis are stimulated and attracted by the horse body heat thereby reaching the skin breaches. Likewise, the infective larvae of *H. microstoma* enter the skin punctures whenever the infected stablefly pierces the skin while in the act of sucking blood. In either mode of infection, the larvae invade the cutaneous tissues. As to whether or not some of these larvae migrate from the skin to the stomach where they develop to adults is not definitely known.

Gastric Infection.— The *Musca* spp. and *Stomoxys calcitrans* are known to live for a few weeks only in the tropics. Just before death, the infected flies may gain access to the feed and water of horses and are thus accidentally ingested.

The *Habronema* larvae are then liberated in the horse stomach. These larvae can also reach the horse stomach by other means. While the infected *Musca* sp. is feeding on particles of food on the horse lips, the larvae are stimulated and attracted by the horse body heat and crawl down the proboscis to reach the lips and at least some of them are later accidentally swallowed with the food and water. On the other hand, whenever the infected stablefly pierces the skin of the horse, irritation and itchiness are produced at the points of bites. If these points are accessible to the horse mouth, the sensitive animal will naturally bite these points and at least some of the larvae still in the oozing blood will come in contact with the horse labial mucosa and adhere thereto. Likewise, this larvae are swallowed later with the food and water. In either of these modes of infection, the larvae invade the gastric mucosa and develop to adults.

PATHOGENESIS AND COMPLICATIONS

Both the larvae and adults of the three species of *Habronema* are highly pathogenic to horses; they invade the cutaneous tissues and the gastric mucosa including the submucosa as their respective sites of infection where they wander, suck blood and excrete irritant substances. Like certain other species of blood-sucking worms, these species possibly also excrete toxic substances which are absorbed by the host tissues.

CUTANEOUS HABRONEMIASIS

The movements in the skin and the excreted irritant substances cause much irritation to the skin. Chronic inflammation sets in resulting in granular dermatitis in different parts of the body if caused by *H. microstoma* larvae; at points of skin breaches, generally in the legs and feet, if by *H. megastoma* larvae and partly by *H. muscae* larvae; and near the inner canthus and even in the conjunctiva, if by *H. muscae* larvae.

Succeeding infections with *H. megastoma* larvae cause severe allergic reactions followed by tissue proliferation resulting initially in the growth of exuberant tissues and ultimately in the formation of granulomata. Experimentally, van Saceghem (1918) and Bull (1919) produced granulomata with larvae of *H. megastoma* in exposed wounds of horses. Datta (1933) points out that the histological changes in bursatti lesions, which he calls "kunkurs", are "similar to those found in gastric habronemic abscesses and other kinds of worm-caused nodules". These lesions are shown in Plates I, II, and III.

Complications.— Due to itchiness and pain, the afflicted horse bites are rubs the lesions against hard objects in an effort to relieve the suffering thereby causing these lesions to bleed. Then, the bleeding lesions, if left unattended, will attract houseflies,

hematophagous flies, myiasis flies, and even scavenger flies, bringing to the lesions varied infective organisms. Observations in this study have shown that the common complications are suppuration, necrobacillosis, and myiasis. Several cases with granulomata having sanguino-purulent discharge were found in Sriracha to be infested with maggots.

Under these conditions, the affected horses have deformed skin at the infected parts and suffer from nervousness, toxemia, sometimes pyemia, and lowered body resistance.

GASTRIC HABRONOMIASIS

The lesions produced by the adult *Habronema* spp. are very characteristic to the species. Because of this, one can fairly foretell the causative species by simply observing closely the gastric lesions.

Habronema megastoma

Upon reaching the stomach, the larvae invade the mucosa and submucosa of the non-glandular or cardiac portion where they develop to adults. The movements of the worms as well as the irritant substances excreted cause much irritation leading to chronic inflammation. As in cutaneous habronemiasis, succeeding infections cause severe allergic reactions followed by tissue proliferation and the formation of granulomata ranging in sizes generally from that of a baby's fist to that of a man's fist; larger sizes had been observed and reported. The writer had an experimental horse having a large habronemic granuloma at the cardiac portion of the stomach close to the lower end of the esophagus; this horse was sacrificed being very much weakened and in prostration after showing symptoms of recurrent acute gastritis and anorexia and that it could no longer swallow even finely chopped forage given in small amounts by forced feeding.

Complication.— The common complication in this infection is abscess formation in the granulomata. Topacio (1934) reported a fatal case involving an Arabian stallion that had a large suppurating habronemic granuloma in the cardiac portion of the stomach. This horse became emaciated, anemic, icteric, and edematous in the legs. Antemortem examination of the blood showed the presence of *Habronema* larvae. On autopsy, *H. megostoma* adults were found in the walls of the abscess; and the immediate cause of death was "parasitic, vascular asphyxia brought about by capillary blocking and acute edema of the lungs". In this case, toxemia and pyemia cannot be ruled out, just as in other cases without complication toxemia and gastritis are present.

Habronema muscae

The adults of this species are found usually in the glandular portion of the horse stomach with their heads partly buried in the mucosa for attachment and for sucking blood. In heavy infection, severe gastritis is produced and the afflicted animal shows symptoms of gastric disturbances, lack of appetite and impaired digestion leading to emaciation and weakness. Such an animal has a very much lowered body resistance.

On autopsy of sacrificed or dead cases, the glandular portion of the gastric mucosa is found to be covered with thick, tenacious mucus within which and under which are the adult worms. The infected mucosa is brownish red in color with eroded areas and is much thicker than normal. A specimen showing these characteristic lesions has been recently collected from an emaciated and weakened purebred horse which was donated to the Faculty of Veterinary Science where it was sacrificed for anatomy instruction purposes. The emaciation and weakened condition were due to heavy infection with *H. muscae* alone.

Habronema microstoma

While this species has the smallest mouth, its pharynx is provided with a dorsal and a ventral tooth in the anterior part for tearing or cutting certain points of the mucosa to which it is attached in order to suck blood and to lodge in broken tissues. Like the adults of *H. megastoma*, the adults of *H. microstoma* have the peculiar habit of grouping in large numbers in heavy infections at certain circumscribed areas at or near the junction of the non-glandular and glandular portions of the gastric mucosa. Their combined and repeated tearing of the mucosa with their teeth lead to the production of fairly large wounds which are roughly circular, shallow and lacerated, ranging in diameters from 1 to 5 cm. as observed by the writer in past autopsies. The irritation produced and the infected wounds cause localized acute gastritis as well as gastric hemorrhages.

Complication.— The invasion by pyogenic bacteria convert these wounds into gastric ulcers which are bound to become deeper and wider due to tissue destruction on the part of the worms remaining in the ulcers. In past autopsies of cadavers of emaciated Philippine ponies, the adults of *H. microstoma* were found in the walls of gastric ulcers one of which was in bleeding condition.

METHODS OF DIAGNOSIS

Habronemiasis is quite difficult to diagnose. The methods of diagnosis of the cutaneous type are different from those of the gastric type.

CUTANEOUS HABRONEMIASIS

The lesions, though varied as described under pathogenesis, are quite pathognomonic of this disease. A few of these varied lesions are shown in Plates I, II, and III. However, it is necessary to clinch the diagnosis by demonstrating the causative worm.

Direct Methods

These methods are the examinations of the scrapings from, and the histological sections of, the lesions for the presence *Habronema* larvae.

Scrapings.— It should be noted that this method is useful only for lesions that are not of long duration and are only in the form of granular dermatitis or small, low cutaneous nodules. With a curette, the lesion is scraped deeply beyond the dermis for the larvae are not found superficially. Then, the scrapings are mixed with equal volume of normal saline solution and examined microscopically under the 16-mm. objective at a magnification of about 100 x. The larva is long and active, which is very much larger than a microfilaria, so that one can easily see it whenever present.

Histological Sections.— On biopsy, a piece of the cutaneous lesion is excised for the usual histological sections. This method is necessary for lesions of long standing including those in the form of granulomata. Datta (1933) states that failure to see the larvae by this method is due to lack of complete serial sections.

Indirect Methods

In a suspiciously infected horse farm or stable, the common *Musca* spp. and stableflies (*Stomoxys*) are caught with insect nets, killed in cyanide bottles, separated into groups by genus, and examined for *Habronema* larvae.

Dissecting Few Flies.— If there are only few flies caught, each is dissected by teasing the thorax and abdomen with dissecting needles, placed on a microslide, wetted with normal saline solution, and examined microscopically under the 16-mm. objective for *Habronema* larvae.

Many Flies in Baermann Apparatus.— If there are many flies caught, one group, either *Musca* or *Stomoxys*, is crushed or chopped to break the insect bodies, and placed in the Baermann apparatus from which the larvae are collected. The writer and Mr. Prakai Chitrakorn collected by this method a large number of *Habronema* larvae from flies caught in one infected horse farm and one infected stable.

GASTRIC HABRONEMIASIS

Since the ova of *Habronema* spp. are not passed in the feces and the non-infective larvae are not easily seen therein nor conveniently collected therefrom, the most practical and reliable method of diagnosis of this type of habronemiasis is by the following:

Biological Method

A sample of feces, weighing from 200 to 500 grams, is collected either from a freshly voided feces or from the rectum of a suspected horse. This is placed in a large tin can, preferably an empty kerosene can opened on one side, and exposed to the flies for a few days to let them oviposit on it. The fecal culture is covered one week later with a piece of fly-proof wire netting.

Then, the pupae or the adult flies from this culture are examined for *Habronema* larvae as described above. If the fly intermediate host is found positive, the horse from which the feces was taken is positive for gastric habronemiasis.

TREATMENT

Like the diagnosis, the treatment of cutaneous habronemiasis is very different from that of gastric habronemiasis; they are thus generally considered as separate diseases.

CUTANEOUS HABRONEMIASIS

Various investigators recommend different methods of treatment; certain methods reported to be effective by some are reported to be ineffective by others. While the condition in the form of granular dermatitis is quite amenable to chemotherapy, that in the form of granulomata is only amenable to surgery.

Granular Dermatitis

In the incipient stages, this condition is fairly curable if the infection is localized in the open lesions, but not if it is generalized in apparently normal skin unless an effective drug is found for parenteral administration.

One method is to apply a pack liberally wetted with the following preparation:

Carbolic acid U.S.P.	- - - -	30 cc.
Glycerine	- - - -	50 cc.
Distilled water q. s.	- - - -	1,000 cc.

For lesions wherein necrobacillosis has set in, either one of the following may be applied after cleaning the area with 2 per carbolic acid solution:

For wetting the lesions daily -

Formalin	- - - -	20 cc.
Glycerine	- - - -	50 cc.
Distilled water q. s.	- - - -	1,000 cc.

For dusting the lesions daily -

Chlorinated lime **ad. lib.**

If the lesion is complicated with myiasis, it is necessary to irrigate the holes or pockets with 5 per cent carbolic acid solution so as to flush out the maggots; and this is repeated daily until all the maggots have been removed. Then, the maggot holes or pockets are simply treated like an infected punctured wound and smeared with pine tar or any other fly repellent (*vide infra*).

For habronemic granular dermatitis, Descazeaux and Morel (1933) and Morel (1934) recommend the application of "novarsenobenzol" either in glycerine, in powdered form, or as an ointment. They claim that this drug has given excellent results as a treatment for summer wounds. This drug is also known as neoarsphenamine, or neosalvasan and its therapeutic doses for intravenous administration to large horses are from 3 to 6 grams as recorded in a pharmacopoea.

Habronemic Granuloma

The treatment of this condition is necessarily drastic; it is necessary to excise this tumor as early as possible or while it is small. However, any complication as in granular dermatitis form should be treated first before the surgical treatment.

To avoid recurrence due to the *Habronema* larvae that may be left, the resulting wound should be partly treated like the lesion in granular dermatitis. Like any operation wound, the surgical wound in this case must be protected from flies.

GASTRIC HABRONEMIASIS

This type is easily curable if only caused by *H. muscae*; fairly curable, if by *H. microstoma*; and generally incurable, if by *H. megastoma*. This is due to their respective positions or locations in the equine stomach as described elsewhere in this paper (*vide supra*).

The infected horse is first fasted for 18 to 24 hours. In order to loosen and wash away at least most of the thick mucus that covers the adult *H. muscae* and *H. microstoma* on the gastric mucosa thereby exposing them later to the anthelmintic, it is necessary to give the animal a stomach lavage. For large horses, from 8 to 10 liters of 2 per cent sodium bicarbonate solution at body temperature is administered through a stomach tube and leaving the liquid in the stomach for about 1 hour and without removing the tube. Thereafter, the horse head is lowered down with the stomach tube to drain any remaining portion of the sodium bicarbonate solution that may not have passed into the intestine. Then, the horse head is raised up and through the same stomach tube, carbon bisulphide at the rate of 5 cc. per 100 kilograms body weight is administered followed by about 50 cc. of water to wash down any remaining portion of the highly irritant drug in the stomach tube before it is withdrawn.

This treatment will kill most or all the *H. muscae* adults being free on the mucosa, the *H. microstoma* adults which are not embedded in the walls of the habronemic ulcers, and the *H. megastoma* adults which are still free in the stomach as in very recent infection; but it will not affect at all those *H. megastoma* adults which are deeply lodged in the habronemic granulomata. Hence, cases that do not respond favorably to repeated treatments may be considered as infected with *H. megastoma* and are serving as sources of infection in cutaneous and gastric habronemiasis and should be sacrificed as a logical means of prevention.

PREVENTIVE MEASURES

The following preventive measures should be instituted in horse stables and farms, more particularly in those having positive cases:

1. Proper Disposal of Horse Manure

This is the most important preventive measure in habronemiasis, because even if there are always flies from the neighboring stables and farms, these insects cannot be infected with the *Habronema* larvae so long that their maggots did not develop in the manure of positive horses. Moreover, the regular collection and burial of horse manure is the best method of biological control of houseflies and stableflies by depriving them of their most favorable breeding place.

Trench Method.— Long, parallel trenches, measuring about 1 meter wide between the edges, about 1/2 meter wide at the bottom and about 1 meter deep, are dug near the stables. For convenience, the soil dug up is piled along the edges of the trench. Every morning and afternoon, all the manure in the stables and on the pasture is collected in wheelbarrows and dumped into the trench, starting at one end, and immediately covered with soil about 6 inches thick; it must be so completely covered that no portion of the manure is exposed to the flies. The dumping of manure and covering it is continued until one point of the trench is so filled up that the uppermost soil cover is about 1 foot higher than the surrounding ground. Any portion of the buried manure at least 6 months old can be dug up and used with safety for fertilizer; the vacated or emptied part of the trench can then be used again for manure disposal.

2. Effective Insecticide for Fly Control

The most effective contact poison and the best stomach poison for flies should be selected on the basis of their long residual effects, cheapness, and practical application.

Contact Poison.— A 5 per cent DDT solution in diesel oil or in kerosene should be sprayed once a week on the walls, railings and posts of stables and on

the trunks of trees on the pastures. If wettable DDT is available, a 4 per cent solution in water may be sprayed on the body and legs of horses sufficiently so to moisten the hair coat once a week.

Stomach Poison.— The use of the following preparation for wetting old or discarded gunny sacks had been found to be effective in the control *Musca* spp. in horse stables and farms:

Sodium arsenite	— — — — —	200 Grams
Molasses	— — — — —	8,000 cc.
Water q. s.	— — — — —	20,000 cc.

The sodium arsenite is dissolved first in half the amount of water before adding the molasses and the rest of the water. The gunny sacks, wetted at least once a week with this preparation, should be suspended from the stable rafters. The flies are attracted by the smell of molasses and are poisoned by feeding on it.

3. Protection of Skin Breaches

As has been stated, the portals of infection in cutaneous habronemiasis are wounds, scratches, abrasions, and rope burns. These skin breaches must be treated immediately and if they cannot be under bandage they must be smeared with pine tar or with the following fly repellent preparation which is also a germicide:

Turpentine	— — — — —	1,000 cc.
Kerosene	— — — — —	7,000 cc.
Coconut oil q.s.	— — — — —	20,000 cc.

4. Prevention of Rope Burns

While it is preferable to use cotton rope for tying any part of the body of animals, especially horses, this kind of rope is expensive and does not last long on animals in the tropics. Hemp rope, also known as Manila rope, is thus commonly used; but this kind of rope is quite hard and its surface is so rough that it easily causes rope burns. Hence, before using it on animals this rope should be softened first.

Softening Hemp Rope.— The rope is boiled first in a 5 per cent solution of sodium carbonate in water for at least 2 hours. Then, while wet, it is pounded with a heavy mallet, or a piece of hard wood, point by point along its length until it becomes soft, especially its surface.

Need for Padding.— At points on the feet like the pasterns and at those on the back and breast where the rope is applied with much pressure, a padding should be used to avoid rope burns. For padding in these cases, several layers of a piece of discarded cloth or two layers of a piece of gunny sack will serve the purpose.

5. Care of the Skin and Feet

The equine species has a thin and sensitive skin; when the skin of the body is soiled for sometime, it becomes itchy for the horse by nature is a sensitive animal. Similarly, old dirt on the feet causes itchiness there in the skin.

Necessary Bathing and Grooming.—Horses in confinement, more particularly the Occidental breeds kept in the tropics, should not only be bathed whenever their bodies are soiled but also be currycombed and brushed daily until their hair coat becomes glossy in order to keep the skin healthy. To avoid the transmission of certain skin diseases, each horse should have a separate set of grooming utensils.

6. Raising Resistance to Parasitic Infections

In addition to the rigors of practically continuous warm weather several other factors generally existing in the tropics tend to lower the resistance of Occidental breeds, especially of large herbivorous animals like the horses, to parasitic infections. The blood-sucking insects such as the stableflies, mosquitoes and tabanids are common pests throughout the year that attack horses. The lack of suitable and succulent leguminous plants in the pastures deprive them of sufficient amount of easily digestible protein and of certain minerals and vitamins in their diet. It is pointed out by Turner (1947) that the supply of protein in animal diet has a great influence upon immune response and upon resistance to infection; by Ackert (1931), that of vitamins A and B, and by Gaafar and Ackert (1950) (1952), that of minerals upon resistance to parasitism. Therefore, as stressed by de Jesus (1958), there is a great need for a systematic control of the common arthropod pests in animal farm and stable management, for the improvement of pastures by liming and extensive planting of forage legumes, and for sufficient protein and mineral supplements in the ration in order to raise the resistance of horses in the tropics to parasitism.

SUMMARY

A report on habronemiasis seriously affecting the improved types of horses in Thailand is herein presented with discussions on the transmission, pathogenesis, diagnosis, treatment, and prevention for the control of this destructive parasitic disease.

The Occidental breeds of horses appear to be more susceptible to this disease than the native horses possibly due to their lower resistance to this parasitism because of certain unfavorable factors in their new habitat, or because their ancestors had not been long exposed to this spirurid infection.

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ILLUSTRATIONS

Plate I

HABRONEMIC GRANULAR DERMATITIS

Figure 1.- Lesion just below the right knee.

Figure 2.- Lesion at the fetlock.

Figure 3.- Lesion at the pastern.

HABRONEMIC GRANULOMATA

Figure 4.- Lesion at the left front fetlock.

Figure 5.- Lesion on all four feet involving the fetlocks and pasterns.

An emaciated horse suffering from gastric habronemiasis and cutaneous habronemiasis.

Plate II

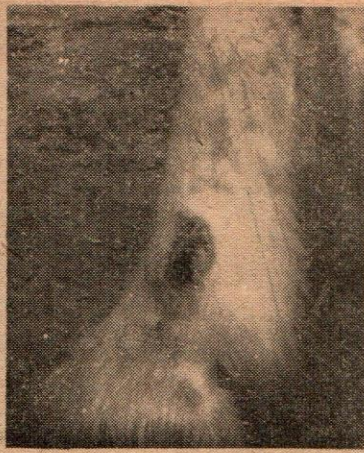
Lesion in habronemic granular dermatitis, normal size, showing granulation tissue.

Plate III

An advance case of habronemic granuloma, normal size, in suppurating condition.



1



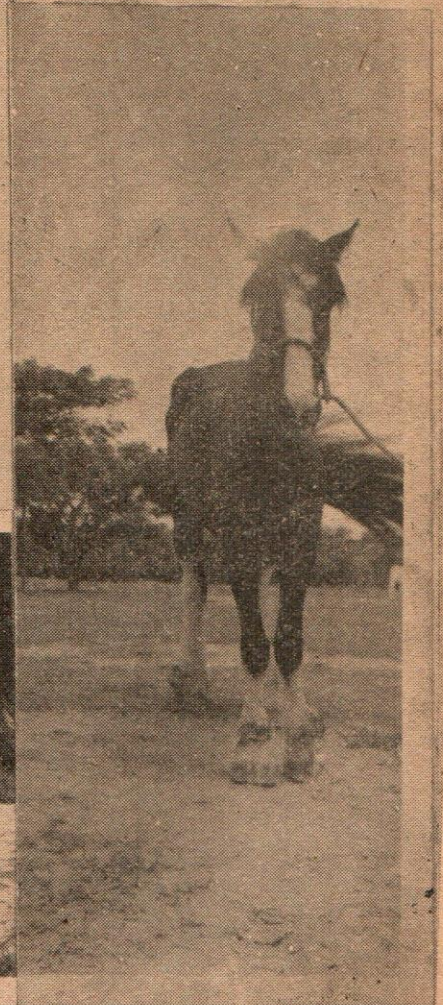
2



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Plate II



Plate III



Mr. R.P. Jones, M.R.C.V.S.