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BULLETIN No. 26

THE POISONING OF HORSES

BY THE

COMMON BRACKEN (*Pteris Aquilina* L.)

BY

S. HADWEN, D.V.Sc.

Pathologist, Veterinary Research Laboratory, Agassiz, B.C.

AND

E. A. BRUCE, V.S.

Assistant, Veterinary Research Laboratory, Agassiz, B.C.

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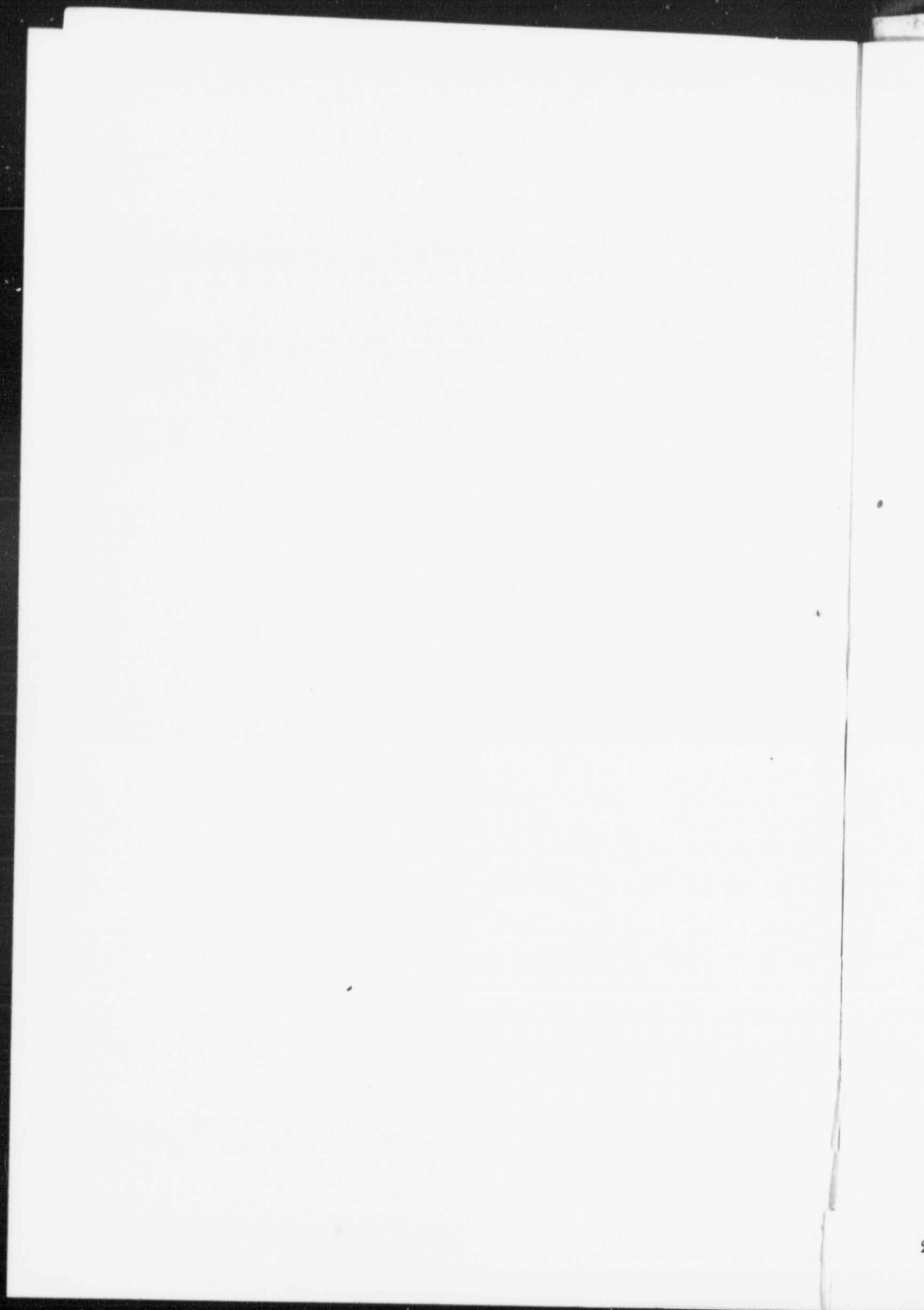
OTTAWA

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Honourable MARTIN BURRELL,
Minister of Agriculture.

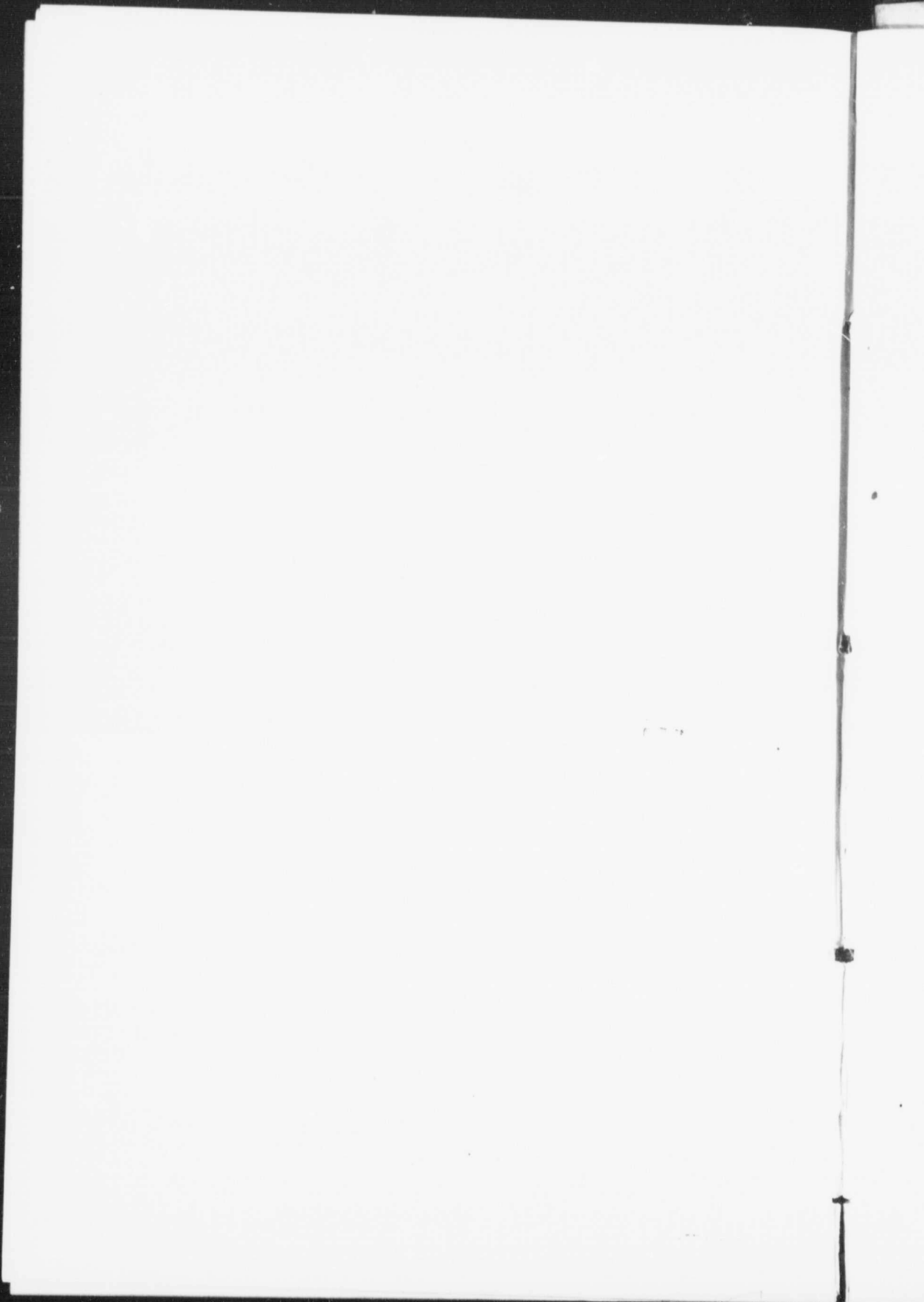
SIR,—I have the honour to submit to you a report with regard to The Poisoning of Horses by S. Hadwen, D.V.Sc., Pathologist, Veterinary Research Laboratory, Agassiz, B.C., and E. A. Bruce, V.S., Assistant Pathologist, Agassiz, B.C., and request that it be printed as Bulletin No. 26.

I have the honour to be, sir,

Your obedient servant,

F. TORRANCE,
Veterinary Director General.

OTTAWA, 30th May, 1917.



THE POISONING OF HORSES BY THE COMMON BRACKEN

(*Pteris aquilina* L.)*

SEYMOUR HADWEN AND E. A. BRUCE.

A disease known locally as Staggers has been prevalent on the Pacific slope for many years. It is characterized by uncertain gait, loss of equilibrium, general unthriftiness and unimpaired appetite. The greatest number of cases occur during the winter months, the disease being most common when the weather is severe and protracted. Treatment if instituted early is usually successful, but neglected animals generally die.

On all the farms where cases occurred, bracken (*Pteris aquilina* L.) was found in the hay. While it was thought that bracken might be the cause of the trouble, very little literature could be found on the subject. Various authorities have mentioned that the plant was suspected of being poisonous but do not support their statement by any experimental evidence. The best description of bracken poisoning is given by Lander, in his book on toxicology, i.e., "The poisoning of horses after prolonged feeding on bracken along with other forage is mentioned by the German authorities." Poisoning is thought to be due to the effects of an acid (pteritannic acid), similar to and possibly identical with filicic acid of male-fern. Bracken poisoning of the horse does not appear to have been reported in Great Britain, but quite recently we were advised by a returned army veterinarian (L. D. Swenerton) that he had seen some cases in the South of England that had been fed on ferny hay from Northumberland, at the time, however, he did not connect the bracken with the trouble, as at that time he had not seen our preliminary communication. In 1909-1910 the British Board of Agriculture investigated a somewhat obscure disorder that occurred in cattle in the early autumn (August-November), after eating bracken. This investigation was confined to cattle and the results obtained show no similarity to the disease with which we are dealing; this may be due to the fact that green bracken was used, their findings, however, were inconclusive. We have never seen cattle or horses eat green bracken unless starved to it.

We have evidence that the disease occurs in Washington and Oregon as well as in British Columbia, and in view of the fact that *Pteris aquilina* has a very wide distribution it seems probable that the fern causes trouble elsewhere. During the hard winter of 1915-1916 the mortality amongst horses in the Fraser Valley and on Vancouver Island was very heavy. As an extreme instance we cite the following:—In the little village of St. Elmo, B.C., out of twenty-four horses owned by eleven farmers, sixteen died of bracken poisoning, four recovered and the balance (four) did not take the disease. To determine definitely whether bracken was the cause of the disease known locally as Staggers or not, it was decided to conduct some experiments. Permission was obtained from the Veterinary Director General to buy the necessary animals and incriminated feed. As the disease has only been reported when horses have been confined, it was decided to simulate in so far as possible the conditions under which animals became affected. It was commonly believed by the majority of people

*NOTE.—In compiling this bulletin it has been necessary to include some matter which may not be of particular interest to the average reader. The attention of farmers is especially directed to the paragraphs dealing with the following:—Summary of experiments, symptoms, treatment and the eradication of fern.

that cold weather was partly responsible for the disorder, but the only bearing such has on the case is that during cold weather the animals get little or no exercise and are not able to supplement their food by picking grass or other green food. The horses attacked are usually those that receive the minimum amount of care, but well cared for greedy horses may contract the disease through eating their bedding which often consists of bracken that has been left in their mangers.

Notes on Experiment No. 1.

Two aged horses were procured and a supply of hay that carried about 20 per cent bracken.

One horse was fed the hay after all fern had been picked out of it, the other animal received the same hay plus the fern. Average daily feed, control horse twenty-four pounds of clean hay; experimental horse seventeen pounds of hay and seven pounds of bracken.

No other food was given either animal.

Both horses were kept in box stalls and allowed no exercise.

April 1.—Feeding commenced.

“ 24.—Fern horse breathing hard; seems to drag his legs.

“ 29.—Fern horse shows slight signs of intoxication.

“ 30.—Fern horse shows undoubted signs of intoxication.

May 1.—Fern horse intoxicated, nearly fell when made to get over in his stall.

“ 2.—Fern horse much worse, was found down at 6.45 a.m., and could not be made to stand. Towards evening he showed a full soft pulse. Struggled now and then. Moved the legs continuously. Looked completely intoxicated. Pupils slightly dilated.

“ 3.—Fern horse, pulse sixty-four. Animal weak and had nervous spells. Trembling. Eats and drinks well. Distinctly intoxicated. Does not struggle. Faeces loose.

“ 4.—Fern horse much weaker; pulse eighty. Nervous spells more frequent. Animal so weak it can hardly get up on its sternum. At night was unable to raise its head off the ground, and though it could not masticate would grasp food between its teeth. Continually twitching. Blood taken coagulated in ten minutes; serum clear and yellow.

“ 5.—Fern horse very weak. Still having nervous spells. The head was drawn in to the neck, the feet which were on the upper side would stand out stiff, the back would arch and all the muscles became tense. As soon as an attack was over the muscles relaxed and the animal breathed heavily until restored. As the horse was battering himself about badly and was clearly dying, the carotid was severed and the animal bled to death.

Autopsy.

The stomach contained about two quarts of a sticky light olive green liquid, which proved to contain bile by Gemlin's test. There were some red spots at the junction of the cardiac mucous membrane. The small intestines were empty, much wrinkled and covered with a greenish yellow mucus. The large intestines contained some well chewed food. All the other organs were normal except the kidneys, which appeared congested in the cortical portion. The brain also appeared congested. The blood clotted normally.

During the whole period of feeding temperatures were taken morning and evening, these proved to be normal.

The control horse that was fed on the hay out of which the fern had been picked, showed absolutely no ill effects.

Notes on Experiment No. 2.

As in the preceding experiment two horses were procured (one having served as control in Experiment No. 1), and a quantity of hay that carried a high percentage of bracken.

One animal received the hay after the fern had been picked out of it, the other received the same hay plus the fern. Average daily feed: control horse twenty-four pounds of clean hay; experimental horse, thirteen pounds of hay and eleven pounds of fern.

Both horses were kept in adjacent box stalls and allowed no exercise.

June 1.—Feeding commenced.

“ 23.—Supply of fern ran out, had to resort to cutting and drying freshly cut bracken, which could not be properly cured owing to continued wet weather.

“ 24.—A small amount of hay was received that contained a little bracken. It was not until July 6th, however, that a sufficient supply of dried fern could be obtained; therefore from June 23rd until July 6th the material fed was a poorly cured sample.

“ 29.—Fern horse shows yellowish red conjunctivæ.

July 1.—A careless attendant was caught giving the fern horse green clover; this, coming on top of our difficulty in procuring properly dried bracken, did not look any too hopeful for our experiment.

“ 8.—Fern horse was noticed to be staggering badly. When the head was raised the animal was inclined to fall.

“ 9.—Fern horse worse. Pulse soft and weak, forty per minute. The urine was examined and found to contain no albumen nor sugar.

“ 10.—Fern horse progressively weaker. Shows distinct signs of intoxication. The eye has an intoxicated look. When the animal is pushed it sways to and fro. Appetite unimpaired.

“ 11.—Fern horse about the same. Pulse forty-two and weak. Intoxication marked.

“ 12.—Fern horse was found down in the morning, but was helped up. Pulse fifty-nine, weak and irregular. Respirations forty-seven per minute. Pupils slightly dilated. When head was raised a few inches the animal nearly fell.

“ 13.—Fern horse pulse fifty-five, weak and irregular. Head carried low.

“ 14.—Fern horse pulse same as yesterday. Pupils more dilated. Head carried very low.

“ 15.—The fern horse went down between 7 and 8 a.m., and could not be made to stand. Animal has nervous spells, twitching of the muscles, more especially of the face. Animal getting badly bruised.

“ 16.—Fern horse battered up badly. Pulse seventy-two and weak. Visible m.ms yellowish red. Temperature 99.5. As the animal was moribund, the carotid was severed at 11.7 a.m. Blood taken at 11.9 a.m. had set by noon (when it was first noticed).

Autopsy.

General condition, emaciated. Lungs normal but for some emphysema of long standing. Trachea and bronchi, congested. Heart normal. Kidneys, cortex congested. Bladder normal. Spleen normal but for some old adhesions. Liver contained a few chalky deposits (degenerated parasites), and was congested. The duodenum contained bile and thick frothy mucous. The large intestines were normal. The most noticeable changes were found in the stomach, brain and spinal cord. The brain and cord were greatly congested. The stomach contained about a gallon of

gelatinous fluid which contained blood and mucin; no bile could be demonstrated. The whole surface was covered with a sticky mucous which held minute particles of bracken. The villous mucous membrane was greatly swollen and congested.

During the experiment temperatures were taken twice a day; no abnormal temperatures were recorded.

The control horse showed no ill effects from eating the hay out of which the fern had been picked.

Notes on Experiment No. 3.

The subject in this experiment was the horse that had served as control in the two previous experiments. The animal was confined as were the former subjects and was fed ferny hay just as it was received. The hay was found to contain 29 per cent bracken. The approximate daily feed was 20½ pounds, of this bracken composed about 5¾ pounds.

October 27.—Feeding commenced.

November 25.—Up to this time the animal laid down at night.

“ 26.—Did not lie down during the night.

“ 27.—Did not lie down during the night.

“ 28.—Animal went down at 3.15 p.m., was helped to rise. Temperature 99.8.

“ 29.—Animal down and cannot rise. Tetanic spasms, the head being drawn back. Pulse seventy-six, fairly strong. Temperature 97.4.

“ 30.—Animal much the same as yesterday. Temperature 100.3.

December 1.—Animal not so violent as former subjects, otherwise much the same. Pulse eighty and weak. Temperature 99.5 a.m., 100.9 p.m.

“ 2.—Animal found dead in the morning.

Autopsy.

Blood dark. Liver and kidneys engorged. Clots in heart. Lungs and spleen normal. Stomach contained dry ingesta and was distended with gas. At the cardiac end the mucous membrane was lined and crevassed; at the junction of the pyloric portion there was a deep erosion and under this was a gelatinous infiltration. The bottom of the crevasses was red, giving a raw-looking appearance. The duodenum was covered with a slimy thick mucous of a greenish yellow colour and had reddened areas. In the ilium the catarrhal exudate was of a greyish colour. The large intestines were more or less empty. The bladder was full of urine, faintly alkaline and containing albumin. The brain was congested and there were well marked haemorrhagic areas under the pia-mater of the cord.

During the experiment temperatures were taken twice a day; no abnormal temperatures were recorded.

The hay fed to this animal was weighed carefully at each feeding; the total amount consumed was 670 pounds, of which about 29 per cent was bracken, the amount of fern fed was therefore 194.3 pounds.

Notes on Experiment No. 4.

The subject in this experiment was a strong healthy gelding. The amount of hay and bracken fed was as follows:—

From March 13-April 2.

Fed 290.5 pounds of hay and 93.5 pounds of fern; daily feed of fern equals 4.4 pounds.

From April 3-April 23.

Fed 406.4 pounds of hay and 51.6 pounds of fern; daily feed of fern equals 2.4 pounds.

From April 24-May 23.

Fed 333 pounds of hay and 202 pounds of fern; daily feed of fern equals 6.9 pounds.

May 19.—Up to this date the animal appeared normal.

" 20.—Conjunctivae yellowish red. Shows slight symptoms.

" 21.—Abdominal breathing noticed. Pulse 24.

" 22.—Staggering. Eyes have staring look. Conjunctivae yellowish red. Not feeding well.

" 23.—Animal off feed and staggering badly. Temperature 99.4 Pulse 26.

" 24.—Animal quite intoxicated. Pulse 32.

" 25.—Staggering badly. Fell down, but got up. Was turned out into yard. Temperature 99.4. Pulse 40.

" 26.—Staggering badly. Animal killed.

Autopsy.

Carcase in fair condition. Icterus. Liver congested. Lungs emphysematous. All other organs normal with the following exceptions: Brain greatly congested, the convolutions being sharply defined on section. Cord congested. Stomach, regurgitation of food, small amount of bile present, cardiac portion showed some old eroded patches, pyloric portion showed reddened areas with small haemorrhages. Small intestines bile stained and empty except for a slimy yellowish green mucous, some of which was in clots. Bladder full of urine, no albumin or sugar present.

SUMMARY OF EXPERIMENTS.

The foregoing experiments indicate the cause of "staggers" in horses to be due to the ingestion of dried bracken over a certain period and under certain conditions. No toxic properties can be attributed to the hay, as an animal fed on hay out of which the fern had been picked remained absolutely normal. Of the four animals that developed the disease, one showed symptoms on the 24th day and was dying on the 35th day when it was put out of its misery. The second horse did not show marked symptoms until the 38th day, and was dying on the 46th day when it was killed. The length of time it took the second horse to develop symptoms as compared with the first, was no doubt due to the fact that for about twelve days properly dried bracken could not be procured, and also to the mistaken kindness of a careless attendant who was caught giving the animal green clover. The third horse, which had served as control in the two preceding experiments, was fed on hay exactly as received from a local source. The hay carried 29 per cent bracken and caused the death of the animal in 36 days. The fourth experiment was somewhat different to the others; this animal was fed 4.4 pounds of fern per day for three weeks, and was then reduced to 2.4 pounds per day for a further three weeks with no apparent ill resulting. Upon increasing the daily feed of fern to 6.9 pounds definite symptoms of the disease were noticed on the 29th day (after this increase), and the animal was killed on the 35th day.

Judging from the foregoing, it can be assumed that an addition to the daily diet of about six pounds of dried bracken will kill a horse in about one month.

Pathological Findings.

The brain and cord showed marked congestion. No bacteria were found either in their substance or fluids.

The stomach is the organ chiefly attacked, as would be expected from the nature of the food, which is highly acid. The pyloric end shows the greatest change; fig. 3 illustrates the condition to a marked degree. The m.m.s. have a mottled appearance, and bile stained, and in some places there are bleeding eroded areas.

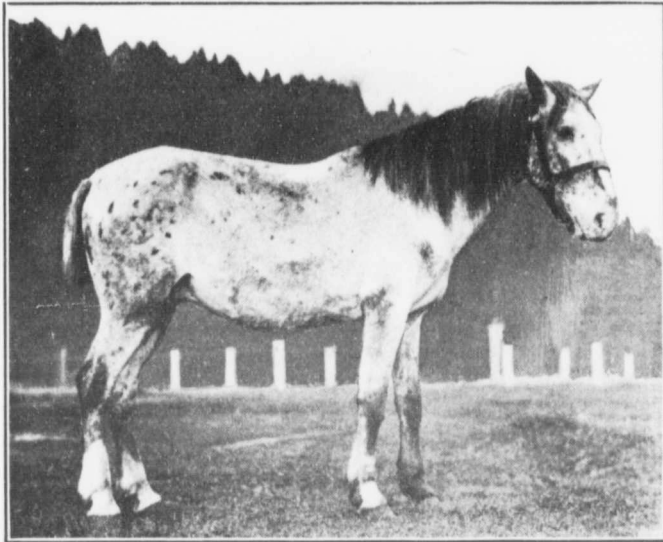


Fig. 1.—Note intoxicated look of the eye. Case No. 4.



Fig. 2.—Horse staggering. Case No. 4.



Fig. 3.—Stomach of Case No. 2. Note mottled appearance.



Fig. 5.—Section of brain showing congestion. Case No. 4.

Emphysema of the lung has been noted, and congestion of the liver. The blood was normal, no bacteria were found, and there was no variation in the percentages of the different leucocytes.

Summary.

In the March number of *The American Journal of Veterinary Medicine*, L. H. Pammel, of the Iowa State College, reviewed a preliminary communication made by us before the British Columbia Veterinary Association, at Vancouver, B.C., on December 6, 1916. In view of Dr. Pammel's well known association with poisonous plants, it may be of interest to quote his words, viz.:—"The bracken is an extremely common plant along the entire Pacific coast, especially in Oregon and Washington and from British Columbia to Alaska. The experiments seem to show that the bracken is poisonous. This fern, like many others related to it, has been regarded as poisonous. However, there are few definite facts on the nature of the poisoning. Many, if not all, of the ferns contain filicic acid and a fixed poisonous oil. In this case, as in others, we need some careful chemical investigations to prove the poisonous



Fig. 4.—Young plant of the common bracken
(*Pteris aquilina* L.)

nature of the plant. We hope that this investigation will be forthcoming."

While up to the present we have not had any satisfactory analyses made, the physiological experiments cannot be gainsaid, and further, we drew attention to the fact that on all farms visited by us where the disease existed, bracken was present in the hay.

That the toxic principle is insoluble in water has been established, as in addition to the feeding experiments already mentioned, a watery extract was prepared and

administered to a horse, twice a day for some sixty-four days. This extract was concentrated down until one cubic centimeter was approximately equivalent to one gramme of the dried fern. The usual daily dose was two thousand cc., but one day as high as five thousand five hundred cc. was administered. In all the animal received the equivalent of about two hundred and ninety pounds of fern, during which time he was only fed clean hay and was not allowed any exercise. No symptoms of bracken poisoning were noted, notwithstanding the fact that this animal had consumed, in the form of an extract, one hundred pounds more than the amount of dried fern necessary to kill experimental horse No. 3.

The disease as it occurs on the average farm in British Columbia is brought about in the following manner:—

Bracken (*Pteris aquilina L.*) is found in a large amount of the hay grown in the lower parts of the province, especially so on newly cleared or poorly worked farms, and it is on such farms that the disease is most common. During the severe weather the animals are confined for a long period, and none too liberal an allowance of hay given each animal, the result being that horses that otherwise would leave the bracken in their mangers are forced to eat it. (We have never seen an animal eat green bracken, and as a general rule horses do not eat dried bracken unless forced to, except greedy horses that eat their bedding, which often consists of fern rejected out of their hay.) The affected horses in nearly all cases received but little else than hay in the shape of food; where animals were given plenty of hay and roots, with occasional feeds of bran and oats, no trouble of this nature occurred. In this connection it may be remarked that no cases were reported in the city stables. While it is evident that a small amount of bracken can be eaten with impunity, large amounts coupled with unhygienic surroundings and lack of variety in diet will bring on the trouble.

Though the cause of this disease had not been definitely established heretofore, veterinarians have been quite successful in treating the malady if they were called early enough, and when at all possible farmers are strongly advised to summon such professional aid as is available.

Symptoms.—Usually the first indication of trouble noticed by the owner is an unsteady gait upon taking the animal out to water. The appetite is usually good. Animal inclined to constipation. Eye congested. Flanks tucked up. Nervousness. In the later stages if the head is raised the horse may fall. Stands with the legs spread and has a distinctly intoxicated look. Greedy horses are most liable to attack.

Treatment.—The treatment recommended by Dr. S. F. Tolmie, of Victoria, B.C., who has had a great deal of experience with such cases is as follows:—Remove all ferny hay and bedding. Administer a good brisk purgative, such as: Barbadoes aloes seven drachms, calomel one drachm, and ginger one drachm. Half-ounce doses of potassium bromide twice a day in the feed or drinking water. One to two drachms of potassium iodide three times a day is recommended. Give medicine in the feed or drinking water or with a syringe. Feed laxative food such as bran mash and carrots. Give enemas if necessary. When animal is very groggy place in slings with extreme care, avoiding excitement as much as possible. Tie with guy ropes on both sides, in front and behind. Slings should be applied so that the belt presses lightly on the abdomen when the animal is standing erect, but so that on the least flexion of the joints support will be given. In some cases cold packs to the head are recommended. Recovery after this form of treatment is the rule, but if begun too late, losses will occur. Care is needed in giving medicines to avoid unnecessary excitement as rough handling will invariably aggravate the symptoms.

To the farmer who is unable to secure professional aid we would suggest the following treatment:—First remove all ferny hay and bedding. Give a quart of raw linseed oil, taking especial care that none falls into the lungs. Give good clean hay, warm bran mashes and roots. The horse should be kept as quiet as possible, owing to

its nervous excitability. Warmth is of aid in combating the affection whilst a cold draughty stable tends to lower the vitality.

The Eradication of Bracken.—We have taken some pains to find out if there was any bulletin or other information on this subject. The only bulletin we can find dealing with this matter is one written by H. R. Cox, of the United States Department of Agriculture, entitled, "Eradication of ferns from pasture lands in the Eastern United States" (Farmers' Bulletin, 687). He recommends methods which can be used in the Eastern States and says that the Department of Agriculture has not investigated the fern problem in the West. Various methods have been tried but the two that have given the best success are spraying with solutions of salt and cutting. Two treatments a year, either spraying or cutting, are advised. The best time to treat ferns is stated to be just before sporing, or about the middle of June and the middle of August. Cutting is somewhat cheaper than spraying. In the East with ferns at an average thickness in a pasture a man ought to cover about 2½ acres a day; in the West where the ferns grow much more vigorously the labour entailed would be greater. Probably the best method for the West would be a combination of cutting and choking out the fern with red clover, as a good stand of clover tends to weaken the fern. Since bracken has now been definitely proved to cause poisoning in horses, we would urge all farmers to make determined efforts to get rid of the plant and to keep all fodder containing it away from their horse stables, even in the shape of bedding.

Acknowledgments.—We beg to acknowledge the valuable information given by Drs. Tolmie and Derby, especially as regards statistics and treatment of the affection. To Dr. F. Torrance, Veterinary Director General, we owe thanks for his interest in our investigation.

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ADDENDUM.

Fatalities Following the Ingestion of Green Bracken.—While we had heard indirectly that animals might suffer from eating green bracken, it was not until quite recently (October 1, 1917) that any cases came directly under our notice.

Two horses owned in the village of Agassiz developed symptoms of narcotic poisoning while confined in a small pasture. The symptoms noted were exactly similar to the experimental cases recorded in this paper. When seen neither animal could stand, though earlier in the day they had been able to do so. The evidence as to the condition being brought about through the ingestion of green fern was indisputable. What grass was in the field had been nibbled so short that the animals were forced to eat the ferns. The most conclusive piece of evidence we found was the fact that the horses had been putting their heads through the wire fence, and that they had left nothing but the fern stalks within the area of their reach. Beyond this area was a green bank of fern. As stated before, the grass had been eaten bare all over the pasture, and the only other vegetation for the horses to eat was bracken, which was very plentiful.

One of the horses died after being down for three days, and the other recovered slowly. The treatment which had been given these animals was of a very rough character; apart from a preliminary dose of arecoline, the animals received but little attention, though their food was changed.

We have stated that horses will only eat dried fern when forced to do so, and from the above it is apparent that the same thing applies to the green fern. The only exception to this rule may be that an otherwise well fed animal will sometimes nibble at any green plant within reach.

S. HADWEN.

E. A. BRUCE.