

Alabama Agricultural Experiment Station

OF THE

Alabama Polytechnic Institute

AUBURN

DAN T. GRAY, *Director*

Poisonous Action of Red Buckeye on Horses, Mules, Cattle, Hogs and Fish

By

C. A. CARY

RED BUCKEYE

By

C. A. CARY

The botanical name for red buckeye is "Aesculus pavia." This plant occurs as a shrub or as a low tree. It is a shrub with 5-7 digitate, nearly smooth, leaflets acute and short, acuminate, pubescent when young, becoming smooth with age; flowers are red and in loose peduncles, calyx tubular and bright red. The red buckeye has a very wide range. It is found in the fertile valleys from Virginia to Florida, Arkansas and in Southern Missouri.

There are three species of buckeye found in Alabama: Namely red, yellow, and spiked. The yellow is usually found in the northern part of the state in and around the Tennessee Valley. It is rarely ever found in other sections of the state. The spiked has a little wider range; it is found in the mountainous regions up to the upper coast pine belt. The red buckeye has a still wider range than either of the preceding species named. It is found throughout the state in woods, along streams and most any moderately fertile soil. The red buckeye can be easily distinguished from the other species by the scarlet color of the flowers and stems. The shrub or tree has a smooth whiteish colored bark and dark green leaves similar to those of the walnut.

The leaves are compound and have from five to seven leaflets, being about 1.5 inches broad and about 5 inches long. The plant blooms in March and April having bright red flowers arranged in panicles. The leaves begin to fall about the first of September depending on the variation of the season. The nuts generally ripen and fall in October. They are reddish in color and vary in size from a small hickory nut to a walnut. The nut has a thin shell and a large white kernel which when crushed has an odor somewhat like that of the china berry.

The leaves and nuts of the buckeye are regarded by some authors as poisonous. Many farmers claim that this is true only at certain seasons of the year. The seed produces sneezing and is used in the manufacture

of snuff. Some writers state that if the nuts are crushed and thrown into the water that the fish become stupefied (narcotic) and come to the top of the water. There are cases on record where buckeye is alleged to have caused abortion in cattle. Some species of buckeye are said to be used as food for live stock, especially for sheep and goats. But none of the species found in this state have been used for such purposes. Dr. Millspaugh states that some species of buckeye causes inflammation of the rectum, constant burning of the stomach, and epigastrium, followed by nausea, retching and violent vomiting. It also causes great tenderness and colicky pains thruout the abdomen. The buckeye is also said to be an irritant to the cerebo-spinal system, the most prominent symptoms being confusion of the mind, vertigo and coma.

According to Pammel, the red buckeye which we used in our tests contains fish poison and saponin and poisonous glucosides, but he does not state that it is poisonous to animals when ingested. He does not give instance where animals had been poisoned or effected by eating this plant or the nuts. Other authors merely state that the red buckeye contains saponin but do not give any cases where it has proven to be injurious to animals.

Saponin seems to be the chief property or substance found in the red buckeye. Stedman says that saponin belongs to a class of substances found in many plants which have the common property of foaming, or making suds when strongly agitated in an aqueous solution. They also hold resinous and fatty substances in solution. They possess the property of glucosides; they are irritable when applied to the mucus membrane, and when given internally in large enough quantities causes nausea and vomiting.

Some authors state that the saponin is not absorbed or does not effect the animal unless the animal has some inflammation of the intestinal tract. It has also been said that saponin and the poisonous glucosides contained in buckeye would cause the breaking down of the red corpuscles by freeing them from hematin and finally causing anemia and emaciation of the animal affected. But there are no cases on record where tests have been made to prove the above statements.

In 1873, Bachelar found from chemical test of the fruit, coloring matter, tannin, resin and a peculiar crystalline body. From the cotyledons: A green or brown oil to the extent of 5%, also cane sugar and a little more than 2% of a peculiar, bitter, acrid, poisonous glucoside of a brown color. The cotyledons are composed mainly of starch.

The fresh nut made into a paste with flour and also the bruised twigs of the shrub were used in the swamps of the Santee River to stupefy fish, so as to cause them to float.

TESTS OF 1918

About October 1, 1918, we gathered a considerable quantity of leaves, bark, roots, and nuts of red buckeye. The leaves and bark were already rather dry, it being late in the fall. This material was ground separately and weighed and fed as given in table below. The nuts were fed in the green condition.

Four pigs were obtained from the serum plant, numbered, and weighed. They were put in separate pens, with good houses and bedding. They were fed on velvet bean meal and shorts, mixed two parts of velvet bean meal to one of shorts, and fed about a week before starting the experiment to get them used to cleaning up all of the meal. Temperatures were taken for three days before starting the test. Blood counts were made from each hog the day the experiment was started and after the experiment was finished. One pig was fed leaves, one bark and roots, and one nuts. The other pig was used as a check. They were started on one-half ounce of material, given twice daily in feed. Temperatures were taken daily, and the general conditions and excretions of pigs noted.

TABLE I.

Weight of Pigs

	Pig No. 842	Pig No. 844	Pig No. 845	Pig No. 850
Initial Weight	29	38	33	33
Final Weight	40	49	43	29
Increase	11	11	10	—4

FOOTNOTE—The 1918 tests were made by senior veterinary medical students, Gissendanner and Murray.

The pigs were given one-half ounce of the material twice daily for five days, then the amount of buckeye was increased to one ounce twice daily. After five days it was again increased to one and one half ounces twice daily. Total of bark fed to pig 842 in 15 days was 30 ounces; of nuts to pig 844 was 30 ounces; of leaves to pig 850 was 30 ounces.

The pigs on leaves and bark cleaned up all of their feed and buckeye at each feeding. As can be seen, they continued in good condition and made a steady gain in weight.

The pig on nuts refused to eat food containing buckeye nuts, hardly consuming a maintenance ration. It seemed hungry at all times, and on several occasions was given a small amount of food not containing buckeye, which it ate greedily. It lost four pounds while the test was being carried out, but regained weight rapidly when the buckeye was withdrawn from the feed. Toward the end of the experiment it was beginning to act dull, lay around a lot, and was unsteady when walking. The temperatures were taken all through the period and were found to be normal.

Differential blood counts were taken before and after the tests and no characteristic changes were found.

The results of this experiment seem to indicate that the dry buckeye leaves and bark have very little, if any, toxic effect on hogs. There was nothing abnormal about the feces or urine in appearance, and the pigs all maintained very good appetites throughout the experiment. Results on the nuts are more doubtful, as it was hard to get the pig to eat any food containing the freshly chopped up nuts, and he altogether refused to eat the nuts themselves, even when very hungry. During the last week of the experiment, water in which the nuts had been macerated was put in his pen and other water cut off, except that used to moisten his feed. Then it became dull and weak, and unsteady on his feet, but its appetite was good. Temperature, pulse, and appearance of feces normal. It appeared that its loss of condition was caused more by abstinence from food and water than from the effect of the buckeye nuts. When put back on food and water free from buckeye it picked up at once.

SECOND EXPERIMENT

April 15, 1918, we gathered a lot of fresh green buckeye, in bloom, which was brought in and ground up, young stems, leaves and all. Three pigs were obtained from the serum plant, weighed and numbered. Weights as follows:

TABLE II.

	<i>Weight of Pigs</i>		
	Pig No. 343	Pig No. 344	Pig No. 345
Initial Weight	48	47	40
Final Weight	52	52	44
Increase	4	5	4

These pigs were placed in separate pens, and fed on a mixture of peanut meal and bran, this being the only feed we could get for them. Temperatures were taken for three days before buckeye was started in the feed.

Pig No. 343 was given one and one-half ounces of the ground buckeye in about the same amount of the mixed meal, twice daily for eight days. The buckeye was still green, and should have retained any volatile poison, if present. Temperatures were taken, and condition of the pig, and excretions noted daily, but nothing abnormal was observed. Blood counts were also made, being apparently normal.

On May 1, 1918, we found a bunch of young tender buckeye, the stems still green, the plants probably being in just the condition when a hog would be most likely to eat them. This material was fed to pigs Nos. 344 and 345, giving them each an armful of the fresh material every afternoon for four days. The mixed feed was omitted in the afternoons while this was being done, being fed only in the morning, to encourage the pigs to clean up the buckeye. Pigs were watched closely during this test. Temperatures remained normal, appetites good, and no sign of diarrhea or constipation. The pigs cleaned up a small amount of the buckeye every afternoon, seeming to like it better in this state than any we had fed before. Blood counts were made, and found normal.

TESTS OF 1919

We gathered our buckeye on February 15. They were rather hard to find at this time of the year as they

FOOTNOTE—The 1919 tests were made by Harper and another senior veterinary medical student.

were covered with leaves and trash. Some of them were dry and shriveled and some were green and about ready to sprout but some of them were rotten. We took the buckeye nuts and put them in a burlap sack and placed them near a fire, keeping them well turned so as to dry them out. We dried them so that they could be pulverized easily. After we got them well dried we pulverized them as fine as possible and placed them in a box.

We obtained two pigs from the serum plant and weighed and numbered them. We then placed them in a large, open pen so as to have them as near as possible under normal conditions. After placing them in the pen we took their temperature and also made a blood count and a hemaglobin test of the blood. On the second day we started feeding the buckeye. We fed the hogs on oats and mixed feed at the beginning of the test, mixing with each meal 7 oz. of the pulverized buckeye. We only fed the hogs twice a day to keep them hungry so that they would clean up the feed. After a few days they seemed to dislike the feed. Then we changed the feed to bran mash and mixed feed. They cleaned this up all right and we had no further trouble about getting them to eat. They did not seem to mind the buckeye in the least. All that could be seen that they did not eat was a few pieces of the tough hulls that they could not chew. We took their temperature once a day and kept a careful record of it. On the second day of the test the hog No. 69 passed an intestinal parasite, but I think that this was not due to the buckeye. The mucus of the mouth and eyes were examined before and after the test and were found to be normal in both cases. We also examined the feces and noticed the urine, but no changes could be seen in either. The feces were somewhat softer during the latter part of the test but this was due to the feeding of the bran mash. After the test was over we again made a blood count and a hemaglobin test of the blood and found them to be the same as before the test, with the exception of a little variation in the blood count. When the final temperatures were taken and we had finished examining them, we took them back to the serum plant and again weighed them and recorded the weights.

The weights, blood counts and Hemaglobin test will be shown in the tables below:

BEFORE TEST

Hog No. 69 Wt. 69 lbs.
Hog No. 34 Wt. 53 lbs.

AFTER TEST

Hog No. 69 Wt. 73 lbs.
Hog No. 34 Wt. 61 lbs.
Hog No. 69 gained 4 lbs. during test.
Hog No. 34 gained 8 lbs. during test.

These pigs were fed a total of 280 ounces of pulverized nuts in 20 days.

	Hog. No. 69	Hog No. 34
Erythrocytes -----	4,396,000	6,574,000
Lymphocytes -----	2,934	1,860
Poly morphoneuclears -----	7,382	8,700
Other Lymphocytes -----	1,020	1,800

BLOOD COUNT (after test)

	Hog. No. 69	Hog No. 34
Erythrocytes -----	4,620,000	5,960,000
Lymphocytes -----	2,460	1,530
Poly morphoneuclears -----	6,840	9,320
Other Lymphocytes -----	9,400	1,460

HAEMOGLOBIN TEST

Before Test

	Haemoglobin
Hog No. 69 -----	90%
Hog No. 34 -----	70%

The No. 69 was fat and in good shape, while the No. 34 was in poor condition.

After Test

	Haemoglobin
Hog No. 69 -----	90%
Hog No. 34 -----	70%

Date	Hog No. 69	Hog No. 34
2/25	102.1	102.4
2/26	102	102.4
2/27	102	102.2
2/28	102.2	102
3/1	102	102.4
3/2	102.4	102.2
3/3	102.8	103
3/4	103	103.2
3/5	103	103.8
3/6	102.8	102.8
3/7	103	102.4
3/8	102.4	103
3/9	102	102.6
3/10	102	102.2
3/11	102	102.2
3/12	102.4	102
3/14	102.4	102
3/15	102	102.4
3/16	102.6	102.8

Some of the temperatures ran a little higher at times, but this was due to the exercising of the hogs when catching them.

After completing the test of feeding the nuts we gathered a quantity of buckeye leaves, stems and blooms.

We again secured two more hogs from the serum plant, and weighed and numbered them in the same pen where the previous test was made.

On March 24, we started the test of feeding leaves, stems and blooms. The first day we took the temperature of the hogs and recorded same. On the second day we started feeding the stems, leaves and blooms. We fed the hogs on bran mash and oats mixed with 10 ozs. of the finely chopped leaves, stems and blossoms. They did not clean up the food as well in this test as in the previous test, probably due to particles of the tough stems and bark that they could not chew. We noticed that the food that remained was full of pieces of stems. As in the previous test we only fed the hogs twice a day and they had plenty of fresh water at all times. We also threw branches of the brush over in the pen and on a few occasions we noticed that the hogs would chew some of the tender leaves. We took the temperature of each hog once a day and kept a careful record of it. The mucus membrane of the eyes and mouth were examined before and after test was made and they were found to be normal. A blood count and hemaglobin tests were made before and after feeding tests were made, but no change could be detected. These pigs were fed 17 days and each one consumed 170 ounces of stems, leaves and flowers.

WEIGHTS OF HOGS (Before Test)

Hog No. 111	Wt. 60 lbs.
Hog No. 87	Wt. 62 lbs.

WEIGHTS OF HOGS (After Test)

Hog No. 111	Wt. 65.5 lbs.
Hog No. 87	Wt. 64 lbs.

The conclusion that we can draw from the test that we made is that red buckeye is not poisonous to the hog and will not cause any injury to them unless forced to eat it in large quantities, which in this case, might cause some digestive disorder and not poison.

It might have been possible that we gathered the nuts too late and the glucosides and saponin had been decomposed and were not active in the decomposed stage.

TESTS OF 1920

Experiment No. 1—Buckeye Nuts

A 750 pound steer was given 3 pounds of freshly collected nuts which had been pulverized and mixed with 2 pounds of commercial sweet feed, the animal eating practically all of the mixture. No symptoms developed, and on the second day the animal was given 5 pounds of nuts, pulverized and mixed with 3 pounds of sweet feed. This was all eaten. The animal was under observation all the time and if there was any change in condition, it was for the better since the animal had not been receiving a great amount of feed before the experiment was started. The following daily record was kept:

	Pulse	Resp.	Tem.	Leucocytes	Erythrocytes
3 P. M. 10/20 (3 lbs. nuts given)	58	20	103.8	19000	4,524,000
3 P. M. 10/21 (5 lbs. nuts given)	52	21	103.2		
3 P. M. 10/22	56	19	102.8	18000	4,448,000
3 P. M. 10/23	56	20	103.0		

The high leucocytic count is probably accounted for by the fact that the animal had an epithelioma in the right pharyngeal region accompanied by more or less secondary infection.

Experiment No. 2—Buckeye Root Extract

A 10 pound pig was given a gruel made of 1 pound of corn meal in 1 quart of a liquid obtained by maceration of 2 pounds of buckeye roots in water. About one-half of this was eaten and the pig refused to take any more although all other feed was withheld for two days. No changes could be noted in condition of animal, temperature remaining normal.

NOTE:—The 1920 tests were made by senior veterinary medical students, J. H. Murray, John Oliver, Jr., and W. A. Neal.

Experiment No. 3—Buckeye Root Extract and Leaves

After being starved for twenty-four hours, a 50 pound pig was given a gruel made of 1 pound of corn meal and 1 quart of a liquid derived from maceration of 2 pounds of buckeye roots or tuber-like growths, and all of which was eaten. On the third day the pig was given a gruel containing 3 pints of liquid made from 2 pounds of roots, practically all of which was eaten. No effects could be noted and on the fifth day the pig was given a good quantity of buckeye leaves, of which about 2 pounds were eaten during a period of twenty-four hours. No clinical symptoms were noted and temperature remained normal during time of experiment.

Experiment No. 4—Buckeye Roots and Leaves

One-half gallon of a liquid made by macerating 4 pounds of buckeye roots in water for several days was pumped into the stomach of a sixteen year old, 700 pound mule. After sixteen hours the pulse was depressed and weak, visible mucous membranes were pale, and animal apparently in some abdominal pain, being very sensitive to palpation over the abdomen. The mule was noticed pushing against fence with head, and after trying this for a few minutes would stop and walk backwards and forwards for a time. When approached for taking temperature, the mule exhibited considerable life and had to be cornered before he could be caught. Twenty-four hours after receiving the liquid all symptoms had subsided and the animal was grazing. One-half gallon of liquid obtained from maceration of 2 pounds of freshly gathered young buckeye leaves was then pumped into the stomach, from which no clinical symptoms could be noted. The following week the same animal was given 5 quarts of thick liquid made by macerating for three days and then straining through gauze of 6 pounds of fresh and finely ground young buckeye leaves; no symptoms resulting. The following record was kept in addition to frequent observations for clinical symptoms.

	Pulse	Resp.	Temp.	Leucocytes	Erythrocytes
3 P. M. 4/5—Root liquid given	49	17	100.2	8000	6,624,000
3 P. M. 4/6—Leaf extract given	31	19	98.6	12000	4,688,000
3 P. M. 4/7	46	16	99.8		
3 P. M. 4/14—6 lbs. extract given	48	17	100.0		
3 P. M. 4/15	47	16	99.6		

Urine drawn April 5th showed a specific gravity of 1.050, was negative to Fehling's test for sugar and neutral in reaction. Not enough urine could be obtained on April 6th at time of taking blood for count to make specific gravity test, but the reaction was neutral and no sugar was found.

Experiment No. 5—Buckeye Leaves

One-half gallon of a thick watery material made by macerating 6 pounds of freshly gathered and finely ground young buckeye leaves in water for one-half hour and then straining through cheese cloth was pumped into the stomach of a 750 pound mare. The animal remained active throughout, exhibiting no symptoms during a period of twenty-four hours, as indicated by the following record:

	Pulse	Resp.	Temp.
4 P. M. 4/22—6 lbs. leaf extract given	32	24	99.5
6:30 P. M. 4/22		No symptoms	
8 A. M. 4/23		No symptoms	
3 P. M. 4/23	32	22	99.4

Experiment No. 6—Buckeye Leaves

A 750 pound Holstein bull was penned up and given no feed for twenty-four hours and then given a good quantity of buckeye leaves. During the first twenty-four hours the leaves were before him, the bull ate 3 to 3½ pounds, but refused to eat any more, although all other feed was withheld for a period of ninety hours. As indicated by the following record, no changes developed, and the animal was as active as ever when finally released.

	Pulse	Resp.	Temp.
4 P. M. 4/29—Leaves given	52 (weak)	17	100.6
4 P. M. 4/30—After eating			
3-3½ lbs. leaves	44 (weak)	22	100.1
4 P. M. 5/1—Nothing eaten	46 (weak)	21	100.6

Experiment No. 7—Leaves

A 750 pound mare was penned up and all feed withheld for twenty-four hours, after which a good quantity of buckeye leaves was placed before her. After fasting for ninety hours the mare was released, having steadily refused to touch the leaves.

Miscellaneous

Fresh young buckeye leaves, obtained before other green stuff was plentiful, was offered to goats, cattle, horses and mules, and while all were invariably attracted by the young leaves, each animal, with the exception of one old mare which ate a small handful, refused to eat the leaves.

TESTS OF 1921 and 1922

TESTS WITH BUCKEYE (*Aesculus pavia*)

Experiment No. 1—Gray mare mule

(Wt. 800, age 16)

Five pounds of ground leaves and flowers were soaked in two gallons of hot water for ten minutes. This infusion was given by the stomach tube. No symptoms manifested. The mule did not cease to graze.

Experiment No. 2—Brown mare mule

(Wt. 850, age 14)

We made an infusion of ten pounds of the leaves and gave two gallons at 10:30 A. M. The mule passed normal feces at the time. At 1.30 P. M., the feces were watery. The mule lay down and we had to help her up. The mule was already thin and weak, so we did not know how much of the effects to attribute to the buckeye.

Experiment No. 3—Brown mare mule

(Wt. 1000, age 10)

Ten pounds of leaves were soaked in three gallons of water over night and the liquid was given to the

FOOTNOTE—Tests of 1921-22 were made by Denson and Everett, senior veterinary medical students.

mule by the stomach tube. The only change noted was a twitching of the upper lip. Later, we made a decoction of five pounds of ground leaves and beaten roots and gave to the same mule. Results, no effect.

Experiment No. 4—Brown mare mule

(Wt. 1000, age 21)

An infusion of three gallons made from ten pounds of leaves was given this mule. There was no toxic or abnormal results.

Blood counts, hemaglobin tests, urinalysis were made of all four of the above cases, before and after giving buckeye, and found no changes.

Experiment No. 5—Bull (Wt. 400, age 2 yrs.)

A decoction of five gallons from ten pounds of leaves was given to the above calf by the stomach tube.

The bull began to urinate in fifteen minutes and urinated frequently and profusely for three hours. No other symptoms except the feces, passed at one time, had streaks of blood. The specific gravity of the urine was 1010. The animal continued to eat.

We gave the same animal five gallons of tap water the next week as a check. We got the same symptoms, except the urine was not so profuse, and bowels were normal.

Experiment No. 6—Bull calves

(One and two yrs. old, wt. 250 and 400 respectively)

We chipped fine the leaves and fruit and gave each of the above two pounds by rolling into boluses and forcing back into the mouth.

Rumination did not cease and the calves did not manifest any symptoms whatever.

Experiment No. 7—Bull calf (Age 2, wt. 350)

March 19, 1922.

We starved the calf twenty-four hours and then began feeding small quantities of bran, mixed feed and buckeye leaves. We did this for one week. The calf would separate the leaves from the feed and refuse to eat the leaves.

March 25, 1922:

We gave the calf two pounds of leaves chipped very finely and mixed with the feed. We sprinkled water on the leaves, so that the leaves and feed stuck to-

gether. We repeated this for seven days. At the beginning of the test the temperature was 98.5, pulse 66, respiration 16.

March 27, 1922:

8 A. M.—Temperature 99.8, pulse 62, respiration 10 and shallow.

12 A. M.—Temperature 101.8, pulse 76, respiration 10.

At 8 A. M. he walked as if he had laminitis in the front feet. The hind limbs swayed. He had difficulty in getting up. The pupils dilated. Saliva flowing from the mouth. The calf still eats.

At twelve A. M. almost complete motor paralysis in the front limbs. At one P. M. the temperature was 102, pulse 38, respiration 10 and deep. The calf had to lean against the wall to stand. He walked side-ways to the left. We fed more leaves and oats. Eats greedily. While eating the femoral muscles quivered and the animal was easily excited.

March 28, 1922:

Temperature 101, pulse 52, respiration 9 and deep. Conjunctiva highly congested. Has less strength than yesterday. Feces normal; lay on broad side most of the day.

March 29, 1922:

Temperature 99.4, pulse 52, respiration 15 labored and deep. The calf lying down with head drawn back, all the muscles quivering.

March 30, 1922:

Calf better and able to stand a good while.

March 31, 1922:

The calf was broad side and had the same general symptoms. Blood was in the feces.

April 1, 1922.

The calf was able to get up and walk around. The symptoms were gone and we turned the calf out.

Experiment No. 8—Bull (Age 3, wt. 600)

March 30, 1922:

Temperature 102, pulse 65, respiration 12. Fed five pounds of chipped leaves and flowers in mixed feed and bran.

March 31, 1922:

Temperature 100.2, pulse 64, respiration 10. The bull was a little sluggish. We fed eight pounds of leaves as yesterday.

April 1, 1922:

Temperature 100.2, pulse 64, respiration 10. The animal was sluggish. We fed four pounds of fresh leaves.

April 2, 1922:

The animal was very sluggish. The hind limbs swayed as he walked. The pupils dilated. The bull was able to get up at all times.

Experiment No. 9

October 8, 1922:

We beat up about twenty pounds of fruit and put in a croker sack. We drug this around in a hole of water, twelve feet long, eight feet wide and an average depth of two feet. In fifteen minutes, the fish began to show toxic symptoms they came to the top and floated on their sides as if paralysed. In thirty minutes, several were dead. All these were small fish. I have seen fish weighing eight and ten pounds caught with it.

REVIEW OF CASES

1918:

PIGS

One pig fed buckeye leaves remained normal.

One pig fed buckeye bark and roots remained normal.

One pig fed buckeye nuts toward close of 15 day test, began to act dull, lie around in lot and had an unsteady gait.

One pig given 3 ounces of green buckeye nuts for 8 days and it remained normal.

Two pigs were given a large armful of young tender and green buckeye leaves, stems and twigs for 4 days. The pigs ate some every day and the temperature remained normal; appetite good; no diarrhea or constipation and blood counts were made and found normal.

1919:

Two pigs were fed 280 ounces buckeye nut meal in

20 days and they remained normal except they had no appetite for the buckeye nut meal.

Two pigs were fed stems, leaves and flowers of red buckeye, 10 ounces per day for 17 days, and they remained normal in temperature, hemaglobin and in blood cells.

1920:

One 10 pound pig ate a mixture of one-half pound of corn meal stirred into 1 pint of liquid, made by macerating 1 pound of buckeye roots in water; and pig remained clinically normal.

One 50 pound pig ate all of 1 pound of corn meal mixed in 1 quart of liquid, made by macerating 2 pounds of buckeye roots, and on the third day thereafter this same pig was given a gruel made with 3 pints of liquid made by macerating 2 pounds of roots in water and on the fifth day this pig ate 2 pounds of buckeye leaves in 24 hours. This pig never showed any abnormal clinical symptoms.

MULES AND HORSES

1920:

One 700 pound mule, 16 years old, was given by stomach pump, 2 quarts of liquid made by macerating in water 4 pounds of buckeye roots. In 16 hours pulse depressed and weak; visible mucous membranes were pale; slight abdominal pain; mule would push against a fence with its head for a few minutes and then walk backwards and forwards for a time. All of these symptoms passed off at the end of 24 hours. Then 2 quarts of liquid made by macerating 2 pounds of leaves in water was pumped into this mule's stomach. It produced no clinical symptoms. In several days thereafter, 5 quarts of thick liquid made by macerating, for 3 days, 6 pounds of fresh and finely ground buckeye leaves were given this mule. No abnormal changes were produced in the urine, pulse or respiration. There was a slight decrease in temperature and an apparent increase in leucocytes and decrease in red blood cells.

One 750 pound mare was given 2 quarts of thick liquid made by macerating for 30 minutes 6 pounds of fresh leaves finely ground. No clinical effects came from it.

One 750 pound mare was tempted to eat buckeye leaves and refused for ninety hours.

One 750 pound Holstein bull was deprived of feed for 24 hours and then given fresh buckeye leaves and during the first 24 hours ate 3 pounds and refused to eat any more for 90 hours. No changes were produced.

1921 and 1922:

1. One 800 pound mare mule, 16 years old, was given with stomach tube, 2 gallons of an infusion made with 5 pounds of ground leaves and flowers; no effects.

2. Brown mare mule, 850 pounds, 14 years old, was given at 10:30 A. M. an infusion of 10 pounds of leaves in 2 gallons of water. At 1:30 P. M. mule down and so weak that she had to be helped to get up, and feces were soft. Mule was weak in beginning.

3. Brown mare mule, weight 1000 pounds, age 10, was given by stomach tube, 3 gallons liquid made by soaking ten pounds of leaves over night. The only clinical symptom was twitching of upper lip. This same mule was given later a decoction of 5 pounds of ground leaves and beaten or crushed roots. This produced no changes.

4. Brown mare, weight 1000 pounds, age 21, was given an infusion made of 10 pounds of leaves. It gave no results.

Blood counts, hemoglobin test and urinalyses before and after giving the buckeye in each of the four animals were made, and no changes were found.

5. One 2 year old bull, weight 400 pounds, was given by stomach tube, a decoction of 5 gallons made with 10 pounds of leaves. This calf began to urinate in 15 minutes and continued for 3 hours. The feces showed some streaks of blood. No other symptoms. Specific gravity of urine was 1010. The next week, this same bull was given 5 gallons of water and it produced same flow of urine except it was not in quite such a large quantity.

6. Two bulls, 1 and 2 years old, weight 250 pounds and 400 pounds. Each one was given chopped leaves and fruit, 2 pounds in boluses. No abnormal results.

7. Bull, 2 years old, weight 350 pounds, was given

chopped leaves in mixed feed for seven days. Began on the 20th and no distinct change appeared until the 27th. Then the bull exhibited motor paralysis inco-ordination, twitching of muscles, walk to left, easily excited, blood in feces, pupils dilated, excess of saliva. Respiration became deep and labored, very like the deep breathing produced by morphine. At times the respiration were decreased in number; also, the pulse was accelerated from 38 to 52. Temperature changed from 101 and 102 to 99.4. This may have been due to inactivity. This bull never lost appetite for mixed feed and bran.

8. Bull 3 years old, weight 600 pounds, fed 17 pounds of chopped fresh leaves and flowers in mixed feed and bran in 3 days. On the first day 5 pounds and second day 8 pounds and third 4 pounds. On second day bull became slightly sluggish and on the third day, distinctly sluggish, and on the fourth day, very sluggish; hind limbs swayed from side to side as he walked. Pupils were dilated. Temperature slightly lowered. Pulse remained normal and respirations were slightly decreased in number.

9. Twenty pounds of nuts were beat up and put into a coffee or croker sack. This was drug around in a water hole 12 feet long, and 8 feet wide and 2 feet deep. In 15 minutes the fish in the water began to float on their sides and in 30 minutes several were dead. All were small fish.

CONCLUSIONS

1. Of the 12 pigs fed some part of red buckeye plant, only one that was fed nuts at the end of the close of 15 day test showed dullness, sluggishness and an unsteady gait.

2. Of the 7 mules and horses fed, or given some part of red buckeye plant, only 3 showed slight effect; one was depressed and weak, mucous membranes pale, put head against fence and then walked backward and forward. One was originally weak and became weaker and had to be helped up and stools were soft. One exhibited twitching of the upper lip.

3. Of 6 cattle fed or given some part of red buckeye plant, 1 exhibited slight symptoms and 2 exhibited distinct toxic effects.

4. One test of nuts on fish in water proved to be toxic for fish.

5. Fresh leaves and flowers seem to be most toxic for cattle, and apparently the early leaves and flowers are most dangerous for cattle. At the time the flowers and leaves come out, the cattle are more inclined to eat them on account of lack of grass or pasture. Possibly the sugar in the flowers give them palatability.

6. It may be that nuts and roots, or leaves and flowers are toxic for pigs, but these tests do not show it conclusively.

7. It is doubtful if horses and mules eat red buck-eye, and also, it is somewhat doubtful if they are susceptible to the poison.

Some station chemist, or pharmacist, should isolate glucosides, saponin, other poisons from the various parts of the plant and at the different stages of growth and then have a veterinarian test out these ingredients on the different animals.

Clinical symptoms: Labored, deep respirations, and some time accelerated respiration and pulse; temperature may be slightly elevated; motor paralyses, in coordination of movements; twitching of voluntary muscles; at times animal easily excited and some times sluggish and sleepy; pupils dilated; at times excessive flow of saliva; usually has an appetite for ordinary feed.

Diagnosis can not always be made definitely or positively by clinical examination. But seeing animal eat flowers and leaves, or finding good quantity of leaves in rumen or in feces and the presence of the clinical symptoms may be sufficient to make a reasonably sure diagnosis.

Treatment.—We used no treatment in any of the cases and every animal recovered from the toxic effects as soon as we stopped giving the plants to them. It seems that prevention is the treatment. Take away the cause and the animals get well or never have it. If purgatives are given as suggested by some to remove the plant from stomach or intestines, give once or twice daily strong coffee, and sweet oil or melted lard until bowels become lax or act freely.