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A STUDY OF THE TREATMENT
OF THE
INTESTINAL PARASITES
OF SWINE

by

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SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF
MASTER OF ARTS
in the

GRADUATE SCHOOL

of the

UNIVERSITY OF MISSOURI

1914

*Approved.
L. S. Backus.*

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CONTENTS.

Foreword -----	1
Object of Experiment-----	2
Plan of Experiment-----	2
The Experiment-----	3
Results Obtained-----	19
Discussion of Results-----	21
Vermifuge Properties Shown by More Efficient Drugs -----	23
Contemporary Data -----	24
Conclusions-----	26
Bibliography -----	28

FOREWORD.

Parasitic infestation of the intestines is one of the most serious and wide spread diseases of swine. With the exception of cholera there is probably no other one disease causing greater loss to hog owners. Parasitism, being very slow in its progress, gains a firm foot-hold on the affected animal before its presence is suspected and is especially injurious to young, poorly fed shoats. Older hogs when properly fed are able to withstand its attacks for some time before any noticeable symptoms of parasitic invasion may be observed. Increased value of market pork has stimulated an added interest in this disease by the veterinary profession as well as by the owners of swine.

For a matter of such general interest there seems to have been very little exact experimental work done upon the subject. This is probably due in part to the small value previously placed upon young shoats showing marked symptoms of infestation; and in part to the fact that parasitic infestation is often not recognized until the affected hogs show marked symptoms of ill health, and in this condition many succumb to ^{some} other infection, as pneumonia or cholera, and the true cause of the disease is lost sight of.

Seeing the economic bearing of the subject, what then is the most efficient treatment of the intestinal parasites of swine?

OBJECT OF THE EXPERIMENT.

The object of this experiment was three fold.

1. To make a study of the intestinal parasites of swine and determine their presence by frequent examination of feces for ova.

2. To determine the minimum, maximum, and toxic doses of the more efficient vermifuges.

3. To determine the most efficient treatment for expelling intestinal parasites.

PLAN OF THE EXPERIMENT.

The plan upon which this experiment was conducted was first to identify the ovum of the intestinal worms by taking ova direct from the body of the female worm. Second, to determine the minimum, maximum, and toxic doses of the more efficient vermifuges, now used, by giving these in the feed of infested hogs. Third, to determine the thoroughness of the treatment by fecal examination for ova and also when possible by post mortem examination. Fourth, since the common round worm, Ascaris suilla, and the thorn-headed worm, Echinorhynchus gigas, are the intestinal worms more commonly found here at the Experiment Station the work was confined mainly to these two parasites.

THE EXPERIMENT.

The work done on this experiment was as follows: First, identifications were made of the ova of Ascaris suilla, Echinorhynchus gigas, and Trichocephalus crenatus. For this and subsequent determinations, four separate pens large enough to comfortably accommodate a pig weighing up to 100 pounds were constructed with tongue and grooved floors. By this means each pig's feces were kept in the pen until taken out for examination. Four thinly fleshed, unthrifty appearing pigs obtained from an infested herd located on infested grounds were put in the above pens. Each pig was numbered for identification and record.

Fresh feces were obtained from pig No. 1 and carefully examined. The method used in this and subsequent examinations was the one commonly used by parasitologists. The method consisted in placing a small sample of freshly obtained feces in a shallow dish containing a few cubic centimeters of tap water. Then by means of a tooth pick a small particle of the feces was smeared on a glass slide, covered with a cover glass, and examined under the microscope. If no ova were found after ten such examinations had been made they were considered absent in the entire mass.

Since pig No. 1's feces contained two kinds of ova, this pig was killed and ova obtained direct from the body of the worms present. The intestines of this pig contained both round and thorn-headed worms. Ova were forced from the body of each kind of worm and a good collection of each was permanently mounted on a glass slide to be used in future identifications.

Second, determinations were made of the minimum dose of turpentine, copper sulphate, iron sulphate, tobacco, santonin, sodium chloride, areca nut, and arsenous acid, with pigs in medium condition and with good appetite. These pigs were obtained from an infested herd and as shown by fecal examination for ova were infested. The drugs were fed to the pigs in a thin slop consisting of corn chops 1 part, bran 2 parts, and middlings 2 parts. Two and one half quarts of this mixed feed were fed per 100 pounds live weight. No plain food was given during the same day as the treatment. Except in one determination, which is noted in the records, the pigs were kept in separate pens. The pigs were closely observed after each feeding to ascertain the amount of food and medicine eaten, the rate of eating, and if any worms were passed. In Table I is given the data obtained in the determinations of this dose.

Third, determinations were made of the maximum dose of turpentine, copper sulphate, tobacco, santonin, magnesium sulphate, and kerosene. These determinations were made with pigs shown by fecal examination to be passing ova. The pigs were kept in separate pens, and the vermifuges fed in a thin slop made of the same feed as used in the determinations of the minimum dose. The pigs were closely observed during the tests to determine the amount of food and medicine eaten, rate of eating, and whether or not worms were passed. Table II gives the data obtained from this test.

Fourth, determinations were made of the toxic dose of turpentine, copper sulphate, iron sulphate, tobacco, santonin, calomel, 95% carbolic acid, crude carbolic acid, sodium chloride, thymol, gasoline, and kerosene. For this test 15 pigs with good appetites, and in fair to medium condition were obtained. These pigs were put in separate pens and given fairly large doses of the above drugs with their food. The amount and kind of food was the same as that used in the previous dose determinations. The pigs were closely observed during the tests to note any toxicity produced. In Table III is given the data of these tests.

Fifth, determinations of the extent of treatment necessary to entirely free infested pigs of worms were

made with a total of 11 pigs, in fair to medium condition and varying in weight from 25 to 86 pounds. The pigs passing ova at the beginning of the test are shown in the data. They were placed in separate pens and the medicine given in their food in the same way as in the determinations of the doses of vermifuges. The pigs were closely observed during the tests to note any worms passed and also the effect of treatment on the pig. Post mortem examination was made of all but three pigs. The number of worms present and condition of the organs were carefully noted. The data obtained in these determinations is given in Table IV.

Post mortem examination of pigs used in the determinations of the extent of treatment necessary to entirely free infested pigs of worms follow on pages 15 to 18.

TABLE I.

DETERMINATIONS MADE OF THE MINIMUM DOSE OF THE MORE EFFICIENT VERMIFUGES.

These pigs were all infested as shown by subsequent observations.

Vermifuge	Pig No.	Wt. #	Dose 100#	Amt. food & Med. eaten	Rate eaten	Worms passed		Not passed	
						Asc.	Ech.	Asc.	Ech.
Turpentine	2	37	$\frac{1}{2}$ dr.	all	normal	0	0	0	1
	6	47	1	"	"	0	0	0-	3- (1)
	33	40	1	"	"	0	0	2	0
Copper sulphate	2	37	5 gr.	"	"	0	0	0	1
	6	47	10	"	"	0	0	0-	3-
	5	60	20	"	"	0	0	1	0
	32	55	20	"	slow	0	0	0	4
	31	50	30	"	"	0	0	1	3
	30	45	40	"	"	0	0	0	4
	33	40	50	"	"	0	0	2	0
	18	30	50	"	normal	0	1	0-	0- (2)
Iron sulphate	21	45	50	"	"	0	0	0	4
	6	47	100gr.	"	"	0	0	0-	1-
Tobacco	12	71	5 gr.	"	"	0	0	9-	0-
	7	86	10	"	"	0	0	5-	0-
Santonin	12	71	2 dr.	"	"	3	0	6-	0-
	6	47	$2\frac{1}{2}$ gr.	"	"	0	0	0-	1-
Sodium chloride	5	60	10	"	"	0	0	1	0
	33	40	4 dr.	"	slow	0	0	2	0
Areca nut	33	40	100 gr.	"	normal	0	0	2	0
	43	30	200	"	"	0	0	5	0
Arsenic	33	40	10 gr.	"	"	0	0	2	0

- (1) Indicates post mortem examination not made. The worms recorded as "not passed" by this treatment were passed after other treatments or found upon post mortem examination. (2) Pigs 18 and 21 were both in one pen.

TABLE II.

SHOWING DETERMINATIONS MADE OF THE MAXIMUM DOSE OF THE MORE EFFICIENT
VERMIFUGES.

Vermifuge	Pig No.	Wt. #	Dose 100#	Amt. Food & Med. eaten	Rate eaten	Worms passed		Not passed	
						Asc.	Ech.	Asc.	Ech.
Turpentine	5	60	4 dr.	all	normal	0	0	1	0
	2	38	4	"	"	0	0	0	1
	6	47	8	"	"	0	0	0-	3-*
	30	45	8	"	"	0	0	0	4
	31	50	8	"	"	0	0	0	2
	32	55	8	"	"	0	0	0	4
Copper	5	60	60 gr.	"	"	0	0	1	0
sulphate	6	47	75	"	"	0	0	0-	1-*
Tobacco	7	86	28 dr.	"	"	5	0	0-	0-*
	12	71	16	"	slow	6	0	0-	0-*
	31	50	16	"	"	1	0	0	2
	32	55	16	"	"	0	0	0	4
	46	45	5 oz.	"	"	0	0	2	0
	43	25	5	"	"	1	0	6	0
	30	45	16 dr.	"	"	0	0	0	4
Santonin	5	60	240 gr.	"	normal	1	0	0	0
	6	47	80	"	"	0	0	0	1
Kerosene	46	45	8 dr.	"	slow	0	0	2	0
Magnesium	6	47	4 oz.	"	"	0	1	0-	0-*
sulphate									

* Indicates that post mortem examination was not made. The worms recorded as "not passed" by this treatment were passed after other treatments or found upon post mortem examination.

TABLE III.

SHOWING DETERMINATIONS MADE OF THE TOXIC DOSE OF THE MORE

EFFICIENT VERMIFUGES.

Vermifuge	Date	Pig No.	Wt.	Dose	Amt. food & Med. eaten		Notes on effect of treatment.	
							Toxic symptoms	Appetite
Turpentine	3/21/13	6	47	8 dr.	all		none observed	Continued good
	1/22/14	41	36	9	3/4	"	"	" "
		42	34	10	3/4	"	"	" "
	3/26/13	2	38	12	3/4	"	"	" "
Copper sulphate	3/21/13	4	50	12	all	"	"	" "
	3/18/13	4	51	75 gr.	"	"	"	" "
	3/17/13	5	60	80	3/4	"	"	" "
	3/24/13	4	51	100	all	"	"	" "
Iron sulphate		5	60	100	2/3	"	"	" "
	4/3/13	6	47	1000gr.	all	"	"	" "
		4	51	1200	"	"	"	" "
Tobacco	4/24/13	7	86	12 dr.	"	"	"	" "
	4/25/13	12	71	16	3/4	"	"	" "
Santonin	3/30/13	4	50	100gr.	all	"	"	" "
		6	51	80	"	"	"	" "
		5	63	16 gr.	"	"	"	" "
Calomel	4/7/13	5	63	16 gr.	"	"	Pig listless	No appetite
95% Carbol. Acid	1.5/1/13	12	71	5 dr.	"	"	none observed	Continued good
		6	51	6	"	"	"	" "
		4	50	7	"	"	"	" "
		7	86	8	3/4	"	"	" "
Crude Carbol. acid					"	"	"	" "
	4/29/14	4	50	4 dr.	all	"	"	" "
		6	51	6	3/4	"	"	" "
		7	86	8	3/4	"	"	" "

(Continued on next page)

TABLE III. (CONTINUED).

Sodium chloride	4/23/14	35 45	2 oz.	all	None observed	Continued good
		36 49	3	"	" "	" "
		39 34	5	3/4	" "	" "
Areca nut	2/19/14	33 40	100 gr.	all	" "	appetite increases
		35 45	300	"	" "	" " ed
		37 22	500	"	" "	" "
Sulphur	5/29/13	12 71	4 oz.	"	Pig listless	" dull
		7 86	6	"	" "	" "
Arsenous acid	5/19/13	6 51	10 gr.	"	None observed	" increased
		7 86	12	"	" "	" "
	3/7/13	35 45	15	"	" "	" "
		36 49	20	"	" "	" "
Naphthalene	5/8/13	12 71	4 dr.	"	" "	" "
		7 86	6	"	" "	Continued good
Thymol	3/17/14	35 45	1 dr.	"	" "	Continued good
		36 49	3	"	" "	" "
		41 36	6	"	" "	" "
Gasoline	3/9/14	45 35	4 oz.	"	" "	" "
		46 45	6	"	Pig listless	Appetite dull
Kerosene	3/13/14	45 35	4 oz.	"	None observed	Continued good
		46 45	6	"	" "	" "

TABLE IV.

DETERMINATIONS MADE ON EXTENT OF TREATMENT NECESSARY TO ENTIRELY
FREE INFESTED PIGS OF WORMS.

Pig No.	Wt. #	Vermifuge	Date first dose given	Dose	No. days given.	Ova passed at begin, of exp.)		Worms passed Asc.Ech.		Worms found on postmort-em exam.)	
2	38	Turpentine	2/28/13	$\frac{1}{2}$ dr.	14	-	-	0	0		
		Copper sulph.	3/14/13	5, 10, 15, 20, 30 gr.	5			0	0		
		Turpentine	3/20/13	4, 4, -, -, 8, 8, 12 dr.	7			0	0		
		Turpentine	3/27/13	10 dr. twice daily	10			0	0	0	1
5	60	Turpentine	2/28/13	4 dr.	14	-	-	0	0		
		Copper sulph.	3/14/13	20, 40, 60, 80, 100 gr.	5			0	0		
		Turpentine	3/20/13	32, 16 dr.	2			0	0		
		Copper sulph.	3/24/13	100, 125, 125 gr.	3			0	0		
		Santonin	3/29/13	10, 60, 120, 240, -770 gr.	4			1	0	0	0
6	47	Turpentine	2/28/13	1 dr.	14	-	-	0	0		
		Copper sulph.	3/14/13	10, 20, 30, 40, 50 gr.	5			0	2		
		Turpentine	3/20/13	8 dr.	2			0	0		
		Copper sulph.	3/24/13	50, 75, 100 gr.	3			0	0		
		Santonin	3/29/13	2 $\frac{1}{2}$, 30, 80 gr.	3			0	0		
		Iron sulph.	4/1/13	100, 200, 300, 600, 1000, 1400 gr.	3			0	0		
		Calomel	4/5/13	4, -, 4, -, 16 gr.	5			0	0		
		Magnesium sulph.	4/15/13	4 oz.	1			0	1	Pig not killed	
7	86	Tobacco	4/21/13	20 gr., 1, 5, 12, 28 dr.	5	+	-	0	0		

(Continued on next page)

TABLE IV. (CONTINUED)

		Crude Carbol.Ac.	4/28/13	8,6 dr.	2		5	0	Pig not killed
12	71	Tobacco	4/21/13	5,30, gr.2,6,16 dr.	5	+ -	9	0	" " "
30	45	Copper Sulph.	11/12/13	40 gr.1,1,1,-,-,1 dr.	7	- +	0	0	
		Tobacco	11/26/13	2,-,-,-,-,2,2,-,-, 2,2, oz.	10		0	0	
		Turpentine	12/8/13	1,1,1,1,1,1,-,1,1,1,oz.9			0	0	0 4
31	55	Copper Sulph.	11/12/13	30,60,40,-,-,60 gr.	6	- +	0	1	
		Tobacco	11/26/13	2,-,-,-,-,2,2,-,-, 2,2, oz.	10		1	0	
		Turpentine	12/8/13	1 oz.	8		0	0	0 4
32	50	Copper Sulph.	11/12/13	1/3,-,-,-,-,-,-,-, 1,1,-,-,1 dr.	13	- +	0	0	
		Tobacco	11/26/13	1,-,-,-,-,2,2,-,-, 2,2 oz.	10		0	0	
		Turpentine	12/8/13	1 oz.	2		0	0	0 4
33	40	Turpentine	1/22/14	1,1,-,-,1,1,1,1,1, -,-,1,1,-,-,-,1,-,-,-, 1,1,1,1 dr.	14	+ -	0	0	
		Areca Nut	2/19/14	100 gr.	1		0	0	
		NaCl	2/23/14	4 dr.	1		0	0	
		Copper Sulph.	2/27/14	50,-,-,125 gr.	4		0	0	
		Arsenous Acid	3/7/14	10 gr.	1		0	0	2 0
43	25	Areca Nut	2/19/14	200 gr.	1	+ -	0	0	
		Tobacco	2/14/14	2,-,2,2,2,2,2,2 oz.	8		0	0	
			2/25/14	5,4,-,-,-,5,-,4 oz.	8		2	0	5 0
46	45	Tobacco	2/14/14	12,-,12,12,12,12, 12,12 dr.	8	- -	0	0	
			2/25/14	4,4,-,-,-,5,-,4 oz.	8		0	0	
		Gasoline	3/9/14	6 oz.	1		0	0	
		Kerosene	3/13/14	6,8 oz.	2		0	0	2 0

TABLE V.

SHOWING THE RESULTS OF VERMIFUGE TREATMENTS GIVEN TO PIGS INFESTED
WITH INTESTINAL WORMS.

Treatment given.	Pig No.	Wt. #	Doses	No. consecutive days.	Worms passed.		Not passed.	
					Asc.S.	Ech.G.	Asc.S.	Ech. G.
Copper	2	37	5, 10, 15, 20, 30 gr.	5	0	0	0	1
sulphate	5	60	20, 40, 60, 80, 100 gr.	5	0	0	1	0
			100, 125, 125 gr.	3	0	0	1	0
	6	47	10, 20, 30, 40, 50 gr.	5	0	2	0-	1-*
			50, 75, 100 gr.	3	0	0	0-	1-*
	30	45	40, 60, 60, 60, -, -, 60 gr.	7	0	0	0	4
	31	55	30, 60, 40, -, -, 60 gr.	6	0	1	1	4
	32	50	20, -, -, -, -, -, -, 60, 60, -, -, 60 gr.	13	0	0	0	4
	33	40	50, -, -, 125 gr.	4	0	0	2	0
Turpentine	2	37	$\frac{1}{2}$ dr.	14	0	0	0	1
			4, 4, -, -, 8, 8, 12 dr.	7	0	0	0	1
			10 dr. twice daily	10	0	0	0	1
	5	60	4 dr.	14	0	0	1	0
			32, 16 dr.	2	0	0	1	0
	6	47	1 dr.	14	0	0	0-	3-*
			8 dr.	2	0	0	0-	1-*
	30	45	1, 1, 1, 1, 1, 1, -, 1, 1 oz.	9	0	0	0	4
	31	55	1 oz.	8	0	0	0	4
	32	50	1 oz.	2	0	0	0	4
	33	40	1, 1, -, -, 1, 1, 1, 1, 1, -, -, 1, 1, -, -, 1, 1, 1, 1, dr.	24	0	0	2	0
Tobacco	7	86	20 gr. 1, 5, 12, 28 dr.	5	0	0	5-	0-*
	12	71	5, 30 gr. 2, 6, 16 dr.	5	9	0	0	4
	30	45	2, -, -, -, -, 2, 2, -, 2, 2, oz.	10	0	0	0	4
	31	55	2, -, -, -, -, 2, 2, -, 2, 2, oz.	10	1	0	0	4

(Continued on next page)

TABLE V. (CONTINUED).

	32	50	1,-,-,-,-,2,2,-,2,2 oz.	10	0	0	0	4
	43	25	2,-,2,2,2,2,2,-,-,2,2,5,4,-,-,-,5,19 -4 oz.	19	2	0	5	0
	46	45	1½,-,1½,1½,1½,1½,1½,-,-,1½,1½, 4,4,-,-,-,5,-,4 oz.	19	0	0	2	0
Santonin	5	60	10,60,120,240,-,770 gr.	4	1	0	0	0
	6	47	2½,30,80 gr.	3	0	0	0-	1-*
Calomel	6	47	4,-,4,-,16 gr.	5	0	0	0	1
Magnesium sulphate	6	47	4 oz.	1	0	1	0	0
Crude Carb. Ac.	7	86	8,6 dr.	2	5	0	0-	0-*
Areca Nut	33	40	100 gr.	1	0	0	2	0
	43	25	200 gr.	1	0	0	7	0
NaCl	33	40	4 dr.	1	0	0	2	0
Arsenic (white)	33	40	10 gr.	1	0	0	2	0
Gasoline	46	46	6 oz.	1	0	0	2	0
Kerosene	46	45	6,8 oz.	2	0	0	2	0
Iron Sulph.	6	47	100,200,300,600,1000,1400 gr.	3	0	0	0-	1-*

*Indicates post mortem examination not made. Worms recorded "not passed" were either passed after other treatments or found upon post mortem examination.

Post mortem examination of pig No. 2Apr. 6, 1913.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Lungs	Slightly congested throughout.	
Stomach	Mucosa slightly congested.	None.
Small intestines	Normal	1 Echinorhynchus gigas.
Large intestines	Normal	None.
Spleen	Normal	
Kidneys	Congested on external surface	
Urinary bladder	Normal	
Lymph glands	Normal	

This pig was killed to note effectiveness of treatment given. It was in only fair condition at time killed.

Post mortem examination of pig No. 5Apr. 11, 1913.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Lungs	Normal	2 Strongylus par- adoxus.
Kidneys	Rather soft and slightly paler than normal in color.	
Stomach	Mucosa ulcerated over quite a large part of its surface.	None.
Small intestines	Normal	None.
Large intestines	Caecum and double colon deeply ulcerated throughout their entire length. Floating colon contents bloody.	None.

Note.- This pig was killed to note extent of poisoning.

Post mortem examination of pig No. 30Dec. 17, 1913.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Stomach	Normal	None
Small intestines	Normal	4 Echinorhynchus gigas, 4-10" long.
Large intestines	Normal	None.

Note.- This pig was killed to determine the effectiveness of treatment given. It was thin in flesh and not doing well.

Post mortem examination of pig No. 31Dec. 17, 1913.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Stomach	Normal	None
Small intestines	Normal	2 Echinorhynchus gigas, 4-10" long.
Large intestines	Normal	None
Lungs	Normal	None

Note.- This pig was killed to determine effectiveness of treatment given. It was doing fairly well but was thin in flesh.

Post mortem examination of pig No. 32Dec. 10, 1913.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Stomach	Normal	None
Small intestines	Normal	4 Echinorhynchus gigas, 2-10" long.
Large intestines	Normal	20 Trichocephalus crenatus in caecum.
Lungs	Evidences of previous attack of pleuro-pneumonia. One large abscess was found at base of each lung.	
Kidneys	Normal	
Lymph glands	Normal	

Note.- Pig was killed to determine effectiveness of treatment and effect of drugs on pig's body. The pig was doing fairly well previous to this date.

Post mortem examination of pig No. 33Mar. 12, 1914.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Stomach	Normal	None
Small intestines	Severely congested	2 mature Ascaris suilla.
Large intestines	Normal	10 Tricho- cephalus crenatus in caecum.
Lungs	Normal	
Kidneys	Normal	

This pig was killed to note effect of treatment.

Post mortem examination of pig No. 43Mar. 7, 1914.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Stomach	Normal	1 mature Ascaris suilla.
Small intestines	Normal	3 mature Ascaris suilla.
Large intestines	Normal, except caecum which was slightly congested.	1 mature Ascaris suilla.
Lungs	Normal	
Kidneys	Normal	

Note.- This pig became weak and was unable to be on feet 24 hours before death.

Post mortem examination of pig No. 46Mar. 30, 1914.

<u>Organ.</u>	<u>Condition.</u>	<u>Worms.</u>
Stomach	Slightly congested, mucosa firm.	None
Small intestines	Invaginated for 3 inches	1 mature Ascaris suilla.
Large intestines		
Caecum	Slightly congested	None
Double colon	Slightly congested throughout its entire length	1 mature Ascaris suilla.
Floating colon	Slightly congested	None
Lungs	Normal	

Note.- Death probably due to getting the large doses of tobacco, gasoline, and kerosene.

RESULTS OBTAINED.

The examination of the feces for ova being passed gave very satisfactory results in determining infestation with mature worms as shown in Table IV; and also as shown in the test made with pig No. 1. Of the 11 pigs used in the determinations of the extent of treatment necessary to entirely free infested pigs of worms, which is shown in Table IV, six were passing ova at the beginning of the determination and each of these pigs either passed mature worms, or worms were found upon post mortem examination; or, as with pig No. 43, some worms were passed and more found upon post mortem examination. The pigs lightly infested with only one or two worms did not show ova in their feces, yet as shown in Table IV, the worms were either passed during the test or were found on post mortem examination.

RESULTS OF DETERMINATIONS OF THE MINIMUM DOSE OF VERMIFUGES USED.

The results obtained by determinations of the minimum dose are shown in Table I. Post mortem examinations were not made of all the pigs, as indicated in the same table, but where worms were passed subsequently with other treatments they were recorded here as a means of showing as far as possible the exact

number and kind of worms infesting each pig treated.

RESULTS OF DETERMINATIONS OF THE MAXIMUM DOSE OF VERMIFUGES USED.

The results obtained of determinations of the maximum dose are shown in Table II. The pigs, which were not examined post mortem, were closely observed in subsequent treatments and all worms passed recorded. Thus data of the number and kinds of worms infesting each pig treated was obtained.

RESULTS OF DETERMINATIONS OF THE TOXIC DOSE OF VERMIFUGES USED.

The results obtained of determinations of the toxic dose are shown in Table III. It was difficult to get the pigs to take enough of the vermifuges having a disagreeable taste or smell, as copper sulphate and crude carbolic acid, ^{to produce toxic symptoms}. The insoluble vermifuges were readily taken in injurious amounts. The toxic symptoms shown by the pigs are recorded in Table III. Post mortem examination of ^{eight of} these pigs are shown on pages 15 to 18.

RESULTS OF DETERMINATIONS OF THE EXTENT
OF TREATMENT NECESSARY TO ENTIRELY FREE AN INFESTED
PIG OF WORMS.

The results obtained of these determinations are shown in Table IV. In Table V is given a summary of results obtained by use of the different vermifuges tested with infested pigs.

DISCUSSION OF RESULTS.

Examination of pigs' feces for ova showed that in case of light infestation even with mature worms a great many eggs are passed. This provides a very satisfactory means of determining whether or not worms are present and the kinds present in the intestinal tract. But the number of ova present in a given amount of feces may not always be in proportion to the number of worms present. The ova passed by worms located nearer the rectum are more apt to be in greater numbers in a small amount of feces than when the ova passed in the stomach or small intestines since there is less mixing of the intestinal content in the large intestines.

The determinations of the minimum dose of the vermifuges used show that in the pigs treated a rather large amount of each drug was necessary to expel any

worms. These pigs, however, as may be seen in Table I were lightly infested. Smaller doses are satisfactory when given to pigs heavily infested.

The determinations of the maximum dose of the vermifuges used show that rather large doses did not expel any worms from some pigs known to be infested. Here again it may be well to state that these pigs were lightly infested as may be seen in Table II.

The determinations of the toxic dose of the vermifuges used show that vermifuges having a disagreeable taste or smell are not readily taken with the food in amounts large enough to produce poisoning. But drugs insoluble in water, as calomel and arsenous acid, were taken in the food in amounts large enough to produce toxic symptoms.

The determinations of the extent of treatment necessary to entirely free infested pigs^{of worms} show, as may be seen in Table IV, that pigs rather lightly infested are entirely freed of worms only with great difficulty in a large majority of cases as compared with the ease of expelling a large number of worms from pigs heavily infested with worms. When a lightly infested pig is given the vermifuge treatment along with its food the few worms present seem to have power to select the

food taken into their bodies, and are thus able to avoid the drug given. In case of heavy infestation this power to obtain the food desired by the parasite is probably greatly diminished and as a result of a strong appetite the ^{worms} select their food with less care.

VERMIFUGE PROPERTIES SHOWN BY THE
MORE EFFICIENT DRUGS.

Turpentine produced very good results when given alone. The feces passed after its administration were slightly softer than normal.

Copper sulphate showed the need of a purgative drug to aid its vermifuge action. Its ~~caustic~~^o effect was well overcome by giving 2 ounces of magnesium sulphate at the same time.

Iron sulphate being less ~~caustic~~^o than copper sulphate worked very well alone in producing frequent passages of soft feces. Yet magnesium sulphate at the rate of 2 ounces per 100 pounds was a very satisfactory aid to this drug.

Tobacco proved to be a satisfactory vermifuge as well as vermicide. The bowels were readily loosened in a satisfactory way. No violent purging occurred after its administration.

Santonin showed the need of a purging drug to aid its action. Calomel, while ordinarily used for this purpose, did not prove to ^{be a} satisfactory purgative.

CONTEMPORARY DATA.

No such experiment as the one dealt with in this thesis has ever been reported to the knowledge of the writer. For this reason the writer wrote to all the Experiment Stations in the principal hog growing States to ascertain if similar investigations had been made. Of the twenty-one Stations reporting only four report having carried on investigations of this problem. Yet a large majority of the answers mentioned the importance of the problem to the swine industry.

The answers received from the different Stations are herein embodied in the original copy.

The Purdue Experiment Station reports satisfactory results with santonin 3-5 grains and calomel 5-8 grains per 100 pounds live weight given with the feed.

The Ames Experiment Station reports satisfactory results from tests made at the Station by the use of

Santonin	8 grains
Areca nut	2 drams
Calomel	1 grain
Sodium Bicarbonate	1 dram

per 100 pounds live weight, given with the feed. Food

is withheld twenty-four hours and the treatment repeated in three weeks if thought necessary.

The Delaware Experiment Station reports more or less success from the use of

Powdered areca nut	2 parts
Powdered gentian	1 part
Epsom Salts	3 parts

Dose, one tablespoonful in a little slop or feed for each 100 pounds live weight. Food is withheld twelve to twenty-four hours before treating and treatment repeated in five to seven days if necessary.

CONCLUSIONS.

1. Parasitic invasion of the intestinal tract of hogs may be diagnosed by three principal means: first, by finding worms in the feces; second, by finding ova in the feces; third, by finding worms in the intestines upon post mortem examination.

2. It is not possible to diagnose intestinal parasitic invasion by the condition of the animal.

3. The minimum vermifuge dose of the more efficient vermifuges is relatively large when the medicine is given in the feed.

4. The maximum vermifuge dose of the more efficient vermifuges is relatively large when the medicine is given in the feed.

5. Turpentine, iron sulphate, copper sulphate, tobacco, santonin, and areca nut are efficient vermifuges for the round worm infesting the hog.

6. Copper sulphate is an efficient vermifuge for the thorn-headed worm infesting the hog.

7. To aid vermifuge drugs in expelling worms from the intestinal tract of the hog a purgative should be given at the same time or twelve to twenty-four hours after the vermifuge is given.

8. It is not a satisfactory practice to treat lightly infested hogs until all worms are expelled. The necessary treatment is more injurious to the animal than the effect produced by a few worms.

9. The practice of keeping a mixture of vermifuge drugs as iron sulphate, sulphur, salt, sal soda, and ashes before hogs at all times is a very satisfactory means of preventing heavy *infestation?* of hogs by intestinal parasites.

BIBLIOGRAPHY.

- Braun, M. C. C. C., Animal Parasites of Man. 1908
- Dun, F., Veterinary Medicine. 1911
- Friedberger & Frohner, Veterinary Pathology, 1909
- Hall, M. C., A Comparative Study of Methods of
Examining Feces for Evidences of Parasitism, 1911
- Hutyra and Marek, Special Pathology and Therapeutics of
the Diseases of Domestic Animals, 1913
- Kaupp, B. F., Animal Parasites and Parasitic Diseases, 1910
- Law, J., Veterinary Medicine, 1896
- Leidy, J., Researches in Helminthology and Parasitology, 1904
- Lewis, L. L., Common Parasites of Domestic Animals,
Okla. Sta. Bulletin 53
- McCarthy, G., Parasites of Domestic Animals, N. C. Sta.
Bulletin 127, 1896
- Neumann- Fleming, A Treatise on the Parasites and Parasitic
Diseases of the Domestic Animals, 1905
- Peters, A. T., Ill. State Board of Live Stock Commissions,
Bulletin 2, 1910
- Ransom, B. H. How Parasites are Transmitted, U.S. D.A.
Yearbook 1905
- Stange, C. H., Some Common Internal Parasites of Hogs and
Their Treatment. 1913
- Stiles, C. W., Animal Parasites, U.S. D.A., Bureau of
Animal Industry, Bulletin 35

Van Beneden, P. J., Animal Parasites and Mess Mates, 1889.

Winslow, K., Veterinary Materia Medica and Therapeutics, 1908.

ENTOMOLOGY

C. W. WOODWORTH, ENTOMOLOGIST
H. J. QUAYLE, FIELD INVESTIGATIONS
W. B. HERMS, PARASITOLOGY
G. A. COLEMAN, MUSEUM
G. P. GRAY, INSECTICIDES
E. C. VAN DYKE, TAXONOMY
L. J. NICKELS, APICULTURE
W. H. VOLCK, FIELD ASSISTANT
E. L. MORRIS, FIELD ASSISTANT
M. R. MILLER, INSECTICIDES
R. E. CAMPBELL, LABORATORY ASSISTANT

UNIVERSITY OF CALIFORNIA
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY

BENJ. IDE WHEELER, PRESIDENT
THOMAS FORSYTH HUNT, DEAN AND DIRECTOR
H. E. VAN NORMAN, VICE-DIRECTOR AND DEAN
UNIVERSITY FARM SCHOOL

April 28, 1914

T. T.
Dr. J. J. Tucker
Assistant in Veterinary Science
Agr. Exp. Station,
Columbia, Mo.

Dear Sir:-

Your letter of March 23rd to Dr. C. M. Haring has been referred to me for reply. I regret to say that I have no information at hand relative to intestinal parasites of swine that would be of use to you. As elsewhere round worms, Ascaris suum, are quite common here in California while the thorn-headed worm, Echinorhyncus gigas is relatively uncommon. We have done little or no work on either species as yet. Other species of Helminths have hardly been touched.

Very truly yours

W. B. Herms

VETERINARY SCIENCE

UNIVERSITY OF CALIFORNIA
COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION
BERKELEY

BENJ. IDE WHEELER, PRESIDENT
THOMAS FORSYTH HUNT, DEAN AND DIRECTOR
H. E. VAN NORMAN, VICE-DIRECTOR AND DEAN
UNIVERSITY FARM SCHOOL

April 1, 1914.

Dr. T. T. Tucker,
Assistant in Veterinary Science,
Agricultural Experiment Station,
Columbia, Missouri.

Dear Sir:

Replying to your letter of the 23rd instant, I would say that we have very little data on the treatment of worms in hogs and I have referred your letter to Prof. W. T. Herms. Prof. Herms is making a study of parasites in domesticated animals.

Very truly yours,

C. M. Haring

CMH:W

COLORADO STATE AGRICULTURAL COLLEGE

CHAS. A. LORY, PRESIDENT

C. L. BARNES, MATERIA MEDICA

DIVISION OF VETERINARY MEDICINE

H. E. KINGMAN, SURGERY

A. W. WHITEHOUSE, ANATOMY

GEO. H. GLOVER, HEAD OF DIVISION

I. E. NEWSOM, PATHOLOGY

THEORY AND PRACTICE

FORT COLLINS, COLORADO.

March 26, 1914.

Dr. T. T. Tucker,
State University,
Columbia, Mo.

Dear Doctor:

Replying to your communication of March 23rd
addressed to Dr. Glover, will say that we have done no work
on parasites of swine.

I hope that your investigations may be published
and am sure they will be of great benefit to the swine in-
dustry of the country.

Very truly yours,

I. E. Newsom

IEN/L

DELAWARE COLLEGE
AGRICULTURAL EXPERIMENT STATION

DEPARTMENT OF BACTERIOLOGY
HYGIENE AND VETERINARY SCIENCE
RAYMOND C. REED, PROFESSOR

NEWARK, DEL. April 6, 1914.

Dr. T. T. Tucker,
Department of Veterinary Science,
Univ. of Missouri,
Columbia, Mo.

Dear Doctor:

We have no bulletins on the subject of parasites in swine nor have we carried on any special experiments regarding them. The only thing that I can suggest is a simple remedy which we have used with more or less success in expelling the common round worms. You probably have already used the same or similar remedy but I will give it nevertheless.

Powdered Areca Nut	2 parts
Powdered Gentian	1 "
Epsom Salts	3 "

Dose, one tablespoonful in a little slop or feed for each 100 lbs. weight of hogs. Give after fasting twelve to twenty-four hours. Repeat in five to seven days if necessary.

Yours very truly,

RCR/MR

R. C. Reed

ATE COLLEGE OF AGRICULTURE
AND MECHANIC ARTS
UNIVERSITY OF GEORGIA
ATHENS, GEORGIA.

March 27, 1914.

Department of Veterinary Science
W. M. Burson, D.V.M. Professor
H. H. Rothe, D.V.M. Instructor

Mr. T. T. Tucker,
Assistant in Veterinary Science,
Columbia, Mo.

Dear Sir:-

I have your letter of March 23rd relative to the intestinal parasites in swine, and I am sorry to state that we have no information in regard to the development of parasites which would be of any value to you. Of course, I realize that this is an important subject and especially to the South where parasitic invasions are exceptionally common in farm animals. On post mortem examinations of the hogs killed at the serum laboratory we frequently observe very heavy infestations of Echinorhynchus Gigas, Strongylus Paradoxus, Stephanurus Dentatus and Ascaris Suilla. We have not made any special study of parasites, consequently have nothing now to offer along this line. I hope that you will be able to give ^(us) you some better information on the subject than we have heretofore possessed.

With best wishes,

Yours very truly,

W. M. Burson
Professor of Veterinary Science.

DR. E. T. BAKER
VETERINARIAN
MOSCOW, IDAHO

ASSISTANT STATE VETERINARIAN

April 2, 1914.

Dr. T. T. Tucker,
Columbia, Mo.

Dear Doctor:

Replying to your favor of the 23d inst., in regard to intestinal parasites of hogs, will say that I am not connected with the experiment station any more--preferring general practise and more money to the former. I had in mind taking parasites--both internal and external, from a cholera-infected hog and giving them to healthy ones. I think here is a real problem, for in the end, what the farmer wants is results, not mere theoretical experiments.

Wishing you success in your work, I remain,

Very truly yours,

E. T. Baker

HEADS OF DEPARTMENTS

UNIVERSITY OF ILLINOIS

E. J. JAMES, PRESIDENT

COLLEGE OF AGRICULTURE

AND

AGRICULTURAL EXPERIMENT STATION

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W. MUMFORD, Animal Husbandry
E. L. BEVIER, Household Science
D. H. RANKIN, Agricultural Extension
A. HARDING, Dairy Husbandry

Champaign, Ill., April 1, 1914.

Mr. T. T. Tucker,
Columbia, Mo.,

Dear Sir:-

I received your letter and I am sorry that I have nothing better than is found in the works of Verrill and Cobbold, who have spent a life-time investigating the internal parasites of animals, among these the pig. These investigators give the life-cycle of the worms. These books will likely be in the library of your University.

Very truly yours,

D. W. McIntosh

DIVISION OF VETERINARY MEDICINE
AND STATE BIOLOGICAL LABORATORY
IOWA STATE COLLEGE

OFFICE OF THE DEAN AND DIRECTOR
CHARLES H. STANGE

AMES, IOWA, March 27, 1914

Mr. T. T. Tucker,
University of Missouri,
Columbia, Mo.

Dear Sir:--

Replying to your favor of March 25rd, we have not kept any records of life-cycle of parasites in hogs, but have found the remedies as set forth in attached bulletin to be very successful. (Enc. 14 Iowa Sta)

If I can be of any further service, would be glad to hear from you.

Very truly yours,

P/B

IOWA AGRICULTURAL EXPERIMENT
STATION

Veterinary Section

Some Common Internal Parasites
(Worms) of Hogs and Their
Treatment

BY

DR. C. H. STANGE

Next to hog cholera, probably no subject is of greater importance to swine raisers than that of worms in hogs. Intestinal worms in hogs is a common condition. An understanding of the mode of infestation and the methods of prevention and treating these common parasites will largely prevent losses from worms in swine herds.

In this bulletin the more common types of worms affecting hogs are described and suitable remedies are suggested. The reader is urged to make certain, if possible, the nature of the affection before applying the treatment. Complicated or difficult diagnosis should be referred to competent veterinarians in order to secure the best results. The descriptive material on the following pages is too brief and incomplete to be of value except in ordinary affections, such as are too often overlooked, or subjected to home treatment, or perhaps escape treatment entirely.

Most of the worms for which the hog is host are more numerous some years than others, this being due to the fact that conditions are more favorable some seasons for the complete development (life history) of the parasite in its various stages. It may seem strange that the common intestinal worms of the hog pass a part of their life history outside of the body of the hog. Such, nevertheless, is the case. Whether or not these parasites perish during this time depends largely upon conditions, i. e., moisture, warmth, etc.

WORMS INFESTING THE INTESTINES

The most important worms of the hog are the large round worms infesting the intestine, and the small thread-like ones found in the lungs. The former are by far the most frequent and are most readily and effectively treated.

The COMMON ROUND OR LUMBRICOID WORM (*Ascaris Suilla*) prefers to live in the small intestine but has frequently been found in the stomach, bile ducts and in the gall bladder. It is a common parasite in young, unthrifty pigs and may be found in sufficiently large numbers to fill the intestine for several feet. It is a round worm, tapering at both ends, white or yellowish white in color. The female worm averages nine to ten inches in length, while the male is usually about three inches shorter. The eggs laid by the female pass out with the intestinal contents, and soon hatch if the ground is moist and warm. If not, they remain in the egg stage for some time. Hogs feeding on dirty floors or from the ground or drinking from dirty troughs or ponds, take in the newly hatched worm or eggs about to hatch, and from this time on growth and development in the hog's intestine

Common Round Worm
(*Ascaris Suilla*)

into a fully matured worm are simply a matter of time.

THORN HEADED WORM (*Echinorhynchus Gigas*). This worm is somewhat larger than the common round worm, the female often reaching eleven inches in length. The male is much smaller and will average about three inches in length. The color of both male and female is a milky white, the body is somewhat wrinkled transversely and tapers to a blunt point at the posterior extremity. The anterior extremity (head) carries a hook which can be drawn back and which is covered by many small hooklets which curve backward. The worm attaches itself to the wall (inside) of the intestine by means of this hook.

The eggs pass out with the manure as with the common round worm. They are then taken up by the white grubs (larval form of May beetle) which are found about manure piles. It is possible that some forms of the snail may also take up these eggs, and unless they are taken up by the common grub or the snail their further development

stops. Hogs become infested by eating the grubs and snails. Hogs pastured on clover seem to show the greatest infestation.

The PIN WORM (*Desophagastoma Dentatum*) is a small white or brownish white worm, pointed at both ends and often found in large numbers in the first portion of the large intestines. The male is one-half inch long, the female averaging a little longer. They rarely create much disturbance, but probably assist in aggravating the symptoms when other parasites are present. The animal becomes infested through the same source as with the common round worm.

Thorn Headed Worm
(*Echinorhynchus Gigas*)

The WHIP WORM (*Trichocephalus Crenatus*) is generally found in

Lung Worm
(*Strongylus*
Paradoxus)

Whip Worm
(*Trichocephalus*
Crenatus)

same portion of the intestine as the pin worm. It is about one and one-half inches in length. The anterior two-thirds of the body is very thin (whip lash) while the posterior one-third expands suddenly at its juncture with the anterior portion and is cylindrical and quite thick (whip stock) as compared with the anterior portion, whence the name, whip worms. The eggs pass out, develop and are taken in as with the common round worm. The effect on the hog is about the same as with the pin worms.

SYMPTOMS OF WORMS IN HOGS.

The severity of the symptoms depends quite largely on the number of worms present. The presence of more kinds of worms usually aggravates the symptoms. A few worms may be present without producing appreciable symptoms.

Among the most common symptoms are those seen in chronic indigestion, i. e., irregular appetite, alternate diarrhoea and constipation, loss of condition, sometimes vomiting, rough coat and other symptoms of unthriftiness. When thorn headed worms are present there is considerable irritation of the lining of the intestines and there are in addition to the above symptoms, restlessness, weakness, and in young pigs, convulsions. The most certain method of determining the presence of intestinal worms is to find worms or their eggs in the manure.

PREVENTION AND TREATMENT.

The prevention is very important and consists of methods having for their object the destruction of the eggs outside of the body so as to prevent further infestation. Inasmuch as moisture is an important element in assisting the eggs to hatch all pastures should be well drained, and wallow holes should not be allowed to form. The water supply should come from a deep well, and the feeding troughs and floors should be kept as clean as possible. When possible, a frequent change of pasture is recommended. When thorn headed worms are present, hogs should not be allowed to root about old straw stacks and manure piles. Plowing the hog lots will help to free them from the white grubs and the eggs of the round worm as well.

In selecting a medicinal treatment it is necessary to select such drugs as will destroy the worms and still not injure the hog to an appreciable degree. The following formula which was first used on the college herd by the Division of Veterinary Medicine and has since been recommended by the Animal Husbandry Department has given such satisfactory results that it is now considered advisable to publish it for the general use of hog raisers.

Santonin, eight grains;	Calomel, one grain;
Areca Nut, two drams;	Sodium Bicarbonate, one dram.

The above quantities are for one hog weighing 100 pounds and the quantity should be increased or decreased according to the size of the hog and multiplied by the number of hogs. The most satisfactory results are secured when the hogs are divided into lots of twenty or less and food should always be withheld for twenty-four hours. Then mix the worm powder thoroughly with some moist ground feed and give it in such a way that each hog will get its share of the medicine in the feed. Not too much feed should be used as it dilutes the medicine. This treatment may be repeated in three weeks if the worms are not all removed by the first administration, but usually one treatment is sufficient.

LUNG WORM OF SWINE.

The LUNG WORM OF SWINE (*Strongylus Paradoxus*) is a delicate white

or brownish thread like worm, one-half to one and one-quarter inches long. The entire life history of this worm is not quite clear but is probably similar to one of the lung worms in sheep in which case the eggs are expelled into water or moist earth and may remain alive for months. When conditions are favorable (warmth and moisture) they

Lung Worm in Lung of Hog (*Strongylus Paradoxus*)

undergo a moulting process and if dried up soon after this they can be preserved for a year or more without being killed. Therefore the worm is very resistant to drying and may enter the body with the dust by inhalation or with the food or drinking water. On cutting through the affected part of the lung the worms in the air passages are frequently sufficiently numerous to completely fill them.

SYMPTOMS.

The first symptom is a cough, noticed especially when the pig leaves the bed or following exercise or after eating. This cough is sometimes called whooping cough. In extreme cases there may be vomiting. Quite often the pig thrives and recovers, while in other cases there is unthriftiness, difficult breathing (thumps) which finally leads to death after a chronic course.

TREATMENT.

The most important part of the treatment is to keep the pigs in a growing healthy condition. New pastures and lots which do not receive drainage from the old ones should be provided and all possible precautions should be observed in keeping infested hogs from contaminating the new pastures. The hog houses should be thoroughly cleansed and disinfected, and the old pastures may be plowed and cultivated or used as a pasture for stock other than hogs. The medicinal treatment is as yet not satisfactory or practical.

F. S. SCHOENLEBER, D. V. S., PROFESSOR
LEONARD W. GOSS, D. V. M., ASST. PROFESSOR
J. H. BURT, D. V. M., ASST. PROFESSOR
R. R. DYKSTRA, D. V. M., ASST. PROFESSOR
BURTON R. ROGERS, D. V. M., INSTRUCTOR

Kansas State Agricultural College
Manhattan, Kansas

R. V. CHRISTIAN, D. V. M., ASSISTANT
THOS. P. HASLAM, M. S., ASSISTANT
O. M. FRANKLIN, D. V. M., ASSISTANT
C. W. HOBBS, V. S., FIELD VETERINARIAN
J. I. KIRKPATRICK, D. V. M., ASSISTANT

DEPARTMENT OF VETERINARY MEDICINE

March 26, 1914.

Mr. T. T. Tucker,

Columbia, Mo.

Dear Sir:

We cannot furnish you with any exact scientific data regarding the eradication of intestinal parasites in hogs. We have done no work along this line, and therefore cannot offer anything original.

Very truly yours,

D-0

Kentucky Agricultural Experiment Station
State University

JOSEPH H. KASTLE
DIRECTOR

ALL REQUESTS FOR HOG CHOLERA SERUM SHOULD
BE ADDRESSED TO ROBERT GRAHAM, IN CHARGE

VETERINARY DEPARTMENT
HOG CHOLERA SERUM LABORATORY
DR. ROBERT GRAHAM, IN CHARGE

Lexington, Ky., March 27th 1914.

Mr. T. T. Tucker,
Columbia, Missouri.

Dear Sir:--

Your letter of March 23rd requesting literature on intestinal parasites of swine has been received. I am very sorry to advise that we have no available experiments or test on these problems, therefore, cannot be of assistance to you.

Yours very truly,

Dictated.

A large, stylized handwritten signature in dark ink, appearing to read "Robert Graham". The signature is written over the typed name "Robert Graham" and extends across the right side of the page.

LOUISIANA STATE UNIVERSITY
BATON ROUGE, U. S. A.

COLLEGE OF AGRICULTURE
DEPARTMENT OF VETERINARY SCIENCE

OFFICE OF
DR. W. H. DALRYMPLE

EXPERIMENT STATIONS
VETERINARY DEPARTMENT

March 26. 1914.

Mr. T. T. Tucker,
University of Missouri,
Columbia, Missouri.

My dear Sir:

Your favor of the 23rd has been duly received, and in
reply will say that we have no Station literature on parasites of
the digestive tract of the Pig.

Expressing my regrets,

Very sincerely yours,

W. H. Dalrymple.

DEPARTMENT OF VETERINARY MEDICINE

G. A. ROBERTS, B.S., D.V.S., PROFESSOR
VETERINARIAN TO EXPERIMENT STATION

B. T. SIMMS, D.V.M.
INSTRUCTOR IN PHYSIOLOGY AND PATHOLOGY

L. F. KOONCE, B.S., D.V.S.
DEMONSTRATOR IN ANATOMY AND CLINICS

THE NORTH CAROLINA

COLLEGE OF AGRICULTURE AND MECHANIC ARTS

D. H. HILL, PRESIDENT

WEST RALEIGH, N. C.,

April 21, 1914.

Mr. T. T. Tucker,
Columbia, Mo.

My dear Sir:

I regret to state that the Station nor myself
have ^{any} ~~no~~ results from the Study of parasites in swine nor the
~~treatment~~
~~drawing~~ for same, however we have made quite a large number of
observations in determining those which are more or less common.

be loose, The Sarcophagid and Demodectic manges. *Of* the internal parasite, the
Ascaris, the Echinorhynchus gigas, the Strongylous Paradoxus, the
Stephanurus dentatus, ~~and~~ the Esophagostoma dentatum, the Tri-
chocephalus crenatus, the Cysticercus cellulosae, ~~the~~ Trichina,
These latter two ~~are~~ are in limited numbers.

Very truly yours,

G. A. Roberts

518.

J. H. WORST, LL.D.
PRESIDENT

W. A. YODER
SECRETARY

NORTH DAKOTA AGRICULTURAL COLLEGE
AND
GOVERNMENT EXPERIMENT STATION

AGRICULTURAL COLLEGE, NORTH DAKOTA.

DEPARTMENT OF VETERINARY SCIENCE

L. VAN ES, PROFESSOR

A. F. SCHALK, ASSISTANT PROFESSOR

S. O'TOOLE, ASSISTANT PROFESSOR

March 26, 1914.

Mr. T.T. Tucker,
Department of Veterinary Science,
University of Missouri, Columbia, Mo.

Dear Sir:-

In reply to your favor of the 23rd
inst., I beg to advise you that we have no
data on the subject you are interested in.

Yours very truly,

L. Van Es

OHIO AGRICULTURAL EXPERIMENT STATION

CHAS. E. THORNE, DIRECTOR
WOOSTER, OHIO

DEPARTMENT OF
ANIMAL HUSBANDRY

B. E. CARMICHAEL
J. W. HAMMOND
GEO. R. EASTWOOD
DON C. MOTE
W. J. BUSS

April 7, 1914.

Mr. T. T. Tucker,
University of Missouri,
Columbia, Mo.

Dear Sir:-

Replying to your recent letter relative to your investigation of the bionomics, control and treatment of the intestinal parasites of hogs, I regret to inform you that we have no published data on the subject. However, if you should desire definite information on any one of the parasites, feel free to ask for it and we will endeavor to supply the information if possible.

Assuring you that we shall gladly serve you whenever possible,
I am,

Very truly,

Don C. Mote

Assistant, Animal Parasitology.

THE OHIO STATE UNIVERSITY

W. O. THOMPSON, PRESIDENT

COLLEGE OF VETERINARY MEDICINE
DAVID S. WHITE, DEAN

COLUMBUS, Ohio, March 28, 1914.

Mr. T. T. Tucker,
University of Missouri,
Columbia, Mo.

Dear Sir:

Replying to your letter of March 23, '14 I
beg leave to state that we have no results of experi-
ments or tests concerning the life-cycle and develop-
ment of the intestinal parasites of swine, nor have
we original data in regard to the most efficient treat-
ment for this condition.

Regretting that I cannot aid you in the
matter, I am

Very truly yours,

Dean.

P. S. If you get positive results, I shall be pleased
to have a copy of your thesis. W.

Michigan Agricultural College

EAST LANSING

DIVISION OF VETERINARY SCIENCE
DR. R. P. LYMAN, DEAN

March 30, 1914.

Dr. T. T. Tucker,
University of Missouri,
Columbia, Missouri.

Dear Dr. Tucker:

This is to acknowledge your letter of the 23d. I regret that I have no material available in the way of experiments or tests concerning the life-cycle or treatment beyond that ordinarily in vogue for expelling intestinal parasites of swine. Regretting that I am unable to aid you at this time, I beg to remain

Yours very truly,

RPL/AJ.

Dean, Veterinary Division.

The University of Minnesota

Department of Agriculture

University Farm, St. Paul

DIVISION OF VETERINARY SCIENCE

March 28, 1914.

Mr. T. T. Tucker,

Columbia, Mo.

Dear Doctor:-

Replying to your letter of March 25th I regret to say we have no original information to offer you along the line of intestinal parasites of swine. If copy of your thesis is available for distribution I should appreciate one very much.

Yours truly,

M. H. Reynolds

Chief, Veterinary Division.

L. L. LEWIS
Veterinarian
ROY C. POTTS
Dairyman
C. E. SANBORN
Entomologist
CHAS. K. FRANCIS
Chemist
N. O. BOOTH
Horticulturist
O. O. CHURCHILL
Agronomist
A. H. WRIGHT
Assistant Agronomist
R. O. BAIRD
Assistant Chemist
A. A. JONES
Assistant Chemist

Address All Communications to the Experiment Station, Stillwater, Oklahoma

Oklahoma Agricultural Experiment Station

L. L. LEWIS, ACTING DIRECTOR
STILLWATER

C. I. BRAY
Asst. Animal Husbandman
D. C. MOORING
Assistant Horticulturist
W. P. SHULER
Assistant Bacteriologist
A. F. ROLF
Poultry Husbandry
LOYAL F. PAYNE
Poultryman
E. E. HALL
Assistant Agronomist
J. L. McKEOWN
Financial Secretary
LULA TOURTELLOTTE
Clerk

Mar. 26, 1914.

Mr. T. T. Tucker,
University of Missouri,
Columbia, Mo.

Dear Sir:

I am in receipt of your letter of recent date with reference to literature and the life-cycle and treatment of intestinal parasites of hogs.

I regret very much that we are unable to supply you with material of any considerable importance along this line. I am very much interested in this line of work and would be very glad if investigations are put into print to receive a copy of it.

Regretting our inability of service to you, I am,

Yours respectfully,

LLL/AC.

Veterinarian.

859.

Clemson Agricultural College

DIVISION OF VETERINARY SCIENCE

M. RAY POWERS, D. V. S.
State Veterinarian
Professor Veterinary Science
Consulting Veterinarian
S. C. Experiment Station

[STATE AGRICULTURAL AND MECHANICAL COLLEGE]

Department of Agriculture

Clemson College, S. C.

ASSISTANT STATE VETERINARIANS

R. O. FEELEY, D. V. S.
Field Veterinarian
Investigation of Contagious Diseases
M. L. QUIGLEY, V. M. D.
Field Veterinarian
Tick Eradication Work
W. A. BARNETTE, B. S., D. V. M.
In Charge
Anti-Hog Cholera Serum Laboratory

April 10, 1914.

Mr. T. T. Tucker,
Dep't. of Vet. Science,
Columbia, Mo.

Dear Sir:-

In reply to your letter of the 8th inst. I regret to say that the South Carolina Experiment Station has never conducted any tests or experiments along the lines you mention, therefore I cannot furnish you with the information you desire.

Regretting my inability to be of service to you, I remain

Very truly yours,

MRP.EMS.

HEADS OF DEPARTMENTS

C. ARTHUR, Chief in Botany
I. CHRISTIE, Sup't Agricultural Extension
A. CRAIG, Chief Veterinarian
F. HUNZIKER, Chief in Dairy Husbandry
J. JONES, JR., State Chemist (Fertilizer
and Feeding Stuff Control)
H. SKINNER, Chief in Animal Husbandry
JAMES TROOP, Chief in Entomology
T. WIANCKO, Chief in Soils and Crops
G. WOODBURY, Chief in Horticulture

PURDUE UNIVERSITY

AGRICULTURAL EXPERIMENT STATION

ARTHUR GOSS, DIRECTOR

VETERINARY DEPARTMENT

R. A. CRAIG, Chief Veterinarian
R. A. WHITING, Associate in Animal Pathology
H. C. PAINE, Assistant Veterinarian
D. B. CLARK, Assistant Veterinarian
F. L. WALKEY, Assistant in Serum Production
A. J. HUNTER, Assistant in Serum Production

LAFAYETTE, IND.

March 27, 1914

Dr. T. T. Tucker,

University of Missouri.

Columbia, Mo.

Dear Doctor:

Your letter of March 23rd., was received.

We have not investigated the life cycle of the different parasites found in the intestines and lungs in hogs. We have been recommending with very satisfactory results the following line of treatment for intestinal worm:

Santonin 3 - 5 grains.

Calomel 5 -8 grains. This is sufficient for every 100 lbs live weight. If the pigs are small or if it takes two pigs to weigh 100 lbs., you may give them the large dose. If the hogs are large, weighing 100 lbs., or more; give them the small dose. Have the druggist prepare the mixture in powders large enough for lots of ten or twelve hogs, and dose each lot separate. It is given with ground feed. A little ground feed is put into the trough and the powder sprinkled over the top of the feed.

Yours very truly,

R. A. Craig

COLLEGE OF AGRICULTURE AND EXPERIMENT STATION
UNIVERSITY OF TENNESSEE
KNOXVILLE

M. JACOB, V. M. D.
VETERINARIAN

April 17, 1914

Dr. T. T. Tucker,
Dept. of Veterinary Science,
University of Missouri,
Columbia, Mo.

Dear Doctor:-

Your esteemed favor with reference to investigation of intestinal parasites in swine is at hand, and beg to advise that we have no available material here at this time which would be of any material value to you in your work. I may state, however, that the subject of your thesis is certainly a commendable one, and I wish for you every success in accomplishing your purpose.

Yours truly,

Veterinarian

W. A. HENRY, EMERITUS PROF. OF AGR.
S. M. BABCOCK, EMERITUS PROF. OF AGR.
CHEMISTRY

A. S. ALEXANDER, STALLION ENROLLMENT
L. J. COLE, EXPERIMENTAL BREEDING
A. M. COOK, FORESTRY
E. H. FARRINGTON, DAIRY HUSBANDRY
F. B. HADLEY, VETERINARY SCIENCE ✓
J. G. HALPIN, POULTRY HUSBANDRY
E. B. HART, AGR. CHEMISTRY
E. G. HASTINGS, AGR. BACTERIOLOGY
K. L. HATCH, AGR. EDUCATION
C. S. HEAN, AGR. LIBRARY
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AGR. EDITOR
G. C. HUMPHREY, ANIMAL HUSBANDRY
L. R. JONES, PLANT PATHOLOGY

THE UNIVERSITY OF WISCONSIN

COLLEGE OF AGRICULTURE AND AGRICULTURAL EXPERIMENT STATION

CHARLES R. VAN HISE, PRESIDENT OF THE UNIVERSITY
H. L. RUSSELL, DEAN AND DIR. D. H. OTIS, ASST. DEAN
F. B. MORRISON, ASST. TO THE DEAN K. L. HATCH,
SEC'Y OF AGR. EXTENSION
M. H. CRISSEY, EXECUTIVE SEC'Y

O. G. MALDE, SUPT. CRANBERRY STATION
GRAND RAPIDS, WISCONSIN
A. L. MARLATT, HOME ECONOMICS
J. G. MOORE, HORTICULTURE
R. A. MOORE, AGRONOMY
J. G. SANDERS, ECONOMIC ENTOMOLOGY;
NURSERY INSPECTION
H. C. TAYLOR, AGR. ECONOMICS
F. M. WHITE, AGR. ENGINEERING
A. R. WHITSON, SOILS
FEED AND FERTILIZER
INSPECTION; DAIRY TESTS

VETERINARY SCIENCE

A. S. ALEXANDER
F. B. HADLEY
B. A. BEACH
H. LOTHE

MADISON, WIS., March 26, 1914.

Mr. T. T. Tucker,
College of Agriculture,
Columbia, Mo.

Dear Sir:-

The treatment for intestinal parasites of hogs which we have found most satisfactory is as follows:

Place the hogs on a clean swept floor so that the results of the treatment may be carefully noted. Diet them for 24 hours and give each 100 pound pig from three to five drams of turpentine mixed with sweet milk once a day for two days. Then place them on very light slop diet to which has been added sufficient laxative such as sodium sulphate, which should cause them to physic.

I shall be glad to have you write me the results of your experiments in ridding swine of intestinal parasites as this is a very important problem.

Yours very truly,

F. B. Hadley

Veterinarian.

FBH-D

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XT796

University of Missouri - Columbia

010-100960505

RECEIVED
MAY 18 1915
UNIV. OF MO.

This thesis is never to leave this room.
Neither is it to be checked out overnight.