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## Animal Parasites of Nebraska

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# REPORT OF THE ZOOLOGIST.

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## ANIMAL PARASITES OF NEBRASKA.

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HENRY B. WARD, PH.D.

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The report submitted this year consists of two main portions: the first a short study on the numerical frequency of parasites among the dog, cat, and chickens of Nebraska, and the second of several brief accounts of new and important parasites discovered within the state since the publication of the last report.

### **I. Statistical Studies on Nebraska Parasites.**

#### **A. Parasites of Dogs and Cats.**

It seemed important to obtain some definite information with reference to the occurrence of parasitic worms among the common house animals the dog and cat, which, on account of their abundance, universal presence, and close association with the human family, are particularly likely to be sources of infection for man himself. To this end a large number of animals have been examined in Lincoln within the last two years and the results of this examination are given here.\* The importance of examining these particular animals may be further emphasized on account of the fact that many of the parasites that are found in them, may in one stage or another occur in man himself. Among the animals which were examined were representatives of various conditions of life under which these forms are found, both the half wild "strays" of the city streets and alleys and the pet animals of the home. The dogs of which statistics are given all came from Lincoln and were carefully examined throughout. A considerable number of dogs which were subjected to a partial examination only are not listed here; the results from them bear out the figures tabulated.

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\*I am indebted to a number of my students for kindly assistance and particularly to W. C. Hall, H. W. Orr, H. M. Benedict, A. D. Brewer, R. A. Lyman, and F. W. Faurot.

TABLE A.

	Total number examined.	Free from parasites.	With one kind of parasite.	With two kinds of parasites.	With three kinds of parasites.	Slightly infected.	Badly infected.
Actual number.....	20	5	3	8	4	4	4
Percentage.....	.....	25	15	40	20	20	20

TABLE B.

DOGS INFECTED WITH SPECIES AT RIGHT.	<i>Taenia marginata.</i>	<i>Taenia serrata.</i>	<i>Taenia serialis.</i>	<i>Dipylidium caninum.</i>	<i>Ascaris mystax.</i>	<i>Uncinaria trionocephala.</i>	<i>Echinorhynchus sp.?</i>
Actual number ....	*1	9	1	13	4	2	1
Percentage infected	5	45	5	65	20	10	5
Slightly infected.	5	20	5	25	20	10	5
Badly infected...	.....	15	.....	15	.....	.....	.....
Infected with.....							
<i>Small number of parasites (1-9)..</i>	1	4	1	3	4	2	1
<i>With medium number (10-25)..</i>	.....	4	.....	2	.....	.....	.....
<i>With large number (25-100).....</i>	.....	.....	.....	5	.....	.....	.....
<i>With very large number (100-500)</i>	.....	1	.....	3	.....	.....	.....
Average number of parasites in each animal infected with the species..	1	12	1	100	5	4	1

Records were made of but two dogs examined in another part of the state, namely at Table Rock. The one individual harbored about a dozen specimens of *Taenia serrata*, while the other contained 152 of the same species. No other parasites were found.

It is interesting to compare with this the results of similar examinations which have been made in other parts of the world. To this end there is appended a table given by Deffke † with slight modifications and with the addition of recent investigations made in Washington, D. C., by Sommer ‡ and of the figures obtained in Lincoln.

\*Possibly a new species; see text.

† Entozoen des Hundes, Arch. f. wiss. Thierheilkunde, 1891, p. 259.

‡ Vet. Mag., Aug. 1896.

EXAMINER AND LOCALITY.												No. of animals examined.	Percentage infected.											
	<i>Hemistoma alatum.</i>	<i>Taenia serrata.</i>	<i>Taenia marginata.</i>	<i>Taenia coenurus.</i>	<i>Taenia serialis.</i>	<i>Taenia echinococcus.</i>	<i>Dipylidium caninum.</i>	<i>Bothriocephalus latus.</i>	<i>Bothriocephalus fuscus.</i>	<i>Cysticercus cellulosae.</i>	<i>Echinococcus polymorphus.</i>			<i>Mesocestoides lineatus.</i>	<i>Ascaris mystax.</i>	<i>Uncinaria trigenocephala.</i>	<i>Spiroptera sanguinolenta.</i>	<i>Enstrongylus sigas.</i>	<i>Trichocephalus depressiusculus.</i>	<i>Echinorhynchus sp.</i>	<i>Pentastoma taenitoides.</i>	Fly larvae.		
Krabbe, Copenhagen .....		17.3	2.16	...	1.08	47.03	...	...	...	...	...	...	20.54	1.62	...	...	...	...	...	...	...	...	65.	
Krabbe, Denmark.....	0.2	14.	1.	...	0.40	48.	0.2	...	...	...	...	...	24.	2.	...	...	...	...	...	...	...	500	72.	
Krabbe, Iceland.....		75.	18.	...	28.	57.	...	5.	...	...	...	...	21.	2.	...	...	...	...	...	...	...	100	*100.	
Thomas, Victoria.....		40.	...	...	40.	60.	...	...	...	...	...	...	27.	...	...	...	...	...	...	...	...	...	90.	
Thomas, South Australia.....		27.	...	...	40.	60.	...	...	...	...	...	...	27.	...	...	...	...	...	...	...	...	...	80.	
Schoene, Leipzig or Saxony	1.	15.	27.	1.	...	25.	...	...	1	1.	...	...	24.	1.	...	...	...	...	...	...	5.	...	100	63.
Deffke, Berlin, Germany.....	.5	7.	0.5	...	1.	40.	0.5	...	...	...	...	...	18.5	4.5	2.	1.	...	...	...	...	6.5	2.	200	62.
Sommer, Washington, D.C.....	12.	2.	...	...	...	44.	...	...	...	...	...	...	28.	56.	2.	*2	70.	...	...	...	...	...	50	96.
Ward, Lincoln, Neb.....	45.	35.	...	...	5.	65.	...	...	...	...	...	...	20.	10.	...	...	...	...	...	...	...	...	20	75.

An examination of this table brings to light some important facts, foremost among which is the large percentage of American dogs infected, if the localities from which investigations have been reported can be considered typical of the country in general. This is due, in large part at least, to the extraordinarily large number of dogs that harbored *Taenia serrata* and *Dipylidium caninum*. Both of these species are present here in decidedly greater percentage of hosts than in any other country cited, while the others are not for both localities in the United States uniformly so large in excess. *Trichocephalus depressiusculus*, which was very abundant in Washington, was not encountered once in Lincoln. Of the two species which were found in both places in excess *Taenia serrata* is not dangerous to man either in the adult condition, or in the larval form, which is found in the omentum of the rabbit and is known under the name of *Cysticercus pisiformis*. This larval form is common in both wild and tame rabbits in the vicinity of Lincoln. *Dipylidium caninum*, the other species in question, has as its intermediate or larval host the dog flea or dog-louse and in three cases was present in from 200 to 500 individuals. It is occasionally found in man, though evidently infection is not easy if ordinary precautions are observed.

On the other hand, the comparison of American with European canine

\*Almost.  
 †Found in spleen.  
 ‡Possibly new species; see text.

parasites reveals the apparent absence, or certainly far greater rarity, here of several dangerous parasites. *Taenia coenurus* has not yet been found in America, and its occurrence in this state, reported in the last annual volume, was an error. The larva of this species, *Coenurus cerebralis*, which is found in the brain of the sheep, is the cause of the "gid" or "turnstick" disease. Its absence from our country is not at all to be regretted. The species of *Bothriocephalus* come from some fish, which is the larval host, and hence their non-appearance here is not at all noteworthy. The larval host of *Taenia marginata* may be any of the Ruminants as also that of *Taenia echinococcus*, which occurs in man in the larval condition known as the Echinococcus or hydatid, one of the most dreaded of all parasites. The extreme infrequency of these species is due, in part at least, to the recent settlement of the country and to the uncontaminated character of fields and pasture lands, but also in part, I believe, to the general prevalence of large slaughtering establishments where all fragments are made use of and that in such a way as to effectually destroy whatever bladder worms may be present in them. Thus the parasites do not reach the final host and the number is ultimately unquestionably reduced. Deffke shows that a reduction in the number of canine parasites has taken place in Berlin, Germany, since the introduction of meat examinations and the destruction of infected parts.

The parasites, furthermore, which are most abundant in the dogs here, come from the rabbit, which is not only very common here, and often hunted by dogs for their own sake, but also if used as human food, is dressed at home or in small shops where the refuse easily falls in the way of dogs of all kinds. In conclusion, it may be affirmed that although the dogs in this country are more seriously infected with parasites than those of northern Europe, they are not such a menace to public health since the parasitic species peculiarly dangerous to human health are either wanting or extremely rare.

In the same way records have been kept of the parasites taken from cats during the past three years, and the results of the complete examinations are appended. Many other hosts were subject to a partial examination, and the parasites found in these agree in kind and frequency with those given in the following list:

TABLE C.

OATS EXAMINED.	Total.	Free from parasites.	With one species.	With two species.	With three species.	With four species.	Slightly infected.	Badly infected.
Actual number.....	20	1	12	3	1	3	13	3
Percentage .....	100	5	60	15	5	15	65	15

TABLE D.

CATS INFECTED WITH SPECIES AT RIGHT.	<i>Taenia crassicolis.</i>	<i>Dipylidium caninum.</i>	<i>Distoma felineum.</i>	<i>Ascaris mystax.</i>	<i>Uncinaria trionocephala.</i>
Actual number .....	5	3	*6	14	5
Percentage infected.....	25	15	†30	70	25
Percentage lightly infected.	25	15	20	55	15
Percentage badly infected. ....	.....	.....	10	5	.....
Average number of parasites found in cases infected with each.....	1	6	19	9	6

\*7, see text.

†35, see text.

The comparison of these tables with those given on a preceding page for Lincoln dogs shows first the smaller number of parasitic species collected from the cats, there being five found in the latter against seven from dogs. In the second place the number of individuals of each parasitic form is much smaller for a single host than in the dogs. The largest total number of parasites taken from any cat was less than sixty while four dogs harbored from two to five hundred parasites each. Furthermore, twelve of the nineteen infected cats contained each but a single species of parasites, whereas twelve of the fifteen infected dogs yielded more than one species of parasites from each host. On the other hand, five dogs out of twenty were entirely free from parasites, while only a single cat in the same number failed to yield any parasites.

As an examination of the preceding tables then distinctly shows, in this region cats are much more generally infected than dogs, although decidedly less severely. Only three cats could be said to be at all badly infected, and in no case did the number of parasites reach that which was found in several of the dogs listed. *Ascaris mystax*, the common stomach worm of cats, occurred only once in other than small numbers. *Taenia crassicolis* was represented by a single specimen in all but one case when three were found. There was no cat in which *Uncinaria* occurred where the number of parasites was above twelve; and *Dipylidium caninum* which was found in the dog in such large numbers, was present here in from two to eight specimens in each host.

*Distoma felineum* occurred in a large per cent of the cats examined, and may have been present in a greater number, as it is difficult to be sure in cases apparently free from this parasite that not a single specimen is found in the liver. A good illustration of this may be cited from one of

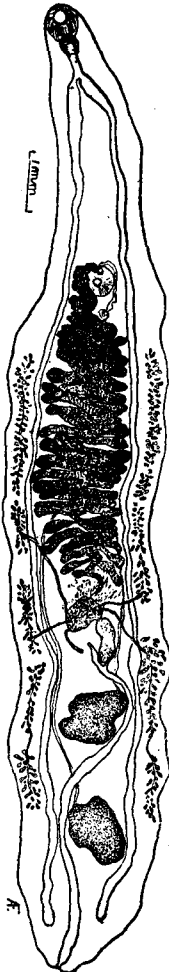


Fig. 1.

the specimens included in the table. From a certain cat which had been examined and listed without any distomes a small piece of the liver was laid aside to be sectioned on account of curious nodules near the margin of the organ. When the alcoholic specimen was divided preparatory to sectioning a distome was found in one of the ducts; there may have been others also. This discovery calls for the correction of the table D as given in the footnotes while the figures in the table itself correspond to the entries made in the blanks at the time of examination. Evidently there may have been other cases of similar light infection which would raise the percentage of occurrence of this particular parasite. The other parasites listed are from their nature and place of occurrence not likely to be overlooked in this way.

The species in question was described at length in the report for 1894, and the figure given then is reproduced here (Fig. 1). Dr. Stiles, of Washington, is inclined to doubt the identity of this species with the European form, and recent studies have shown characters that tend to bear out his view. Full grown worms if measured alive are very much larger than *D. felineum*, one series recently obtained measuring from 16 to 20 mm. in length. The vitelline glands may also extend further posteriad than noted in the previous report reaching even a little beyond the posterior margin of the posterior testis. These forms are often found far out in the biliary ducts toward the periphery of the liver and may be present in large numbers. Then the liver appears much enlarged, though it displays no other evident changes of a macroscopic character.

The frequency of the occurrence of this parasite makes it of great importance from a hygienic standpoint; and its close similarity to *D. felineum* of Europe, if not its actual identity with that form, which is also known as a human parasite, suggests the necessity of ascertaining whether it may not here at times infect man himself.

## B. Parasites of Chickens.

Among the forms examined during the past year for parasites, domestic birds have received the most careful attention. It has long been known that these animals harbor a large number of parasitic forms, which at times give rise to serious epizootics. These troubles, which have been regularly reported in Europe, have not remained unknown in America, as has been shown by isolated articles with reference to outbreaks in other states. One of these cases was mentioned in the report of last year, in

which a parasite was the cause of a disease, closely resembling tuberculosis, that had been described by Dr. Moore, of the U. S. Bureau of Animal Industry; furthermore, a serious epidemic at Grand Island, in our own state, emphasized the immediate danger and the necessity of more careful information with reference to the number and distribution of the parasites of domesticated birds in this region. During the past year a large number of specimens have been examined, and the occurrence of parasites is illustrated by the following tables. These parasites are at present only imperfectly described and understood, and it has not been possible to investigate the forms so accurately as to give detailed statements with reference to the species which occur. Within the past year the U. S. Bureau of Animal Industry has published lists of the parasites of chickens, ducks, and turkeys, and an extensive report upon the present knowledge of the tapeworms of poultry. Even with these it is not possible with the limited literature and with the material at hand to make accurate studies of the different forms. At present they can only be grouped generally, but it is hoped that another year a larger supply of material and longer study will enable me to give more detailed information.

The following table includes the results of the examinations made during the year:

TABLE E.

	Chickens.	Ducks.	Turkeys.	Geese.
Total number examined.....	162	9	56	1
Total number infected.....	60	0	2	1
with Cestodes.....	24	.....	2	.....
with Nematodes.....	43	.....	1	1
Percentage infected.....	37	.....	4	.....
with Cestodes.....	14	.....	4	.....
with Nematodes.....	26	.....	.....	.....
Average number found in each host, of Cestodes.....	7	.....	1	.....
of Nematodes.....	4	.....	.....	1
CESTODE INFECTION.				
Infected with few (1-4).....	14	.....	2	.....
" " average number (4-6).....	6	.....	.....	.....
" " large number (20-31).....	3	.....	.....	.....
NEMATODE INFECTION.				
Infected with few (1-4).....	30	.....	.....	1
" " average number (4-8).....	6	.....	.....	.....
" " large number (12-16).....	3	.....	.....	.....
" " very large no. (25-30).....	2	.....	.....	.....

The number of ducks, turkeys, and geese examined is far too small that one could make any general statements with reference to the frequency of parasites in them. With the chickens, however, it is possible to say something of the degree of infection from each kind of parasite, and the results given in the table are in general true for the time of year. How-



ever, it should be borne in mind in this connection that the large majority of these examinations was made in the late fall and early winter and that the examination, while carefully conducted, was possible only so far as accorded with the preparation of the birds for market; hence the oesophagus was not examined, and the lungs only rarely, so that the list represents in reality the parasites of the large and small intestines and body cavity. The twenty-four chickens infected with cestodes contained a total of 117 worms, together with a considerable number of fragments, making an average for each individual, excluding those from which the fragments only were obtained, of about seven cestodes in a host. Fourteen of the twenty-four chickens, or more than fifty-eight per cent, harbored from one to four cestodes each; six sheltered from four to six worms each; and in three only were found a large number of specimens, varying from twenty to thirty-one. Thus, it will be seen that only twelve per cent of the chickens are seriously affected at this time of year with cestode parasites.

The total number of nematodes found in forty-three chickens was 181, making an average of more than four parasites to each host. Thirty chickens, or sixty-eight per cent of the number examined, were infected with from one to four nematodes each; six harbored from four to eight each; three contained from twelve to sixteen each; and in two were found twenty-five and twenty-nine nematode parasites respectively.

In this list is not included the Grand Island bird spoken of in another place, from which 112 nematodes and one tapeworm were removed. The figures just given show that the chickens are, at that time of year at least, more seriously infected with nematodes in this vicinity than they are with cestodes. This fact stands in biological accord with the dry climate of the state as compared with the moist coast regions and the lowlands of Europe, and the consequent absence, or, at least, rarity of some of the known and supposed intermediate hosts of the tapeworms. It is probable that most species of nematodes develop directly without the necessity of a larval host, and hence they are liable to sudden increase in the poultry yard when external conditions are favorable. It is imperative that the poultry raiser adopt means to prevent the spread of these parasites among the flocks, or serious loss will accrue.

## II. Parasites New to Nebraska.

### A. *Taenia confusa*.

Among the most important parasites which have been discovered within the past year is a new human tapeworm, which was briefly noted in the last report. The distinct nature of this specimen is more apparent, however, on further study. A detailed description is being prepared by one of my students, but the following general description of this form may be given here: At first sight it appears to be in some respects intermediate between the pork tapeworm, *Taenia solium*, and the beef tape-

worm, *Taenia saginata*. It has much of the slender appearance and more delicate structure of the former, but in respect to the size of the segments is even larger than the latter. Two specimens have thus far come into my possession, only one of which had the head still in position. One of these

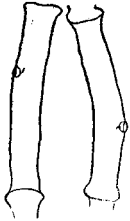


FIG. 2.—Ripe segments of *Taenia confusa*, nine-tenths natural size. [Original.]

specimens has been used in making slides for study, but the other is preserved almost intact. The total length of this specimen is about 500 centimeters. The terminal proglottids, which separate very readily from the chain, are from five to three and five-tenths mm. in width, of nearly uniform breadth throughout (Fig. 2), save that near one end a prominent increase in width affords the base to which the subsequent proglottid is attached. These posterior segments vary from 27 to 35 mm. in length. The sexual pore, which is distinct, does not project markedly beyond the margin of the segment. One meter from the end of the worm the segments measure fifteen by seven and one-half mm., one meter further forward they are from ten to twelve by seven to eight mm. square, or in one or two evidently somewhat contracted segments seven mm. long by nine wide.

One meter from the head the segments measure 3.5 by 4 mm. long by 7 to 8 wide. This is the only place where the segments are wider than long, and this condition continues only for a very short distance. The genital pore is round and prominent, though it projects but little. It lies a little more than one-third the length of the segments from the posterior end. The



FIG. 3.—Photomicrograph of two segments of *Taenia confusa*. [Original.]

branches of the uterus are short, heavy, and much branched, in this particular resembling strongly *Taenia solium*, but in number being two or three times the number of branches found in this species although fewer than are present in *Taenia saginata*. Weinland described in 1858 a tapeworm from a North American Indian, which in its slender form recalls the species under consideration. It has been suggested that his species is the same as this new form, and I have endeavored to secure some fragments of the original species for comparison, but am informed by the Museum of Comparative Zoology at Harvard College that the specimen cannot be found and has probably been removed from the museum. With reference to the similarity of the two, let me say that in size of the proglottids they do not agree, and their shape is equally dissimilar as appears both from the description and figures given by Weinland, and from the account of Leuckart. The number of branches of the uterus is very much greater and their form slender in Weinland's specimen, in sharp contradistinction to those figured here (Fig. 3) for *Taenia confusa*. Weinland says that the head, neck, and the entire anterior half of the body were lacking, and it would be possible that the other

differences were due to the inaccuracies of his description, were it not that Leuckart has figured from portions sent him a segment of the same worm, and it will be seen on comparison that his figure differs much from the specimen illustrated here.

The most striking peculiarity of the new species is by all odds the head, which is shown here (Fig. 4). This was present in only one specimen, and yet in that one so well preserved and so perfect that little doubt remains as to its general features. It is extremely small, measuring only 0.3 mm. in diameter, and is followed by a slender neck which shows immediately the boundary lines of the segments.



FIG. 4.—Head of *Taenia confusa*. Magnified 125. [Original.]

The four suckers, while distinct, do not, in this specimen, project so as to make any apparent break in the outline of the head itself. At the apex of the head one finds a deep depression into which is drawn in this specimen, the so-called rostellum. This structure is thimble-shaped and measures 0.05 mm. wide by 0.07 mm. long and is supplied with powerful muscles. It is covered by six or seven rows of hooks, closely set together. They decrease in size from the apex to the base, but their exact shape is difficult to determine on account of the thickness of the muscular mass, which surrounds the rostellum. One may recognize without any difficulty, however, the clear, highly refractive appearance, which is characteristic of these structures. One would be inclined to say that the parasite maintains a very firm

hold on the intestinal walls of the host and it is probable that the tapeworm would be more difficult to drive out than the common, unarmed *Taenia saginata*. That the characteristics of this new species may be more easily determined I append a table, giving the measurements of the three species of large tapeworms belonging to the genus *Taenia*, which are found in the human alimentary canal. The measurements for the two well-known species are cited from Leuckart.

	<i>T. confusa</i> .	<i>T. saginata</i> .	<i>T. solium</i> .
Length of entire specimen.....	5 m.	4-8 m.	2-3 m.
Length of terminal proglottids....	27-35 mm.	18-20 mm.	10-12 mm.
Width of terminal proglottids.....	5-3.5 mm.	.....	.....
Greatest width of chain.....	8-9 mm.	12-13 mm.	7-8 mm.
Diameter of head.....	0.3 mm.	1.5-2 mm.	1 mm.
Size of eggs.....	.039 x .030 mm.	.03 mm.	.03 mm.
Number of branches of uterus....	14-18	20-30	7-10

**B. *Taenia serialis*.**

Among the parasites listed in the report for 1895, page 259, as occurring in Nebraska was *Taenia coenurus* from the small intestine of a dog. The

specimen on which this diagnosis was based was sent to Dr. Stiles, of Washington, and by him pronounced to be a specimen of *Taenia serialis*, which has also been found here in other hosts since that time. This parasite of the dog closely resembles *Taenia coenurus*. It has not been previously described in this report, although reference to it may be found in the table for the identification of dog tapeworms given in the report for 1894, page 277. A short description may well be included here.

*Taenia serialis* Baillet 1863.—Length 45 to 70 cm.; head spherical, 0.85 to 1.3 mm. in diameter; rostellum with double crown of twenty-six to thirty-two hooks (Fig. 5), the larger 0.135 to 0.157 mm. long, the smaller 0.085 to 0.112 mm. long with short dorsal, bi-lobed ventral roots. The segments resemble *Taenia coenurus* in general form and in shape of uterus, but the ripe proglottids are slightly narrower with rather projecting posterior angles. The embryophors (eggs) measure 0.033 to 0.041 by 0.026 to 0.031 mm.

This tapeworm is found in the small intestines of the dog. Its bladderworm (*Coenurus serialis* P. Gervais 1845.) is found in the connective tissue of the rabbit and some other forms. Stiles has reported it from a horse in the United States. It occurs quite frequently in wild rabbits, particularly the larger species killed in this region and is more commonly found in the subdermal connective tissue, especially in the angles of the leg. It reaches a size frequently of an inch or more in length (Fig. 6) and shows clearly on the surface the numerous invaginations which form the heads of the bladderworm. These invaginations seem to be distributed in groups, which are more or less linear as the figure shows, and this peculiarity is said to have been the source of the specific name. According to Railliet this bladder may produce either internal or external secondary bladders of the same structure and equally capable with the primary bladder of forming tapeworm heads. The external vesicles remain fastened by a delicate stalk to the primary but the internal become detached and float about in the interior of the original sac. The connection of the bladderworm with the tapeworm has several times been experimentally demonstrated by French helminthologists, and from the eggs of the tapeworm the bladders of the rabbits have also been experimentally produced. In spite of the close resemblance of this form to *Taenia coenurus*, all experimental attempts to infect sheep with bladderworm of this species have yielded negative results, and have confirmed the distinct character of the two species. Little trouble seems to be caused by the worm in either stage of its existence, and it is at most an infrequent parasite. The flesh of the rabbits in which the bladderworm occurs is not dangerous for food, and probably could not be distinguished in any way were the bladders removed.

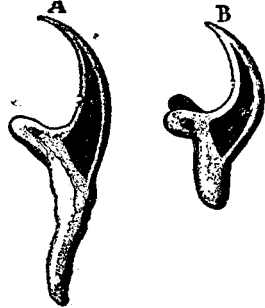


FIG. 5.—Hooks of *Taenia serialis*, x250. [After Neumann.]



FIG. 6.—*Coenurus serialis* from Jack Rabbit. Natural size. [Original.]

Comparison of the hooks of this species and of the description given here with the figures and account of *Taenia coenurus* found in the report for 1894 (p. 272-3) will enable one to distinguish them.

### C. *Heterakis perspicillum*.

Among the most important of the round worms, or nematodes, which have thus far been reported from the chickens of this state, is a representative of the genus *Heterakis*, which has caused at least one serious epidemic, with large loss accompanying its progress. The genus *Heterakis* is characterized by the presence, in the males, of a large sucking-disc on the ventral surface, just in front of the anal opening.

*Heterakis perspicillum* (Rud.).—The body (Fig. 7) is pale, yellowish white; the mouth possesses three prominent lips, one of which is much larger than the other two. The female is six to twelve cm. long, with conical caudal extremity and sexual pore in front of the middle of the body. The male is three to eight cm. in length, with an obliquely truncate posterior extremity (Fig. 8). Ten papillae are present on each side of the body, three in front of, and seven behind the anus. [Two of the small postanal papillae have not been brought out in reproducing the figure.] Two chitinous spicules are distinctly seen.

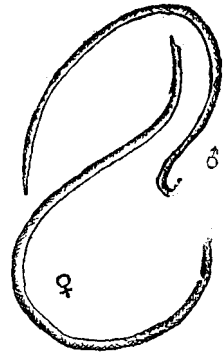


FIG. 7.—Male and female of *Heterakis perspicillum*, natural size. [Original.]

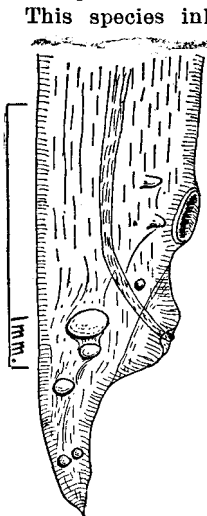


FIG. 8.—Posterior end of male *Heterakis perspicillum* magnified. [Original.]

This species inhabits the small intestines of chickens and turkeys. They have also been found free in the body cavity, and have been known to ascend the oviduct and become entangled in the white of the egg before the formation of the shell. Several authors have reported epidemics among chickens, which were due to the presence of considerable numbers of the worms.

One specimen of a chicken was sent to the University from Grand Island, where an unknown disease had made large ravages among a flock of birds. The examination of the alimentary canal of the chicken disclosed the presence of 125 worms of this species. There is no doubt that the malady was caused by the worms, and its spread was arrested by the adoption of remedies for removing the parasites.

Megnin asserts that the disease caused by this species displays itself first in diminished appetite, and general dull indifferent manner of the bird accompanied by diarrhoea. He recommends that santonin should be mixed with the food given to the birds; pills of bread soaked in weak turpentine solution seem to have been effective in the cases which have occurred in places in this state under our observation.

This parasite seems to be quite widely distributed and is present in small numbers in a large per cent of the fowls which were examined in Lincoln. It is probable that damp poultry yards or other favorable conditions, as yet unknown, will produce at times rapid increase in numbers of these parasites, with accompanying fatal results of a parasitic epidemic. The presence of the parasites should be carefully watched, and the number kept at least within narrow limits.

#### D. *Uncinaria trigenocephala*.

In the course of the examinations which have been made on the parasites of cats, there was discovered a form new to this region, and one which may be the cause of very serious disorders. In the Report of the

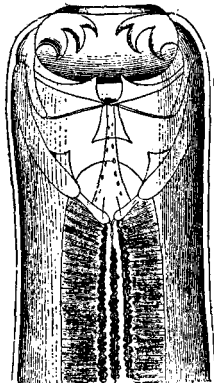


FIG. 9.—Head of *Uncinaria trigenocephala*. Magnified 100 diameters. [After Raillet.]

Zoologist for 1894 (page 311) will be found a description of a human parasite, which is the cause of the miners' disease, and on the following page is noted the fact that related species are found in dogs and in sheep, where they also give rise to similar serious disturbances. The form from the cat and dog has been found a number of times in animals killed in Lincoln. It is known as *Uncinaria trigenocephala*. The body is pale; the buccal capsule (Fig. 9) is slightly expanded, having on each side of the middle line a projection with three recurved teeth, on the dorsal surface there are also two small straight projections. The male has a length of nine to twelve mm., and the caudal pouch is three-lobed, the middle lobe being quite small. Two slender spicules measure from 0.6 to 0.8 mm. in length. The female is from 9 to 21 mm. long, with a bluntly truncated tail, prolonged into a delicate point. The female sexual opening is near the posterior third of the body. The ellipsoidal eggs measure from 0.074 to 0.084 mm. by 0.048 to 0.054 mm.

This form inhabits the small intestines of the dog and cat and several closely related wild species such as fox and fennet. It was found in several instances in the small intestine of cats and dogs obtained in Lincoln (compare Tables A and C, page 174, 176), not, however, in large numbers, as not above a dozen specimens were obtained from any one host. The different stages of development show great similarity to those of the closely related human parasite. When the eggs are laid they are in an advanced stage of division, and are further incubated in water, where, at a suitable temperature, the embryo is formed and hatched in two to three days. These embryos, which measure about one-third of a mm. in length, moult two or three times and attain the adult condition without entering into a secondary host. They pass with water into the intestines of the dog or cat, and after two further moults become fully mature. It is altogether probable that the infection takes place through the drinking water and

domestic animals infect one another by scattering the eggs of the parasite about their drinking places.

Pathology.—This form produces much the same effect on the dog and cat as is caused by the closely related human parasite. A serious form of anaemia common among hunting dogs is ascribed to the species under description. It is characterized particularly by nasal hemorrhages; debility of the animals is very marked, and the disease results fatally in a considerable number of cases. The examination of dogs which have died from this malady shows the worms attached to the mucous membrane of the intestines, which is locally highly inflamed and very much thickened in places.

Various reports have been received of the difficulty of raising cats in certain parts of the state. From the descriptions given it is evident that the trouble is due to the presence of some parasitic form. This may be either the liver fluke (*Distoma felineum*), which was described and figured on page 239 of the report for 1894, and on page 178 of this article, or to the form which has just been described. From the tables it may be seen that the liver fluke is quite generally present in cats examined in Lincoln, and that it is quite frequently found in considerable numbers. In the event that the liver fluke is suspected injections of salt water will be of service. The treatment to be recommended for the *Uncinaria* consists in the employment of anthelmintics. When the complaint makes its appearance in an animal, extreme care should be exercised with reference to the cleanliness of its living places and particularly in reference to the source of drinking water. The vessels in which this is supplied should also be frequently and thoroughly cleaned. A common disease among cats in Italy is caused by the species under consideration. The treatment usually results in expelling the worms and relieving the animal.

In a recent paper on animal parasites of dogs at Washington, D. C., H. O. Sommer says that in the forms studied this species of *Uncinaria* was common, occurring in fifty-six per cent of the animals examined in that locality. (See table p 175.)

### **E. Sclerostoma equinum.**

Among the specimens which have been sent in during the past year are some of a small round worm, which were taken from the intestine of a horse that died near Lincoln. These are in some respects the most important form recorded in the year. There were in the bottle about forty specimens of the so-called "Palisade Worm," or Armed Strongyle of the horse, one of the most dangerous and insidious parasites which attacks any of the domestic animals. It is found in the caecum and upper portion of the colon and is perhaps the most common parasite of horses, yet its frequency varies within wide limits in different regions. In Russia it occurs in 1.1 per cent of the horses examined, in Denmark in 86 per cent, in Vienna in 5 per cent; in France it is almost universally present and frequently in such numbers that in one case one thousand of the worms were counted within an area of two square inches. In our own

continent the only statistics at hand are from Toronto (Canada) where it was found only once in fifty horses.

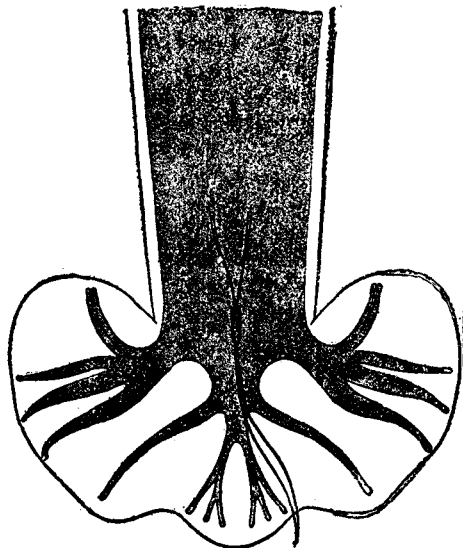


FIG. 10. Caudal end of *Sclerostoma* male; x30. [After Railliet.]

blunt tail, and the sexual pore in the last third of the body; eggs elliptical, 0.092 by 0.050 mm.

By means of the cup-shaped buccal capsule they adhere firmly to the mucous membrane lining the intestines, and the sucking action of the capsule forms a small projection at the point of attachment (Fig. 11). The worms are frequently present in considerable numbers, but it is uncertain that the irritation which they cause is evidenced by any peculiar symptoms, though various complaints have been attributed to their presence. It is not, however, the adult worm in the intestines which is the peculiar

This form was briefly described in the report for 1894, page 308; some points may be reviewed here. Body brown or gray, straight and rigid, the anterior part broader, mouth circular, distended, with chitinous rings provided with small teeth; the mouth capsule is supported by a longitudinal rib, and has at the bottom two round sharp plates. Male, length 18 to 20 mm., caudal sac (Fig. 10), 3-lobed; posterior ribs 3-parted, the middle, double, the anterior divided; two spicules long and slim. Female, 20 to 55 mm. long, with a long

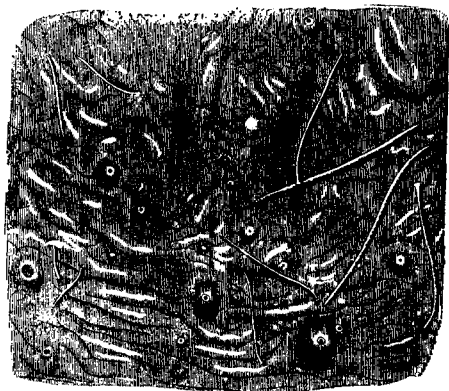


FIG. 11.—Portion of wall from Caecum of horse showing tumors of different sizes due to *Sclerostoma*, as well as the parasites fastened to the mucous membrane. The two varieties of *Scl. equinum* are shown at the right, while those of *Scl. tetracanthum* appear on the left; two-thirds natural size. [After Railliet.]



source of trouble. Younger, immature forms occur in cysts of the intestinal walls and also in aneurisms of the mesenteric artery and other vessels.

The tumors of the intestinal walls in which they occur vary greatly in size, as shown in Fig. 11. Within these tumors the young worms are found coiled up, or there may be an opening in the swelling from which the worm has recently emerged. From this point they pass into the circulatory system, and are found in the abdominal arteries, where, adhering to the wall of the vessel, they produce what is known as aneurismal dilations,

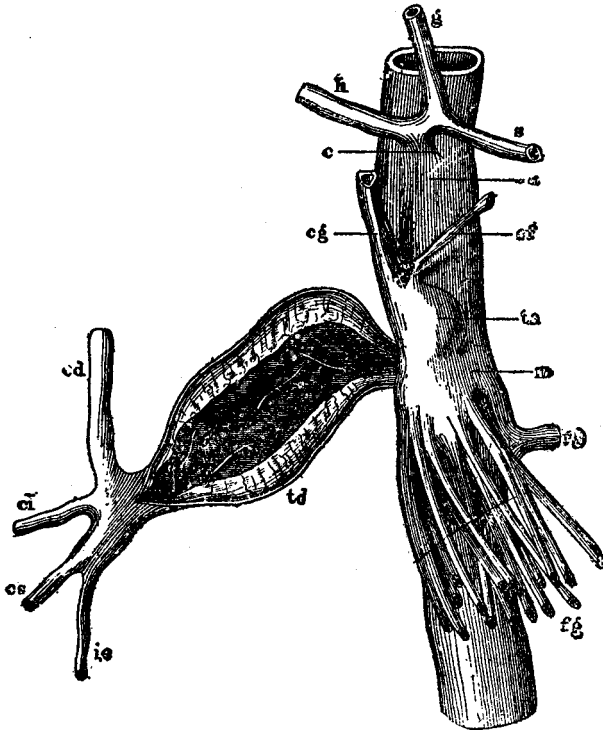


FIG. 12.—Verminous aneurism of the great mesenteric artery, half natural size. *a*, aorta; *c*, cœliac trunk; *cd*, right or straight colic artery; *cf*, first artery of floating colon; *cg*, left colic artery; *ci*, inferior caecal artery; *cs*, superior caecal artery; *ig*, arteries of left fasciculus, or small intestine; *g*, gastric artery; *h*, hepatic artery; *ic*, ileo-caecal artery; *m*, trunk of the great mesenteric artery; *rg*, left renal artery; *s*, splenic artery; *ta*, trunk of the anterior fasciculus, the seat of a small aneurism; *td*, trunk of the right fasciculus, the seat of an aneurism. [After Railliet.]

Here they grow to a length of three to four mm. After a time they loose their hold and are carried with the blood into the smaller vessels of the intestinal walls, and here again become encysted. Having attained complete development they forsake these cysts, attach themselves to the inner wall of the intestines, and attain quickly the stage of sexual maturity. The

tumors formed in the walls of the intestines by the larval stages appear to be entirely harmless, but the aneurismal worms by weakening the walls of the intestines produce conditions which are extremely dangerous. This is true on account of risk of rupture of the vessels, but more particularly because of more dangerous effects in another way.

Many cases of colic and gas in the intestines result from the breaking off of portions from the clot. The broken portion carried by the blood current enters and closes a small vessel. Paralysis of the intestines results, peristaltic action stops, the faecal matter does not advance, and colics follow. The frequency of the parasite is a matter of importance in determining the extent of this affection. In Europe one authority estimates that 90 per cent of the horses are affected with aneurisms and the older the animal the more liable it is to become affected. "Among every forty horses affected with internal disease," says Ballinger, "forty are ill with colic. Among any hundred deceased horses, forty have perished from colic, and among one hundred colic patients, eighty-seven recover while thirteen die." The same author holds that the blocking of the mesenteric arteries, spoken of above, is the cause of the vast majority of colics. In this country the frequency of affection among horses in the eastern portion of the country is not over one-third that already given from England. In Nebraska this parasite has never been reported heretofore; its frequency is entirely unknown, and the damage caused by it is at least unrecognized. Apparently causeless colics should be viewed with great suspicion, and especially if the animal be in poor condition.

Neumann says it is of the highest importance from the above considerations to diminish the extension of the sclerostomes as much as possible. This can only be done by a most careful inspection of the water horses drink, and filtration alone affords reliable security; but the harmfulness of the aneurismal worm is not sufficiently tangible, at least to owners of horses, to permit of a hope that a precaution which would be so contrary to present usages is likely to be adopted.

It is very difficult to say what treatment is useful, and it is only by the most rigorous inspection and control of the drinking water that reliable security is afforded. The free worms are difficult to remove from the caecum by means of vermifuges, and it is naturally impossible to handle the encysted worms in this manner. It is said that oil of turpentine has a good effect on these worms in the aneurismal stage, but no very definite observations are at hand.

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