

A SURVEY OF THE CESTODES IN THE CATS
OF WINNIPEG.

BY



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Since Winnipeg has been definitely located in one of the *Diphyllobothrium* areas of North America, this survey was made to determine if this genus was present in one of our domestic animals, and at the same time, to find what other genera were being harbored by such an animal.

The cat was selected for this investigation for the following reasons:

It is fond of raw meat and fish; it is a small animal easily handled and the remains incinerated; and finally because it could be obtained in sufficient numbers from which to draw conclusions.

Materials and Methods.

The cats were obtained from the Winnipeg Humane Society. They were killed with hydrocyanic acid administered through the mouth by an official of the society and delivered on the same day. In practically all cases the cestodes were still alive when found.

The cats came from all sections of the city and were examined over the period of time from the latter part of October to the end of January. During this period 72 cats were examined at the rate of six to eight a week.

In searching for the cestodes the abdomen was opened along the mid-ventral line and the gut was torn free from the surrounding mesentery. A ligature was tied to the posterior end of the small intestine before the latter was cut. The anterior end was held in the fingers and cut next

to the stomach. The gut was then held under the warm tap to remove the blood before being stretched out on the glass plate for cutting open.

Beginning at the anterior end the gut was cut open about six inches at a time and examined. If no tapeworms were present this length was cut off and dropped into a beaker of warm water for later decantation. When cestodes were present the gut was cut open for their entire length then cut off and dropped into a shallow dish of warm water until they were disengaged. They were then removed to a glass plate with a camel's hair brush, stretched out and painted with a warm solution of 10% formalin to fix them. They were then dropped into small bottles of 5% formalin and put away for later identification.

For mounting, the cestodes were soaked for an hour in running water, then stained with dilute Delafield's haematoxylin over night, then up the alcohols, one half hour in each, destaining at 70% then to 95%. They were then cleared and mounted in Canada balsam.

Dipylidium cleared best in clove oil, while *Taenia* and *Diphyllobothrium* required absolute alcohol and methyl salicylate (synthetic) to clear them satisfactorily.

The writer found that a piece of white cotton thread tied near the end of the strobile, a useful device for handling the specimens in changing from one liquid to the next and for holding them while the head, mature, and ripe segments were cut off into the balsam on the slide.

Alum cochineal was tried as a stain but gave satisfactory results in only one instance.

Three genera of cestodes were found in the cats as follows: *Dipylidium*, *Taenia*, and *Diphylobothrium*.

Genus *Dipylidium*.

Eighteen cats out of the 72 were infested with this genus. They numbered from one to over thirty per cat and in the latter case were usually in two or three groups spread out along the gut.

Identifications were based on the characteristics described by Miss T. M. Millner, and the following species were found.

D. caninum was identified by its long thin unsegmented neck, the scolex bearing four rows of hooks, the anterior hooks measuring .013mm. and the posterior hooks measuring .006 mm.

D. sexocoronatum was identified by its irregular lateral margins, wide short scalloped neck, the scolex bearing six rows of hooks, the anterior hooks measuring .0178 mm. and the posterior hooks measuring .005 mm.

D. compactum was identified by its short segmented neck, the scolex bearing six rows of hooks, the anterior hooks measuring .014 mm. and the posterior hooks measuring .009 mm.

D. gracile was identified by its long unsegmented neck, the scolex bearing six rows of hooks, the anterior hooks measuring .008 mm. and the posterior hooks measuring .005 mm.

D. diffusum was identified by its very short scalloped neck, the scolex bearing seven rows of hooks, the anterior hooks measuring .0098 mm. and the posterior hooks measuring .0056 mm.

The accompanying figures were drawn in outline by means of a projecting microscope and finished free hand using suitable power to bring out the details required.

The following table was used in identifying the above species. The figures and descriptive facts were taken from Hillzner and rearranged in a more convenient form for this use.

Validity of the use of Micro-measurements in Separating Species in Dipylidium.

In examining the following table it will be noted that the measurements of the soft parts of the different species show considerable overlapping, or else differences are only a few hundredths of a millimeter.

For example the range of lengths for the scolices of D. compactum is .370 to .450 mm. and this range enters all species except caninum and only misses this species by .005 mm.

Diameters of the suckers show even closer approximation. The writer was not able to use these measurements in identification because in practically all cases there was a variation of several hundredths of a millimeter between his measurements and those given in the table.

However this variation should be expected because the

methods of technique were different, also there is considerable difference in pressure of the cover glass on the slide. For these reasons the writer does not think the above micro-measurements of much use in separating species in *Dipylidium*.

The writer found the lengths of the hooks the most constant and useful measurement although they were difficult to obtain, and these, along with the numbers of rows of hooks, the description of the neck region and the lateral margins were used to identify the different species.

Table of Specific Characters for Five Dipylidium Species
Found in Winnipeg Cats (Adapted from Millaner)

	caninum		sexocor- onatum		compactum		gracile		diffusum	
<u>Strobila</u>										
Length Cm.	15	50	10	30	5	15	4	20	7	15
Width Mm.	2	3	2		2		2		2.5	
<u>Scolax</u>										
Length Mm.	.365		.320	.380	.370	.450	.360	.480	.420	.500
Width Mm.	.327		.340	.380	.400	.445	.420	.500	.450	.470
<u>Suckers</u>										
Diameters Mm.	.165	.150	.185	.160	.175	.180	.170	.172	.175	.163
<u>Rostellum</u>										
Length Mm.	.060		.065		.065		.070		.075	
Width Mm.	.100		.115		.100		.120		.110	
Rows of hooks	4		6--7		6		5--7		6--8	
Ant. Hooks Mm.	.012	.015	.011		.015		.008		.009	
Post. Hooks Mm.	.005		.004		.009		.005		.005	
No. Testes.	110	175	150	175	140	200	200	250	160	256
No. Eggs per Cap.	4	20	2	15	2	10	3	10	3	10
Ovary	compact		compact		compact		diffuse compact		diffuse	
Neck Region	long thin unsegment- ed		wide short scalloped		short segment- ed		long un- segmented		short scalloped	
Lateral Margin.	smooth		irregular		smooth		smooth		scalloped	

EXPLANATION OF PLATES

PLATE ONE

Dipylidium sexocoronatum

Fig. 1. Rostellum (Hooks not shown)

Fig. 2. Scolex and anterior portion of strobila

Fig. 3. Mature segment

Fig. 4. Ripe segment

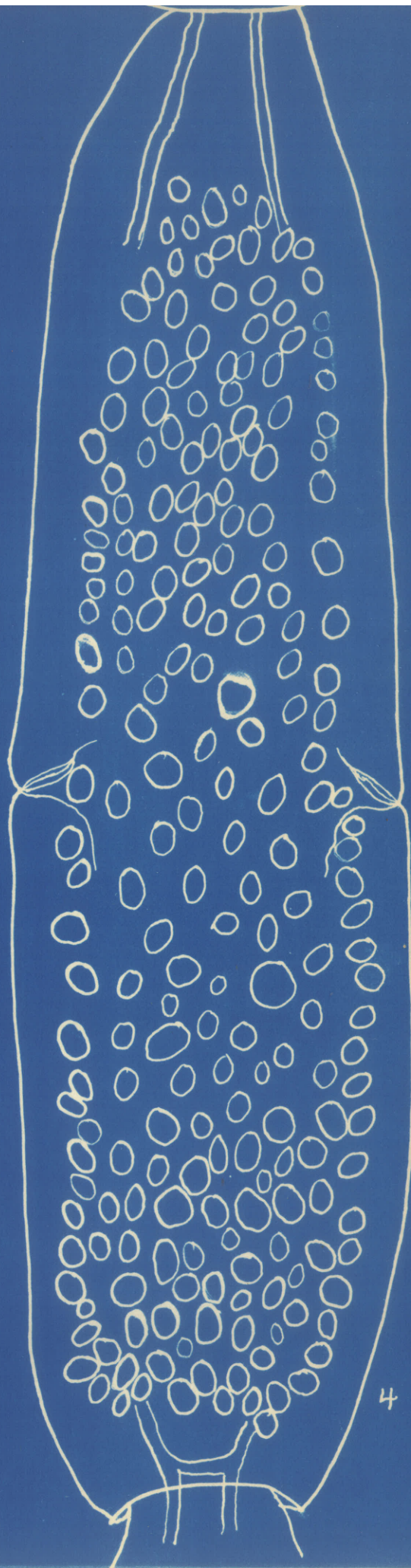
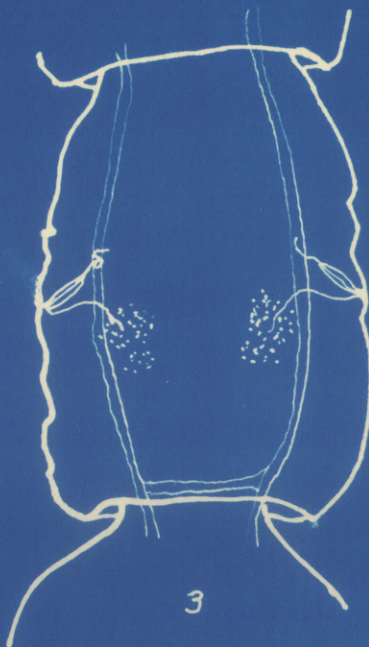
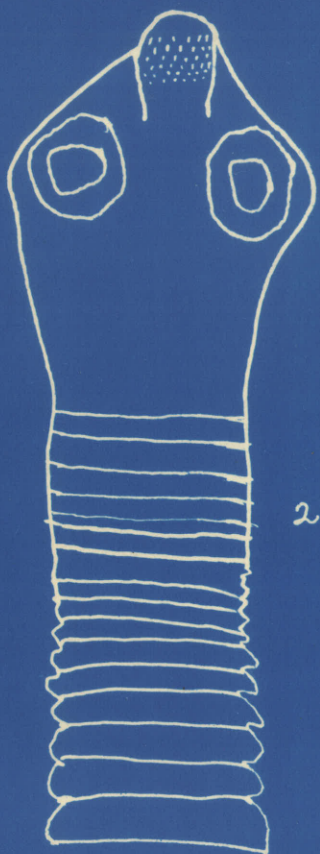
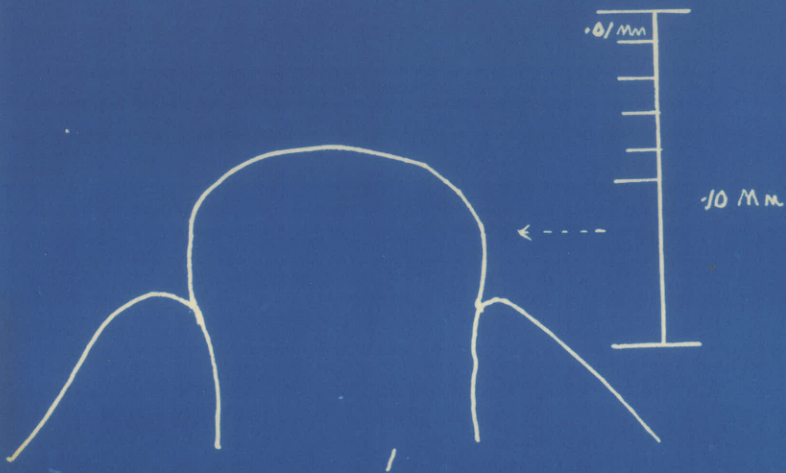


PLATE TWO

Dipylidium compactum.

Fig. 5. Rostellum and hooks

Fig. 6. Scolex and anterior portion of strobila

Fig. 7. Mature segment

Fig. 8. Ripe segment

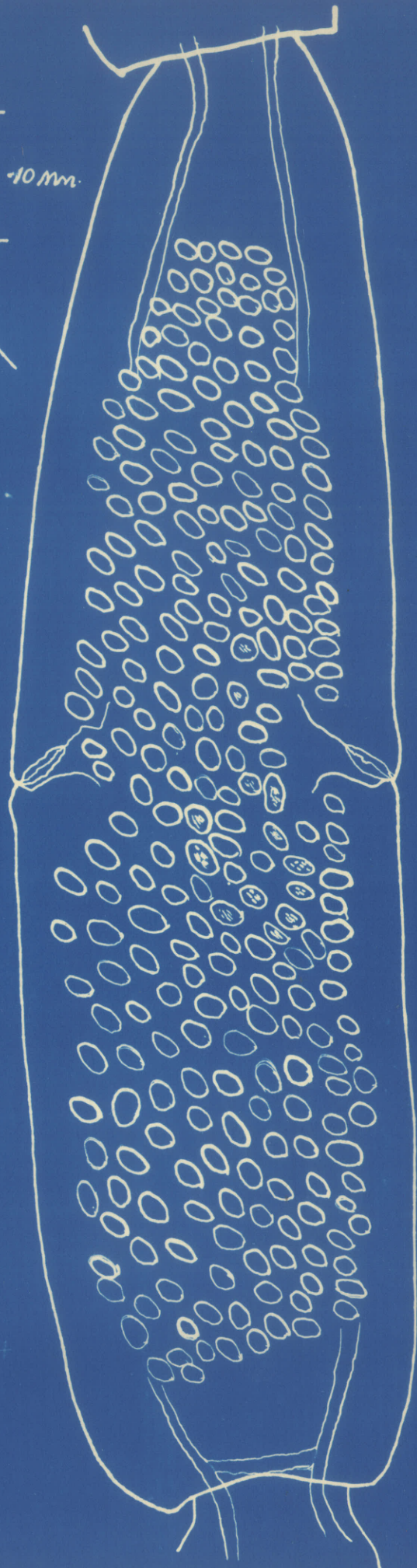
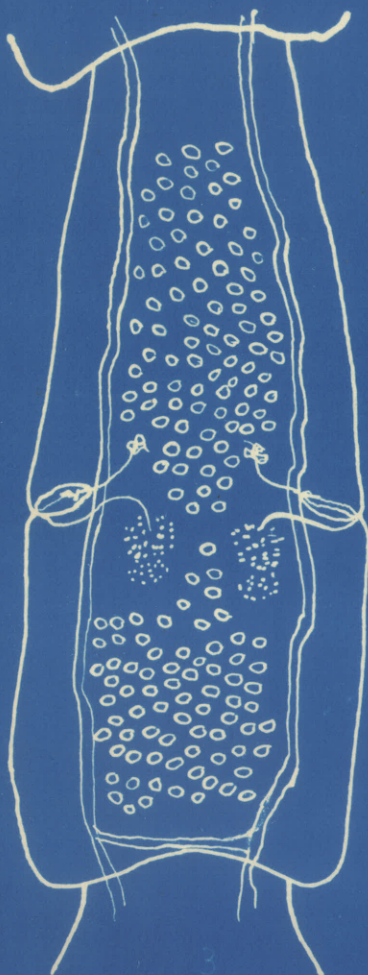
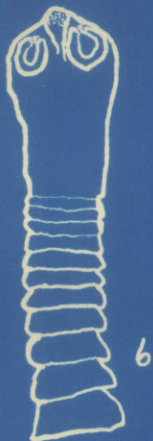


PLATE THREE

Dipylidium gracile

Fig. 9. Rostellum and hooks

Fig.10. Scolex and anterior portion of strobila

Fig.11. Mature segment

Fig.12. Ripe segment

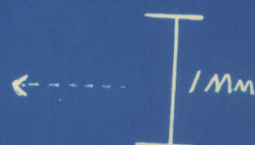
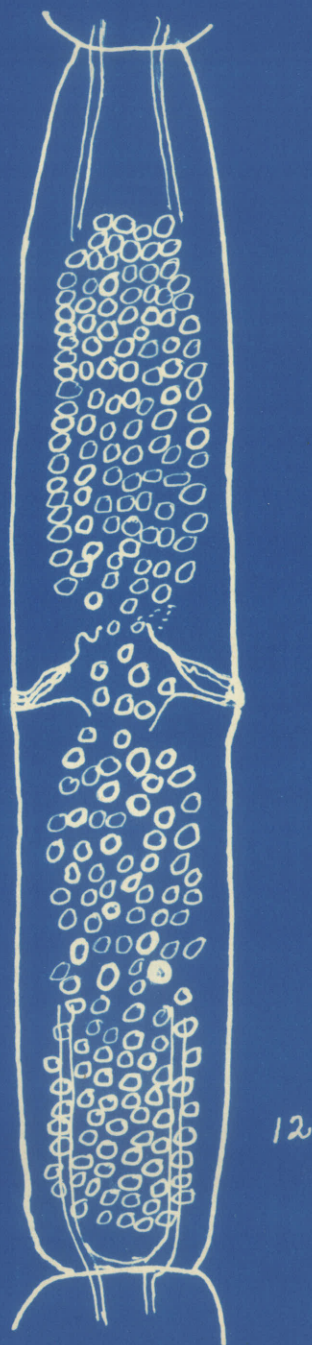
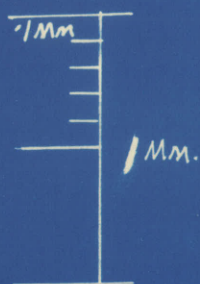
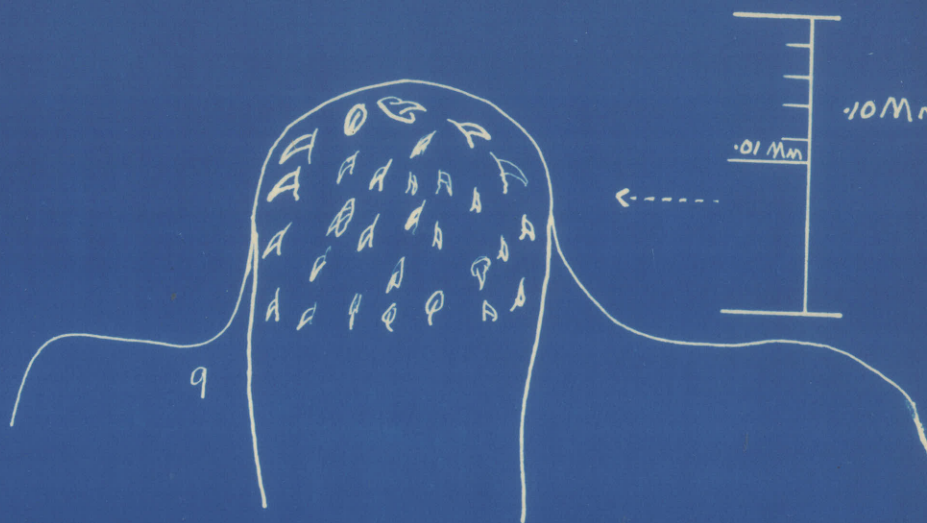


PLATE FOUR

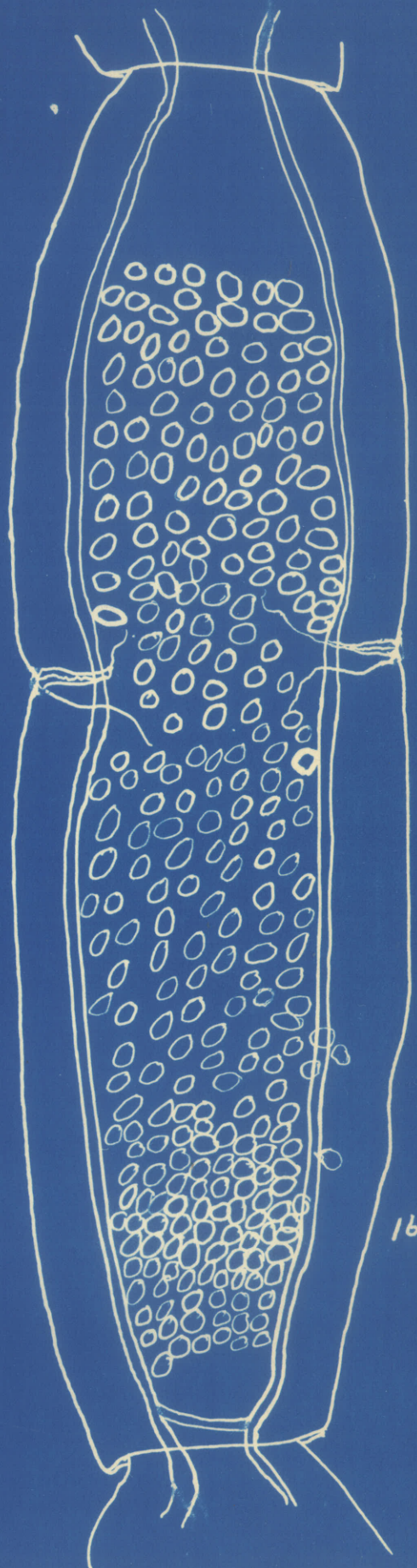
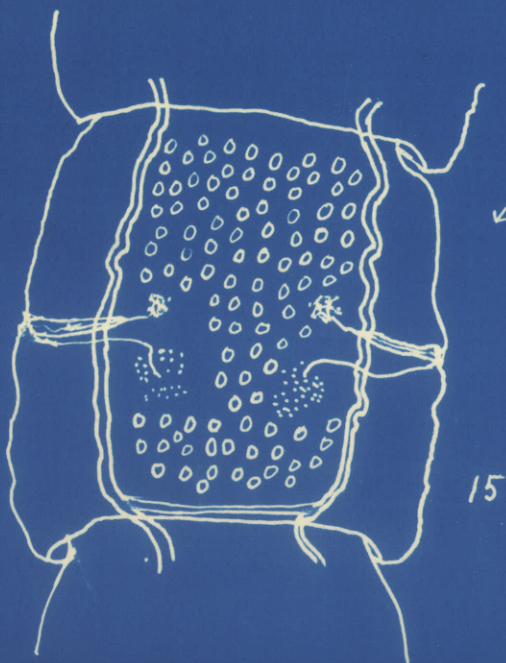
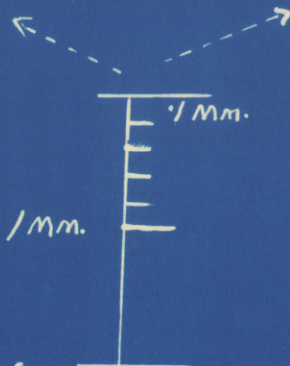
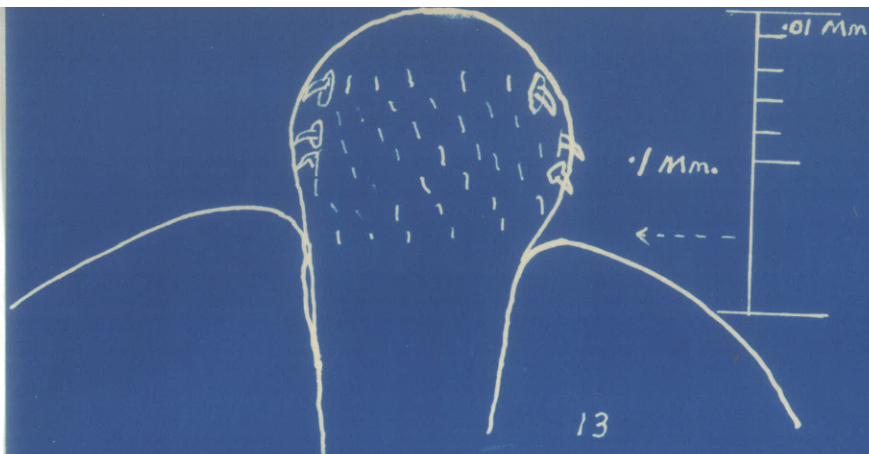
Dipylidium diffusum

Fig. 13. Rostellum and hooks

Fig. 14 Scolex and anterior portion of strobila.

Fig. 15. Mature segment.

Fig. 16. Ripe segment.



Genus *Taenia*.

Only four cats out of the 72 were infested with this genus. In each of two cats there was only one specimen, while in the third, there were two, and in the fourth, there were three specimens with ripe proglottids and one immature tapeworm, 12 Cm. long.

Instead of being extended along the gut, as were the other two genera, these cestodes were coiled back and forth three or four times, to fill the lumen of the gut.

In one case, two terminal ripe proglottids broke off as the tapeworm was being removed, and worked their way along the gut by alternately expanding and contracting the proglottids.

These specimens were identified by the number of hooks on the rostellum and the branching of the ripe uterus as *Taenia hydatigena*, when compared with the figures given by Hall.

The length of the mature specimens was from 24 Cm. to 36 Cm. The number of ripe proglottids was from two to four and these were longer than wide. The number of mature proglottids was over one hundred, and there was a larger number of immature segments.

In the accompanying figures plate 1. is photomicrograph of a ripe proglottid. It was taken on two plates in order to get in both ends of the segment. The genital pore appears on both plates and serves to show the amount of overlapping in the photographs. The composite picture

shows nine lateral branches of the uterus with the characteristic branches at each end. The collar with a notch in it of the anterior segment shows in the figure 1.

Plate 2. is also a photomicrograph. It shows the rostellum with its double crown of hooks. There are 18 large hooks and 19 small hooks.

Plate 3. shows two sagittal sections of the head. Figure 4. shows the hooks penetrating the mucous lining of the gut. The villi are pushed aside by the head and the crypts of Lieberkuhn show in cross section because the gut curled up in the fixing and clearing agents.

Figure 5. shows two of the four suckers. The one on the left shows the diameter and the thickness of the muscular walls, and the one on the right shows the depth. It also shows the diameter of the neck region.

Plate 4. shows sections of the post mature proglottids. Figure 6 shows a longitudinal section through part of two segments showing sections of the branches of the uterus, the transverse excretory canal at the juncture of the two segments, and the collar of the anterior segment.

Figure 7 is a cross section showing sections of the uterus containing eggs, the longitudinal excretory canals, and the longitudinal grooves on the surface mentioned by Hall.

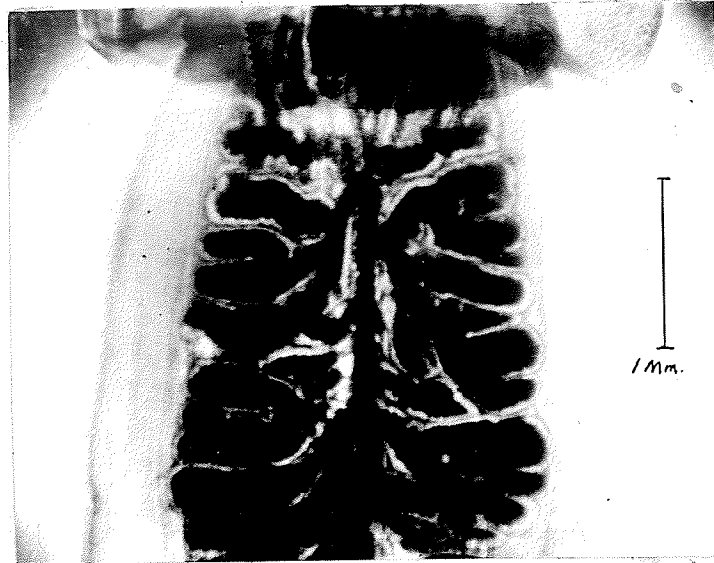
PLATE ONE

Taenia hydatigena

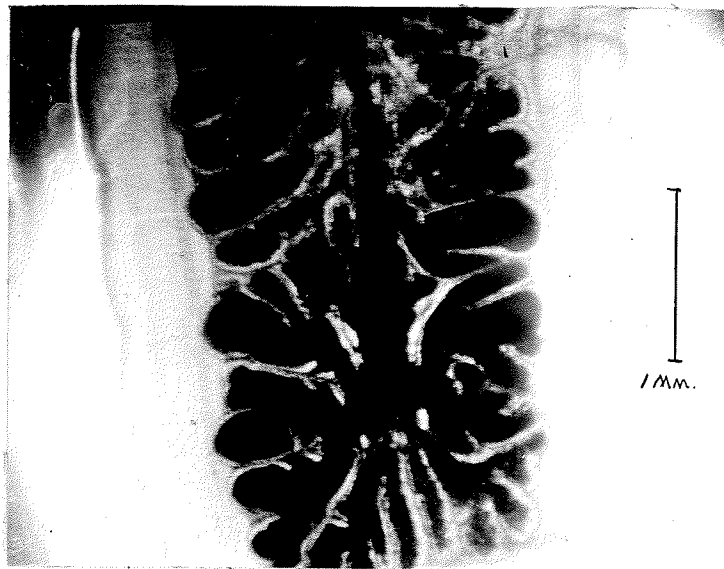
Fig. 1. Anterior portion of ripe segment.

Fig. 2. Posterior portion of ripe segment.

Plate 1.



1.



2.

PLATE ONE

Taenia hydatigena

Fig. 1. Anterior portion of ripe segment.

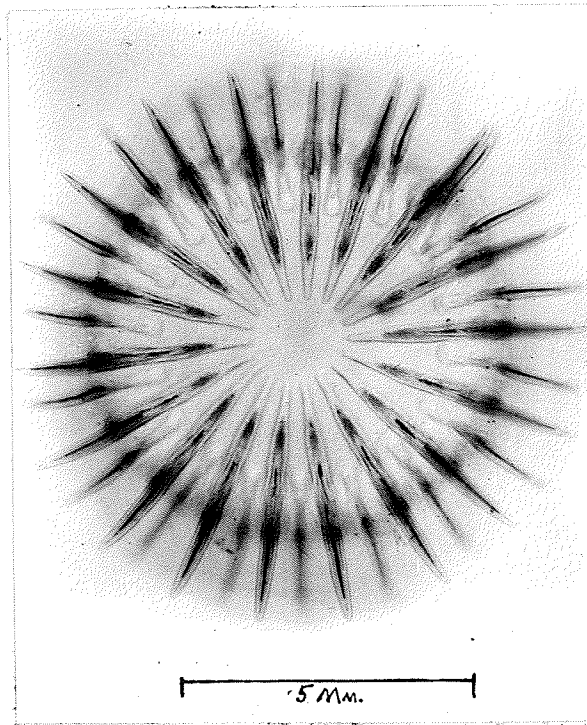
Fig. 2. Posterior portion of ripe segment.

PLATE TWO

Taenia hydatigena.

Fig. 3. Circles of hooks viewed from the front.

Plate 2.



3.

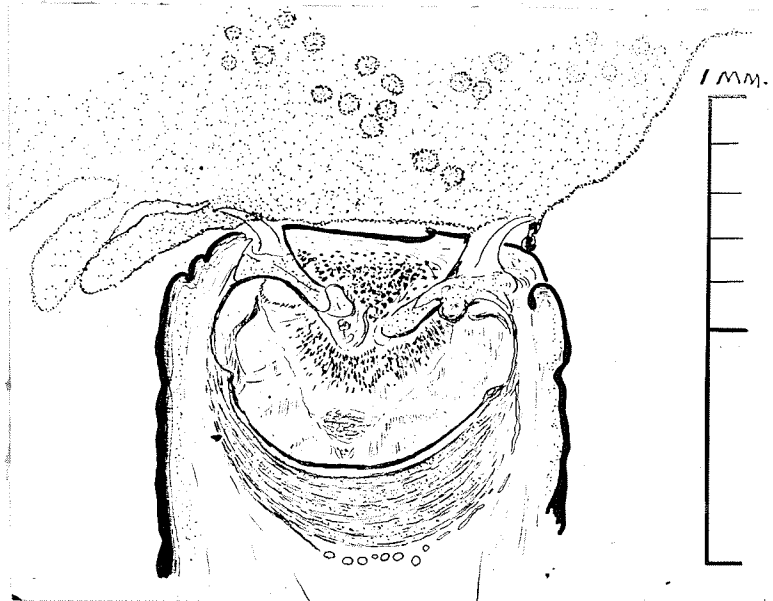
PLATE THREE

Taenia hydatigena.

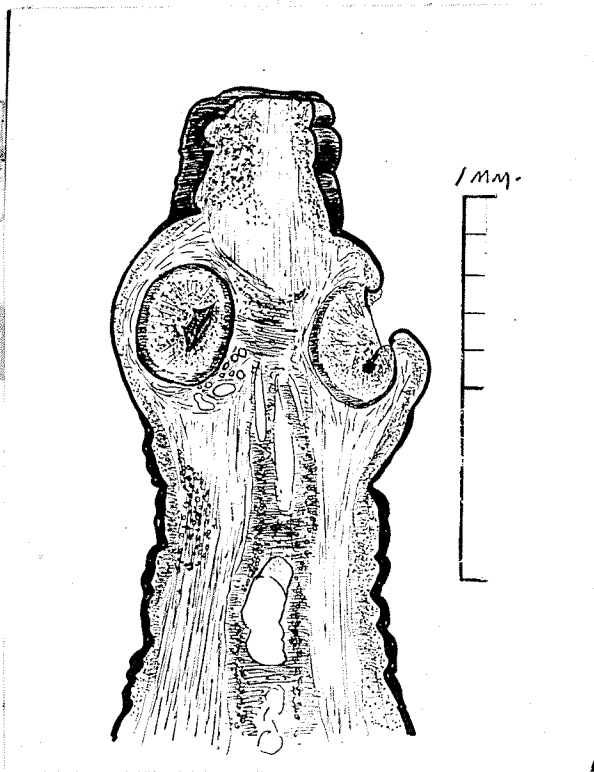
Fig. 4. Sagittal section of the head showing attachment to gut.

Fig. 5. Sagittal section of head through two suckers.

Plate 3.



4.



5.

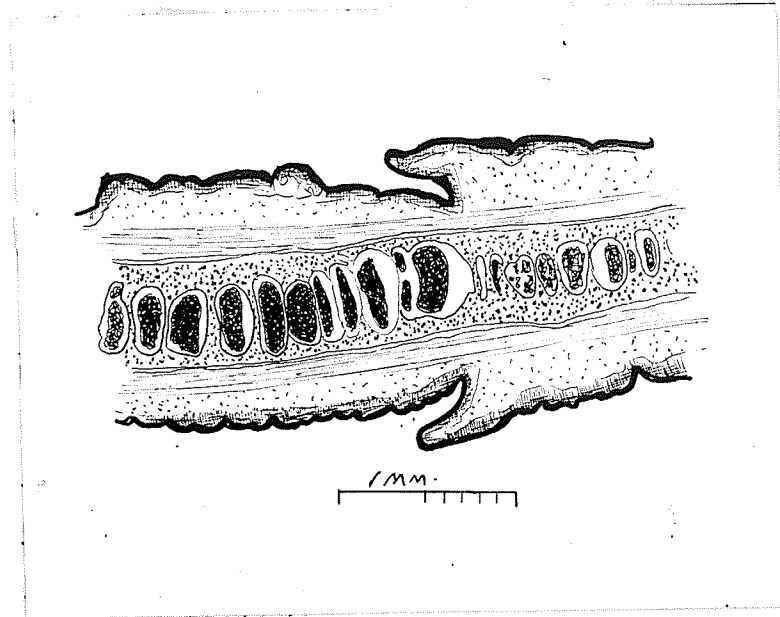
PLATE FOUR

Taenia hydatigena.

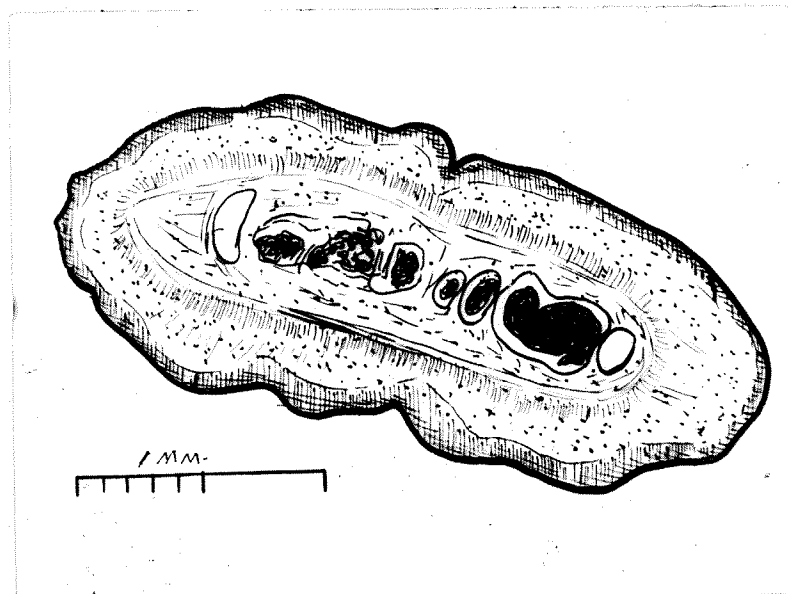
Fig. 6. Longitudinal section through ripe segment.

Fig. 7. Cross section through ripe segment.

Plate 4.



6.



7.

Genus Diphyllobothrium

Of the four cats infested with this genus, five immature, and only one mature specimen was found.

The immature specimens were 6 to 8 Cm. long and about 1 Mm. wide. They blended so well with the material in the gut that they were not discovered on inspection, but only by decanting the water from the beaker containing the cut up gut into a petri dish three or four times. From this fact the writer is inclined to believe that this genus may be more frequent in cats than is generally thought, but that they have escaped detection. This condition may be particularly true where experimental feeding of infected fish has been tried on cats.

The mature specimen was taken from a full grown male Persian cat and had the following measurements after fixing in 10% formalin.

Total length 43 Cm.

Maximum width 1 Cm.

Length of head 1 Mm.

Width of head 1.2Mm.

Width of neck 1Mm.

Number of mature proglottids over 200.

Neither Haematoxylin nor alum cochineal stains brought out, the structure of the uterus clearly. Finally the writer took a section up the alcohols to absolute for 1 hour then into methyl salicylate (synthetic)

for 1 hour and mounted in balsam. This method gave a clear picture of the uterus.

From the head and the shape of the uterus the writer identified the specimen as *Diphyllobothrium latum*. The terminal segments had been sloughed off this specimen but the ripe uterus and head compares closely with figures given by Magath and Nicholson.

In plate 1. of *Diphyllobothrium* figure 1 is a photomicrograph of a cross section of the head through the widest part showing the bothria.

Figure 2 is a photomicrograph of the head of one of the immature specimens which corresponded closely to the head of the mature specimen. The length of the bothria is shown by the light line at the left of the image.

Plate 2 was drawn by camera lucida and then photographed because the branching of the uterus did not show clearly in the direct negative. It shows part of three segments of the tapeworm taken about 6 Cm. from the posterior end of the specimen. The characteristic branching of the *latum* uterus is quite evident.

Conclusions.

Of the three genera of cestodes present in cats only 25% were infected with *Dipylidium*, 5.5% were infested with *Taenia*, 5.5% were infested with *Diphyllobothrium*.

Miss Willaner found 83% infestation in cats. The difference in percentage of infection may be due to a

greater freedom from fleas in our cats or to the season of the year in which they were examined.

The writer has not been able to obtain comparative figures for *Taenia*.

It has been pointed out by Nicholson, and also mentioned to the writer personally, by Mr. Bajkov, that summer fish are more heavily infested with plerocercoids than winter caught fish. This fact may account for the low infestation with *Diphyllobothrium*.

The author plans to investigate this possibility during the coming summer.

The writer wishes to thank Professor R. A. Wardle for his many helpful suggestions during the working out of the above material. Thanks are also due to Dr. Daniel Nicholson of the Manitoba Medical College who confirmed the author's identification of *D. latum*.

Many thanks are due to the Winnipeg Humane Society for supplying us with the cats used in this survey.

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EXPLANATION OF PLATES

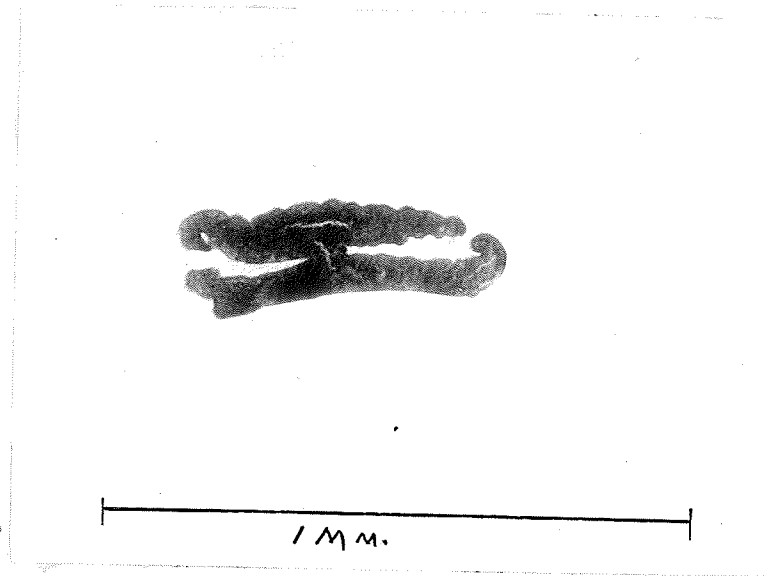
PLATE ONE

Diphyllbothrium latum

Fig. 1. Cross Section of head.

Fig. 2. Entire head.

Plate 1.



1.



2.

PLATE TWO

Diphyllbothrium latum

Fig. 3. Portion of mature segments showing uterus.

Plate 2.

