Helminth parasites of the Black-billed Magpie (Pica pica hudsonia Sabine) in Gallatin County, Montana
by Kenneth S Todd

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE in Zoology
Montana State University

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KENNETH S. TODD, JR.

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree

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ABSTRACT

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Data have been compiled after examination of 145 magpies ranging in age from one day to adults. 87.6% of all birds examined contained parasites. The ten species of helminths recovered were: Echinostoma sp., Dilepis undula, Hymenolepis stylosa, Haploparaxis sp., Hymenolepis sp., Anomotaenia constricta, Capillaria resecta, Syngamus trachea, Acuaria anthuris and Microtetrameres sp. Three of the species recovered are new host records and one is a new record for the United States.

While there was little difference in incidence of infection between juvenile and adult birds, juvenile birds had a higher mean total number of helminths than adults. The earliest infection found in nestlings was in a thirteen day-old bird.

INTRODUCTION

While the helminth parasites of birds have frequently been reported in the literature, there have been few studies on seasonal variations of parasite infections and the effect of the host's age on susceptibility to helminths. Most detailed studies of bird parasites have been confined to the parasites of domesticated or game birds and birds that are disseminators of parasites to economically important birds.

Although several studies have been conducted on the blood parasites of the magpie in the United States, little has been published about the other internal parasites. Luft (1960) made a survey of the parasites of the digestive tract of the magpie in Poland and reported an earlier study (Markowski, 1933) of magpie parasites in Poland. Timon-David (1953b) studied the trematodes of magpies in France.

This study was conducted to determine the helminth parasites of the digestive tract, lungs, body cavities, and associated organs, their seasonal variations, and differences in infections of different age groups of the Black-billed Magpie (Pica pica hudsonia Sabine) from Gallatin County, Montana.

Appendix 1 is a taxonomic list of the helminth parasites of the Magpie (Pica pica L.) that has been compiled from the available literature. It includes only the helminths of the digestive tract and associated organs. Stabler (1961) included a review of the literature on the blood parasites of the magpie in a comprehensive study of the parasites of the blood and bone marrow of the Black-billed Magpie. The plan of Appendix 1 is to list the family, the species, the author of the species

name, and the date of publication of the name. Following is the name of the author reporting the parasite and the country from which the parasite was reported if it is known. Names that are now considered to be synonymous with accepted or priority names are included in parentheses following the name of the country from which the parasite was reported. Appendix 1 includes seventeen trematodes, eight cestodes, one acanthocephalan, and eighteen nematodes.

In addition to Appendix 1, Naumann (1905) reported Ascaris picae and Markowski (1933) reported Agamospiura sp. from the magpie. Neither of these species is considered by Yamaguti (1958, 1959, 1961) nor does any of the available literature give a synonym for either one.

The following terminology is used: nestlings are birds taken from clutches of known age; juveniles are birds out of the nest that have not passed their first reproductive period; adults are birds one year old or older.

METHODS

Twenty-five nestlings, sixty-five juveniles, and fifty-five adults were collected between April 7, 1963, and March 19, 1964. All of the birds were collected in S 9, T 1N, R 4E approximately fifteen miles northwest of Bozeman, Gallatin County, Montana.

Except for nestlings which were collected during May, 1963, ten birds were collected during each month of the study period. All birds were collected with a trap except nestlings which were taken from the nest and birds taken during March and June with a shotgun.

The trap was a five-feet square, three-feet high enclosure constructed from one-inch-mesh wire screen. A funnel-shaped piece of wire screen allowed the magpies to enter the trap but prevented them from leaving. The trap was baited with viscera from domestic livestock. During the first part of the collecting period the trap was placed on the ground. Later it was placed on a farm implement wagon to prevent skunks from entering the trap.

The birds were either examined within forty-eight hours after trapping or frozen until immediately before examination. The birds were dissected and the various components of the coelom were examined for parasites. The intestinal contents were washed in sixty and eighty-mesh screens and the residue was examined microscopically. Representative sections of all tissues were pressed between glass slides and examined for embedded helminths. Some tissues were digested in a 0.5% hydrochloric acid and 1.0% pepsin solution to test the accuracy of pressing the tissues between slides for recovering helminths. Trematodes and cestodes were fixed in AFA solution. Permanent slides were made by staining trematodes with Semichon's aceto-carmine and cestodes with Delafield's or Harris' hematoxylin. Study slides of cestodes were made by staining with Semichon's aceto-carmine and the trichrome method. Nematodes were fixed in 70% alcohol and 5% glycerine and permanent mounts were made in glycerine jelly. Study slides of nematodes were made using glycerine. Some proventriculi were digested in a 0.5% hydrochloric acid and 1.0% pepsin solution to recover nematodes; however, they disintegrated after being placed in glycerine alcohol.

Parts of the gizzard with nematodes embedded in the muscle were fixed in 10% buffered formalin for preparation of slides. The six-micron-thick

sections were stained with hematoxylin and eosin.

Birds were aged by the plumage characteristics of Linsdale (1937) and the presence of the bursa of Fabricius. The plumage of the birds hatched in 1962 was similar to that of those hatched in 1963, but the bursa of Fabricius was present in the former until the latter had assumed the adult plumage.

RESULTS

Table I presents the intensity of infection with the various helminth groups for the three age classes of birds examined. Of all birds examined, 87.6% (127 of 145) harbored parasites. All sixty-five juveniles and 98.2% (54 and 55) of the adults were infected. There was little difference between the percent of adults and juveniles parasitized by the different helminth groups. Nestling infection was low (32.0%) because ten of the twenty-five nestlings examined were less than thirteen days old and harbored no parasites. Tapeworms made up the largest group found in nestlings.

Ten species of helminths were recovered, including one trematode, five cestodes, and four nematodes. In the following list of parasites recovered, certain characteristics of each species are listed.

TREMATODA

Echinostoma sp. was recovered from the posterior third of the small intestine of two adults, the large intestine of one juvenile, and the bursa of Fabricius of one nestling. All specimens recovered had gravid uteri. Because the cephalic spines of all specimens recovered were damaged, specific identification of this fluke were impossible.

CESTODA

Dilepis undula (Schrank, 1788) was recovered from the posterior third of the small intestine of one juvenile. The four specimens recovered had gravid uteri.

Hymenolepis stylosa (Rudolphi, 1808) was found in the posterior two-thirds of the small intestine of nestlings, juveniles, and adults. Although gravid proglottids were recovered, it was impossible to determine the number of worms with gravid proglottids because of the fragility of the strobilia and subsequent breaking.

Haploparaxis sp. was recovered from all three age classes of birds. Gravid proglottids were found in all cases. This tapeworm does not conform to the description of previously reported species and evidently constitutes a new species.

Hymenolepis sp. was found in the small and large intestine of one adult magpie. All forty-seven specimens recovered were immature and contained no discernible sexual organs.

Anomotaenia constricta (Molin, 1858) was recovered from the small and large intestine of juvenile and adult birds. Only scoleces and one or two immature proglottids were generally recovered. When the complete strobilia was present, gravid proglottids were found in the posterior portion of the intestine.

NEMATODA

Capillaria resecta (Dujardin, 1843) was found in the small intestine and occasionally in the large intestine of all three age classes. When

Table I. Incidence of Helminth Infections in Black-billed Magpies by Age Groups.

Age Class	No. Exam.	No. Inf.	% Inf.	Group	No. Inf.	% Inf.
				Trematoda	1	4.0
Nestlings	25	8	32.0	Cestoda	7	28.0
				Nematoda	5	20.0
				Trematoda	1	1.5
Juveniles	65	65	100.0	Cestoda	41	63.1
				Nematoda	64	98.5
				Trematoda	2	3.6
Adults	55	54	98.2	Cestoda	32	58.2
				Nematoda	54	98.2
Total	145	127	87.6			

freshly killed birds were examined, no worms were found in the large intestine. This parasite was frequently embedded in the mucosa of the small intestine. Females with gravid uteri were always present.

Syngamus trachea (Montague, 1811) was recovered from the anterior half of the trachea of juveniles and adults. Although the lungs were examined, no immature forms were found. In all cases except one, males and females occurred in copula.

Acuaria anthuris (Rudolphi, 1819) occurred under the horny lining of the gizzard of both juveniles and adults. Female worms were often deeply embedded in the muscular layer of the gizzard and considerable pathology was evident with heavy infections. Measurements of anatomical features used for classification of this nematode varied considerably; however, the indicies of Williams (1929) were used for identification. Williams' (1929) description of A. nebraskensis is considered by Yamaguti (1962) to be synonymous with A. anthuris.

Microtetrameres sp. was found in the glandular part of the stomach. Females were found in the gastric gland pits and males in the lumen of the proventriculus. All of the males recovered were sexually mature and both mature and immature females were present.

One larval nematode was recovered from liver tissue. This worm was damaged and indentification was impossible.

Nestlings were separated into the following age classes: 1 - one to five days old, 2 - six to ten days old, 3 - eleven to fifteen days old, 4 - sixteen to twenty days old, 5 - twenty to twenty-five days old, and

6 - twenty-six to thirty days old.

Table II shows the incidence of infection of the different age classes of nestlings. Of the twenty-five nestlings examined, eight (32%) were infected with helminths. Five (20%) were infected with C. resecta, four (16%) with H. stylosa, three (12%) with Haploparaxis sp., and one (4%) with Echinostoma sp.

The youngest infected bird was a thirteen-day old magpie which contained H. stylosa, Capillaria resecta, Haploparaxis sp, and Echinostoma sp. were first found in birds twenty-three days old. The number of C. resecta recovered ranged from one to six with an average of 4.2 per infected bird. For Haploparaxis sp. the range was one to three (average 2.0 per infected bird) and for H. stylosa the range was one to four (average 2 per infected bird).

Juveniles harbored nine helminth species. In Table III the following information is recorded for the helminths recovered from juvenile birds: number of infected birds, percentage incidence, and mean number and range of helminths per infected bird. The most common species was C. resecta, with an incidence of 97.0%. This was followed by Microtetrameres sp. (61.5%), A. anthuris (58.4%), A. constricta (26.1%), H. stylosa (21.5%), S. trachea (16.9%), Haploparaxis sp. (12.3%), Echinostoma sp. (1.5%), and D. undula (1.5%). The mean number of parasites per infected bird was highest for C. resecta (60.3) and Microtetrameres sp. (27.3). The highest number of helminths of a single species found in one bird was 692 specimens of C. resecta.

Table II. Incidence of Helminth Infections in Twenty-five Nestling Magpies

Age Class	No. Exam.	Infected No.	Infected %	*C. resecta*	*H. stylosa*	*Haploparaxis* sp.	*Echinostoma* sp.
1	4	0	0	0	0	0	0
2	6	0	0	0	0	0	0
3	6	2	8	0	8	0	0
4	1	0	0	0	0	0	0
5	6	4	16	12	8	8	4
6	2	2	8	8	4	0	0
Total	25	8	32	20	20	8	4

The incidence of infection of juveniles varied from some species during the year (Table IV). To compare data the year was divided into four quarters as follows: 1 - January to March, 1964; 2 - April to June, 1963; 3 - July to September, 1963; and 4 - October to December, 1963. A. anthuris and C. resecta infections varied little throughout the year. Species that showed peaks of incidence during the year were Haploparaxis sp. in the first quarter, H. stylosa, and Microtetrameres sp. in the second quarter, A. constricta in the third quarter, and S. trachea in the fourth quarter. Of the nine species found in juvenile birds, H. stylosa, A. anthuris, C. resecta, and Microtetrameres sp. occurred consistently throughout the year.

In comparing the quarterly distribution of the numbers of helminth species in juvenile birds (Table V) it was found that a combination of three species was most common throughout the year.

Nine helminth species were recovered from adult birds. Table VI lists these species with information on the incidence of infection. Capillaria resecta was the most common species with an incidence of 90.9%. Following in the order of incidence were A. anthuris (67.3%), Microtetrameres sp. (63.6%), A. constricta (23.6%), H. stylosa (20.0%), Haploparaxis sp. (18.2%), S. trachea (5.5%), Echinostoma sp. (3.6%), and Hymenolepis sp. (1.8%). Capillaria resecta was the species with the highest mean number of helminths per infected bird (23.1) and the largest number of individuals of one species in a single bird (139).

In Table VII data on the quarterly incidence of helminth species are presented. Capillaria resecta and Microtetrameres sp. infections varied

little throughout the year. There were peaks of infection with Haploparaxis sp. in the second quarter, A. anthuris in the third quarter, and H. stylosa in the fourth quarter. Echinostoma sp., S. trachea, and Hymenolepis sp. were not recovered during all quarters of the year. Six of the nine species recovered were found in all four periods.

There were some differences in the distribution of numbers of species of helminths recovered during the different quarters (Table VIII). Two species were most common during the first quarter and three during the third quarter. Two, three, and four species were equally common during the second quarter. One bird was found to be free of parasites.

In comparing the mean total number of helminths from adult and juvenile birds (Table IX) it was found that adults had a higher mean total number only during the months of January and September. When the data were compared by quarters, juveniles in all quarters had a higher mean total number of parasites than adults.

There was no difference in incidence of infection and mean total number of parasites between male and female birds. When comparing weights of birds with incidence of infection and total number of parasites per bird, no correlation could be found.

In some cases when large numbers of cestodes were found anterior to C. resecta in the small intestine, the numbers of C. resecta would be less than average. This was not consistent in all birds.

DISCUSSION

Of the ten helminth species recovered, Echinostoma sp., Haploparaxis

Table III. Incidence and Intensity of Helminth Species in Juvenile Magpies.

Species	Number Infected	Percent Incidence	Mean Number/ Infection	Range- Infected Birds
Echinostoma sp.	1	1.5	1.0	--
D. undula	1	1.5	4.0	--
A. constricta	17	26.1	6.8	1-42
H. stylosa	14	21.5	5.6	1-14
Haploparaxis sp.	8	12.3	9.6	1-32
A. anthuris	38	58.5	4.6	1-19
C. resecta	63	96.9	60.3	1-692
Microtetrameres sp.	40	61.5	23.7	1-103
S. trachea	11	16.9	2.1*	1-7

*Numbers of *S. trachea* refer to pairs

Table IV. Quarterly Incidence of Helminth Species in Juvenile Magpies.

Species	Percentage Incidence			
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Echinostoma sp.	--	9.1	--	--
D. umdula	--	--	--	6.3
H. stylosa	20.0	36.4	16.7	18.8
Haploparaxis sp.	30.0	--	5.6	6.3
A. constricta	25.0	--	38.9	18.8
A. anthuris	55.0	63.6	50.0	68.8
C. resecta	95.0	100.0	100.0	93.8
Microtetrameres sp.	70.0	81.8	50.0	50.0
S. trachea	--	9.1	16.7	43.8
No. of Birds	20	11	18	16

Table V. Quarterly Distribution of Helminth Species in Juvenile Magpies.

No. of Species	Percentage Infected				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Total
1	5.0	--	5.6	--	3.1
2	15.0	18.2	16.7	12.5	16.9
3	45.0	54.5	61.1	62.5	53.8
4	35.0	27.3	16.7	18.8	24.6
5	--	--	--	6.3	1.5
No. of Birds	20	11	18	16	65

Table VI. Incidence and Intensity of Helminth Species in Adult Magpies.

Species	Number Infected	Percent Incidence	Mean Number/ Infection	Range- Infected Birds
Echinostoma sp.	2	3.6	1.0	--
A. constricta	13	23.6	6.2	1-27
H. stylosa	11	20.0	3.7	1-7
Hymenolepis sp.	1	1.8	4.7	--
Haploparaxis sp.	10	18.2	14.3	1-47
A. anthuris	37	67.3	5.3	1-23
C. resecta	50	90.9	23.1	1-139
Microtetrameres sp.	35	63.6	16.4	1-91
S. trachea	3	5.5	1.3*	1-2

*Number of *S. trachea* refer to pairs

Table VII. Quarterly Incidence of Helminth Species in Adult Magpies.

Species	Percentage Incidence 1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Echinostoma sp.	--	5.3	--	7.1
Hymenolepis sp.	--	5.3	--	--
H. stylosa	20.0	10.5	16.7	35.7
Haploparaxis sp.	10.0	26.3	16.7	14.3
A. constricta	30.0	21.1	25.0	21.4
A. anthuris	60.0	68.4	83.3	57.1
C. resecta	100.0	84.2	100.0	85.7
Microtetrameres sp.	60.0	63.2	66.7	64.3
S. trachea	10.0	--	8.3	7.1
No. of Birds	10	19	12	14

Table VIII. Quarterly Distribution of Helminth Species in Adult Magpies.

No. of Species	Percentage Infected				
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.	Total
0	--	5.3	--	--	1.8
1	10.0	--	8.3	14.3	7.1
2	40.0	31.6	16.7	28.6	29.1
3	30.0	31.6	50.0	21.4	32.7
4	10.0	31.6	25.0	28.6	25.5
5	10.0	--	--	7.1	3.6
No. of Birds	10	19	12	14	55

Table IX. Mean Total Number of Helminths From Adult and Juvenile Birds.

	Mean Number of Helminths			
	Juveniles		Adults	
Month	Month	Quarter	Month	Quarter
January	27.8		40.0	
February	54.0	42.0	34.0	34.3
March	42.2		28.8	
April	69.5		33.3	
May	45.9	54.1	27.3	39.4
June	59.4		56.4	
July	70.5		52.3	
August	60.9	55.9	31.3	44.8
September	31.4		46.8	
October	177.7		43.0	
November	232.2	174.5	49.4	40.7
December	113.0		30.2	

sp., and Microtetrameres sp. are new host records for the magpie. Capillaria resecta had not been reported from the magpie in the United States. Luft (1960) recovered three of the species found during this study (H. stylosa, S. trachea, and A. anthuris) in a survey of the helminths of the magpie in Poland. She reported incidences of infection of 37% for H. stylosa, 6% for S. trachea, and 1.5% for A. anthuris. The figures for the present study were 20.0%, 13.9%, and 51.7%, respectively.

While there was little difference between the intensity of infection in juvenile and adult magpies during the year, there was a difference in the mean total number of helminths present. When the data are examined by quarters, juveniles consistently had a higher mean total number of helminths. The increase in total numbers of helminths in juveniles was influenced chiefly by the increase in numbers of C. resecta.

Peaks of intensity of cestode infections were not in all cases noted during the summer months when suitable arthropod intermediate hosts would be abundant. The peak of infection of H. stylosa in adult magpies during the fourth quarter is unusual. Mettrick (1960) found that in twenty-two species of birds examined in England, infection was at a maximum in May and fell to a minimum during late August and September. This was not noted during the present study. Peaks of intensity of infection were highest for juveniles during the fourth quarter. The mean number of helminths per infected bird was at a maximum and minimum for different helminth species at different times of the year. Acuaria anthuris infections were at a maximum during May and November and at a minimum during August and September.

Syngamus trachea was at a peak in October and infection was relatively constant during the rest of the year. Capillaria resecta numbers were highest during October and November. Intensity of infection was variable for Microtetrameres sp. during the study period except during September and October, when infection was at a low. Cestode infections were erratic during the study period.

In juveniles there was a gradual increase in mean total numbers of helminths until a peak was reached during the fourth quarter. The numbers then decreased to a level similar to that for adults. This may indicate that as the numbers of parasites increase, there is a stimulation to the host's immune mechanisms which results in a decrease in the total numbers of helminths.

SUMMARY

1. A total of 145 Black-billed Magpies was examined for helminths. They were collected over a period of one year during 1963 and 1964 in Gallatin County, Montana.

2. Ten helminth species were recovered during the study. 98.2% of adults, 100% of juveniles, and 32.0% of nestlings were infected.

3. Seasonal fluctuations occurred for most of the helminths. Infection by the most common species, Capillaria resecta, varied little throughout the year.

4. Three new host records for the magpie and one new record for the United States are reported.

5. A list of previously reported helminths of the magpie is included as an appendix.

APPENDIX

Appendix I. List of Helminths Previously Reported from the Magpie (Pica pica L.)

TREMATODA

Metacercaria renalis Timon-David, 1953: Timon-David, 1953b, France.

STRIGEIDAE Railliet, 1919

Strigea strigis (Schrank, 1788): Nicoll, 1923, Great Britian.

PLAGIORCHIIDAE Lühe, 1901

Plagiorchis cirratus (Rudolphi, 1802): Naumann, 1905, (Distomum cirratum Rudolphi, 1809); Nicoll, 1923, Great Britian, (Lepoderma cirratum Looss, 1899).

PROSTHOGONOMIDAE Nicoll, 1924

Prosthogonimus brauni Skrjabin, 1919: Timon-David, 1953b, France.

Prosthogonimus cuneatus (Rudolphi, 1809): Timon-David, 1953b, France.

Prosthogonimus madelinangeli Skryabin, 1961: Skryabin, 1961, Russia.

Prosthogonimus ovatus (Rudolphi, 1803):Dawes, 1956; Macy, 1934, Russia; Markowski, 1933, Poland; Naumann, 1905, (Distomum ovatum Rudolphi, 1809).

BRACHYLAEMIDAE Joyeux and Foley, 1930

Brachylaemus fuscatus (Rudolphi, 1819): Timon-David, 1953b, France.

DICROCOELIIDAE Odhner, 1910

Brachylecithum lobatum (Ralliet, 1900): Nicoll, 1923, Great Britian, (Lyperosomum lobatum Ralliet, 1900); Timon-David, 1953b, France.

Lyperosomum longicauda (Rudolphi, 1809): Dawes, 1956; Nicoll, 1923, Great Britian; Timon-David, 1953b, France.

Lyperosomum petiolatum (Ralliet, 1900): Timon-David, 1953b, France.

Zonorchis panduriforme (Ralliet, 1900): Timon-David, 1953b, France.

TROGLOTREMATIDAE Odhner, 1914

Renicola bretensis Timon-David, 1953: Timon-David, 1953a, 1953b, France.

CYCLOCOELIDAE Kossack, 1911

Cyclocoelum dollfusi Timon-David, 1950: Timon-David, 1953b, France.

EUCOTYLIDAE Skrjabin, 1924

Tamerlania zarudnyi Skrjabin 1924: Timon-David, 1953b, France.

OPISTHORCHIIDAE Braun, 1901

Amphimerus lancea (Diesing, 1850): Nicoll, 1923, Great Britian.

LEUCOCHLORIDIIDAE Dolfuss, 1934

Urotocus tholonetensis Timon-David, 1955: Timon-David, 1955, France.

CESTODA

MESOCESTOIDIDAE Perrier, 1897

Tetrathyridium variabile (Diesing, 1850): Joyeux and Baer, 1936, France; Markowski, 1933, Poland.

DAVAINEIDAE Fuhrmann, 1907

Raillietina corvina (Fuhrmann, 1905): Southwell, 1916, India. (Davainea corvina, Fuhrmann, 1905).

DILEPIDIDAE Railliet and Henry, 1909

Anomotaenia constricta (Molin, 1858): Fuhrmann, 1908; Joyeux and Baer,

1936, France; Ransom, 1909, North America.

Choanotaenia spinoscapite Joyeux and Baer, 1955: Joyeux and Baer, 1955, France.

Dilepis undula (Schrank, 1788): Fuhrmann, 1908; Joyeux and Baer, 1936, France; Lopez-Neyra, 1947, Spain; Markowski, 1933, Poland; Mettrick, 1958, England; Ransom, 1909, North America.

HYMENOLEPIDIDAE Railliet and Henry, 1909

Hymenolepis farciminosa (Goeze, 1782): Joyeux and Baer, 1936, France; Mettrick, 1958, England.

Hymenolepis serpentulus (Schrank, 1788: Fuhrmann, 1908; Joyeux and Baer, 1936, France; Hall, 1929; Lopez-Neyra, 1947, Spain, (Dicranotaenia serpentulus Lopez-Neyra, 1942); Markowski, 1933, Poland; Mettrick, 1958, England; Naumann, 1905; Ransom, 1909, North America.

Hymenolepis stylosa (Rudolphi, 1810): Fuhrmann, 1908; Joyeux and Baer, 1936, France; Lopez-Neyra, 1947, Spain, (Dicranotaenia stylosa Lopez-Neyra, 1942); Luft, 1960, Poland; Mettrick, 1958, England; Naumann, 1905; Ransom, 1909, North America.

ACANTHOCEPHALA

ECHINORHYNCHIDAE Cobbold, 1879

Centrorhynchus teres (Westrumb, 1821): Naumann, 1905, (Echinorhynchus hepaticus Molin, 1858 and Echinorhynchus teres Dies, 1851).

NEMATODA

TRICHURIDAE Railliet, 1915

Capillaria corvicola (Wassilkowa, 1930): Cram, 1936; Lopez-Neyra, 1947, Spain; Madsen, 1945.

Capillaria corvorum (Rudolphi, 1819): Jimenez-Milan, 1961, Spain; Luft, 1960, Poland; Madsen, 1945.

Capillaria resecta (Dujardin, 1843): Naumann, 1905, (Capillaria resectum Dujardin, 1843).

SYNGAMIDAE Leiper, 1912

Syngamus trachea (Montagu, 1811): Campbell, 1935, England; Cram, 1927, (Syngamus pugionatus Scholtthauber, 1860); Jimenez-Milan, 1961, Spain; Luft, 1960, Poland; Naumann, 1905, (Syngamus primitivus Molin, 1861); Nicholson, 1930, England.

HETEROCHEILIDAE Railliet and Henry, 1915

Porrocaecum ensicaudatum (Zeder, 1800): Cram, 1927; Luft, 1960, Poland.

SPIRURIDAE Oerley, 1885

Hadjelia truncata (Creplin, 1825): Sarwar, 1956, Pakistan.

THELAZIIDAE Skrjabin, 1915

Oxyspriura sigmoidea (Molin, 1860): Yamaguti, 1961, Russia.

ACUARIIDAE Seurat, 1913

Acuaria anthuris (Rudolphi, 1819): Chaubaud and Petter, 1961, France; Cram, 1927; Luft, 1960, Poland; Naumann, 1905, (Filaria anthuris Rudolphi, 1819).

Acuaria attenuata (Rudolphi, 1819): Naumann, 1905, (Filaria attenuata Rudolphi, 1819).

Acuaria cordata (Muller, 1897): Cram, 1927.

Dispharynx spiralis (Molin, 1858): Sarwar, 1956, Pakistan.

TETRAMERIDAE Travassos, 1914.

Microtetrameres inermis (Linstow, 1879): Yamaguti, 1961, Russia.

FILARIIDAE Claus, 1885

Diplotriaena tricuspis Fedtsch, 1874: Yamaguti, 1961, Russia.

Quadriplotriaena dolichodemus Wehr, 1939: Wehr, 1939, United States.

DIPETALONEMATIDAE Wehr, 1935

Lemdana convicola Schikhobalova, 1948: Schikhobalova, 1948, Russia.

Splendidofilaria bosei (Chandler, 1924): Yamaguti, 1961, Russia.

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