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Helminth Parasites of the Wild Turkey in South Dakota

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HELMINTH PARASITES OF THE WILD TURKEY IN SOUTH DAKOTA

BY

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This thesis is approved as a creditable, independent investigation by a candidate for the degree, Master of Science, and acceptable as meeting the thesis requirements for this degree; but without implying that the conclusions reached by the candidate are necessarily the conclusions of the major department.

Thesis Advisor

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C. F. D.

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INTRODUCTION

History Of The Wild Turkey In South Dakota

The original range of the eastern wild turkey (Meleagris gallopavo silvestris) included part of South Dakota. There is some question, however, as to whether wild turkeys inhabited the Black Hills as part of their original range. Latham (10), Mosby (13), and Edminster (2) indicate that the wild turkey inhabited only the southeastern portion of the state. Hipschman (7) in his history of the South Dakota Game, Fish, and Parks Department relates instances of turkeys being shot for food by early miners and by Custer's soldiers in the Black Hills. In either case, it appears that wild turkeys disappeared from South Dakota by 1920 (10).

Mr. Ray Hart (5), State Game Biologist in Rapid City, indicates that turkeys were not reintroduced into South Dakota until 1948. Eight birds of the southwestern race of wild turkey (Meleagris gallopavo merriami) were obtained from New Mexico in exchange for sage grouse and were stocked in the Black Hills. In 1950, fifteen more birds were obtained from Colorado, and in 1951, six additional ones were obtained from New Mexico. Hart (personal correspondence, January 11, 1961) also indicates that small numbers of eastern wild turkeys (Meleagris gallopavo silvestris) can be found in Custer State Park, and on Farm Island in the Missouri River near Pierre. Those in Custer State Park are zoo birds that wander throughout the park at times.

In 1958, 561 turkeys were harvested by hunters; 198 of these were examined and form the basis for this study.

Reason For The Study

After reviewing the literature on turkey parasites, one will realize little has been done concerning the macroscopic endoparasites of wild turkeys in any region, and no work of this nature has been undertaken in South Dakota. Therefore, the South Dakota Department of Game, Fish, and Parks entered into a cooperative arrangement with South Dakota State College to determine the incidence and distribution of helminths in wild turkeys of western South Dakota.

REVIEW OF THE LITERATURE

Many species of parasitic worms are known to occur in domestic turkeys, but relatively few have been reported from wild turkeys. Tables I through IV list the helminths reported from both domestic and wild birds. At this point, further comments will be concerned with helminths of wild turkeys.

Cestodes

The tapeworm, Metroliasthes lucida, has been taken from wild turkeys (Meleagris gallopavo intermedia) on the Wichita Mountains Wildlife Refuge in Oklahoma. Of 47 birds examined, 28 were infected with this cestode and as many as 50 adult worms were taken from a single bird (17). M. lucida has also been reported from the eastern wild turkey (Meleagris gallopavo silvestris) kept in the Philadelphia Zoological Gardens (24).

The cestode, Raillietina cesticillus, has been reported from the eastern wild turkey in Maryland. It is also known to occur in pheasants, bobwhite quail, and a number of other wild birds (3, 12). This worm is a common parasite of domestic poultry.

Wild turkeys in Maryland have been found to be infected with Davainea meleagridis and Raillietina williamsi (3). Synonyms of the latter are Davainea fuhrmanni and Raillietina silvestris (25).

Raillietina ransomi (Williams, 1931) has been reported infecting wild turkeys near Honey Grove, Pennsylvania (23). Both R. williamsi and R. ransomi have been reported from M. g. silvestris kept in the

Philadelphia Zoological Gardens (24).

Trematodes

Although a number of trematodes are known to occur in domestic turkeys (Table II), only two species have been reported from wild turkeys. Echinoparyphium recurvatum and Zygocotyle lunata were found infecting wild turkeys (M. g. intermedia) on the Wichita Mountains Wildlife Refuge in Oklahoma (17).

Nematodes

Only a few different nematodes have been discovered infecting wild turkeys; however, several species commonly occur in domestic flocks (Table III). Syngamus trachea, Ascaridia dissimilis, Cheilospirura hamulosa, and Capillaria contorta were discovered in wild turkeys taken in Pennsylvania (23).

Acanthocephalans

The only record found of acanthocephalans in turkeys of North America was an instance in which larval forms of Oncicola canis were reported to be encysted in the esophageal lining of domestic turkey poults in Texas (14). This species normally is a parasite of dogs.

The only record of mature thorny-headed worms in turkeys is the report of four specimens of Mediorhynchus (= Empodius) gigantisus (Meyer, 1931) from a turkey in German East Africa (11). Presumably this was a domestic bird. Apparently, there have been no reports of acanthocephalans from wild turkeys previous to the present study, in which another species

of Mediorhynchus was found. However, Van Cleave (20) and Ward (21) had suggested that the acanthocephalans having the most opportunity for becoming established in poultry are members of the genus Mediorhynchus. M. papillosus has been found in the intestine of a prairie chicken from southern Illinois. M. grandis is known to occur in several species of wild birds and, because of its life history (see page 22), has the strongest opportunity for becoming established in flocks of turkeys (20).

TABLE I. CESTODES FOUND IN TURKEYS[1]

Name	Location in host
Metroliasthes lucida[2]	Small intestine
Raillietina cesticillus[2]	Small intestine
Raillietina williamsi[2]	Small intestine
Raillietina ransomi[2]	Small intestine
Raillietina tetragona	Small intestine
Raillietina echinobothrida	Small intestine
Davainea meleagridis[2]	Small intestine
Choanotaenia infundibulum	Small intestine
Amoebotaenia sphenoides	Small intestine
Hymenolepis carioca	Small intestine
Hymenolepis cataniana	Small intestine

[1] Refer to 6, 9, 12, and 15.

[2] Known to occur in wild turkeys.

TABLE II. TREMATODES FOUND IN TURKEYS[1]

Name	Location in host
Echinoparyphium recurvatum[2]	Small intestine, ceca
Zygocotyle lunata[2]	Small intestine, ceca
Collyriclum faba	Skin
Strigea falconis	Viscera
Amphimerus spp.	Liver
Plagiorchis lariocola	Small intestine
Brachylaemus commutatum	Small intestine, ceca
Prosthogoniumus macrorchis	Oviduct

[1] Refer to 6, 12, 15, and 17.

[2] Known to occur in wild turkeys.

TABLE III. NEMATODES FOUND IN TURKEYS[1]

Name	Location in host
Syngamus trachea[2]	Trachea
Trichostrongylus tenius	Small intestine
Ascaridia galli	Small intestine
Ascaridia dissimilis[2]	Small intestine
Heterakis gallinae	Ceca
Subulura brumpti	Ceca
Subulura suctoria	Ceca
Dispharynx nasuta	Proventriculus
Dispharynx spiralis	Esophagus, proventriculus
Cheilospirura hamulosa[2]	Gizzard
Gongylonema ingluvicola	Crop
Capillaria annulata	Crop
Capillaria contorta[2]	Crop
Capillaria caudinflata	Small intestine
Capillaria columbae	Small intestine
Capillaria longicollis	Small intestine
Capillaria contorula	Crop
Oxyspirura mansoni	Eye
Tetrameres confusa	Proventriculus
Tetrameres fissispina	Proventriculus

[1] Refer to 1, 4, 6, 12, 15, 23, and 26.

[2] Known to occur in wild turkeys.

TABLE IV. ACANTHOCEPHALANS FOUND IN TURKEYS

Name	Location in host
Oncicola canis[1] (larval forms)	Esophagus
Mediorhynchus grandis[2]	Small intestine
Mediorhynchus giganteus[3]	Small intestine

[1] Normally a parasite of dogs (14).

[2] Previously unreported in wild or domestic turkeys.

[3] Reported only from Africa (11).

PROCEDURE

Each hunter, when purchasing his turkey hunting license in 1958, was supplied with a plastic sack and a printed data card (Figure 1) asking for cooperation in collecting materials for this study. The card informed the hunter of the study and requested that he remove the entire digestive tract with the trachea, heart, and liver from his turkey and place them in the plastic sack with the data card. The specimens were then left at central collecting points by the hunters. (See Figure 2 for location of kills of turkeys used for study.)

The entrails were gathered from the collection points and kept frozen until studied during the summer of 1959. The intestine was cut into thirds and opened, one third at a time. The parasitic worms were removed, washed, and placed in numbered vials containing AFA fixative. A host-parasite record sheet was filled out and kept for each specimen.

The worms were removed from the AFA fixative and washed in distilled water. Some were then put into a solution of Mayer's Hemalum in distilled water for staining while others were placed directly into a mixture of 35 per cent alcohol and Semichon's Acid Carmine for staining. All were subsequently removed from both stains and placed in 35 per cent alcohol and then in an ascending series to 70 per cent acid alcohol where they were destained. After destaining, they were placed in 70 per cent alcohol and carried up to absolute alcohol until finally cleared in a mixture of 1/2 absolute alcohol and 1/2 xylol and lastly pure xylol. The worms were then mounted on slides with Permount.

Attn: Turkey License Holders

South Dakota State College and the Department of Game, Fish and Parks are interested in a study of the parasites of wild turkey. It will be greatly appreciated if you will place the entrails (complete digestive tract, including gullet, crop, stomach, gizzard, small and large intestines with caeca; also heart and liver if you do not want them, and trachea or windpipe) in the plastic bag furnished and leave it at one of the following places:

a check station; any member of the Game, Fish and Parks Department; the Big Game Office at 216 Main, Rapid City; the Federal Fish Hatchery at Spearfish; the Cleghorn Springs State Fish Hatchery at Rapid City; and locker plant designated on enclosed card.

Please fill in the blanks on the opposite side in pencil and place this card inside the plastic bag. Thank you.

Name of hunter_____

Address_____

Locality where turkey killed_____

Weight of bird, if known_____

Sex of bird, if known_____

Date_____

Figure 1. Illustration of both sides of hunter information card.

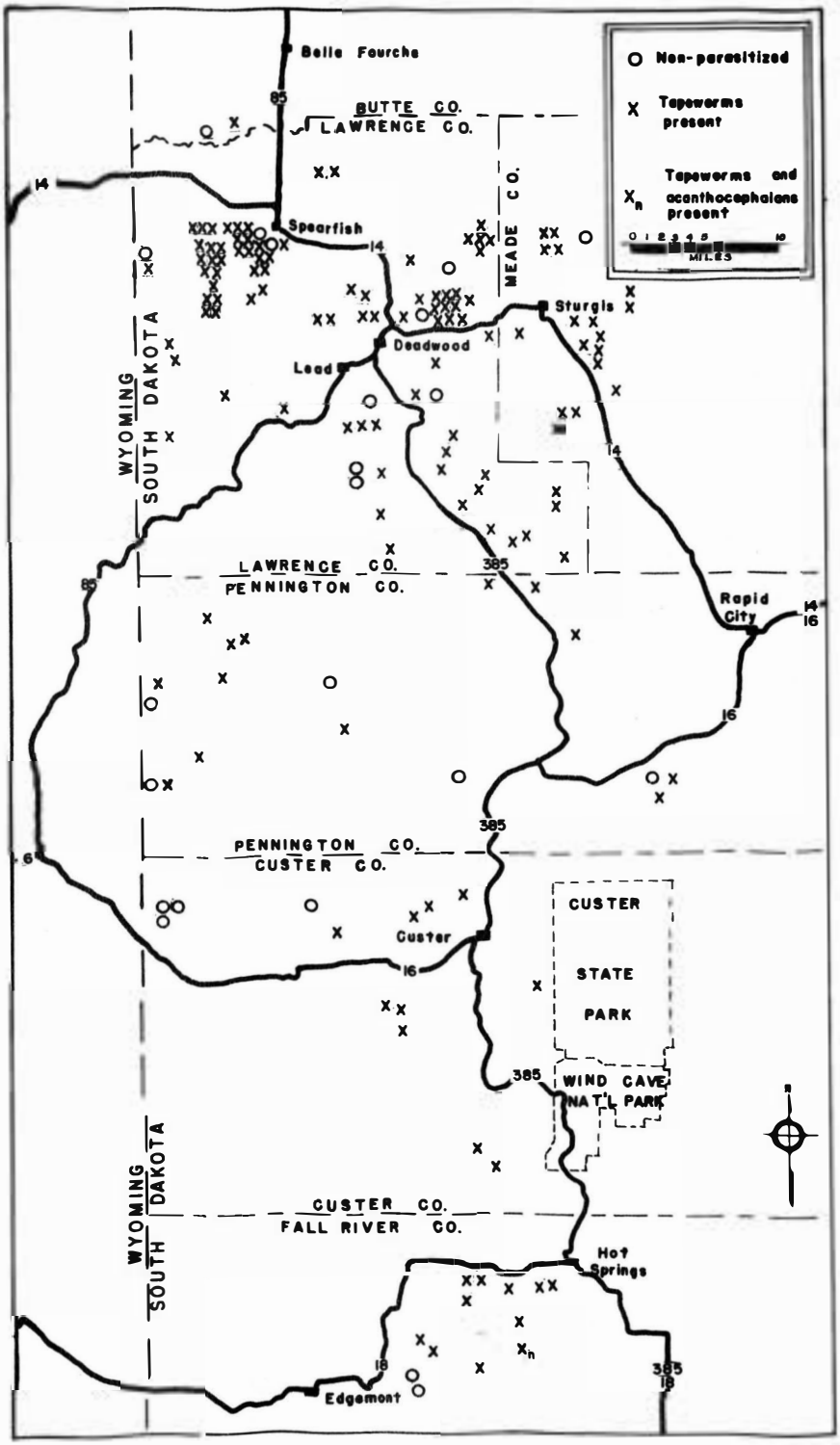

Figure 2. Black Hills localities from which wild turkey entrails were collected for study.

HELMINTHS FOUND IN WILD TURKEYS OF SOUTH DAKOTA

Cestodes

Using the publications of Morgan and Hawkins (12), Wardle and McLeod (22), and Yamaguti (25) as guides, the tapeworms found in this study were identified as Metroliasthes lucida, Raillietina cesticillus, plus one other that can only be keyed to the family Dilepididae.

M. lucida (Figure 6) was first described by Ransom from specimens taken from a domestic turkey near Lincoln, Nebraska (16). The mature worms are about 20 cm. long and up to 2.5 mm. wide. The scolex is 700 to 750 microns wide. There is no rostellum nor hooks on the scolex. The four prominent round suckers are well developed. Genital pores are irregularly alternate and are located laterally near the middle of the segment. In gravid proglottids, however, the genital pores are posterior to the middle of the segment. The cirrus pouch is cylindrical and about 400 microns long. It is armed with long spines which form a dark central region in the pouch. Testes number 20 to 40 in each segment. The fully developed uterus appears as two fused sacs lying adjacent in the posterior portion of the segment. The ovary is approximately in the middle of the segment, just anterior to the testes; its anterior border is lobed and its posterior border concave. The paruterine organ is a conical fibrous structure anterior to the uterus; it functions as a heavy-walled egg capsule. The worm is somewhat transparent the entire length, but much more so in the posterior proglottids. The paruterine organ in fresh gravid segments appears as an opaque white or yellowish mass (8, 12, 16).

Metroliasthes lucida is in the order Cyclophyllidea, family Dilepididae, and subfamily Paruterininae. The family Dilepididae is parasitic in birds and mammals, but rarely in reptiles. It is characterized by having four suckers, which may or may not be armed, and a retractable rostellum. Rarely the rostellum may be lacking, degenerate, or unarmed in this family (22, 25).

Raillietina cesticillus (Figure 5) is a large worm measuring from 9 to 130 mm. long and 1.5 to 3 mm. wide. The scolex is 300 to 600 microns wide; the rostellum is broad and flat and is armed with 400 to 500 small hooklets, each 7 to 12 microns long. The suckers are not armed, and genital pores are irregularly alternate. There are 18 to 30 testes in each mature proglottid. Egg capsules completely fill the gravid proglottid, each capsule containing a single egg (12, 22).

R. cesticillus is in the order Cyclophyllidia, family Davaineidae, and subfamily Davaineinae. The family Davaineidae is characterized by having a retractable rostellum armed with hooks. As adults, Davaineidae are parasites of birds and mammals (22, 25).

Acanthocephalans

This study resulted in the first report of a thorny-headed worm from wild turkeys. Only one bird was infected. It harbored three female specimens of Mediorhynchus grandis Van Cleave, 1916 (family Gigantorhynchidae). According to Van Cleave (18, 19), the females of this species are 27 to 35 mm. long and the males about 8 mm. long. A recognition feature for the genus is the elongate trunk which appears to be distinctly segmented (Figure 3), in spite of the fact that one of

the characteristics of the Phylum Acanthocephala is absence of segmentation. This pseudosegmentation is due to the development of a regular pattern in the lacunar system within the integument. A further recognition feature is in the general appearance of the proboscis which is usually partially inverted and is armed with rows of large, recurved hooks anteriorly and with tiny spines posteriorly (Figure 4). In the species, Mediorhynchus grandis, the roots of the recurved hooks are unusually large and plainly visible. The massive roots distinguish this species from two other similar species, M. robustus and M. papillosus.

M. grandis has been reported from several kinds of wild birds (purple grackle, bronze grackle, crow, eastern meadowlark, red-winged blackbird, rusty blackbird) from various regions in the eastern half of the United States (15, 19).

Nematodes

It is noteworthy that no nematodes were found in the 195 sets of viscera examined. This is surprising, as nematodes are perhaps the most common worm parasites of domestic poultry. Unlike the flatworms and acanthocephalans, many nematode life cycles are direct (involving no intermediate host) and therefore become established readily in flocks of birds.

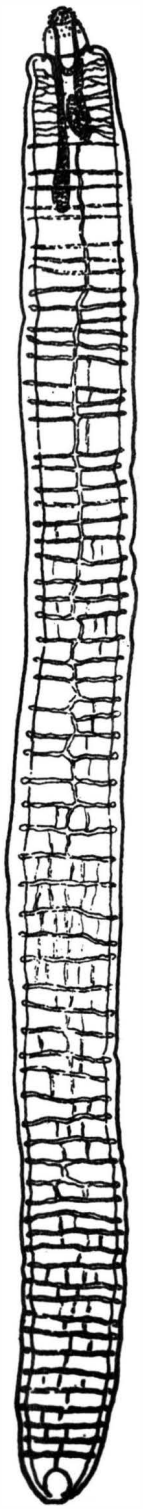

Figure 3. (left) Mediorhynchus showing pseudosegmentation due to lacunar system (After Meyer, 1933).

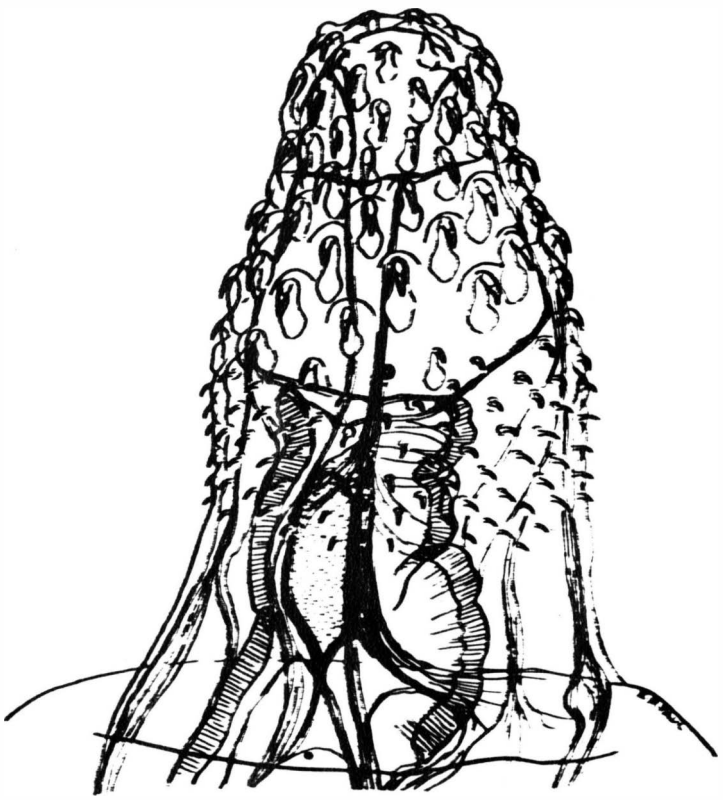

Figure 4. (above) Proboscis of Mediorhynchus grandis (After Van Cleave, 1947).

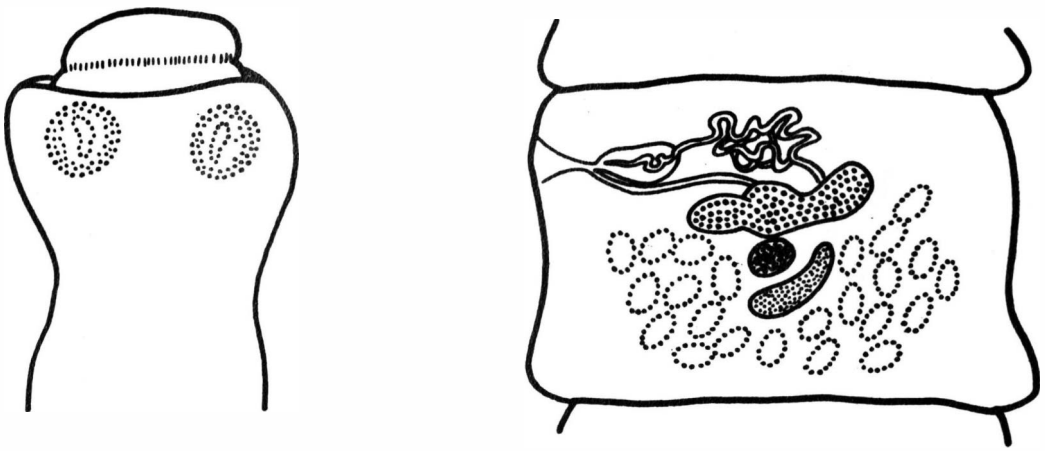

Figure 5. Scolex and mature proglottid of Raillietina cesticillus (After Morgan and Hawkins, 1949).

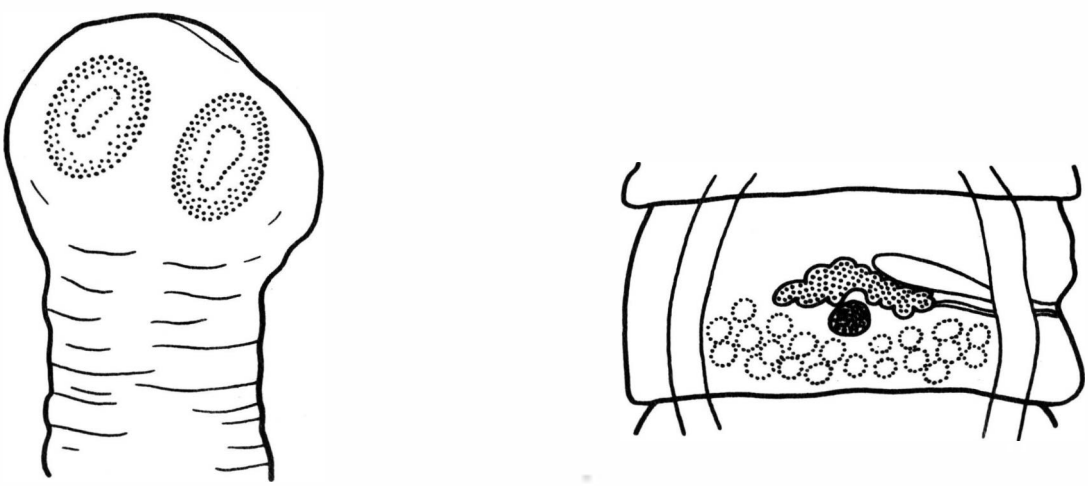

Figure 6. Scolex and mature proglottid of Metroliasthes lucida (After Morgan and Hawkins, 1949).

INCIDENCE AND DISTRIBUTION OF HELMINTHS

Only 29 entrails of the sample of 198 were not parasitized; thus 85.35 per cent of the sample contained parasites (refer to Table V). No trematode or nematode parasites were found and only in one entrail was an acanthocephalan parasite noted. The entrail containing these thorny-headed worms also contained tapeworms. Parasites were found only in the small intestines. Of the 169 parasitized viscera, 92.3 per cent, or 156 intestines, contained Metroliasthes lucida only. Six intestines contained Raillietina cesticillus only, five contained both M. lucida and R. cesticillus, while two contained an unidentified cestode only.

Figure 2 shows the general localities where turkeys were taken. The largest sample came from the northern portion of the Black Hills in the Spearfish-Sturgis area. Most of these birds were parasitized. The only locality where no parasitized birds were taken was in northwestern Custer County (Redbird Canyon and adjoining Bole's Canyon. However, only three sets of viscera were received from this locality. Not shown on Figure 2 are six birds taken in Harding County in northwestern South Dakota. Five out of the six birds taken from that locality were free of helminths. This was in the areas known as Slim Buttes and Cave Hills.

Not all turkeys in the total sample are shown on Figure 2. This is because some information cards were missing from the samples and some hunters did not give sufficient information on the card to locate the exact area where their birds were taken.

Hart (5) brings out an interesting point in his manuscript. He points out that domestic turkeys have been incorporated into the wild

flock. Farmers have reported wild gobblers enticing the domestic hens away from the farms and out into the forest with the wild flock. Most farmers in the Black Hills area have given up raising turkeys because of this.

This could have been the manner in which tapeworms were introduced into the wild birds. The incidence of tapeworms in the Black Hills area probably was endemic and maintained by domestic turkeys.

TABLE V. PARASITES OF 198 WILD TURKEYS FROM WESTERN SOUTH DAKOTA

Taxonomic group	Species of parasite	Number of turkeys infected	Per cent of total sample infected
Cestoda	Metroliasthes lucida	161	81.31%
	Raillietina cesticillus	11	5.55%
	Dilepididae sp.	2	1.01%
Acanthocephala	Mediorhynchus grandis	1	0.5%

LIFE CYCLES

Grasshoppers (*Melanoplus* spp., *Chorthippus curtipennus*, *Paroxya clavuliger*, and *Schistocerca damnifica*) have been reported as suitable hosts for the development of the cysticercoids of the tapeworm, *Metroliasthes lucida*. The hatched tapeworm embryos were noticed in the grasshopper's digestive tract as soon as two hours after the grasshopper had been fed a gravid segment of *M. lucida*. However, the time needed for development of the infective cysticercoid in the intermediate host varied from 15 days in summer to six weeks or more during the winter months. After turkeys had been fed infected grasshoppers experimentally, about three weeks were required for adult worms to develop (8, 12).

Ground and dung beetles serve as intermediate hosts for *Raillietina cesticillus*. These include the following genera: *Discoderus*, *Pterostichus*, *Agonoderus*, *Anisodactylus*, *Stenolophus*, *Aphodius*, *Alphitobius*, *Amara*, *Anisotarsus*, *Chlaenius*, *Harpalus*, *Anaferonis*, and *Tribolium*. Within three or four weeks after the beetles have ingested the tapeworm eggs, infective cysticercoids have developed. After the beetle is ingested by the turkey, development of the adult worm requires two or three weeks (12).

Professor (emeritus) H. C. Severin of the Entomology-Zoology Department at South Dakota State College informed the author that grasshoppers of the genus *Melanoplus* are common in the Black Hills area and that *Chorthippus curtipennus* is also present. Grasshoppers taken from the turkey crops collected for this study were identified by him as *Melanoplus* sp. Beetles taken from the crop of one of the specimens were

identified by him as belonging to the genus Aphodius.

Edminster (2) indicated that as much as five per cent of the diet of wild turkeys may be made up of grasshoppers during the fall months. The percentage may go higher than that in the summer.

Information from Mr. William Hantsbarger, Extension Entomologist at South Dakota State College, indicates that in 1958, a serious infestation of migratory grasshoppers (Melanoplus bilituratus) existed in the Black Hills area. Infestation was so high that spraying was done to reduce grasshopper numbers between Rapid City and Sturgis, and also between Sturgis and Spearfish. Infestation was also high throughout much of the remaining sections of the Black Hills area. At the same time, the incidence of grasshoppers in Harding County, where most of the samples were unparasitized, was low.

So it can be said that the intermediate hosts for the two most prevalent species of tapeworms found in Black Hills turkeys are present. However, since no attempt was made to locate cysticeroids in grasshoppers or other insects from the Black Hills region, it can not be stated definitely that the turkeys are picking up the parasites by eating these particular insects.

The acanthocephalans of the species found in this study also may use grasshoppers as an intermediate host. The grasshopper species Chortophaga viridifasciata australior, Orphuella pelidna, and Arphia lutiola have been shown in experimental infections as the arthropod intermediate host of Mediorhynchus grandis (20). Professor Severin informed the author that C. viridifasciata, O. pelidna, and Arphia spp.

are present in the Black Hills. *M. grandis* lives normally in the intestine of crows (*Corvus brachyrhynchos*), meadow larks (*Sturnella magna*), and grackles (*Quiscalus quiscula*). Turkeys on open range frequented by crows, grackles, or meadow larks might become infected by eating grasshoppers carrying the larvae of *M. grandis* (19, 20).

EFFECTS OF HELMINTH INFECTION

Raillietina cesticillus is reported by Morgan and Hawkins (12) as probably the least pathogenic of the common tapeworms of turkeys. There are few, if any, symptoms noticed in lightly infected birds. There may be some retardation of growth rate in heavily infected birds. The digestive tract may appear considerably thickened. In severe cases there may be a catarrhal enteritis along with congestion and hemorrhage. Often there is a heavy mucus coating over the mucosa. Microscopically it is possible to note capillary congestion and lymphocytic and polymorphonuclear infiltration in the villi around the crypt occupied by the scolex of the worm. There is moderate increase of epithelial cells and areas of fibrosis.

Little is known of the possible effects of Metroliasthes lucida. Morgan and Hawkins (12) suggest that probably the effects are much the same as from Raillietina cesticillus. Edminster (2) states that Metroliasthes and Raillietina spp. rarely cause serious illness in wild turkeys.

Regarding the pathogenicity of acanthocephalans, Ward (21) states that the spiny proboscis causes considerable mechanical damage to the intestine of the host. Furthermore, this damage offers opportunities for secondary bacterial invasion.

Control of Infection

Tapeworm infection can be reduced or eliminated only by getting rid of the intermediate host of the parasite. Drugs are not practical,

even in domestic flocks (4, 6, 15). The same would be true for acanthocephalans. In the wild flocks, there appears to be no feasible or economical way of eliminating the arthropod intermediate hosts of tapeworms and acanthocephalans.

SUMMARY AND CONCLUSIONS

Of the total of 198 viscera collected, 85.35 per cent contained parasites. Cestodes are the most common endoparasites infecting the wild turkey flock in South Dakota's Black Hills. No trematodes or nematodes were found during this study. In only one turkey entrail was an acanthocephalan found. Metroliasthes lucida was the most common tapeworm, followed by Raillietina cesticillus. One unidentified cestode was found.

The acanthocephalan, Mediorhynchus grandis, has not previously been reported from turkeys. Possibly, more work should be done regarding the extent of infection by this parasite in the wild turkey flock.

The intermediate hosts for all the parasites noted in this study are probably grasshoppers and beetles. Most of the species that have served experimentally in the laboratory as intermediate hosts for the parasites found in this study are known to occur in the Black Hills region. More work could be done in this area by examining grasshoppers from the Black Hills for evidence of tapeworm cysticercoids or acanthocephalan larvae.

There are no feasible or economical methods by which tapeworm infections of wild flocks can be controlled. Any control methods would have to involve reducing the numbers of grasshoppers to very low population levels. This does not seem practical.

More information could be gathered on this problem if it were possible to obtain turkey entrails during various seasons of the year. In that way a more complete analysis of the progress of infection could

be made. Also it would be desirable to obtain fresh specimens. The inability to identify one of the cestodes can partly be laid to its poor state of preservation. Some of the entrails began to deteriorate before they could be frozen.

Since Metroliasthes lucida and Raillietina cesticillus are probably the least pathogenic of any of the turkey tapeworms, and since infection by them apparently produces no noticeable symptoms in turkeys, there should be no cause for alarm unless the turkeys become very heavily infected.

If the incidence of acanthocephalan infection becomes heavy it may be of some concern because of the mechanical damage to the intestine, with the possibility of secondary bacterial infection.

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