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Helminth Parasites of Rails and Host-Parasite Relationships of the Trematode *Protechinostoma mucronisertulatum*[1]

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Abstract. In a survey of 15 soras (*Porzana carolina*) and 31 Virginia rails (*Rallus limicola*) collected in Iowa during May-September 1963, *Protechinostoma mucronisertulatum* was the most frequently encountered trematode of the sora. It does not occur in the Virginia rail. Experimentally-developed metacercariae and adults were obtained and host-parasite relationships studied with special reference to annual incidence of infection in snails. Additional helminths of the sora and the Virginia rail include several representing new host records.

Stagnicola reflexa (Say), a very commonly encountered pond snail in the vicinity of the Iowa Lakeside Laboratory in northwest Iowa, harbors cercariae and metacercariae of an echinostome species heretofore not known from the region. Metacercariae of the species occur as well in other snails (*Helisoma* spp. *Physa* spp., and *Lymnaea stagnalis*). Despite extensive collections of birds and mammals carried on in the region for almost a decade, no record could be found of any trematode whose life cycle included such cercariae or metacercariae.

Collections of infected *S. reflexa* were made between July 1962 and July 1963. Of approximately 1100 snails collected, 150 (13%) were infected with these cercariae. In the laboratory, adult worms were successfully reared in white mice which had been fed experimentally developed metacercariae. These adult worms were subsequently identified as *Protechinostoma mucronisertulatum* Beaver 1943, a species parasitizing the sora [*Porzana carolina* (*Linnaeus*)], an inconspicuous marsh dweller.

The purpose of this study is to contribute information on host-parasite relationships of *P. mucronisertulatum* and to report on additional helminths occurring in the sora and in a related species, the Virginia rail (*Rallus limicola* Vieillot).

REVIEW OF LITERATURE

Several accounts of echinostome cercariae from *Stagnicola* spp. appear in helminthological literature. Cort (1915), for example, described large echinostome cercariae from *S. reflexa* collected near Chicago, Illinois, and named them *Cercaria reflexae*. Sewell in 1922 believed Cort's species to be a larval stage of a member of the genus *Himasthla*. Feldman (1941) recovered cercariae from *S. reflexa* near Edina, Minnesota, and con-

[1] This study was supported in part by a research grant (G 23597) from the National Science Foundation

sidered them identical to *C. reflexae* of Cort, but stated that Sewell was in error in assuming *C. reflexae* and the cercariae of *Himathla militaris* to be closely related. Feldman, using snails naturally infected with *C. reflexae,* was able to obtain adult worms by feeding metacercariae to laboratory-reared chicks. He considered the adults so obtained as belonging to the family Psilostomidae, and named the species *Psilostomum reflexae* (presumably the adult stage of *C. reflexae*). Redial and cercarial stages which Feldman described were not experimentally reared, however, but were described from natural infections. Feldman supposed the natural host for the fluke to be a snail-eating bird.

Price (1942) disagreed with Feldman's inclusion of *P. reflexae* in the genus *Psilostomum* because this species possesses two rows of collar spines and a long, slender esophagus, neither feature being characteristic of the genotype *P. playurum* (Mühling) [= *P. brevicolle* (Creplin)].

Beaver (1943) reported finding large echinostome cercariae in *Stagnicola palustris elodes* (Say) near Black Creek, Wisconsin He successfully cultured the adult in laboratory-reared albino mice and reported finding a similar trematode in a sora. Beaver considered these flukes identical to *Psilostomum reflexae* Feldman, 1941. Because of the crown of spines possessed by this species, however, Beaver contended it could not be a member of the genus *Psilostomum* but should more properly be placed in the family Echinostomatidae. For this species he erected a new genus. *Protechinostoma,* and named his experimentally reared trematodes (and those from the sora) *Protechinostoma mucronisertulatum.* He felt there was no justification for Feldman's considering the cercaria of the latter to be identical to *C. reflexae* Cort because of differences in size and spination. Beaver contributed additional data on the redial, cercarial, metacercarial and adult stages of *P. mucronisertulatum.* He demonstrated that the collar of this trematode possesses a weakly developed crown of spines and considered the genus as intermediary between the least specialized of the true echinostomes and the rather numerous echinostome-like genera (including some psilostomes) in which a distinct collar with a ventrally interrupted crown of spines is lacking. Since the time of Beaver's report, no additional adult species of the genus have been described. However, Brooks (1943), studying larval trematodes collected from the Lake Okoboji region in 1940-42, described what appears to be a very similar cercaria which is named *Cercaria ornatocauda.* His published figure (1943), however, includes no flame cells, so critical comparisons of the two species are difficult.

Very little data concerning helminths of the sora and the Virginia rail occur in helminthological literature. Previous accounts of parasites of these birds appear to be limited to studies on flukes. According to Dr. Allen McIntosh[2], Smith (1908) reported finding *Cyclocoelum mutabile* (=*Monostoma mutabile* Zeder, 1800) in the liver of the sora. McIntosh (1927) described *Leucochloridium sorae*, now known to be *Neoleucochloridum problematicum* (Magath, 1920) Kagan, 1951, in the sora. Kagan (1951, 1952a) successfully reared adults of *N. problematicum* in a sora and in a Virginia rail (both laboratory-reared). Harwood (1939) reported *Notocotyle porzanae* from the colic ceca of the sora. Lumsden and Zischke (1963) reported finding a dicrocoeliid, *Eurytrema lubens*, in the gall bladder of the sora.

Additional reports concerning parasites of the sora and the Virginia rail are presented in this study.

A preliminary report concerning this work was published by Redington and Ulmer (1964).

Materials and Methods

Rails were collected by shooting and trapping. Most rails were captured in a specially constructed live trap described in a later section of this report.

Helminths taken from definitive hosts were fixed in hot A.F.A., stained in Mayer's paracarmine, counterstained in fast green, cleared in methyl salicylate and mounted in a synthetic resin.

Eggs of *P. mucronisertulatum* were recovered by teasing apart adult worms. These eggs were placed in previously aerated water which was changed daily; small amounts of terramycin were added to control bacterial growth.

Living cercariae and those fixed in hot 10% formalin (or heat-killed) were studied. Aqueous Nile blue sulfate and neutral red facilitated study of the excretory system.

Fully developed metacercariae were obtained by exposing laboratory-reared *L. stagnalis* and *S. reflexa* to cercariae of *P. mucronisertulatum* for three days. Metacercariae recovered from the mantle cavity were then force-fed to experimental definitive hosts (chickens, ducks, mice and pigeons).

Notes on Life Cycle Stages of *Protechinostoma mucronisertulatum*

During the course of this study, attempts were made to recover eggs of *P. mucronisertulatum* by checking fecal samples of lab-

[2] Dr. Allen McIntosh, United States Department of Agriculture, Agricultural Research Service, Animal Disease and Parasite Research Division, Beltsville, Md. Data concerning *Monostoma mutabile*. Private communication. 1965.

oratory infected albino mice and chicks. Because of the small number of worms harbored by such experimental hosts and the relatively few eggs present per worm (never more than 10), this method of egg collection was abandoned. Attempts were then made to recover eggs by teasing apart gravid worms, placing intra-uterine eggs in water and checking such cultures periodically for miracidia. When naturally infected soras became available, additional eggs were removed from gravid worms and were cultured. Unfortunately, only a few of these eggs developed to early miracidial stages, due to bacterial and fungal contamination.

Cercariae from naturally infected snails were carefully studied, and data on their morphology corresponded closely to those published by Feldman (1941) and Beaver (1943). Cercarial emergence is induced by increasing light intensity; cercariae begin to emerge by 9 or 10 AM, greatest numbers appearing during the early afternoon hours. Cercariae swim actively for approximately 12 hours, then settle to the bottom of the container, where they move about in leech-like fashion. No indication that cercariae are either positvely or negatively phototactic could be discerned.

Beaver reported finding as many as 40 metacercariae of *P. mucronisertulatum* in various species of pulmonate snails (*Stagnicola palustris, Lymnaea stagnalis, Physa* spp., *Helisoma trivolvis,* and *Fossaria* sp.) collected from sloughs where cercarial infections were known to occur. However, in our observations of *L. stagnalis* taken from one locality (Jemmerson Slough, 1962) of cercarial infection as many as 200 metacercariae were found within the mantle chamber of some specimens. Furthermore, after laboratory-reared *L. stagnalis* were exposed to cercariae from naturally infected S. *reflexae,* the former were found to contain comparable numbers of metacercariae. Occasionally, such snails died before their contained metacercariae (over 250) were fully developed. Such high numbers of metacercariae may have contributed directly or indirectly to the death of the snails.

The large number of metacercariae found within snail hosts appears to be directly related to the percentage of cercarial infection in that area. During the period that *L. stagnalis* were examined for metacercariae in Jemmerson Slough in 1962, almost one of every three S. *reflexa* in the same area were shedding cercariae. Beaver's observations on the number of metacercariae per snail host probably were made in areas where the percentage of cercarial infections was considerably lower.

The availability of large numbers of laboratory-reared metacercariae made possible a series of feeding experiments for the recovery of adult *P. mucronisertulatum.* Animals fed such metacercariae included 25 mice, eight chicks, five ducks, and three pigeons.

Efforts had first been made to establish infections of adult worms in ducks and mice by using metacercariae of unknown age, but such experiments proved unsuccessful. The remaining feeding experiments made use of metacercariae (at least 4 weeks old) from laboratory-reared *L. stagnalis.*

Only a few mice and one chick were found to be infected with adult worms (8-10 days post-feeding) after exposure of these hosts to 100-150 metacercariae. The percentage of infection never exceeded 7%. These findings are in agreement with those of Feldman (1941) and Beaver (1943). Williams (1964), however, has recently reported that *Anas domestica, Turdus migratorius* and *Sturnus vulgaris* also serve as experimental definitive hosts.

Natural Infections of P. mucronisertulatum in Soras

With the knowledge that *P. mucronisertulatum* is not easily reared in the laboratory, an attempt was made to collect adult worms from their natural host, the sora, so that viable eggs could be obtained for experimental work on larval stages. Furthermore, it was felt that a survey of rails in those areas in which infected snails were abundant would aid in understanding certain aspects of the host-parasite relationships of the fluke. Rails are very elusive creatures and in the field are seen only with difficulty. For this reason, a rail trap modified somewhat from that described by Tanner (1953) was constructed.

This trap consists of two leads and a central trapping box, all constructed of chicken wire of one-inch mesh. The leads, each 40 feet long, are held upright by slender steel rods whose bases are inserted into the marsh bottom at 10 foot intervals. The leads are planted at an approximately 120-degree angle to each other, forming a wide V. A small opening (at ground level) about four inches high and two inches wide is located on that side of the box directed toward the apex of the V formed by the two leads. The trap, set near the water, usually is aligned so that a line bisecting the V is parallel to the water's edge. Bottoms of the leads are kept either under water or are firmly anchored against the marsh bottom. Because rails generally do not frequent open areas, the trap is set only in regions characterized by heavy marsh vegetation such as *Carax, Phragmites,* and *Typha.*

Two to 10 people are used to drive the rails into the trap. The drive is started on the open side of the trap about 30 to 60 yards distant. The drivers are spaced along a line extending from upland vegetation to open water, such an area constituting the normal habitat of rails. The rails, hearing the disturbance, run ahead of the drivers who walk slowly toward the trap. As the drivers approach the trap, the pace is slowed, giving rails ample time to follow the leads. Rails generally will not fly under such circumstances and, having been directed by the leads to the opening of the trapping box, enter it readily.

Eleven soras were collected (some acquired by trapping, others by shooting) from Smith's Slough (located adjacent to Trumbull Lake in Clay County, Iowa) between July 17 and September 8, 1963, and 10 were found to harbor adults of *P. mucronisertulatum*. As many as 274 adults were removed from one host. From one sora trapped at Jemmerson Slough on September 7, 176 adults of the parasite were removed. One sora was trapped at Goose Lake (Hamilton County, Iowa), another at Dan Green's Slough (in the Trumbull Lake region), and one at Jones Slough (Dickinson County), but *P. mucronisertulatum* was not found in any of these birds. The number of worms recovered per host varied from 1 to 274 (an average of 59 per bird). Most worms recovered were situated in the posterior portion of the small intestine near the colic caeca (Figs. 1 and 2). A few were found in the duodenal region. None were ever recovered, however, from the colic caeca or associated structures of the hind gut. A summary of all birds examined is presented in Table 1.

Table 1. Summary of soras examined for *Protechinostoma mucronisertulatum* infections.

Age & Sex of Host A-Adult J-Juvenile	Date of Collection	Collecting Area	No. Adults Recovered	No. Gravid Worms
A Male	5- 3-63	Dan Green's Slough	0	0
A Female	5- 9-63	Goose Lake	0	0
J Male	9- 7-63	Jemmerson Slough	176	55
A Male	7-22-63	Jones Slough	0	0
J Male	7-17-63	Smith's Slough	109	0
J Male	7-29-63	Smith's Slough	8	0
J Male	7-31-63	Smith's Slough	107	34
J Female	8- 1-63	Smith's Slough	3	0
J Female	8- 5-63	Smith's Slough	9	0
J Female	8- 6-63	Smith's Slough	167	23
A Male	8- 6-63	Smith's Slough	274	27
A Male	8-14-63	Smith's Slough	0	0
J Male	8-18-63	Smith's Slough	37	0
J Male	8-19-63	Smith's Slough	1	1
J Male	9- 8-63	Smith's Slough	1	1

In addition to the soras indicated above, metacercariae and immature adults of *P. mucronisertulatum* were found in three specimens of blue-winged teal (*Anas discors*) taken in July, 1963, in the Lake Okoboji region. Most of the worms were found in the cloaca and none were attached. Such young worms showed no indications of sexual maturity and porbably are incapable of completing their development in teal.

Virginia rails are frequently found in the same areas as soras and harbor a number of helminths, some of which are also found in the sora. Virginia rails collected from the Lake Okoboji region and Smith's Slough showed no evidence of *P. mucronisertulatum* infection.

Host-Parasite Relationships

In this study, as many as 200 metacercariae of *P. mucronisertulatum* were found within the mantle chamber of naturally infected snails. Furthermore, after laboratory-reared *L. stagnalis* were exposed to cercariae from naturally infected *S. reflexa*, comparable numbers of metacercariae developed within the former species. Occasionally, such heavily infected snails died before their contained metacercariae (over 250) were fully developed. The large number of metacercariae within a single snail host is considerably greater than the maximum of 40 found by Beaver (1943) in naturally infected molluscs and appears to be directly related to the percentage of snails harboring cercarial infections. Approximately one of every three *S. reflexa* examined for metacercariae in Jemmerson Slough in 1962 was shedding cercariae of *P. mucronisertulatum.*

Infections of *P. mucronisertulatum* in snails are dependent principally upon the periodic presence of soras infected with adult worms. The degree of snail infection is highly variable and collections made during successive years may show pronounced differences. The following account of two locations (Jemmerson Slough in Dickinson Dounty and Smith's Slough near Trumbull Lake in Clay County) demonstrates how the presence or absence of soras is directly associated with wide fluctuations of *P. mucronisertulatum* infections in *S. reflexa*.

In early May, 1963, only one sora was seen at Jemmerson Slough near the location of collections taken for the survey of snail infections in that area (Table 2). However, by late May it apparently had left and no more soras were seen or heard in that area until mid-August. During the spring of 1963, two distinct generations of *S. reflexa* were present in the same area of Jemmerson Slough. Older snails included those having matured by late fall of 1962, and having overwintered until the following spring. A smaller, younger, immature generation included individuals which probably hatched either in later summer or autumn of 1962 and which had also overwintered. These two generations could be easily differentiated from one another on the basis of size. Redial, cercarial and metacercarial stages of the parasite were present only in larger snails collected in the spring and early summer of 1963. As indicated in Table 2, cercarial stages had been abundant during the summer and fall of the previous year (1962). However, only metacercarial stages occurred in the younger generation of snails during spring and summer of 1963. The absence of redial and cercarial stages in these younger snails, then, may be accounted for by the lack of soras in that area during the spring of 1963.

Table 2. Natural infections of *P. mucronisertulatum* cercariae in *Stagnicola reflexa* collected in Jemmerson Slough, Dickinson County, Iowa.

Date of collection	No. of *S. reflexa* collected	No. snails Infected	% infecton
7-23-62	40	8	20
8- 4-62	33	8	24
8-13-62	55	16	29
8-24-62	63	5	8
8-29-62	63	8	13
9-15-62	111	16	14
10-25-62	214	7	3
11-23-62	106	15	14
4-11-63	73	9	12
4-13-63	99	30	30
5- 4-63	60	11	18
5-30-63	55	7	13
6-26-63	70	8	11
7- 6-63	54	2	4
8- 5-63	60	0	0
8-27-63	60	0	0
9-14-63	50	0	0

The older generation of snails began dying in large numbers in early June, 1963, and no evidence of living ones could be seen by mid-July. All collections made on and previous to July 6, 1963 (Table 2) represent snails of the older generation. The last three entries indicated on the table represent younger snails, none of which harbored cercarial infections. Although all snails in these last collections were observed for emerging cercariae and were afterwards dissected for earlier stages, neither cercariae nor young redial infections were found. Metacercariae of *P. mucronisertulatum,* however, occurred in 60% of them, such metacercariae having been acquired from cercarial infections of older snails.

Snails were also collected in 1963 in an area of Smith's Slough (Clay County) where soras had been heard all summer, had been captured, and had been found to harbor *P. mucronisertulatum.* One such collection taken August 8, 1963 consisted of 40 immature and two older snails. The latter were shedding cercariae, but young snails showed no evidence of emerging cercariae. One young snail when crushed, however, contained a young daughter redial infection of *P. mucronisertulatum.* Apparently, then, the presence of infected snails is directly related to the presence of infected soras. The two areas studied are essentially similar in their molluscan fauna. The absence of infected snails in one area (Jemmerson Slough) and their presence in another (Smith's Slough) at precisely the same time of year (August), together with the observation that soras frequented only the latter area and were absent from the former, probably explains the varying distribution of the parasite.

Survey of Intestinal Helminths of the Sora and the Virginia Rail

Our knowledge of the helminth fauna of soras and Virginia rails is very scanty. In addition to *Protechinostoma mucronisertulatum* in the intestine of the sora, other helminths were encountered during the examination of these birds collected in nature, some of which have not been previously reported for this avian species. Virginia rails inhabit areas generally similar to those of the sora and during trapping operations were frequently taken with them. The survey reported below includes accounts of additional host records for helminths parasitizing this species.

Only the intestinal tract and associated structures of soras and Virginia rails were available for examination during this study, because other portions of the bodies were utilized in a concurrent ecological study of these birds. Those portions of the viscera examined for helminths included the liver, gall bladder and associated ducts, pancreas and pancreatic ducts, small and large intestine, colic ceca, bursa Fabricii, cloaca, and mesenteries.

Despite the presence of large numbers of helminths in some hosts, e.g., up to 274 *P. mucronisertulatum* in one sora, infected hosts demonstrated no apparent ill effects as a result of their helminth burden.

Fifteen soras (10 juveniles and 5 adults) and 31 Virginia rails (11 juveniles and 20 adults) were collected from Clay, Dickinson, and Hamilton Counties from May to September, 1963. A summary of helminths recovered from these hosts appears in Table 3.

Brachylecithum sp.

Numerous flukes recovered from the bile ducts of two Virginia rails in July, 1963, were identified as members of the genus *Brachylecithum* Strom, 1940 (*Lyperosomum* Looss, 1899 *partim*), according to the keys of Yamaguti (1958). Criteria presently used in identifying species within the genus are not reliable due to their extreme morphological variability. The worms found

Table 3. Summary of helminths recovered from the sora (*Porzana carolina*) and Virginia rail (*Rallus limicola*).

Species of helminth	No. birds infected	No. helminths recovered per bird	Location of parasites
Sora (*Porzana carolina*)			
**Corynosoma constrictum*	3	1-4	small intestine
**Echinoparyphium flexum*	10	1-34	small intestine
Neoleucochloridium problematicum	6	1-16	bursa Fabricii
Notocotylus porzanae	5	1-3	colic ceca
Protechinostomum mucronisertulatum	11	1-274	small intestine
**Zonorchis sp.*	1	1	bile duct
Unidentified immature cestode	1	20	small intestine
Unidentified nematode	9	1-41	small intestine
Virginia rail (*Rallus limicola*)			
**Aploparaksis* sp.	1	1	small intestine
**Brachylecithum* sp.	2	1-66	bile duct
**Corynosoma constrictum*	2	1-3	small intestine
**Diplostomum* sp.	2	2-8	small intestine
**Echinoparyphium flexum*	15	1-36	small intestine
**Notocotylus porzanae*	17	1-16	colic ceca
**Ophthalmophagus singularis*	1	1	air sac (?)
Unidentified diplostomula	1	numerous	mesenteries
Unidentified immature cestode	8	1-6	small intestine colic ceca, cloaca
Unidentified nematode	5	1	small intestine

* new host records

in rails varied markedly in relationships of length and width, in the anterior fusion of vitellaria, in position of the genital pore, and in size and shape of gonads. Baer (1957), aware of numerous variations relative to dicrocoeliids in general, has placed into synonomy many genera in an attempt to simplify the taxonomy of the group until more reliable criteria for identification are established. Thus, it seems advisable at this time to designate the dicrocoeliids fround in rails merely as *Brachylecithum* sp. The presence of a member of this genus in a Virginia rail constitutes a new host record.

Diplostomum sp.

Several specimens of a strigeoid belonging to the genus *Diplostomum* von Nordmann, 1832, were recovered from the small intestine of two Virginia rails. Due to the small number of specimens collected, only one of which was gravid, precise identification was not possible. No record was found of any previous account of worms of this genus in the Virginia rail.

Echinoparyphium flexum (Linton, 1892) Dietz, 1910

Echinostomes identified as members of the genus *Echinoparyphium* Dietz, 1909, were recovered from the small intestine of 15 Virginia rails and 10 soras (1 to 36 per host) from May to September, 1963. The specimens recovered most closely resemble *Echinopharyphium flexum* (Linton, 1892) Dietz, 1910. The sora and the Virginia rail have not been previously listed as hosts for this echinostome.

Neoleucochloridium problematicum (Magath, 1920) Kagan 1951.

This species of brachylaimatid occurs in the cloaca of birds of the family Rallidae. A. McIntosh (1927) first described the adult which was recovered from the intestine of a sora in Minnesota. Broodsacs, presumably of this species, were reported by L. McIntosh (1948) from succineid snails (*Oxyloma retusa*) collected at Silver Lake, Dickinson County, in northwest Iowa. A complete account of the life cycle was presented by Kagan (1951, 1952a,b.) who successfully reared adults of *N. problematicum* in a laboratory-reared sora and Virginia rail. Specimens of *N. leucochloridium* collected in the present study varied in number from 1 to 16 per host.

Harwood (1939) recovered notocotylids from the colic ceca of a sora in Tennessee in 1934, and established the species, *N. porzanae.* Additional descriptive material relating to this species was presented by Dubois (1951). In the present study, *N. porzanae* was found in five soras and 17 Virginia rails between May and September, 1963, The presence of this notocotylid in the Virginia rail constitutes a new host record.

Ophthalmophagus singularis Stossich, 1902

According to Dollfus (1948) and Dubois (1959) the cyclocoelid *Ophthalmophagus singularis* Stossich 1902, has been reported from the orbital cavity of *Porzana pusilla* by Stossich in 1902, and by Kossack in 1911, and in the nasal fossa of the water rail (*Rallus aquaticus*) by Witenberg in 1926. The latter named this species *O. nasicola,* which has since been considered a synonym of *O. singularis* by Dubois (1959). The cyclocoelid recovered from a Virginia rail in the present study corresponds closely to the species description of *O. singularis* Stossich 1902, as given by Dubois (1959). It was recovered from body washings, but its precise location within the host is unknown. The recovery of *O. singularis* from the Virginia rail constitutes a new host record for the species.

Zonorchis sp.

One gravid dicrocoelid fluke was recovered from the bile duct of a sora taken at Goose Lake, Hamilton County, in May, 1963. According to keys of Yamaguti (1958), the worm is of the genus *Zonorchis* Travassos, 1944. Further attempts to identify the specimen, however, were not made due to the availability of only one specimen and the apparent morphological variations occurring within existing species. Comparison of the single worm recovered with descriptive accounts presented by Travassos (1944) and others suggests that a critical review of this genus is needed.

Reference to the literature indicates that heretofore *Zonorchis* has not been recovered from the sora.

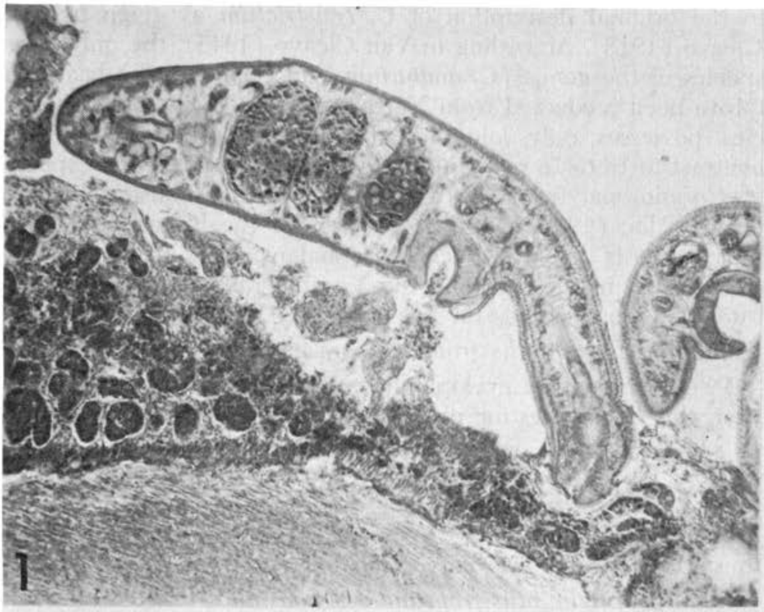
Aploparaksis (*Haploparaxis*) sp.

One gravid tapeworm (displaying only one testis per segment) recovered from a Virginia rail in July, 1963, was identified as a member of the genus *Aploparaxis* (*Haploparaxis*) Clerc, 1903, according to the keys of Yamagui (1958). Further examination of the cestode revealed the presence of a spinose cirrus characteristic of only a few members of this genus in avian hosts. According to Schiller (1951), six of the 25 avian species of this genus known at that time possess a spinose cirrus. These include: *Aploparaxis fuliginosa* Solowiow, 1911, from the tufted duck (*Aythya fuligula*); *A. veitchi* Baylis, 1934, from the Australian grey teal (*Anas gibberifrons gracilis*); *A. clerci* (*pseudofilum*) Yamaguti, 1935 and *A. scolopacis* (*crassirostris*) Yamaguti, 1935, from the European woodcock (*Scolopax rusticola*); *A. xemae* Schiller 1951, from Sabine's gull (*Xema sabini*); and *A. galli* Rausch, 1951, from the ptarmigan (*Lagopus* spp.). In the same publication, Schiller added to the list a new species, *A. rissae* from he Pacific kittiwake (*Rissa tridactyla*). A thorough search of the literature revealed that since Schiller's 1951 paper, three additional species of *Aploparaxis* possessing a spinose cirrus have been recovered from bids. These are: *A. polystictae* from Steller's eider (*Polysticta stelleri*) by Schiller (1955); and *A schilleri* and *A. rauschi* from the red-backed sandpiper (*Erolia alpina pacifica*) by Webster (1955).

Comparison of the tapeworm from the Virginia rail with published descriptions of the 10 species displaying the spinose cirrus reveals that it does not resemble any of them and probably represents a new species. However, due to lack of sufficient specimens (only one complete worm lacking rostellar hooks was recovered), it seems advisable to indicate the parasite merely as *Aploparaksis* sp.. The recovery of a member of this genus in the Virginia rail constitutes a new host record.

Corynosoma constrictum Van Cleave, 1918

Linton (1892) reported the recovery of two acanthocephalans (from the intestine of an American scoter (*Oidemia americana*) on Yellowstone Lake, Wyoming), which he identified as *Echinorhynchus striatus* Goeze, a species previously found only in European water birds. Van Cleave (1918) re-examined Linton's specimens and placed them in the genus *Corynsoma* Lühe, 1904, considering them as a new species, (*C. constrictum*). According to Machado Filho (1962,), this is one of 13 species of *Corynosoma* found in birds of the world. The specimens found in three soras and two Virginia rails in this study correspond closely



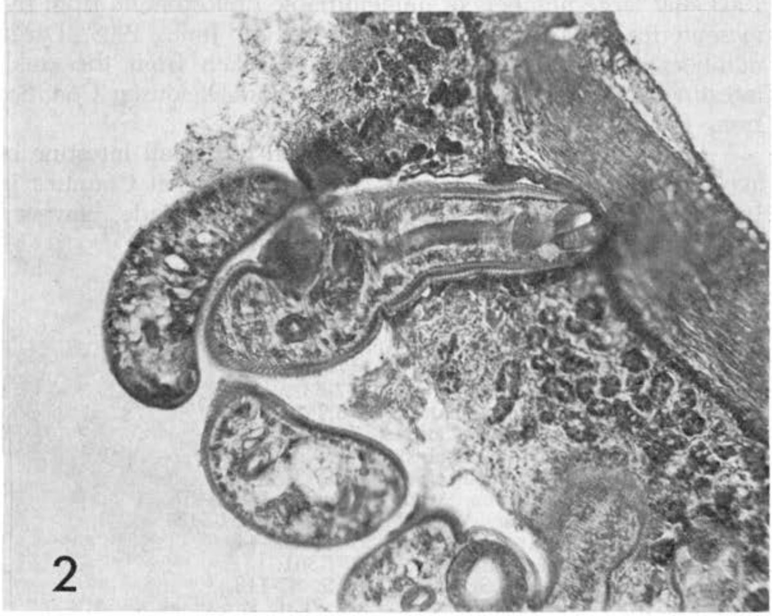


Fig. 1. Adult *P. mucronisertulatum in situ* (*small intestine of sora*). Note extensive tissue damage.

Fig. 2. Adult worm *in situ*. Note the deep penetration of the worm through the submucosa.

to the original description of *C. constrictum* as given by Van Cleave (1918). According to Van Cleave (1945), the only other species of the genus (*C. anatarium* Van Cleave 1945) has heretofore been recovered from North American birds, but this species possesses only longitudinal rows of proboscis hooks, in contrast to 16 to 18 rows in *C. constrictum.* No additional species of *Corynosoma* from North American birds are listed by Machado Filho (1962) nor does a search of the literature indicate rails as hosts for these acanthocephalans. The presence of *C. constrictum* in the sora and the Virginia rail apparently constitutes new host records for this species.

Unidentified helminths from the sora

Twenty immature cyclophyllidean tapeworms were recovered from the small intestine of one sora taken in Hamilton County on May 9, 1963.

From 1 to 41 nematodes were recovered from the small intestine of nine soras taken in Clay and Dickinson Counties from June to September, 1963. No male specimens were recovered; thus identification was very difficult.

Unidentified helminths from the Virginia rail

Numerous immature distomes were collected from the small intestine of three Virginia rails taken from Clay County in July, 1963, and large numbers of unidentifiable diplostomula from the mesenteries of a Virginia rail collected in June, 1963. Large numbers of immature tapeworms were taken from the small intestine of six Virginia rails from Clay and Dickinson Counties from June to August, 1963.

A few nematodes were recovered from the small intestine of five Virginia rails taken from Clay and Dickinson Counties in June and July, 1963. No identification could be made, however, due to the recovery of only female specimens.

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Certain Mollusks of the Environs of St. John, New Brunswick, Canada

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Abstract. This discussion is based upon a paper entitled "A REPORT TO THE PROVINCIAL DEPARTMENT OF PUBLIC HEALTH, PROVINCE OF NEW BRUNSWICK, CANADA, ON A SURVEY FOR CERTAIN MOLLUSKS OF THE ENVIRONS OF ST. JOHN, NEW BRUNSWICK, CANADA" sent to the New Brunswick Provincial Health Department in January, 1966. From this survey 17 different groups of mollusks were collected: *Acmaea testudinalis* Muller, *Amnicola limosa* Say, *Gyraulus parvus* Say, *Helisoma campanulatum* Say, *Littorina littorea* L., *Littorina saxatilis* Olivi, *Lymnaea emarginata* Say, *Lymnaea palustris* Muller, *Lymnaea sp.*, *Mya arenaria* L., *Mytilus edulis* L., *Paludestrina minuta* Totten, *Physa sayi* Toppan, *Physa sp.*, *Polinices heros* Say, *Sphaerium securis* Prime, and *Succinea avara* Say. From fresh water collections *Lymnaea palustris* Muller was the predominant species followed by *Physa sayi* Toppan and *Sphaerium securis* Prime. From marine collections *Littorina littorea* L. was the predominant species followed by *Mytilus edulis* L. Other biological notes from this survey were given. Specific acknowledgement for identification of these specimens by the staff, Natural History Branch, National Museum of Canada, Ottawa, Ontario, Canada, is cited.

This discussion is based upon a paper entitled "A REPORT TO THE PROVINCIAL DEPARTMENT OF PUBLIC HEALTH,