SOME TREMATODES OF KANSAS SNAKES.

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Plate XIX.

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INTRODUCTION.

DURING the summer of 1911, as a member of the State Biological Survey, I had the opportunity of examining a large number of snakes, frogs, turtles, fish, etc., for parasitic worms. All of the forms were more or less infested, so quite a number of worms were procured. Some of these have been studied with the object of determining the distinctive characteristics and the placing of them in their respective systematic position. Lack of time has prevented the presentation of more than three species in this paper. All three worms were found in snakes, and are new to science.

The worms were placed directly into 70 per cent alcohol. This causes a very slight shrinkage, but they stain well in any stain and clear perfectly. Borax carmine was used with best results in staining both whole mounts and sections. Hæmalum, picrocarmine and Wright's blood stain were also used with varying results. Specimens mounted in glycerine showed the various ducts very distinctly.

These worms differ in some respects, but they are so closely related that there can be no doubt they belong to the same genus. While they all differ in some minor points from the type specimen, they surely belong to the genus Renifer, characterized by Pratt as follows:

Small distomes, with body more or less elliptical and covered with minute spines or scales. Mouth subterminal; acetabulum somewhat

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larger than oral sucker, and in anterior half of body. Pharynx present; oesophagus short or wanting; intestinal cæca reach about to the middle of the body or a little past it. Excretory vesicle very large, Y-shaped, extending into the forward end of body. Genital pore in front of the acetabulum often to the left or the right of the median line. Testes two, usually lobate, in the same transverse plane near the middle of the body; cirrus-sac often long, containing a vesícula seminalis, and in front of the testes; yolk glands lateral in position and occupying the middle third of the body; Laurer's canal present; uterus composed of a descending and an ascending limb, and extending to the hinder end of the body; recep- tacula seminis absent or minute. Parasite in the mouth or air-pas- sages of snakes and in the intestines of turtles.


**Renifer megasorchis** sp. nov.

This worm was found attached to the wall of the uterus of a large *Natrix rhombifera*, a common nonpoisonous snake. It is a comparatively large worm, pinkish in color and slightly lanceolate in form. The body is widest just posterior of the middle and tapers to blunt points at both ends, but more rapidly to the posterior end. The ventral surface is flat or slightly elliptical, the dorsal surface cylindrical. In length the body measures 5 millimeters; the width at the widest point, 1.72 millimeters; thickness, .92 millimeter. The body is covered with short spines arranged in transverse rows, the spines in each row alternating with the row proximal to it. The spines are slightly longer and less numerous towards the posterior end of the body. The two suckers are sessile. The oral sucker is subterminal and measures .46 millimeter in length and .43 millimeter in width. The acetabulum is slightly larger than the oral sucker and is .48 millimeter in diameter. It is situated in the median line in the second fourth of the ventral surface.

The digestive tract consists of pharynx, oesophagus and intestinal cæca. The pharynx measures .247 millimeter in length and .226 millimeter in diameter. It is a very muscular organ, the radially disposed fibers constituting the principal part, with a very thin layer of circular fibers on the outside. The oesophagus is a small, round, straight tube, .06 millimeter in diameter and .32 millimeter long. Both the pharynx and
œsophagus are surrounded by glands. The intestinal cæca are simple tubes, without lateral projections, extending to the beginning of the last fourth of the body. The right tube is slightly longer than the left. They lie in about the same plane and follow the general body outline. They are generally round, with an average diameter of .09 millimeter.

The excretory vesicle is a Y-shaped tube, with very thin walls—so thin that it can be traced only in sections. From the small opening at the extreme posterior end of the body the tube proceeds forward, gradually growing larger till it reaches the anterior end of the testes, where it divides, each branch passing forward just inside its respective intestinal cæcum to about the posterior edge of the acetabulum. From the bifurcation the crura grow rapidly smaller and terminate as blunt points. At the widest point the vesicle measures .91 millimeter in width, while the dorsoventral diameter at the same point is only .04 millimeter. At the neck, or just inside the pore, the diameter of the thin cylindrical tube is .036 millimeter. The neck is surrounded by glands which define its limits clearly. The position of the excretory vesicle is dorsal to all the other organs except the yolk ducts.

The testes are two very large oval bodies, situated in the third fourth of the body, and nearly filling the body cavity at its widest point. The left testis is slightly in advance of the right one. They are the same size and measure .98 millimeter in length, .61 millimeter in width and .77 millimeter in thickness. The vasa efferentia arise from the anterior surface of each testis and pass forward dorsal to the uterus and to the left of the ovary to the posterior end of the cirrus-sac, where they join to form the vesicula seminalis. The vasa are very small tubes, .0098 millimeter in diameter, and can be seen only in sections. The vesicula seminalis is entirely within the cirrus-sac, nearly filling it at the posterior end. In its course it bends upon itself and is continued as a short pars prostatica. The cirrus which follows is a large, long organ, and extends through the cirrus-sac and outside the body wall a distance of .528 millimeter. Its length within the cirrus-sac is about equal to that outside the body. It measures .092 millimeter in diameter. The cirrus-sac is a large organ enclosing the cirrus, vesicula seminalis, pars prostatica and prostate glands. It measures .363 millimeter in diameter at the widest point—
the posterior end—and tapers gradually to a diameter of about .12 millimeter. The prostate glands occupy all the cavity of the cirrus-sac not taken up by the other enclosed organs.

The ovary is situated a little to the right of the median line against the dorsal body wall, just posterior the cirrus-sac. It is oval in shape, measuring .415 millimeter in length and .332 millimeter in diameter. The oviduct arises from the left dorsal surface of the ovary as a small short tube, and passes at once into the small oötype, which is surrounded by the shell gland. There is no receptaculum seminis. From the oötype a slender Laurer's canal passes slightly posteriorly to the dorsal body wall, having its external opening in the median line. The yolk glands consist of about fifty rounded bodies on each side of the body, mainly outside of the intestinal cæca, extending over about the middle third of the body. A main duct from the anterior and one from the posterior parts of each gland join to form the two transverse ducts which join in the median line to form the common yolk duct, which enters the oötype on the posterior side. On the ventral side of the oötype the uterus arises as a small tube, which soon turns posteriorly, and as it passes toward the hinder end of the body grows larger and pursues a rather serpentine course. Near the posterior end of the body the uterus turns back and passes anteriorly, dorsal to the descending limb, to a point to the left of the middle of the cirrus-sac, where it enters the metra-term. The ascending limb becomes very voluminous as it passes forward and occupies a large part of the body cavity. In younger specimens the limbs of the uterus are small and of the same diameter, but in the adult the ascending limb is many times larger, and, being filled with a dense mass of eggs, often hides many of the other structures. The egg measures .031 millimeter in length and .016 millimeter in width. The metra-term lies in the same plane as the cirrus-sac and to its left. It passes in a curved course to the genital pore, which lies in the median ventral line a short distance anterior to the acetabulum, immediately anterior to the cirrus. It is a comparatively thick-walled structure, with many folds in its inner wall. In diameter it measures .146 millimeter, and is five or six times as long.

Specific diagnosis of Renifer megasorchis: Slightly lanceolate, semicylindrical worms, 5 millimeters long, 1.72 milli-
meters wide, and .92 millimeter thick. Body covered with short spines. Oral sucker subterminal, .46 millimeter in length, .13 millimeter in width. Acetabulum sessile, .48 millimeter in diameter. Pharynx moderate; oesophagus moderately long; intestinal cæca simple, reaching to third fourth of body. Excretory vesicle Y-shaped; long, voluminous median portion; crura short and extend very little past the middle of the body. Testes two very large oval bodies; the left slightly anterior to right; behind ovary and acetabulum. Ovary immediately behind acetabulum; large and oval in shape. Uterus very voluminous; metraterm long and muscular, genital pore in front of acetabulum in median line. Egg .031 millimeter long and .016 millimeter wide. Laurer's canal small; no receptaculum seminis. Cirrus-sac large; cirrus extends .523 millimeter beyond body wall. Yolk glands lateral, occupying middle third of body. Parasite in the uterus of Natrix rhombifera.

Renifer acetabularis sp. nov.

This worm was found in the mouth of Natrix rhombifera. It is elliptical in outline, slightly concave on the ventral side, while the dorsal side is cylindrical, a cross section thus being almost a half of a sphere. In all of the specimens there was a characteristic downward bend from the acetabulum forward. In length the worm measured 1.56 millimeters, and .62 millimeter in width at the middle of the body. The thickness at this place was .151 millimeter. The body is covered with short, stiff spines. The suckers are very large and sessile. The oral sucker is subterminal in position and measures .286 millimeter in length and .241 millimeter in width. The mouth cavity occupies a little more than half of the space inclosed by the sucker. The acetabulum, a very large, round, sessile organ, is situated on the mid-ventral surface. It measures .453 millimeter in diameter.

The digestive system is made up of mouth, pharynx and two intestinal cæca. The mouth is a funnel-shaped structure, opening from the oral sucker directly into the pharynx. The pharynx measures .081 millimeter in length and .074 millimeter in diameter. The opening through the pharynx is nearly one-third of the whole diameter of the organ. The intestinal cæca branch off directly from the posterior end of the pharynx and
extend to the posterior end of the middle third of the body, almost to the testes. They are very thin-walled tubes, with many shallow outpouchings. They are about the same diameter at all points, except at the very end, where there is a slight enlargement. The average diameter is .064 millimeter.

The excretory vesicle is a Y-shaped, very voluminous organ. Beginning with a very small pore at the posterior end of the body, the vesicle extends anteriorly, suddenly becoming much larger and filling the greater part of the body cavity for a short distance. It becomes narrow to pass between the testes, but widens again, and soon bifurcates, each branch passing forward just within the intestinal caeca, and, gradually growing smaller, ends near the bifurcation of the intestinal caeca. The course is dorsal to all other organs, through the very tips of the crura pass partially ventral to the intestinal caeca. The walls are very thin, and, except a short distance at the posterior end, can be traced only in sections.

The testes are two partially lobate bodies, situated just posterior to the middle third of the body in the same transverse plane. They differ somewhat in shape, but they are approximately the same size. The shape is variable in different individuals. The average size is .144 millimeter in length and .126 millimeter in width. The *vasa efferentia* pass from the anterior end forward and join the *vesicula seminalis* separately. The last-named organ, together with the *pars prostatica* and cirrus, are enclosed in the long cirrus-sac, which begins just to the left of the median line anterior to the acetabulum and passes in a curving course to the genital pore on the left ventral surface, near the oral sucker. The cirrus-sac is .456 millimeter in length and .052 millimeter in diameter at the largest point. The *vesicula seminalis* bends on itself in the posterior end of the cirrus-sac. It is followed by a very short *pars prostatica*, which in turn is followed by the cirrus. The cirrus is small and weak.

The ovary is situated just posterior to the middle of the body and to the right of the median line. It is nearly spherical, measuring .105 millimeter long and .098 millimeter in diameter. Slightly dorsal and to the left is the shell gland surrounding the small oötype. The short oviduct joins the oötype on the anterior and the yolk duct on the posterior side. From the ventral side of the oötype the uterus proceeds pos-
teriorly in a serpentine course to near the hinder end of the body. Here it turns and passes ventral to the descending limb to the branching of the intestinal cæca, and then diagonally to the genital pore. No metraterm is developed. The eggs with which the uterus is filled are .032 millimeter long and .016 millimeter wide.

The yolk glands are a number of rounded or elongated bodies, averaging about .04 millimeter in diameter, lying in two groups on each side of the body. One group on each side lies lateral and mainly anterior to the respective testis. The other group is situated at the anterior edge of the acetabulum, mainly ventral and lateral to the intestinal cæca. There are about fifteen bodies in each group. A duct from the anterior group meets one from the posterior group and form the transverse duct on each side. These join near the ovary, and form the common yolk duct which enters the oötype.

Specific diagnosis of *Renifer acetabularis*: Elliptical, semicylindrical worms, 1.56 millimeters long and .62 millimeter wide; body covered with short spines. Suckers very large and sessile; oral sucker subterminal, .286 millimeter in length and .241 millimeter in width; acetabulum circular, .453 millimeter in diameter, and in center of ventral surface. No oesophagus; pharynx and intestinal cæca moderate; latter with many shallow outpouchings; reaches to posterior end of middle third of body. Excretory vesicle very large, Y-shaped; crura extend almost to pharynx. Testes two small, slightly lobate bodies in posterior third of body, in same transverse plane, behind ovary and acetabulum. Ovary immediately dorsal to acetabulum, nearly spherical, and moderate in size. Uterus voluminous, extends to near posterior end of body. Genital pore to left of oral sucker on ventral surface. Egg .0321 millimeter long, .0162 millimeter wide. No oötype, Laurer's canal or receptaculum seminis seen. Cirrus-sac large, encloses cirrus, *pars prostatica* and *vesicular seminalis*; yolk glands in two groups on both sides of body. Parasite in mouth of *Natrix rhombifera*.

*Renifer kansensis* sp. nov.

Several specimens of this worm were found attached in the mouth of *Ancistrodon contortrix*—the copperhead snake. It
is nearly elliptical in outline; the dorsal body is oval, the ventral flat. The body is covered with short, stiff spines, arranged somewhat regularly. The worm is 4.56 millimeters long, 1.18 millimeters wide, and .387 millimeter thick. The suckers are nearly the same size and sessile. The oral sucker is subterminal and measures .392 millimeter in length and .356 in width; the opening has a diameter of .127 millimeter. The round acetabulum is situated in the second fourth of the body. It measures .453 millimeter in diameter. The genital pore is on the ventral surface, very close to the left edge of the body, in same transverse plane as the posterior end of the pharynx. The excretory pore is at the posterior end of the body.

The digestive system is made up of the pharynx, oesophagus and intestinal caeca. The pharynx is spherical, .21 millimeter in diameter. An oesophagus .36 millimeter in length follows. It increases slightly in diameter as it passes posteriorly, and divides into the two intestinal caeca. These are simple tubes, which reach to the middle of the body. They have a diameter of .07 millimeter at the widest point. The left one is slightly longer than the right.

The excretory vesicle is long and voluminous. It has the shape of the letter Y. The median portion extends forward to the anterior end of the testes, and the crura almost reach the branching of the digestive tract. The median portion has a great number of lateral, irregular outpouchings, which posterior to the uterus nearly fill the body cavity. The walls are very thin and, even in sections, are difficult to trace. The crura, however, are more definite tubes, which are more regular in their course. They lie mainly dorsal to the intestinal caeca, and for the most part parallel. They are generally round and about half the diameter of the intestinal caeca. The position of the excretory vesicle is dorsal to the other organs.

The testes are two small lobate bodies, situated slightly posterior to the middle of the body. They are generally round, though very irregular in shape, averaging .275 millimeter in diameter. The very small vasa efferentia pass from the anterior ends of the testes forward to a point a short distance anterior to the acetabulum, where they enter the vesicula seminalis. This organ, the pars prostatica and cirrus are enclosed in the cirrus-sac. The cirrus-sac is very long, measuring about .50 millimeter in length. It lies ventral to the left intestinal
ceca, and passes diagonally to the gential pore at the left side of the body. The vesicula seminalis makes a spiral bend in the posterior end of the cirrus-sac and nearly fills that part. A short pars prostatica follows, then the cirrus continues through the cirrus-sac. The end of the cirrus protrudes a short distance.

The ovary is a small, round organ, .22 millimeter in diameter, which lies partly behind and dorsal to the acetabulum. It is dorsal in position and just to the right of the median line. The short oviduct passes toward the median line and enters the oötype, which lies in the midst of the shell gland. The shell gland lies to the left and slightly dorsal to the ovary. No receptaculum seminis or Laurer's canal are present. The yolk glands consist of about fifty small, irregular-shaped bodies on each side of the body. They are lateral and mainly ventral to the intestinal ceca, and extend over a little more than the middle third of the body. Several small ducts from each gland join to form the lateral duct, which proceeds toward the median line, where it meets its fellow. The common yolk duct thus formed passes anterior a very short distance and joins the oötype on the posterior side. The uterus is a very voluminous organ. It consists of a descending and an ascending limb, both of which have a serpentine course. The descending limb passes from the oötype along the median line to near the hinder end of the body. The ascending limb proceeds forward between the testes to the branching of the intestinal ceca, where it passes ventral to the left one to the genital pore at the left side of the body. There is no specialized metraterm. The ascending limb is several times larger than the descending, and fills about half of the body cavity behind the testes. The uterus is filled with eggs, which measure .045 millimeter by .019 millimeter.

The following is a specific diagnosis of Renifer kansensis:
Small, elongated, semicylindrical worms, 4.56 millimeters long, 1.18 millimeters wide, and .387 millimeter thick. Body covered with short spines. Oral sucker subterminal, .392 millimeter long and .356 millimeter wide. Acetabulum sessile, .453 millimeter in diameter. The pharynx is small; oesophagus moderate; intestinal ceca simple tubes, which reach to middle of body. Excretory vesicle voluminous. Y-shaped, with many outpouchings in median portion; crura and median portion
long. Tests two, slightly posterior to middle of body, behind ovary and acetabulum. Ovary partly behind and partly to the right of acetabulum. No Laurer's canal or receptaculum seminis present. Yolk glands lateral, extending over middle third of body. Genital pore near left edge of body, near oral sucker. Cirrus-sac long and lying diagonally across body. Uterus very voluminous. Egg measures .045 millimeter by .019 millimeter. Parasite in the mouth of Ancistrodon contortrix.

BIBLIOGRAPHY.