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On the American Representatives of *Distomum* *variegatum*.

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With plate 33.

I. General.

As knowledge of faunistic helminthology widens, it becomes increasingly apparent that, in many cases, the conception of a species of the older investigators must, in the future, be broadened to include a group of closely-related forms. One has but to think of such species as *Distomum appendiculatum*, of fishes, and *Distomum cygnoides*, of amphibia, and of many conflicting statements in the literature to understand what confusion is likely to arise by a too-fervent anti-pathology towards increasing the number of specific terms.

Distomum variegatum RUD., from the lungs of anurous amphibia, is another of the original species that has to be resolved into a group of modern species. Its history dates back to ZEDER's *Erster Nachtrag zur Naturgeschichte der Eingeweidewürmer*, Leipzig, 1800; its name dates from RUDOLPHI's *Entozoorum Synopsis*, Berolini, 1819. BREMSER, CREPLIN, DUJARDIN, BLANCHARD, DIESING, PAGENSTECHEER and others have had their turn in working out its anatomy and life-history. A modern and most thorough account of it is to be found in the large volume by LOOSS: *Die Distomen unserer Fische und*

Frösche, Stuttgart, 1894. There the author noticed certain variations, particularly of the structure of the skin, and in his *Weitere Beiträge zur Kenntniss der Trematoden-Fauna Aegyptens*, in: *Zool. Jahrb.* V. 12, Anat. 1899, he makes 3 species: *Haematoleochus variegatus*, *H. similis*, and *H. asper*, with differences chiefly in the skin, the size and position of the genital organs, and the size and shape of the egg.

At intervals during the last two years I have examined our Canadian Amphibia for the Distome in question and have studied, in one way or another, many hundreds of its representatives taken from their lungs. It is my intention to announce here my results so far as segregation of species is concerned.

For some time after entering upon this study, all the worms presented a sameness of appearance which was sufficiently well expressed in the word '*variegatum*'. But after gaining some insight into the distribution of black, brown and gray it became gradually apparent that the variegated look of the animals — due chiefly to the coils and foldings of the long uterus, distended with its countless brown-shelled eggs — was accompanied by certain regularly recurring characters. All the individuals I have yet come upon fall into one or another of five different types — none of which agree with the European forms as described by Looss. Notwithstanding numberless slight variations, these five types appear to be constant in the possession of certain characters which may, with tolerable readiness, be used to distinguish them and which we shall, consequently, regard as specific. To distinguish one of the members of this group from any other species is not a difficult matter; what we have to do is to show that there are sufficient differences to distinguish the members from one another. For the present, I shall briefly name them No. 1, 2, 3, 4, 5; and, since they are very closely related, I can deal with them most concisely by including a number of considerations under the present heading '*General*' and afterwards recount their chief characteristics under the heading '*Specific*'.

Occurrence. I have examined eight species of our Tailless Batrachia, belonging to the genera *Bufo*, *Hyla* and *Rana*, but only the Toad, the Bull Frog and the Green Frog in large numbers. The worms occur in the lungs, attached by their mouth suckers and insinuated between the spongy fibres.

External Features. Size and Shape are not characters of wide and safe application, since the animals reach sexual maturity

long before they attain to their largest dimensions, and one may not know that the worm in hand, although black with contained eggs, is only a small, young individual. The drawings are made from worms near the maximum size for each species, and bear an approximate ratio to the measurements of the largest individuals. Each is about twelve times the length of my largest mounted specimen of the species, but is rather broader in proportion. The shape of the living worm may of course vary continually. The drawings represent worms at rest or killed under the same conditions in a mixture of glacial acetic acid and alcohol.

For a brief approximate statement of their external appearances and for a provisional means of distinguishing them, I refer to the following table. Nos. 1 and 5 are the extremes and are easy to distinguish by the folding of the uterus. Nos. 2, 3 and 4 are much alike in this respect but may be distinguished by the size of their testes, ventral suckers or eggs.

Posterior lateral folds of uterus reaching to level of pharynx.

No. 1 — short, broad, thick.

Posterior lateral folds reaching only to last testis.

Large, lobed testes.

No. 2 — long, broad, thin.

Small testes.

Small ventral sucker and medium sized egg.

No. 3 — long, median in breadth and depth.

Large ventral sucker and large egg.

No. 4 — short, tapering, thick or rounded.

No posterior lateral folds to the uterus.

No. 5 — long, narrow, thick or rounded.

In Colour the younger worms are lighter, the older darker, due to the brown eggs they contain. The eggs in the first part of the uterus are latest from the ovary and are of the lightest shade, while the oldest eggs in the distal half of the uterus are deepest in colour. Knowing this, one can often distinguish overlying folds or proximal and distal parts of the uterus. The colour of the intestinal caeca is often reddish from the contained frog's blood, or blackish from the disintegrated pigment of the same or from their own eggs that have been swallowed.

Suckers. The ventral sucker is always smaller than the oral sucker. It is usually a little less than half as broad as the mouth-

sucker but in No. 4 the proportion of mouth-sucker to ventral sucker is as 5:4. The relative sizes of the suckers is not a very useful distinguishing feature, since in four out of the five species there is little difference in this respect, and, besides, the ventral sucker is difficult to see in adult worms, being obscured by the dark-coloured uterus. Its position is a little more than one-third the length of the animal from the anterior end along the mid-ventral line.

Cuticle. This in No. 1 is thick and perfectly smooth but in all the rest it contains numerous backwardly projecting, sharp spines. In the living worm, it must be studied as soon as the worm is removed from its natural medium, for the cuticle soon disintegrates, in contact with water or pressure. Killing fluids containing acids are likely to destroy both cuticle and spines so that mounted specimens, whose history is forgotten, are not to be depended upon. Worms killed in alcohol preserve these structures and should be mounted as control specimens.

The Muscular, Parenchymatous, Digestive, Glandular, Excretory and Nervous Systems are of little value in the identification of species. The Digestive System is of importance, however, because it offers so many landmarks in description. In all of the species it consists of a mouth perforating the oral sucker, a bulblike muscular pharynx, a short oesophagus and an intestine consisting of two lateral caeca.

Reproductive System. This is the most important system of organs in classifying the present group of distomes, for the reason that it represents the greatest number of easily recognizable differences. In the development of such a group of closely-related forms, the genital organs, among all the parts of the body, are the ones that have been subject to the greatest variation. Ovary and testes are, as a rule, easily seen in living or unstained specimens as an irregular longitudinal series of three brighter spots among bands and streaks of black. The ovary lies just behind the ventral sucker, the first testis behind and on the opposite side of the body, the second testis still farther back and on the same side as the ovary. Sometimes the ovary is near the middle line and in No. 1 the testes are side by side. The ovary may be compact or lobed and from its inner, posterior end gives origin to the oviduct. Fertilization space and receptaculum seminis are present but there is no LAURER'S canal. After receiving the vitelline duct there is an ootype with shell-gland. All of these belong to the first short piece of the

oviduct, which from this point onwards is called the uterus. The first short piece of the latter may be filled with sperm (recept. sem. uterinum), but the rest, in adults, is filled with eggs.

A very useful character in this group of worms is the arrangement of the uterus, which one might at first be inclined to think unimportant upon the ground that the uterus is a very long tube, fixed at both ends and with the intermediate part free to take whatever position may be accorded it by the other organs. It is however the constancy in size, shape and position of other organs as ovary, testes, intestine, which necessitates a particular mode of folding of the uterus, and, when we find this associated with other constant differences, we can afford to attribute to it a higher value. The general course of the uterus is from the ovary backwards, through the middle, dorsal part of the body to the posterior end, where it makes a loop forwards and back, first on one side and then on the other, outside of each intestinal caecum i. e. between the intestine and the lateral wall of the body; after reaching the middle of the posterior end again, it runs forwards, more towards the ventral surface, accompanying the first part of its course as far as the ovary, beyond which it proceeds alone to the external genital opening, below the pharynx. The parts of the uterus belonging to the middle longitudinal axis are not straight, except in young worms, but thrown into shorter or longer transverse folds or spirals. In No. 1 it forms a broad, deep-brown, median band, thrown into a large spiral in front, but with only a few small twists behind. In all the others there is a tolerable similarity in the part anterior to the ovary, but the middle portion always forms a broad band or several small folds, crossing the body between the testes, and between the anterior testis and the ovary. In No. 1 the posterior lateral loops reach forwards, nearly, or quite, to the level of the pharynx; in Nos. 2, 3 and 4 they extend only to the posterior testis; in No. 5 they are entirely absent, but the descending limb of the uterus forms a coil on one side, and the ascending a coil on the other — both between the intestinal caeca.

The ovary may be median, right, or left in position, and is characteristically lobed only in No. 2. In Nos. 1 and 3 it may be compact or obscurely lobed, and in Nos. 4 and 5 it is round or elliptical.

The testes, in their size, shape, and position, offer better points of recognition. In No. 1 they are long, narrow organs, situated side by side in the posterior part of the body. In No. 2 one testis is

half ahead of the other, and they are long and somewhat lobed on their outer sides. In the other three species they are small, rounded, or elliptical, compact bodies, one some way in front of the other. The anterior ends of the testes narrow into vasa deferentia, thin ducts which run forwards and unite at the posterior end of the penis sack. This is a much broader but still tolerably narrow and pretty uniform, tubular organ, stretching from the proximity of the ventral sucker to the external genital pore. Its posterior part contains the vesicula seminalis, and its anterior part the ductus ejaculatorius, while between these and the penis sack are prostate glands. Both the anterior end of the uterus, or vagina, and of the penis open, together, into a short sinus, communicating with the exterior by the genital pore. All of these latter organs are too difficult to examine, or are too much alike in the several species, to be of use in distinguishing them.

The vitellaria consist of two longitudinal, latero-dorsal rows of about ten bunches of follicles, lying above the intestinal caeca, and connected by a duct on each side, which from its middle gives off a transverse branch — the two latter uniting to form a vitelline reservoir, which opens into the oviduct as already mentioned. A very good way to see the ducts, follicles, and in fact many other organs, is to allow the worm to remain in water for a time, when it will lay the great mass of its eggs, thereby becoming transparent, and may be studied alive, or preserved and mounted. The vitellaria are too much alike, or are too variable, to be depended upon and can only be taken into account with other organs.

The Egg was the first sure guide in distinguishing those species that are most alike. It is approximately of the same size in Nos. 1 and 2; in Nos. 3 and 5, it is of equal size but larger than in the first pair; in No. 4, it is larger still. The thick, hard shell does not shrink (it may double longitudinally) under the influence of re-agents, so that the eggs of preserved or mounted animals or of sections may be compared with those of living ones. In making measurements it is well to select eggs of similar age and of normal size and structure. There are always imperfectly formed, irregular, small ones. A convenient way is to take those first extruded from the genital pore of each worm.

The Development, Metamorphosis, Intermediate Host & c. will, I am satisfied, throw light on the difference of species but they are not yet sufficiently known.

II. Specific.

After considerable deliberation, I have ventured upon the following method of designating these species:

1. *Haematoloechus longiplexus*.
2. " *breviplexus*.
3. " *varioplexus*.
4. " *similiplexus*.
4. " *medioplexus*.

The generic name *Haematoloechus* (αἱματιολοιχός, blood-licking), as already intimated, has been given by Looss (1899) to the European forms; the specific terms *longiplexus* and *breviplexus* refer to the lateral folds of the uterus, *varioplexus* and *similiplexus* express a similarity to the European species *H. variegatus* and *similis*, while the posterior median folds of the uterus suggest the word *medioplexus*.

1. *Haematoloechus longiplexus* n. sp.

(Plate 33, fig. 1.)

This was the first of the 5 species with which I became acquainted. It is by far the commonest form in the lungs of *Rana catesbiana* SHAW (the Bull-frog), and occurs wherever I have had occasion to look for it; viz. in several localities in Ontario, Quebec, New Brunswick, and Nova Scotia. It does not occur in every frog of the above species but one can scarcely ever open two or three without finding it and often to the number of half-a-dozen, in each lung. I have more than once collected nearly a hundred from six or eight castaway bodies of frogs that had been recently used for physiological purposes; this proved a satisfactory way of obtaining them.

Most of my adult, mounted examples of this form are 7 or 8 mm in length and about 2 mm in breadth, but of course they would measure more when alive. A large living specimen, slightly compressed, gave the following measurements: length 15 mm, breadth 3 mm, mouth sucker 7 mm. When brought out of its natural habitat this worm is rather a sluggish creature, movements being usually restricted to the anterior end, and it soon becomes entirely motionless. From either surface it is somewhat long-oblong with the posterior

end rounded and the anterior end abruptly narrowed. It is flattened from above downwards, but is tolerably thick. A sagittal section through the long axis of one specimen showing mouth, ventral sucker, ovary and receptaculum seminis measured 6·74 mm in length and 1·42 mm in depth; and a transverse section cutting ovary, receptaculum and ventral sucker of another measured 2·55 mm in breadth and 1·39 mm in depth. The ventral sucker in the first case was 2·6 mm from the anterior end and measured 2 mm in length and ·06 mm in depth — a little shallow concavity on the mid-ventral line, its walls being hardly thicker than the integument of the region. The mouth-sucker was a strong muscular organ ·46 mm in length and depth. In the cross section the ventral sucker was ·23 mm across and ·12 mm in depth while the mouth-sucker was ·38 mm in depth and ·49 mm in breadth.

The cuticle of this species is thick and perfectly smooth, there being no trace of spines, in either the fresh worm or in preserved sections.

The ovary is pretty compact, although it is often longer in one direction than the other, and in large animals frequently with short, blunt, rounded lobes along one side. Its position is above the ventral sucker from which it is separated by the receptaculum seminis. It is close under the dorsal skin, which it presses up into a prominent elevation of that region, especially noticeable in preserved animals. Frequently, its long axis lies across the body, but not always, and it often lies slightly to one side or the other, following no regular rule, but with the lobed side outwards. In those worms that have been subjected to pressure it is oftenest a little more posterior than the position mentioned. Immediately behind the ovary are the shell-gland and ootype — all three overlying the large receptaculum seminis which fills the space between the intestinal caeca of this region.

The testes are two long, narrow but deep bodies lying parallel to one another and each between an intestinal caecum and the median portions of the uterus; when one is slightly in advance of the other, it is generally on the opposite side from the ovary.

Two vitellaria extend from about half way between the suckers to the posterior end of the body and consist of about ten bunches of follicles on each side, but the number appears to be subject to variation as well as their arrangement. Frequently one or two bunches of each side are moved towards the middle, dorsal line and

come to lie between the lateral bunches, and this may occur at both ends of the series. Sometimes one or two groups of one side, at the posterior end, are lacking, and their place may be taken by bunches connected with the longitudinal duct of the opposite side. The number of follicles in a bunch is variable and difficult to count, but I have seen from ten to thirty, and the follicles appear to be rather small.

The uterus has characteristic long, black, lateral loops, outwards from the intestinal caeca and extending from the posterior end to near the pharynx, as well as two median bands, the dorsal light coloured, reaching from the ovary to the posterior end, the ventral running the whole length of the body to the genital pore close under the mouth-sucker.

The egg, in both fresh and preserved specimens, varies a little about 0.22×0.17 mm. Ripe eggs are of a uniform, light-brown colour, short-elliptical, with ends equal, or more oval with a lid at the small end and, often, a little more convex on one side than the other.

Young worms, from half a millimetre length upwards, can easily be recognized as belonging to the species. The smallest, that I have mounted, occurred in the lung of a bull-frog, along with large ones of the same kind. It measures 0.58 mm by 0.18 mm. The mouth-sucker is 0.08 mm and the ventral 0.06 mm in section — the latter behind the middle of the length of the animal. The caeca are relatively large and filled with pigment — decomposed blood corpuscles — and the rudiments of genital organs are present. Missing some intermediate stages in which there is nothing special to note and coming to one 1.33 mm in length, the ventral sucker is anterior to the middle and is less than half the diameter of the mouth-sucker. Ovary and testes are enlarged and the oviduct can be traced — by its contained pigment globules — from the middle of the animal backwards; the two lateral loops are present, but very short; the long median part to below the mouth-sucker, and in fact all with the exception of the small origin from the ovary, is ventral in position and almost straight. At 2 mm length the lateral loops reach nearly to the middle of the body, and at a length of 2.75 mm the animal has taken the form of the adult.

2. *Haematoloechus breviflexus* n. sp.

(Fig. 2.)

This was the first species I recognized as different from the preceding one, which, up to that time, nearly two years ago, I took for *D. variegatum* RUD. When once noticed, however, it is an easy matter to sort the two species, either while alive, or in alcohol, or mounted. In the lungs of *Rana catesbiana* it is not by any means so common as the preceding species, only occasionally a few to be found with a number of the other kind. In about one hundred worms, taken from a few frogs, I remember once counting about ten that belonged to this species, but one cannot depend upon always obtaining 10%. This species also occurs in *R. virescens* KALM. (the Common Frog, Green Frog).

In outline it is long-elliptical or long-oblong with narrowing ends — the anterior long-tapering. In size, it is the largest of all five species, both in length and breadth, but not in depth. While alive, it may reach 16 or 18 mm but my longest mounted specimen is 12 mm while most of my preserved adults vary from 2 to 2.5 mm in breadth. A sagittal section, through mouth and ventral sucker, measured 9 mm in length and .8 mm in depth and a transverse section, through the region of the ventral sucker of another worm, was 1.75 mm in breadth and .75 mm in depth. Comparing these figures with similar ones for the preceding species, it will be seen that a longer worm of species No. 2 is but little over half the thickness of No. 1.

The ventral sucker is on the mid-ventral line, between the first and second thirds of the length of the worm. In both the above mentioned sections it is .16 mm broad and .12 mm deep. The mouth-suckers of the same were of twice these dimensions, which I have also proved from mounted specimens of like size.

The cuticle of this species is thick but, unlike that of the preceding species, it is beset with numerous, backwardly-projecting spines.

The ovary is situated just posterior to the ventral sucker and may be on either side. It is very irregular and branched, but is, usually, tolerably straight along the side turned towards the median plane, and branched along the side turned outwards towards that side of the body on which it lies. From sections, it is found that the receptaculum seminis lies above the ventral sucker, the shell-gland above this, and the ovary to one side and behind the latter.

The testes are situated in the centre of the posterior two-thirds of the body — the first one on the opposite side from the ovary and the second on the same side as the ovary. They overlap, to the extent of about half their length, and are irregular and variable in outline, frequently having blunt lobes on the outer sides but sometimes on both sides. The posterior one is mostly the larger.

The vitellaria are similar to those of the preceding species. In my largest mounted specimen, I have counted thirteen clusters on one side but generally I could not see that there was a greater number than in the former species. The number of follicles appears to be fewer (8 to 15) in a bunch but the follicles are larger than in No. 1. Their measurements are difficult to fix and appear to vary with the size of the worm and the number in a bunch but perhaps $\cdot 16$ to $\cdot 18$ mm is an approximate figure for the length of one, viewed from its side, in a mounted worm.

The uterus in this species is more complexly folded than in No. 1, the complexity being due to the greater length of its median, ascending portion. This forms a number of irregular coils behind and in front of each testis and anterior to the ventral sucker, where it forms broad transverse folds. The posterior lateral folds, outside of the ends of the intestinal caeca, are short, extending only to the level of the posterior testis on one side, and to its middle on the other.

The egg is of the same size, shape, and colour as that of No. 1.

Young animals of this species, of 5 or 6 mm length and 1 mm breadth, are most beautiful objects. At a length of 3.3 mm and breadth of $\cdot 6$ mm the ovary is lobed and the testes show signs of lobation, the posterior lateral loops barely curve round the ends of the caeca and the median band of the oviduct is almost straight, while the vitellaria are well formed. A few eggs are present in the uterus, but they are small and round or badly formed. The youngest specimen I have, that I can recognize as belonging to this species, is 1.14 mm long by $\cdot 27$ mm broad. Its intestine is filled with black pigment and the rudiments of ovary and testes have their characteristic position. The testes are also long and narrow and the posterior one a little irregular in outline. The size of the ventral as compared with the oral sucker is 3:5.

3. *Haematoloechus varioplexus* n. sp.

(Fig. 3.)

This species also occurs in *Rana catesbiana*. I have obtained it in Toronto and in Montreal, but I find that I have only few mounted specimens and imperfect notes; consequently I shall not describe it at length but trust to the drawing to illustrate its chief characteristics; I shall be glad to come upon it in numbers for greater assurance as to its claims for specific distinction. It rivals No. 2 in size, my largest mounted specimen being 10·5 mm in length and 2 mm in breadth. It also resembles No. 2 in shape, the spines of its integument, its vitellaria, and the distribution and foldings of its uterus; of these the spines and the uterus are the only things that can be considered of great importance. On the other hand, this worm has a more compact ovary, small, rounded, or short, elliptical testes some distance apart, and larger eggs (·029 mm \times ·018 mm).

This species appears to be closest related to *Haematoloechus variegatus* as described by Looss; the resemblance is chiefly in size and shape, shape of ovary, shape and position of testes, and size of egg. It differs, however, in having spines in the skin, the egg being rather broader and of a more accurate ellipse with equal ends, and in the disposition of the uterus-folds. With regard to the last point, the lateral loops are much shorter and the median parts very much more folded. I cannot regard this as due to difference of age for the worm figured by Looss was 13·6 mm in length and consequently not far from the largest adult size as given by him (16 to 18 mm). Considering that the comparatively straight, median part of the uterus might have become slightly longer and more folded with further growth of the animal, then it must also be admitted that the lateral folds would correspondingly lengthen which would increase the difference, as compared with the worm I have figured. A mounted specimen of this species, nearly 5 mm in length, differs from the adult but little; the lateral folds of the uterus are slightly shorter in proportion but the egg has the normal measurements (·029 \times ·018 mm), which is, perhaps, the surest distinction from the young of other species. Another point to be noted is that this worm occurs in an American species of frog.

4. *Haematoloechus simitiplexus* n. sp.

(Fig. 4.)

This species occurs in the lungs of *Rana virescens* KALM. (Common Frog, Green Frog) and of *Bufo lentiginosus* SHAW (American Toad). In the common frog it is equally plentiful with the next species to be described. They occur together, or sometimes one species alone, and sometimes the other, often 3 to 7 in one lung. My mounted specimens vary from 3 to 8 mm in length and I have measurements of living ones up to 9 mm in length by 2 mm in breadth. Many are spindle-shaped, with the largest diameter at the middle and gradually rounding and tapering off towards each end, but they are commonly broadest between the middle and the posterior end, with a long tapering anterior end. They are more inclined to appear cylindrical than any of the preceding species but the older worms may be distinctly flattened.

The cuticle in preserved specimens is about .018 mm thick and is regularly and thickly beset with spines, about .022 mm in length, leaning backwards, with a slight curvature, and extending through the whole thickness of the cuticle, with the points projecting beyond. Viewed from the surface, where one can see great numbers of them together, they appear to be in longitudinal and transverse rows, often .015 to .02 mm apart but sometimes even less, or more, depending upon the region and the state of contraction of the animal. As is common, they are most abundant at the anterior end.

The ventral sucker, except when obscured by dark folds of the uterus, is rather a conspicuous object in this as compared with the other species. It is situated anterior to the middle of the worm and, in a mounted specimen 7 mm long, it measured .38 mm in diameter. The mouth-sucker of the same animal was .41 mm broad by .44 mm long. In a living worm 8.5 mm long the mouth-sucker was .51 × .57 and the ventral sucker .41 mm across. In a transverse section the ventral sucker was as deep as broad and extended half way through to the dorsal surface, while the breadth of the section was twice its depth.

The ovary is a small, compact, rounded body, or it may be slightly longer than broad, situated pretty close behind and to one side of the ventral sucker. In a group of twenty, examined with regard to this point, the ovary was on the right side in twelve and on the left side in eight.

The testès are also small, oblong bodies, with rounded ends, generally slightly larger than the ovary, the posterior one, which is on the same side as the ovary, being the larger of the two.

The vitellaria have the usual structure and the uterus shows that this species belongs in the series 2, 3, 4, distinct from 1, and 5.

The one thing that led me to study every character of this worm was the egg. Even with a medium power of the microscope one can notice that it is much larger than in the other species. The commonest measurements gave $\cdot 039 \times \cdot 019$ mm but variations a little above and below occurred. It is dark-brown, longer than oval and rather flat along the sides, with often a little thickening in the shell at the big end.

3 young specimens, about half-grown, were obtained from a toad, nearly two years ago. They are cylindrical, with the posterior lateral loops of the oviduct shorter than in the adult. A still younger worm, 2·37 mm long, from the green frog, has its uterus already filled with eggs.

This species appears to be closest related to *Haematolocchus similis* of Looss. The points of similarity are size, spines, ovary and testes, size of egg. The spines of this, however, extend through the cuticle. The ovary and testes of this do not agree any more closely with the accounts of Looss than do those of Nos. 3 and 5. Notwithstanding the close agreement in the dimensions of the eggs, those of this species are not so dark, nor do they appear to be of the same shape. They look longer and the point of greatest breadth is nearer the large end. The vitellaria of this worm extend completely into the posterior end of the body — in fact to the end of the intestinal caeca. Differences in the shape of the worm and in the foldings of the uterus are shown in the drawing: the anterior end is characteristically narrowed, the lateral folds of the uterus are shorter and the median transverse folds are very marked as compared with *H. similis*. The hosts are American.

5. *Haematolocchus medioplexus* n. sp.

(Fig. 5.)

The species here described occurs, equally abundantly with the last, in *Rana virescens*. In the lungs of one frog I found 5+4, in another 5+7, in a third 2+0. My first examples were obtained from *Bufo lentiginosa*, nearly two years ago, when, upon first ob-

serving the worm, I thought I had *D. cylindraceum*, a species which I have never yet found represented in any of our amphibia.

In form this worm appears long and narrow, broadest near the posterior end which is rounded and heavy, but tapering gradually towards the anterior end which is usually thin. Sections show the greatest depth in the region of the ovary, where the vertical and transverse diameters are to each other as 2:3. My longest mounted preparation measures 11 mm by 1.25 mm. Living ones may reach 15 or 16 mm in length.

The ventral sucker is very small and difficult to see but may be found in alcoholic specimens by a lens. It is situated a little more than one third from the anterior end and is less than one-half the diameter of the oral sucker. In a worm 9 mm long it measured .12 mm across as compared with .31 mm for the mouth-sucker and was 3.33 from the anterior end. Sections of a worm but slightly shorter than this show the sucker to be .062 mm in depth.

The cuticle is only half as thick as in the preceding species; its spines are similar in shape but only half as long, very thin and at least four times as numerous, so that, under a high objective and low ocular, they appear very much like a dense coat of short hair.

The ovary is generally round or oval, but sometimes distinctly lengthened and, in a few cases, with two or three shallow indentations on the outer side and short, rounded lobes between them. As in the preceding species the number of cases in which it is situated on the right side seems to be slightly the greater. In 19, examined at the one time, 12 were on the right. It is a little farther separated from the ventral sucker than is usual in this group of forms and has the large receptaculum seminis immediately behind it, but more in the centre.

The testes are at a greater distance from the ovary than is usual. Sometimes they are perfectly round in appearance but at other times they are slightly lengthened and, in one preparation I have, they show slight lobings, which may, however, be due to contraction. Their arrangement, right or left, depends rigidly upon the position of the ovary — the one nearest the ovary being on the other side, that farthest away on the same side.

The vitellaria have the usual position and arrangement of ten to twenty large follicles in a group.

The most characteristic part of the uterus is that behind the last testis; the descending limb forms folds, loops, or coils down one

side, and the ascending limb is similarly arranged up the other side, both series being between the intestinal caeca; there are no loops outside of the caeca. It passes from side to side between the testes and between the first testis and the ovary and, on account of the small size of these bodies, there is room for several coils.

The egg agrees pretty well in length with that of No. 3, but is a shade smaller, elliptical with ends nearly equal, but sometimes more oval with the centre of the large end flat and the small end blunt-pointed. The size is $\cdot 028 \times \cdot 018$ mm.

I have two young worms, 1·8 mm long by $\cdot 5$ mm broad, which I think must belong to this species. They were found together with some of both No. 4 and No. 5. There are no eggs in the uterus which extends to the posterior end and back again without coils. The caeca are broad with brown contents. The ventral sucker is in the middle of the animal and is $\cdot 15$ mm across, while the oral sucker is $\cdot 22 \times \cdot 24$ mm. No spines are preserved. They appear quite different from my youngest specimens of No. 4.

Montreal, Feb. 12, 1902.

Explanation of the figures.

Plate 33.

Fig. 1. *Haematoloechus longiplexus*.

Fig. 2. *Haematoloechus breviflexus*.

MS mouth-sucker.

Ph pharynx.

GO genital opening.

Pe penis-sack, below it the oesophagus.

I right intestinal caecum.

V vitellaria.

VS ventral sucker.

RS receptaculum seminis.

O ovary.

MU median part of uterus.

T posterior testis.

PU posterior-lateral fold of uterus.

Fig. 3. *Haematoloechus varioplexus*.

Fig. 4. *Haematoloechus similiplexus*.

Fig. 5. *Haematoloechus medioplexus*.

All drawn from the ventral surface, under the same magnification, their parts easily determined by reference to Fig. 2.

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