AMERICAN MUSEUM NOVITATES

No. 12

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By Horace W. Stunkard

Issued July 16, 1921

By Order of the Trustees

of

THE AMERICAN MUSEUM OF NATURAL HISTORY

New York City

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NOTES ON NORTH AMERICAN BLOOD FLUKES[1]

By Horace W. Stunkard

The first North American blood flukes discovered by the writer were found in 1913, while he was a graduate student at the University of Illinois. In the autumn of that year an extensive parasitological examination of turtles was begun. Shipments of various species of turtles were obtained for this work from collectors in Havana, Illinois; Walker, Iowa; Newton, Texas; and Raleigh, North Carolina. On November 5, 1913, in the washings of the intestine of *Pseudemys elegans* collected near Havana, Illinois, a trematode was discovered which attracted attention by its peculiar and unusual movements. On November 18, 1913, an additional specimen of this particular trematode was found in the œsophagus of another specimen of *P. elegans* caught near Havana, Illinois. On December 15, 1913, a similar trematode was removed from the trachea of *Malacoclemmys leseurii* collected near Newton, Texas. The two specimens removed from *P. elegans* were stained and mounted *in toto*, and that taken from *M. leseurii* was cut in cross-sections. No other specimens were found at that time. The following summer turtles were collected in Iowa and Illinois, and in the autumn a second shipment was received from Raleigh, North Carolina. On examination of this material, the peculiar trematode was again encountered and its true nature discovered. On April 10, 1915, three specimens were removed from the heart and six from the large arteries of *Pseudemys scripta* collected near Raleigh. N. C. During the spring of 1915, blood flukes were removed from the heart and arteries of *Chrysemys marginata* collected in Iowa, Illinois, Indiana, and Ohio; from *Chelydra serpentina* collected in Iowa, Illinois, Ohio, Louisiana, and Texas; and from *Pseudemys elegans* and *Malacoclemmys geographicus* collected in Louisiana. In the fall of 1916, examinations were continued at New York University and blood flukes recovered from the heart and larger arteries of *Chrysemys picta* and *Chelydra serpentina* collected in New York, New Jersey, and North Carolina; and also from *Chelopus guttatus* and *Cistudo carolina* collected at various points in New York and New Jersey. This material obviously belonged to a common genus, but it included forms so different that it was impossible to refer them to the same species.

[1]Contribution from the Biological Laboratory, New York University.

The study was interrupted from the spring of 1917 to that of 1919, during which time the writer was in the U. S. army in France. With the resumption of scientific work on release from military service, I found that in a paper dated July, 1918, Dr. G. A. MacCallum had published a description of a trematode from the intestine of *Chelopus insculptus*, so similar to the blood flukes I had collected that it appeared they must be the same. MacCallum named this parasite *Spirorchis*, but omitted the specific name. The blood flukes and the form described by MacCallum are monostomes of almost the same size and shape; they agree in position and character of oral sucker, position and extent of intestinal cæca, position and extent of vitellaria, vitelline ducts and receptacle, position and shape of ovary, oviduct and uterus, position, character and extent of testes, shape and location of seminal vesicle and vas deferens, as well as the position of the excretory pore. They are alike in character of the intestinal contents, which led MacCallum to describe the form as a hæmatophagic trematode. The only points of difference are found in the statement of MacCallum that in *Spirorchis* a pharynx is present and that the genital pore is median near the posterior end of the body, while in the blood flukes a pharynx is absent and the genital pore is lateral, slightly posterior to the level of the ovary.

Conferring with Dr. MacCallum, I learned that the description was made from specimens mounted *in toto*, but unfortunately the slide could not be found. Dr. MacCallum examined several of my slides and noted the similarity between these worms and that described by him, but was not certain that they were the same. In correspondence with Professor Henry B. Ward, of the University of Illinois, under whose direction my graduate work was done and who was familiar with my studies on blood flukes, I wrote on February 2, 1920, that I was certain that the form described by MacCallum as *Spirorchis* is not from the intestine but from the mesenteric vessels and that it belongs to the group of blood flukes, and asked whether in his opinion I should describe the blood flukes as a new genus or assign them to the genus *Spirorchis*. Subsequently, I wrote Dr. C. W. Stiles of the International Commission on Nomenclature, stating the case and asking for information as to the correct method of procedure in determining a name for the blood flukes. In his reply, dated March 1, 1920, Dr. Stiles gave as his opinion that the name *Spirorchis* would be established by "finding the original slide or by collecting material from the type host and type locality and redescribing the genus." "If it proves that your material is identical with *Spirorchis*, I believe that *Spirorchis* would take priority." "According to the rulings

of the International Commission, a generic name may be valid even though no specific name is published with it. The first specific name that is published after the generic name becomes the type of the genus."

In the Journal of Parasitology, March 21, 1921, Ward published certain observations and a description of 'A New Blood Fluke from Turtles,' giving to this parasite the name, *Proparorchis artericola*. He reports that the fluke has been found in several distinct species of turtles and widely separated localities, and records it from *Pseudemys elegans* at Havana, Illinois; *Malacoclemmys leseurii* from Newton, Texas; *Pseudemys scripta* from Raleigh, North Carolina; and *Chrysemys marginata* from Fairport, Iowa. He adds, "The data in my possession are not all referable to the single species which has just been described. In details of structure, in regard to the eggs, in the location in the host in which they have been observed, and in some other details, certain specimens differ so distinctly that I can not at present include them under the same heading." Referring to MacCallum's paper, Ward accepted his diagnosis as it stands, assigned to the form the specific name *innominata*, and included the genera *Spirorchis* and *Proparorchis* as members of a new subfamily Proparorchinæ. He removed the genus *Hapalotrema* Looss 1899, from the subfamily Liolopinæ Odhner 1912, and included it with the subfamily Proparorchinæ in a new family, Proparorchidæ.

Though engaged for several years in the study of blood flukes of turtles, publication has been delayed because of lack of certainty regarding two points; first, the question of nomenclature and the relation of the blood flukes to the genus *Spirorchis*, and second, the difficulty of specific determination of the material at hand. The latter of these questions is still under investigation, and may not be solved until the developmental stages and life history are known; the former has now been answered. The original specimens of *Spirorchis*, to which Ward assigned the specific name *innominata*, have been found, and through the kindness of Dr. MacCallum have been loaned to me for examination. After careful study I wish to make certain corrections and additions to the description of the form. As noted previously, the only cardinal differences between the blood flukes and the description of MacCallum are the presence or absence of a pharynx, the position of the genital pore, and the location within the host. The structure described as a pharynx in *Spirorchis*, though it somewhat resembles such an organ, is in reality the œsophageal commissure of the nervous system and no pharynx is present. The œsophagus is surrounded by unicellular glands which at the posterior region are large and stain deeply. The genital pore is ventral, below the

cæcum of the left side, a short distance posterior to the level of the ovary. MacCallum traced the cirrus sac to the intestine, but was unable to follow the genital ducts to the structure he regarded as the genital pore. It is a significant fact that though MacCallum reported the parasite from the intestine, he noted that its intestinal content showed it to be a hæmatophagic trematode. As Ward pointed out, "It is not unlikely that its presence in the intestine was accidental, due to the opening of some blood vessel during the dissection." The first blood flukes found by the writer were discovered in the washings of the intestine after its dissection, and though I have not as yet been able to secure specimens of *Spirorchis* from the circulatory system of *Chelopus insculptus*, I have found eggs of blood flukes in the tissue of that species and I am still of the opinion stated over a year ago that the specimens described by MacCallum came originally from mesenteric blood vessels.

On the basis of morphological similarity, there can be no doubt that the blood flukes of turtles belong to the genus *Spirorchis*. I have specimens collected from the same hosts and the same localities as those of Ward, and which are certainly specifically identical with his material. These specimens show no generic differences from those discovered by MacCallum. The generic description of *Proparorchis* as given by Ward agrees with the corrected description of *Spirorchis*, demonstrating the identity of these forms. With the establishment of their identity, *Proparorchis* disappears as synonym. With the synonomy of *Spirorchis* and *Proparorchis* and the suppression of the latter name, the subfamily and family names Proparorchinæ and Proparorchidæ also disappear. *Spirorchis* remains then as the only known genus and type of the subfamily to which it belongs, and for which, in conformity with the rules of zoological nomenclature, I propose the name **Spirorchinæ**. I agree with Ward that *Hapalotrema* does not find a natural position in the subfamily Liolopinæ of the family Harmostomidæ, and that it must be removed from those groups. It differs from *Spirorchis* in the location of the ovarian complex and genital pore and also in the possession of an acetabulum. No existing subfamily will contain it, and it may well be considered as the type of a new subfamily, the **Hapalotreminæ**. Ward included *Hapalotrema* and the Proparorchinæ (syn. Spirorchinæ) in a new family, for which I propose the name **Spirorchidæ**.

In position of female organs and genital pore, *Spirorchis* resembles *Aporocotyle* and manifests relationship to that form. The discovery of the American blood flukes of turtles establishes a firmer basis for the conception of the unity and evolution of the blood inhabiting trematodes.

In my opinion, the Aporocotylidæ of fishes, the Spirorchidæ of turtles, and the Schistosomidæ of birds and mammals constitute a well-defined group with inherent natural relationships. The Spirorchidæ stand in an intermediate position, and the schistosomes are, I believe, derived through them from the Aporocotylidæ rather than from the Harmostomidæ as maintained by Odhner.

Specimens of *Spirorchis* collected from various species of turtles, on which these notes are based, form part of the collection of blood flukes in the Department of Lower Invertebrates of The American Museum of Natural History.

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FRANK E. LUTZ, Editor

Issued, as occasion requires, for the publication of preliminary announcements, descriptions of new forms, and similar matters.

The articles are numbered serially but paged independently. An index will be provided for each 300 (approximately) pages.