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AMERICAN WORK ON CESTODES IN 1893.

Reviewed by HENRY B. WARD, Ph. D.

An important advance in the morphological and systematic knowledge of the Cestoda has been made this year through two papers published by Dr. C. W. Stiles, of the Bureau of Animal Industry. They command attention not only since they emanate from an American worker, but also by reason of the methods employed. Heretofore it has been largely true that tapeworms were identified by their hosts and by their general appearance, and hence no branch of systematic zoölogy has been more confused. The same form from different hosts was the recipient of as many different names, and even specimens from the same hosts were renamed, owing to the dissimilarity of external appearance due to different methods of preservation. Not only this, but it was almost impossible to identify a species a second time, since the descriptions, containing little or no mention of internal anatomy, were so general as to apply to more than one species. Finally, the genus *Tænia* had become overloaded with species that in structure were far from closely related. Railliet, Blanchard, and others have been constant in their endeavors to limit this genus by excluding groups of forms anatomically related, which were, after being separated, classed as cognate genera. Dr. Stiles, in the two papers (93, 93a), has done much to extend our knowledge of the Cestodes and to further the end just mentioned. To quote from his conclusions (93a, p. 88):

“(1.) Descriptions of Cestodes based upon external form alone, unassociated with internal anatomy, are of little value.

“(2). In the case of those forms of which the original type specimens can be obtained we may be able to recognize the species, but in most of the cases of which the types have been lost the determination of the species is extremely uncertain. We shall hence be obliged to ignore a great number of forms which have been described as species.

“(3.) The present genus *Tænia*, as generally accepted by authors, contains forms which must be restudied and arranged in several subfamilies and a number of genera.

“(4.) This revision must be based upon internal anatomy.”

In these studies the best modern methods of microscopical research were used. As to the preparation of specimens, Dr. Stiles says (93a, p. 13): “The Cestodes collected by this bureau for the last eighteen months have been fixed in the following solution: 50 parts of an aqueous solution of corrosive sublimate plus 50 parts of 70 per cent. alcohol plus a few drops of glacial acetic acid. The worms were placed in this liquid, which had been heated to 45–53° C. The liquid was then allowed to cool for 20 to 60 minutes. The parasites were next washed in running water for 1 to 24 hours, and passed through 30 per cent., 50 per cent., 70 per cent., 95 per cent., and absolute alcohol. The preparations have been colored in alcoholic hydrochloric acid carmine after Grenacher or hæmatoxylin, and finally mounted in Canada balsam.” Serial sections in three planes were employed to confirm and extend the observations made on whole mounts.

The first paper treats of the topographical anatomy of the excretory vessels in the family of the *Tæniadæ*, and shows that the mutual relations of nerve, excretory trunks, and sexual ducts furnish a reliable basis for distinguishing the genera and subgenera of the family. Diagrammatic representations of these relations are given, and at the close of the article is a key including, with these, other structures—*i. e.*, representing the approximate phylogenetic relations of the forms. It is reproduced here in full:

“I. Scolex in most cases with hooks; uterus having a median trunk with lateral branches; vitellaria simple, median; genital pore single; dorsal vessel narrower than the ventral and dorso-median to the latter; no circular commissure; eggs without pyriform apparatus. *Tænia* s. str.

A. Genital ducts pass on the ventral side of the nerve and of the two longitudinal vessels; dorsal vessels surrounded by two branches of the transverse commissure. *T. crassicolis.*

B. Genital ducts pass between dorsal and ventral longitudinal vessels.

a. Nerve on dorsal side of genital ducts.

(a) Uterus with 7 to 10 lateral branches; scolex with hooks. *T. solium.*

(β) Uterus with 17 to 30 lateral branches; scolex without hooks. *T. saginata.*

b. Nerve on ventral side of genital ducts. *T. serrata.*

II. Scolax without hooks; one or two transverse uteri present; one or two genital pores and vitellaria, latter never median; genital ducts pass to the dorsal side of the nerve; eggs with pyriform apparatus.

A. One transverse uterus present.

a. Uterus with simple dilatations; genital ducts dorsal to two longitudinal vessels; dorsal vessel between nerve and ventral vessel; two genital pores. *T. marmotæ*.

b. Uterus with ascon-spore-like egg sacs; pyriform apparatus without horns; genital ducts between dorsal and ventral longitudinal vessels. *Thysanosoma*.

(a) Proglottids fimbriated; testes in median field; two genital pores; dorsal vessels united by transverse proglottidal vessels. *Th. actinoides*.

(β) Proglottids not fimbriated; testes in lateral fields; one (exceptionally two) genital pores; no transverse dorsal vessel present. *Th. Giardi*.

B. Two uteri and two genital pores present; horns of the pyriform apparatus well developed; genital ducts pass to the dorsal side of the dorsal and ventral vessels. *Moniezia*.

(a) Interproglottidal glands not present.

Denticulata group.

(β) Interproglottidal glands linear, not grouped around blind sacs.

Planissima group.

(γ) Interproglottidal glands grouped around blind sacs.

Expansa group.

III. All four longitudinal vessels well developed and connected by a circular commissure; nerve passes dorsal to the genital ducts; only one genital pore in each proglottid; two lateral elongated vitellaria.

T. fillicollis.

T. torulosa."

The peculiar position of *T. marmotæ* in the above key will probably entitle it to rank as a new genus when it is made the subject of more extended study. In his second paper Dr. Stiles has called particular attention to this point; then also a new genus, *Stilesia*, recently founded by Railliet, is added to those mentioned above. Its position would be:

II.

C. Uterus single or double and without ascon-spore-like egg sacs; genital pores irregularly alternate; eggs with a single shell; strobila narrow; testes absent from the median portion of median field.

a. Median portion of median field occupied by a transverse uterus, "head 2 mm. in diameter." *S. centripunctata*.

b. Median portion of median field transparent; two lateral uteri in each proglottid; "head less than 1 mm. in diameter." *S. globipunctata*.

The second paper, for which the first was in part a preliminary, though more extensive in some respects, embodies the results of a detailed and careful study of the Cattle Cestodes of this country. One noteworthy and praiseworthy point is the rigid enforcement accorded the law of priority, without which scientific nomenclature is a farce, and the confusion as great as existed before the introduction of the present system. This necessitated a reëxamination of the type specimens, and Dr. Stiles was fortunate enough to be able to study almost all the species concerned, including some of Rudolphi's original material, and to give the first accurate description of the latter which has been published. The work on species already known was done by Dr. Stiles; that on new forms and on the bibliography by both authors.

Of the numerous interesting anatomical details found in the paper, mention can be made of only a few here. In *Moniezia* the interproglottidal glands, first found by Dr. Stiles, occupy when present a narrow area near the posterior edge of the proglottid, being a dark-staining linear mass in the *Planissima* group, and being arranged in clusters around blind sacs in the *Expansa* group. It should be remembered that with age or the partial maceration of the material these come to stain less and less easily and are demonstrated with difficulty, if at all, on old and poor specimens. New species in this genus are *M. planissima*, *M. oblongiceps*, *M. trigonophora*.

Tænia fimbriata Dies., and *T. Giardi* Riv., are included in the reëstablished genus *Thysanosoma*, under which name a fragment of the first species was originally described by Diesing. The question as to double or alternate genital pores in the second species seems to be satisfactorily settled by the discovery of *both* conditions in the material studied. The genus *Stilesia* was founded by Railliet between the appearance of the two papers by Stiles, and includes the old forms *Tænia centripunctata* and *T. globipunctata*; reference has already been made to their position in the key. The genus does not seem to be as well established as the others, and Dr. Stiles lists at the close of his anatomical description a considerable number of points which must be settled from fresh material. The number of doubtful species of the genus *Tænia* discussed in various parts of the paper make it clear that the subject is by no means exhausted by this study.

The data on hosts, geographical distribution, and the full list of literature which precedes each species are admirable, as is also the

historical review under each. But one cannot help wishing that the authors had used a more modern method of referring to papers than by mere numbers—a method which inevitably results, as here, in mistakes often difficult for the reader to correct. On the other hand, the short note of contents which accompanies each reference and the exact measurements given for all organs are highly commendable features.

Near the close of the paper is a good key for the determination of species. There is unfortunately little hope that it will come into immediate general use, as it involves greater knowledge of the parasites and more time in the preparation of specimens than the average veterinarian will bestow upon it. He will, no doubt, continue to diagnose as "*T. expansa*" any one of the several species which in general external form approximate that species. To scientific workers and to students in helminthology, however, this key will be a real aid, as are also the splendid figures which accompany the paper; they are the work of Mr. Haines, the artist of the Bureau.

The members of the American Microscopical Society will welcome the introduction of modern microscopical methods into another department of government work and can be relied upon to urge its continuance. It is by the pursuance of these investigations that such exact knowledge will be obtained as to permit the department to meet with success the sporadic epidemics which often threaten the grazing interests of our country in one section or another. In such a case to diagnose the complaint incorrectly, to confuse two species, is to give up the vantage ground which scientific effort has won.

In closing, the reviewer wishes to call the attention of the microscopist to the interesting field here opened to his study. The Bureau of Animal Industry offers to exchange type specimens for *well-preserved helminthological material*, and extends to all workers the use of its exhaustive card catalogue, by which it is possible to refer to the literature on any parasite or to the known parasites of any host. The value of such privileges is duly appreciated by an increasing number of workers in this country.

*Papers Cited.***Stiles, C. W.**

- 93.** Bemerkungen über Parasiten. 17. Ueber die topographische Anatomie des Gefäss systems in der Familie Tæniadæ. Centralblatt f. Bakteriologie u. Parasitenkunde, Bd. xiii, pp. 457-465, 12 figs.
- 93a.** The portions of the following paper which are published over the initials C. W. S. are quoted in this review as the work of the senior author, since according to the preface they emanate entirely from him.

Stiles, C. W., and Hassall, A.

- 93.** A Revision of the Adult Cestodes of Cattle, Sheep, and Allied Animals. U. S. Department of Agriculture, Bureau of Animal Industry, Bulletin No. 4; 103 pp., xiv pls.