

VARIATIONS IN *TAENIA GAI GERI* (HALL, 1919.¹)

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This is an uncommon tapeworm, for with the exception of the material sent to Hall by Gaiger, on which the original description was based, the only records of the adult worms up to the present time (when we have found this species in 4 out of 200 dogs examined by us) are those in which worms have once or twice been recovered from dogs artificially infected by feeding them on the larval stage.

As there were a good many worms in the infected dogs it was possible to note that many variations from the standard description are liable to occur. The variations were so wide and frequent in our collection of specimens that individual worms might very well have been described as different species, but the almost imperceptible gradation between the extremes of variation showed that we were dealing, not with many, but with a single species. Consequently we give below a re-description of *T. gaigeri* placing special emphasis on the variations.

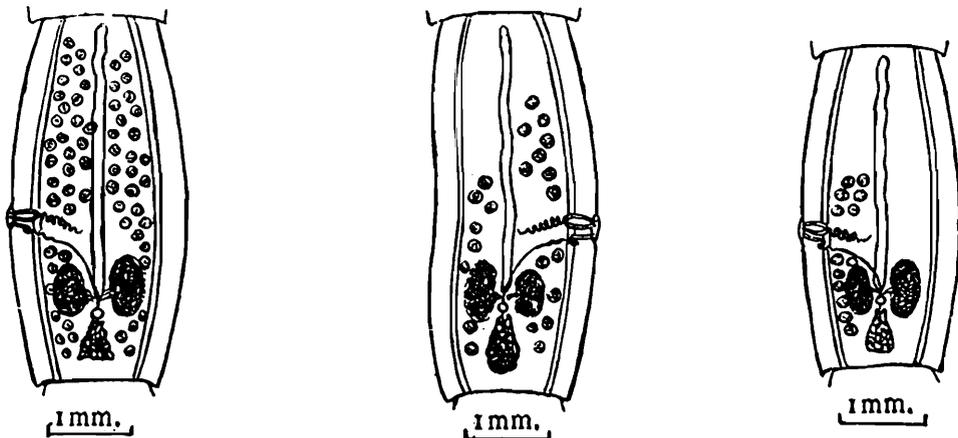
Head.—The head is square in end-on view and pyriform when viewed laterally, with its diameter varying between 0.69 and 1.27 mm. The poorly-developed rostellum bears a double crown of 26-34 hooks (Hall, 28-32). The hooks are 144 to 168 μ in length (Hall, 160-180 μ), and are so arranged that the tips of the handles of the larger hooks are nearer the centre. The blade is slightly curved, the handle shows undulations on both its sub-parallel borders, and its end is slightly up-turned. The guard on lateral view, is bulb-shaped anteriorly with no visible notch in the middle. The short hooks measure 84 to 124 μ (Hall, 115-150 μ), the blade is slightly more curved and the handle relatively longer and more tapering than in the long hooks. The guard of the short hooks has a distinct notch in the middle, so that if a long and a short hook are examined with the blades looking directly upwards the guard of the short hook is much wider than that of the long hook.

Neck.—The neck is clearly defined, 0.45 to 0.75 mm. in diameter (Hall, 0.650 mm.), and 1.5 to 2.77 mm. in length.

Mature segments.—Mature segments are usually longer than broad but the ratio between length and breadth varies so much that we have decided to divide them into two main types, between which there are innumerable gradations of shape and size. In one type the segment is much longer than broad and is shaped like a "melon seed," with the

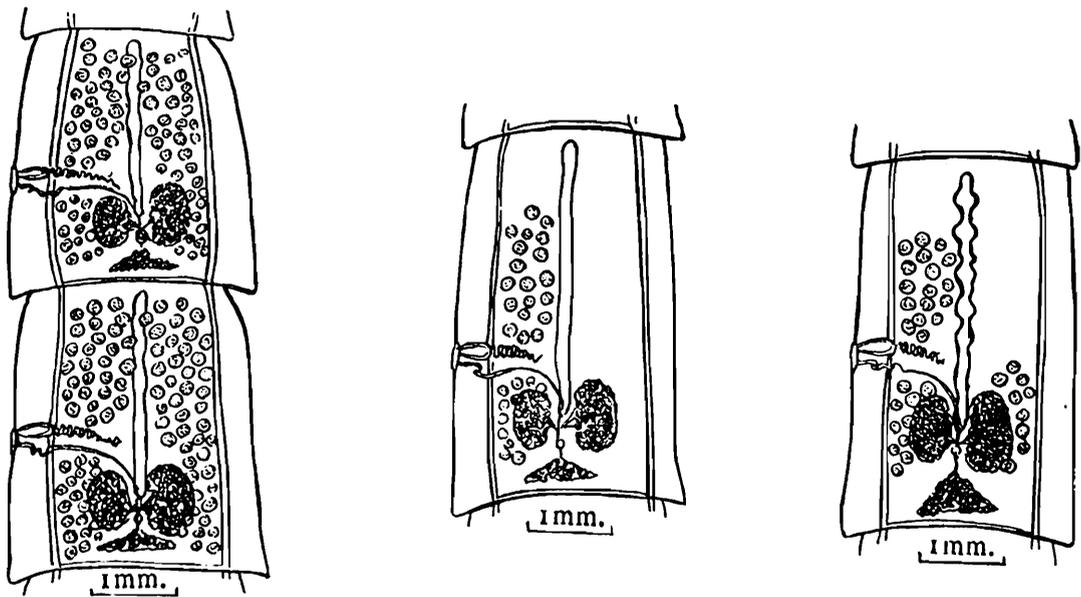
¹ We have followed Southwell (1930) in placing this worm in the genus *Taenia* instead of *Multiceps* in which Hall placed it. Our reason is that the generic character of *Multiceps* depends on the fact that the larval form is a *Coenurus*, but the adults have all the characters of a *Taenia*, and as the larval form can only be known in artificially induced infections this basis for a genus seems unsound.

widest part in the middle and the curved sides tapering towards both ends (text-fig. 1). In the other type the sides are straight, diverging



TEXT-FIG. 1.—“Melon seed” type of mature segment of *Taenia gaigeri* (Hall) showing variation in testicular development.

towards the posterior end and the segments are very little longer than broad, and the posterior angles project laterally so that the segments have the appearance of a “truncated cone” (text-fig.-2). This difference seems



TEXT-FIG. 2.—“Truncate cone” type of mature segments of *Taenia gaigeri* (Hall) showing similar testicular variation.

to lie in the fact that some segments retain the shape of the immature worm whereas others assume more rapidly the shape of the gravid segments which are always of the “melon seed” type.

The genital pores are slightly prominent, are situated about the middle or a little behind the middle of one side, and are irregularly alternating.

Male genitalia.—The testes are spherical and occupy the lateral fields, for the most part. They do not quite reach the anterior end of the uterus, and extend on either side to the excretory canals. On the pore side they do not encroach on the area occupied by the vas deferens and vagina, and in the centre, in front of the ovaries, there is an area without testes. The testes lie close to the ovaries on their outer borders and pass round behind them to the edge of the vitellarium. The develop-

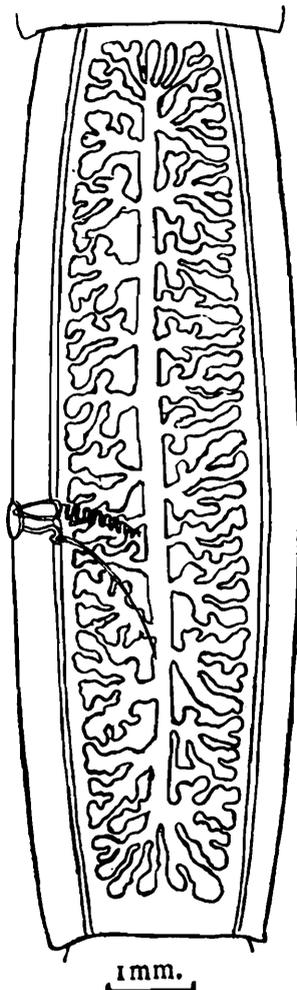
ment and distribution of the testes often present a considerable degree of variation. For example, there may be no more than one or two acini in some segments although the ovaries and other sexual organs appear quite normal, and from this very deficient form all grades occur up to those with normally abundant testes. When this deficiency occurs it is generally more marked on the a-poral than on the pore side, and frequently there are no testes on the side away from the pore. This testicular deficiency may occur in groups of segments either behind or in front of perfectly normal segments, therefore, it is clearly not a manifestation of the regular atrophy of the sex glands which takes place in all cestodes as maturity gives way to development of the uterus and the deposition of eggs. The vas deferens is a closely coiled tube running roughly parallel to the vagina some little distance anterior to it, and it opens into the cirrus pouch, which extends from opposite the excretory canals to the genital atrium on the lateral border of the segment (text-figs. 1 & 2).

Female genitalia.—The ovaries are reniform and are elongate in an antero-posterior direction. They are usually unequal, the one on the pore side being the smaller. The vitelline gland lies between and behind the ovaries. It is triangular in shape and in the short broad type of segment it has a broad base with the subtending angle opposite its centre only a short distance anterior to it; in the elongate "melon seed" type of segment it is still triangular but with the subtending angle much further away from the base so that the organ as a whole is longer than broad. Hall (1919) recorded an occasional abnormal type of gland in which he claimed that the vitellarium ran right forwards between the ovaries as a long narrow structure reaching nearly to the anterior border of the segment, overlying exactly the developing uterus. We searched our ample material for this abnormality and occasionally found a segment in which this condition appeared to be present, but closer examination always revealed that it was divided off from the vitelline gland in the inter-ovarian space by the shell-gland, ovarian ducts, etc., and that it was simply the uterus that had unaccountably taken the carmine stain so that its structure appeared granular like that of the vitelline gland. The shell-gland lies between the posterior poles of the ovaries, and the uterus begins just in front of it. The vagina runs from the ventral side of the commencement of the uterus and curving forward and outward it always runs round the anterior border of the ovary on that side and pursues a slightly undulating or a direct course as far as the excretory canals, where it is usually reflexed before proceeding to open into the genital atrium. The uterus runs straight forward from immediately in front of the shell-gland to near the anterior border of the segment (text-figs. 1 & 2).

Both male and female genital ducts pass between the lateral excretory canals, and when sections were examined it was found that the dorsal canal on one side was larger than the ventral one while on the other side of the segment the ventral canal was the larger. Further examination of this peculiar character demonstrated that the larger canal was always dorsal on the pore side, and as the pores are irregularly alternating, these canals, if traced through several consecutive segments,

would show alternate dilatations and constrictions, corresponding with the opening of the genital pore. The testes lie wholly within the inner circular muscle layer and in the middle of the segment in the dorso-ventral plane.

Gravid segments.—These are always elongate and have slightly convex lateral borders irrespective of whether the mature segments in the same strobila are of the “truncated cone” or “melon seed” type. They vary from 7.1 to 14.9 mm. in length and 2.5 to 4 mm. in breadth.



TEXT-FIG. 3.—A typical gravid segment of *Taenia gaigeri* (Hall).

The uterus has ten to fourteen primary branches on each side, which immediately break up into secondary branches, and thus form a confused pattern in a gravid segment in which it is difficult to enumerate the primary branches (text-fig. 3).

DISCUSSION.

The size and shape of the hooks, the shape and character of the mature segments, the position and shape of the genital pores and the average distribution of the testes are the characters relied upon by Hall for the determination of this species, and although on the whole they are reliable we have shown that they are subject to a considerable degree of variation.

For example :—(a) The hooks in all our worms are smaller than what Hall describes, but they are typical in shape. This smallness is not to be explained by under-development in our specimens.

(b) The mature segments may have the shape of a "truncated cone" or of a "melon seed" with innumerable intermediate forms.

(c) The testes are subject to a great variation in number and distribution.

The variation in the shape of the segments is apparently a true morphological character and is not due to differences in contraction during the process of fixation, because all the worms were fully relaxed first and then fixed by the same technique in every instance. Testicular under-development is not to be explained by deficiency in nutrition, in the large number of worms present all the other organs appear perfectly developed, and the testicular under-development appears haphazard, irregularly alternating with fully developed segments in the same chain of proglottids.

The differences we have recorded in this paper are greater than have been used in many instances for differentiating species of cestodes, and it was only the large amount of material at our disposal that enabled us to assess them at their true worth. We are accordingly publishing these notes to prevent the creation of a number of species out of this single one, a possibility in the event of only one or two specimens being available for study by subsequent workers. This possibility is all the greater in the case of *T. gaigeri*, which on account of its rarity, has not been extensively studied. It is probable that much of the confusion that exists at the present day among the *Taeniae* of dogs has been brought about in the manner shown above and we hope that this paper will prevent such an occurrence in the case of this species.

REFERENCES.

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