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FOUND IN SHEEP.

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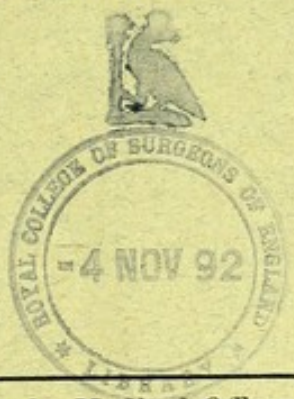

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With The Author's Compliments

A description of two new nematode parasites found in sheep.

BY

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Strongylus colubriformis* and *Trichosomum verrucosum. } **sp. n.**

With a note on *S. ventricosus*, (Rud.?)

As already noted in the preceding paper on nodular disease of the intestine, during that investigation, I met with two nematodes which appear to be new to science. It is probable that both are innocent of doing much harm, beyond abstracting a certain amount of nourishment; but it is nevertheless desirable that a sufficient description of them should be placed on record.

Strongylus colubriformis, sp. n.

Description.—Male nearly 6 mm. (0·2″) in length, 0·13 mm. in thickness. Female, about 8 mm. (0·3″) in length, about the same thickness.

Body dark coloured, the female usually straight, the male more usually contorted. Both sexes have the head extremely attenuated, and become progressively thicker as the caudal extremity is approached; but while in the male the thickest part is quite at the caudal extremity, the female is thickest opposite the vulva, which is placed one-fifth of the entire body's length from the mucronate extremity of the tail. Mouth, entire; quite unarmed. The female is provided with a pair of semi-ellipticalæ, situated opposite the neck, which is markedly constricted, giving her the outline of a cobra.

Bursa of male deeply bilobed, the dorsal cleft being almost as deep as the ventral, so that the organ looks like a mussel shell, placed transversely, and attached to the worm at the hinge. Ventral costa small; the lateral and ventro-lateral costæ stout, subequal, and forming a closely packed group; dorsal and dorso-lateral costæ small.

Ova (intra-uterine) elliptical, 0·09 mm. long by 0·046 mm. wide. A more advanced ovum, apparently mature, measured 0·11 mm.

This small species inhabits the small intestine, and is most numerous about the middle of its length. I have found it, both at Shillong and Sanawar, in every

carcase examined completely. It attaches itself to the mucous membrane in exactly the same manner as is done by the *Trichocephali*, the head tunnelling just below the epithelium for some little distance, while the tail hangs free. It is almost impossible to detect it in the primary examination of the intestine; requiring careful examination of the mucous membrane under the simple microscope.

The easiest way to find it, however, is to wash a certain length of intestine which has soaked for some hours in carbolized water, rubbing it well between the fingers and to examine the washings by transmitted light. From the numbers I have obtained by washing a comparatively small portion of intestine, I should say that they are often present in enormous numbers.

Its close resemblance, in all save size, to *S. contortus*, the common sheep maw-worm, cannot be overlooked. Dr. Curtice[1] gives an excellent description and plate of *S. contortus*, but neither figures nor describes the cervical alæ described by Diesing in his diagnosis of the species. It is, however, present in a large proportion of the specimens in my own collection, though it is seldom wide enough to merit Diesing's epithet of "semi-elliptical." Its presence, however, adds a new resemblance to *S. colubriformis*, the minute species at present under consideration, though I am by no means sure that it is uniformly present in that, even in females.

The determination of this point is rendered difficult by the fact that they are only visible when the worm is lying, so that they project; when half turned round they cannot be seen at all; and this is the very position in which the worm naturally lies.

It might therefore be suggested that the present species is merely a younger stage of *S. contortus*, but the circumstance that all the specimens examined were sexually mature tells strongly against such a supposition. Their habitat again is different, and no specimens of intermediate size could be discovered, either in the stomach or intestine.

The present species too wants the peculiar flap guarding the vulva, so characteristic of *S. contortus*.

Another, and I think conclusive, point is that the ova of the smaller species are considerably larger than those of *S. contortus* and also differ somewhat in shape, those of *S. colubriformis* having an elongated elliptical outline, with almost symmetrical poles, while the ova of *S. contortus*, though about the same width, are stouter and ovate, one pole being distinctly blunter than the other.

The size of nematode ova is very constant for the same species, and seems constant through all adult stages of the same worm, so that it forms an excellent specific character. This is very noticeable in the cases of *Dochmius duodenalis*, and *Sclerostomum tetracanthum*. In dimensions and appearance the free, or rhabditis, stages of these species, which I have recently described, are about

[1] *Loc. cit.*

as dissimilar from their entozoic stages as any two nematode species can well be. In each case, however, the ova, whether produced by entozoic, or free-stage worms, are microscopically identical.

I think, therefore, that there can be no doubt that *S. colubriformis* will be found to be a good species; and I have little doubt that it will be ultimately found to have a tolerably wide distribution, as I believe that it is entirely owing to its minute size that it has hitherto escaped recognition.

Although it certainly attaches itself by penetrating the intestinal mucous membrane, it may be doubted if its presence can have any great pathological significance, the small size of, and absence of, armature to the mouth being against the supposition that it has any leech-like propensities, though, at the same time, its dark colour would somewhat countenance such a view. The possibility of it working much harm seems to me to depend entirely on this point, as, if it be a blood-sucking species, very large numbers might quite compensate for its small size, and rapidly produce a destructive anæmia.

In the probable absence, however, of any such habit, the most it can be credited with is an aggravation of the dyspeptic symptoms brought about by the presence of other and more formidable species.

Before quitting our consideration of this worm, I may as well note the very peculiar structure of the female generative ducts. The vulva opens into the middle of a sort of cylindrical sac, which extends for a short distance forward and backward from the vaginal opening. The peculiar point is that the connection between this vagina and the uterine canals is effected by means of a thick, chitinous, valvular apparatus, which closely resembles the œsophageal bulb of certain nematodes, and, on high power examination, is seen to be of a most complicated structure, the chitinous lining of the vagina projecting up into the end of the lax uterine canal, and having a deeply sinuate margin. Surrounding this structure is a very thick muscular ring, which gives the bulb-like outline to the whole apparatus. An exactly similar structure is faintly outlined in Curtice's figure of *S. ventricosus*, though he makes no special mention of it in his text; and something similar is also to be made out in *S. contortus*, though the bulb is proportionally much smaller and weaker, being scarcely more than a thickening of the muscular coat in this situation.

Trichosomum verrucosum, sp. n.

This species, which also appears to be hitherto undescribed, was found in the stomach of a sheep at Shillong, a few being found in each division, except in the reticulum. It seemed then so improbable that so comparatively large and obvious a species should be new that I only collected a few specimens for identification, and I now find that, without exception, these are females. The male is probably much smaller, and so escaped observation.

Owing to the want of male specimens the determination of its generic

position is uncertain. It is even possibly a strongyle, the ova possessing the broad transparent external zone so characteristic of most members of that family; but, on the whole, I prefer to refer it provisionally to the genus *Trichosomum*, more specially as I found attached to one of my specimens a portion of the male generative organ; and this had a curiously echinate sheath, such as is characteristic of many members of that genus.

Description.—Female, about 9 c. m. long ($3\frac{1}{2}$ inches). Somewhat tapered alike at head and tail; but elsewhere uniformly about 0·5 mm. in thickness. The mouth is unarmed, and surrounded by six blunt papillæ. The œsophagus is soft and thin-walled. The skin of the head, and first half inch of the body is thickly beset with irregularly shaped, flat verrucosities, which, however, involve only the cuticular layer.

The female generative opening is situated about 2 mm. in front of the caudal extremity; the otherwise symmetrical uterus on one side making a caudal loop below it, about half-way to the anus, which is situated immediately in front of the caudal extremity, which ends in a curious, finger-shaped process, bent towards the ventral aspect. The uteri are so large that the mature worm seems little else than an elongated sac of ova. The ova (intra-uterine) measure 0·05 mm. in length by 0·027 mm. in width, and are regularly oval in outline with a broad transparent zone and thin external envelope.

The most advanced specimens contained a pear-shaped embryo bent on itself.

Note on ***Steongylus ventricosus,*** Rud.

While on the subject of ovine parasites, it may be well to note that it is difficult to reconcile the original description of this species with the description and figure of the species which Dr. Curtice[1] identifies by this name. Rudolphi's species was found in *Cervus elaphus*, L. and belongs to Diesing's division of the genus, in which the head is bialate, and the bursa of the male multilobular, both of which characters, to begin with, are conspicuous by their absence in Dr. Curtice's species, the exquisite figure of which is obviously too minutely drawn to admit of any doubt as to its accuracy.

Briefly the differences between the two species may be formulated as below:—

S. ventricosas, Rud.	***Dr. Curtice's species frem American sheep.***
Head attenuate with two thin alæ.	Head cylindrically inflated, with no alæ.
Body capillary, about a third from its commencement, very thickly ventricose; vulva near the ventricosity.	Body "comparatively stout;" vulva about two-ninths to one-third of the entire length of the female from the tail.
Bursa of the male multilobate, radiate.	Bursa conical and bilobed, the ventral membrane being narrow, the dorsal wide.
Length, 6-8″ (13-19 mm.)	Length: male, 6 mm., female, 13 mm.

It will thus be seen that, beyond a superficial resemblance, the only common

[1] *Loc. cit.*, p. 149.

character is the marked ventricosity of the neighbourhood of the vulva, which, however, is differently placed in its relation to the length of the body.

It is obvious then that Dr. Curtice's species is distinct from *S. ventricosus*, Rud. Might I suggest that it should be named *S. Curticii?*

It is obvious that this species is very closely allied to that I have just described as *S. colubriformis.* At first I thought that they might be identical, but the absence of alæ and the cylindrically inflated head, it seems to me, should be sufficient to distinguish them. Moreover, the male bursæ, though very much alike, differ in certain particulars, and I have not been able to find any trace of the peculiar dotted appearance of the skin, which is prominently noticed alike in his description and figure. Further, I have never met with a single female which, by any straining of terms, could be said to be ventricose. At the same time I do not consider the question can be considered as quite settled until actual specimens are compared.

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SANAWAR:

The 26th November 1891.

ADDENDUM.

A recent fresh find of the species described in these memoirs as *Trichosomum verrucosum* sp. n., including a number of males, has enabled me to determine definitely its generic position. It is undoubtedly a *Spiroptera*, and should therefore stand as Spiroptera verrucosa sp. n. The males, which appear to be much less numerous than the females, are much smaller than the latter, measuring only 4·2 c. m. in length, and are about half their thickness. The favourite habitat of the worm appears to be the reticulum and psalterium and most commonly it burrows the whole or the greater part of its length into the submucosa. The present find was in the zelu and not in sheep, and its prevalence appears seasonal, as none could be found in the winter, whereas it now appears to be tolerably common.

Sanawar, the 23rd May 1892. G. M. GILES.

Explanation of Plate

Strongylus columbriformis, sp. n.

FIG. 1. Male × 30 diameters.
" 1a. " natural size.
" 2. Female × 30 diameters.
" 2a. " natural size.
" 3. Male bursa spread, × 170 diameters.
" 4. " copulatory spicula × 170 diameters.
" 5. " bursa viewed somewhat obliquely, from the ventral aspect × 17 diameters.
" 6. Anterior extremity of female × 440 diameters.
" 7. Vulvar portion of body of female × 130 diameters—
a—vulva.
bb—valvular apparatus, guarding the mouths of the uteri.
The darkly shaded portion represents the intestine.
" 8. Caudal end of female × 170 diameters.
" 9. An ovum (from uterine cavity) × 440 diameters.

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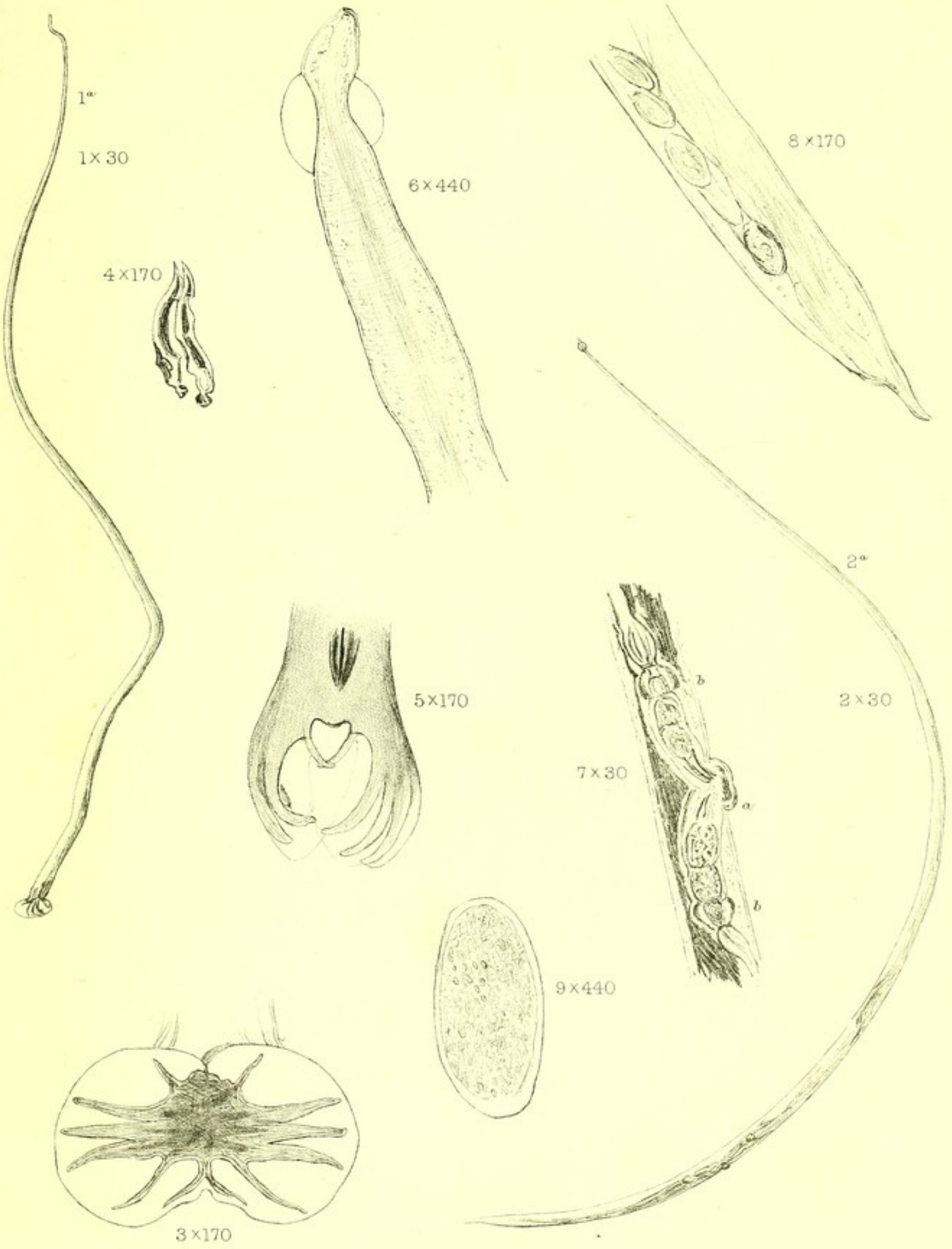

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