NOTES ON TENNESSEE HELMINTHS II. TWO NEW SPECIES OF *STRONGYLURIS* (NEMATODA) AND NOTES ON THE GENUS

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The 12 proposed species which are referred to the genus *Strongyluris* at the present time represent a very compact group wherein the differential characters require full descriptions. However, several of the older species are incompletely described, and as yet few redescriptions are available. Consequently, there exists a real confusion in the present-day literature as to which of the proposed species are valid and which are synonyms.

The writer, while attempting to classify some specimens collected in Tennessee and belonging to this genus, was unable to obtain a reasonably clear conception of the genus as it is now known. Largely through the kindness of Dr. J. H. Sandground, he was able to study additional material belonging to several species. The data thus obtained are included in this communication although they concern African material.

While making this study I have had opportunity to study the following material kindly loaned by Dr. Sandground. *S. elegans* from *Chamaeleon goetzei,* which was erroneously reported as *S. brevicaudata; S. ornata* from *Agama* sp., which is redescribed below in order to clarify its position with reference to the other members of the genus; *S. media* n. sp. from *Chamaeleon multituberculata;* and *S. paradoxus* from *Hagedashia hagedash niolotica.* The original description of this last species is, for the most part, adequate, but there are a few points which I have been able to make out in my restudy that may be mentioned here. There is a conspicuous crown of papillae near the cephalic end; and, furthermore, there are 10 pairs of caudal papillae present in the male instead of 8 as reported. The pulp of the dorsal lip is very similar to that of *S. calotis,* while the cuticular spike on the inside of the lip is rounded at the end instead of being sharply pointed.

I have been able to examine also a few specimens of *S. brevicaudata* from *Agama* sp., and those specimens which are described below as *S. rubra* n. sp.

Strongyluris ornata (LINSTOW, 1897) BAYLIS AND DAUBNEY, 1922

Specific diagnosis.—Strongyluris: Body white in preserved material. Cross striations of cuticula, fine, about 3μ apart; fine longi-

tudinal striations likewise present. Mouth surrounded by 3 equal lips, set off from body by a marked constriction. Two large papillae on dorsal lip, a large papilla and an amphid on each lateral lip, 2 pairs of small papillae on apex of each lip; free cuticular border of each lip curved inward; small, sharply pointed, forward projecting cuticular spike on inner side of each lip; pulp of dorsal lip almost identical to that figured for *S. calotis*, possessing a rounded lobe ending just cephalic to bases of the 2 papillae; arising from the bases of the papillae inside this lobe, 2 smaller lobes of the pulp extending cephalad in lip beyond ends of the papillae. Somatic papillae numerous and concentrated in a crown near cephalic end. Lateral lines very broad, usually occupying ½ the lateral aspect.

Male: Body fusiform except for truncated caudal end. Length 12 to 14.3 mm., width at base of esophagus, 0.6 to 0.7 mm. Pharynx 0.32 to 0.56 mm. long. Distance from cephalic end to caudal end of esophagus, 0.21 to 0.35 mm. Esophageal bulb 0.27 to 0.34 mm. wide. Nerve ring 0.46 to 0.63 mm., and excretory pore 1.62 to 1.82 mm., from cephalic end. Tail very short, actual length variable, largely due to state of contraction. Caudal alae very well developed, the usual 10 pairs of papillae present, somewhat more slender than in *S. brevicaudata*. Spicules 1.19 to 1.55 mm. long, equaling 1/8 to 1/12 total body length.

Female: Body fusiform, length 17 to 19 mm.; width at vulva, 0.75 to 1.2 mm. Pharynx 0.32 to 0.45 mm. long. Distance from cephalic extremity to caudal end of esophagus, 3 to 3.2 mm. Nerve ring about 0.7 mm., and excretory pore 2 to 2.2 mm., from cephalic extremity. Esophageal bulb 0.32 to 0.42 mm. wide. Distance from anterior end to vulva, 10.5 to 11.57 mm. Tail 0.31 to 0.35 mm. long. Phasmids about 0.1 from tip of tail. Eggs ready for laying, 70 to 77μ long by 40 to 45μ wide.

Hosts (from which the material for this description was taken): *Agama agama turnensis* and *A. atricollis*.

Locality: Tanganyika Territory, Africa.

Specimens: Museum of Comparative Zoology, Harvard College, vials 200 and 201; also U. S. Nat. Mus. Helm. Coll. No. 39592.

Remarks: Strongyluris ornata (Linstow, 1897) is one of the first known of those species that are now included in this genus. As with many older descriptions, the detail given is inadequate for modern taxonomic purposes, and *S. ornata* might be any of several known species. Unfortunately, the type material is not available to me, if indeed it still exists, and I cannot with certainty identify with *S. ornata* the material loaned me by Dr. Sandground. However, there are only a few points in which this material is at variance with the original description, and those points can be easily explained. Linstow has described 22 caudal papillae, whereas I have found only 20. However, the figure shows that Linstow mistook the notch in the caudal wall of the sucker for one papilla, and another is probably an artifact

since it is figured as a median, postanal papilla which is not present in any other member of this group. The remaining 20 papillae are placed as in the specimens available to me. Linstow described in the lateral lines a black pigment which I have not seen, but there is present in my material a brown substance which might easily appear black after the use of some preservatives or some clearing media. Linstow has not mentioned the somatic papillae which are so conspicuous in my specimens, but we cannot conclude from the omission that the papillae were absent. These are the only points of importance in which my material differs from the original description of *S. ornata.* In all measurements and other morphological points mentioned there is very good agreement. Therefore, it is very likely that I am dealing with the same species which Linstow had at hand when he wrote the description of *S. ornata,* and since the original description is now inadequate for certain recognition of the species, I am redescribing these specimens under that name. If any of the type material can be located, and it can be shown that the types differ from this description, it will be necessary to assign another name to the worms which I have studied.

Since Baylis and Daubney (1922), Spaul (1923), and Taylor (1924) have all suggested that *S. ornata* be declared a synonym of *S. brevicaudata,* there may be some doubt as to whether the former name is still available, but it seems to the present writer that it is possible to show differences between the genotype and *S. ornata* as described by Linstow. For this purpose it is necessary to establish certain limits to the variation in *S. brevicaudata.* Fortunately this worm has been described several times (Mueller, 1894; Spaul, 1923; Taylor, 1924); and, furthermore, the present writer has a few specimens at his disposal. In all these cases the ratio of the length of the spicules to the total length varies from 1:3.6 to 1:7.6. We may say, therefore, that the spicules are at most ⅛ the total body length. To be sure, other authors have described nematodes under the name of *S. brevicaudata* and have given data not in accord with the above, but it will be shown that these were misidentifications.

Linstow gives 12 mm. for the length of his nematodes and 1.06 mm. for the length of the spicules. Therefore, the ratio of the length of spicules to total length is approximately 1:11, or somewhat different than the similar ratio in *S. brevicaudata.* This ratio alone is not certain evidence that these 2 parasites represent distinct species, but the difference is strong presumptive evidence, and sufficient ground for retaining the name *S. ornata.*

Strongyluris ornata, as herein described, may be distinguished from the genotype by the pulp of the dorsal lip which possesses, in *S. ornata,* 2 lobes directed cephalad, but in the figure of *S. brevicaudata* by Yorke and Maplestone (1926) and in the material available to me these lobes are lacking. Furthermore, *S. ornata* is larger, has relatively shorter spicules, and wider lateral lines.

It may be mentioned here that there were in this material 3 males

which agreed with *S. ornata* in every respect except the caudal papillae. In the preanal group there were the usual 3 papillae on one side of the sucker, but there were 4 on the other. This asymmetry is obviously a small anomaly which barely warrants mention.

Gendre (1909a) described a nematode which he questionably identified as *S. ornata,* but later in the same year (1909b) he stated that his material was co-specific with *S. brevicaudata.* However the ratio of the spicule length to the total length, when computed from Gendre's measurements, varies from 1:8 to 1:10. Furthermore, Gendre has indicated in his figure of the head that the pulp of the dorsal lip extends well beyond the papillae and is bilobed. Therefore, in view of the data given above it seems more likely that Gendre was dealing with *S. ornata* than with *S. brevicaudata* as it is regarded here.

Taylor (1924) thought it likely that *S. calotis* Baylis and Daubney, 1923, was a synonym of *S. brevicaudata,* but it is distinguished easily from the genotype by the absence of somatic papillae, shorter spicules, and bilobed pulp of the dorsal lip. Later Hsü and Hoeppli (1931) and Hsü (1932) described some parasites of this genus under the name *S. brevicaudata.* Since they made it clear that their specimens agreed closely with *S. calotis* rather than with the description of the genotype, it is obvious that *S. brevicaudata* Hsü and Hoeppli should be regarded as a synonym of *S. calotis.*

Strongyluris media N. SP.

Specific diagnosis.—Strongyluris: Body light brown in preserved specimens. Mouth surrounded by 3 equal lips, set off from the body by a marked constriction; 2 large papillae on the dorsal lip, 1 large papilla and an amphid on each lateral lip; a free cuticular flange present on the summit of each lip; a small forward projecting cuticular spike on inner surface of each lip; pulp of dorsal lip very simple and similar to that of *S. brevicaudata.* Neither somatic papillae nor cross striations of the cuticula observed; fine longitudinal striations present.

Male: Body fusiform except for truncated caudal end. Length 12.8 to 13.8 mm., width at base of esophagus, 0.34 to 0.5 mm. Diameter of head about 60μ. Pharynx 0.25 mm. long. Cephalic extremity to caudal end of esophagus, 1.85 to 1.96 mm. Esophageal bulb 0.25 mm. wide. Nerve ring 0.42 to 0.45 mm., and excretory pore 1.12 and 1.14 mm., from cephalic extremity. Tail about 70μ long; tail spike about 28μ long. Caudal alae very well developed, the usual 10 pairs of caudal papillae present. Spicules 0.8 to 0.95 mm. long, the ratio to total body length varying from 1:14.5 to 1:16; diameter of spicules about 35μ.

Female: Body fusiform, length 16.65 to 22.3 mm., width at vulva 0.7 to 0.76 mm., diameter of head about 70μ. Pharynx 0.28 to 0.31 mm. long. Distance from cephalic end to caudal end of esophagus, 2.3 to 2.4 mm. Esophageal bulb 0.32 to 0.33 mm. wide. Nerve ring 0.5 to 0.56 mm., and excretory pore about 1.55 mm., from cephalic extremity. Vulva slightly caudal to equator of body, 9.8 to 12.9 mm.

from lips. Tail 0.42 to 0.5 mm. long, tapering gradually to a fine point. Eggs about 70μ by 40μ. Ovejector about 0.42 mm. long, running directly cephalad from vulva.

Host: Chamaeleon multituberculata.

Locality: East Africa.

Specimens: Types and paratypes, Museum of Comparative Zoology, Harvard College; also paratypes, U. S. Nat. Mus. Helm. Coll. No. 39591.

Remarks: Strongyluris media n. sp. is among those members of this genus which lack somatic papillae, and of these it is, by virtue of its spicule ratio, most similar to *S. calotis*. From this species it may be separated by the relatively simple pulp in the dorsal lip, the longer female tail, and larger size. *S. media* is also similar to *S. sai* Travassos, 1926, but it may be distinguished from that species by the position of the nerve ring, the nature of the cuticular striations, and the shape of the ovejector. The material upon which this description was based consists of 6 specimens, 4 males and 2 females, kindly supplied by Dr. Sandground.

Strongyluris rubra N. SP.

Specific diagnosis.—Strongyluris: Body red when alive, turning gray or light brown when preserved, the discolored pigment remaining and making study of the internal organs and of the papillae more difficult than usual. Cross striations of cuticula fine, about 3μ apart. Lontigudinal striations fine. Mouth surrounded by 3 equal lips set off from body by a marked constriction, the dorsal bearing 2 large papillae, the lateral each one large papilla and an amphid; each lip bearing on its inner surface a sharp forward-directed, cuticular spike. Behind the lips, a distance a little less than their height, is a ring of small papillae.

Male: Body fusiform except for truncated caudal end. Length 6.5 to 10 mm.; width near base of esophagus, 0.35 to 0.56 mm. Diameter of head 60 to 65μ. Pharynx 0.17 to 0.24 mm. long. Distance from cephalic end to caudal end of esophagus, 1.12 to 1.52 mm. Esophageal bulb 0.16 to 0.2 mm. long by 0.15 to 0.25 mm. wide. Nerve ring about 0.37, and excretory pore about 0.83 mm. from cephalic end. Tail very short, 10μ to 60μ long, its actual length depending largely on state of contraction; short, blunt tail spike about 12μ long present, but often drawn into the body. Caudal alae very well developed. Only 9 of the usual 10 pairs of caudal papillae located, 1 of the adanal pairs not being found. Spicules from 0.37 to 0.63 mm. long by 23μ in diameter, faintly cross striated; ratio of spicule length to total body length, 1:13 to 1.16. Anal sucker 0.063 to 0.1 mm. in diameter, a distinct notch present in its caudal rim, but usually difficult to observe.

Female: Body fusiform, length 9.6 to 13.5 mm.; width at vulva, 0.48 to 0.62 mm. Head 60μ wide. Pharynx 0.23 to 0.25 mm. long.

Distance from cephalic end to caudal end of esophagus, 1.33 mm. to 2 mm. Esophageal bulb 0.2 to 0.22 mm. long by 0.18 to 0.24 mm. wide. Nerve ring about 0.53 mm., and excretory pore about 1 mm., from cephalic extremity. Vulva slightly caudal to equator of body, 5.3 mm. to 8 mm. from lips. Tail 0.22 to 0.35 mm. long, either smoothly conical or appearing folded as though strongly contracted. Eggs, when ready for deposition, unsegmented, 70 to 80μ long by 41 to 50μ wide; egg shell very thick.

Host: Sceloporus undulatus (the rail fence lizard).

Habitat: Rectum.

Locality: Environs of Radnor Lake near Nashville, Tenn., and Raleigh, North Carolina.

Specimens: Types, U. S. Nat. Mus. Helm. Coll. No. 39589; paratypes, U. S. Nat. Mus. Helm. Coll. Nos. 39590, 15891, and 15892.

Remarks: Strongyluris rubra n. sp. is the first species of the genus which is definitely known to be red in color when alive. As other descriptions seem to be based on preserved material, this fact, apparently, could not have been ascertained. *S. rubra* possesses the somatic papillae found in many species of this genus, but in this form they are confined to a single crown of small papillae just behind the lips. In this respect it resembles most closely *S. elegans* (Gendre, 1909) from which it is easily separated by the lesser number of caudal papillae which are more irregularly placed, and by the blunt end of the tail spike.

S. rubra is the first recorded member of this genus from North America. The material upon which this description is based came from 2 sources. About 17 specimens were taken from 3 lizards, all of which had been collected in the immediate vicinity of Radnor Lake. These were all the lizards of this species examined from that locality, but of 12 other members of the same species taken in other localities about Nashville none was infested. This suggests a peculiar local distribution, but further data are needed before any conclusions may be drawn regarding this. The writer had access also to 2 specimens collected in North Carolina by Dr. Foster and deposited in the National Museum without any specific determination.

In the following key to the species of *Strongyluris,* the writer has based his main division on the presence or absence of somatic papillae. Several species for which these structures are not described are keyed out in both groups. *S. streptocsophageus* Connal, 1912, does not appear in this key since Baylis and Daubney (1922), Spaul (1923), and Taylor (1924) believed it to be a synonym of *S. brevicaudata,* and the present writer has been unable to find any reason for not accepting their decision. *Strongyluris paronai* (Stossich, 1902) is so poorly described that it is impossible to be certain that it belongs to this genus. Its position in the key is, therefore, tentative. It is hoped that those having access to the original material or to additional material will add to the present available data on this species.

KEY TO THE SPECIES OF *Strongyluris*

1. Species over 30 mm. long, large; vulva near equator of body; spicules 1/30 to 1/45 total length 2
   Species less than 30 mm. long; vulva variable in position; spicules 1/3 to 1/20 total length 3
2. Crown of large papillae immediately behind lips of male; eggs 72μ by 36μ; length over 50 mm. ..... *S. loveridgei*
   No crown of papillae immediately behind lips of male; eggs 150μ by 36μ; length less than 50 mm. ..... *S. gigas*
3. No somatic papillae present 4
   Somatic papillae present, at least immediately behind lips 9
4. Eleven pairs of caudal papillae present; male tail relatively long and conical ..... *S. paronai*
   Not more than 10 pairs of caudal papillae present; male tail obliquely truncate 5
5. Two pairs of caudal papillae cephalic to caudal sucker, 2 pairs lateral to sucker ..... *S. oscari*
   One pair of caudal papillae cephalic to caudal sucker; 2 pairs lateral to sucker 6
6. Nerve ring in middle of esophagus; tail relatively long, 1/20 to 1/25 total length ..... *S. sai*
   Nerve ring cephalic to caudal end of cephalic third of esophagus; tail relatively short, not more than 1/40 total length 7
7. Spicules more than 1 mm. long, about 1/6 total body length; 9? pairs of caudal papillae ..... *S. chamaeleonis*
   Spicules less than 1 mm. long, 1/14 to 1/16 total length; 10 pairs of caudal papillae 8
8. Pulp of dorsal lip with 2 lobes extending past the large papillae; cuticular striations, fine ..... *S. calotis*
   Pulp of dorsal lip simple without cephalic lobes; cuticular striations, absent ..... *S. media*
9. Male tail with 11 pairs of papillae; from an Australian lizard ..... *S. paronai*
   Male tail with 10 or fewer pairs of caudal papillae except *S. elegans* with 11 pairs; not from Australia 10
10. Male tail 0.53 mm. long, 1/20 total body length; female tail 0.52 mm. long, 1/25 total body length; nerve ring in middle of esophagus ..... *S. sai*
    Male tail 0.2 mm. long or shorter, not more than 1/40 total body length; female tail less than 0.35 mm. long, not more than 1/30 total body length; nerve ring cephalic to middle of esophagus 11
11. Two pairs of papillae cephalic to sucker, 2 pairs lateral to sucker ..... *S. oscari*
    One pair of papillae cephalic to sucker, 2 pairs lateral to sucker 12
12. Male tail with 11 pairs of caudal papillae; tail spike long and sharply pointed ..... *S. elegans*
    Male tail with not more than 10 pairs of caudal papillae; tail spike short and blunt 13
13. Somatic papillae limited to a single ring behind lips; color red when alive ..... *S. rubra*
    Somatic papillae in several rings behind lips; color when alive undescribed 14
14. Pulp of dorsal lip simple, not projecting beyond papillae; spicules 1/3.6 to 1/7.4 total body length ..... *S. brevicaudata*
    Pulp of dorsal lip with 2 small lobes projecting beyond the large papillae; spicules 1/8 to 1/12 total body length 15
15. Forward projecting spine on inside of lips bluntly pointed; caudal alae poorly developed ..... *S. paradoxus*
    Forward projecting spine on inside of lip acutely pointed; caudal alae well developed ..... *S. ornata*

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PLATE 1

EXPLANATION OF PLATE

Fig. 1. *Strongyluris ornata.* Caudal end of male; ventral view.

Fig. 2. *Strongyluris ornata.* Dorsal lip.

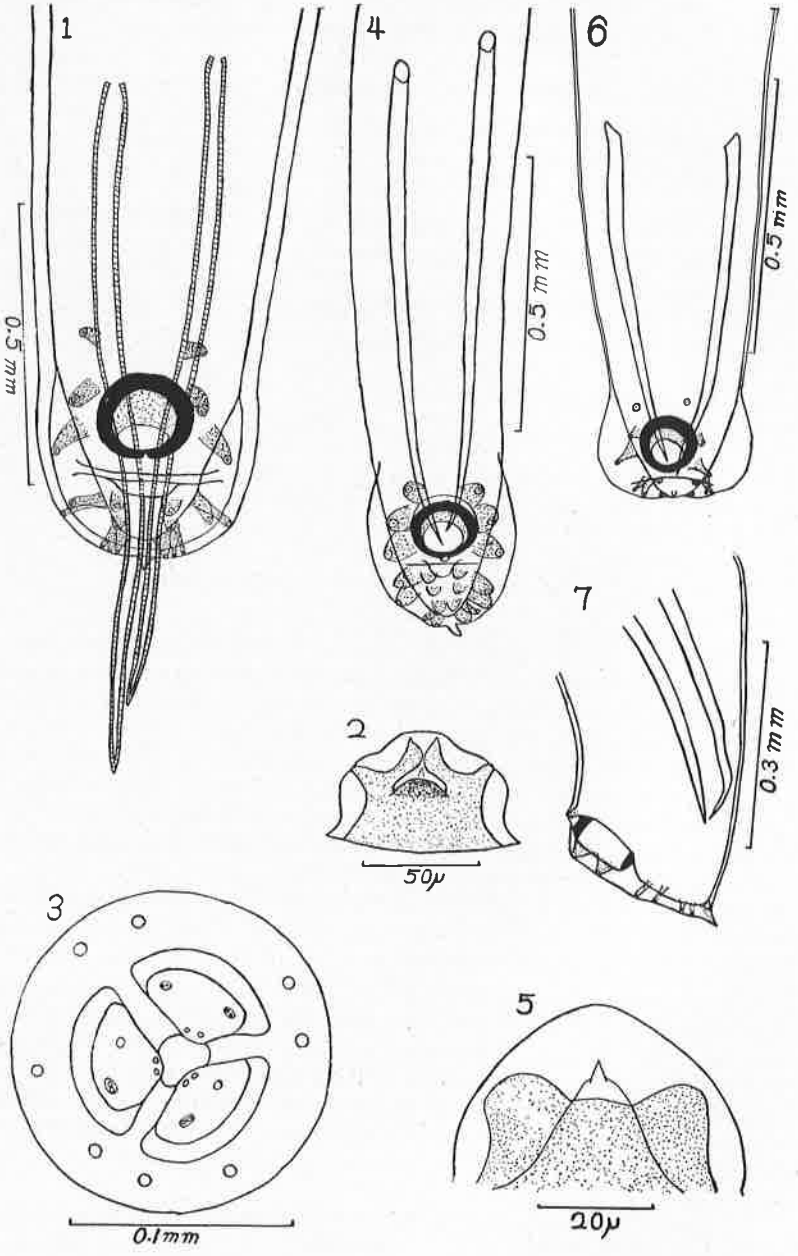
Fig. 3. *Strongyluris ornata.* Lips: cephalic view.

Fig. 4. *Strongyluris media.* Caudal end of male; ventral view.

Fig. 5. *Strongyluris media.* Dorsal lip.

Fig. 6. *Strongyluris rubra.* Caudal end of male; ventral view.

Fig. 7. *Strongyluris rubra.* Caudal end of male; lateral view.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