SOME PARASITIC ROUND WORMS OF THE RABBIT WITH DESCRIPTIONS OF TWO NEW SPECIES.

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In the course of parasitological examinations of domestic rabbits kept in the animal house of the Rice Institute biological laboratory, it was found that nearly every specimen was infested by trichostrongylid worms, and in some instances three different species were present in considerable numbers at the same time. The fact that immature specimens of all three species were present in some of the rabbits which had been kept in the animal house for from six weeks to two months, would seem to indicate that the infection, in some instances at least, was acquired in the animal house. Since all of the rabbits which have been kept in the house have been obtained in Texas, from breeders either in Houston or New Braunfels, it is probable that the worms originally came from Texas.

One of the species, and the one found in greatest abundance and in the largest number of individuals, is *Trichostrongylus calcaratus*, described by Ransom (1911) from cotton-tail rabbits, *Sylvilagus floridanus mallurus*, in Maryland. A number of young individuals of this species were found. The males, up to a length of about 3 to 3.5 mm., have the posterior end of the body terminated in a bulb with a conspicuous spine on the postero-dorsal extremity of it (fig. 1). Within the bulb the bursa of the adult develops, the body then drawing away somewhat from the larval cuticle, as shown in the figure. No doubt the final moult takes place shortly after this.

NEMATODIRUS LEPORIS, new species.

Plate 1, figs. 2–5.

Specific diagnosis. Long slender worms of small size, blood red when freshly removed. Inflated cuticle of neck asymmetrical, and conspicuously striated.

Male 8 to 13 mm. long with a maximum diameter of from 95 to 135 μ. Esophagus 400 to 500 μ in length. Bursa (fig. 3) well expanded, its breadth (250 μ), greater than its length (210 μ), an

unusual condition in the genus. Dorsal lobes of bursa set off from lateral lobes by a distinct notch and separated from each other by a shallow indentation. Dorsal ray moderately stout, bifurcated to about one-fourth its length from the tip of the longest prong. Externo-dorsal rays long and very slender, about midway between dorsal ray and postero-lateral ray. Postero-lateral and medio-lateral rays close together, arising from a common trunk, and extending almost to the margin of the bursa. Externo-lateral ray stout, curving sharply away from other lateral rays in its distal third, and ending at some distance from the bursal margin. Latero-ventral and ventro-ventral rays in contact for their whole length, curved forward, and ending at some distance from the bursal margin. These rays are much more slender than the lateral rays, but much thicker than the dorsal ray. Their length is only about half that of the externo-lateral and medio-lateral pair. Bosses numerous and small, occupying the portion of the bursa from near the ventral margin to the externo-lateral and medio-lateral pair of rays. Spicules (figs. 4–5) deep brownish red in color, 0.65 to 1.05 mm. long, united for the greater part of their length, and showing distinct striations on the proximal half. Tip of spicule curved ventrally, and ending in a membranous bulb. A pair of membranous wing-like expansions occur along the ventral side distally, ending in obtuse angles just proximal to the bulb. These membranous expansions have very fine markings as shown in figure 5. The body of the spicule ends in a finger-like process bent sharply dorsal, and ending on the dorsal margin of the bulb.

Female 16.5 to 20 mm. in length, with a maximum diameter of 180 to 220 μ at the vulva. Diameter abruptly but moderately reduced behind vulva. Head diameter 35 to 40 μ, exclusive of inflated cuticle: latter well developed, usually markedly asymmetrical, conspicuously striated, reaching a diameter of from 55 to 75 μ and extending back on the neck to a point 130 to 145 μ from the anterior end. Esophagus 450 to 600 μ in length. Tip of tail truncated and provided with the usual bristle-like process. Anus 105 to 115 μ from truncated end of body. Vulva a transverse slit 420 to 486 μ, almost exactly one-fourth length of body, from posterior end. Eggs long oval, measuring 160 to 180 μ by 80 to 90 μ, in various stages of development from morula to fully formed embryo when deposited.

Host.—Domestic rabbit, *Oryctolagus cuniculus.*

Location.—Duodenum.

Locality.—Houston, Texas.

Type.—Male, U.S.N.M., Helm. Coll. 7733; paratypes, males and females, U.S.N.M., Helm. Coll. 7734.

This species of *Nematodirus* seems to come closest to *filicollis*, which it resembles in general bursal characteristics, short spicules,

and position of vulva, and distinctly falls into the *filicollis* group as described by May (1920). The male differs, however, in the form of the tip of the spicules, in the shape of the bursa, in details of the arrangement and relative size of the bursal rays, in the number and arrangement of bosses, and in the thickness of the body. The female differs in its more slender body, the greater length of the tail, and in the more posterior position of the vulva. The latter characteristic is sufficient to distinguish the females from any other species of the genus. In this respect it approaches the genus *Mecistocirrus*, but does not approach it at all, as do some other species, in length of spicules, size of eggs, or presence of cervical papillae. This still further bears out May's (1920) contention that *Mecistocirrus* is not justifiably separated from *Vematodirus*.

OBELISCUS CUNICULI Graybill (1923).

Plate 2, figs. 6–11.

Since the original draft of this paper was written, the description of this worm by Graybill (1923), as a new genus and species, has appeared. It seems desirable, however, to add a few details to Graybill's description.

The worms are relatively large and robust for Trichostrongylids. Graybill describes them as whitish in color with some dark streaking due to the color of the intestine, but when living, in a freshly opened stomach, the worms are blood red in color. The longitudinal cuticular ridges vary in number from 16 to 26 in males and from 36 to 40 in females. These ridges are broken by transverse indentations at intervals of about 200 μ in the anterior portion of the female, and at somewhat shorter and more irregular intervals in the male. Extremely fine and inconspicuous transverse striations are present, most evident in the region of the vulva and on the tail of the female. The nerve ring crosses the esophagus a little anterior to the middle of its length.

The bursa (fig. 7), as mentioned by Graybill, consists of two large rounded lateral lobes, separated from each other dorsally by a relatively small dorsal lobe. At the obtuse angles formed where the ventral rays on the one hand, and the medio and postero lateral rays on the other, terminate near their margins, the bursal lobes have a maximum width of about 400 to 450 μ, while their maximum length, measured to the point where the externo-lateral ray terminates, is about 500 to 600 μ. The entire ventral surface of the bursa, except a fluted margin about 40 μ in width, is thickly covered with dew-drop-like bosses, giving the bursa a beautifully sculptured appearance. The ventro-ventral ray is smaller than any of the other rays in the lateral lobes except the externo-dorsal. The latero-

ventral ray is the largest of all. It is very stout basally and runs nearly parallel with the externo-lateral for about half its length, being widely separated from the ventro-ventral. The distal half, which tapers markedly, performs a wide sweeping curve forward until it comes very near to the ventro-ventral at the inner limit of the fluted bursal margin. At this point it bends outward again, so that the tips of the two ventral rays come to lie parallel in the fluted margin of the bursa, in an obtuse angle formed in the bursa at this point, directly opposite a similar obtuse angle formed where the medio- and postero-lateral rays terminate. These latter two rays are of moderate size, approximately equal, parallel, and curving dorsally. The externo-lateral ray is much larger than the other lateral rays, curves toward the ventral rays, and terminates in a sharply constricted finger-like tip at a point on the margin of the bursa about midway between the ventral and the other lateral rays. The small but stout externo-dorsal ray curves dorsally and terminates in the margin of the bursa about midway between the tips of the postero and medio-lateral rays and the junction of dorsal and lateral lobes.

The small dorsal lobe (fig. 8) is of very peculiar structure. It is overlapped, as Graybill has pointed out, by the lateral lobes, and is sharply marked off from them. It is supported by a single dorsal ray which forks distally into two bifurcated tips. Near the middle of its length a pair of branches are given off which curve ventrally, pass through a minute foramen, and enter a vesicular swelling as in *Cooperia*. Ventral to this swelling there is an additional membranous flap, supported by a pair of very minute, delicate parallel rays.

In some of the specimens measured the spicules (figs. 9–10) are considerably larger than those measured by Graybill, a number of them varying between 500 and 540 μ in length with a lateral diameter of 50 μ. Although the chitinous portion of the spicules is cleft distally, and terminates in a dorsal and a ventral hook, the spicules can not be said to be cleft, since these parts are connected by a membrane as shown in figures 9 and 10. The ventral hook is the larger and coarser, bending in a medioventral direction; the dorsal hook bends dorsally, laterally, and then distally, ending in a slender point. The membranous expansions at the distal ends of the spicules extend beyond the chitinous hooks.

A few of the females reach a length of 20 mm. Graybill gives the maximum length as 18.5 mm. He records the maximum width of one specimen as 546 μ, but in the Texas specimens the greatest width, of about a dozen specimens measured, was 400 μ, just anterior to the vulva. At this point there is a marked reduction in

diameter to from 305 to 340 μ. The diameter of the head anteriorly is only 80 μ, but 110 μ from the anterior end it has widened out to 150 μ. Graybill gives the diameter of the head as 119 μ. The vulva, guarded by a pair of inconspicuous lips, is situated about one-fifth the length of the body (3.6 to 4.5 mm.) from the posterior end, its location being readily recognized by the abrupt diminution in diameter of the body and the angular bending of the body at this point. The vagina is very short, joining the divergent ovijectors almost immediately. The muscular portions of the ovijectors can hold four or five eggs apiece; there is no well-marked sphincter between the muscular and nonmuscular portions, but a very strong sphincter separates the nonmuscular portion from the uterus. The terminal portion of the uterus is also muscular, and can contract so that only one egg at a time can reach the sphincter. The eggs in the Texas specimens measure 80 to 92 μ by 56 to 64 μ, whereas Graybill records measurements of 76 to 86 μ by 44 to 45 μ in the New Jersey specimens.

In spite of a number of slight discrepancies in the descriptions and measurements of the Texas and New Jersey specimens, it is very unlikely that more than one species is represented. My measurements were made from living narcotized worms, whereas Graybill's may have been made from preserved and prepared specimens, which would account for some of the differences.

When present in considerable numbers this worm produces a very marked erosion and ulceration of the stomach wall. The worms are found adhering firmly to the mucous membranes, and in some instances seem to have their heads buried deeply in the wall. In most of the rabbits examined only from one to five or six worms were found, but in one specimen about 50 adult worms and a number of immature specimens were found. Part of the material described above has been deposited in the Helminthological Collections of the U. S. National Museum, Nos. 7735 and 7736.

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EXPLANATIONS OF PLATES.

a.—anus.
a. d. l.—accessory dorsal lobe.
a. d. v.—accessory dorsal ray.
a. ov.—ascending oviduct.
d.—dorsal ray.
d. h.—dorsal hook.
d. l.—dorsal lobe.
d. v.—ventral branch of dorsal ray.
e. d.—externo-dorsal ray.
e. l.—externo-lateral ray.
l. v.—latero-ventral ray.
m. l.—medio-lateral ray.
m. ovij.—muscular portion of ovijector.
n. m. ovij.—non-muscular portion of ovijector.
oe.—esophagus.
p. l.—postero-lateral ray.
s.—sphincter of ovijector.
u.—uterus.
v.—vulva.
va.—vagina.
v. h.—ventral hook.
v. l.—ventral lobe.
v. s.—vesicular swelling under dorsal lobe.
v. v.—ventro-ventral ray.

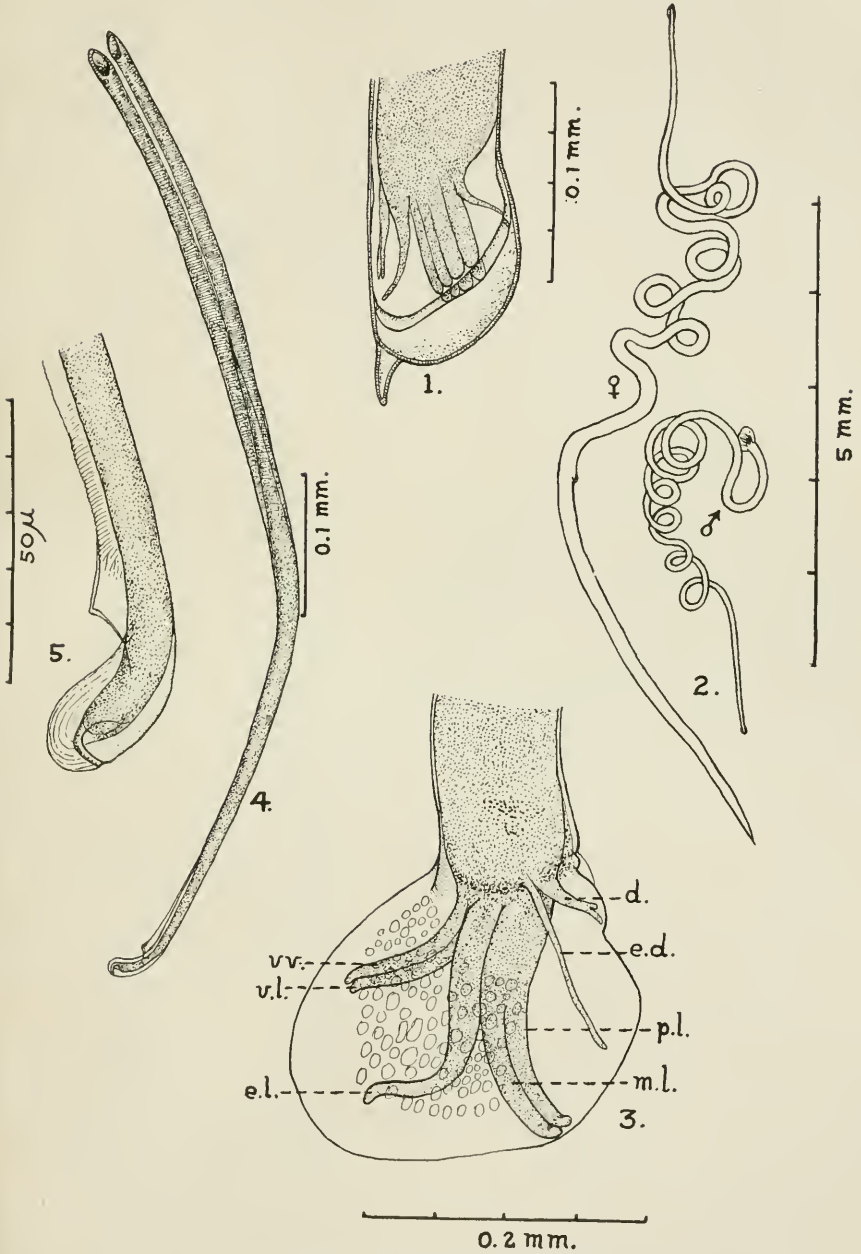
PLATE 1.

FIG. 1.—*Trichostrongylus calcaratus*. Posterior end of young male, showing bulb-like expansion of larval cuticle, with developing bursa inside.

2–5.—*Nematodirus leporis*, new species. 2, adult worms, entire. 3, bursa, from left side. 4, spicules, entire, from left side. 5, tip of spicules, from left side.

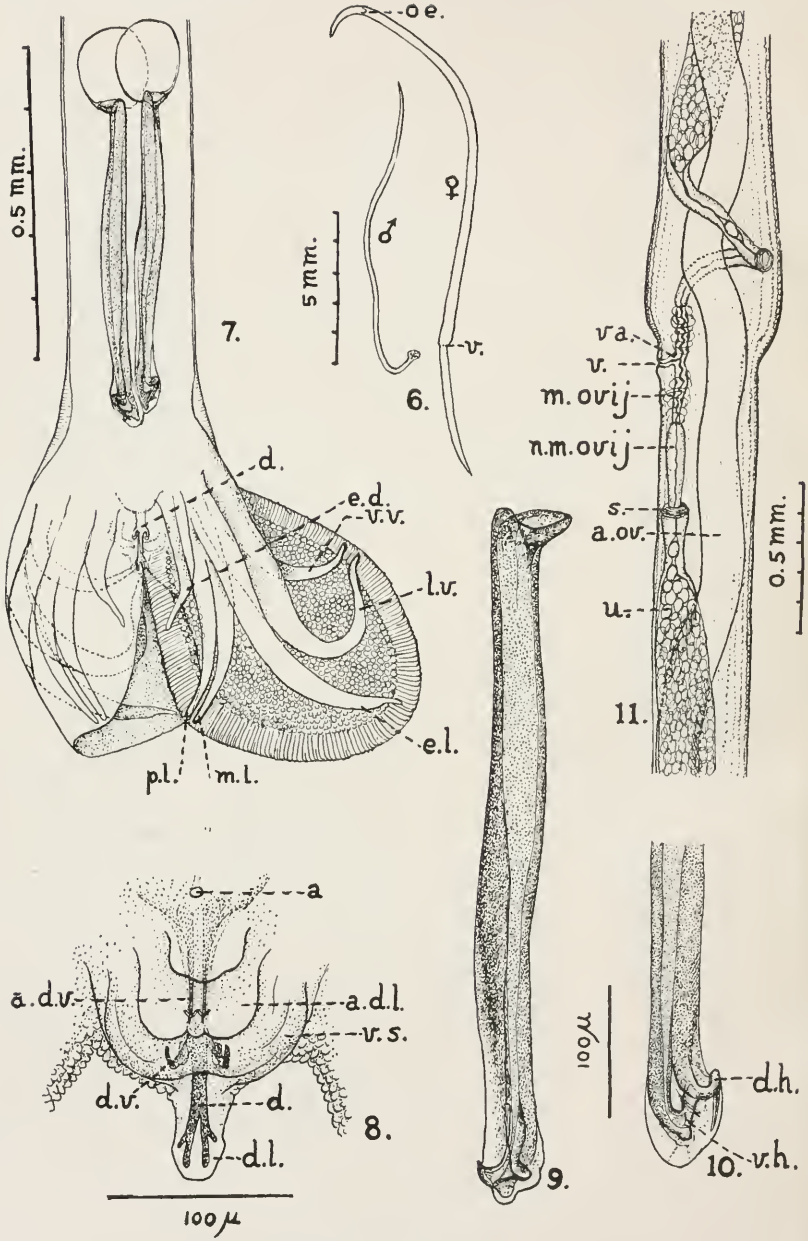
PLATE 2.

FIGS. 6–11.—*Obeliscus cuniculi*. 6, adult worms, entire. 7, bursa, dorsal view. 8, dorsal lobe and accessory parts, from ventral side. 9, spicule, entire, lateral view. 10, Distal portion of spicule, dorsal view, slightly medial. 11, Vulval region of female, showing ovijectors.



TRICHOSTRONGYLUS CALCARATUS AND NEMATODIRUS LEPORIS

FOR EXPLANATION OF PLATE SEE PAGE 6



OBELISCUS CUNICULI

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