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A NEW CESTODE, *RAILLIETINA (RAILLIETINA)*
OLIGOCAPSULATA N. SP., AND
R. (R.) DEMERARIENSIS (DANIELS, 1895)
FROM VENEZUELAN MAMMALS¹

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Raillietina (Raillietina) oligocapsulata n. sp. and *R. (R.) demerariensis* (DANIELS, 1895) obtained from *Sylvilagus brasiliensis*, and *R. (R.) demerariensis* (DANIELS, 1895) from *Agouti paca* in Venezuela are described. All the raillietinid cestodes reported herein are closely related to the Neotropical mammalian *Raillietina*, especially *R. (R.) demerariensis*. However, *R. (R.) oligocapsulata* n. sp. is distinguished from its congeners by its slender shape and the smaller number of egg capsules (24-44). The new species is also distinct from the North American species of *Raillietina* from lagomorphs and rodents. *R. (R.) demerariensis* from *Sylvilagus brasiliensis* represents the new host record.

Key words: *Raillietina (Raillietina) oligocapsulata* n. sp., *R. (R.) demerariensis*, *Sylvilagus brasiliensis*, *Agouti paca*, Cestoda, Venezuela

INTRODUCTION

There were many complications about the specific determination of mammalian species of *Raillietina* in the Neotropical region (CHANDLER & PRADATSUNDARASAR, 1957; RÊGO, 1964; STUNKARD, 1953). Now, however, it has been recognized that three species of mammalian *Raillietina*, all of which belong to the subgenus *Raillietina*, viz., *R. (R.) demerariensis* (DANIELS, 1895) JOYEUX & BAER, 1929, *R. (R.) alouattae* BAYLIS, 1947, and *R. (R.) trinitatae* (CAMERON & REESAL, 1951) BAER & SANDARS, 1956, exist in that region (BAER & SANDARS, 1956). These species have been reported from various rodents (Hystricomorpha and Myomorpha), monkeys and man (RÊGO, 1964). No species of *Raillietina* has been described from lagomorphs in the Neotropical

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region, although four species of the cestodes have been reported from hares (*Lepus* spp.) and rabbits (*Sylvilagus* spp.) in North America (BUSCHER, 1975); *R. (P.) retractiles* STILES, 1895, *R. (F.) salmoni* STILES, 1895, *R. (R.) loeweni* BARTEL & HANSEN, 1964, and *R. (R.) selfi* BUSCHER, 1975.

We obtained some cestodes referable to the genus *Raillietina* and to the subgenus *Raillietina* from two forest rabbits, *Sylvilagus brasiliensis*, and a paca, *Agouti paca*, in the Upper Orinoco region of Venezuela.

MATERIALS AND METHODS

The host animals were shot in Coyoweteri, Sierra Parima, Territorio Federal Amazonas (T. F. A.), Venezuela (2°19'34"N-64°18'42"W), and the carcasses were immediately necropsied. The cestodes collected were fixed in 10% formalin solution, followed by relaxation in 50% acetic acid, and then stained with Semichon's acetic carmine. Although the worms shrank to certain degree during the dehydration procedures for staining, descriptions were made using only stained specimens. In addition, individual scoleces with hooks were squashed under a coverslip, and the rostellar and acetabular hooks were examined in lateral view. Figures were prepared with the use of a camera lucida. Measurements are in micrometers unless otherwise stated. The number following the character is the range of it and the figures in parentheses represent the average value with standard deviation. The specimens are deposited in the Department of Parasitology, Faculty of Veterinary Medicine, Hokkaido University and also in the CAICET, Puerto Ayacucho, T. F. A., Venezuela.

RESULTS

Raillietina (Raillietina) oligocapsulata n. sp.

Host: *Sylvilagus brasiliensis*

Habitat: Small intestine

Locality: Coyoweteri, Sierra Parima, T. F. A., Venezuela

Date collected: July 15, 1986

Ten slender worms obtained from a forest rabbit measured 28–160mm with maximum width of 0.5–1.1 mm in fixed condition. Description was made using four complete and incomplete stained specimens (Fig. 1–5).

Description: Two complete specimens having 461 or 500 segments measured 115 × 0.9mm or 134 × 0.8mm, respectively. Two incomplete specimens with 322 or 350 segments, excluding the gravid segments, measured 60 × 0.6mm or 54 × 0.7mm, respectively. Metamerism distinct, craspedote. All of the proglottids broader than long except for fully gravid ones.

Scolex 280–296 (289 ± 7) in width and 168–212 (188 ± 19) in length, bearing four suckers, and not distinctly set off from neck. Rostellum small, 96–100 wide and

44–72 long, armed with double crowns of 170 alternating hooks. End of the anterior row protruding only 1–2 in front of that of posterior row. Anterior hook about 19 long, posterior one about 15 long, hammer-shaped, and about 1 in thickness. Sucker 96–120 (108 ± 8) in diameter, and provided with numerous hooks of 3–8 long, arranged in diagonal rows with about 13–15 hooks per row on the inside wall around opening. Neck 208–240 (224 ± 15) in narrowest width and 360–544 (472 ± 79) in length. First evidence of segmentation 540–736 (660 ± 84) from anterior end.

Testes fully developed first in segments 480–712 (596 ± 95) wide and 216–320 (265 ± 44) long, 31–38mm (35 ± 3 mm) from anterior end. Female reproductive system developed first in segments 512–700 (618 ± 78) wide and 250–304 (276 ± 22) long, 39–44mm (41 ± 3 mm) from anterior end. Egg capsules fully developed in segments measuring 680–820 wide and 620–720 long, and gravid segment began 89–107mm from anterior end. Towards end of strobila segment barrel-shaped, about 0.6–0.9mm wide and 0.7–1.1mm long.

Genital duct passing between ventral and dorsal osmoregulatory canals, and genital pore unilateral (dextral), situated anterior to middle, $1/3$ and $2/5$ of segment. Genital atrium 34–44 deep.

Cirrus sac gourd-shaped, 120–160 long by 40–55 wide, not reaching osmoregulatory canal. Internal vas deferens straight in distal part of sac, with several loops in proximal wider part. External vas deferens very much convoluted. Testes confined to middle portion of segment, with several ones extending over ventral osmoregulatory canals on either side. Testes 55–73 (64 ± 7) in number, about $7/12$ of them situated on aporal side, about $1/4$ of them poral behind genital duct, and the rest $1/6$ posterior to female organ. Fully mature testis, oval or slightly irregular in shape, measuring up to $36\text{--}44 \times 26\text{--}32$.

Vagina convoluted with opening into genital atrium immediately behind cirrus sac. Distal portion of vagina slightly enlarged for distance of 140–180, with diameter of 12–16, then narrowing before enlarged convoluted tube. Ovary, bilobed, made up of numerous finger-like lobules, $200\text{--}240 \times 120\text{--}192$ in maximum, situated slightly towards poral side of segment. Vitelline gland, $96\text{--}112 \times 56\text{--}72$ in maximum, immediately behind ovary, but slightly towards aporal side of segment.

Egg capsules 24–44 (34 ± 5) in number, polygonal, each of which containing 15–20 eggs. Individual capsule measuring $140\text{--}230 \times 80\text{--}120$. Egg measuring $20\text{--}28 \times 28\text{--}40$; oncosphere $8\text{--}12 \times 12\text{--}16$.

Syntype: Deposited in the helminthological collection, No. 2833, in the Department of Parasitology, Faculty of Veterinary Medicine, Hokkaido University.

Paratype: Deposited as syntype, No. 2834, and in part in the helminthological collection of CAICET, Venezuela.

Raillietina (Raillietina) demerariensis (DANIELS, 1895) from a forest rabbit

Host : *Sylvilagus brasiliensis*

Habitat : Small intestine

Locality : Coyoweteri, Sierra Parima, T. F. A., Venezuela

Date collected : July 21, 1986

Two very contracted worms were obtained from a forest rabbit. Description was made using these two stained specimens except for scolex, for which one worm was measured (Fig. 6-9; a). Respective acetabular hooks of the specimens from this forest rabbit and a paca were not figured because these were identical to those of *R. (R.) oligocapsulata* n. sp. (Fig.3).

Description : Specimens measuring 136×3.5 mm or 65×1.8 mm, and having 475 or 434 segments, respectively. Metamerism distinct, craspedote. All of the proglottids broader than long except for fully gravid ones. Scolex globose, 316 in width and 220 in length, bearing four suckers, and not distinctly set off from neck. Rostellum small, 100 wide and 60 long, armed with double crowns of 168 alternating hooks. End of the anterior row protruding only 1-2 in front of that of posterior row. Anterior hook about 20 long, posterior one about 15 long, hammer-shaped, and only about 1 in thickness. Sucker 100 in diameter, and provided with numerous hooks of 3-9 long, arranged in diagonal rows with about 13-15 hooks per row on the inside walls around opening. Neck 220 in narrowest width and 480 in length.

Testes fully developed first in segments 1380 or 1190 wide and 80 or 76 long, 8.5 or 7.4mm from anterior end, respectively. Female reproductive system developed first in segments 1580 or 1200 wide and 92 or 88 long, respectively, and 10.5mm from anterior end. Egg capsules fully developed in segments measuring 2260 or 1800 wide and 540 or 600 long, respectively, and gravid segment began 39.5 or 44.7mm from anterior end. Towards end of strobila segment square or barrel-shaped, about 1.8-3.5mm wide and 0.6-2.2mm long.

Genital duct passing between ventral and dorsal osmoregulatory canals, and genital pore unilateral (dextral), situated anterior to middle, 1/4 and 1/3 of segment. Genital atrium about 36 deep.

Cirrus sac gourd-shaped, 140-170 long by 40-55 wide, not reaching osmoregulatory canal. Internal vas deferens straight in distal part of sac, with several loops in proximal wider part. External vas deferens very much convoluted. Testes confined to middle portion of segment, with several ones extending over ventral osmoregulatory canals on either side. Testes 48-70 (59 ± 7) in number, about 7/12 of them situated aporal, about 1/4 of them poral behind genital duct, and the rest 1/6 posterior to female organ. Fully mature testis, oval or slightly irregular in shape, measuring up to $48-60 \times 28-32$.

Vagina convoluted with opening into genital atrium immediately behind cirrus sac. Distal portion of vagina slightly enlarged for distance of 120-180, with diameter of

12–16, then narrowing before enlarged convoluted tube. Ovary, bilobed, made up of numerous finger-like lobules, 510–560×160–225 in maximum, situated slightly towards poral side of segment. Vitelline gland, 175–240×96–136 in maximum, immediately behind ovary, but slightly towards aporal side of segment.

Egg capsules 125–187 (158±18) in number, polygonal, each of which containing 16–25 eggs. Individual capsule measuring 140–240×90–150. Egg measuring 18–20×28–34; oncosphere 8–12×13–17.

Raillietina (Raillietina) demerariensis (DANIELS, 1895) from a paca

Host: *Agouti paca*

Habitat: Small intestine

Locality: Coyoweteri, Sierra Parima, T. F. A., Venezuela

Date collected: July 24, 1986

Twenty-one worms obtained from a paca measured 320–660mm with maximum width of 2.8–3.0mm in fixed condition. Description was made using four complete stained specimens (Fig. 3, 6–9; b).

Description: Specimens having 582–806 segments measured 365–520×1.8–2.7mm. Metamerism distinct, craspedote. All of the proglottids broader than long except for fully gravid ones.

Scolex 276–308 in width and 140–160 in length, bearing four suckers, and not distinctly set off from neck. Rostellum small, 104–152×48–64, armed with double crowns of 162–184 alternating hooks. End of the anterior row protruding only 1–2 in front of that of posterior row. Anterior hook about 18–19 long, posterior one about 15 long, hammer-shaped, and only about 1 in thickness. Sucker 112–132×52–94, and provided with numerous hooks of 3–8 long, arranged in diagonal rows with about 13–15 hooks per row on the inside wall around opening. Neck 224–360 in narrowest width and 400–760 in length. First evidence of segmentation 744–920 from anterior end.

Testes fully developed first in segments 940–1160 (1053±114) wide and 180–240 (225±30) long, 21–35mm (31±7mm) from anterior end. Female system developed first in segments 1220–1360 (1300±71) wide and 340–460 (395±55) long, 51–62mm (57±5mm) from anterior end. Egg capsules fully developed in segments measuring 1720–2300 (2075±273) wide and 1240–1660 (1400±185) long, and gravid segment began 211–306mm from anterior end. Towards end of strobila segment square or slightly barrel-shaped, about 0.7–2.7mm wide and 0.9–3.5mm long.

Genital duct passing between ventral and dorsal osmoregulatory canals, and genital pore unilateral (dextral), situated anterior to middle, 1/3 and 1/2 of segment. Genital atrium about 20 deep.

Cirrus sac gourd-shaped, 160–210 long by 45–65 wide, not reaching osmoregula-

tory canal. Internal vas deferens straight in distal part of sac, with several loops in proximal wider part. External vas deferens very much convoluted. Testes confined to middle portion of segment, with several ones extending over ventral opmoregulatory canals on either side. Testes 44–73 (58 ± 7) in number, about 7/12 of them situated aporal, about 1/4 of them poral behind genital duct, and the rest 1/6 posterior to female organ. Fully mature testis, oval or slightly irregular in shape, measuring up to $60\text{--}90 \times 40\text{--}60$.

Vagina convoluted with opening into genital atrium immediately behind cirrus sac. Distal portion of vagina slightly enlarged for distance of 240–260, with diameter of 14–18, then narrowing before enlarged convoluted tube. Ovary, bilobed, made up of numerous finger-like lobules, $450\text{--}500 \times 320\text{--}450$ in maximum, situated slightly towards poral side of segment. Vitelline gland, $160\text{--}190 \times 120\text{--}160$ in maximum, immediately behind ovary, but slightly towards aporal side of segment.

Egg capsules 234–331 (282 ± 25) in number, polygonal, each of which containing about 20 eggs. Individual capsule measuring $160\text{--}240 \times 80\text{--}160$. Egg measuring $22\text{--}24 \times 32\text{--}36$; oncosphere $9\text{--}10 \times 12\text{--}16$.

DISCUSSION

Among the three species of mammalian *Raillietina* recognized in the Neotropical region, *R. (R.) demerariensis* (DANIELS, 1895) is the most common one with many synonyms and has been reported from various rodents (RÊGO & NASCIMENTO, 1962) including the paca, the red howler monkey (JOYEUX & BAER, 1940) and also man (DOLLFUS, 1938; DOLLFUS, 1939–1940^a; DOLLFUS, 1939–1940^b; JOYEUX & BAER, 1929; JOYEUX & BAER, 1940; JOYEUX & BAER, 1949; LEÓN, 1938; LOPEZ-NEYRA, 1931). *R. (R.) alouattae* BAYLIS, 1947 has more or less smaller hooks of rostellum, a greater number of testes and smaller number of egg capsules than *R. (R.) demerariensis*, and reported only from howler monkeys (BAYLIS, 1947; PERKINS, 1950; PINTO & GOMEZ, 1976). *R. (R.) trinitatae* (CAMERON & REESAL, 1951) has smaller rostellar hooks and a smaller number of testes than *R. (R.) demerariensis*, and reported from hystricomorph rodents and the titi monkey (CAMERON & REESAL, 1951; DUNN, 1962; RÊGO, 1964; STUNKARD, 1953). The body size and measurement of the organs of all these species are compared in Table 1. In addition to these 3 species, LOPEZ-NEYRA and DIAZ-UNGRÍA (1957) described a valid subspecies, *R. (R.) demerariensis venezolanensis*, from the porcupine, *Coendou melanurus*, in the delta of Orinoco, which has a slightly greater number of testes (mostly 76–85, and rarely 93–104) than *R. (R.) demerariensis*. The criteria for differentiation are the following; number of testes, size and number of rostellar hooks, length of cirrus sac, number of egg capsules, and number of eggs per capsule (CHANDLER & PRADATSUNDARASAR, 1957).

Morphologically, all the raillietinid cestodes reported herein show close affinities to the Neotropical mammalian *Raillietina*, especially *R. (R.) demerariensis* (Table 1).

TABLE 1 Comparison of Neotropical mammalian *Raillietina* with present specimens

Species & References	<i>R.(R.)oligocapsulata</i> from forest rabbit present authors	<i>R.(R.)demerariensis</i> from forest rabbit present authors	<i>R.(R.)demerariensis</i> from paca present authors	<i>R.(R.)demerariensis</i> incl. synonyms 9-11,13,15,17,18*	<i>R.(R.)alouattae</i> incl. synonyms 4, 19, 20	<i>R.(R.)trinitatae</i> incl. synonyms 6, 12, 21, 24
Total length(mm)	115-134	65-136	365-520	160-1000	130-340	60-320
Maximum width(mm)	0.8-0.9	1.8- 3.5	1.8-2.7	2.5-3.0	2.5-7.0	1.1-2.7
Scolex width(mm)	0.28-0.30	0.32	0.28-0.31	0.21-0.60	0.45-0.62	0.27-0.37
Rostellar hooks						
Number	170	168	162-184	150-164	176-224	150-175
Row	2	2	2	2	2	2
Length	15-19	15-20	15-19	15-22	14-18	9-14
Acetabular hooks	present	present	present	present	present	present
Position of genital pore	unilateral anterior 1/3-2/5	unilateral anterior 1/4-1/3	unilateral anterior 1/3-1/2	unilateral anterior 1/3-2/3	unilateral quite anterior	unilateral anterior 1/3-1/2
Cirrus sac	120-160×40-55	140-170×40-55	160-210×45-65	140-300×40-100	220-310×86-110	90-200×45-70
Number of testes	55-73	48-70	44-73	40-75	110-150	20-46
Ovary	200-240×120-192	510-560×160-225	450-500×320-450	250-500×200-300	360-430	277
Vitellium	96-112×56-72	175-240×96-136	160-190×120-160	100-250	110-140	124
Number of egg capsules	24-44	125-187	234-331	120-350	40-80	50-250
Eggs/egg capsule	15-20	16-25	20	3-11	3-8	5-20

* Reference number.

Raillietina oligocapsulata n. sp. and *R. demerariensis*

TABLE 2 Comparison of North American mammalian *Raillietina*

Species & References	<i>R.(R.)bakeri</i> 7*	<i>R.(R.)sigmodontis</i> 23	<i>R.(R.)loeweni</i> 3	<i>R.(R.)selfi</i> 5	<i>R.(P.)retractiles</i> 1	<i>R.(F.)salmoni</i> 1
Total length	60	80	370-740	100-160	105	86
Maximum width	1.2	2	2-3	2.54-3.03	3	3
Scolex width	0.250-0.375	0.23-0.36	0.78-1.1	0.409-0.641	0.37-0.68	0.736
Rostellar hooks						
Number	66	66	87	120-130	40-60	60
Row			1	2	2	2
Length	20-22	20-22	7.5-8.6	18.5-22	12	20
Acetabular hooks	present	present	present	present	present	present
Position of genital pore	unilateral anterior 1/3	unilateral anterior 1/3	unilateral	unilateral posterior 1/3	unilateral middle	irregularly alternating
Cirrus sac	90-95×35	130-150×40-50	110-137×72-91	147-160×86-98	120×60	140×44
Number of testes	30-40	15-19	45-70	65-84		
Ovary				328-397		
Vitellium						
Number of egg capsules	80-90	30-35	368-600	145-180		160
Eggs/egg capsule	6-9	15-25	1-5	3-8	1	3-15

* Reference number

The range of cottontail rabbits, *Sylvilagus* spp., extends from South Canada to Argentina and Paraguay (WALKER, 1975), and four of the six species of mammalian *Raillietina* have been reported from lagomorphs (*Sylvilagus* spp. and *Lepus* spp.) in North America (BUSCHER, 1975). However, two species of *Raillietina* detected from the forest rabbit are distinct from the North American species (Tables 1 & 2).

CAMERON and REESAL (1951) noted that considerable variation in dimensions and numbers of hooks, testes and egg capsules even within the cestodes from the same host could be observed in Neotropical mammalian *Raillietina*. In the present study, however, the number of egg capsules is an important criterion for specific determination. *R. (R.) oligocapsulata* n. sp. from a forest rabbit has only 24–44 (34 ± 5) egg capsules, which is outside the range of those of *R. (R.) demerariensis*. Furthermore, *R. (R.) oligocapsulata* n. sp. has smaller maximum width of strobila and its ovary and vitellium half the size of those of *R. (R.) demerariensis*. Among the six species of North American mammalian *Raillietina*, *R. (R.) sigmodontis* SMITH, 1954 from *Sigmodon hispidus* has been reported to have 30–35 egg capsules, which is comparable with that of *R. (R.) oligocapsulata* n. sp., but has only 66 rostellar hooks and 17 testes.

All the measurable values for the specific determination of the specimens from a forest rabbit and a paca, defined both as *R. (R.) demerariensis* in the present study, fall within the usual range of intraspecific variation of that species. However, the number of egg capsules of the specimens from the forest rabbit differs from that of the specimens from the paca, 125–187 in the former and 234–331 in the latter, respectively. The number of egg capsules of *R. (R.) demerariensis* including synonyms reported previously ranges from 120 to 350.

It has been suspected that in this genus, as in other cestode genera, there is a considerable degree of host specificity (CHANDLER & PRADATSUNDARASAR, 1957). However, three of the four species which parasitize the North American lagomorphs have been reported also from rodents, which are considered as an accidental host (BUSCHER, 1975). In this respect, *R. (R.) demerariensis* has been reported from a wide range of hosts as tabulated by RÊGO (1964); 3 genera of hystricomorph rodents, 3 genera of myomorph rodents, the red howler monkey and man, the latter two are considered to be accidental hosts of this species. The precise relationship between the Neotropical mammalian *Raillietina* and Neotropical lagomorphs cannot be determined until more informations are collected.

Present descriptions of *R. (R.) oligocapsulata* n. sp. and *R. (R.) demerariensis* from the forest rabbit represents the first report and new host record of raillietinid infection in lagomorphs from the Neotropical region.

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EXPLANATION OF FIGURES

PLATE I

Fig. 1-5. *Raillietina (Raillietina) oligocapsulata* n. sp., 1. scolex and neck (bar = 300 μ), 2. rostellar hooks (bar = 20 μ), 3. acetabular hooks (bar = 10 μ), 4. mature segment (bar = 400 μ), 5. gravid segment (bar = 800 μ)

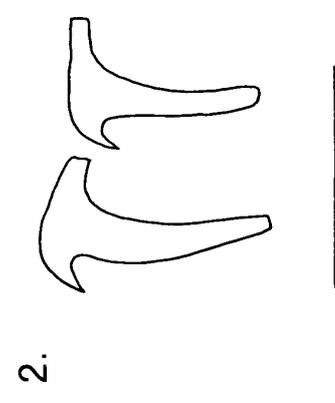
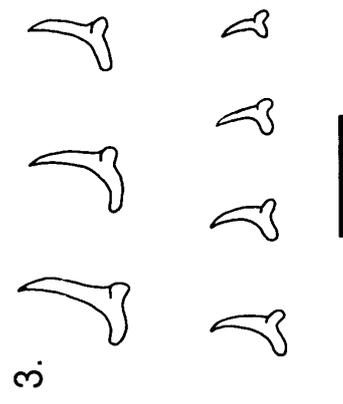
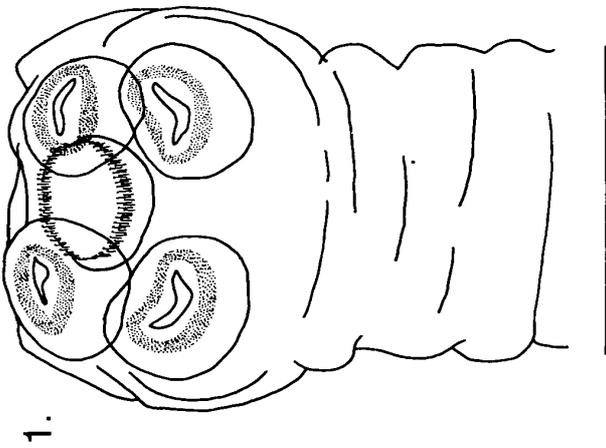
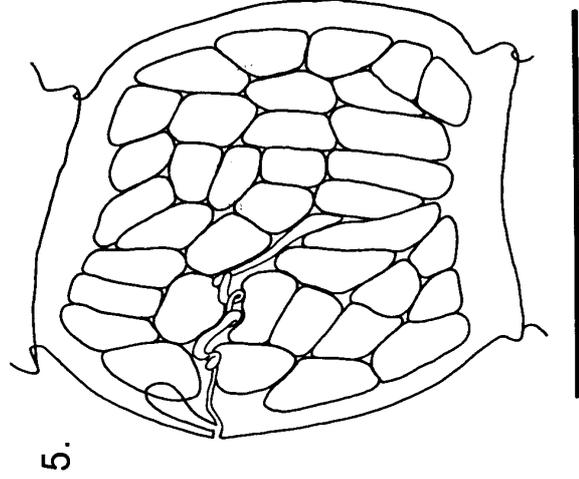
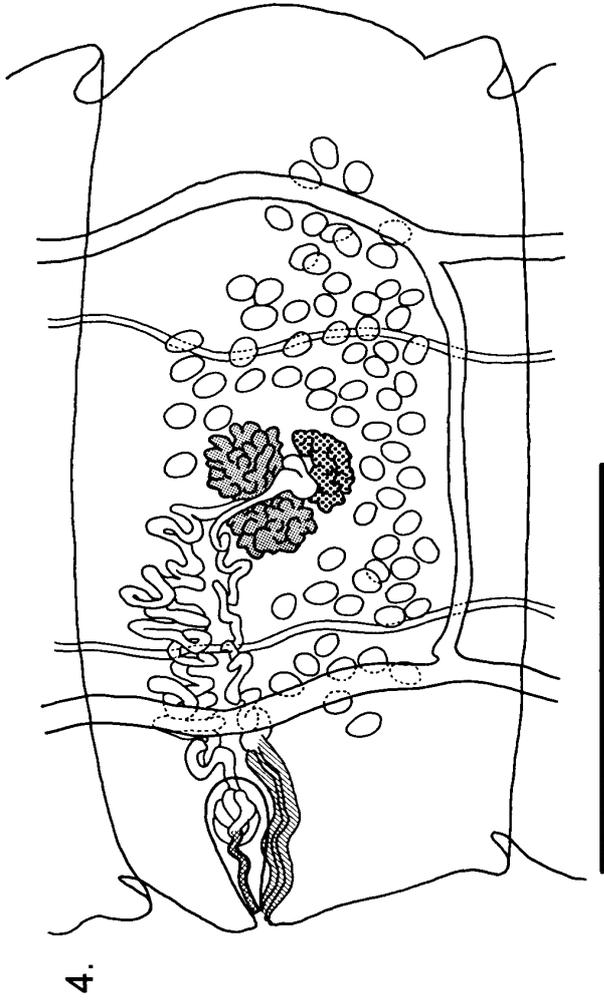


PLATE II

Fig. 6-9. *Raillietina (Raillietina) demerariensis*; a. specimens from a forest rabbit, b. specimens from a paca. 6. scolex and neck (bar=300 μ), 7. rostellar hooks (bar=20 μ), 8. mature segment (bar=500 μ), 9. gravid segment (bar=2,000 μ)

