RAILLIETINA (RAILLIETINA) SELFI SP. N. (CESTODA: DAVAINEIDAE) FROM THE DESERT COTTONTAIL IN OKLAHOMA WITH NOTES ON THE DISTRIBUTION OF *RAILLIETINA* FROM NORTH AMERICAN MAMMALS

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Raillietina (Raillietina) selfi sp. n. is described. The host for this *Raillietina* was the desert cottontail (*Sylvilagus audubonii*) from the panhandle area of Oklahoma. A key for differentiating the species of *Raillietina* found in North American mammals is included. The distribution of *Raillietina* in the U. S. relative to the distribution of its recorded hosts is discussed.

Although the genus *Raillietina* has over 200 known species with more than 40 representatives reported in mammals, there have been only five species reported or described from mammals in North America. The previous studies concerning these five species are summarized in Table I.

During a survey of parasites of vertebrates inhabiting prairie dog towns in Oklahoma (5, 6), four desert cottontails, *Sylvilagus audubonii*, were examined. Three of the four harbored *Raillietina* (*R.*) *selfi* sp. n. The cestode is named in honor of Dr. J. Teague Self, University of Oklahoma, Norman, Oklahoma, for his many contributions to the field of parasitology.

MATERIALS AND METHODS

The procedures describing collection, preservation and preparation for study of this cestode have been previously reported (5, 6). The description is a composite based on measurements of ten gravid cestodes fixed in AFA and stained in Harris's hematoxylin and Semichon's carmine. Egg pouches were teased from fixed gravid proglottids, measured and counted. The size of eggs and oncospheres were determined from eggs teased from fixed egg pouches. Drawings were made with the aid of a camera lucida.

RESULTS

Representative drawings of *Raillietina (Raillientina) selfi* sp. n. are presented in Fig. 1 to 6. Mature worms with gravid proglottids 100 to 160[1] (145) in length; maximum width in mature proglottids, 2.54 to 3.03 (2.86), tapering down to 1.07 to 1.32 (1.21) in the terminal gravid proglottids. Scolex 0.528 to 0.707 (0.611) long and 0.409 to 0.641 (0.488) wide. Rostellum well developed, minutely spinose; rostellar crown 0.076 to 0.083 in diameter, with 120 to 130 (128) hammer-shaped hooks 18.5 to 22 (20.9) μ in length and 7.5 to 8.75 (8.125) μ in width, arranged in two rows. Suckers oval, 0.167 to 0.180 (0.175) long

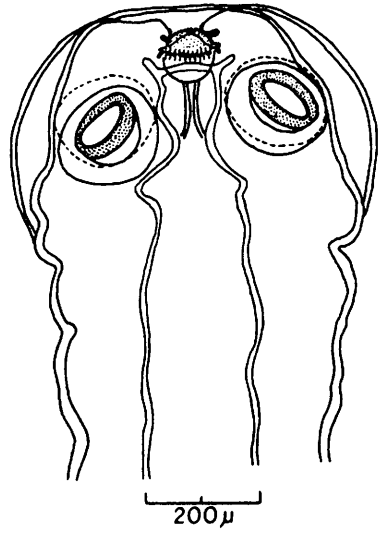

FIGURE 1. *Raillietina (R.) selfi* sp. n. Scolex.

[1] Measurements are in millimeters unless otherwise specified. Average measurements are shown in parentheses following the range.

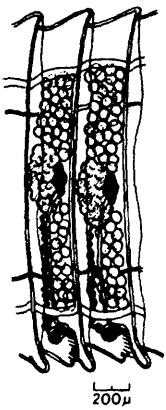

FIGURE 2. *Raillietina (R.) selfi* sp. n. Mature proglottids.

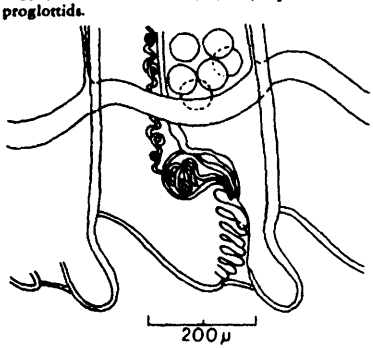

FIGURE 3. *Raillietina (R.) selfi* sp. n. Enlarged view of fimbriae in genital atrium.

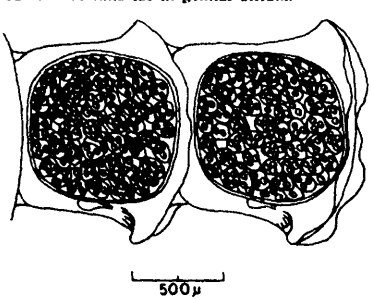

FIGURE 4. *Raillietina (R.) selfi* sp. n. Terminal gravid proglottids.

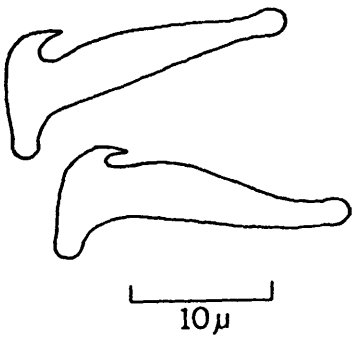

FIGURE 5. *Raillietina (R.) selfi* sp. n. Rostellar hooks.

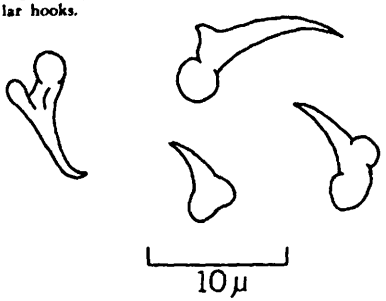

FIGURE 6. *Raillietina (R.) selfi* sp. n. Sucker hooks.

and 0.152 to 0.157 (0.154) wide, with numerous hooks of varying form, 6.25 to 11.88 μ long and 3.75 to 5.625 μ wide, arranged in diagonal rows with 18 to 22 hooks per row. Neck 0.66 to 2.07 long. Genital pores unilateral, situated in posterior third of each segment; genital atrium nearly filled by fimbriae extending from its anterior wall. Testes approximately spherical, 65 to 84 (74) in number, measuring 0.05 to 0.06 (0.057) in diameter; arranged in two groups, about 25 poral and 50 aporal, and distributed between the conspicuous ventral excretory canals. Vas deferens becomes evident at about the center of each proglottid and extends laterally with many convolutions to the base of the cirrus sac. Cirrus sac muscular, 0.086 to 0.098 (0.092) wide and 0.147 to 0.160 (0.151) long; extending in an anteroposterior direction and not reaching the ventral excretory canal; cirrus unarmed. Ovary approximately central in

proglottid, lobate, occupying about two-thirds of the anteroposterior length of the proglottid and 0.328 to 0.397 (0.355) wide. Vitelline gland smooth, may appear to have three or four lobes; located median and posterior to ovary. Vagina unconvoluted, situated posterior to vas deferens, extends laterally dorsal to the ventral excretory canal and enters the genital atrium immediately posterior to the cirrus. Gravid proglottids contain 145 to 180 egg pouches, each with 3 to 8 (4) eggs; egg pouches irregularly oval, 0.137 to 0.180 (0.153) long and 0.107 to 0.167 (0.140) wide, located between ventral excretory canals. Eggs (fixed in AFA) 30.7 to 39.6 (35.5) μ by 28.2 to 34.8 (31.8) μ ; oncosphere (fixed in AFA) oval, 16.02 to 18.0 (16.85) μ long by 14.22 to 18.0 (15.7) μ wide.

Host: Desert Cottontail (*Sylvilagus audubonii*)

Location: small intestine

Type locality: Near Boise City in Cimarron County, Oklahoma

Syntypes: USNM Helm. Coll. No. 73186

Comparisons

Raillietina (*R.*) *selfi* sp. n. was compared with the type specimens and descriptions of the five previously described species in this genus from North American mammals. It can be differentiated from all five by the minutely spinose rostellum, by the posterior position of the cirrus sac, and by the presence of well-developed fimbriae in the genital atrium.

The new species can be further differentiated from the two species occurring in rodents, *R. bakeri* Chandler, 1942, and *R. sigmodontis* Smith, 1954, by having a greater length and width, a larger scolex, a greater number of rostellar hooks, larger suckers with larger hooks, a greater number of testes, and a greater number of egg pouches. It can be further differentiated from *R. salmoni* (Stiles, 1896) and *R. retractilis* (Stiles, 1896) by the subgeneric characteristics of these two species, viz., unilateral genital pores as compared to irregularly alternating genital pores in *R. salmoni* and more than one egg per pouch as compared to one egg per pouch in *R. retractilis*. Characteristics that further differentiate the new species from *R. loeweni* Bartel and Hansen, 1964 include: shorter length; smaller scolex; two rows of rostellar hooks; smaller suckers; smaller number of egg pouches; and smaller eggs.

KEY TO THE SPECIES OF *RAILLIETINA* IN NORTH AMERICAN MAMMALS

(adapted from Bartel and Hansen, 1964)

1. Genital pores alternating irregularly ..... *R.* (*P.*) *salmoni*
   Genital pores unilateral 2
2. Egg pouches less than 100 μ in diameter, one egg per pouch *R.* (*P.*) *retractilis*
   Egg pouches 100 μ or more in diameter, one or more eggs per pouch 3
3. One to five eggs per pouch, one row of rostellar hooks ..... *R.* (*R.*) *loeweni*
   Three or more eggs per pouch, two rows of rostellar hooks 4
4. Three to eight eggs per pouch, 145 to 180 pouches ..... *R.* (*R.*) *selfi*
   Six to ten eggs per pouch, 80 to 90 pouches ..... *R.* (*R.*) *bakeri*
   Fifteen to twenty-five eggs, per pouch, 30 to 35 pouches *R.* (*R.*) *sigmodontis*

DISCUSSION

The reported distribution of *Raillietina* in North American mammals is listed in Table 1 and further illustrated in Figure 7. It is apparent that, with three exceptions, the reports concerning this genus have come from west of the Mississippi River. This western distribution of the genus *Raillietina* in mammals can be directly correlated to the distribution of the hosts. For example, of the 19 hosts listed in Table 1, 13 (viz., *L. californicus, L. alleni, S. auduboni, S. nuttalli, S. bachmani, S. idahoensis, C. ludovicianus, M. flaviventris, S. variegatus, D. ordi, N. lepida, N. fuscipes* and *N. cinerea*) are found only west of the Mississippi. Additionally, the distributions of two others, *L. townsendi* and *G. bursarius*, are almost entirely west of the Mississippi. Only four recorded hosts, then, have significant distributions, east of the Mississippi River. These are: *S. floridanus, S. aquaticus, S. niger* and *S. hispidus*. It should be noted, however, that *Raillietina* has been reported only in *S. floridanus* and *S. hispidus* east of the Mississippi, the single reports from *S. niger* and *S. aquaticus* being from southeast Texas.

It might be suspected that the lack of reports of *Raillietina* from mammals east of the Mississippi could be due to a lack of investigations of the typical hosts, e.g., hares, rabbits and other gnawing rodents as indicated in Table 1. However, this does

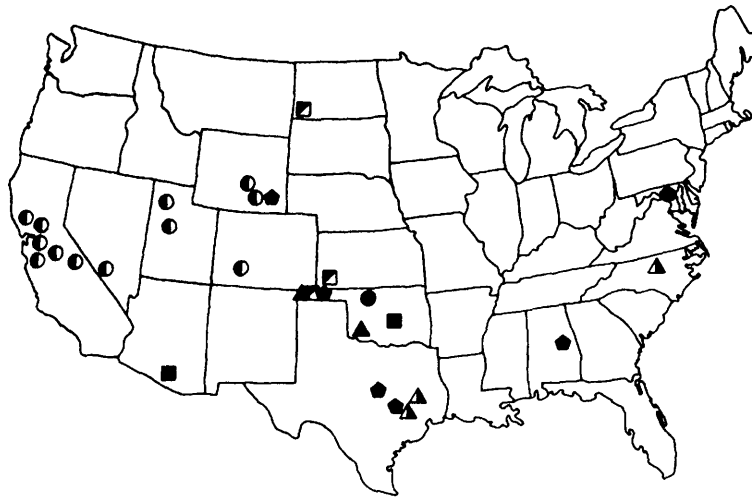

FIGURE 7. Distribution map of *Raillietina* in U.S. mammals ● = R. (*F.*) *salmoni*; ◐ = *R.* (*P.*) *retractilis*; ● = *R.* (*R.*) *sigmodontis*; ▲ = *R.* (*R.*) *bakeri*; ▲ = *R.* (*R.*) *selfi* sp. n.; ◪ = *R.* (*R.*) *loeweni*; ■ = *Raillietina* sp.

not seem to be the case since many studies have been done on these mammals in the eastern U. S., but few have reported *Raillietina*, suggesting that this genus is uncommon in mammals east of the Mississippi River.

Hares (*Lepus* spp.) and rabbits (*Sylvilagus* spp.) seem to be the most popular hosts for this genus in the U.S., being the hosts of record for four of the six species in 15 studies. Additionally, one study (23) reported an unidentified raillietinid in a hare in Arizona. Each of the other hosts has been reported only once except for *Sigmodon hispidus* which has been recorded as host for two of the species in four separate studies and *Neotoma fuscipes* which was found to harbor *R. retractilis* in two separate studies in California.

Raillietina retractilis appears to be the most versatile of the six North American species, being found in twelve different mammals in the U.S. Its distribution based on investigations to date, however, is restricted to five western states, viz., California, Nevada, Utah, Colorado and Wyoming (Fig. 7). It has also been recorded once outside the U.S. in *Rattus rattus* from Madagascar (25). *Raillietina salmoni*, on the other hand, has been found in only five host species (Table 1) but is the most widely distributed (Fig. 7). *Raillietina sigmodontis* seems to be the least versatile of the six described species, having been reported only in *S. hispidus*.

Undoubtedly, the distribution and number of hosts for the species in this genus which are found in North American mammals will continue to change as more information concerning these parasites becomes known. It is hoped that this study will stimulate further work in this area.

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TABLE 1. *Summary of previous reports of raillietina in North American mammals*

Parasite	Host	Location and Literature Reference
R. (F.) salmoni	*Lepus californicus*	Texas (1); Wyoming (2)
	Sylvilagus floridanus	Maryland (1); Wyoming (2); Alabama (3)
	Sylvilagus audubonl	Wyoming (2)
	Sylvilagus aquaticus	Texas (4)
	Cynomys ludovicianus	Oklahoma (6)
R. (P.) retractilus	*Lepus californicus*	Utah (7); California (8)
	Lepus townsendi	Wyoming (2)
	Sylvilagus audubonl	Nevada (1); Wyoming (2); California (9)
	Sylvilagus nuttalli	Wyoming (2,10); Colorado (11)
	Sylvilagus bachmani	California (12)
	Sylvilagus idahoensis	California (12)
	Marmota flaviventris	Wyoming (2)
	Spermophilus variegatus	Utah (13)
	Dipodomys ordi	Utah (7)
	Neotoma lepida	Utah (7)
	Neotoma fuscipes	California (12,14)
	Neotoma cinerea	Colorado (11)
R. (R.) loewenl	*Lepus californicus*	Kansas (15,16)
	Lepus townsendi	North Dakota (17)
	Sylvilagus audubonl	Oklahoma (6)
R. (R.) bakeri	*Sciurus niger*	Texas (18)
	Sigmodon hispidus	Texas (19); North Carolina (20); Southern U.S. (21)
R. (R.) sigmodontis	*Sigmodon hispidus*	Oklahoma (22)
Raillietina sp.	*Lepus alleni*	Arizona (23)
	Geomys bursarius	Oklahoma (24)
	Sylvilagus audubonl	Oklahoma (6)
	Cynomys ludovicianus	Oklahoma (6)

REFERENCES

1. C. W. STILES, Proc. U.S. Nat. Mus. 19(1105): 145-235 (1896).
2. R. F. HONESS and K. B. WINTER, Wyoming Game and Fish Comm. Bull. 9: 109-112 (1956).
3. E. R. MOORE, Ala. Polytechnic Inst. Thesis. Abs. in Wildl. Rev. Nov. 23 (1939).
4. E. W. PRICE, J. Parasit. 14: 200-201 (1928).
5. J. D. TYLER and H. N. BUSCHER, Proc. Okla. Acad. Sci. In Press (1975).
6. H. N. BUSCHER and J. D. TYLER, Proc. Okla. Acad. Sci. In Press (1975).
7. A. W. GRUNDMANN, J. Parasit, 44: 425-429 (1958).
8. R. R. LECHLEITNER, Calif. Fish and Game 45: 83-91 (1959).
9. C. M. HERMAN and H. A. JANKIEWICZ, J. Wildl. Mgmt. 7: 395-400 (1943).
10. R. F. HONESS, Univ. Wyoming Pub. Sci. 2: 1-10 (1935).
11. A. D. STOCK, Univ. Utah Anthrop. Papers, No. 59, Upper Colorado Series, No. 8: 162-166 (1962).
12. M. VOGE, Amer. Midl. Nat. 54(2): 413-417 (1955).
13. E. JENKINS and A. W. GRUNDMANN, Proc. Helm. Soc. Wash. 40: 76-86 (1973).
14. J. M. LINSDALE and L. P. TEVIS. *Dusky-footed wood rat; a record of observations made at the Hastings Natural History reservation.* 664 pp. Univ. of Calif. Press (1951).
15. E. T. LYONS, M. F. HANSEN and O. W. TIEMEIER, Tran. Kansas Acad. Sci. 63: 135-140 (1960).
16. M. H. BARTEL and M. F. HANSEN, J. Parasit. 50: 448-453 (1964).
17. D. R. VOTH and T. JAMES, Proc. N. Dak. Acad. Sci. 19: 15-18 (1965).
18. A. C. CHANDLER, J. Parasit. 28: 135-140 (1942).
19. E. J. HUGGHINS, Amer. Midl. Nat. 46(1): 230-244 (1951).
20. R. HARKEMA and L. KARTMANN, J. Elisha Mitchell Sci. Soc. 64: 183-191 (1948).
21. H. A. BAYLIS, Ann. and Mag. Nat. Hist., Series 2, 12: 189-194 (1945).
22. C. F. SMITH, J. Parasit. 40: 245-254 (1954).
23. C. T. VORHIES and W. P. TAYLOR, Ariz. Coll. Agr. and Exp. Sta. Tech. Bull. 49: 549-553 (1933).
24. H. DOUTHITT, Illinois Biol. Monogr. 1: 353-496 (1915).
25. C. JOYEUX and J. G. BAER, Ann. Parasit. 5: 27-36 (1927).