

## Two New Species of *Pterygodermatites* (*Paucipectines*) Quentin, 1969 (Nematoda: Rictulariidae) with a Key to the Species from North American Rodents

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**ABSTRACT:** *Pterygodermatites coloradensis* (Hall, 1916) Quentin, 1969 (= *Rictularia coloradensis*) and a species formerly confused with it—*Rictularia coloradensis*, *sensu* Tiner (1948)—are separated. The former is redescribed; the latter is defined and named *Pterygodermatites peromysci* sp. n. A third species, previously reported from tree squirrels and a wood rat as *Rictularia* sp., is described and named *Pterygodermatites parkeri* sp. n. The three species have apical mouths; three equal buccal teeth; 61–67 cuticular processes, of which 29–31 are prevulvar; and 20 or fewer perioral denticles. They can be separated from each other by differences in the morphology of the buccal teeth, size of the buccal teeth relative to the size of the buccal cavity, size of cuticular processes, and ratio of the lengths of left and right spicules.

In the course of identifying *Rictularia* sp. from *Peromyscus leucopus* it became clear that specimens commonly identified as *R. coloradensis* Hall, 1916 exhibited sufficient differences from the syntypes of Hall's species to warrant recognition as a separate species. The original description of *R. coloradensis* from a Colorado chipmunk was based on one male with nearly equal spicules and one incomplete female with its tail missing. However, most workers accept the "redescription" given by Tiner (1948) as the definition of *R. coloradensis*. Tiner's (1948) specimens were from *Peromyscus leucopus* and *P. maniculatus* from Wisconsin and more Eastern localities and the males had markedly unequal spicules. Tiner recognized that his males differed sufficiently to be regarded as a separate species, but he apparently found no distinguishing characters between the females. He decided to follow earlier workers and identify his specimens as *R. coloradensis* until more males could be studied. Unfortunately, he "redescribed *R. coloradensis*" solely from the specimens from *Peromyscus*.

My study of the syntypes of *R. coloradensis* and the species Tiner (1948) "redescribed" revealed differences between both males and females. In addition, study of *Rictularia* sp. from other North American rodents has led to the recognition of another new species. *R. coloradensis* is redescribed and two new species are described below.

The genus *Rictularia* Froelich, 1802 was recently divided by Quentin (1969) into two

genera: *Rictularia* Froelich, 1802 *s. str.*, containing the species that have a completely dorsal transverse mouth with a single buccal tooth (= esophageal teeth *sensu* Quentin, 1969); and *Pterygodermatites* Wedl, 1861, *s. str.*, containing the species that have mouths ranging from apical to dorsal, but never completely dorsal and transverse, with three buccal teeth. He further subdivided *Pterygodermatites* into five subgenera.

Five species from North American rodents—*Pterygodermatites coloradensis* (Hall, 1916); *P. onychomis* (Cuckler, 1939); *P. ondatrae* (Chandler, 1941); *P. dipodomis* (Tiner, 1948), *sensu* Read and Millemann (1953); and *P. microti* (McPherson and Tiner, 1952)—are among 15 species with apical mouths assigned by Quentin (1969) to the subgenus *Paucipectines* (Type: *P. coloradensis*). All species described or discussed herein are members of this subgenus.

### Materials and Methods

Nematodes of the subgenus *Paucipectines* from nine species of rodents were studied. In addition, types of all five previously described North American species of the subgenus *Paucipectines* were examined.

The nematodes were studied as temporary whole mounts cleared in phenol-alcohol, except for the syntypes of *P. coloradensis* which are permanent whole mounts. *En face* preparations were made of females only because of the shortage of males. The buccal teeth of a

few females were studied by rolling severed heads under cover glasses in temporary mountings. All drawings were made with the aid of a camera lucida. Measurements are given in microns unless otherwise indicated. They were made with an ocular micrometer or a projection microscope and a measuring wheel. In the descriptions of females only measurements of mature worms containing embryonated eggs are given. Observations on smaller immature fifth stage females are given in the "Remarks," the "Discussion," and the figures.

The numbering system of Chabaud and Petter (1961) is followed for the genital papillae. The arrangement for the subgenus *Paucipectines* from anterior to posterior is: 1, 2, 4, 3, 5, 6, 8, 7, 9, phasmids, 10.

### Results

The morphology of the buccal teeth and buccal capsule are basically the same in both sexes of all species that were studied or examined. Although there is a great difference between the sexes in size, and in size and proportion of cuticular combs, comparative comb size was useful in matching males and females of a species. With these characters, and because all males were found only with females of their own species, it was possible to determine conspecificity of males and females with confidence. Thus, characters of both sexes can be used in species determinations.

#### *Pterygodermatites* Wedl, 1861 *sensu* Quentin, 1969

Rictulariidae. Mouth apical or inclined dorsally, but never totally dorsal and transverse; three buccal teeth; 29–56 cuticular processes prevulvar.

#### Subgenus *Paucipectines* Quentin, 1969

*Pterygodermatites*. Mouth apical; genital papillae prs. no. 1, 2, 4, and 8 placed lateral to line of other papillae; 29–39 prs. of cuticular processes prevulvar.

#### *Pterygodermatites coloradensis* (Hall, 1916) (Figs. 1–5)

HOSTS: (Type) *Eutamias quadrivittatus* (Say), Colorado chipmunk; (Other) *Peromyscus maniculatus* (Wagner), deer mouse.

LOCATION: Small intestine.

LOCALITIES: (Type) Pagosa Springs, Colorado; (Other) Utah.

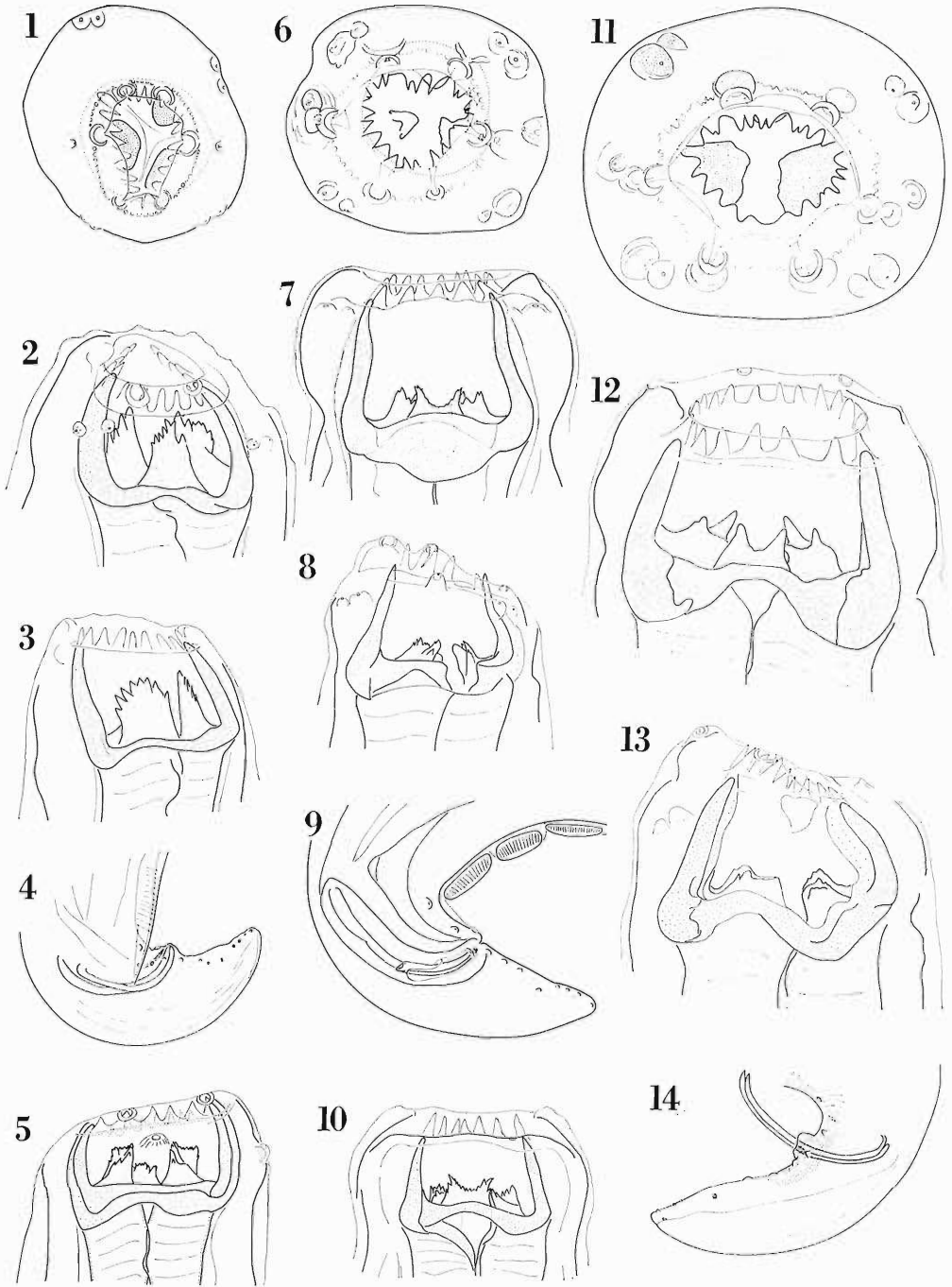
SPECIMENS: USDA Par. Coll. Nos. 16569 (lectotype: female and paralectotype: male); 66238 (fragment of immature female from deer mouse).

### Redescription

Buccal cavity contains three equally large buccal teeth extending anteriorly from its floor about one-half its depth. Center portion of each buccal tooth longer than lateral portions giving anterior edge of each tooth convex appearance. (The shape of the anterior edges of the buccal teeth can best be determined as follows: the dorsal tooth in a dorsal or ventral view; the subventrals in a subventral view. Subsequent references to tooth shape refer to the appearance in these aspects.)

FEMALE (LECTOTYPE): Length of incomplete specimen 8.46 mm. Estimated length of specimen when complete 9.0 mm. Diameter: maximum 360; at vulva 270; at base of buccal capsule 120. Buccal cavity 54 deep by 78 wide (dorso-ventrally). Mouth bordered by about 17 perioral denticles up to 9 long. Esophagus 1.5 mm long; anterior muscular portion 470 long. Nerve ring 250 from anterior end. Cervical papillae 400 from anterior end between 6th and 7th prs. of combs. (Excretory pore not seen.) Vulva at level of posterior end of esophagus between comb prs. nos. 31 and 32. (Cuticle and esophagus wrinkled and contracted so that normal relationship of vulva and esophagus cannot be determined.) Eggs embryonated 38–40 by 22–24. Transition from combs to spines not distinct; 32–34 pairs of combs plus spines totaling 65 pairs of cuticular processes. Largest comb 105 long by 42 high. Longest spine 81. (Tail missing.)

MALE (PARALECTOTYPE): Length 3.3 mm. Maximum diameter 250; at base of buccal capsule 70. Buccal cavity 27 deep by 49 wide (latero-dorsally). Mouth bordered by perioral denticles (could not count or measure). Esophagus 875 long. (Nerve ring, cervical papillae and excretory pore not seen; according to original description, nerve ring 100 from anterior end.) Forty-two pairs of combs, begin slightly posterior to base of buccal capsule, end 481 from tail end. Largest comb 85 long by 45 high. Ventral cuticular fans absent. Vent



.1 mm  
Figs. 5-9, 11-13

.05 mm  
Figs. 1-3, 10

.2 mm  
Figs. 4, 14

on elevation 130 from end of blunt conical tail. Spicules nearly equal, ventrally curved; left 240, right 215, long. Gubernaculum not discernible. A delicate accessory piece located ventrally near spicule tips, 57 long. Ventral surface of tail and pericloacal region with 10 paired and one unpaired genital papillae and a finely rugose papillation in the pericloacal region (Fig. 4).

### Remarks

This redescription agrees with the description by Hall (1916) except in details of the buccal teeth, lengths of the spicules, and genital papillae of the male. Hall's (1916) measurements of the spicules were made in a straight line from tip to tip. They are, therefore, shorter than mine which followed the curvature.

The female syntype is designated the lectotype, although the posterior one-tenth is missing, for two reasons: (1) most species of the genus are represented by female holotypes; and (2) males are rarely collected.

It was possible to estimate the length of the incomplete female lectotype fairly accurately because, although the tail and anus are missing, the intestino-rectal valve is present.

An additional specimen that I believe to be *P. coloradensis* collected in Utah from *Peromyscus maniculatus* by Dr. A. W. Grundmann was found in the National Parasite Collection (USDA Par. Coll. No. 66238). It is a fragment of a young adult female containing no eggs, that probably was 5–10 mm long. Its mouth is elongated dorso-ventrally and the teeth are large and markedly convex on the anterior edge. The buccal cavity is round in *en face* and is not elongated like the mouth (Figs. 1–3). I regard this specimen, the lectotype female and the paralectotype male to be the only known specimens of *P. coloradensis*.

### *Pterygodermatites peromysci*, sp. n. (Figs. 6–10)

Host: (Type) *Peromyscus leucopus* (Rafinesque), white-footed mouse; (Others) *Peromyscus maniculatus* (Wagner), deer mouse; *P. floridanus* (Chapman), Florida mouse; *P. polionotus* (Wagner), oldfield mouse; *Tamias striatus* (Linnaeus), Eastern chipmunk.

LOCATION: Small intestine.

LOCALITIES: (Type) Montgomery County, Maryland; (Others) Virginia, Wisconsin, Georgia, Florida.

SPECIMENS: USNM Helm. Coll. Nos. 63204 (holotype: female) and 63205 (allotype: male); USDA Par. Coll. Nos. 65598, 65599, 41768, 46320, 40571, and 19390 (paratypes). Nos. 46320 and 19390 include males.

### Description

Buccal cavity contains three equally large buccal teeth that extend anteriorly from its floor about one-third its depth. Buccal teeth consist of three main parts with middle portion shorter than lateral portions, giving anterior edge of each tooth a concave appearance.

FEMALE (Based on 30 specimens): Length 16.7–29.3 mm. Diameter: maximum 562–784; at vulva 315–422; at base of buccal capsule 134–200. Buccal cavity round in *en face*; 68–115 deep by 65–97 wide. Mouth roughly oval in shape, elongated laterally very slightly; bordered by 16–19 perioral denticles, up to 13–24 long. Esophagus length 2.65–4.05 mm; anterior muscular portion 650–910 long. Nerve ring 288–389, and excretory pore 496–629, from anterior end. Cervical papillae 448–623 from anterior end at level of 6th or 7th pair of combs. Vulva anterior to posterior end of esophagus, between pairs of cuticular processes numbers 29 and 32, 2.00–3.38 mm from anterior end. Vagina vera 174–208 long. Uterus bifurcates 348–380 posterior to vulva. Eggs

←

Figures 1–14. Three species of *Pterygodermatites* (*Paucipectines*) from North American rodents. 1–3. Immature female *Pterygodermatites coloradensis* (Hall, 1916) from *Peromyscus maniculatus*: 1. *En face*. 2. Dorsal view of head. 3. Left lateral view of head. 4. Male tail (paralectotype), *P. coloradensis*. 5. Right lateral view of head, female (lectotype), *P. coloradensis*. 6–10. *Pterygodermatites peromysci* sp. n. from *Peromyscus* spp: 6. *En face*, female. 7. Dorsal view of head, female (holotype). 8. Left lateral view of head, female. 9. Male tail. 10. Dorsal view of head, immature female. 11–14. *Pterygodermatites parkeri* sp. n. from *Sciurus carolinensis*: 11. *En face*, female. 12. Dorsal view of head, female. 13. Left lateral view of head, female. 14. Male tail.

embryonated, 43–46 by 30–32. Total number pairs of cuticular processes 61–64, including 28–30 pairs of combs. Largest combs 94–127 long by 40–56 high. Longest spine 70–103. Tail length 355–470.

**MALE** (Based on 3 specimens): Length 1.92–2.88 mm. Maximum diameter 118–138. Buccal cavity 18–20 deep by 15–17 wide; circle of 12 perioral denticles 3–4 long. Esophagus length 562–640; anterior muscular portion 150 long. Nerve ring 111 from anterior end. Cervical papillae 230 from anterior end at level of 6th or 7th pair of combs. (Excretory pore not seen.) Forty-one pairs of combs; longest comb 50–65; last comb 216–420 from tail end. Three ventral cuticular fans anterior to vent; posterior fan 41–59 long by 19–20 high, others smaller. Tail length 67–70. Spicules markedly unequal, curved ventrally; left 92–98, right 43–50, long. Gubernaculum 40 long, portion extends ventrally around spicules (difficult to discern in two of three specimens). Ventral surface of tail and pericloacal region with 10 paired and one unpaired genital papillae and a very finely rugose papillation in the pericloacal region (Fig. 9).

### Remarks

This is the species described by Tiner (1948) in his "redescription" of *P. coloradensis*. Specimens examined by both Tiner and me include USDA Par. Coll. Nos. 40571, 46320, and 19390.

Measurements given above include only those that I made, although the range includes, almost without exception, the measurements given by Tiner (1948). Females as short as 5.4 mm were studied and will be referred to in the discussion.

Both male and female *P. peromysci* differ from *P. coloradensis* in the morphology of the buccal teeth and the size of the teeth relative to the size of the buccal cavity. The males can also be separated by the ratios of the lengths of the left and right spicules.

### *Pterygodermatites parkeri*, sp. n.

(Figs. 11–14)

**Hosts:** (Type) *Sciurus carolinensis* Gmelin, Eastern gray squirrel; (Others) *Neotoma magister* Baird, Pennsylvania packrat; *Napeo-*

*zapus insignis* (Miller), woodland jumping mouse.

**LOCATION:** Small intestine.

**LOCALITIES:** (Type) Montgomery County, Virginia. (Others) Ohio, Maryland and Connecticut.

**SPECIMENS:** USNM Helm. Coll. Nos. 63207 (holotype: female) and 63208 (allotype: male); USDA Par. Coll. Nos. 42690, 24977, 66286, and 57254 (paratypes: female).

### Description

Buccal cavity contains three equally large buccal teeth that extend anteriorly from its floor about one-third its depth. Buccal teeth consist of three main portions with middle portion of each tooth shorter than lateral portions, giving anterior edge of each tooth a concave appearance.

**FEMALE** (Based on 12 complete specimens and some fragments): Length 19.9–34.4 mm. Diameter at vulva 315–536. Buccal cavity round in *en face* 65–100 deep by 65–105 wide. Mouth roughly oval, slightly elongated laterally, bordered by 14–19 perioral denticles up to 13–16 long. Esophagus length 2.70–4.14 mm; anterior muscular portion 610–810 long. Nerve ring 315–449 and excretory pore 518–555 from anterior end. Cervical papillae 415–700 from anterior end at level of 6th or 7th pr. of combs. Vulva posterior to end of esophagus (except specimens from *Napeozapus* in which it is anterior), between pairs of cuticular processes numbers 30 and 32, 2.25–4.27 mm from anterior end. Eggs embryonated, length 40–50; width 30–33. Total number pairs cuticular processes 61–67 including 32–34 pairs of combs. Largest combs 147–240 by 60–120 high. Maximum spine length 97–167. Tail length 255–442.

**MALE** (allotype): Length 6.18 mm. Diameter: maximum 268; at base of buccal capsule 100. Buccal cavity 43 by 43. Mouth bordered by 13 perioral denticles up to 11 long. Esophagus length 1.40 mm; anterior muscular portion 400. (Excretory pore not seen.) Nerve ring 175 from anterior end between 3rd and 4th combs. Cervical papillae between 5th and 8th pairs of combs 300 from anterior end. Total of 42 pairs of combs; largest 162 long by 59 high; last one 500 from tail end. Ventral cuticular fans absent. Tail

length 243. Spicules nearly equal, curved ventrally, left 270, right 256, long. (Neither gubernaculum nor accessory piece discernible.) Ventral surface of tail and pericloacal region with 10 paired and one unpaired genital papillae, and a finely rugose papillation in the pericloacal region (Fig. 14).

### Remarks

The description of the female refers to specimens from all three hosts listed above unless noted otherwise. This species includes, at least in part, those referred to as the "long-combed group" by Tiner (1948) and McPherson and Tiner (1952). Some of the females from the gray squirrel and those from the wood rat were examined by both Tiner and me. According to Tiner (1948) similar specimens have been collected in Ohio by Rausch and Tiner (1948) from the fox squirrel, *Sciurus niger*; the red squirrel *Tamiasciurus hadronicus*; and the Eastern gray squirrel.

*P. parkeri* differs from both *P. coloradensis* and *P. peromysci* in the length of its combs. It further differs from *P. coloradensis* in the morphology of its buccal teeth and the size of the teeth relative to that of the buccal cavity; and from *P. peromysci* in the ratio of the lengths of the spicules. *P. parkeri* is named in honor of James C. Parker who provided me with the only known male of the species and several females from an Eastern gray squirrel (Parker, 1968).

### Discussion

The possibility was considered that differences in morphology of buccal teeth were due to wearing, with the older specimens having teeth like *P. peromysci*, since the only specimens of *P. coloradensis* are smaller and perhaps younger than the others. However, this possibility was eliminated by finding that immature specimens of *P. peromysci* (Fig. 10), smaller than the *P. coloradensis* lectotype, have buccal teeth like the adult *P. peromysci* and that mature adult *P. microti* from Alaskan voles have teeth like *P. coloradensis*.

Separate keys are given herein to males and females of the seven North American species of the subgenus *Paucipectines*. It appears that only three exotic species are sufficiently similar

to those described herein to require discussion: (1) *P. baicalensis* (Spasskii, Ryzhikov and Sudarikov, 1952) is similar to *P. coloradensis*, but its buccal teeth are bicuspid and smaller in relation to the size of the buccal cavity. (2) *P. sibiricensis* (Morozov, 1959) has buccal teeth similar to *P. coloradensis* and *P. microti*, but differs by having 33 pairs of prevulvar cuticular processes in the female and 44 pairs of combs and markedly unequal spicules in the male. (3) *P. zygodontomis* (Quentin, 1967) is similar to *P. peromysci*, but differs from it in the position of the nerve ring and length of esophagus of males and females and in the number of cuticular processes of the females.

McPherson and Tiner (1952) reported finding two kinds of males in a single white-footed mouse in Illinois. One had unequal spicules and conformed with the description of *P. peromysci*; the other had equal spicules 238 long. Similarly, Oswald (1958a, 1958b) reported both kinds of males in experimental infections derived from naturally infected white-footed mice collected in Ohio. Since the known geographical distribution of *P. coloradensis* now includes only Colorado and Utah, it is probable that the males with equal spicules reported from the white-footed mice were *P. parkeri* which occurs in Ohio.

The results of the present study emphasize the importance of a valid species determination of organisms used in experimental work. The identity of the nematodes used in the life cycle work of Oswald (1958a, 1958b) and Swartz (1959) on "*P. coloradensis*" is questionable since it is uncertain whether *P. coloradensis*, *P. peromysci*, *P. parkeri*, or some mixture of them was used. Questions of taxonomy may be avoided by depositing samples of organisms in museums such as the National Parasite Collection.

### Acknowledgments

Thanks are expressed to Mr. James C. Parker, Biology Department, Virginia Polytechnic Institute and Mr. Ralph Eckerlin, Department of Zoology and Entomology, University of Connecticut who provided specimens; Miss Judith M. Humphrey, Beltsville Parasitological Laboratory who translated several Russian papers.

**Key to Male *Pterygodermatites* (*Paucipectines*) Quentin, 1969 from North American Rodents\***

- I. Spicules equal or nearly equal in length
- A. 52 pairs of cuticular processes; left spicule 110, right 98 long — *P. ondatrae*
  - B. 45 pairs of cuticular processes; both spicules 132 long ————— *P. microti*
  - C. 42 pairs of cuticular processes; spicules 215 to 270 long
    1. top edge of buccal teeth convex; longest comb 85 ——— *P. coloradensis*
    2. top edge of buccal teeth concave; longest comb 162 ————— *P. parkeri*
- II. Spicules markedly unequal, right about ½ as long as left
- A. 38 to 40 pairs of cuticular processes; knob on proximal end of left spicule twice diameter of shaft — *P. dipodomis*
  - B. 41 pairs of cuticular processes; proximal end of left spicule only slightly wider than shaft — *P. peromysci*

\* The male *P. onychomis* is unknown.

**Key to Female *Pterygodermatites* (*Paucipectines*) Quentin, 1969 from North American Rodents**

- I. More than 70 pairs of cuticular processes
- A. 40 of 71 to 74 pairs of processes prevulvar; buccal cavity small, 26 deep by 40 wide ————— *P. dipodomis*
  - B. 32 of 73 to 75 pairs of processes prevulvar; buccal cavity large, 90 deep by 85 wide ————— *P. ondatrae*
- II. 61 to 67 pairs of cuticular processes
- A. 24 to 26 perioral denticles; 32 to 33 pairs of processes prevulvar
    1. maximum comb length 131 to 145; maximum spine length 150 to 160; ratio, comb length/spine length .87 to .91 ————— *P. microti*
    2. maximum comb length 270; maximum spine length 113; ratio, comb length/spine length 2.4 ————— *P. onychomis*

- B. 14 to 20 perioral denticles; 29 to 31 pairs of processes prevulvar; ratio, comb length/spine length 1.1 to 1.6
  1. top edge of buccal teeth convex; buccal teeth extended anteriorly about ½ depth of buccal cavity ————— *P. coloradensis*
  2. top edge of buccal teeth concave; buccal teeth extend anteriorly about ⅓ depth of buccal cavity
    - a. maximum comb length 94 to 127 ————— *P. peromysci*
    - b. maximum comb length 147 to 240 ————— *P. parkeri*

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## *Ascocotyle sexidigita* sp. n. (Trematoda: Heterophyidae) with Notes on its Life Cycle\*

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**ABSTRACT:** The new species *Ascocotyle sexidigita* is described from Southern California. Naturally infected killifish, *Fundulus parvipinnis parvipinnis* (Girard), harbored the metacercariae in the stomach and intestinal wall. Metacercariae were fed to hatchery-raised chicks and all of them served as hosts to the adult worms. The worms developed in the ceca of the chicks which they reached within twenty-four hours after feeding. They required about six days to become egg bearing. *A. sexidigita* differs from all species in the genus in the nature of the gonotyl which bears six digits supported by what appear to be calcareous deposits.

The killifish, *Fundulus parvipinnis parvipinnis* (Girard), collected in an estuary at the Bolsa Chica Gun Club near Huntington Beach, California had metacercariae embedded in the wall of the intestine. These metacercariae possessed characters of the genus *Ascocotyle* Looss, 1899. They were fed to hatchery-raised chicks and adult worms were recovered from the ceca and large intestine. Adults are described as a new species.

Living, fixed (Heidenhain's "Susa") whole mounts stained with Mayer's paracarmine, and sections stained with Mallory's Triple were studied. Measurements are expressed in millimeters unless noted otherwise.

### Diagnosis

#### *Ascocotyle sexidigita* sp. n. (Figs. 1, 4)

Body pyriform to cylindrical depending on state of contraction. Body length 0.35-0.81, av. 0.57 (measurements based on 16 egg-bearing specimens); maximum body width 0.14-0.29, av. 0.24. Integument covered with small spines arranged in quincuncial pattern.

Prepharynx about 0.05 long, opens into ventral side of oral appendage. Pharynx oval, 0.034-0.05, av. 0.045 long, 0.02-0.047, av. 0.033 wide. Esophagus length varies with degree of contraction but when extended is about 0.05 long. Prepharynx and esophagus walls contain fine longitudinal and transverse muscle fibers. Ceca relatively short, not reaching acetabular level in extended specimens. Mouth surrounded by coronet of two rows of spines of nearly equal size, each row having 29-30 spines. Spines of anterior row average about 10  $\mu$  in length, while those of the posterior row average about 9  $\mu$ . Oral appendage extends to pharynx and turns back on itself a short distance, or if nearly straight, extends posterior to pharynx, has muscular sheath and cellular core, when contracted it produces an expansion of spine-bearing region, averages about 0.08 in transverse diameter. Dorsal to mouth is a protrusible lip upon whose anterior margin are openings of 14 cephalic glands retained from the metacercarial stage plus those of about 12 short tubular glands. Ventral sucker 0.038-0.056, av. 0.048 in length, 0.037-0.06, av. 0.05 in width, enclosed in ventro-genital sack. Vitellaria consist of numerous small follicles laterally

\* Supported by NSF G6962.