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Canadian Journal of Zoology

Réimpression du

Journal canadien de zoologie

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Volume 51 • Number/numéro 5 • 1973

Pages 521–529

Published by the National Research Council of Canada

Publié par le Conseil national de recherches du Canada

Dracunculus lutrae n. sp. (Nematoda: Dracunculoidea) from the otter, *Lutra canadensis*, in Ontario, Canada

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Received October 23, 1972

CRICHTON, V. F. J., and M. BEVERLEY-BURTON. 1973. *Dracunculus lutrae* n. sp. (Nematoda: Dracunculoidea) from the otter, *Lutra canadensis*, in Ontario, Canada. Can. J. Zool. **51**: 521–529.

Over the interval 1969–1971, carcasses of 1147 mammals taken in Ontario, Canada, were examined for guinea worm. ***Dracunculus lutrae*** n. sp., was recovered from otter *Lutra canadensis* (Schreber). *Dracunculus insignis* (Leidy 1858) Chandler 1942, was found in raccoon *Procyon lotor* (L.), mink (*Mustela vison* Schreber), and fisher (*Martes pennanti* (Erxleben)). Female worms identified, in the absence of males, as *Dracunculus* sp. were found in muskrat (*Ondatra zibethicus* (L.), opossum (*Didelphis marsupialis* L.), and short-tailed weasel (*Mustela erminea* L.) from Ontario and a single badger (*Taxidea taxus* (Schreber)) from Manitoba.

Dracunculus lutrae n. sp. is distinguished from other species of *Dracunculus* which parasitize mammals (namely *D. medinensis* (Linnaeus 1758), *D. insignis*, and *D. fuelleborni* Travassos 1934), by the greater length of males, greater length of spicules and gubernaculum, presence of three pairs of preanal papillae, and the arrangement in two transverse rows of papillae immediately posterior to the anus. A brief redescription of *D. insignis* from raccoon and mink is given. The taxonomic status of the species of *Dracunculus* parasitizing mammals is briefly discussed.

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De 1969 à 1971, on a examiné 1147 carcasses de mammifères provenant d'Ontario, au Canada, afin de vérifier la présence de vers de guinée. On a trouvé, sur la loutre *Lutra canadensis* (Schreber), une nouvelle espèce, ***Dracunculus lutrae***. *Dracunculus insignis* (Leidy 1858) Chandler 1942, parasite le raton-laveur *Procyon lotor* (L.), le vison (*Mustela vison* Schreber) et la martre (*Martes pennanti* (Erxleben)). En l'absence de mâles, on a appelé *Dracunculus* sp. les vers femelles recueillis chez le rat musqué (*Ondatra zibethicus* (L.)), l'opossum (*Didelphis marsupialis* L.) et la belette (*Mustela erminea* L.) en Ontario, de même que chez un spécimen unique de blaireau (*Taxidea taxus* (Schreber)) du Manitoba.

Dracunculus lutrae n. sp. se distingue des autres espèces de *Dracunculus* parasites de mammifères (*D. medinensis* (Linnaeus 1758), *D. insignis* et *D. fuelleborni* Travasses 1934), par la plus grande taille des mâles, la longueur plus considérable des spicules et du gubernaculum, la présence de trois paires de papilles préanales et par l'arrangement en deux rangées transversales des papilles situées immédiatement derrière l'anus. On redonne ici une brève description de *D. insignis* parasite du raton-laveur et du vison. On discute brièvement de la situation taxonomique des espèces de *Dracunculus* parasitant les mammifères. [Traduit par le journal]

Introduction

Three species of the genus *Dracunculus*, commonly called guinea worm, are known to parasitize mammals. *Dracunculus medinensis* (Linnaeus 1758) occurs primarily in man and is presently confined to Africa and Asia. *Dracunculus fuelleborni* was described by Travassos (1934) from material recovered from opossum (*Didelphis aurita*) in Brazil while the North American guinea worm, which is generally referred to as *Dracunculus insignis* (Leidy 1858), has been reported from a variety of mammals. According to the previous literature, which is mainly concerned with taxonomy and geographic distribution, *D. insignis* occurs in the United States east of the Rocky Mountains. In Canada *D. insignis* has been recorded only from Ontario (Chitwood 1933; Fyvie 1964, 1966; Crichton 1971; Webster and Casey 1970; Gibson and McKiel 1972) where it is a common parasite of fur-bearing mammals. Cheatum and Cook (1948) and Fyvie (1964, 1966) reported guinea worm from otter. These specimens were identified, in the absence of male worms, as *D. insignis*. During the present study male and female worms were found in otter, and *D. lutrae* n. sp. is proposed for this form. *D. insignis* is briefly redescribed and the taxonomic position of *Dracunculus* spp. parasitizing mammals is summarized and discussed.

This paper represents part of a study on the biology of *Dracunculus* spp. in wildlife of Ontario (Crichton 1972). Subsequent papers will include our findings on development, prevalence, distribution, etc.

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Materials and Methods

In the trapping seasons from 1969 to 1972, 1147 pelted and usually frozen carcasses of various species of fur-bearing mammals (Crichton 1972) were obtained from trappers throughout much of Ontario. In addition, from March to December of 1970 and 1971, raccoon (live-trapped by V.F.J.C.), mink, and muskrat from the Lake Huron Administrative District of the Ministry of Natural Resources were examined while fresh.

The following parts of each host were examined for guinea worm: pelt and subcutaneous fat (when available); external surface of all superficial muscles including fat deposits; connective tissue beneath the latissimus dorsi; connective tissue of the inguinal and axillary region; intermuscular areas of the legs and feet; and abdominal and thoracic cavities.

Initially, fresh carcasses were quartered and soaked in physiological saline for 5 h, and the saline subsequently examined for living worms. It was found, however, that few worms were overlooked when the pelt (placed flesh side out on a drying board), fat, and musculature were examined with the naked eye under good illumination. Subsequently, this latter procedure was used.

Most worms were preserved in a hot 10% solution of glycerin in 70% alcohol. After clearing in glycerin, worms were measured and drawn with the aid of a camera lucida. *En face* preparations were made with glycerin jelly as the supporting medium. The tail of the male was cut in front of the anus and then cut again between the anus and caudal extremity. The two pieces were placed in a drop of glycerin, ventral side up between two thin glass rods. A cover slip was not used during examination of the tail as a ×12.5 ocular and a ×40 objective gave sufficient magnification for one to see the number and arrangement of the caudal papillae.

For drawing and measuring, larvae were placed in a drop of tap water under a vaseline-ringed cover slip. The preparation was then gently heated for 2–3 s to relax the larvae.

Results

In addition to the guinea worms on which the following descriptions are based, several female worms identified, in the absence of males, as *Dracunculus* sp. were found in muskrat (*Ondatra zibethicus* (L.)), opossum (*Didelphis marsupialis* L.), and short-tailed weasel (*Mustela erminea* L.) from Ontario and a single badger (*Taxidea taxus* (Schreber)) from Manitoba.

Dracunculus lutrae n. sp.

(Figs. 1–7, Tables 1, 2, and 3)

General

Dracunculoidea, Dracunculidae, *Dracunculus* Reichard 1759. Buccal cavity reduced. Circumoral opening surrounded by four submedian double papillae and one lateral pair. Amphids posterior to lateral papillae. Circumoral cuticularized plate well developed. Cephalic extremity with prominent cuticular elevations. Oesophagus with short anterior muscular portion and longer glandular portion. Glandular oesophagus with prominent inflation anterior to nerve ring. Deirids immediately posterior to nerve ring. Intestine atrophied, light amber in color. Tail

TABLE 1

Dimensions (mm) of paratypes of *Dracunculus lutrae* n. sp.

	Male	Female
No. specimens	10	10
Length	36 (32.2–40.0)	247 (200–290)
Width	0.29 (0.25–0.35)	1.1 (1.0–1.2)
Nerve ring*	0.79 (0.74–0.87)	0.90 (0.80–0.99)
Excretory pore*	0.99 (0.91–1.15)	1.15 (1.06–1.26)
Deirids*	0.98 (0.89–1.13)	1.10 (0.93–1.25)
Length of oesophagus	11.4 (10.2–15.3)	32.0 (28.0–37.0)
Muscular portion	0.28 (0.25–0.29)	0.34 (0.30–0.46)
Length of right spicule	0.64 (0.59–0.72)	—
Length of left spicule	0.61 (0.51–0.68)	—
Length of gubernaculum	0.17 (0.16–0.18)	—
Vulva*		129 (97–152)
Length of tail	0.46 (0.42–0.52)	0.80 (0.70–1.20)
Preanal papillae (pairs)	3	—
Postanal papillae (pairs)		
Subventral	2	—
Ventrolateral	1	—
Tail papillae (pairs)		
Subventral	2	—
Lateral	1	—
Phasmids from posterior		0.53 (0.42–0.69)

NOTE: Average values are followed by the range.
*Distance from anterior.

pointed, with ventral curvature more marked in male. Cuticle with closely spaced striations.

Male (Holotype)

Length 36.3 mm. Maximum width (at end of oesophagus) 0.31 mm. Oesophagus 10.8 mm in length; muscular region 0.29 mm. Oesophageal inflation 0.43 mm in length and 0.16 mm in width. Nerve ring 0.78 mm and excretory pore 0.95 mm from anterior extremity (Fig. 6). Deirids 0.93 mm from anterior extremity. Spicules similar in morphology, right 0.65 mm and left 0.62 mm in length (Fig. 1). Gubernaculum 0.18 mm in length. Tail 0.43 mm in length.

Oral opening surrounded by hexagonal cuticularized plate (Fig. 4). Four cuticularized elevations present at anterior extremity, two dorsal and two ventral to oral opening.

Preanal papillae consisting of three subventral pairs arranged in oblique rows (Fig. 2). Postanal papillae as follows: two subventral pairs immediately posterior to anus arranged with posterior pair almost directly behind anterior pair, one pair of ventrolateral papillae immediately behind preceding papillae, one pair of lateral papillae and two pairs of subventral papillae near caudal extremity (Fig. 3). Some variation in number of papillae was observed in type material as follows: two worms with four and five preanal papillae on one side and the usual number of three on the other, one with three posterior subventral papillae on one side and the usual two on the other, and another lacking one lateral postanal papilla. Phasmids lateral, near caudal extremity.

Spicules long and needlelike, right averaging about 0.3 mm longer than the left. Spicules with expansion at proximal end. Gubernaculum rounded at posterior extremity with two lateral infoldings partially enclosing spicules. Infoldings gradually tapering to two small winglike expansions about halfway along gubernaculum.

Female (Allotype)

Length 254 mm. Maximum width (at end of oesophagus) 1.2 mm. Oesophagus 35 mm in

TABLE 2

Diagnostic features of *Dracunculus lutrae* n. sp. compared to other *Dracunculus* spp. in mammals

	D. medinensis (Muller, 1971)	*D. fuelleborni* (Travassos, 1934)	*D. insignis* (present material)	*D. lutrae* (present material)
Length	15.5 (15–16)	28 (27–29)	24.3 (19.4–30.1)	36 (32.2–40.0)
Length of right spicule	0.44 (0.41–0.52)	0.40 (0.38–0.42)	0.48 (0.43–0.52)	0.64 (0.59–0.72)
Length of left spicule	0.42 (0.40–0.52)	0.40 (0.38–0.42)	0.48 (0.42–0.51)	0.61 (0.51–0.68)
Length of gubernaculum	0.12 (0.12–0.12)	0.09 (0.09–0.10)	0.12 (0.12–0.13)	0.17 (0.16–0.18)

NOTE: All measurements in millimeters; average values are followed by the range.

TABLE 3

Dimensions (μ) of first-stage larvae of *Dracunculus* spp. from 20 specimens each of raccoon, mink, and otter

	D. insignis		*D. lutrae* n. sp.
	Raccoon	Mink	Otter
Length	664 (596–857)	698 (673–749)	655 (608–722)
Width (maximum)	20 (18–23)	21 (20–23)	23 (16–28)
Nerve ring*	77 (66–101)	76 (62–90)	75 (65–84)
%†	11.7 (10.0–16.1)	10.9 (9.0–12.3)	11.5 (10.4–12.8)
Excretory pore*	87 (73–107)	80 (64–94)	97 (83–113)
%	13.1 (11.2–17.1)	11.4 (9.3–12.8)	14.8 (13.6–16.4)
Oesophagus	145 (133–166)	145 (131–154)	151 (138–169)
%	21.8 (19.4–25.1)	20.7 (19.1–22.4)	23.1 (21.3–25.3)
Position of g.p.*	310 (253–420)	314 (278–351)	300 (275–337)
%	46.6 (39.3–54.0)	44.9 (39.9–50.4)	45.2 (41.4–48.9)
Length of g.p.	42 (28–55)	33 (28–39)	26 (16–33)
Anus*	385 (337–482)	408 (371–446)	376 (330–420)
%	58.0 (53.7–66.2)	58.4 (51.6–64.0)	57.4 (54.3–59.9)
Tail	281 (250–375)	289 (251–325)	279 (246–308)
%	42.4 (37.9–44.0)	41.3 (36.0–43.5)	42.6 (40.1–45.7)

NOTE: Average values are followed by the range.
*Distance from anterior extremity; g.p. = genital primordium.
†%=the position of the relevant structure from the anterior extremity expressed as a percentage of the total body length.

length; muscular region 0.36 mm. Oesophageal inflation 0.50 mm in length. Nerve ring 0.98 mm and excretory pore 1.23 mm from anterior extremity. Deirids 1.25 mm and vulva 136 mm from anterior extremity. Tail 0.80 mm in length. Phasmids lateral and posterior to anus.

Oral opening surrounded by rectangular cuticularized plate (Fig. 5). Anterior extremity with two cuticular elevations, one dorsal and one ventral to oral opening (Figs. 5 and 7).

Host

Otter (*Lutra canadensis* (Schreber)).

Site

In connective tissue beneath latissimus dorsi or in subcutaneous and intermuscular connective tissue of thorax, abdomen, legs, and feet.

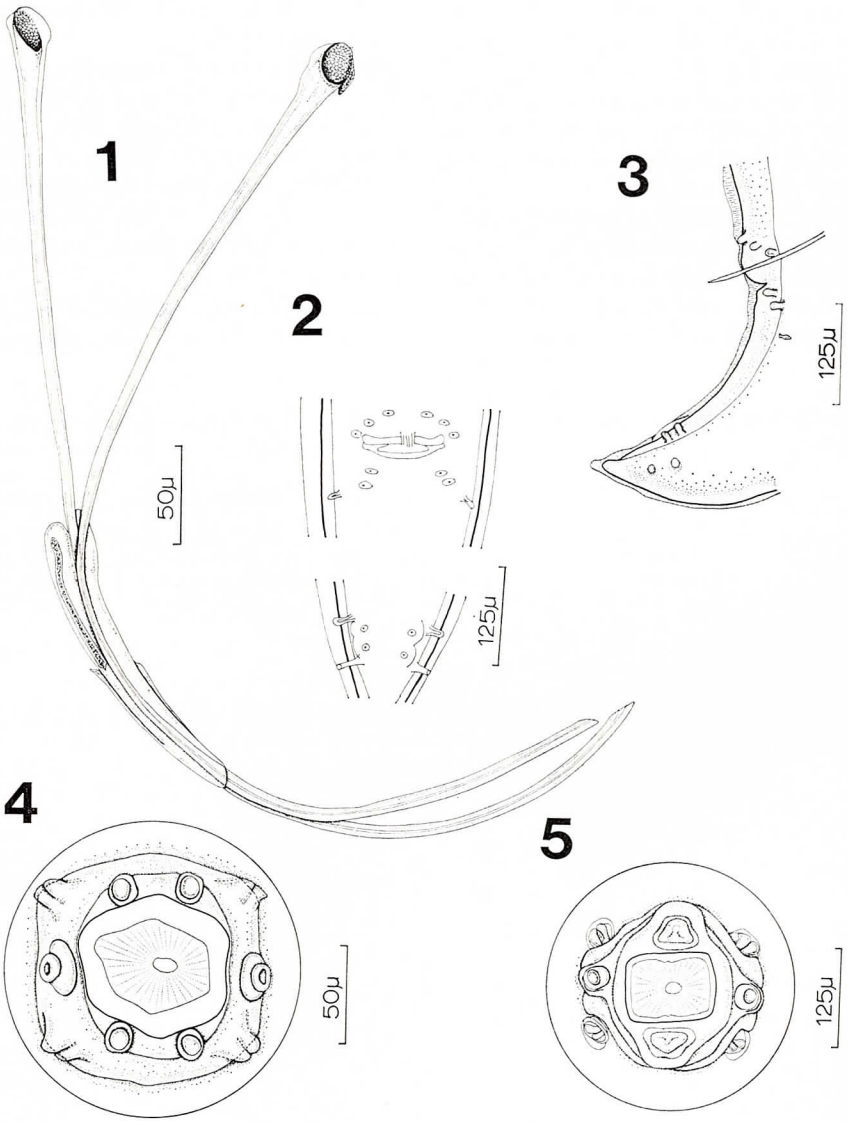

FIG. 1. Spicules and gubernaculum of *D. lutrae* n. sp. FIG. 2. Caudal papillae of *D. lutrae* n. sp. FIG. 3. Lateral view of ♂ tail of *D. lutrae* n. sp. FIG. 4. *En face* of *D. lutrae* n. sp. ♂. FIG. 5. *En face* of *D. lutrae* n. sp. ♀.

Locality

Ontario, Canada (13G Township, Chapleau Administrative District of the Ministry of Natural Resources. 83°36′ longitude and 47°43′ latitude).

Specimens

Holotype, allotype, and paratypes to be assigned to the U.S. National Museum Collection (Nos. 72467 to 72471 inclusive).

First-Stage Larvae

First-stage larvae of *D. lutrae* and *D. insignis* were recovered from female worms located in the extremities of naturally infected otter or raccoon and mink respectively. First-stage larvae of *D. lutrae* and *D. insignis* (Fig. 9) were morphologically indistinguishable (Table 3). The cuticle had regular transverse striations. A small dorsal tooth was present at the anterior extremity. The tail was long and filamentous. The oesophagus was long and its nuclei located in the posterior half; the lumen was large and the wall of the oesophagus thin. The excretory cell and its nucleus were conspicuous and situated slightly anterior to the oesophageal–intestinal valve. The lumen of the intestine seemed to end blindly in the region of the genital primordium. The genital primordium was difficult to determine but it was much longer than wide. Conspicuous phasmids were present slightly posterior to the anus.

First-stage larvae were extremely active and could be kept alive in tap water for about 14 days. In saline they died in about 24 h.

Specific Diagnosis

D. lutrae is readily distinguished from other species of *Dracunculus* occurring in mammals by the greater length of males, greater length of spicules and gubernaculum (Table 2), the presence of three pairs of preanal papillae compared to five pairs in *D. insignis*, four–five pairs in *D. medinensis*, and four–five pairs in *D. fuelleborni*. Also, the two pairs of subventral papillae immediately posterior to the anus are arranged in two distinct transverse rows while in *D. insignis* and *D. medinensis* these papillae are situated in a single transverse row. It is difficult to determine the arrangement of the postanal papillae in the original description of *D. fuelleborni*.

Dracunculus insignis (Leidy 1858) Chandler 1942
(Figs. 8 and 9, Tables 2 and 4)

Male

Oral opening surrounded by hexagonal cuticularized plate. Four cuticularized elevations present at anterior extremity, two dorsal and two ventral to oral opening.

Typical arrangement of caudal papillae as follows: preanal papillae consisting of five subventral pairs arranged in oblique rows; postanal papillae consisting of transverse rows of four subventral papillae immediately posterior to anus, one pair of ventrolateral papillae immediately behind preceding papillae, one pair of lateral papillae and two pairs of subventral papillae near caudal extremity (Fig. 8). Variation in caudal papillae as follows: of 10 specimens from raccoon, one with six pairs of preanal papillae, 2 with six and seven preanal papillae on one side only and five on the other, and 1 with three pairs of subventral papillae on caudal extremity. Of 10 specimens from mink, 2 with six and eight preanal papillae on one side only and five on the other, and 1 without one papilla of two subventral pairs at caudal extremity. Preanal papillae sometimes not arranged in straight oblique rows but scattered slightly. Phasmids lateral, near caudal extremity.

Spicules similar in morphology, long and needlelike with expansion at proximal end. Gubernaculum rounded at distal extremity with two lateral infoldings partially enclosing spicules; infoldings terminating in two small winglike expansions about halfway along gubernaculum.

Female

Oral opening surrounded by rectangular cuticularized plate. Anterior extremity with two cuticular elevations, one dorsal and one ventral to oral opening.

Caudal papillae absent. Phasmids lateral and posterior to anus.

The following data refer to material collected in the present survey.

Host

Raccoon (*Procyon lotor* (L.)), mink (*Mustela vison* Schreber), and fisher (*Martes pennanti* (Erxleben)).

Site

Subcutaneous and intermuscular connective tissue of thorax, abdomen, legs, and feet.

Locality

Southern Ontario, Canada.

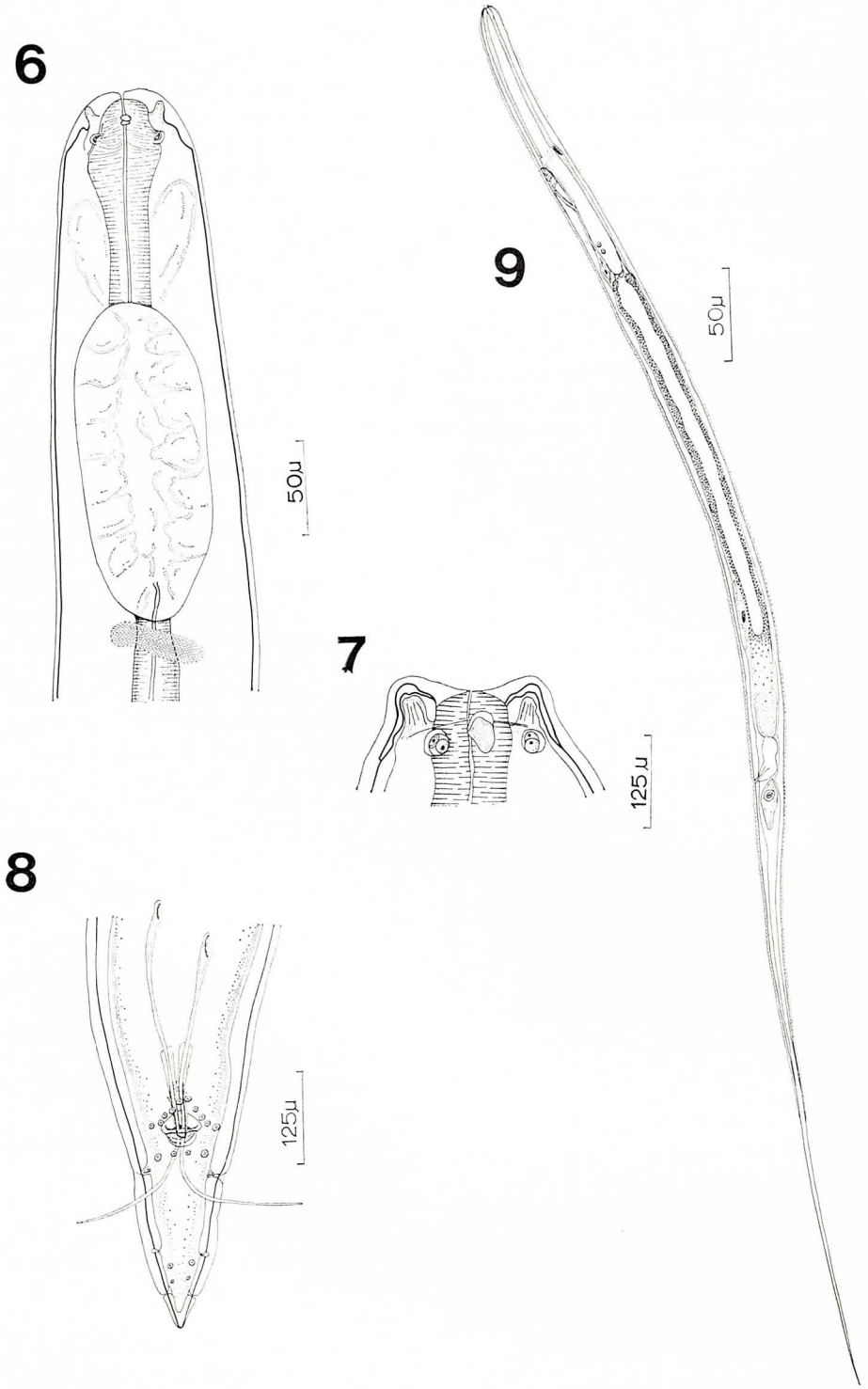

FIG. 6. Lateral view of head and anterior oesophagus region of *D. lutrae* n. sp. ♂. FIG. 7. Lateral view of head of *D. lutrae* n. sp. ♀. FIG. 8. Spicules, gubernaculum, and caudal papillae of *D. insignis*. FIG. 9. First-stage larva of *D. insignis*.

TABLE 4

Dimensions (mm) of *Dracunculus insignis* from 10 male and 10 female specimens from raccoon and mink

	Male		Female	
	Raccoon	Mink	Raccoon	Mink
Length	24.3 (19.4–30.1)	18.0 (14.2–19.7)	246 (200–310)	220 (192–275)
Width	0.20 (0.18–0.22)	0.17 (0.15–0.21)	1.2 (1.1–1.3)	1.1 (1.0–1.2)
Nerve ring*	0.55 (0.52–0.63)	0.47 (0.39–0.54)	0.99 (0.87–1.15)	0.98 (0.83–1.09)
Excretory pore*	0.70 (0.65–0.82)	0.60 (0.52–0.74)	1.14 (1.00–1.36)	1.07 (0.81–1.26)
Deirids*	0.74 (0.68–0.81)	0.60 (0.50–0.71)	1.22 (1.08–1.63)	1.15 (0.96–1.31)
Length of oesophagus	12.2 (11.2–18.1)	9.2 (6.3–10.7)	34 (23–45)	30 (22–35)
Muscular portion	0.20 (0.16–0.23)	0.18 (0.15–0.21)	0.32 (0.24–0.38)	0.30 (0.24–0.35)
Length of right spicule	0.48 (0.43–0.52)	0.50 (0.46–0.55)	—	—
Length of left spicule	0.48 (0.42–0.51)	0.46 (0.43–0.52)	—	—
Length of gubernaculum	0.12 (0.12–0.13)	0.11 (0.10–0.12)	—	—
Vulva*	—	—	141 (86–250)	124 (95–160)
Length of tail	0.33 (0.29–0.35)	0.28 (0.22–0.34)	1.00 (0.70–1.30)	0.80 (0.70–1.00)
Preanal papillae (pairs)	5	5	—	—
Postanal papillae (pairs)				
Subventral	2	2	—	—
Ventrolateral	1	1	—	—
Tail papillae (pairs)				
Subventral	2	2	—	—
Lateral	1	1	—	—
Phasmids from posterior	—	—	0.59 (0.44–0.93)	0.52 (0.40–0.62)

NOTE: Average values are followed by the range.
*Distance from anterior extremity.

Discussion

Guinea worm occurs in 11 species of New World mammals (Crichton 1972). It has not previously been reported from opossum or badger in North America. However, until male worms have been recovered from all host species, the possibility that another species of guinea worm is involved cannot be discounted and the taxonomic status of *D. fuelleborni*, described from the opossum by Travassos (1934), remains uncertain. Chabaud (1960) suggested that *D. fuelleborni* may be synonymous with *D. insignis*. The finding of a female guinea worm in an opossum during this study in an area in which *D. insignis* is endemic supports Chabaud's suggestion.

The relationship between *D. medinensis* and *D. insignis* has yet to be resolved.

Benbrook (1932) first recognized *Dracunculus* in North American carnivores and reported it as *D. medinensis*. Chitwood (1933) raised the question of the relationship of Old and New World species of guinea worm. He suggested that the species in North American wildlife was *D. medinensis* but probably a different physiological strain from that adapted to man. However, in North America, man does not customarily take his drinking water from open wells abounding in copepods as is done in Africa and Asia. This factor might account for the extreme rarity of human infection in North America. Chandler (1942), on the other hand, concluded that guinea worm in North America was not *D. medinensis*. He proposed the combination *D. insignis* on the assumption that *Filaria insignis* described by Leidy (1858) was in fact a guinea worm. Most investigators have accepted this combination.

Generally, identifications of guinea worm (Crichton 1972) in North American mammals have been based wholly on female worms which do not have characters suitable for the separation of species. Chitwood (1950), however, described two males of *D. insignis* from raccoon and Gibson and McKiel (1972) described males from a muskrat.

Chitwood (1950) compared his male specimens with Moorthy's (1937) description of *D. medinensis* and stated "it would appear that *D. insignis* may be separated from *D. medinensis* on the basis of length of gubernaculum and number of preanal genital papillae." The gubernaculum of Chitwood's specimens was 119 μ in length while that of *D. medinensis* was 200 μ in length. However, the figure given in text by

Moorthy (1937) does not agree with the scale on his illustration of the gubernaculum and Muller (1971) gave the length of the gubernaculum of *D. medinensis* as 117 μ. The average length of the gubernaculum of *D. insignis* from raccoon was 123 μ and from mink 111 μ. Gibson and McKiel (1972) gave the length of the gubernaculum of *D. insignis* from muskrat as 114–121 μ.

Chitwood (1950) studied Moorthy's specimens of *D. medinensis* and stated there were clearly six pairs of preanal genital papillae compared to only five pairs in *D. insignis*. However, Moorthy's illustration of the tail of *D. medinensis* showed only four pairs of preanal papillae and he stated in text that there are four pairs. According to Muller (1971) the number of preanal papillae in *D. medinensis* varied from three to four on one side and four to six on the other.

The number of postanal papillae of *D. insignis* found in the present study is similar to that described by Chitwood (1950). However, although Chitwood did not mention them in text, his illustration of these papillae depicted one lateral pair slightly anterior to the latter two subventral pairs. This pair was observed in the present material.

A difference of opinion exists concerning the interpretation of the cephalic structures. Moorthy (1937), Muller (1971), and Gibson and McKiel (1972) consider that the four cuticular elevations in the immediate area of the mouth are, in fact, the internodorsal and internoventral papillae of the internal circle. Unlike sensory papillae the cuticular elevations appear to consist of extensions of arcadial tissue covered by thick cuticle. In the related superfamily Filarioidea, in which cephalic papillae have been comprehensively studied (Anderson 1968), the persistence of internal papillae dorsal and ventral to the oral opening is extremely rare although dorsal and ventral cuticular elevations are commonly found in the Setariidae. In filarioids the internal papillae most likely to persist are the internolaterals and not the internodorsals and internoventrals. Moreover, one would not expect to find marked sexual dimorphism in sensory papillae. It is for these reasons that structures found in *Dracunculus* are interpreted as cuticular elevations and not internal papillae.

The morphology of first-stage larvae of *D. lutrae* and *D. insignis* is similar. Size differences have been reported between first-stage larvae recovered from otter (Cheatum and Cook 1948) and those reported from raccoon (Chandler 1942) but they were not significant. Probably Chandler (1942), who reported larval lengths shorter than those observed in the present study, measured preserved rather than heat-relaxed specimens. Crites (personal communication) confirmed that the larvae he measured (Crites 1963) were fixed specimens, which explains the shorter length. Moorthy (1938) studied preserved first-stage larvae of *D. medinensis* which measured 581–635 μ in length. Muller (1971) did not describe how his larvae were treated but gave the average length of first-stage larvae of *D. medinensis* as 643 μ.

First-stage larvae of *D. lutrae* and *D. insignis* are similar to those of *D. medinensis* as drawn by Moorthy (1938).

Acknowledgments

We thank the various fur trappers throughout Ontario who supplied carcasses, and the personnel of the Ministry of Natural Resources who collected the carcasses, especially Mr. Vincent A. M. Crichton. We are grateful for Dr. R. C. Anderson's constructive criticism and comments throughout this study and for Mrs. Uta Strelive's line drawings.

For financial support we acknowledge the National Research Council of Canada (Grant No. 574-91 to M.B-B.), the Canadian National Sportsmen's Show, and the Canadian Wildlife Service, Department of the Environment.

ANDERSON, R. C. 1968. The comparative morphology of cephalic structures in the superfamily Filarioidea (Nematoda). Can. J. Zool. **46**: 181–199.

BENBROOK, E. A. 1932. *Dracunculus medinensis* (Linnaeus 1758) appears in the United States as a parasite of the fox. J. Am. Vet. Med. Assoc. **81**: 821–824.

CHABAUD, A. G. 1960. Deux nématodes parasites de serpents malgaches. Mem. Inst. Sci. Madagascar (Ser. A), **14**: 94–103.

CHANDLER, A. C. 1942. The guinea-worm *Dracunculus insignis* (Leidy 1858), a common parasite of raccoons in East Texas. Am. J. Trop. Med. **22**: 153–157.

CHEATUM, E. L., and A. H. COOK. 1948. On the occurrence of the North American guinea worm in mink, otter, raccoon and skunk in New York State. Cornell Vet. **38**: 421–423.

CHITWOOD, B. G. 1933. Does the guinea-worm occur in North America? J. Am. Med. Assoc. **100**: 802–804.

——— 1950. The male of *Dracunculus insignis* (Leidy 1858) Chandler 1942. Proc. Helminthol. Soc. Wash. **17**: 14–15.

CRICHTON, V. J. 1971. Dracunculiasis in otter, mink, and raccoon from Ontario. J. Parasitol. **57**(Sect. II, Part 1): 13.

——— 1972. The biology of *Dracunculus* spp. (Dracunculoidea: Dracunculidae) in wildlife from Ontario. Ph.D. Thesis, University of Guelph, Guelph, Ontario.

CRITES, J. L. 1963. Dracontiasis in Ohio carnivores and reptiles with a discussion of the dracunculid taxonomic problem (Nematoda: Dracunculidae). Ohio J. Sci. **63**: 1–6.

FYVIE, A. 1964. Manual of common parasites, diseases and anomalies of wildlife in Ontario. 1st ed. Ont. Dep. Lands For.

——— 1966. A review and current survey of the common diseases and parasites of wildlife in Ontario. Ont. Dep. Lands For. Sect. Rep. (Wildl.) No. 63.

GIBSON, G. G., and D. A. MCKIEL. 1972. *Dracunculus insignis* (Leidy 1858) and larval *Eustrongylides* sp. in a muskrat from Ontario, Canada. Can. J. Zool. **50**: 897–901.

LEIDY, J. 1858. Contributions to helminthology. Acad. Nat. Sci. Phila. Proc. **10**: 110–112.

MOORTHY, V. N. 1937. A redescription of *Dracunculus medinensis*. J. Parasitol. **23**: 220–224.

——— 1938. Observations on the development of *Dracunculus medinensis* larvae in cyclops. Am. J. Hyg. **27**: 437–460.

MULLER, R. 1971. *Dracunculus* and Dracunculiasis. Adv. Parasitol. **9**: 73–151.

TRAVASSOS, L. A. 1934. *Dracunculus fuelleborni* n. sp. parasito de *Didelphis aurita* Wied. Mem. Inst. Oswaldo Cruz, Rio de Janeiro, **28**: 235–237.

WEBSTER, W. A., and D. A. CASEY. 1970. The occurrence of *Dracunculus insignis* (Leidy 1858) Chandler 1942 in a skunk from Ontario, Canada. J. Wildl. Dis. **6**: 71.