

## HOOKWORMS OF THE GENUS UNCINARIA OF THE DOG, FOX, AND BADGER.

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Looss in 1911 described, as a new species which he named *Uncinaria polaris*, a hookworm from *Vulpes lagopus*, North America. In the same paper he redescribed *Uncinaria criniformis* originally reported by Goeze in 1782 from the European badger (*Meles taxus*). Furthermore, he concluded that *Uncinaria stenocephala* (Railliet) whose type host is the dog in Europe is identical with *U. criniformis*. The specimens (at least 12 in number) from which *U. polaris* was described were sent to Looss by Stiles many years previously (Looss, 1911, p. 194). The original material, Looss states (p. 213), bore the number 3250 and came from the Zoological Gardens, Washington, D. C. The number 3250 evidently refers to a catalogue number of the Helminthological Collection of the United States National Museum, inasmuch as there are in these collections at the present time, labeled with this number, numerous specimens of hookworms which according to the label were collected from *Vulpes lagopus* at Washington, D. C., by Hassall, August, 1901. These specimens so far as I have examined them are all of one species and correspond closely to Looss's description of *Uncinaria polaris*. Undoubtedly Looss's specimens came from this lot of material and unquestionably the specimens now in the Museum Collections under the catalogue number 3250 belong to Looss's species, *Uncinaria polaris*.

It does not appear in Looss's paper whether he actually examined specimens of *Uncinaria* from dogs before arriving at the conclusion that *Uncinaria stenocephala* is identical with *U. criniformis*. Although he states in general terms that "*Uncinaria criniformis* is common in canine animals in various parts of Europe" (p. 194) and that it occurs "in various Canidae and Mustelidae of mid and northern Europe" (p. 213), he does not say specifically that he has studied specimens from dogs. On the other hand he refers definitely to *Uncinaria criniformis* from *Meles taxus* (p. 607) in connection with his drawings (figs. 105 and 106a) of the mouth-capsule of this species.

In any case, irrespective of the possibility of the occurrence of the species, which Looss calls *U. criniformis*, in dogs, there is unquestionably another species common in European dogs, which Railliet has called *Uncinaria stenocephala*, that is distinctly different from *U. criniformis* of *Meles taxus*. Furthermore *Uncinaria stenocephala* instead of being the same species as *U. criniformis* is in reality the same as *U. polaris*. Not only does Railliet's description of *U. stenocephala* in certain important respects (size of worms, maximum length of spicules, and tridigitation of terminal branches of dorsal ray of bursa) agree with what is found in the specimens of *Uncinaria polaris* (U. S. N. M., 3250) and differing in these respects from what is found in *U. criniformis*, but specimens of *Uncinaria* from dogs in various parts of Europe corresponding to Railliet's description of *Uncinaria stenocephala* agree among themselves and with *U. polaris* and differ from *U. criniformis* as described by Looss and as shown by several lots of specimens from *Meles taxus*. For European specimens of *U. stenocephala* from dogs and *U. criniformis* from *Meles taxus* to compare with *U. polaris* I am indebted to Prof. P. Ciurea, Bucarest, Rumania; Prof. A. Henry, Alfort, France; Prof. J. E. W. Ihle, Utrecht, Holland, and Prof. T. Pintner, Vienna, Austria.

Readily recognizable differences between the two species involved, *Uncinaria criniformis* and *U. stenocephala*, including its synonym, *U. polaris*, are shown in the following brief descriptions. The descriptions are not intended to be complete but refer specially to characters that seem useful for diagnostic purposes.

UNCINARIA CRINIFORMIS (Goeze, 1782).

*Specific diagnosis.*—*Uncinaria*: Male about 5.5 (5.3 to 5.9) mm., female about 7.5 (6.8 to 8.2) mm. long. The ventral wall of the mouth capsule when viewed in optical section from the side is only slightly curved as a rule (fig. 9). The boundary line between the thicker ventral portion and the thinner dorsal portion of the mouth capsule wall (side view) turns forward along the ventral side of the cord of tissue which terminates in the lateral cephalic papilla, and meets the anterior border of the mouth capsule almost at right angles (fig. 9, *x*). Esophagus of male about 0.55 mm. long, of female about 0.6 mm. long. Lateral lobes of male bursa only a little more than semicircular in shape. Medio-lateral ray slightly thicker than the postero-lateral ray and much thicker than the externo-lateral ray (fig. 10). Dorsal ray bifurcated distally, each branch bidigitate (fig. 11). Spicules 0.46 to 0.63 mm. long with rounded membranous tips. Tail of female 125 to 135  $\mu$  long; tip of tail into which the caudal bristle is inserted almost ogival in outline (fig. 12). Vulva 4.5 to 5.5 mm. from anterior end of body.

Parasitic in intestine of *Meles taxus* in Europe. Not certainly known as yet to occur in other animals.

UNCINARIA STENOCEPHALA (Railliet, 1884).

*Synonym.*—*Uncinaria polaris* Looss, 1911.

*Specific diagnosis.*—*Uncinaria*: Male about 7 (5.6 to 8.5) mm., female about 10 (7.7 to 12) mm. long. The ventral wall of the mouth capsule when viewed in optical section from the side is considerably curved as a rule (figs. 1, 5). The boundary line between the thicker ventral portion and the thinner dorsal portion of the mouth capsule wall (side view) anteriorly continues to curve toward the dorsum and meets the anterior border of the mouth capsule obliquely after crossing the cord of tissue which terminates in the lateral cephalic papilla (figs. 1, 5, *x*). Esophagus of male about 0.75 mm., of female about 0.85 mm. long. Lateral lobes of male bursa rather long, considerably more semi-oval than semicircular in shape. Medio-lateral ray of about the same width as the externo-lateral ray and the postero-lateral ray (figs. 2, 6). Dorsal ray bifurcated distally, each branch tridigitate (figs. 3, 7). Spicules 0.64 to 0.76 mm. long with sharply pointed tips. Tail of female 150 to 290  $\mu$  long; tip of tail, into which the caudal bristle is inserted, bluntly rounded (figs. 4, 8). Vulva 5 to 7.5 mm. from anterior end of body.

Parasitic in the intestine of the dog in Europe (type host and type locality). Common in fur foxes in Northern North America. Has also been found in the dog in Alaska (Hadwen) and in the hog (in stomach) at Ottawa, Canada (Hadwen).

REMARKS.

A lateral view of the head is usually more readily secured in mounted specimens of *U. criniformis* and *U. stenocephala* and in my experience is more useful for diagnostic purposes than a dorsal view. Dorsal views give very variable pictures because of differences in the tilting of the head in different specimens, and comparisons of specimens and of drawings are more difficult than in the case of lateral views. It may be noted as of interest that Railliet's drawing of the dorsal view of the head of *Uncinaria stenocephala* (see Railliet, 1893*a*, fig. 331) corresponds very well with the appearance frequently shown by specimens of *U. polaris* (U. S. N. M., 3250) which happen to be less tilted than in the view pictured by Looss (1911, fig. 108).

Looss (1911, p. 213) states that the boundary line between the thicker ventral portion and the thinner dorsal portion of the mouth-capsule wall of *U. polaris* is nearly straight and he shows it but very slightly curved in his drawing (Looss, 1911, fig. 107). In full lateral views of the mouth-capsule of *U. polaris* (= *U. stenocephala*) from the fox (fig. 1, *x*), and of *U. stenocephala* from the dog (fig. 5, *x*) I have found it more curved than Looss has described and figured it.

In Looss's drawing (Looss, 1911, fig. 116) of the bursa of *U. criniformis* the postero-lateral ray is shown as thicker than the medio-lateral ray. In all the specimens I have examined the reverse is true (fig. 10).

The lateral membranous ala of the spicule is more strongly developed in *U. criniformis* than in *U. stenocephala* and extends around the tip. In *U. stenocephala* it narrows down and disappears before the tip of the spicule is reached.

In the specimens that I have examined, the cuticle of *Uncinaria stenocephala* is usually considerably thicker than that of *U. criniformis*. For example, on the tail of the female of the latter species it has not been found to exceed 5  $\mu$  in thickness, but commonly measures 7 or 8  $\mu$  in thickness in the same region of the female of *U. stenocephala*.

In both *U. criniformis* and *U. stenocephala* the excretory pore, nerve ring and cervical papillae are located in the same general region of the neck, but vary more or less in their relative positions in different specimens in both species. I have failed to find constant differences in these characters between the two species.

The caudal pores on the tail of the female are about 45  $\mu$  from the tip (excluding the caudal bristle) in *U. stenocephala*, and in the only case measured in *U. criniformis* were 30  $\mu$  from the tip.

It is of interest to note that as yet *Uncinaria stenocephala* is not known to have become established as a parasite of the dog in the United States except in Alaska. On the other hand it is a common parasite of the foxes on fur farms in the Northern United States, including Alaska and in Canada, and is one of the most serious pests with which fox raisers have to contend. Thus far, the only cases of this parasite in dogs in North America of which I have knowledge are those seen by Hadwen in Alaska. The same observer has found *U. stenocephala* in a hog at Ottawa, Canada (Ransom, 1921, p. 190).

#### ADDENDUM.

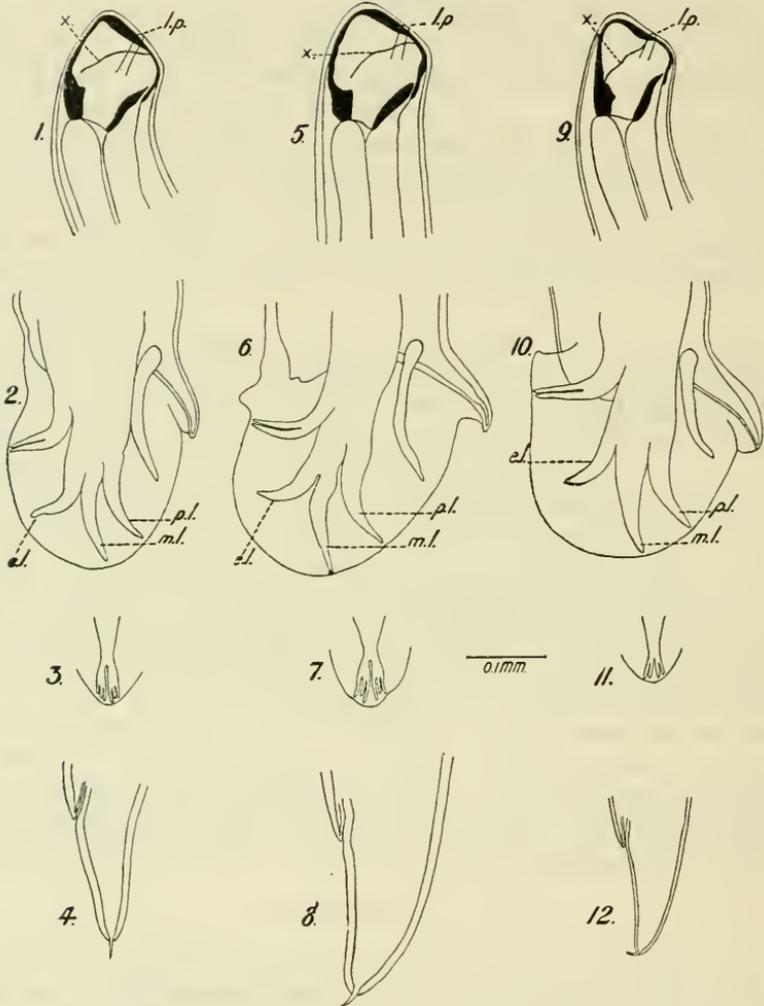
While the present paper was in the hands of the printer two papers, one by Fülleborn (1924) and one by Cameron (1924) have appeared which bear upon the question of the identity of *Uncinaria polaris* and *U. stenocephala*. Both authors are of the opinion that the two forms belong to the same species, an opinion which accords with my own findings based upon a study of the material from which Looss obtained his specimens of *U. polaris*. Cameron appears to be doubtful whether the form described by Goeze as *Ascaris criniformis* should be considered an identifiable species. In view of the fact, however, that a well-defined species of *Uncinaria* occurs in the European badger which seems in all probability to be the same as that described by Goeze there appears to be no good reason



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*Uncinaria*  
*polaris*  
(= *stenocephala*).  
Fox.

*Uncinaria*  
*stenocephala*  
Dog.

*Uncinaria*  
*criniformis*.  
Badger.

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FOR EXPLANATION OF PLATE SEE PAGE 5

why it should not be accepted as belonging to Goeze's species until it can be shown to be different.

## REFERENCES.

CAMERON, T. W. M.

1924.—*Dochmoides*: a new genus for the hookworm "*Uncinaria*" *stenocephala* Railliet. Journ. Helminth., London, vol. 2, pp. 46-50, figs. 1-5.

FÜLLEBORN, FRIEDRICH.

1924.—Bemerkungen über die Identifikation von "Hakenwürmern." Arch. f. Schiffs- u. Tropen-Hyg., Leipzig, vol. 28, pp. 12-15, pl. 1, figs. 1-6.

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1911a.—The anatomy and life history of *Agchylostoma duodenale* Dub. A monograph. Part. 2. The development in the free state. Rec. School Med., Ministry Education, Egypt, Cairo, vol. 4, pp. 159-613, pls. 11-19, figs. 101-208, photograms 7-41.

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1893a.—Traité de zoologie médicale et agricole. 2 éd. [fasc. 1]. 736 pp., 494 figs. 8°. Paris.

RANSOM, B. H.

1921.—[Unusual parasites of the domestic hog] [Read before Helminthological Society of Washington, Nov. 20, 1920]. Journ. Parasitology, Urbana, Ill., vol. 7 (4), June, p. 190.

1922.—[Notes on hookworms] [Read before Helminthological Society of Washington, May 14, 1921]. Journ. Parasitology, Urbana, Ill., vol. 8 (2), Dec., 1921, p. 96.

## EXPLANATION OF PLATE.

All figures drawn with camera lucida at same magnification as indicated by scale on plate.

## ABBREVIATIONS.

*e. l.*, externo-lateral ray.

*l. p.*, lateral cephalic papilla.

*m. l.*, medio-lateral ray.

*p. l.*, postero-lateral ray.

*x.*, boundary line between thicker ventral portion and thinner dorsal portion of lateral wall of oral capsule.

FIGS. 1-4.—*Uncinaria polaris* (= *stenocephala*).

FIG. 1.—Head from left side. U.S.N.M. Helm. Coll. 3250.

2.—Male bursa from left side. U.S.N.M. Helm. Coll. 3250.

3.—Dorsal ray of male bursa. U.S.N.M. Helm. Coll. 3250.

4.—Tail of female from left side. U.S.N.M. Helm. Coll. 3250.

FIGS. 5-8.—*Uncinaria stenocephala*.

FIG. 5.—Head from left side. U.S.N.M. Helm. Coll. 19,326.

6.—Male bursa from left side. U.S.N.M. Helm. Coll. 19,326.

7.—Dorsal ray of male bursa. U.S.N.M. Helm. Coll. 19,330.

8.—Tail of female from left side. U.S.N.M. Helm. Coll. 19,330.

FIGS. 9-12.—*Uncinaria criniformis*.

FIG. 9.—Head from left side. U.S.N.M. Helm. Coll. 3392.

10.—Male bursa from left side. U.S.M.N. Helm. Coll. 24,788.

11.—Dorsal ray of male bursa. U.S.N.M. Helm. Coll. 19,332.

12.—Tail of female from left side. U.S.N.M. Helm. Coll. 3392.