

DANISH REVIEW
of
GAME BIOLOGY

Edited by

Jagtraadets vildtbiologiske Undersøgelser

Managing editor: R. Spärck, Zoological Museum,
Copenhagen

Vol. I, Part 1

HOLGER MADSEN:

The species of *Capillaria* parasitic in the digestive tract of Danish gallinaceous and anatine game birds

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PREFACE

During the last ten years investigations concerning the food and the parasites of Danish game birds have been carried out in the Zoological Museum of Copenhagen. These investigations have been made possible by grants from Ministeriet for Landbrug og Fiskeri (the Department of Agriculture and Fisheries), which on the recommendation of Jagtraadet (the Hunter's Council) has placed the necessary amount of the funds of Jagtfonden (the Game Fund) at disposal. In the course of these years the food of the following game birds and other wild birds has been studied: the Danish species of gulls; the Partridge, Pheasant, Black Grouse; surface-feeding ducks, diving ducks, saw-bills; the Rook, Jackdaw, House Sparrow; looms, grebes, the Cormorant; the Danish species of the Auk-tribe and the waders. In addition the parasites of several of these birds, especially the gallinaceous and anatine game birds, have also been subjected to investigation. The investigations were originally in charge of a committee consisting of Prof. M. Christiansen of the State Veterinary Serum Laboratory, the late Mr. C. A. Rønholt, chief adviser, and Prof. R. Spärck of the University of Copenhagen. Last year the investigations were placed under a special institution, Jagtraadets vildtbiologiske Undersøgelser (Game Investigations), Nørregade 10, Copenhagen K, under the leadership of Prof. M. Christiansen and Prof. R. Spärck. The following scientists have assisted in these investigations:

The late R. Hørring, mag. scient., food of gulls.

Mr. H. Madsen, of the Museum of Copenhagen, food of gulls and House Sparrow.

Holger Madsen, mag. scient., the parasites.

M. Køie, mag. scient., remains of plants contained in the food.

Marie Hammer, dr. phil., insects.

Schiøtz-Christensen, cand. mag., food of Rook and Jackdaw.

F. Jensenius Madsen, mag. scient., invertebrates and remains of fishes in the food.

F. Søggaard Andersen, cand. mag., food of gulls and waders.

It is the intention in this periodical to publish the results of our above mentioned and future investigations on game biology. The columns of the periodical will further be open to all publications on the subject. On behalf of Jagtraadets vildtbiologiske Undersøgelser I wish to express my sincerest thanks for the support which we have received from Ministeriet for Landbrug og Fiskeri and from Jagtraadet.

Copenhagen, November 2nd 1945.

R. Spärck.

The species of *Capillaria*
(Nematodes, Trichinelloidea) parasitic
in the digestive tract of Danish gallinaceous and
anatine game birds, with a revised list of
species of *Capillaria* in birds

by

Holger Madsen

Copenhagen 1945

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INTRODUCTION

This paper forms part of the game investigations being made under the auspices of the Jagtfond (Game Fund) of the Ministry of Agriculture. Some preliminary results of the parasitological investigations of partridges and pheasants have been published in the Journal of Parasitology (Holger Madsen 1941).

As it was very difficult to determine exactly the species of *Capillaria* found owing to the many insufficient descriptions in the literature, a closer investigation of the species of *Capillaria* in gallinaceous birds was made with the aim of obtaining a material which could give an expression to the extent of the variation. As I was now familiar with the species of *Capillaria* I also worked up my material from anatine birds and the coot and lastly revised the literature concerning the species of *Capillaria* in birds. The results of all these investigations are given below. In the first section dealing with the species of *Capillaria* in the lower digestive tract of gallinaceous birds, the descriptions and measurements are very exhaustive with the intention of showing which features are of the greatest importance. In the second and third sections regard has only been paid to the most important features. These latter sections deal with the occurrence of *C. contorta* in the oesophagus of all my host material, and the species of *Capillaria* in the lower digestive tract of anatine birds and the coot respectively. In the fourth section is given a revised list of all the species of *Capillaria* found in birds and an exhaustive host list.

The whole worm material consists of almost 2000 specimens which were all submitted to a minute investigation. They were permanently mounted in a glycerine gum solution. All the unbroken specimens were delineated under the Edinger apparatus, spicules likewise through the camera lucida and afterwards measured with a map measurer.

SPECIES OF *CAPILLARIA* IN THE LOWER DIGESTIVE TRACT OF GALLINACEOUS GAME BIRDS, WITH RELATED SPECIES FROM FOWL ETC.

The worms were collected from a host material consisting of 133 adult partridges, 40 partridge chicks, 177 adult pheasants, 65 pheasant chicks, 39 adult black grouse and 16 black grouse chicks. They originated from the

localities marked off on the chart (Fig. 1). The worm material consisted of a little more than 1000 specimens.

In my paper of 1941 (pag. 31-32) the following *Capillaria* species from the lower digestive tract are mentioned:

Capillaria longicollis (Rud. 1819).

Capillaria columbae (Rud. 1819) (= *C. dujardini* Travassos 1915).

Capillaria cellaris (v. Linst. 1873).

The material of *Capillaria longicollis* consisted of about 300 specimens wherefore it was possible to give rather a considerable number of measurements to indicate the range of the variation, and a description of *Capillaria columbae* (= *C. dujardini*) is also given as a contribution to the same. (Further has a species described by Graybill (1924) as *C. columbae* been recognized as *C. obsignata* nom. nov.). The species that with some hesitation was called *Capillaria collaris* proved to be a new species, and a further new species was found in two partridge chicks. These species were respectively:

Capillaria cadovulvata n. sp.

Capillaria tiaras n. sp.

Among the specimens of *Capillaria cadovulvata* (about 700) was also found a small number which really could be referred to as *Capillaria collaris*.

So in all five *Capillaria* species have been found viz. *Capillaria longicollis*, *dujardini*, and *tiaras* in the small intestine, *Capillaria cadovulvata* and *collaris* in the coeca, and no exception from this occurrence was found. Besides on the place in the host they are also otherwise easily discernible. Of the species in the small intestine the females of *Capillaria longicollis* have a membranous appendage at the vulva, this being missing in females of *Capillaria dujardini*, and just the same difference is found in females of *Capillaria cadovulvata* and *collaris* respectively. The males are best distinguished through the shape of the spicule, the spicule sheath and the tail end.

In my material of *Capillaria* species in gallinaceous birds the different species were closely bound to a fixed section of the alimentary canal, so that the place in the host could be considered of systematical value, and this is also the case in most investigations. Further, considering the great difference in e. g. chemical respect in the varying sections of the intestines, it seems a priori most probably the case. Nevertheless there are statements here and there which impart the occurrence of the same species in different parts of the intestines. Unfortunately this is often the case in some papers which also in other respects do not seem quite reliable. And according to my knowledge such a statement has not been met with as regards any well

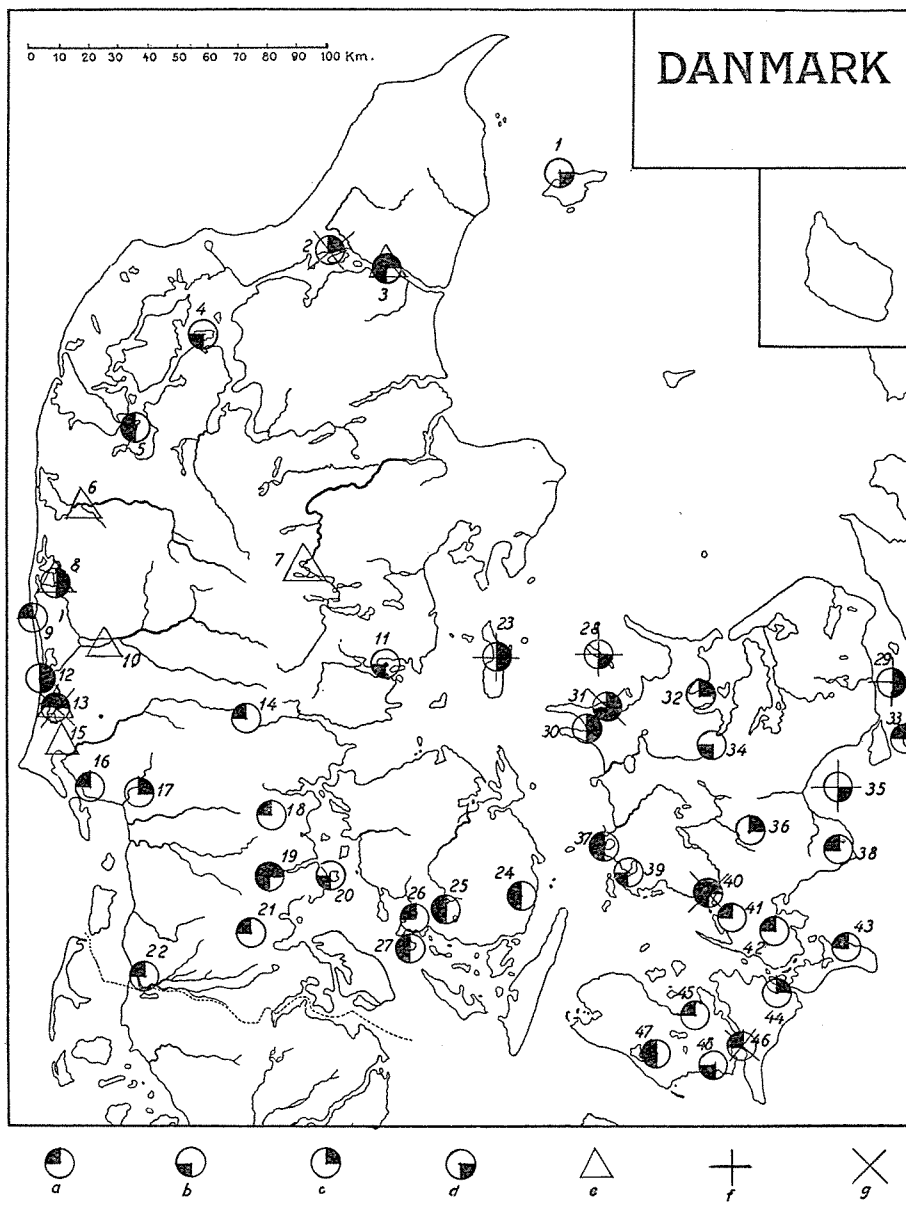


Fig. 1. Map showing the localities in which the host material has been collected. (See table 1) — a) partridge, b) pheasant, c) river and pond ducks, d) diving ducks, e) Black grouse, f) fish ducks, g) coot.

Table I.

Localities of host

	Lyrurus tetrrix, black grouse		Perdix perdix, partridge		Phasianus colchicus, pheasant		Anas crecca, teal	Anas querquedula, garganey	Mareca penelope, wigeon	Anas acuta, pintail duck	Anas platyrhynchos, mallard, wild duck	
	chicks		chicks		chicks							ducklings
<i>Jylland:</i>												
1. Nordre Rønner ...	—	—	—	—	—	—	—	—	—	—	—	—
2. Halvrimmen	—	—	—	—	—	—	22	—	—	—	14	2
3. Aalborg	1	—	3	—	3	—	6	1	—	5	—	—
4. Fur	—	—	—	—	6	—	—	—	—	—	—	—
5. Venø	—	—	6	—	5	—	—	—	—	—	—	—
6. Ulborg	5	1	—	—	—	—	—	—	—	—	—	—
7. Silkeborg	4	3	—	—	—	—	—	—	—	—	—	—
8. Ringkøbing	5	3	—	—	—	—	—	1	—	1	—	—
9. Holmslands klit ...	—	—	8	—	—	—	—	—	—	—	—	—
10. Skjern	21	8	—	—	—	—	—	—	—	—	—	—
11. Vaarsø	—	—	—	—	47(37) ¹	—	—	—	—	—	—	—
12. Nymindégab	—	—	—	—	—	—	—	—	2	6	25	—
13. Henne, Filsø	1	1	—	—	—	—	—	—	6	—	8	—
14. Fromsejer	—	—	8 (8)	—	—	—	—	—	—	—	—	—
15. Oksbøl	2	—	—	—	—	—	—	—	—	—	—	—
16. Esbjerg	—	—	22	3	—	—	—	—	—	—	—	—
17. Bramminge	—	—	—	—	—	—	—	—	—	—	2	—
18. Farris	—	—	1	—	—	—	—	—	—	—	—	—
19. Haderslev	—	—	5 (5)	5	2	4	—	—	—	—	1	—
20. Aarø	—	—	—	—	10	6	—	—	—	—	—	—
21. Hellevad	—	—	4	—	—	—	—	—	—	—	—	—
22. Tønder	—	—	2	4	—	—	—	—	—	—	—	—
23. Samsø	—	—	—	—	—	—	—	—	—	—	1	—
<i>Fyn.</i>												
24. Gudme	—	—	3	10	3	9	—	—	—	—	—	—
25. Brahetrolleborg ...	—	—	9	6	15	7	—	—	—	—	—	—
26. Horne	—	—	3	—	—	—	—	—	—	—	—	—
27. Lyø	—	—	7	—	4	—	—	—	—	—	—	—

¹) Numbers in brackets indicate material only searched for *C. contorta*.

Species of Capillaria

material (see fig. 1).

Spatula clypeata, shoveler, spoon bill duck		3		10	
Nyroca fuligula, tufted duck					
Nyroca marila, scaup duck					
Nyroca ferina, pochard		3		1	
Bucephala clangula, golden eye					
Clangula hyemalis, long- tailed duck		3			
Oidemia nigra, common scooter		1		1	
Melanitta fusca, velvet scoo- ter					
Somateria mollissima, eider duck				3	
Somateria spectabilis, king eider					
Mergus merganser, goosan- der		1			
Mergus serrator, red-breast- ed merganser					
Fulica atra, coot				18	
chicks					

(Table 1).

	Lyrurus tetrrix, black grouse		Perdix perdix, partridge		Phasianus colchicus, pheasant		Anas crecca, teal	Anas querquedula, garganey	Mareca penelope, wigeon	Anas acuta, pintail duck	Anas platyrhynchos, mallard, wild duck	ducklings
		chicks		chicks		chicks						
<i>Sjælland.</i>												
28. Sejro	—	—	—	—	—	—	—	—	—	—	—	—
29. Øresund	—	—	—	—	—	—	—	—	—	—	—	—
30. Kalundborg	—	—	—	—	—	—	6	—	—	—	—	—
31. Saltbækvig	—	—	—	—	—	3	13	—	7	—	10	4
32. Holbæk	—	—	—	—	—	—	—	—	—	—	15	—
33. Saltholm	—	—	10	—	—	—	—	—	—	—	2	—
34. Tølløse	—	—	—	—	8	—	—	—	—	—	—	—
35. Køge bugt	—	—	—	—	—	—	—	—	—	—	—	—
36. Bregentved	—	—	—	—	—	—	—	—	—	—	—	—
37. Korsør	—	—	4	—	19 (4)	12	—	1	—	—	4	—
38. Stevns	—	—	(3)	—	—	—	—	—	—	—	—	—
39. Skelskør	—	—	—	—	4 (3)	10	—	—	—	—	—	—
40. Gaunø	—	—	2	10	7	10	48	6	16	3	36	19
41. Lundby	—	—	3	9	—	—	—	—	—	—	—	—
42. Mern	—	—	(11)	—	—	—	—	—	—	—	—	—
<i>Møn.</i>												
43. Nordfeldt	—	—	(2)	—	—	—	—	—	—	—	—	—
<i>Lolland-Falster.</i>												
44. Stubbekøbing	—	—	—	—	—	—	—	—	—	—	1	—
45. Sakskøbing	—	—	(12)	—	—	—	—	—	—	—	—	—
46. Nykøbing, F.	—	—	(15)	—	—	—	—	—	—	—	—	—
47. Holeby	—	—	3	7	5	4	—	—	—	—	—	—
48. Nysted	—	—	—	—	14	5	—	—	—	—	—	—
Total	39	16	103 (56)	54	155 (44)	67	95	9	31	15	118	25

Species of Capillaria

18	Spatula clypeata, shoveler, spoon bill duck										chicks
26	Nyroca fuligula, tufted duck		23		3						
14	Nyroca marila, scaup duck		14								
7	Nyroca ferina, pochard		1		1						
25	Bucephala clangula, golden eye		21		3						
10	Clangula hyemalis, long-tailed duck		7								
14	Oidemia nigra, common scoter		12								
17	Melanitta fusca, velvet scoter		11		1		5				
18	Somateria mollissima, eider duck		8		7						
1	Somateria spectabilis, king eider		1								
19	Mergus merganser, goosander		15				3				
—	Mergus serrator, red-breasted merganser		3		6						
79	Fulica atra, coot		18		8			30			
12								12			

Table 2.
Own material of species of *Capillaria* in the lower digestive tract of gallinaceous game birds.

	Number investigated	<i>C. cadovulvata</i>		<i>C. collaris</i>		<i>C. dujardini</i>		<i>C. longicollis</i>		<i>C. tiaras</i>	
		Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen
Lyrurus tetrix, black grouse	39	—	—	—	—	—	—	3 (10)	1	—	—
Chicks.....	16	—	—	—	—	—	—	6 (10)	1	—	—
Perdix perdix, partridge.	103	2 (14, 18, 24)	1	2 (24, 27)	1	6 (16, 18, 26, 33, 41)	1	17 (All ÷ 9, 18, 22, 33)	2,7	—	—
Chicks.....	54	—	—	—	—	2 (41)	1	30 (All)	2	4 (16, 41)	1
Phasianus colchicus, pheasant.	155	61 (All ÷ 19, 31, 39)	17	3 (20, 40)	1	—	—	23 (All ÷ 31)	4,5	—	—
Chicks.....	67	3 (40)	4,3	—	—	2 (37)	1	28 (All)	5,7	—	—

Figures in bracketts indicate numbers of the localities in which the species has been found (fig. 1, table 1).

Species of *Capillaria*

established species in gallinaceous birds. At all events this point must in the future be more accurately stressed. Only in very heavy infections, notably possible through feeding with eggs, the worms can extend their range to the whole intestine, as observed in *Capillaria dujardini* (Levine 1938). Some species of *Capillaria* from ducks, however, occur both in the small intestine and coeca, although most often in the latter location.

The chief result of this part of the investigation I should think is the specification of the characters which in the *Capillaria* species are of the greatest significance and constancy in a systematical sense viz. the size and shape of the spicule, the appearance of the spicule sheath, the shape of the tail end of the male, the presence or non-presence of vulvar appendage, and the shape of this latter and finally the shape of the eggs. Naturally these statements are not quite new, possibly with the exception of the reference to the shape of the eggs. One author mentions one or a few of them, another author some other, but practically no author mentions all of them. A not inconsiderable number of descriptions mention none of the enumerated features of special systematical significance. The bacillary bands, on the other hand, are considered by many authors to be of great systematic importance. It may be so. But when the worms are mounted in toto they are very often not discernable, as is also pointed out by Freitas and Almeida (1935), and are therefore of limited practical importance.

Capillaria longicollis (Mehlis 1831) nomen auctoris emendavi.

(Fig. 5 a—f, fig. 6 a—e).

<i>Gordius gallinae</i>	Goeze 1782, p. 126 pl. 7 fig. 8—10 (?).
<i>Filaria phasiani</i>	Froelich 1791, p. 110 (?).
<i>Linguatula unilinguis</i>	Schranck 1796, p. 231 (?).
<i>Filaria tetricis</i>	Froelich 1802, p. 28 (?).
<i>Capillaria semiteres</i>	Zeder 1803, p. 61 (?).
<i>Hamularia nodulosa</i>	Rudolphi 1808, p. 84 (?).
<i>Trichosoma longicolle</i>	Rudolphi 1819, p. 14 (?).
<i>Trichosoma longicolle</i>	Mehlis 1831, p. 74.
<i>Trichosoma longicolle</i>	Dujardin 1845, p. 19 pro parte (?).
<i>Trichosoma longicolle</i>	Diesing 1851, p. 260 (?).
<i>Calodium caudinflatum</i>	Mclin 1859, p. 302.
<i>Calodium caudinflatum</i>	Diesing 1861, 1, p. 690.
nec <i>Trichosomum longicolle</i>	Eberth 1863, p. 57—58 (= <i>C. collaris</i> v. Linst. 1873).
<i>Trichosoma caudinflatum</i>	von Linstow 1878, p. 121.
<i>Trichosoma longicolle</i>	von Linstow 1878, p. 122—123 (?).

- Trichosoma caudinflatum* Stossich 1890, p. 7—8.
Trichosoma longicolle Stossich 1890, p. 15 p. p. (?).
Trichosoma gallinum Kowalewski 1894, p. 279.
Trichosoma gallinum Kowalewski 1895, p. 362—364, pl. 8, fig. 18—22.

Trichosoma caudinflatum Kowalewski 1900, p. 185.
Trichosoma caudinflatum Kowalewski 1901, p. 274—277, pl. 6, fig. 8—11.
Trichosoma longicolle Wolffhügel 1900, p. 46, 49, 50, 52, 53. (?).
Trichosoma longicolle Shipley 1909₁, p. 345—348, pl. 52, fig. 29, pl. 53, fig. 30—34, pl. 54, fig. 35—41.

Trichosoma longicolle Wehrmann 1909, p. 235.
Trichosoma papillosum Blome 1909, p. 354—365, pl. 1—2, fig. 1—12.
Trichosoma papilligera Raillet & Henry 1911.
Trichosomum meleagris-gallopavo Barile 1912, p. 129—133, fig. 1—3.

Capillaria longecolle Travassos 1915, p. 148, p. p.
Capillaria meleagris Travassos 1915, p. 156.
Capillaria blomei Travassos 1915, p. 156.
Trichosoma longicolle Brinkmann 1921—22, p. 20—21.
Capillaria caudinflata Wawilowa 1926, p. 16—18, fig. 9—11.
Capillaria longicollis Yorke & Maplestone 1926, p. 26.
Capillaria meleagris-gallopavo Yorke & Maplestone 1926, p. 26.
Capillaria papilligera Yorke & Maplestone 1926, p. 27.
Capillaria caudinflata var. *balthica*. Otte 1927.

Capillaria longicollis Huus 1928, p. 31.
Capillaria longicollis Baylis 1929, p. 264.
Capillaria caudinflata Baylis 1929, p. 264.
Capillaria gallina Baylis 1929, p. 264.
Capillaria meleagris-gallopavo Baylis 1929, p. 264.
Capillaria caudinflata Orosz 1931₂, p. 5, 7—10, 24—25, 26, 27, fig. 1, a—b.

Capillaria longicollis Morgan 1932, p. 185, fig. 1—5.
Capillaria gallina Sprehn 1932, p. 772.
Capillaria longicolle Sprehn 1932, p. 774.
Capillaria meleagris-gallopavo Sprehn 1932, p. 774—775, fig. 363.
Capillaria papilligera Sprehn 1929, p. 796.
Capillaria bursata Freitas & Almeida 1934, p. 273 p. p. (?).
Capillaria longicollis Clapham 1935, p. 142.
Capillaria longicollis Freitas & Almeida 1935₂, p. 322—326, pl. 2, fig. 7—11, pl. 3, fig. 12—13.

Species of *Capillaria*

<i>Capillaria longicollis</i>	Clapham 1936, p. 63.
<i>Capillaria longicollis</i>	Neveu-Lemaire 1936, p. 1307.
<i>Capillaria caudinflata</i>	Neveu-Lemaire 1936, p. 1311.
<i>Capillaria gallina</i>	Neveu-Lemaire 1936, p. 1314.
<i>Capillaria bursata</i>	Neveu-Lemaire 1936, p. 1317 p. p. (?).
<i>Capillaria meleagris-gallopavo</i>	Neveu-Lemaire 1936, p. 1316—1317.
<i>Capillaria longicollis</i>	Clapham 1935, p. 142.
<i>Capillaria longicollis</i>	Clapham 1936, p. 63.
<i>Capillaria longicollis</i>	Clapham 1937, p. 50—51.
<i>Capillaria longicollis</i>	Clapham 1938, p. 48.
<i>Capillaria longicollis</i>	Koffman 1939, p. 530—531, fig. 14—15.
<i>Capillaria gallina</i>	Koffman 1939, p. 534.
<i>Capillaria longicollis</i>	Holger Madsen 1941, p. 31.

This species occurred with about equal frequency in my material of partridges and pheasants. In partridge chicks the frequency was 30 per cent, in pheasant chicks 28 per cent. The corresponding figures for adult birds are 17 per cent and 23 per cent, for the whole material (chicks and adults together) respectively 20 per cent and 24 per cent. It occurred in almost all localities, although not always in both hosts. In only six localities it was missing. In the following these localities are categorized with the number of birds investigated in round brackets: Holmsland Klit (8 partridges), Tønder (6 partridges), Farris (1 partridge), Saltholm (10 partridges) and Saltbækvig (3 pheasants). This absence is mostly due to chance. But in some cases the special life conditions may have played a part. Holmsland Klit consists mostly of heath, in Saltholm there are only salt marshes. This species was the only one found in black grouse, and that only in rare cases. It occurred once in an adult (Sønder Vium, 8.-11.-39) and once in a chick (Lyhne, 15.-7.-39). In a small material of 6 *Columba palumbus* in 4 cases, notably in duodenum but also in jejunum. The worms were found all the year round.

Males: Length 7,0 mm to 20,4 mm. The most frequent figure is 11,2 mm (Fig. 2, I). The breadth (measured on the level of the proximal end of the spicule, when this is not or only slightly extruded and only based on 7 measurements) varies between 0,025 and 0,030 mm. The index length/breadth lies between 350 and 400. The spicule length varies considerably showing a very peculiar fact. The dispersion covers no less than 1,22 mm, from 0,67 to 1,89 mm. The regular dispersion comprises only 0,57 mm, from 0,67 to 1,24 mm. The most frequent figure is 0,975 mm. (Fig. 3, I). Between the greatest figure of the regular dispersion and the next figure in the curve there is a gap of 0,35 mm. At first I was inclined to assume a distinct species in as much as there seemed to be other differences, i. a. in the shape of the spicule and

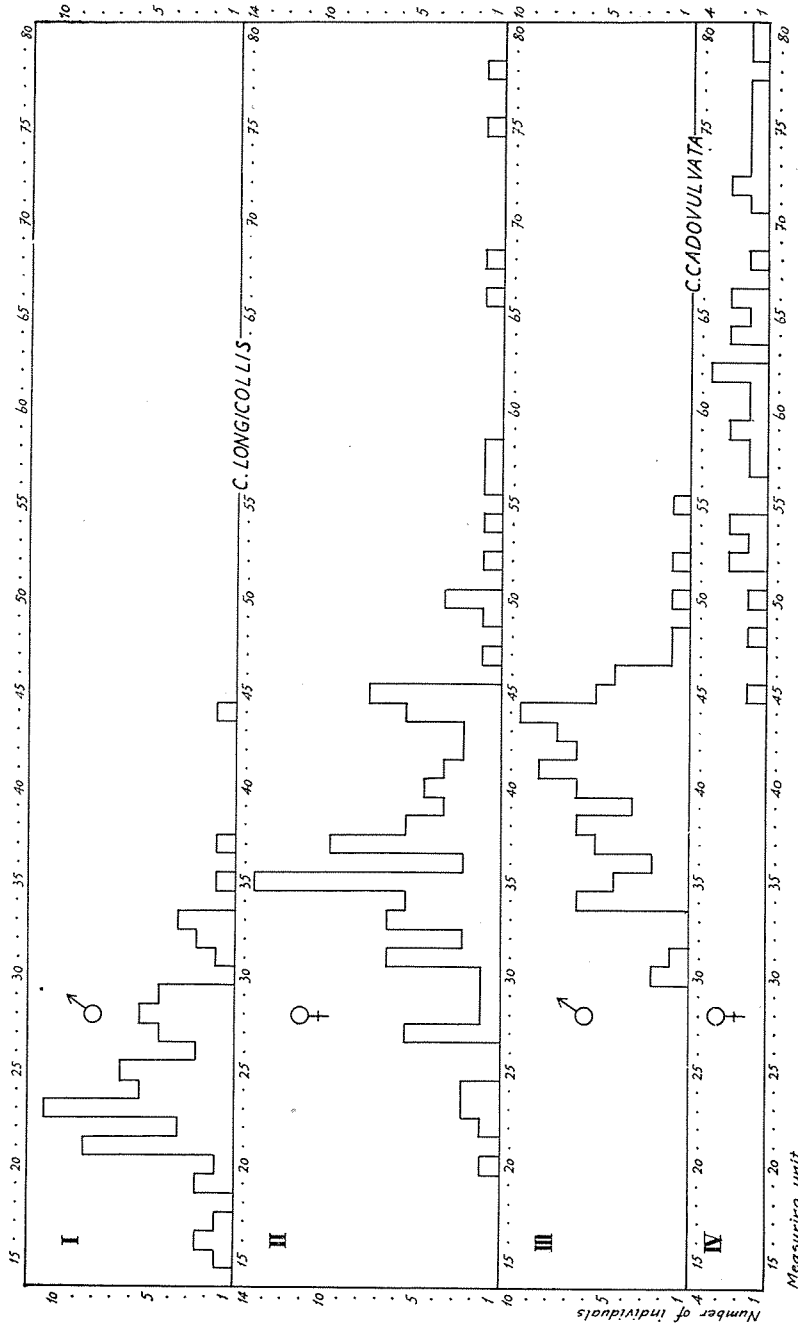


Fig. 2. Lengths of *Capillaria longicollis*, males and females, and *Capillaria cadovulvata*, males and females. — The measuring unit corresponds to 0,465 mm.

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in the striation of the spicule sheath. But these differences were not constant. As also measurements of other authors in what was undoubtedly *Capillaria longicollis* even exceed my highest values, I must regard all the material as belonging to this species.

The spicule is cylindrical, very slender, in the proximal end broadest,

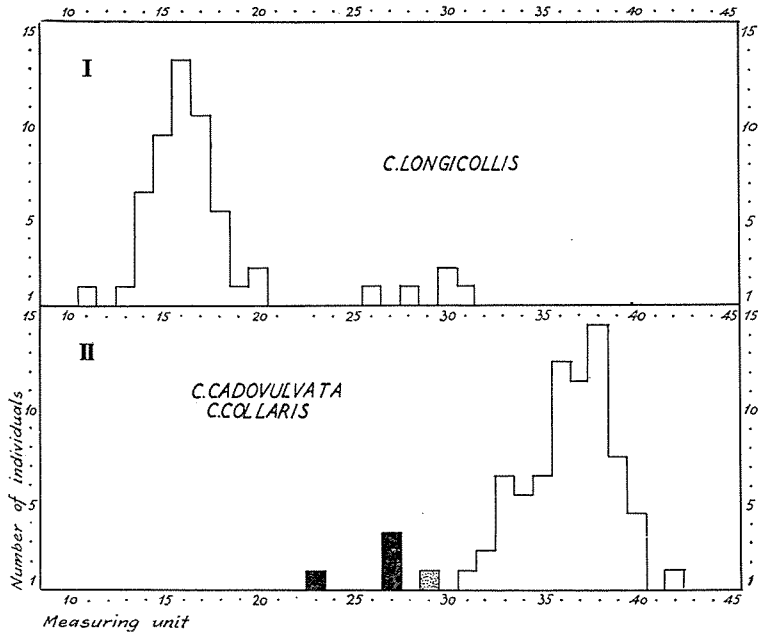


Fig. 3. Spicule lengths of *Capillaria longicollis*, *Capillaria cadovulvata* (white and dotted) and *Capillaria collaris* (black and dotted). — The measuring unit corresponds to 0,061 mm.

but nevertheless normally only 0,005 mm. As a rule it is not inflated here, only in a few cases notably in the individuals with very long spicules, it broadens somewhat quite near the proximal end and besides this latter is often somewhat frayed. (Fig. 5 c, e, 6 c). In rare cases it is in this region triangular in cross-section. Distally the spicule tapers and ends in a very sharp tip. (Fig. 5 a, b, d, 6 d). The index length/spicule length varies between 9,5—17,0. The most frequent figure is 11,5 (Fig. 4, I).

The spicule sheath at any rate reaches a length of 1,4 mm with the breadth of 0,011 mm. When extruded it is possible, being strongly magnified, to see very fine spines (Fig. 5 a) and even when drawn in transverse striation can be seen in places. This latter may vary in a high degree (Fig. 5 a, b, d, 6 d). Sometimes it can be seen when slightly magnified, sometimes only with

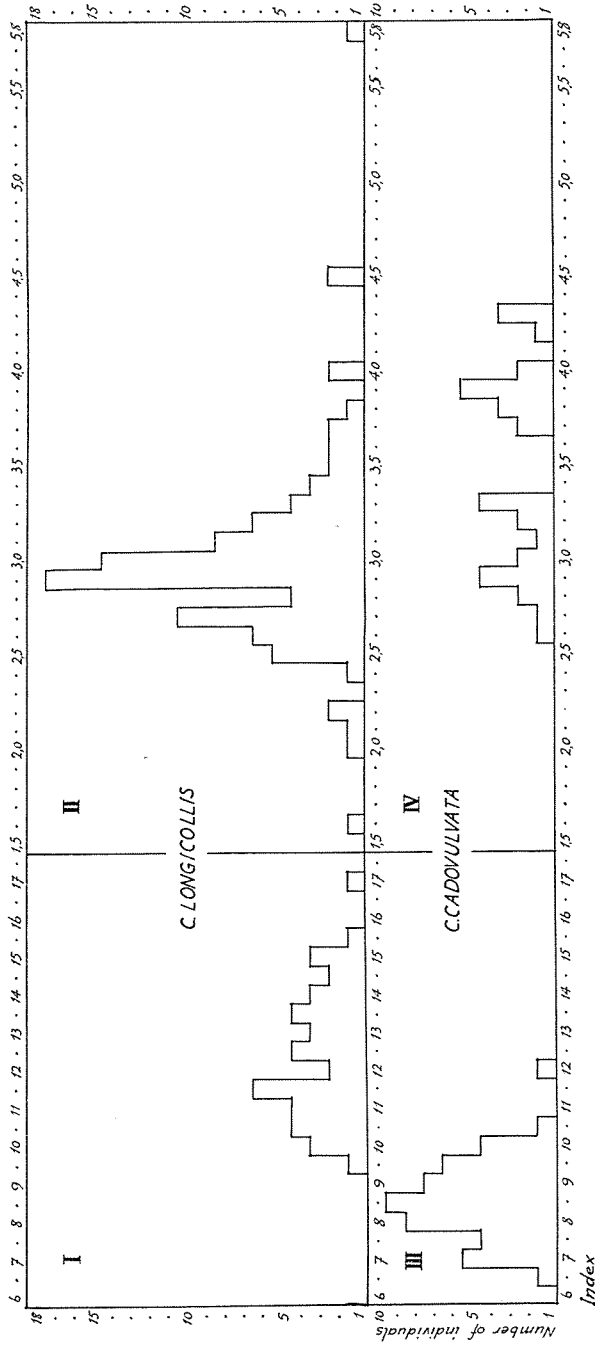


Fig. 4. The range of the indices length/spicule length (I, III) and length/vulva distance (from the anterior end) (II, IV) of *Capillaria longicollis* and *Capillaria cadovulvata* respectively.

immersion objectives, magnified 1700 times, and in rare cases even under these circumstances it is impossible to see.

Besides the spicule also the caudal end of the males of this species is very characteristic. In front of the caudal "bursa" there are two lateral alae, in my material (10 measurements) varying from 0,055—0,095 mm, most

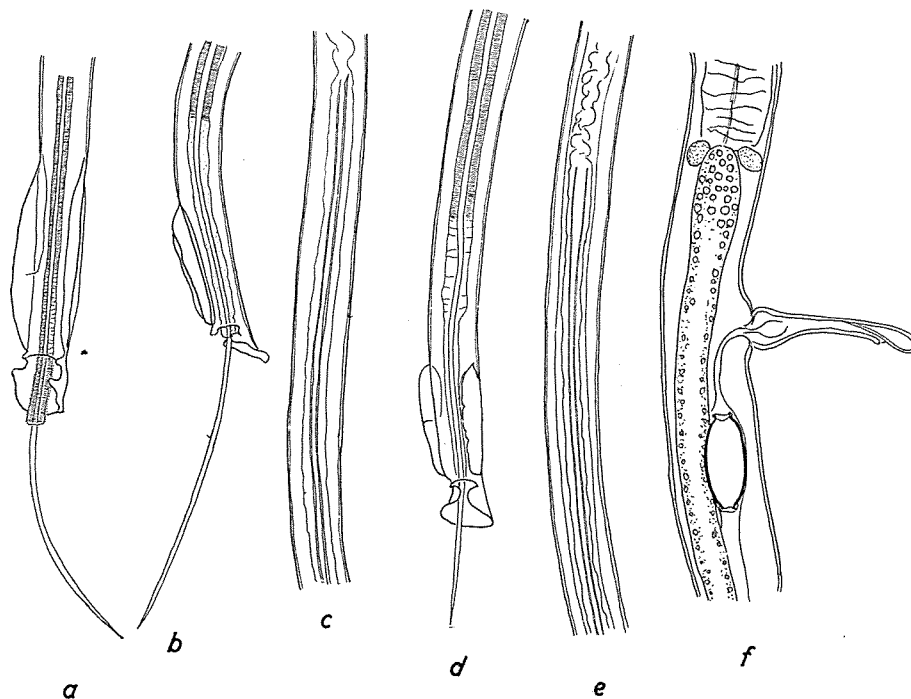


Fig. 5.¹⁾ a—f) *Capillaria longicollis*.

a) male tail end, ventral view, b—c) tail end and proximal end of spicule of male, lateral view, d—e) another specimen seen ventrally, f) vulva region, lateral view. — a—c and f are specimens from partridges, d—e from pheasant chicks.

often about 0,075 mm in length (Fig. 5 a, b, d). In the frontal part of them there is an inflation, which in my preparations is generally difficult to be seen. It is described very well by Blome (1909) (Fig. 5 d).

Also the "bursa" itself has generally a characteristic appearance, especially when seen laterally. (Fig. 5 b). This picture is frequently seen, and it has also been figured by several authors (e. g. Barile 1909, Kowalewski 1901, Koffman 1939). But sometimes it appears in another way, as fig. 6 d shows. As this frequently appeared simultaneously with long spicule, it puzzled me

¹⁾ When not otherwise stated, the scale is no. 2 (see fig. 12 d).

for a time. But in material lent to me by Phyllis Clapham I also observed the usual picture in connection with long spicule. In any case the cloacal aperture is surrounded laterally with two lobes, which connect behind through a rounded border. There are papillae present (see Fig. 6 d), but their number

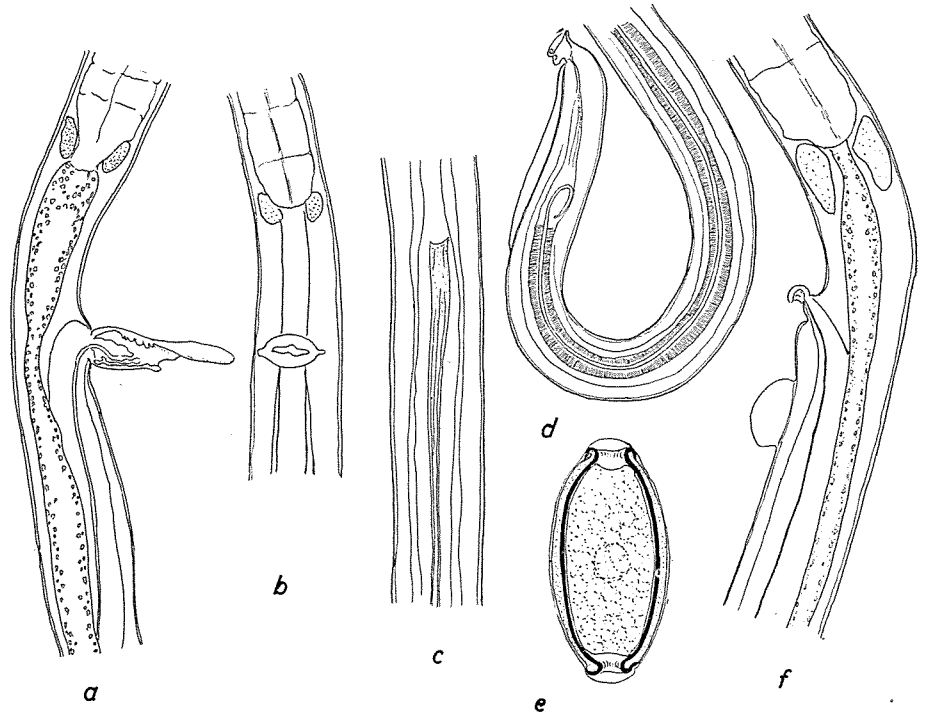


Fig. 6. a—e) *Capillaria longicollis*. f) *Capillaria cf. bursata*. a) vulva region, lateral view, b) vulva region, ventral view, c—d) tail end and proximal end of spicule, seen laterally, e) egg (scale 3)¹⁾, f) vulva region, lateral view. — a specimen from partridge, b and e from pheasant chicks, c—d and f specimens from adult pheasants.

and place are difficult to determine, as they are missing — or very indistinct — in most preparations. The different appearance of the caudal end evidently depends on the position of the borders round the cloacal aperture, — the “bursa”. As a rule they are bent to the rear.

Females: Length 9,3 mm to 36,3 mm. The most frequent figure is 16,3 mm (Fig. 2, II). The breadth by the vulva (25 measurements) varies from 0,030 mm to 0,070 mm, the most frequent figure being 0,045 mm. The index length/breadth varies from 200 to 600, most frequently 350—500. The distance from

¹⁾ See fig. 12 d.

vulva to the front end varies from 4,2 mm to 9,3 mm, 5,6 mm being the most frequent. The index length/vulva distance (from head end) varies between 1,6 and 5,8, — the most frequent 2,9 (Fig. 4, II). The vulva in this species is a transversal slit (Fig. 6 b) and is provided with a delicate cuticular appendice of a very characteristic (nearly oblique vase) shape (Fig. 5 f and 6 a). It has been illustrated in very different ways by different authors, the divergence being due to maceration in the preparation, but also, I should think, because they have shown living specimens (e. g. Blome 1909, Shipley 1909). Morgan (1932) giving the most modern account of species of *Capillaria* in gallinaceous birds, shows the appendice in a similar way as I do. 23 measured appendices varied from 0,050 mm to 0,100 mm. Most frequently values were about 0,070—0,095 mm. The breadth is about 0,019 to 0,021 mm. A very prominent feature in the females of this species is, as already pointed out by Morgan (1932), a notched area ventrally just in front of the vulva. This notch is only visible laterally. The breadth here is most often 0,008 mm smaller than by the vulva.

A distance very often given in *Capillaria* investigations is the space between the vulva and the beginning of the cellular body of the cesophagus. This is very elastic and its place in relation to the vulva varies therefore considerably, although it generally lies in front of the vulva. In 37 cases I have measured this distance. It ranged from 0,030 to 0,210 mm. The most frequent distance was 0,095 mm, although only observed in six cases. This distance therefore must be considered as relatively valueless.

The eggs also furnish an important systematic feature (Fig. 6 e). The plugs are very broad and the innermost eggshell bends in a characteristic way to a collar. This feature has hitherto only been observed in a few cases and has not been clearly recognised. Altogether the eggs of *Capillaria* species are shown too inaccurately, considering their systematic value.

In a few cases in my material, in very long individuals, the vulva appendice was missing. Remnants could, however, be demonstrated. The characteristic notch in front of the vulva was also present.

The size of the eggs is 0,043—0,057 × 0,022—0,027 mm, again most frequently 0,049 × 0,024 mm. (Table 3). The plug is 0,009 to 0,014 mm broad (7 measurements) and 0,004 to 0,005 mm high. (3 measurements).

In some of the relatively few worms with bacillary bands visible, I measured the breadth. When these are distinct you can follow them from the beginning to the end of the worm where they are broadest. They are narrower in the males, varying from 0,006 to 0,015 mm, than in the females where it varies from 0,018 to 0,027 mm.

On the whole my description agrees very well with the information derived from the description of forms which with certainty can be identified.

Generally speaking the measurements also cover those of other authors, with a few exceptions. The worms from grouse (Shipley 1909) and wood grouse (Blome 1909) are somewhat longer than those of mine, males 20—25 mm, females 40—45 mm, so there is only a slight difference.

Orosz (1931) who according to Freitas & Almeida (1935₂) found the spicule length varying from 0,896—2,52 mm, thus exceeding my highest figure with 0,62 mm, has the most important difference. But considering

Table 3.

Length of eggs in species of Capillaria in the lower digestive tract of gallinaceous birds.

Measuring unit (2,7 μ)	<i>C. cadovulvata</i>	<i>C. collaris</i>	<i>C. dujardini</i>	<i>C. longicollis</i>
15	—	—	6	—
16	—	—	5	3
17	1	—	7	15
18	10	7	6	44
19	20	32	5	30
20	44	43	(5)	9
21	23	14	—	1
22	3	12	—	—
23	—	2	—	—
Total number of measurements	101	110	24	102

the great variability this is not entirely incredible. Unfortunately the papers of Orosz have not been accessible to me.

As *Capillaria longicollis* in its modern delimitation occurs only in the small intestine, the species very fragmentarily described by Rudolphi under the above mentioned name does unfortunately not belong to this species. But as Mehlis (1831) has found in the small intestine of the pheasant a species which he named *Capillaria longicollis* and the name in the present delimitation has been current for a great number of years, it seems reasonable to retain it, however with Mehlis as author. As the above critical list of synonyms shows, a number of names have been used, most of them made synonymous by earlier authors.

On some points my list differs from those of the earlier authors, notably the very exhaustive list submitted by Freitas & Almeida 1935₂, as I have considered only papers containing original systematic information, or the more dependable bibliographic synopses. In all the cases where the habitat is the coeca, I doubt the identity; or, more correctly, consider it impossible.

The species by Dujardin (1845) named *Trichosoma longicolle*, has been much disputed. Dujardin only gives the habitat as the intestines. The occurrence of one broad bacillary band has induced the earlier authors to assume it being identical with *Capillaria retusa* (= *Capillaria collaris*) which occurs in the caeca of gallinaceous birds. But this species lacks the membranaceous appendage of the vulva, which Dujardin clearly describes. Therefore it seems possible that he has confused these — in his time not easily discernible species — but the question, I dare say, will never be cleared up with certainty.

Trichosoma papilligera, Railliet et Henry 1911 (= *Tr. papillosum* Blome 1909 = *Capillaria blomei* Travassos 1915) has not previously been recognised as a synonym to *Capillaria longicollis*.

In one case I found in the small intestine of a pheasant (shot near Korsør 8.-6.-38) together with fully normal *Capillaria longicollis*, a single female of a *Capillaria* (*C. cf. bursata*), unfortunately without eggs. It differs from *Capillaria longicollis* in not having any long vulva appendage. Just in front of the vulva there is a curious cup-shaped little membrane. In front of the vulva the characteristic notch is also missing. Finally the cuticle a short distance behind the vulva presents an inflation. (Fig. 6 f). The dimensions otherwise agree with *C. longicollis*, the length being 18,1 mm, the vulva's distance from the anterior end 6 mm. The breadth is 0,052 mm by the vulva. The index length/vulva distance is 3,0.

These dimensions are somewhat smaller than those given for females of *Capillaria bursata*, Freitas & Almeida 1934, (a species described, from the small intestine of the hen) with which species there is some resemblance. Behind the vulva there is a cuticular swelling, but this is divided into more segments. The vulva is surrounded by two valvules laterally. The identity of this specimen is therefore uncertain. The future must decide whether it is a distinct species.

The male of *Capillaria bursata* has alae of a similar appearance to those at the tail end of the male of *Capillaria longicollis*, and it is on the whole difficult, according to the description, to see any difference. Especially the shape and size of the spicule and also the spicule sheath seem to be identical. Possibly there is a difference in the shape of the "bursa", but this is difficult to decide, considering the variable appearance of this not easily discernible organ. On the other hand, the female described as *Capillaria bursata* does not seem to be identical with *Capillaria longicollis*. The vulva appendages figured in *Capillaria bursata* remind one, however, to some extent, of the pictures which the above-mentioned long females of *Capillaria longicollis* presented, when the appendage was partly missing. But the notch is missing. If the eggs had been more plainly illustrated it would have been easier to clear up this question. As is the case with so many *Capillaria*, it must be left

to the future to establish, with certainty, an eventual synonymy, and whether or no 2 species in this case have been fused.

Capillaria longicollis is recorded from a great number of notably gallinaeous birds, but some of these records are based upon uncritical acceptance of every record with the *name* of *Capillaria longicollis*. The following list attempts to give a more correct survey, only papers with good illustrations have been taken into consideration or papers mentioning *Capillaria caudinflata* or *Capillaria meleagris-gallopavo*. Where these forms have been investigated altogether they cannot be wrongly determined.

Hosts: Fowl (i. a. Kowalewski 1895, 1902, Morgan 1932), turkey (Barile 1912), pheasant (i. a. Mehlis 1831, Clapham 1935, 1936), partridge (*Perdix perdix*) (Clapham 1935, 1936), quail (*Coturnix coturnix*) (Molin 1858), red legged partridge (*Alectoris rufa*), *Alectoris graeca chukar*, domestic pigeon (*Columba livia dom.*) (Clapham 1938), willow grouse (*Lagopus lagopus*) (Shibley 1909₁, Brinkmann 1921—22, Huus 1928), wood grouse (*Tetrao urogallus*) (Blome 1909, Shibley 1909₂), *Lyrurus tetrax* (Shibley 1909₂) and *Numida meleagris* (Wehrmann 1909). Finally I found it, besides in partridges, pheasants and black grouse also in *Columba palumbus*. When Freitas and Almeida (1935) as well as several other investigators also mention *Chrysolophus pictus*, this is due to the older descriptions, which according to my conviction, do not regard *Capillaria longicollis* in conformity with the present delimitation. When they mention *Sterna cinerea*, it can be traced to Wolffhügel (1900) who p. 53 mentions the species from *Sterna cinerea* = *Perdix perdix*.

On the other hand its occurrence in *Chrysolophus* is quite probable.

Capillaria dujardini Travassos 1915.

(Fig. 7 a—e).

<i>Trichosoma columbae</i>	Rudolphi 1819, p. 15. (?)
<i>Calodium tenue</i>	Dujardin 1845, p. 28—29. (?)
<i>Trichosoma</i> sp.	Bellingham 1845, p. 477.
<i>Trichosomum tenuissimum</i>	Diesing 1851, p. 256—257 pro parte (?)
<i>Calodium tenue</i>	Molin 1860, p. 616. (?)
<i>Trichosomum tenuissimum</i>	Eberth 1863, p. 56, pl. 6 fig. 2.
<i>Trichosoma tenuissimum</i>	v. Linstow 1878, p. 119, p. p. (?)
<i>Trichosoma tenuissimum</i>	Stossich 1890, p. 12, p. p.
<i>Trichosoma tenuissimum</i>	Anacker 1893, p. 185.
<i>Trichosoma tenuissimum</i>	Railliet 1895, p. 486, p. p.
<i>Trichosoma columbae</i>	Stossich 1895, p. 33, p. p.
<i>Trichosoma columbae</i>	Stossich 1898, p. 91, p. p. (?)
<i>Capillaria dujardini</i>	Travassos 1915, p. 153, 160—161, pl. 24, fig. 6.

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<i>Capillaria columbae</i>	Travassos 1915, p. 159. (?)
<i>Capillaria columbae</i>	Irwin-Smith 1920, p. 556-559, fig. 7-14.
<i>Nec Capillaria columbae</i>	Graybill 1924, p. 205-207, fig. 1-7 (= <i>C. obsignata</i> nom. nov.)
<i>Capillaria columbae</i>	Yorke and Maplestone 1926, p. 24-25, fig. 4.
<i>Capillaria columbae</i>	Baylis 1929, p. 264.
<i>Capillaria columbae</i>	Orosz 1931, p. 19-21, fig. 5 a. b. (?)
<i>Capillaria columbae</i>	Morgan 1932, p. 188-190, fig. 6-10.
<i>Capillaria columbae</i>	Sprehn 1932, p. 770, p. p.
<i>Capillaria columbae</i>	Skrjabin, Schulz, Metelkin and Popow 1934, p. 238, fig. 239 a-b.
<i>Capillaria</i> (?) <i>columbae</i>	Pinto et Almeida 1935, p. 55, 61-62, fig. 3.
<i>Capillaria columbae</i>	Freitas et Almeida 1935 ₂ , p. 326-330, pl. 4, fig. 14-17, pl. 5, fig. 18-22.
<i>Capillaria columbae</i>	Freitas et Almeida 1937, p. 91.
<i>Capillaria columbae</i>	Miller 1937, p. 97-98, fig. 7-13.
<i>Capillaria columbae</i> var. <i>sturni</i>	Cannon 1939, p. 40.
<i>Capillaria columbae</i>	Baylis 1939, p. 241-242, fig. 144, non orig.
<i>Capillaria columbae</i>	Koffmann 1939, p. 553-554, fig. 19-21.
<i>Capillaria columbae</i>	Holger Madsen 1941, p. 31.

In my paper of 1941 I recorded this species from partridges only. By the later minute investigation of the material two specimens appeared, viz. in a pheasant chick (Korsør, 12.-8.-37, female) and a young female pheasant (Sophienholm, 1.-12.-37). The first showed a vulva region like the specimens from partridge. Unfortunately it had no eggs. In the second specimen the vulva region was not quite clearly seen. At any rate there was no vulva appendice. The eggs resembled those of *C. dujardini*. On the other hand they deviate somewhat in appearance from eggs found in a specimen from a partridge chick. (Fig. 7 f). It seems reasonable temporarily to include these two specimens under *Capillaria dujardini*, the latter under the name *C. cf dujardini*. Besides the above mentioned localities *Capillaria dujardini* was found in the following places, comprising localities in both Jylland, Fyn and Sjælland: Lundby 25.-8.-37 (partridge male chick), Saltholm 27.-3.-38 (2 young partridges, male and female). Horne 15.-2.-38 (old female), Jerne 15.-12.-37 (old female), Farris 25.-8.-38 (young female).

Males (3 specimens): length: 6,1; 8,7; 9,3 mm. The breadth of the two first specimens are respectively 0,023 and 0,031 mm, the index length/breadth thus being 265 and 280. The spicule is very characteristic. For the same specimens the length is respectively 1,16, 1,46 and 1,53 mm; the index

length/spicule length in the same way, 5,3, 6,0 and 6,1. The spicule is cylindrical, generally 0,005—0,007 mm broad. The anterior end is inflated, ending in an open funnel, which is more or less curved or bent to one side. The spicule ends in a blunt tip, somewhat narrowed just before the end. The spicule

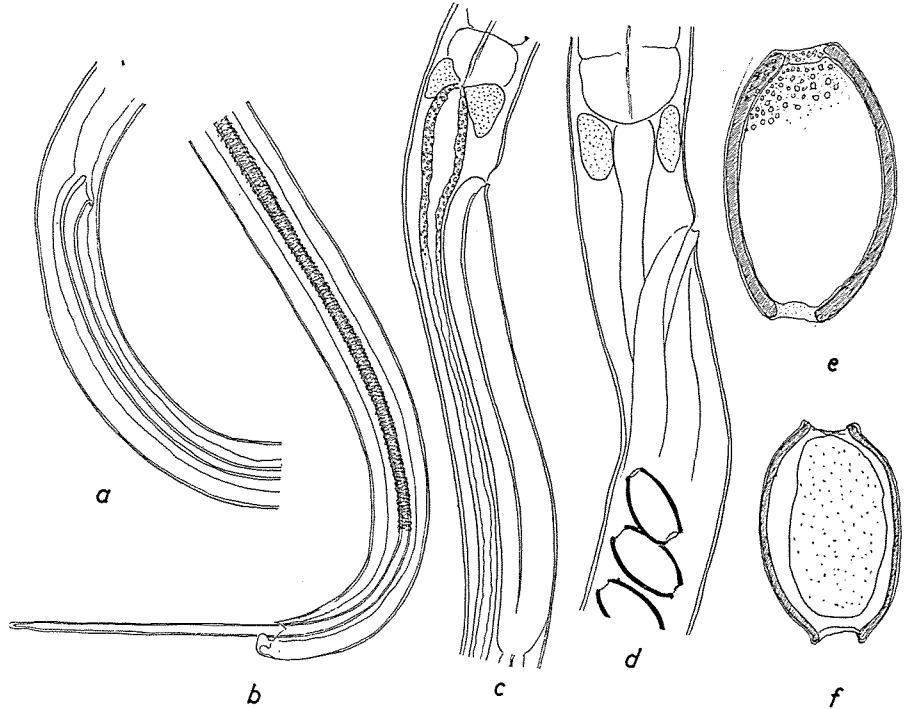


Fig. 7. a—e) *Capillaria dujardini*, f) *Capillaria cf. dujardini*. a—b) proximal end and tail end of spicule, lateral view, c—d) vulva region, lateral view, e) egg (scale 4), f) egg (scale 3). — a—c specimens from adult partridges, d—e from chicks, f specimen from pheasant.

sheath is distinctly transverse striated. The tail end of the worm shows a little bursalike structure, with two lateral lobes. (Fig. 7 a, b).

Females: (4 specimens in partridges, 1 in pheasants). The length and breadth (in parenthesis) were respectively 10,2 (0,041), 12,1 (0,048), 13,9 (0,050), 15,1, 17,6 (0,043) and (in the pheasant, *C. cf. columbae*) 40,0 mm, the index length/breadth being respectively 250, 252, 279 and 409. The index length divided by the distance of the vulva from the anterior end varies between 2,0 and 2,5. The distance between the oesophagus and the vulva varies between 0,046 and 0,076 mm. The vulva so far shows no characteristic features, as there is no vulvar appendice, nor other prominent part. (Fig. 7 c, d). The eggs (measuring 0,041—0,051 mm, Table 3) have not the plug bent to a collar.

In the cases where a sufficient description is given, the species has always been found in the small intestines. Rudolphi (1819), as a nomen nudum, mentions *Capillaria columbae* from the large intestine of pigeons. The excellent observer Dujardin (1845) describes Rudolphi's material, and, as an important feature, the presence of a projecting membranous appendice, at the vulva. As just such an appendice is missing in the species from the small intestine, it seems reasonable to me, for the time being, to reckon with the possibility of a particular species in the large intestine. Possibly the species described by Orcsz (1931) also belongs here, since, according to the table of Freitas and Almeida (1935₂) it has a vulvar appendice. (Unfortunately his paper has not been accessible to me). *Therefore our species should be named Capillaria dujardini, since Travassos was the first to give a recognizable description with a name which has not been preoccupied.* The name of Eberths *Trichosomum tenuissimum* was preoccupied (See p. 22 and 86). Freitas and Almeida (1935₂) suggest as a probability that the species called *Trichosoma tenuissimum* (normally considered synonymous with *Capillaria columbae*), from *Zenaidura carolinensis* found by Leidy (1887) is really a *Strongyloides* species; at any rate, it is no *Capillaria*.

Comparing the literature dealing with *Capillaria dujardini*, one finds, on the whole, that it generally agrees very well, considering the differences in the descriptions. The length ranges given by earlier investigators are 10,0—18,0 mm and 8,4—11,7 mm for females and males respectively. For the females my figures lie within these limits, with the exception of the female from the pheasant which measures 40,0 mm. My figures for the males lie in the lower range, one specimen being even smaller, viz. 6,1 mm. The egg length given is from 0,041 to 0,056 mm, thus covering my figures. In contradistinction to so many *Capillaria* species, the shape of the spicule in this species is well described. The proximal swelling and the blunt tip (distally) of the spicule are common to all descriptions. The measurements of the different authors are very uniform, the total variance on all measurements being from 1,08 to 1,57 mm, a bulk of 0,49 mm, thus being smaller than that of e. g. *Capillaria longicollis*. My measurements lie within these figures. The proximal swelling of the spicule, according to the different drawings, can vary somewhat. The spicules in my material resemble most nearly those of Travassos (1915), Irwin-Smith (1920), Morgan (1932), Freitas and Almeida (1935₂) and Miller (1937). (Graybill's (1924) *Capillaria columbae* has proved to be a new species, *C. obsignata*, the description of which is summarized below, p. 26). My specimens from partridges showed the closest agreement with specimens from the dove kindly sent to me by Dr. Price and also with Danish specimens from the same host. The shape of the eggs is previously known only from Irwin-Smith's illustrations.

Capillaria dujardini has now been found with reasonable certainty in the following hosts: *Columba livia*, *Columba livia domestica*, *Gallus gallus domesticus*, *Perdix perdix* and *Phasianus colchicus*, the two latter hosts being new. According to Cannon (1939) (whose paper has not been accessible to me) it has also been found in the small intestine of *Sturnus vulgaris*.

Capillaria obsignata nom. nov.

(Fig. 8 a-g).

Capillaria columbae Graybill 1924, p. 205-207, fig. 1-7.

Capillaria columbae Sprehn 1932, p. 770 p. p.

Males: Length 8,6-10 mm (2 measurements), maximum width 0,053 mm, spicule length 1,2 mm, width of same 0,008 mm. Specimens from pigeons ranged from 1,3-1,58 mm. The spicule is distally rounded and expanded like a trumpet at the proximal end. (Fig. 8 f). The border of the trumpet is curled. The index length/spicule length is 7,2-8,3 (2 measurements). In cross section the spicule is circular. The spicule sheath in one case was 2,5 mm long. It is finely transversely striated. (Fig. 8 d, e). The cloacal aperture is nearly terminal, it is surrounded dorsally and on the sides by a small, scoop-shaped, transparent bursa. It is not lobed and is surrounded on each side by a broad, rounded ray which is constricted somewhat at its base. (Fig. 8 b, c, d).

Females: 3 specimens measured 10, 10,7 and 12,7 mm long. The index length/vulva distance (from front end) in the two first specimens were 2,2 and 1,3. The length of the eggs goes from 0,050-0,062 mm.

The vulva seems to be slit-shaped, and is without any appendage. The innermost egg shell bends in the plug to a low collar. (Fig. 8 g). The anus is slightly subterminal.

Location in the host: small intestine.

Host occurrence: *Gallus gallus dom.*, *Meleagris gallopavo dom.*

Columba livia dom., from New Jersey.

Capillaria tiaras n. sp.

(Fig. 9 a-d).

This species only occurred twice, and only in the small intestine of partridge chicks, in very distant localities, viz: Lundby, 6.-9.-37 and Jerne 19.-9.-37. Probably the partridge is not the actual host of this species. It is provisionally described as a new species, since it has not been possible to identify it with any known species, possibly due to the fragmentary descriptions of most *Capillaria* species in birds.

Only two male specimens are at hand. The measurements are as follows: Length 15,5 mm and 14,0 mm. Breadth 0,033 mm and 0,030 mm. The index length/breadth: 470 and 467. Spicule length: 2,075 mm and 2,380 mm. Spicule breadth (quite proximally): 0,010 mm and 0,012 mm. The index length/

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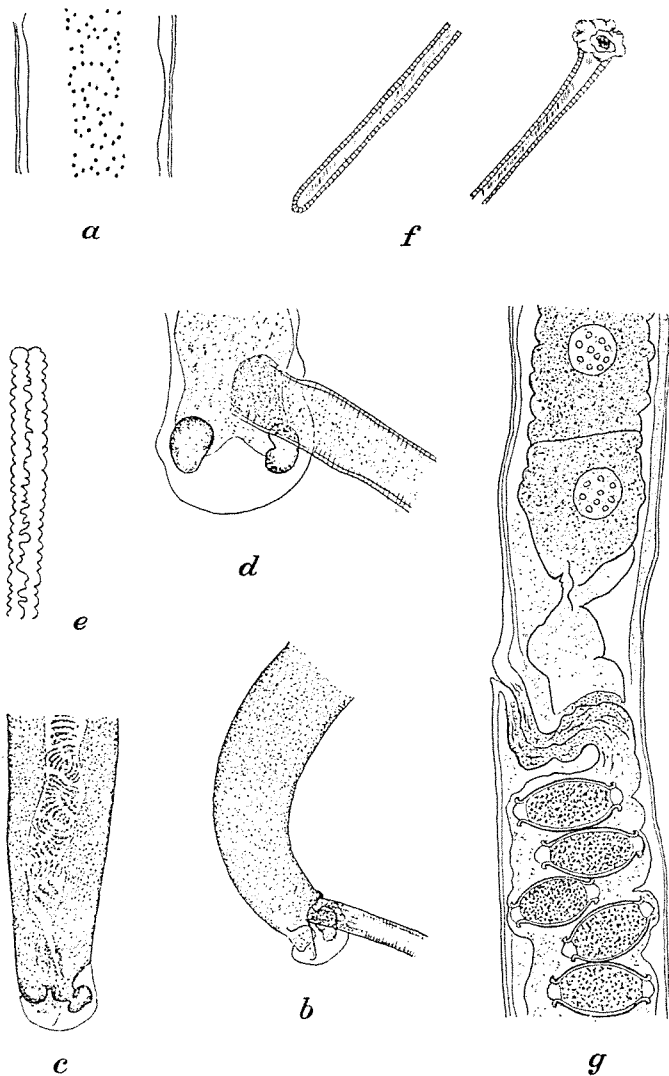


Fig. 8 (after Graybill 1924).

Drawings made with a camera lucida

a) Surface view of body of female at posterior end of esophagus showing lateral bacillary band. $\times 67(?)$, b) posterior end of male showing bursa, its supporting rays and the proximal portion of sheath of spicule. $\times 286$, c) another view of posterior end of a male. $\times 286$, d) ventral view of the posterior end of a male showing the bursa, its rays and the proximal portion of sheath of spicule, $\times 365$, e) distal end of sheath of spicule, $\times 286$, f) proximal and distal portions of spicule, $\times 286$, g) lateral view of body of female in region of vulva showing posterior end of esophagus, vagina and uterus containing ova, $\times 286$.

spicule length 7,63 and 5,88. The spicule is thus rather long. In cross section it is triangular, proximally somewhat inflated in an elegant structure resembling a tiara. (tiaras = *τιάρα* = the mitre of the pope). Distally the spicule tapers to a rather sharp tip. The spicule sheath is distinctly transversely striated. The tail end is provided with two narrow wings. (See fig. 9 a—d).

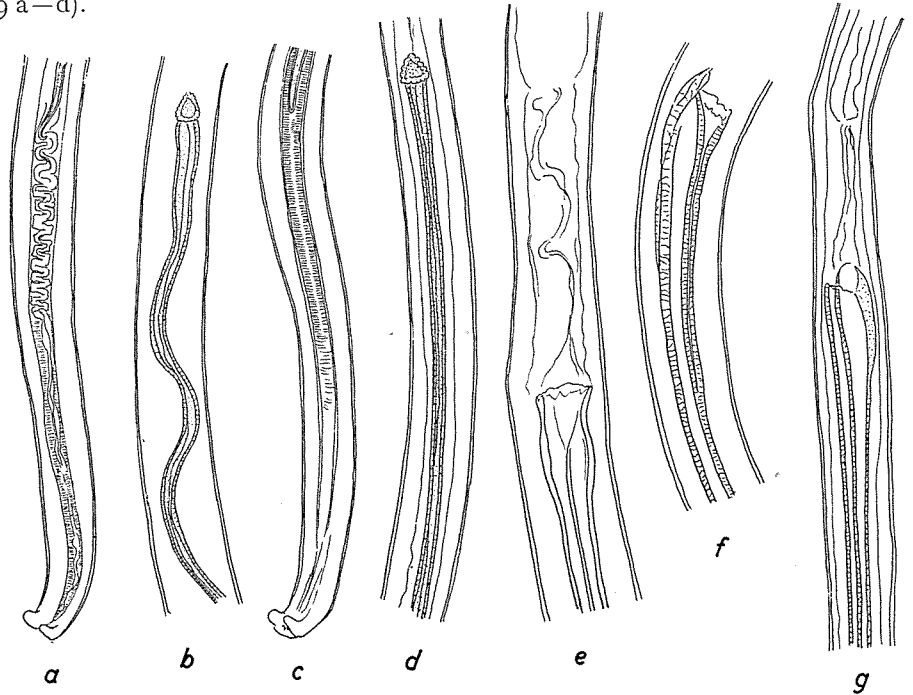


Fig. 9. a—d) *Capillaria tiaras*, e—g) *Capillaria cadovulvata*. a—d) tail end and proximal end of two specimens, ventrolateral view, e—g) proximal end of spicule, 3 specimens. — a—d specimens from partridge chicks, e—g from adult partridges.

Through comparisons with the descriptions of all recorded *Capillaria* species from birds, similarity has been found with only two species, viz. *Capillaria ornata* (Duj. 1843) from the intestines of the titlark, (*Anthus pratensis*) and *Capillaria longevaginata* (v. Linst. 1879) (= *C. alaudae* (Rud. 1819), see below p. 68) from the large intestine of the lark (*Alauda arvensis*). The first species is described (and well described) by Dujardin only. The shapes of the proximal end of the spicules are somewhat similar, although the triangle is not delimited beneath. Distally the spicule is also too thick. Furthermore the tail end is of quite another shape. The spicule length is only 1 mm. The description of *Capillaria alaudae* is very fragmentary. But the distinct transverse striation of the spicule sheath and the

length of the spicule (1,7 mm) resembles my species. On the other hand, the location in the host differs. Only the comparison with material from the lark can decide whether it is the same species. After all the partridge is not the actual host of this species, since it only occurs and even then rarely, in chicks. It is therefore of interest that a resemblance could be found with a species from a host which lives in the same biotop as the partridge.

Capillaria cadovulvata n. sp.

(Fig. 9 e-g, fig. 10 a-h).

Trichosoma longicolle Parona 1886, p. 357-358, pl. 7, fig. 48-49, p. p. (?)
Capillaria collaris Holger Madsen 1941, p. 31, p. p.

This species in my material was found both in partridges and pheasants. In the first hosts it was found only four times (ca. 2 per cent): Farris 25.-8.-37, young female, Fromsejer, 20.-8.-38, Broholm 25.-8.-37, female chick, and Korsør 5.-3.-37, young male. In pheasants it was very common, only missing in three localities, viz. Haderslev, Skelskør and Saltbækvig, from which localities only two, one and three pheasants were examined respectively. The said absence of the worms is naturally due to a mere chance. In the pheasant chicks it was rare, only occurring in 3 per cent. In adults the frequency was 61 per cent, when considering the whole material. Excluding the locality Vaarsø, where the infection percentage in one year was high (96 per cent) the infection percentage is 48. *Capillaria cadovulvata* is thus the most common *Capillaria* species found in my material of gallinaceous birds.

Males: Length 14,0 mm to 26,5 mm. The most frequent figure is 20,5 mm. (Fig. 2, III). The breadth at the base of the spicule (3 measurements) is 0,045 to 0,050 mm, the index length/breadth 350 to 500. The spicule length varies between 1,770 mm and 2,660 mm, the most frequent figure being 2,320 mm (Fig. 3, II). The breadth of the spicule proximally is 0,023 to 0,031 mm. The spicule is flat triangular in cross section. It is bluntly rounded at the tip. Proximally it is gradually swelling to a knob-like or funnel-like structure. (Fig. 9 e-g, 10 a, c). The index length/spicule length varies between 6,5 and 12,0. The most frequent value is 8,5. (Fig. 4, III).

The spicule sheath at any rate reaches a length of 0,128 mm, with a breadth of 0,019 mm. Even when drawn in and with relatively low magnification it is distinctly prickly. (Fig. 10 b, d).

The tail end has two great lateral wings. Sometimes you can see papillae upon them. (Fig. 10 d).

Females: Length 20,9 to 37,3 mm. The most frequent figure is 28,9 mm. (Fig. 2, IV). Breadth at the height of the vulva (16 measurements) 0,040 to 0,075 mm, most often 0,050 mm. The index length/breadth varies between

400 and 650. (6 measurements). The distance from vulva to the head end varies within 6,0—12,5 mm, most frequently 8,9 mm. The index length/vulva distance varies between 2,6 and 4,3. (Fig. 4, IV). The vulva runs into a tube-shaped appendage, through which the eggs are laid. (Fig. 10 e, h). While the eggs are passing it has a characteristic jar or barrel shape (cadus =

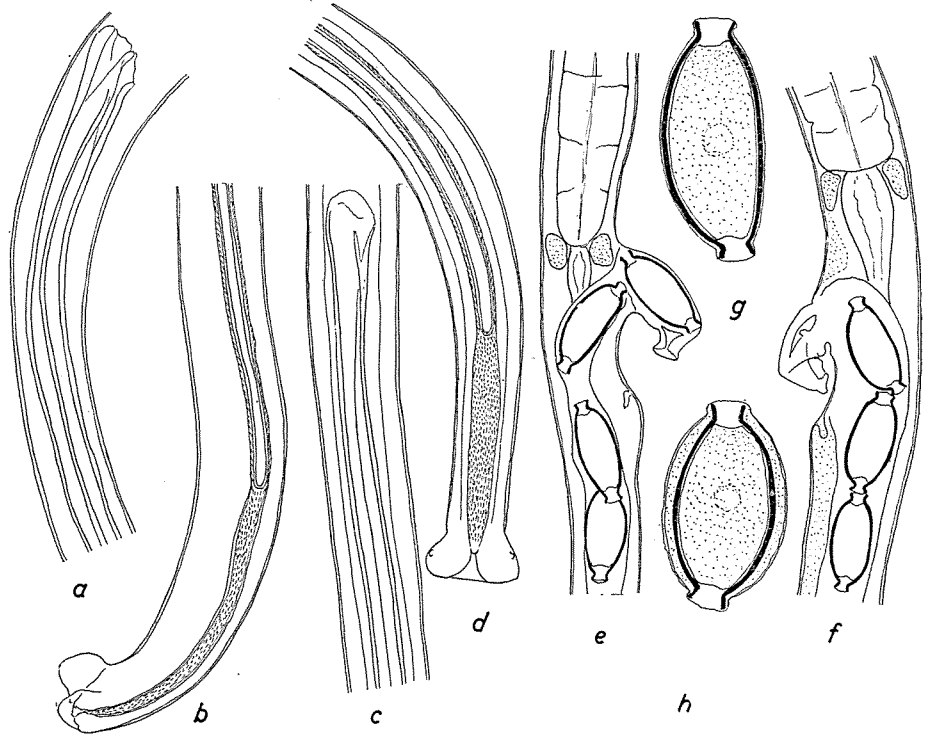


Fig. 10. a—h) *Capillaria cadovulvata*. a—b) tail end of male and proximal end of spicule, ventrolateral view, c—d) another specimen, seen ventrally, e—f) vulva region of two specimens, lateral view, g—h) eggs (scale 3). — All specimens from pheasants.

καδος = jar, barrel). Very characteristic is a swelling, about 0,060 mm behind the vulva. On the top of this swelling you will regularly see a glandular structure.

The eggs are elongated, with a very protruding plug. The innermost shell is not bent backward. The length range is 0,046 to 0,060 mm, the most frequent figure being 0,054 (Table 3). The breadths are 0,022 to 0,024 mm. (Fig. 10 g—h).

In spite of the great number of specimens (700) I have examined, I always failed to see any bacillary band, thus strengthening the above state-

ment of the unimportance of these structures in the practical work of determination.

Capillaria cadovulvata somewhat resembles *Capillaria collaris* (v. Linstow 1873), (especially as it is described by Freitas and Almeida (1935₂)) occurring in the coeca of various gallinaceous birds. This resemblance is only found in the males. Several safe distinguishing marks can be mentioned, however. The spicule looks like that of *Capillaria collaris*, especially with its blunt tip, but proximally it is more distinctly enlarged, and it is almost double the length. The lateral wings in the "bursa" are much greater in my species, and the spines of the spicule sheath are much coarser. The female is quite different. All the characteristics mentioned for my species, deviate from those significant of the females of *Capillaria collaris*.

The closest resemblance is found with *Capillaria vazi* Freitas 1933. This species occurs in an unknown section of the alimentary canal of *Odonthophorus capueira* (Spix) (*Odonthophoridae*: *Galliformes*) in Brazil. Unfortunately the proximal end of the spicule and also the egg have not been described nor illustrated. Taking this into consideration together with the fact that the spicule has only half the length as that of my species, and that the vulvar appendage has not the slit at the tip like in the form described by me, it seems safest for the time being to regard these two forms as being different. The shape of the tail of the male as well as the tip of the spicule closely resembling that of *Capillaria cadovulvata*, the coarsely prickled spicule sheath, the barrel shaped appendage and the swelling behind the vulva show the closest connection between the two species.

Capillaria cadovulvata is, after all, a species characteristic for the pheasant, only occasionally occurring in partridges. It is a very curious fact that it has not hitherto been found, although the coeca of several pheasants, especially in Germany, (beginning of the nineteenth century) have been examined. After all, the species called *Capillaria longicollis* by the earliest authors has been *Capillaria collaris*, since it is stressed that there is no vulvar appendage, and therefore the earlier investigators have not seen *Capillaria cadovulvata*, possibly with the single exception of Parona (1886), who describes a species from coecum (in that of the fowl) with vulvar appendage. On the other hand, the egg he picturizes most nearly resembles that of *Capillaria collaris*. Possibly he has confused the two species.

Capillaria collaris (v. Linstow 1873).

(Fig. 11 a-f, fig. 12 a-c).

Trichosomum longicolle Dujardin 1845, p. 19, p. p. (?)

Trichosomum longicolle Eberth 1863, p. 57-58, pl. 6, fig. 11.

- Trichosoma collare v. Linstow 1873, p. 294—295, pl. 13, fig. 1.
 Trichosoma collare v. Linstow 1878, p. 123.
 Trichosoma collare Stossich 1890, p. 19.
 Trichosoma retusum Railliet 1895, p. 486.
 Trichosoma collare Railliet 1895, p. 487.
 Trichosoma dubium Kowalewski 1894, p. 280.
 Trichosoma dubium Kowalewski 1895, p. 361—362, pl. 8, fig. 14—17.
 Trichosoma retusum Kowalewski 1900, p. 185—186.
 Trichosoma retusum Kowalewski 1901, p. 277—281, pl. 6, fig. 12—15.
 Trichosoma retusum Kowalewski 1902, p. 30.
 Trichosoma retusum Freese 1908, p. 713—716.
 Capillaria retusa Travassos 1915, p. 152, 160, pl. 26, fig. 13.
 Capillaria collare Travassos 1915, p. 155.
 Capillaria collaris Yorke & Maplestone 1926, p. 25.
 Capillaria retusa Yorke & Maplestone 1926, p. 27.
 Capillaria retusa Tubangui 1927, p. 39—40, fig. 21.
 Capillaria collaris Baylis 1929, p. 264.
 Capillaria retusa Baylis 1929, p. 264.
 Capillaria dubia Baylis 1929, p. 264.
 Capillaria retusa Orosz 1931, p. 5, 14—16, 24—25, 26—27, fig. 3 a—1 b.
 Capillaria retusa Morgan 1932, p. 191—193, figs. 11—17.
 Capillaria collare Sprehn 1932, p. 769—770.
 Capillaria retusa Sprehn 1932, p. 778.
 Capillaria retusa Yamaguti 1935, p. 430.
 Capillaria collaris Freitas & Almeida 1935₂, p. 332—337, pl. 6, figs. 26—28, pl. 7, figs. 29—33, pl. 8, fig. 36.
 Capillaria retusa Clapham 1935, p. 142.
 Capillaria retusa Clapham 1936, p. 63.
 Capillaria collaris Neveu-Lemaire 1936, p. 1312.
 Capillaria retusa Neveu-Lemaire 1936, p. 1312—1313.
 Capillaria dubia Neveu-Lemaire 1936, p. 1314—1315.
 Capillaria collaris Freitas & Lent 1937, p. 91.
 Capillaria retusa Koffmann 1939, p. 529—530, fig. 13.
 Capillaria collaris Koffmann 1939, p. 531—533, figs. 17—18.
 Capillaria collaris Holger Madsen 1941, p. 31, P. P.

This species in my material occurred both in partridges and pheasants, in the first host twice, in the second five times, in different parts of the country and at different times of the year viz: Broholm 28.-7.-37, young female partridge, Lyø 22.-9.-37, young female partridge, Aarø 15.-12.-37, two

Species of Capillaria

young male pheasants, 30.-4.-38, young female pheasant, Gaunø 21.-6.-37, old male pheasant. In one specimen of a hybrid between black grouse and pheasant this species also was found (Varde 15.-10.-42).

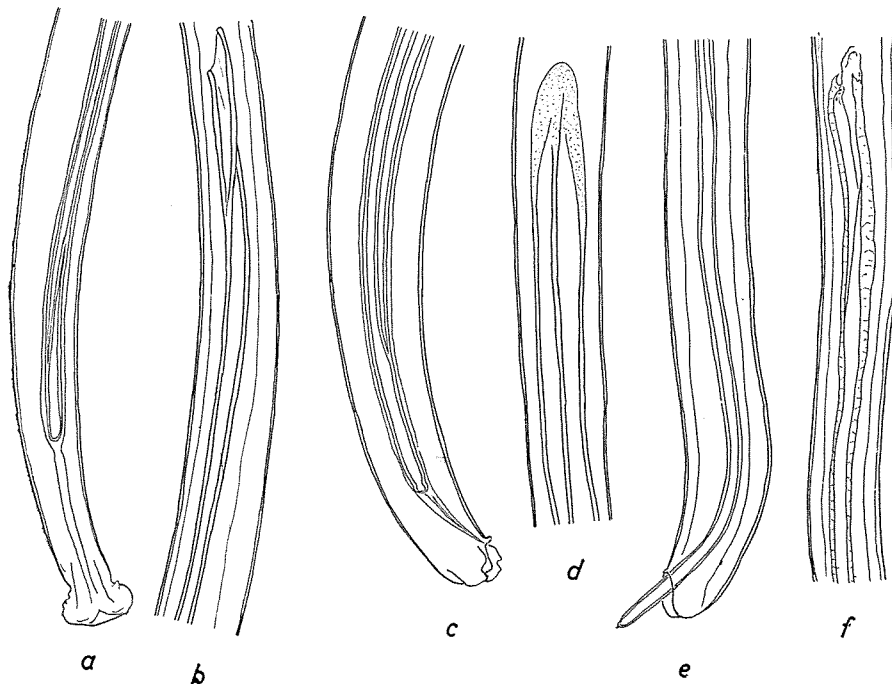


Fig. 11. a—f) *Capillaria collaris*.

a—b) tail end and proximal end of spicule of male, dorsal view, c—f) same, lateral view of two specimens. — a—d specimens from partridges, e—f from pheasants.

Males: Length of four specimens (the corresponding index length/spicule length in round brackets, the index length/breadth in square brackets): 10,7 mm (6,5) [250], 12,6 mm (7,1) [325], 12,7 mm (9,3) [295], 17,7 (10,7). The breadth (6 specimens): 0,034, 0,039, 0,042, 0,043, 0,043 and 0,044 mm. The spicule length varies from 1,370 mm to 1,890 mm, with the most frequent figure 1,650 mm (Fig. 3, II). The spicule proximally is very broad (0,025 mm), slowly tapering towards the tail end of the spicule, (medially the breadth is almost the same), which is blunt. When the spicule is extruded you can see a very fine spine on the tip. In cross section the spicule is flat triangular. The shape of the proximal end, which can be inflated a little differs somewhat in the different specimens. (Fig. 11 a—f). The spicule sheath was in no case extruded. But with immersion objectives you can see very fine bristles on it. The tail end has wings which protrude only a little. Just before the cloacal aperture, upon the ventral side, there is a papilla.

Females: Length of 7 specimens (the corresponding index length/vulva distance in round brackets, the index length/breadth in square brackets): 12,8 mm (2,8), 15,4 mm (2,5) [340], 16,0 (2,7) [370], 17,2 mm (2,7) [430],

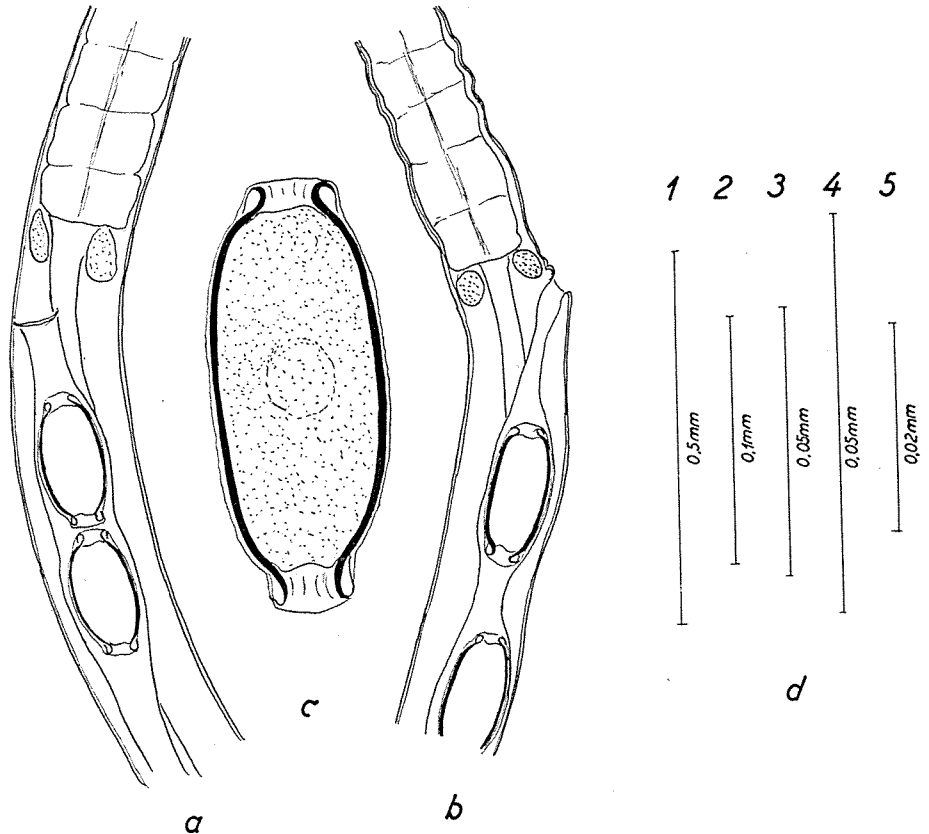


Fig. 12. a—c) *Capillaria collaris*. d) Scales employed. a) vulva region, ventrolateral view, b) the same of another specimen, seen laterally, c) egg (scale 4). — a—b specimens from pheasants, c from partridge. — d) scale 2 has been used when not otherwise stated.

17,2 mm (3,4) [350], 17,7 mm (2,9) [385], 20,9 mm (3,2) [425]. The breadth (8 measurements) varies from 0,040 mm to 0,054 mm. The distance between vulva and the beginning of the oesophagus: 0,065 mm, 0,070 mm, 0,076 mm and 0,095 mm. The vulva has no special equipment, but appears as a transverse fissure (Fig. 12 a, c). The size of the eggs is 0,049—0,062 mm × 0,022 — 0,025 mm. (Table 3). The most frequent length is 0,053 mm. They differ in shape from those of *Capillaria cadovulvata*, but are very like those of *Capil-*

laria longicollis. The innermost egg shell bends in the same manner to a collar. (Fig. 12 b).

Like *Capillaria longicollis* this species has been much disputed although not so much as the first mentioned. Most of the difficulties have been due to the very incomplete description of von Linstow. No later observer has with certainty rediscovered *Capillaria collaris*, whereas several have found species in accordance with Railliet's more complete description of *Capillaria retusa*. This paradoxically enough, is a fact even in von Linstow's case, as he has determined the material of Freese (1908) (concerning this matter see list of synonyms). On the other hand only this species has been found in the coeca of fowl. The main distinguishing mark was the fine bristles on the spicule sheath in *Capillaria collaris* and the smooth spicule sheath of *Capillaria retusa*. But later investigators (e. g. Kowalewski, Morgan, Freitas and Almeida) found fine bristles in obvious *Capillaria retusa*. Freitas and Almeida (1935₂) finally in consequence of this made them synonymous. A feature which has also played a part in the discussion is the broad ventral bacillary band, which several authors have found in *Capillaria retusa*, besides the narrow lateral bands. Von Linstow mentions these latter only. But, especially considering the fragmentary descriptions often given by von Linstow, is it reasonable to suppose that he has overlooked the ventral band, or, as in my own preparations, it has not been visible, as has also been pointed out by Freitas and Almeida.

On the whole my specimens show good accordance with earlier descriptions. Some inconspicuous structures have not been recorded, I should think because they are difficult to see, regarding the males: the small constriction just before the tip of the spicule and the fine bristle on the uttermost tip, also the little papilla in front of the cloacal aperture. The spicule has been picturized only in a few cases. The shape of the proximal end most nearly resembles the drawings shown in Travassos (1915) and Morgan (1932). The illustrations of Freitas and Almeida (1935₂) deviate from other illustrations through the presence of a sharply delineated border at the head end. But as otherwise there is good conformity, and the shape can vary considerably, as my illustrations indicate, the species must be identical. The range of the most important measurements are, according to the earlier authors, as follows: Males: length 7,1—13 mm; spicule length 0,740—1,700 mm. My figures are therefore among the highest or somewhat higher since the greatest length I have found is 17,7 mm, and the longest spicule is 1,890 mm. For the females conditions are alike. A new point in my characterization of them is the accurate illustration of the egg — the drawings of Morgan being different from mine, but they differ in a similar way as those of *Capillaria longicollis*. The drawings of Freitas and Almeida are too sketchy to allow a safe comparison. The range of earlier measurements is as regards the length 9,5—

Table 4.

Principal characters of species of Capillaria in

	<i>C. bursata</i>	<i>C. cf. bursata</i>	<i>C. cadovulvata</i>	<i>C. collaris</i>
Length of male (in mm).....	13,7—14,8	—	14,0—26,5 (20,5 ¹)	7,1—17,7
Length of female (in mm).....	24—26	18,1	20,9—37,3 (28,9)	11,2—20,9
Length of spicule (in mm).....	1,35	—	1,77—2,66 (2,32)	0,74—1,89
Length of eggs (in mm).....	0,056—0,064	—	0,049—0,060 (0,054)	0,046—0,067 (0,054)
Shape of spicule in cross section.	○	—	△	△
Appearance of spicule sheath....	finely transversely striated	—	coarsly spiny	with fine bristles
Vulva with or without appendage	(+)	(+)	+	÷

¹) The figures in round bracketts indicate the most frequent figures.

19,0 mm; the length of the eggs given is from 0,046 to 0,067 mm. For the females my figures are more nearly in accordance with those of earlier authors than for the males, only one female being just a little longer, its length being 20,9 mm.

Capillaria collaris has most often been found in fowl. Dujardin (1845) possibly also found it in partridges (as later Clapham (1935) and (1936)). Finally Railliet (1893) found it in guinea fowl (*Numida meleagris*) and Cram (1933) in the turkey (*Meleagris gallopavo*). In the present paper the pheasant and a hybride between black grouse and pheasant are recorded as hosts for the first time. Freitas and Almeida (1935₂) further note the black grouse (*Lyrurus tetrix*). Their source of this statement I cannot find.

Regarding the place in the host there are some discrepancies. It is mostly recorded as the coeca, records which one is inclined to regard as the most reliable. Only Freese (1908) and Koffmann (1939) state the small intestine as the most frequent place, but as shown above (p. 4) these statements must be considered with a certain scepticism.

Species of Capillaria

the lower digestive tract of gallinaceous birds.

C. dujardini	C. cf. dujardini	C. longicollis	C. obsignata	C. tiaras	C. vazi
6,1—11,7	—	7,0—25,0 (11,2)	8,6—10,0	14,0—14,5	15,5
10,0—19,0	40,0	9,3—45,0 (16,3)	10,6—12,7	—	24,4
1,08—1,57	—	0,67—1,89 (0,975)	1,20—1,58	2,08—2,38	1,07
0,041—0,072	51	0,046—0,057 (0,049)	0,050—0,062	—	0,059
○	—	○	○	△	—
transversely striated	—	smooth to transversely striated	finely transversely striated	transversely striated	finely spiny
÷	÷	+	÷	—	+

The whole material is listed in Table 2.

The most important features of species of Capillaria in the lower digestive tract of gallinaceous birds are summarized in Table 4.

CAPILLARIA CONTORTA (CREPLIN 1839) IN PHEASANTS AND DUCKS

This part of the paper treats the material of the species of Capillaria found in the upper digestive tract, principally the oesophagus of pheasants and river and pond ducks. The only species found is Capillaria contorta. As a great number of species are more or less adequately described from the upper digestive tract of birds and they often, only with difficulty can be distinguished from C. contorta, it seemed reasonable to publish this rather large material to elucidate the variability of the species, as a contribution to a safe base for the differentiation of these difficult species in the future.

Capillaria contorta (Creplin 1839).

(Fig. 13 a—c, fig. 14 a—e).

- | | |
|------------------------|---|
| Trichosomum obtusum | Mehlis 1831, p. 74, pro parte. (?). |
| Trichosoma contortum | Creplin 1839, p. 278, (p. p. (?).) |
| Trichosomum contortum | Dujardin 1845, p. 9, 12—13, 21. |
| Trichosomum contortum | Diesing 1851, II, p. 252. |
| Trichosoma contortum | Baird 1853, p. 2. |
| Trichosomum contortum | Eberth 1863, p. 59, pl. 6, fig. 5, pl. 7, fig. 18, orig. |
| Trichosoma contortum | v. Linstow 1873, p. 296. |
| Trichocoma contortum | v. Linstow 1877 ₂ , p. 176—177. |
| Trichosoma contortum | v. Linstow 1878, p. 98, 99, 100, 112, 132, 134, 136. |
| Trichosoma contortum | v. Linstow 1884, p. 135—136. |
| Trichosoma contortum | v. Linstow 1889, p. 34, 37, 38, 41. |
| Trichosoma contortum | Railliet & Lucet 1889, p. 382—383. |
| Trichosoma contortum | Railliet & Lucet 1890, p. 19—22, fig. 1—6
orig. |
| Trichosoma contortum | Stossich 1890, p. 23—24. |
| Trichosoma contortum | Railliet 1895, p. 487—488, fig. 337, non orig. |
| Trichosoma contortum | Stossich 1895, p. 33. |
| Trichosoma contortum | v. Linstow 1897, p. 618—619, 621, pl. 28,
fig. 30, orig. |
| Trichosoma contortum | Lepri 1898, p. 53—56, fig. 1—5, non orig. |
| Trichosoma contortum | Muehling 1898, p. 50. |
| Trichosoma contortum | Stossich 1898, p. 92. |
| Trichosoma contortum | Wolffhügel 1900, p. 10, 30, 32. (?). |
| Trichosoma contortum | v. Linstow 1909, p. 79, fig. 76, orig. |
| Capillaria contorta | Travassos 1915, p. 154, 162, pl. 25, fig. 11, orig. |
| Capillaria contorta | Skrjabin 1916, p. 552, pl. 8, fig. 59, orig. |
| Capillaria contorta | Yorke & Maplestone 1925, p. 26. |
| Capillaria contorta | Baylis 1929, p. 264. |
| Capillaria contorta | Canavan 1931, p. 199, p. p. (?). |
| Capillaria perforans | Kotlán & Orosz 1931, p. 112. (?). |
| Capillaria contorta | Orosz 1931 (after Freitas & Almeida 1935 ₂),
fig. orig. |
| Capillaria contorta | Sprehn 1932, p. 770. |
| Capillaria lophortygis | Baylis 1934, p. 131—132, 1. fig. orig. |
| Capillaria vanelli | Yamaguti 1935, p. 430, fig. 41 orig., nec Tr.
vanelli Rud 1819, p. 15. |
| Capillaria contorta | Freitas & Almeida 1935 ₁ , p. 125—129, pl. 3,
fig. 16—20, orig. part. |

Species of *Capillaria*

<i>Capillaria contorta</i>	Freitas & Almeida 1935 ² , p. 330—331, pl. 5, fig. 23, orig.
<i>Capillaria contorta</i>	Korkhaus 1935, p. 20, fig. orig.
<i>Capillaria contorta</i>	Cram 1936, p. 8—19, fig. 2—6, non orig.
<i>Capillaria contorta</i>	Neveu-Lemaire 1936, p. 1308—1309, fig. 677, A—C, non orig.
<i>Capillaria perforans</i>	Reis & Nobrega 1938, p. 21—24, 4 pl. (?).
<i>Capillaria contorta</i>	Holger Madsen 1941, p. 31.

Males: Length 6,1—45,5 mm, in ducks 6,1—25,6 mm, in pheasants 20,0—45,5 mm (It is naturally quite casual that the lower figure in this latter case is so high). Fifty per cent lie between 11,2 and 15,4 mm. (Table 5).

Table 5. *Lengths of Capillaria contorta.*

Measuring unit (0,47 m)	Males		Females		Measuring unit (0,47 m)	Males		Females	
13	2 D ¹⁾	0	0	0	54	0	0	2 D	1 P
14	1 —	0	0	0	55	0	1 P	0	2 —
22	1 —	0	0	0	56	1 D	1 —	0	0
23	1 —	0	0	0	57	0	0	1 —	0
24	2 —	0	0	0	58	0	0	2 —	0
25	3 —	0	0	0	60	0	0	1 —	1 —
26	1 —	0	0	0	62	0	0	0	1 —
27	4 —	0	0	0	63	0	0	1 —	0
29	2 —	0	0	0	64	0	0	1 —	0
30	3 —	0	0	0	65	0	0	1 —	1 —
31	2 —	0	0	0	67	0	0	0	2 —
32	4 —	0	0	0	68	0	0	2 —	0
33	3 —	0	1 D	1 P	69	0	0	3 —	0
34	1 —	0	0	0	70	0	0	1 —	1 —
35	2 —	0	0	0	73	0	0	0	1 —
36	0	0	0	1 —	74	0	0	0	1 —
37	2 —	0	0	0	76	0	0	0	1 —
38	1 —	0	0	1 —	78	0	1 —	0	0
42	0	0	0	1 —	79	0	0	1 —	0
43	0	1 P ¹⁾	2 —	1 —	82	0	0	0	2 —
44	0	0	0	1 —	83	0	0	1 —	0 —
45	0	1 —	2 —	2 —	84	0	0	0	1 —
46	0	0	2 —	2 —	85	0	0	0	1 —
47	0	0	1 —	0	87	0	0	0	1 —
48	0	0	1 —	0	95	0	0	0	2 —
49	0	3 —	0	0	98	0	1 —	0	0
50	0	0	2 —	1 —	99	0	0	0	1 —
52	0	2 —	0	1 —	100	0	0	0	0

¹⁾ D and P means specimens from ducks and pheasants respectively.

A spicule is very often absent. When present it can not be seen in its whole extension and therefore cannot be measured. It is very thin and inconspicuous, and was only in a few cases found peeping out of the spicule sheath (fig. 13 b). Generally it is most chitinized in the distal part. In a single

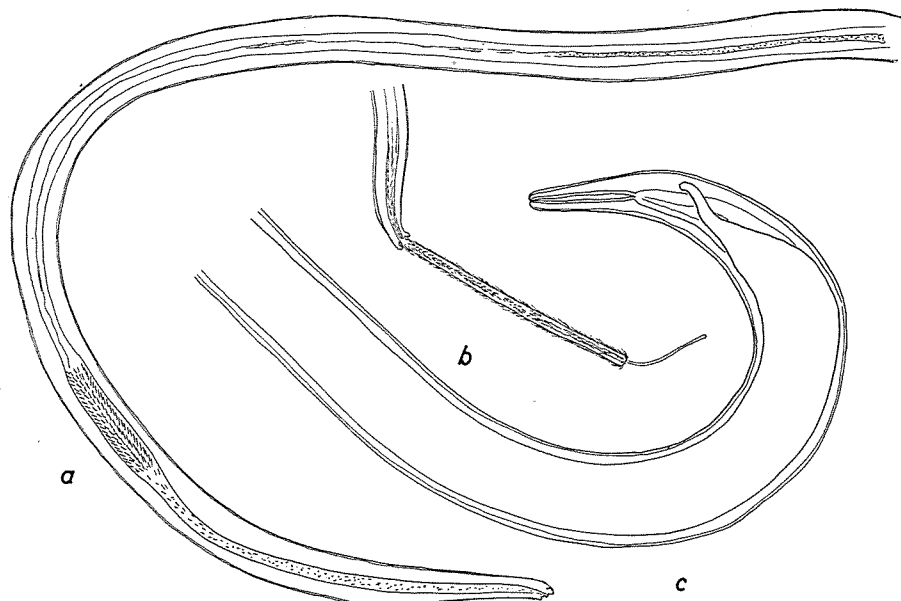


Fig. 13. a—c) *Capillaria contorta* (scale 1).
a) tail end of male, lateral view, b) tail end of another specimen, with spicule sheath extruded and spicule tip peeping out, ventrolateral view, c) tail end of female. — a and c specimens from mallard, b from teal.

case the proximal end of the spicule could be seen (fig. 13 a, 14 a). It was somewhat dilated, and looked as if it were frayed in the edge.

The spicule sheath is distally (when invaginated) covered with fine bristles, somewhat more proximally with coarser spines. It could in a few cases be followed, and presented the following lengths: 1,65 mm (from a garganey) 2,02 mm (from a mallard) and 4,03 mm (from a pheasant). The tail end tapers much, and is provided with more or less inconspicuous papillae (fig. 13 a and b).

Females: Length 15,4—46,0 mm, in ducks only 15,4—38,6 mm, in pheasants the whole variation. Fifty per cent lie between 19,5 and 27,5. The index length/vulva distance (from front) 2,9—6,1, the most frequent being 4,8—4,9, in mean 4,7 mm. (Table 9). The egg lengths are 0,046—0,063 mm, most frequent 0,054 mm. (Table 10).

The vulva is circular, placed on a little protuberance (fig. 14 b, e). The

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eggs have fairly narrow plugs. The innermost shell is not bent to a collar. The outer shell is rather thick. The lumen in the plug can be of different lengths, (fig. 14 c—d). The tail ends in a rather distinct cone (fig. 13 c).

My collection consists of 288 worms. The percentage of males is 31.

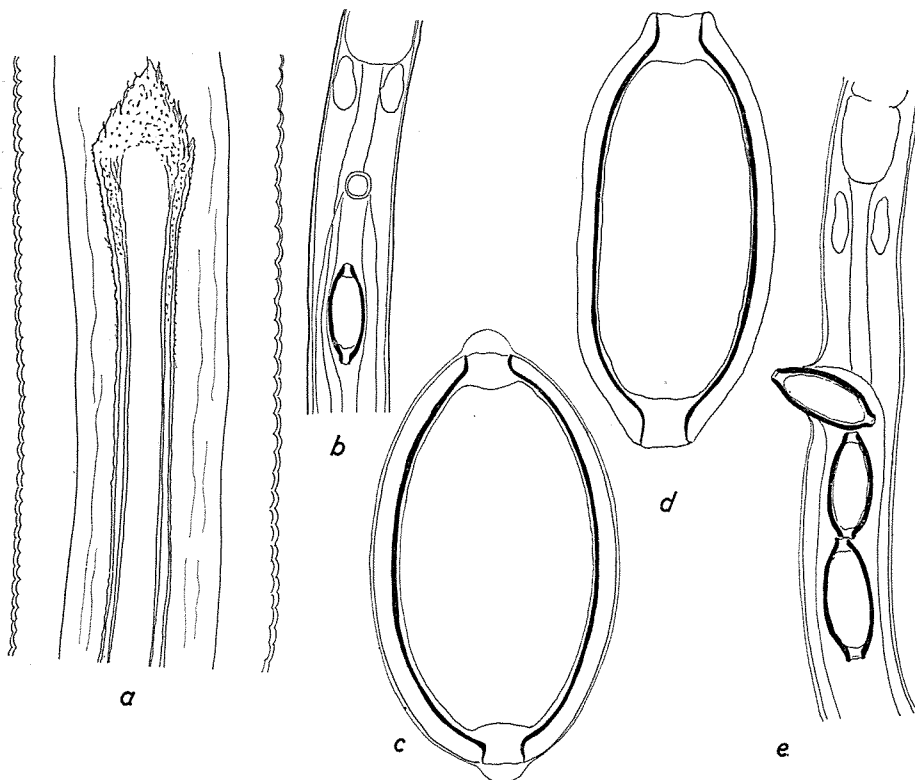


Fig. 14. a—e) *Capillaria contorta*.

a) proximal end of spicule of specimen in fig. 13 a (scale 3), b) vulva region, ventral view, c—d) eggs (scale 5), e) vulva region, lateral view. — a specimen from mallard, c from teal, b and d—e from pheasants.

Location in the host: esophagus, and rarely proventriculus. Host occurrence: *Anas platyrhynchos*, *A. p. domesticus*, *Anas querquedula*, *Anas strepera*, *Daphila acuta*, *Anas crecca*, *Spatula clypeata*, *Tadorna tadorna*, *Gelochelidon nilotica*, *Sterna hirundo*, *Sterna maxima*, *Larus ridibundus*, *Larus argentatus*, *Vanellus vanellus*, *Cepphus grylle*, *Accipiter nisus*, *Buteo buteo*, *Bonasa umbellus*, *Colinus virginianus*, *Crossoptilon mantchuricum*, *Lophortyx californica*, *Meleagris gallopavo*, *Oreortyx picta*, *Perdix perdix*, *Phasianus colchicus*, *Coloeus monedula*, *Corvus corone cornix*, *C. c. corone*, *Corvus frugilegus*, *Erithacus rubecula*, *Phoenicurus ochrurus* and *Sturnus vulgaris*.

As probable hosts (notably older records) can be mentioned *Charadrius hiaticula*, *Philomachus pugnax*, *Recurvirostra avocetta* and *Corvus brachyrhynchus*. New hosts are *Nyroca fuligula*, *Bucephala clangula*, *Eudromias morinellus*, *Erolia alpina* and *Capella gallinago*. — The record of its occurrence in *Plautus alle*, often found in the literature is erroneous. (See below p. 44).

My collection of species serving as host for *Capillaria contorta* comprises 44 pheasants, 117 *Anas platyrhynchos*, 90 *Anas crecca*, 9 *Anas querquedula*, 25 *Bucephala clangula* and 27 *Nyroca fuligula*. The frequency in these species was (respectively) in per cent: 41, 29, 38, 33, 4 and 4. (See table 7).

In species in which it could be expected, and reasonably also really lives, but, I think, so rarely that it was not found, owing to the relatively small number investigated, the following specimens have been searched in vain: 39 black grouse, 16 black grouse chicks, 31 *Anas penelope*, 19 *Spatula clypeata* and 15 *Anas acuta*. Curiously enough I did not find it in *Perdix perdix* (56 specimens have especially been searched for *C. contorta* in 8 localities from Jylland, Sjælland and Lolland-Falster), although the species has been found in it earlier outside Danmark, nor did I find the other esophagus species, *C. annulata* (Molin 1858), which might be expected. *C. contorta* also could not be found in a material of 79 coot and 110 especially marine diving ducks, viz. 14 *Nyroca marila*, 7 *Nyroca ferina*, 10 *Clangula hyemalis*, 14 *Oedemia nigra*, 17 *Melanitta fusca*, 18 *Somateria mollissima*, 19 *Mergus merganser* and 11 *Mergus serrator*.

The number of worms per infested host specimen shows differences to some degree following those of the frequency. The greatest number per host specimen is found in pheasants, viz. 6,3 on an average. In the ducks the corresponding numbers are 3—4 on an average.

In pheasants *C. contorta* has been found in the 3 localities from which pheasants have been investigated in this respect, 2 in West Sjælland, 1 in Jylland (Vaarsø). (The localities 11, 37 and 39, mentioned in table 1). In the ducks it has been found in several localities both in Jylland and Sjælland. (The localities 2, 13, 17, 29, 30, 36 and 40, enumerated in table 1. It has been found in the months of the year in which investigations were made except in April and July).

From the upper digestive tract, especially the esophagus of a number of birds numerous species of *Capillaria* are described, which all show the characteristic feature of a faintly developed or seemingly completely missing spicule, but several of them still showing good differences. As the said property of the spicule is very remarkable also for *C. contorta* all earlier records of this species are uncertain if not described or figured in a clear and unquestionable manner.

The first description given by Creplin (1839) is as already pointed out

by Dujardin (1845) incomplete. But later the species has been so well characterized that its identity is safe, and therefore the name can be used. The hosts which he mentions are the following: *Buteo buteo*, *Vanellus vanellus*, *Philomachus pugnax*, *Recurvirostra avocetta*, *Charadrius hiaticula*, *Cephus grylle* and *Corvus corone cornix*, a surprisingly different group of host species which beforehand should be considered with a certain scepticism. Later investigations, including my own, have however shown that this species is really able to thrive in very different hosts. Of these quite sure hosts can be mentioned a very great number of gallinaceous, anatine and limicole birds, for which host groups I have also evidence myself. Probably *C. contorta* also can be found in some fish-eating birds, since it must be considered probable that the sure *C. contorta* which Travassos (1915) figures has been collected from *Sterna maxima* which is a pronounced fish-eating species. (See e. g. Bent 1921). Cram (1936) also records it from *Sterna hirundo*, seemingly based on own finds. The occurrence in a number of gulls must consequently be considered highly probable, although no finds have been given with figures. On the other hand, they are sometimes given by investigators who in another way have shown that they really knew the species. This latter is also the case with a number of records of *C. contorta* from different birds of prey, which finds thus cannot be disregarded, the more so as Freitas and Almeida (1931), probably themselves found the species in *Falco rusticolus obsoletus*, which host they give as new without literary reference.

On the other hand there is in this field especially great difficulties since from the oesophagus of birds of prey, also *C. dispar* is described, which, it must be pointed out, is not clearly discernible, and even *C. cylindrica*, which can however easily be recognized. Considering the occurrence of *C. contorta* in hosts so different in relationships and habits even its occurrence in *Cephus grylle* is not quite impossible although it needs confirmation.

The quite undisputable host occurrences, based on figures are chronologically the following: Crows (Eberth 1863, Railliet & Lucet 1885) domestic duck (Railliet & Lucet 1889), *Sterna maxima* (Travassos 1915), turkey (Kotlán & Orosz 1931), *Lophortyx californicus* (Baylis 1934), *Vanellus vanellus* (Yamaguti 1935), a long row of gallinaceous birds, *Anas strepera*, *Daphila acuta*, *Spatula clypeata*, *Tadorna tadorna*, *Gelochelidon nilotica*, *Sterna hirundo* and *Larus argentatus* (Cram 1936). This latter paper gives a thorough account of the systematical properties of the species, and besides giving the host lists of earlier authors gives the occurrence in a long series of new hosts, confirming many of the determinations through infestation experiments.

Of probable host occurrences but not confirmed with figures etc. the following are found in the literature: *Larus canus* (Diesing (1851), after Creplin from the Vienna collections). Von Linstow in several papers (1873, 1877,

1884, 1889) has recorded: *Sturnus vulgaris*, *Larus ridibundus*, *Anas crecca*, *Erithacus rubecula*, *Phoenicurus ochrurus*, *Corvus frugilegus*, *Coloeus monedula* and *Accipiter nisus*. When Cram (1936) instead of *Phoenicurus ochrurus* in her list has *Phoenicurus phoenicurus* this is an error, as seen above. Her source when mentioning *Oenanthe* as host is not quite clear. Stossich (1896) who, it must be said, is not quite reliable, mentions the species from *Larus canus* and *Buteo buteo* and (1898) adds *Corvus c. corone* as host. Travassos (1915) besides *Sterna maxima* also mentions *Plautus alle* as host. This statement is beyond doubt erroneous, since *Cephus grylle* is missing in his host list.

Canavan (1931) states *C. contorta* from *Corvus brachyrhynchos*. This host occurrence is quite probable, but the species which he has had before him evidently is only partly *C. contorta* (probably a couple of species confused). Kotlán & Orosz (1931) described as new *C. perforans* from the turkey. Already Cram (1936) supposed it to be synonymous with *C. contorta*, since the principal character differentiating these two species is the long spicule. I consider it a synonym since *C. contorta* by later investigators has been found to be a very characteristic parasite of a vast number of gallinaceous birds. Just the same can be said about *C. lophortygis* inadequately described by Baylis (1934). The *C. vanelli* described as new by Yamaguti (1935), as already pointed out by Freitas & Almeida (1935₁), is evidently identic with *C. contorta*.

There may be some reason to doubt some of the statements of *C. contorta* in crows and gulls since Wassilkowa & Gouchanskaja (1930), although inadequately and without figures, describe *C. corvicola* and *C. laricola* from oesophagus of the corresponding birds. They really seem to be distinct from *C. contorta*.

Comparing the measurements of earlier authors with those of mine the following can be said: The characteristic feature of the relatively short distance especially in older specimens of the vulva from the front end is stated by v. Linstow (1877₂), who gives the index length/vulva distance as 2,5—5,3. He found eggs up to a length of 0,069 mm. In 1884 he found the mentioned index to be up to 6,6, thus slightly exceeding the biggest ones, found by me. Orosz (1931) found eggs up to 0,065 mm, only exceeding my biggest ones by 0,002 mm. The sizes noted of all the previous mentioned authors lie within those found by me, and this is even the case with the males of *C. perforans* (Kotlán & Orosz 1931) above considered a synonym of *C. contorta*. The females in their whole distribution exceed my females, measuring 50—86 mm (on an average 71,8 mm). (My biggest female, is in relation to the sizes reached by the males strikingly short; this is without doubt due to the fact that some of the biggest I have only found in fragments, since the biggest specimens are naturally more exposed to be torn during the

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Table 6.

Principal characters of species of Capillaria in the upper digestive tract of gallinaceous and anatine birds.

	<i>C. contorta</i>	<i>C. annulata</i>	<i>C. cairinae</i>	<i>C. uropapillata</i>
Length of male (in mm).....	6,1—48,0	10,0—37,0	14,3	—
Length of female (in mm)	15,4—86,0	15,0—80,0	36,5—39,9	47,0—55,0
Properties of spicule.....	missing or inconspicuous	missing	missing	—
Length of eggs (in mm).....	0,046—0,070 (0,054)	0,054—0,066	0,043—0,051	0,050—0,057
Appearance of spicule sheath.....	spiny	spiny	coarsely spiny	—
Shape of vulva without appendage..	circular	circular	slit shaped	slit shaped
Special characters.....	—	Cuticular inflation at mouth	—	papillae on tail tip

collecting). It must be admitted that the spicule is very long, the index length/spicule length being about 3; in species of *Capillaria* it most frequently rules about 4—5. Korkhaus (1935) found eggs, which were big, possibly to some degree due to the fact that he examined living eggs in feces, finding a range of 0,060—0,070 mm, exceeding my biggest ones by 0,007 mm. Cram (1936) found *C. contorta* of sizes reaching those of the above mentioned "*C. perforans*", males up to 48 mm, from pheasants, exceeding my measurements by 2,5 mm, but similar sizes were also found in other galliformes. Her measurements of eggs lie wholly within those of mine. The length of the spicule sheath varies very much and more than in my specimens, viz. 0,76—6,5 mm. She could not, as I, in any case measure the spicule itself. The principal characters of species of *Capillaria* in the upper digestive tract of gallinaceous and anatine birds are summarized in Table 6.

THE SPECIES OF CAPILLARIA IN THE LOWER DIGESTIVE TRACT OF DUCKS AND COOT WITH RELATED SPECIES FROM GOOSE.

The material was rather large, comprising 642 worms, collected from 516 investigated birds. The material is listed below (Table 7).

Hitherto only two species of *Capillaria*, viz. *C. anatis* and *C. spinulosa* were described from the lower digestive tract of ducks and geese in Europe. From other Lamellirosstres was further known *C. droummondi* Travassos 1915, found in *Cygnus melanocoriphus*, from Brazil. This species I did not find.

In my collection of the genus *Capillaria* 4 species occurred. Two of these were therefore reasonably new. This was also the case, sc. *C. mergi* notably in fish ducks and *C. nyrocinarum*, from ducks of the Nyrocinae (diving ducks). *C. anatis* was found in different river and pond ducks and the coot, and *C. spinulosa* in different fresh water diving ducks and river and pond ducks. During the revision of the literature rather confused conditions appeared, as it is clearly seen from the lists of synonyms of the species described.

Several species are brought together under the name *C. anatis*. This is seen very clearly with the species described by Eberth (1863). His figure and the host occurrence clearly prove that the species is the same described by me as *C. mergi*. The species *C. nyrocinarum* has not been recognized before. Of special interest is the "*C. anatis*", very well described by Gorschkov (1937) from domestic goose. This species is also new, but in order not to augment the great bulk of names applied to *Capillaria* species, I have given it a name by Rudolphi (1809) as a pure nomen nudum applied to specimens of a species of *Capillaria* from domestic goose, viz. *C. anseris*.

As pointed out above the taxonomically most important characters in species of *Capillaria* are the length and shape of the spicule, the appearance of the vulva and the eggs.

Of the four species in my collection three have long spicules in relation to the total length. Only *C. spinulosa* has a short spicule, the index length/spicule length being about 12, as against an index of about 7 in the other species, also in *C. anseris*, and of the same dimension is the spicule in *C. droummondi*. In three species, *C. anatis*, *C. nyrocinarum* and *C. spinulosa* the spicule is triangular, in *C. mergi* circular, in transverse section. Also in *C. anseris* and *C. droummondi* the spicule is cylindrical. The spicule in the two groups can be separated by different particulars in the shape especially connected with the differences in the appearance of the spicule sheath. In *C. nyrocinarum* and *C. spinulosa* it is furnished with more or less coarse spines. It is smooth or finely transversely striated in *C. anatis* and *C. mergi*, as is also the case in *C. anseris* and *C. droummondi*.

In the females the vulvas are only in *C. nyrocinarum* and *C. mergi*

Species of Capillaria

Table 7.

Own material of species of *Capillaria* in digestive tract of ducks and coot, and in upper digestive tract of pheasants.

Nr. Host species	Number investigated	C. anatis		C. mergi		C. nyroci- narum		C. spinulosa		C. contorta	
		Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen
River and pond ducks . .	275	4	3,2	—	—	—	—	8	2	25	3,2
1. <i>Anas crecca</i> , teal . .	95	1 (40)	1	—	—	—	—	—	—	38 (2, 30, 36, 40)	2,7
2. <i>Anas querquedula</i> , garganey.	9	—	—	—	—	—	—	22 (17, 27, 36, 40)	1	33 (36, 40)	1
3. <i>Mareca penelope</i> , wi- geon.	31	—	—	—	—	—	—	6 (30)	1	—	—
4. <i>Anas acuta</i> , pintail duck.	15	—	—	—	—	—	—	—	—	—	—
5. <i>Anas platyrhyn- chos</i> , mallard, wild duck.	118	10 (2, 12, 13, 17, 30)	3,4	—	—	—	—	12 (12, 13, 17, 30)	2,5	38 (2, 12, 13, 17, 30, 40)	2,7
6. <i>Spatula clypeata</i> , shoveler, spoonbill duck.	18	—	—	—	—	—	—	33 (3, 12)	2,8	—	—
Freshwater diving ducks.	72	—	—	—	—	14	3,9	40	4,8	—	—

(Table 7).

Nr. Host species	Number investigated	C. anatis		C. mergi		C. nyrocinarum		C. spinulosa		C. contorta	
		Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen
7. Nyroca fuligula, tufted duck.	26	—	—	—	—	8 (29)	1	81 (29, 30)	4,6	4 (29)	1
8. Nyroca marila, scaup duck.	14	—	—	—	—	29 (29)	6	50 (29)	5,1	—	—
9. Nyroca ferina, pochard.	7	—	—	—	—	—	—	14 (12)	4	—	—
10. Bucephala clangula, golden eye.	25	—	—	8 (29)	1	16 (28, 29)	3,5	4 (29)	1	4 (30)	1
Marine diving ducks	60	—	—	7	1	45	15,3	—	—	—	—
11. Clangula hyemalis, longtailed duck.	10	—	—	—	—	20 (28)	1,5	—	—	—	—
12. Oidemia nigra, common scoter.	14	—	—	—	—	50 (1, 23, 28)	2,3	—	—	—	—
13. Melanitta fusca, velvet scoter.	17	—	—	6	1	29 (28, 29, 30)	8	—	—	—	—
14. Somateria mollissima, eider duck.	18	—	—	6	1	67 (28, 30)	29,2	—	—	—	—
15. Somateria spectabilis, king eider.	1	—	—	—	—	+ (29)	5	—	—	—	—

Species of Capillaria

(Table 7).

Nr. Host species	Number investigated	C. anatis		C. mergi		C. nyrocinarum		C. spinulosa		C. contorta	
		Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen	Frequency per cent	Number per infested specimen
Fish ducks.....	30	—	—	57	3,7	—	—	—	—	—	—
16. <i>Mergus merganser</i> , goosander.	19	—	—	53 (29, 35)	4	—	—	—	—	—	—
17. <i>Mergus serrator</i> , red- breasted merganser.	11	—	—	63 (28, 29, 35)	3,2	—	—	—	—	—	—
18. <i>Fulica atra</i> , coot...	79	4 (13, 40)	3,7	—	—	—	—	—	—	—	—
19. <i>Phasianus colchicus</i> , pheasant.	44	—	—	—	—	—	—	—	—	41 (11, 37, 39)	6,3

Figures in brackets indicate numbers of the localities in which the species has been found (fig. 1, table 1).

furnished with an appendage, of different shape in the two species. All the other species show no characteristic features in this connection but can be distinguished by the eggs. The eggs of *C. anatis* have a collar constructed of the innermost egg shell, which is bent backwards. Those of *C. spinulosa* lack this collar, and are remarkably thick-walled. The eggs of *C. anseris* look like those of *C. spinulosa*, but are hollowed on the surface. The shape of the eggs of *C. droummondi* is not known.

Capillaria anatis (Schranck 1790).

(Fig. 17 a—i).

- Trichocephalus anatis* Schranck 1790, p. 119.
Capillaria tumida Zeder 1803, p. 61, pl. 1, figs. 8—9. (?)
Trichocephalus capillaris Rudolphi 1809, II, pars 1, p. 86.

- Trichosoma brevicolle Rudolphi 1819, p. 13, p. p.
nec Trichosoma brevicolle Mehlis 1831, p. 74, pl. 2, fig. 4 orig. (= *C. mergi*
nom. nov. (?))
- Trichosomum brevicolle Dujardin 1845, p. 21, p. p.
Trichosomum brevicolle Diesing 1851, II, p. 254-255, p. p.
Trichosoma brevicolle Baird 1853, p. 3.
nec Trichosoma brevicolle Eberth 1863, p. 58. (= *C. mergi* nom. nov.).
Trichosoma brevicolle v. Linstow 1878, p. 156.
Trichosoma brevicolle Stossich 1890, p. 15-16, p. p.
Trichosoma anatis Railliet 1895, p. 486.
nec Trichosoma brevicolle Muehling 1898, p. 49. (= *C. mergi* nom. nov. (?)).
Trichosoma brevicolle Kowalewski 1900, p. 184.
Trichosoma brevicolle Wolffhügel 1900, p. 10, 54, 58, 59. (?)
Trichosoma brevicolle Kowalewski 1901, p. 270-274, 284, figs. 1-7,
orig.
Trichosoma brevicolle v. Linstow 1909, p. 79, fig. 75, orig.?, p. p.
nec Trichosomum brevicolle Fiebiger 1912, p. 247-248, fig. 166. (= *C. anseris*
nom. nov. (?)).
- Capillaria anatis Travassos 1915, p. 147, 148, p. p.
Capillaria anatis Yorke & Maplestone 1926, p. 25, p. p.
Capillaria anatis Baylis 1929, p. 264, p. p.
Capillaria anatis Orosz 1931, p. 5, 17-19, 23, 24-25, 26, fig.
4 a-b, orig.
- Capillaria anatis Sprehn 1932, p. 767, p. p.
Capillaria anatis Freitas & Almeida 1935₂, p. 319-322, pl. 1,
fig. 2 & 5, non. orig., p. p.
- Capillaria anatis Neveu-Lemaire 1936, p. 1305-1306, p. p.
nec Capillaria anatis Gorschkow 1937, p. 195-196, fig. 6-8. (= *C.*
anseris nom. nov.).

Males: The length varies from 7,0 to 12,2 mm, average figure 9,7 mm. (Fig. 15). The spicule lengths rule from 1,22 to 1,83 mm, average figure 1,62 mm. (Fig. 16). The index length/spicule length 4,6-7,3, on an average 6,0. (Table 8).

The spicule is relatively broad, proximally somewhat inflated (17-22 μ). The shape of the proximal end of the spicule differs somewhat, but at any rate the top border is not bounded by a double contour. In cross section the spicule is flat triangular. It tapers against the tail end and terminates in a long cone which distally is blunt, however. (Fig. 17 a-f).

The spicule sheath is quite smooth. The tail is laterally furnished with two broad lobes. (Fig. 17 a-b, d).

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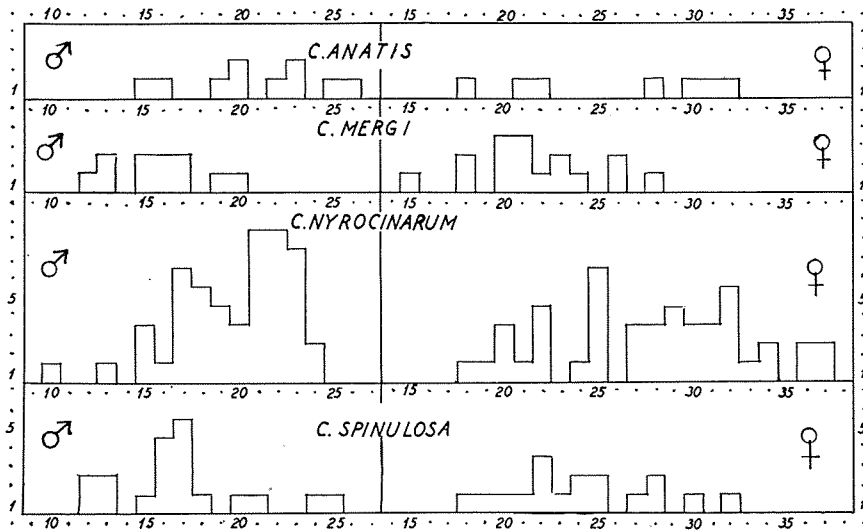


Fig. 15. Lengths of males and females, respectively of *Capillaria anatis*, *C. mergi*, *C. nyrocinarum* and *C. spinulosa*. — The measuring unit is 0,465 mm.

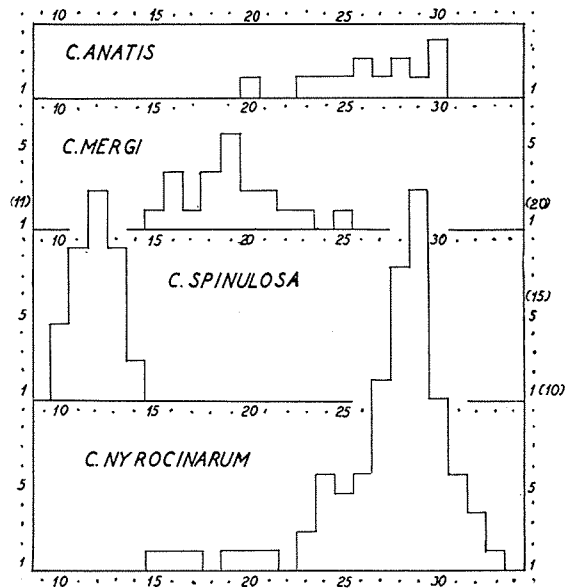


Fig. 16. Spicule lengths of *Capillaria anatis*, *C. mergi*, *C. spinulosa* and *C. nyrocinarum* respectively. — The measuring unit is 0,061 mm.

Females: The length varies from 8,4 to 14,9 mm, average figure being 12,1 mm. (Fig. 15). The index length/vulva distance (from front) 2,1—2,7, on an average 2,3. (Table 9). The length of the eggs 0,049—0,065 mm, the most frequent figure being 0,054 mm. (Table 10).

Table 8.

The index length/spicule length in species of Capillaria in lower digestive tract of species of Capillaria in ducks.

Index	C. anatis	C. mergi	C. nyrocinarum	C. spinulosum.
4,5	1	—	3	—
5,0	1	—	3	—
5,5	1	—	3	—
6,0	3	1	3	—
6,5	3	1	—	—
7,0	—	—	4	—
7,5	1	1	1	—
8,0	—	1	3	—
8,5	—	1	—	—
9,0	—	—	2	—
9,5	—	—	2	1
10,0	—	1	—	1
10,5	—	—	—	—
11,0	—	—	—	1
11,5	—	—	—	2
12,0	—	—	—	1
12,5	—	—	—	1
13,0	—	—	—	—
13,5	—	—	—	1
14,0	—	—	—	1
14,5	—	—	—	—
15,0	—	—	—	—
15,5	—	—	—	—
16,0	—	—	—	—
16,5	—	—	—	1
17,0	—	—	—	—

The vulva shows no special characteristics, being without appendages, and not projecting. (Fig. 17 i). The eggs are very characteristic. The innermost shell in the protruding plug bends to a collar, and furthermore the outermost shell appears undulated in optical section. The most common shape is shown in fig. 17 h, but the collar may be smaller, as seen in fig. 17 g. The tail end is bluntly rounded, the anus being subterminal.

Location in the host: coeca, and more sporadically in the small intestine.

Species of *Capillaria*

Host occurrence: *Anas querquedula*, *Anas crecca*, *Anas platyrhynchos*, *A. p. domestica* and *Fulica atra*. All hosts with the exception of the first and *A. p. dom.* are new.

In my material of hosts in which *C. anatis* according to our present

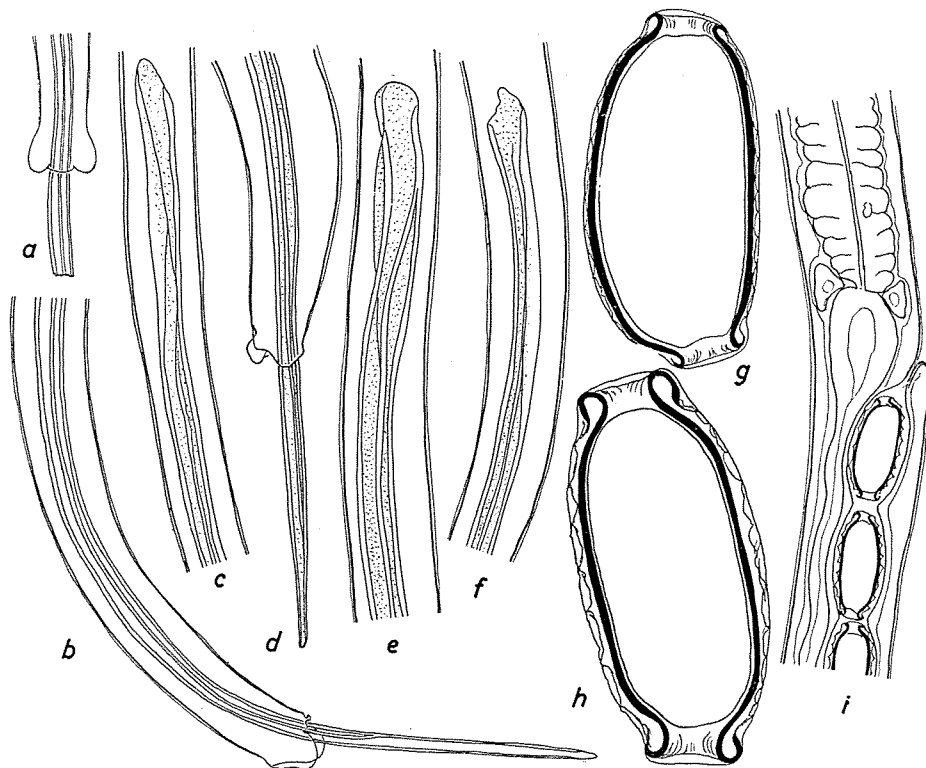


Fig. 17. a—i) *Capillaria anatis*.

a) tail end of male, dorsal view, b—c) tail end and proximal end of spicule, lateral view, d—e) the same of another specimen, laterodorsal view, f) proximal end of spicule of a third specimen, g—h) eggs (scale 5), i) vulva region, lateral view. — a—h) specimens from mallard, i) from coot.

knowledge was to be expected it is remarkably rare, only occurring in 4 per cent, 276 birds being investigated. Of these it has only been found in *Fulica atra* (4 per cent), *Anas platyrhynchos* (10 per cent) and *Anas crecca* (1 per cent). The following hosts have been investigated without result (number of investigated birds can be seen in Table 7): *Anas querquedula*, *Anas penelope*, *Spatula clypeata* and *Anas acuta*. Furthermore 12 coot chicks and 24 mallard ducklings were also searched in vain. The number of worms per host specimen was on an average 3—4, in *Anas crecca* it is only found once in one specimen.

Table 9.
Index length/vulva distance from front end in species of Capillaria in ducks and the upper digestive tract of pheasants.

Index	C. anatis	C. mergi	C. nyroci- narum	C. spinulosa	C. contorta
2,0	—	2	—	—	—
2,1	I	I	I	—	—
2,2	I	2	5	—	—
2,3	I	3	—	—	—
2,4	I	I	2	—	—
2,5	—	I	6	I	—
2,6	—	I	3	2	—
2,7	I	—	5	I	—
2,8	—	—	7	I	—
2,9	—	I	3	I	—
3,0	—	—	I	I	I
3,1	—	—	4	—	—
3,2	—	—	I	I	I
3,3	—	—	2	—	—
3,4	—	—	I	I	2
3,5	—	—	—	—	—
3,6	—	—	—	I	—
3,7	—	—	—	I	—
3,8	—	—	—	—	—
3,9	—	—	—	—	I
4,0	—	I	I	—	—
4,1	—	—	—	—	2
4,2	—	—	—	I	—
4,3	—	—	—	—	3
4,4	—	—	—	—	3
4,5	—	—	—	—	I
4,6	—	—	—	—	2
4,7	—	—	—	—	—
4,8	—	—	—	—	5
4,9	—	—	—	—	5
5,0	—	—	—	—	4
5,1	—	—	—	—	I
5,2	—	—	—	—	2
5,3	—	—	—	—	2
5,4	—	—	—	—	—
5,5	—	—	—	—	—
5,6	—	—	—	—	—
5,7	—	—	—	—	—
5,8	—	—	—	—	—
5,9	—	—	—	—	3

Species of Capillaria

Table 10.

Length of eggs in species of Capillaria in ducks and in the upper digestive tract of pheasants.

Measuring unit (2,7 μ)	<i>C. anatis</i>	<i>C. mergi</i>	<i>C. nyrocinarum</i>	<i>C. spinulosa</i>	<i>C. contorta</i>
15	—	2	—	—	—
16	—	9	—	—	—
17	—	36	—	4	1
18	8	39	—	21	6
19	14	11	—	42	27
20	29	3	10	19	34
21	15	—	22	10	26
22	12	—	35	—	13
23	4	—	21	—	1
24	1	—	8	—	—
25	—	—	2	—	—
Total number of measurements	83	100	88	96	108

My material of *C. anatis* consists of 39 worms. The percentage of males is 28.

When reviewing the literature, a remarkable fact is, as here, often met with during the study of species of *Capillaria*. The name being established in 1790, 111 years elapsed before a description of the species which was only to some degree exhaustive, should appear, viz. that by Kowalewski (1901), a fact so more remarkable, as *Capillaria anatis* is the type species of the genus *Capillaria*. With most of the characteristics given by him there is good agreement, especially the length of the spicule (1,78 mm), the size of the egg (0,048 mm, measured on his figure) and at best the shape of the egg with the wide plug, the short collar and the unevenness of the surface of the egg. Unfortunately he does not figure the entire spicule, the shape of which thus is unknown, especially concerning the important fact whether it is circular or triangular in cross section. The tip of the spicule in his figure is so blunt as I have never found it, but this character can vary considerably. On this point it is much like *C. anseris*, from which, on the other hand, it is separated by the shape of the eggs, whereas the spicule length is the same.

The other more comprehensive revision of *C. anatis*, that of Orosz 1931 has not been accessible to me, but after the extracts of his paper given by Freitas & Almeida it is probable that he has actually described *C. anatis*. The worms are a little larger than mine. (Males: 10,0—13,1 mm, Females:

16,0—26,4 mm), the spicule lengths are the same (1,3—1,8 mm), and the egg lengths are a little smaller (0,042—0,052 mm) altogether however differences of slight importance. I did not see any striation of the spicule sheath, whereas such a striation, although fine, is stated by both Kowalewski and Orosz. As shown for *C. longicollis* from gallinaceous birds this character may exhibit a considerable variation (see above p. 15).

The authors previous to Kowalewski have given only scattered information concerning the appearance of *C. anatis*. The first record, Schranck (1790) only mentions the host, viz. *Anas querquedula*. Concerning the next record (Zeder 1803), since Rudolphi (1809) generally considered as *C. anatis*; owing to the very incomplete description given, it is very doubtful whether it is really a *Capillaria*. In 1809, Rudolphi gives an insufficient description based on specimens from geese, sent to him under the name *Filaria anseris* from Nitzsch. As shown below I have used this name for a species described closely by Gorschkov (1937). Rudolphi (1809) thus gives no new information. Even Rudolphi (1819) has not studied the worms himself, but only cites his statements from 1809. In 1831 there finally appears a description and a figure of a worm, but found in *Clangula hyemalis* (Mehlis). After my own results concerning the occurrence of the species of *Capillaria* in different hosts it must be considered almost impossible, that it should actually be *C. anatis*. The figure given of the male tail with spicule protruding shows close agreement with *C. mergi* both in the shape of the tail and that part of the spicule which is figured as in the unarmoured spicule sheath. This species has been found in 3 species of *Nyrocinæ* (although I have not found it in *Clangula hyemalis* proper). Further Mehlis has later in the collection of the Wiener Museum found the same species in *Mergus serrator* (Diesing 1851). It therefore seems reasonable to me to reckon it synonymous with *C. mergi*. Dujardin (1845) cites the earlier authors, giving some measurements of specimens from geese, which according to the above mentioned should be referred to *C. anseris*. Besides the above cited, Diesing (1851) brings no new information. The same is the case with v. Linstow (1878), Stossich (1890) and Railliet (1895). These papers are mentioned owing to their comprehensive literature records. Muehling (1898) found a species of *Capillaria* in *Clangula hyemalis*, by von Linstow determined to *C. anatis*. They are also most likely *C. mergi*. Kowalewski (1900) gives a summary of his above cited paper from 1901. Wolffhügel (1900) mentions, without descriptions, the occurrence of *C. anatis* from *Otis tarda* and the domestic duck. In accordance with the accounts just made it will be conceived, that it is quite uncertain which species he has seen; v. Linstow (1909) figures the tail end of a species which may be *C. anatis*, but also cites several of the occurrences, which have above been shown to be problematic. Travassos (1915), Yorke and Maplestone (1926) Baylis (1929),

Species of *Capillaria*

Sprehn (1932) and Freitas & Almeida (1935₂) again only contain literature records on *C. anatis*. Besides these papers some more papers mention "*C. anatis*", besides the above mentioned (Schranck (1796), Eberth (1863) and Gorschkov (1937)) also Fiebiger (1912). His specimens, from geese reasonably can be referred to *C. anseris*. Possibly also Cobbold's (1867) species belongs here.

Capillaria anseris nom. nov.

(Fig. 18 a-c).

Linguatula trichocephala	Schranck 1796, p. 232 (?).
Trichocephalus capillaris	Rudolphi 1809, II, pars I, p. 86, p. p. (?).
Filaria anseris	Nitzsch in Rudolphi, 1809, II, pars I, p. 86 nomen nudum (?).
Trichosoma brevicolle	Rudolphi 1819, p. 13, p. p. (?).
Trichosomum brevicolle	Dujardin 1845, p. 21, p. p. (?).
Trichosomum brevicolle	Diesing 1851, II, p. 254-255, p. p. (?).
Trichosoma brevicolle	Baird 1853, p. 3 (?).
Trichosoma brevicolle	Cobbold 1861, p. 122 (?).
Trichosoma brevicolle	v. Linstow 1878, p. 151 (?).
Trichosoma brevicolle	Stossich 1890, p. 15-16, p. p. (?).
Trichosoma brevicolle	v. Linstow 1909, p. 79, p. p. (?).
Capillaria sp.	Wolffhügel 1911, p. 56 (?).
Trichosomum brevicolle	Fiebiger 1912, p. 247-248, fig. 166, orig. (?).
Capillaria anatis	Travassos 1915, p. 147, 148, p. p. (?).
Capillaria anatis	Yorke & Maplestone 1926, p. 24, p. p. (?).
Capillaria anatis	Baylis 1929, p. 264, p. p. (?).
Capillaria anatis	Sprehn 1932, p. 767, p. p. (?).
Capillaria anatis	Freitas & Almeida 1935 ₂ , p. 319-322, pl. 1, fig. 1 & 4, non orig. p. p. (?).
Capillaria anatis	Neveu-Lemaire 1936, p. 1305-1306, p. p. (?).
Capillaria anatis	Gorschkov 1937, p. 195-196, fig. 6-8.

Males: (10 measurements): Length 9,7-13,2 mm, on an average 11,6. Spicule length 1,45-1,99 mm, average figure being 1,66 mm. The index length/spicule length 6,3-8,3, on an average 7,3.

The spicule is cylindrical, rather narrow (about 0,010 mm). Proximally it is dilated, obliquely funnelshaped to a breadth of about 0,025 mm. It is strongly chitinized, with thick, double contoured walls. Distally it ends bluntly almost without tapering. The spicule sheath is rather long and finely transversely striated. (Fig. 18 a).

Females: (5 measurements) Length 14,5-17,0 mm, on an average 16,2

mm. The index length/vulva distance (from front) 2,7–3,1 mm, on an average 2,9. Egg lengths 0,052–0,060 mm, on an average 0,055 mm.

The vulva is a transverse slit, without appendages. The eggs have a short rather narrow plug, without collar of the innermost egg shell. This latter is furnished with point-shaped dimples. The tail end is rounded, obtuse. Anus subterminal (fig. 18 b–c).

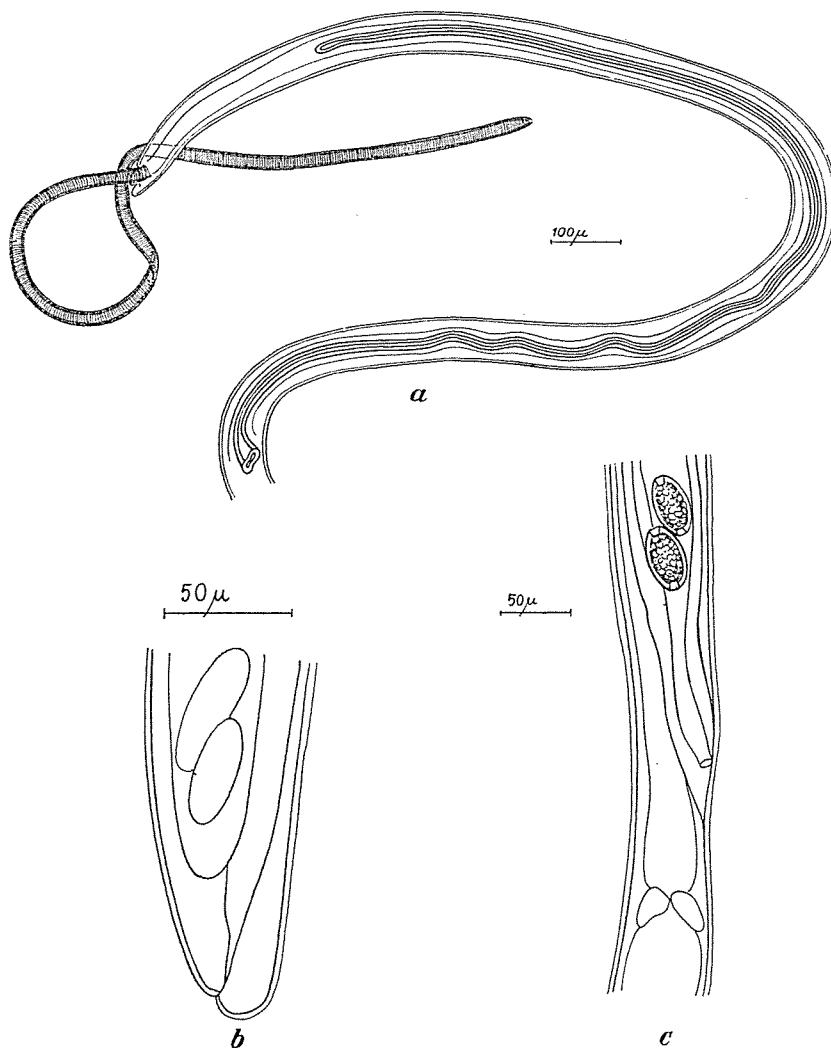


Fig. 18. a–c) *Capillaria anseris* (redrawn after Gorschkov 1937).
a) tail end of male, with the whole spicule, lateral view, b) tail tip of female, c) vulva region, lateral view. — All specimens from domestic goose.

Location in the host: Small intestine.

Host occurrence: Domestic goose. Doubtful host: *Nesothen sandvicensis* (Cobbold 1861). Gorschkov's collection consists of 77 worms, the percentage of males is 33, found in 26 birds. The percentage of occurrence is, since it is found five times, 19. The number of worms per host specimen infested is on an average 15, thus being rather high in comparison with the wild living species.

As pointed out above, this species is new and only described by Gorschkov (1937) from domestic goose. As in the literature several records of species of *Capillaria* in geese are all so fragmentary that they cannot with certainty be classified, I have preferred to cite them all as possible synonyms to the first case, in which a vacant name is specified. The first statement of a worm from goose (Schranck 1796), since Rudolphi (1809) commonly accepted as a *Capillaria*, after all does not refer to a species of *Capillaria*. Therefore the first safe member of the genus *Capillaria* found in goose is the *Filaria anseris*, sent to Rudolphi by Nitzsch (Rudolphi 1809). Dujardin (1845) mentions a few unimportant measurements of specimens from goose. Cobbold (1867) states "*C. brevicolle*" from *Nesothen sandvicensis*. Wolffhügel (1911) found female specimens of a *Capillaria* sp. the measurements of which (length 13.3; index length/vulva distance 2.7; eggs 0.043—0.050 mm) make it probable that it belongs here. Fiebiger (1912) figured as *C. anatis* a specimen from goose, which however hardly shows anything characteristic, besides that it can be seen on the figure that the vulva has no appendage. The egg figured is awkwardly drawn, but may agree with those of *C. anseris*, to which it has therefore been reckoned in this paper. All the other papers enumerated in the synonymy list give only literature records.

Capillaria mergi nom. nov.

(Fig. 19 a—g).

<i>Trichosoma brevicolle</i>	Mehlis 1831, p. 74, pl. 2, fig. 4 orig. (?)
<i>Trichosomum brevicolle</i>	Dujardin 1845, p. 21, p. p.
<i>Trichosomum brevicolle</i>	Diesing 1851, II, p. 254—255, p. p.
<i>Trichosoma brevicolle</i>	Eberth 1863, p. 58, pl. 6, fig. 12 & 17, orig.
<i>Trichosoma brevicolle</i>	v. Linstow 1878, p. 162—163.
<i>Trichosoma brevicolle</i>	Stossich 1890, p. 15—16, p. p.
<i>Trichosoma brevicolle</i>	Muehling 1898, p. 49 (?)
<i>Trichosoma brevicolle</i>	v. Linstow 1909, p. 79, p. p.
<i>Capillaria anatis</i>	Travassos 1915, p. 147, 148, p. p.
<i>Capillaria anatis</i>	Yorke and Maplestone 1926, p. 24, p. p.
<i>Capillaria anatis</i>	Sprehn 1932, p. 767, p. p.
<i>Capillaria anatis</i>	Freitas & Almeida 1935 ₂ , p. 319—322, pl. 1, fig. 3, pl. 2, fig. 6, non orig. p. p.

Males: Length 5,6—9,3 mm, average length 7,3 mm (fig. 15). Spicule length 0,92—1,53 mm, most frequent 1,16 mm (fig. 16). The index length/spicule length 6,0—10,0; average figure 7,8 (table 8).

The spicule is slender, about 0,01 mm broad, cylindrical, and does not taper until quite distally in a fairly blunt tip. Proximally it is dilated, mostly funnelshaped, with the walls of the funnel double contoured, and with a more or less protruding mass which most often is not double contoured (fig. 19 c), but which on the other hand with all transitions is connected with the structure which in its most complicated shape is seen in fig. 19 b. The dilation is somewhat compressed (fig. 19 a). The spicule sheath is finely transversely striated, and very thin. The tail has laterally two small lobes (fig. 19 d).

Females: Length 7,0—13,0 mm, most frequent 9,3 mm (fig. 15), the index length/vulva distance (from front end) 2,0—4,0, mean figure being 2,4. (Table 9). The egg lengths are 0,041—0,054 mm, most frequent 0,049 mm (table 10).

The vulva has a curved appendage which covers it like a cup (fig. 19 e—f). In the egg plugs the innermost egg shell is bent to a short collar. The outermost shell is furnished with small grains. (Fig. 19 g).

Location in the host: coeca and rectum, more rarely also in small intestine.

Host occurrence: *Mergus serrator*, *Mergus merganser*, *Somateria mollissima*, *Melanitta fusca*, *Bucephala clangula*, *Clangula hyemalis*. Of these *Somateria mollissima* and *Bucephala clangula* are at any rate new.

My collection consists of 62 worms. The percentage of males is 39.

In the material investigated by me, this species occurs with great frequency in its typical hosts, the fish ducks, viz. in 57 per cent, in *Mergus merganser* and *Mergus serrator* in 53 and 63 per cent respectively. In these species they occur in a number of 3—4 on an average per infested host specimen. In the other hosts only a single specimen has been found. In the marine diving ducks it also occurs although more rarely, in 5 to 7 per cent according as we reckon all examined diving ducks or the host species in which it is actually found. The diving ducks (besides the fish ducks) in which it is found are the following: *Somateria mollissima* (6 per cent), *Melanitta fusca* (6 per cent) and *Bucephala clangula* (8 per cent). Furthermore the following species have been examined: *Clangula hyemalis*, *Somateria spectabilis* and *Oidemia nigra*.

As already mentioned under *C. anatis* and as the list of synonymy shows, this species in several cases probably has been misjudged. The only quite sure reference is that of Eberth (1863). He figures the vulva region of a female, which has a characteristic appendage of the same shape as found by me, and also his statements in the text are in good agreement, e. g. concerning

the narrowness of the male tail, and the smooth (i. e. not spiny) spicule sheath. Furthermore he found it in *Mergus merganser*. Also the species found by Mehlis in *Mergus serrator* (Dujardin 1845, Diesing 1851) surely belongs here, and, as mentioned by C. anatis, the species found by Mehlis (1831) and Muehling (1898) in *Clangula hyemalis*, is probably also *C. mergi*. The other

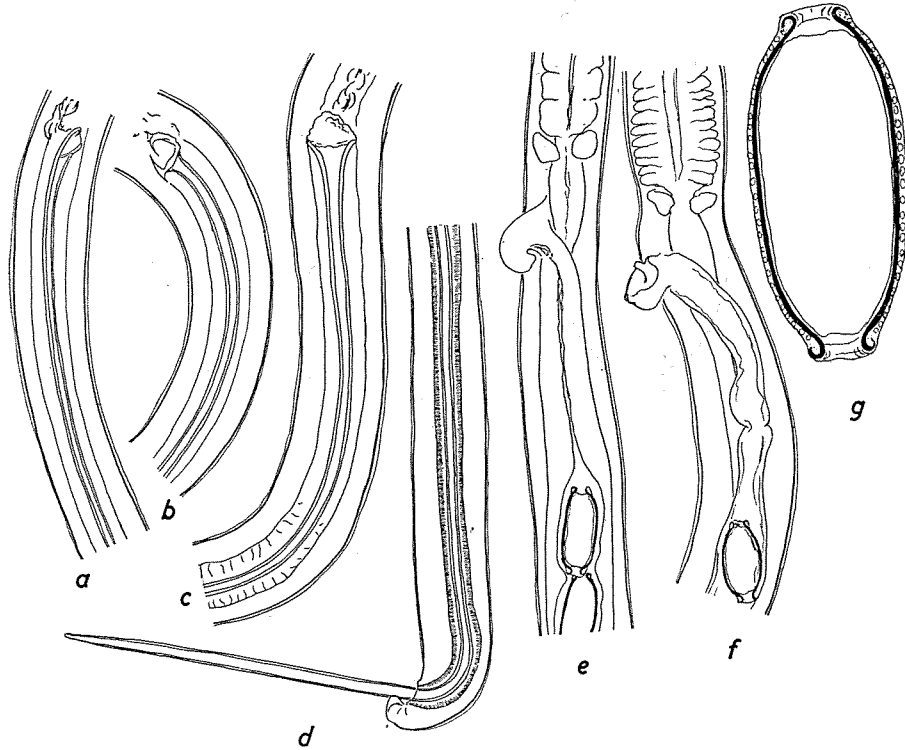


Fig. 19. a—g) *Capillaria mergi*.

a and d) proximal end of spicule and tail, b—c) proximal end of spicule of two other specimens, e—f) vulva region, ventrolateral view, two specimens, g) egg (scale 5). — a—b, d—e and g specimens from red-breasted merganser, f from goosander and c from eider duck.

papers only contain literature references, and thus should all be marked with pro parte, indicating that what they call *Trichosoma brevicolle* and *C. anatis* is partly *C. mergi*.

Capillaria nyrocinarum n. sp.

(Fig. 20 a—h, fig. 21 a—e).

Males: Length 4,7—11,6 mm, most frequently 10,2—10,7 (fig. 15). Spicule length 0,92—2,02 mm, most frequently 1,77 mm (fig. 16). The index length/spicule length 4,5—9,5, mean figure being 6,6 (table 8).

The spicule is flat triangular in cross section, about 0,020—0,025 mm broad tapering against both ends. Distally it ends in a sharp tip, proximally in a more or less irregular edge about 0,015—0,020 mm broad. It is very

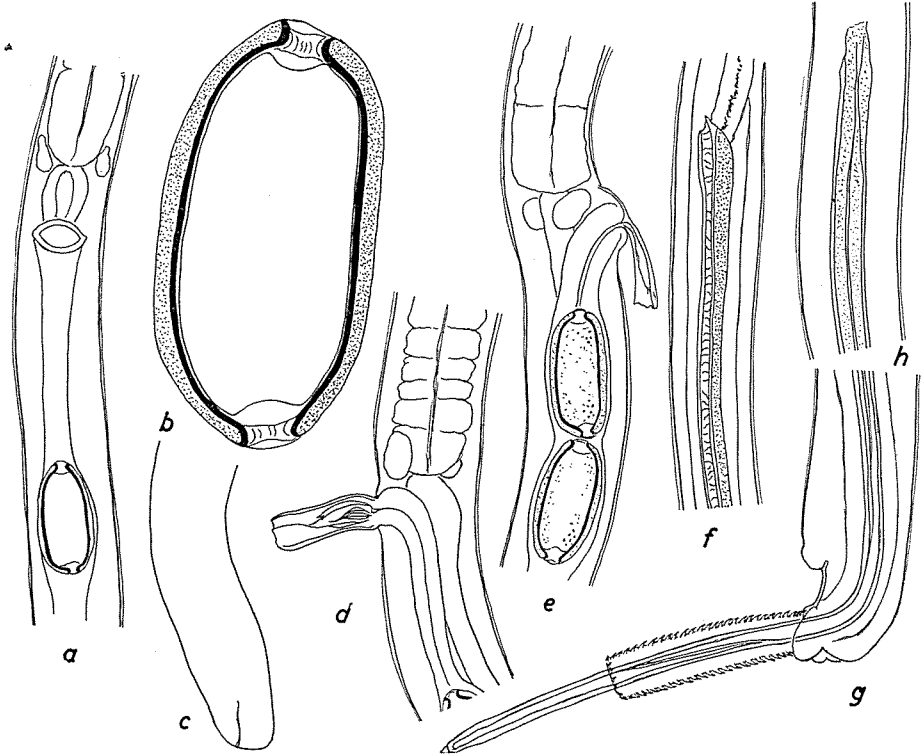


Fig. 20. a—h) *Capillaria nyrocinarum*.

a) vulva region, ventral view, b) egg (scale 5), c) female tail end, d—e) vulva region of two specimens, lateral view, f—g) proximal end of spicule and tail end, lateral view, h) proximal end of spicule, another specimen. — a and d specimens from eider ducks, the other from scaup ducks.

characteristic that one of the lateral edges of the spicule is proximally less chitinized than the two other edges, and therefore only has one contour. The spicule sheath is furnished with very coarse spines. The tail end has a great cloacal aperture, and laterally two well defined lobes (fig. 20 f—h, 21 a—e).

Females: Length 8,4—17,2 mm, most frequently 11,6 (fig. 5). The index length/vulva distance (from front) 2,1—4,0, most frequently 2,8 (table 9). The egg lengths are 0,054—0,068 mm, most frequently 0,059 (table 10).

The vulva region has an appendage of a somewhat varying appearance (possibly owing to its fragility in the outer parts). Most often it is seen like fig. 20 e, but in a few cases a picture as fig. 20 d appeared. The vulva aperture

Species of *Capillaria*

proper is mainly elliptical, as in fig. 20 a. In the narrow plug of the eggs, the innermost shell only has an indication of a bend. The outer shell is very thick (fig. 20 b).

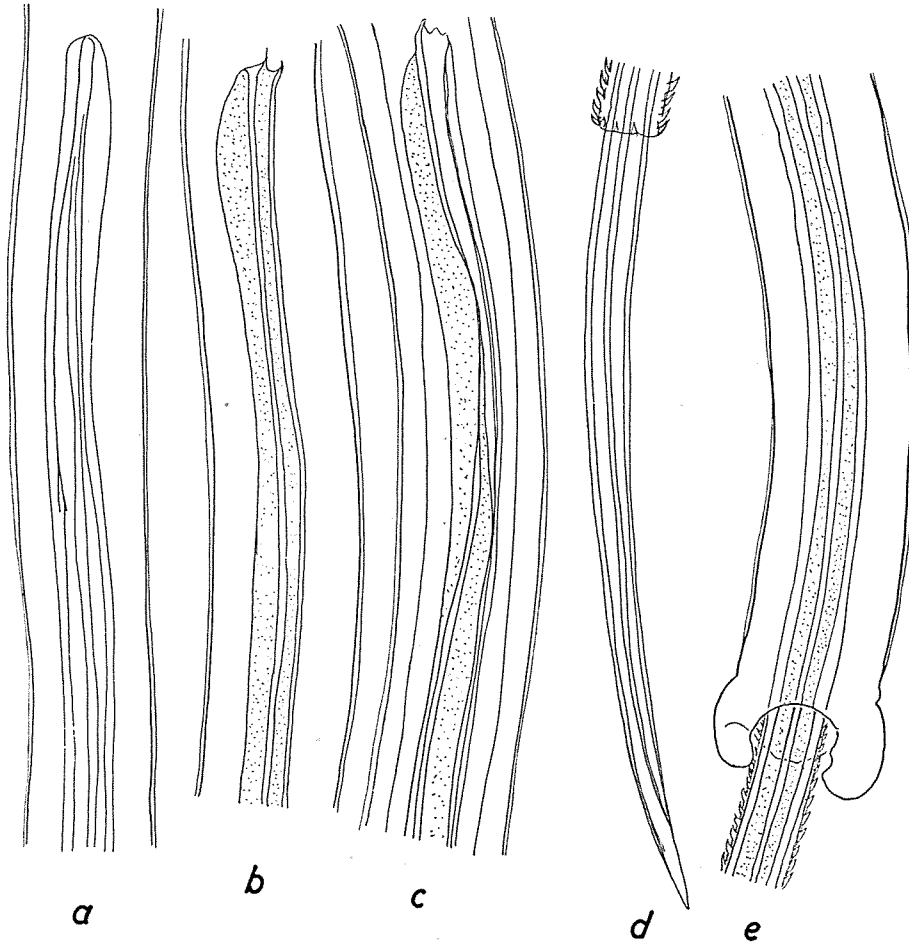


Fig. 21. a—e) *Capillaria nyrocinarum*.

a—c) proximal end of spicule of three specimens, d) spicule tip, e) male tail, ventral view. —
a—b specimens from eider duck, c—e from scaup duck.

Location in the host: coeca and rectum; also frequent in the small intestine, especially the jejunum.

Host occurrence: *Nyroca marila*, *Somateria mollissima*, *Somateria spectabilis*, *Melanitta fusca*, *Oidemia nigra*, *Clangula hyemalis*, *Bucephala clangula*, and *Nyroca fuligula*.

My collection consists of 390 worms. The percentage of males is 44.

This species has only been found in diving ducks, in 28 per cent (132 investigated). The frequency is very different in the different groups and species. *C. nyrocinarum* is more common in marine diving ducks, being found in 45 per cent, than in freshwater diving ducks, in which it occurs in 14 per cent. In the species, in which it occurs it is most common in *Somateria mollissima*, in 67 per cent, most rare in *Nyroca fuligula*, in 8 per cent. Further it has been found in the following hosts (percentage in round brackets): *Nyroca marila* (29), *Melanitta fusca* (29), *Clangula hyemalis* (20), *Bucephala clangula* (16), *Somateria spectabilis* (1 specimen investigated), *Oidemia nigra* (50). Furthermore *Nyroca ferina* has been searched in vain as yet.

The average number of worms per infested host specimen varies considerably. The greatest number is found in eider ducks, viz. 29, in which it also is most frequent. With the exception of *Clangula hyemalis* which has astonishingly few parasites, the other marine diving ducks also present a fairly great number. Although *C. nyrocinarum* is found in 20 per cent of the long-tailed ducks, the number per host specimen is only 1.5. In the other marine species the corresponding numbers are 2—8 (see also table 7).

Capillaria spinulosa (v. Linstow 1890).

(Fig. 22, a—h).

<i>Trichosoma spinulosa</i>	v. Linstow 1890, p. 185.
<i>Capillaria spinulosa</i>	Travassos 1915, p. 156.
<i>Capillaria spinulosa</i>	Yorke and Maplestone 1925, p. 27.
<i>Capillaria spinulosa</i>	Sprehn 1932, p. 779.

Males: Length 5,6—11,6 mm, most frequent 7,9 mm (fig. 15). Spicule lengths are 0,61—1,04 mm, most frequent 0,73 mm (fig. 16). The index length/spicule length varies from 9,5 to 16,5 on an average 12,2 (table 8).

The spicule is flat triangular in cross section, about 0,020 mm, where it is broadest. Quite proximally it is a little dilated. All 3 edges are mostly strongly chitinized and are therefore double contoured. Distally the spicule ends in a tip which is mostly rather sharp, but may be more obtuse. The spicule sheath is furnished with rather small but distinct spines. The tail end has a rather small cloacal aperture and laterally minor lobes (fig. 22 a—d, f, g).

Females: Length 8,4—14,9 mm, most frequent between 10,2 and 11,6 mm (fig. 15). The index length/vulva distance (from front) 2,5—4,2, on an average 3,1 (table 9). Egg lengths are 0,046—0,057 mm, most frequent 0,051 mm (table 10).

Species of Capillaria

The vulva shows no special characteristics being devoid of appendages (fig. 22 e). In the narrow plug of the eggs the innermost shell bends to a minute collar. The outer egg shell is very thick (fig. 22 g).

Location in the host: coeca, rarely in the small intestine.

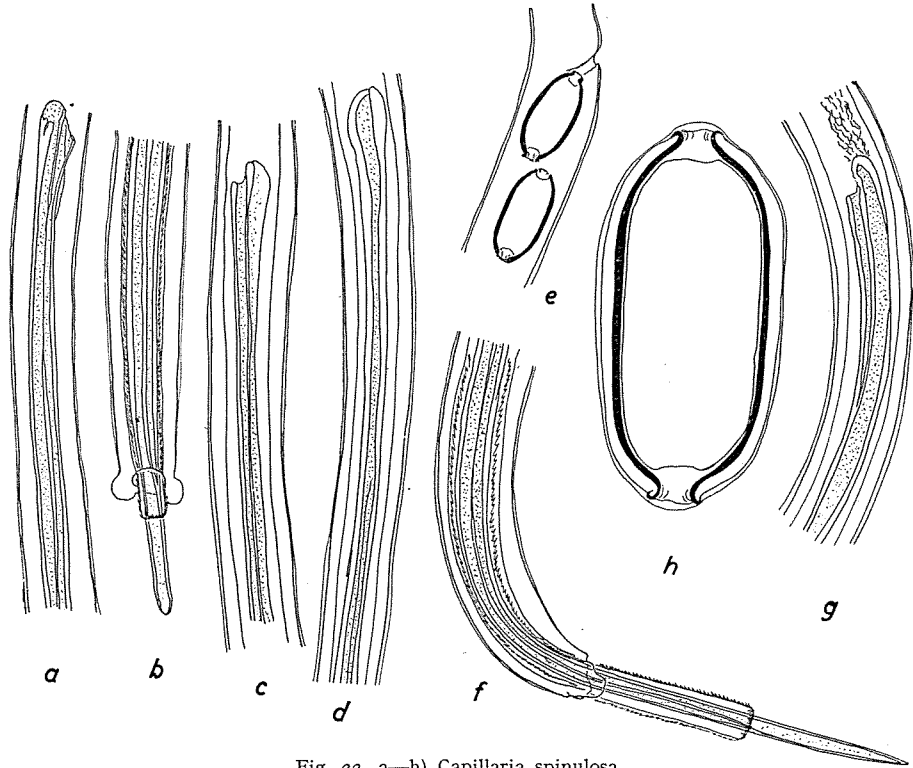


Fig. 22. a—h) *Capillaria spinulosa*.

a—b) proximal end of spicule and tail end, ventral view, c—d) proximal end of spicule of two other specimens, e) vulva region, lateral view, f—g) tail end and proximal end of spicule of a fourth specimen, lateral view h), egg (scale 5). — All specimens from mallard.

Host occurrence: *Anas querquedula*, *Anas penelope*, *Anas platyrhynchos*, *Spatula clypeata*, *Nyroca fuligula*, *Nyroca marila*, *Nyroca ferina* and *Bucephala clangula*. All these host records are new, with the exception of *Nyroca ferina*.

My collection consists of 151 worms. The percentage of males is 36.

This species has in the present collection only been found in river and pond ducks and fresh water diving ducks, and in one species it was present with the greatest frequency found by me in species of *Capillaria*, viz. 81 per cent in 26 investigated *Nyroca fuligula*. It is however more frequent in

the diving ducks (40 per cent) than in the river and pond ducks (8 per cent). It is very remarkable that the species has not at all been found in *Anas crecca* although 95 specimens have been examined. In river and pond ducks *C. spinulosa* is most frequent in *Spatula clypeata* (33 per cent). The occurrences in the other ducks are as follows: *Nyroca marila* (50), *Bucephala clangula* (4), *Nyroca ferina* (14), *Anas querquedula* (22), *Anas platyrhynchos* (12), *Anas penelope* (6). Besides *Anas crecca* also *Anas acuta* has been searched in vain.

The greatest number per host specimen we also find in the diving ducks, viz. 5 worms. The corresponding figure in river and pond ducks is 2.

This species has till now only been found by its describer. Curiously enough he does not mention it in his contribution (1909) to "Süsswasserfauna Deutschlands", although it is described from *Nyroca ferina*. The description is given without figures, and somewhat fragmentary concerning the most important features. Though especially the length of the spicule (0,94 mm) and its relative length (the index length/spicule length 9,8) is quite identical with my measurements. The eggs are thick-shelled but, the only one measured, 0,062 mm long (my largest being 0,057 mm). In the case of the vulva position there is a discrepancy, since the index length/vulva distance (from front) is about 1,2 against that of my specimens of about 3.

The distribution of the species of *Capillaria* in the different hosts show remarkable differences which to some degree are in accordance with the feeding habits of the host. The occurrence of e. g. *C. mergi* seems to point towards the possibility of a transitional host. These problems will be treated in more detail in a later paper.

A REVISED LIST OF SPECIES OF CAPILLARIA IN BIRDS

In the following list all species of *Capillaria* in birds are enumerated alfabetically, both good species, inadequately described species, nomina nuda and names referring to species now having another name. In the list is found a few new species and emendations besides those treated in the earlier part of my paper, due to the fact that with our present knowledge of species of *Capillaria*, we can better judge also the more incomplete descriptions in the literature. A fairly great number of species are now well characterized, with all the systematically important features known, notably of those described more recently. Not few are described, though, it is true, incompletely, in such a manner that when material from the same host is reinvestigated they can easily be recognized. This is especially the case with a number of Dujardin's descriptions. A small number of descriptions, notably some of v. Linstows are so inadequately characterized, that a later identification will be rather arbitrary. Finally there is a not quite small number of no-

Species of Capillaria

Table II.

Principal characters of species of Capillaria in the lower digestive tract of ducks.

	C. anatis	C. anseris	C. droum- mondi	C. mergi	C. nyrocina- rum	C. spinulosa
Length of male (in mm)	7,0—13,1	9,7—13,2	—	5,6—9,3	4,7—11,6 (10,2—10,7) ¹⁾	5,6—11,6 (7,9)
Length of female (in mm).	8,4—26,4	14,7—17,0	8—9	7,0—13,0 (9,3)	8,4—17,2 (11,6)	8,4—14,9 (10,2—11,6)
Length of spicule (in mm).	1,22—1,83	1,45—1,99	0,86	0,92—1,53 (1,16)	0,92—2,02 (1,77)	0,61—1,04 (0,73)
Length of eggs (in mm)	0,042—0,065 (0,054)	0,052—0,060	0,048—0,052	0,041—0,054 (0,049)	0,054—0,068 (0,059)	0,046—0,062 (0,051)
Shape of spicule in cross section.	△	○	○	○	△	△
Appearance of spicule sheath.	smooth to finely striated.	transversely striated	smooth	transversely striated.	coarsly spiny	spiny
Vulva with or Without appendage.	÷	÷	÷	+	+	÷

¹⁾ The figures in round brackets indicate the most frequent figures.

mina nuda, which can be used if material from the hosts in question is present.

In the table 12 (p. 96) enumerating the characters which in the present investigation have proved to be of special importance in taxonomical respect it can at once be seen whether a definite species has been thoroughly described. In this table I have only omitted nomina nuda and a few species which are practically nomina nuda. At last a complete host list is presented. In the future a number of the species enumerated in the list will probably appear to be synonymous. But owing to the inadequate descriptions to hand it seems most practical at present to keep them separated until new material from the hosts in question can be investigated. So the description of Dujardin's *C. dispar* presents nothing which with certainty can separate it from *C. contorta*. The same holds good of a number of species from the intestines of

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birds of prey and owls. The two species *C. falconum* and *C. falconis-nisi* are described at different times and descriptions are for the first species only given for females, for the last only for males. Nor do the descriptions of *C. tenuissima*, notably from owls, give safe characters distinguishing it from *C. falconum*, as is also the case with *C. striata* from *Accipiter nisus* and *C. parilis* from *Bubo bubo*. The species from woodpeckers, *C. longistriata*, which is well described, *C. picorum* and *C. leidyella* require investigations of at any rate European material before a safe distinction can be made.

From thrushes a number of species is enumerated, viz. *C. inflexa*, which is quite inadequately described, *C. similis* and *C. exilis*, which are described in such a manner, that they can be recognized when found again. This is also the case with Eberth's *C. exilis* which undoubtedly is another species than Dujardin's and therefore in the present paper is listed as *C. rasilis* nom. nov.

The rather great number of new species which I have found in the literature, viz. *C. mergi*, *C. anseris*, *C. obsignata* and *C. rasilis* together with the earlier sure cases of several species of *Capillaria* in one host species indicate that such occurrence is more frequent than generally known and caution should be made as to uniting species while found only in the same host. On the other hand, each species of *Capillaria* is also to a greater extent than expected beforehand able to live in a considerable number of hosts, more determined by the habits of the hosts than by their relationships.

Capillaria sp. Wolffhügel 1911, p. 56 =
Capillaria anseris nom. nov. (?).

Capillaria sp. Freitas & Almeida 1935.

Capillaria sp. Freitas & Almeida 1935, 141, pl. 6, fig. 45-47.
In the esophagus of *Anas bahamensis*.

Capillaria alaudae (Rud. 1819).

<i>Trichosoma alaudae</i>	Rudolphi 1819, p. 15.
<i>Trichosomum alaudae</i>	Diesing 1851, II, p. 261.
<i>Trichosoma alaudae</i>	v. Linstow 1878, p. 85.
<i>Trichosoma longevaginatam</i>	v. Linstow 1879, p. 335.
<i>Trichosoma longevaginatam</i>	v. Linstow 1889, p. 33.
<i>Trichosoma alaudae</i>	v. Linstow 1889, p. 33.
<i>Trichosoma alaudae</i>	Stossich 1890, p. 27.
<i>Trichosoma longevaginatam</i>	Stossich 1890, p. 13-14.
<i>Capillaria longevaginata</i>	Travassos 1915, p. 152.

Species of *Capillaria*

- Capillaria longevaginata* Yorke & Maplestone 1926, p. 26.
Capillaria longevaginata Sprehn 1932, p. 774.
 In the large intestine of *Alauda arvensis*.

Capillaria anatis (Schranck 1790).

For synonymy etc. see the earlier part of this paper, p. 49.

Capillaria angusta (Duj. 1845).

- Trichosomum angustum* Dujardin 1845, p. 16.
Trichosomum angustum Diesing 1851, II, p. 253—254, p. P.
Trichosoma angustum v. Linstow 1878, p. 83.
Trichosoma angustum Stossich 1890, p. 9.
Capillaria angusta Travassos 1915, p. 150.
Capillaria angusta Yorke & Maplestone 1926, p. 25.
Capillaria angusta Sprehn 1932, p. 768.
 In the intestines of *Fringilla coelebs*.

Capillaria annulata (Molin 1858).

- Trichosomum annulatum* Molin 1858, p. 156.
Trichosomum annulatum Molin 1861, p. 320—321, pl. 15, figs. 1—2,
 orig. p. p.
Trichosomum annulatum Diesing 1861₁, p. 692.
Trichosomum annulatum Diesing 1861₂, p. 280.
Trichosoma annulatum v. Linstow 1878, p. 123.
Trichosoma longecolle Stossich 1890, p. 15, p. p.
Trichosoma annulatum Railliet 1893, p. 489.
Trichosomum strumosum Reibisch 1893, p. 331—340, pl. XIII, figs.
 1—7, orig.
Trichosoma annulatum Hassall 1896, p. 6.
Trichosoma delicatissimum Perroncito & Tomiolo 1900, p. 68.
Trichosoma delicatissimum Perroncito 1901, p. 494—497, fig. 215 a—c,
 216 a—f, orig.
Trichosoma annulatum Perroncito 1901, p. 497, 500.
Trichosoma delicatissimum Barile 1912, p. 126—127, 132.
Trichosoma strumosum Ciurea 1914, p. 49—55, pl. 5, figs. 1—2, orig.
Capillaria longicollis Travassos 1915, p. 148, p. p.
Capillaria strumosa Travassos 1915, p. 156.
Capillaria strumosa Wharton 1919, p. 25, 27.
Capillaria annulata Cram 1925, p. 113.

- Capillaria strumosa* Yorke & Maplestone 1926, p. 27.
Capillaria annulata Cram 1926, p. 46.
Thominx annulata Tubangui 1927, p. 37—39, figs. 20 A—D, orig. (?).
Capillaria annulata Cram 1927, p. 70.
Capillaria annulata Baylis 1929, p. 264.
Eucoleus strumosa Wassilkowa & Gouschanskaja 1930, p. 621—623.
Capillaria annulata Beaudette & Hudson 1930, p. 562.
Capillaria annulata Hamilton 1931, p. 865.
Capillaria annulata Orozz 1932.
Capillaria annulata Sprehn 1932, p. 768, fig. 361, orig.
Capillaria annulata Adams & Geiser 1933, p. 256—257.
Capillaria annulata Cram 1935, p. 61—62.
Capillaria annulata Graham 1935, p. 62.
Capillaria annulata Freitas & Almeida 1935₁, p. 130—133, pl. 1, fig. 1—5, orig.
Capillaria annulata Cram 1936, p. 4—7, fig. 1, non orig.
Capillaria annulata Neveu-Lemaire 1936, p. 1311—1312, fig. 678, non orig.

In the oesophagus of *Bonasa umbellus*, *Chrysolophus pictus*, *Colinus virginianus*, *Gallus gallus*, *Lyrurus tetrrix*, *Meleagris gallopavo*, *Numida* sp., *Perdix perdix*, *Phasianus colchicus*, *Syrmaticus reevesi* and *Tetrao urogallus*.

Capillaria anseris nom. nov.

For synonymy etc. see p. 57 in the present paper.

Capillaria appendiculata Freitas 1933.

- Capillaria appendiculata* Freitas 1933₁, p. 1195—1196, figs. 5—6, orig.
 In the large intestine of *Phalacrocorax olivaceus*.

Capillaria aramidesi Freitas & Almeida 1933.

No literature has been accessible. In *Aramides* sp.

Capillaria avellari Freitas & Almeida 1935.

- Capillaria avellari* Freitas and Almeida 1935₁, p. 141, pl. 6, figs. 41—44, orig.
 In oesophagus of *Mycteria americana*.

Capillaria blomei Travassos 1914 =
Capillaria longicollis (Mehlis 1831).

Species of *Capillaria*

Capillaria brasiliiana Freitas 1933.

Capillaria brasiliiana Freitas 1933¹, p. 1196—1197.

In small intestine of *Nycticorax nycticorax*.

Capillaria brevicollis (Eberth 1863) =
Capillaria mergi nom. nov.

Capillaria brevicollis (Rud. 1819) =
Capillaria anatis (Schranck 1790).

Capillaria brevicollis (Mehlis 1831) =
Capillaria mergi nom. nov. (?)

Capillaria brevis (v. Linstow 1877).

Trichosoma breve v. Linstow 1877, p. 178.
Trichosoma breve v. Linstow 1878, p. 130.
Trichosoma breve Stossich 1890, p. 27.
Capillaria brevis Travassos 1915, p. 157.
Capillaria brevis Yorke & Maplestone 1926, p. 25.
Capillaria brevis Sprehn 1932, p. 769.

In the intestines of *Tringa erythropus*.

Capillaria bursata Freitas & Almeida 1934

Capillaria longicollis (Mehlis 1831) p. p. (?).
Capillaria bursata Freitas & Almeida 1934, p. 273—286, pl. III—IV.
Capillaria bursata Freitas & Almeida 1935², p. 328, pl. 7, figs. 34—35, orig.
Capillaria bursata Neveu-Lemaire 1936, p. 1317.

See also p. 21 and table 3.

In small intestine of fowl.

Capillaria cadovulvata n. sp.

See above p. 29.

Capillaria cairinae Freitas & Almeida 1935.

Capillaria cairinae Freitas & Almeida 1935³, p. 139—141, 1 fig. orig.
Capillaria cairinae Freitas & Almeida 1935², p. 340, pl. 8, fig. 42, pl. 9, fig. 43—46, non orig.

In oesophagus of *Cairina moschata* dom.

Capillaria capillaris (Rud. 1809) =
Capillaria anatis (Schrank 1790).

Capillaria caprimulgi (Rud. 1819) nom. nud.

<i>Trichosoma caprimulgi</i>	Rudolphi 1819, p. 15.
<i>Trichosomum caprimulgi</i>	Diesing 1851, II, p. 262.
<i>Trichosoma caprimulgi</i>	v. Linstow 1878, p. 77.
<i>Trichosoma caprimulgi</i>	Stossich 1890, p. 27.
<i>Capillaria caprimulgi</i>	Travassos 1915, p. 158.
<i>Capillaria caprimulgi</i>	Yorke & Maplestone 1926, p. 25.

In the intestines of *Caprimulgus europaeus*.

Capillaria carbonis (Rud. 1819).

<i>Trichosoma carbonis</i>	Rudolphi 1819, p. 16.
<i>Trichosomum carbonis</i>	Diesing 1851, p. 262.
<i>Trichosoma carbonis</i>	v. Linstow 1878, p. 164.
<i>Trichosoma carbonis</i>	Stossich 1890, p. 27.
<i>Trichosoma carbonis</i>	Solowiow 1912, p. 109—110.
<i>Capillaria carbonis</i>	Travassos 1915, p. 158.
<i>Capillaria carbonis</i>	Skrjabin 1916, p. 554.
<i>Capillaria carbonis</i>	Yorke & Maplestone 1926, p. 25.
<i>Capillaria carbonis</i>	Sprehn 1932, p. 769.

In the intestines of *Phalacrocorax carbo*. Very incompletely described.

Capillaria caudinflatum (Molin 1858) =
Capillaria longicollis (Mehlis 1831).

Capillaria charadrii (Rud. 1819) nom. nud.

<i>Trichosoma charadrii</i>	Rudolphi 1819, p. 16.
<i>Trichosomum charadrii</i>	Diesing 1851, p. 262.
<i>Trichosoma charadrii</i>	v. Linstow 1878, p. 132.
<i>Trichosoma charadrii</i>	Stossich 1890, p. 27.
<i>Capillaria charadrii</i>	Travassos 1915, p. 158—159.
<i>Capillaria charadrii</i>	Yorke & Maplestone 1926, p. 25.
<i>Capillaria charadrii</i>	Sprehn 1932, p. 769.
<i>Capillaria charadrii</i>	Cram 1936, p. 19.

In the ventriculus of *Charadrius dubius curonicus* and *Himantopus himantopus*.

Species of *Capillaria*

Capillaria chrysotidis (Walter 1866).

- Trichosoma chrysotidis Walter 1866, p. 28.
Trichosoma chrysotidis Stossich 1890, p. 28.
Capillaria chrysotidis Travassos 1915, p. 157.
Capillaria chrysotidis Yorke & Maplestone 1926, p. 25.

In the stomach of *Amazona amazonica*.

Capillaria collaris (v. Linstow 1873).

For synonymy etc. see above p. 31.

- Capillaria Columbae* auctorium noviorum (nec. *C. columbae* Rud. 1819) =
Capillaria dujardini Travassos 1915.

Capillaria columbae (Rud. 1819).

This is probably a separate species. For particulars see *C. dujardini*,
p. 22-25.

- Capillaria columbae* Graybill 1924 =
Capillaria obsignata nom. nov.

Capillaria confusa Freitas & Almeida 1935.

- Capillaria confusa* Freitas & Almeida 1935¹, p. 139, pl. 3, figs.
22-23, pl. 4, figs. 24-25, orig.

In the oesophagus of *Aramides cajanea*.

Capillaria contorta (Creplin 1839).

For synonymy etc. see above p. 38.

Capillaria convoluta (Fourment 1885)

Original literature not acces-
sible.

- Trichosoma convolutum Stossich 1890, p. 17.
Capillaria convoluta Travassos 1915, p. 152.
Capillaria convoluta Yorke & Maplestone 1926, p. 25.

In the intestine of *Macronectes giganteus*.

Capillaria corvicola (Wassilkowa & Gouchanskaja 1930).

- Eucoleus corvicola* Wassilkowa & Gouchanskaja 1930, p. 619
-620.
Capillaria corvicola Baylis 1931, p. 542.
Capillaria corvicola Freitas & Almeida 1935¹, p. 137.
Capillaria corvicola Cram 1936, p. 19-20.

In the oesophagus of *Corvus corone cornix*, *Pica pica* and *Garrulus glandarius*.

Capillaria corvorum (Rud. 1819) nom. nud.

Trichosoma corvorum	Rudolphi 1819, p. 15, 223.
Trichosomum resectum	Diesing 1851, II, p. 254, p. p.
Capillaria corvorum	Travassos 1915, p. 159.
Capillaria corvorum	Yorke & Maplestone 1926, p. 25.
Capillaria corvorum	Sprehn 1932, p. 770.

In the intestine of *Coloeus monedula*, *Nucifraga caryocatactes* and *Pica pica*.

Capillaria crypturi (Rud. 1819).

Trichosoma crypturi	Rudolphi 1819, p. 636—637.
Trichosomum crypturi	Diesing 1851, II, p. 262.
Trichosoma crypturi	v. Linstow 1878, p. 125.
Trichosoma crypturi	Stossich 1890, p. 28.
Capillaria crypturi	Travassos 1915, 159.
Capillaria crypturi	Yorke & Maplestone 1926, p. 25.

It seems unfortunate to me that Freitas (1934) has not identified his new species *C. rudolphi* from the intestine of *Tinamus solitarius* with this species since *C. crypturi* has been quite inadequately described and a new name therefore was unnecessary. It has been found in the intestine of *Tinamus tao*.

Capillaria curvicauda (Duj. 1845).

Trichosomum curvicaudum	Dujardin 1845, p. 16.
Trichosomum curvicaudum	Diesing 1851, II, p. 253, p. p.
Trichosoma curvicauda	v. Linstow 1878, p. 78.
Trichosoma curvicauda	Stossich 1890, p. 10.
Capillaria curvicauda	Travassos 1915, p. 150.
Capillaria curvicauda	Yorke & Maplestone 1926, p. 25.
Capillaria curvicauda	Sprehn 1932, p. 770.

In the intestines of *Hirundo rustica* and *Apus apus*.

Capillaria cylindrica (Eberth 1863).

Trichosomum cylindricum	Eberth 1863, p. 60, pl. 6, fig. 13, orig.
Trichosoma cylindricum	v. Linstow 1878, p. 112.
Trichosoma cylindricum	Stossich 1890, p. 28.
Capillaria cylindrica	Travassos 1915, p. 157.
Capillaria cylindrica	Freitas & Almeida 1935, p. 134, pl. 5, fig. 3, non orig.
Capillaria cylindrica	Cram 1936, p. 20, fig. 7, non orig.

Species of *Capillaria*

- Capillaria cylindrica* Yorke & Maplestone 1926, p. 25.
Capillaria cylindrica Sprehn 1932, p. 771.

In the oesophagus of *Buteo buteo*.

Capillaria delicatissimum (Perroncito & Tomiolo 1899) =
Capillaria annulata (Molin 1858).

Capillaria dispar (Duj. 1845).

- Trichosomum contortum* Dujardin 1843, p. 335, pl. 14, fig. C. 1-2,
 orig. nec Creplin 1839. p. p.
Trichosomum dispar Dujardin 1845, p. 13, pl. 2 A, fig. 1-4¹⁾, orig.
 part.
Trichosomum dispar Diesing 1851, II, p. 261.
Trichosoma dispar Eberth 1863, p. 60, pl. 7, figs. 4 & 17, orig.
Trichosoma dispar v. Linstow 1878, p. 117.
Trichosoma dispar Stossich 1890, p. 20.
Capillaria dispar Travassos 1915, p. 155.
Capillaria dispar Yorke & Maplestone 1926, p. 25.
Capillaria dispar Brüll 1932, p. 293-294, 2 figs. orig.(?)
Capillaria dispar Sprehn 1932, p. 771.
Capillaria dispar Freitas & Almeida 1935¹, p. 129-130, pl. 3,
 fig. 21, non orig.
Capillaria dispar Cram 1936, p. 20-21, fig. 9, non orig.

In the oesophagus of *Buteo buteo*, *Falco subbuteo* and (?) *Falco peregrinus*.

Possibly Dujardins species is *C. contortum*, whereas Eberths seems to be distinct (see above p. 67).

Capillaria droummondi Travassos 1915.

- Capillaria droummondi* Travassos 1915, p. 161, pl. 25, fig. 8, orig.
Capillaria droummondi Yorke & Maplestone 1926, p. 25.

In the intestines of *Cygnus melanocoriphus*.

Capillaria dujardini Travassos 1915

For synonymy etc. see above p. 22.

Capillaria dubia (Kowalewski 1894) =

Capillaria collaris (v. Linstow 1873).

¹⁾ On pl. 2 the numbering of the figures is not quite correct. The following figures should be corrected: B = F, C₁-C₅ = E₁-E₅, D₁ = B₁, D₂ = D₁, D₃ = D₂, D₄ = B₂, D₅ = B₃, D₆ = B₄, D₇ = B₄, E = C, F₁ = D₃.

Capillaria dubia Travassos 1917.

- Capillaria dubia* Travassos 1917, p. 149, nec *Trichosoma dubia*
Kowalewski 1894
Capillaria dubia Yorke & Maplestone 1926, p. 25.
Capillaria dubia Freitas & Almeida 1935, p. 135—136, pl. 1,
fig. 7, pl. 2, figs. 6, 8 & 9, orig.

In the oesophagus of *Lathria cinerea*.

Capillaria exilis (Duj. 1845).

- Trichosomum exile* Dujardin 1845, p. 15, nec *Liniscus exilis*
Duj. 1845, p. 29.
Trochosomum exile Diesing 1851, II, p. 253.
nec *Trichosomum exile* Eberth 1863, p. 57, pl. 7, fig. 7. (= *C. rasilis*
n. nom.).
Trichosoma exile v. Linstow 1878, p. 90, p. p.
Trichosoma exile Stossich 1890, p. 14, p. p.
Capillaria exilis Travassos 1915, p. 151, p. p.
Capillaria exilis Yorke & Maplestone 1926, p. 25, p. p.
Capillaria exilis Sprehn 1932, p. 771, p. p.

In small intestine of *Turdus merula*.

Capillaria falconis-nisi (Diesing 1851) emend. mea.

- Trichosomum contortum* ? Dujardin 1843, p. 335, pl. 14, fig. C. 3, orig.
nec Creplin 1839, p. p.
Trichosome de l'épervier Dujardin 1845, p. 13, pl. 2, fig. A 5.
(*Falco nisus*).
Trichosomum falconis nisi Diesing 1851, II, p. 261.
Trichosomum falconum Diesing 1851, II, p. 260—261, p. p.
Trichosomum falconum v. Linstow 1878, p. 110.
Trichosoma falconum Stossich 1890, p. 21—22, p. p.
Capillaria falconum Travassos 1915, p. 153, p. p.
Capillaria falconum Yorke & Maplestone 1926, p. 26, p. p.
Capillaria falconum Sprehn 1932, p. 772, p. p.

In the intestine of *Accipiter nisus*.

In 1843 Dujardin notes the species from *Milvus migrans* (Godd) probably erroneously, since he does not mention it 1845, p. 13—14 under this host.

Capillaria falconum (Rug. 1819).

- Trichosoma falconum* Rudolphi 1819, p. 15, 222.
Trichosome du busard (*Falco pygargus*) Dujardin 1845, p. 14 (= *Tr. falconis pygargi*
Diesing).

Species of Capillaria

Trichosomum falconum	Diesing 1851, II, p. 260—261, p. p.
Trichosoma falconum	Eberth 1863, p. 59, pl. 6, fig. 1, orig.
Trichosoma falconum	v. Linstow 1878, p. 109, 112.
Trichosoma striatum	v. Linstow 1879 ₂ , p. 182 (?).
Trichosoma falconum	Stossich 1890, p. 21—22, p. p.
Trichosoma striatum	Stossich 1890, p. 19 (?).
Trichosoma falconum	Wolffhügel 1900, p. 13.
Capillaria falconum	Travassos 1915, p. 153, p. p.
Capillaria striata	Travassos 1915, p. 155—156 (?).
Capillaria falconum	Yorke & Maplestone 1926, p. 26, p. p.
Capillaria striata	Yorke & Maplestone 1926, p. 27 (?).
Capillaria falconum	Sprehn 1932, p. 772.
Capillaria striata	Sprehn 1932, p. 779 (?).

In the intestine of Buteo buteo, Milvus milvus, Circus pygargus and(?)
Circus cyaneus and Accipiter nisus.

Capillaria fringillae (Rud. 1819) nom. nud.

Trichosoma fringillae	Rudolphi 1819, p. 15.
Trichosomum angustum	Diesing 1851, II, p. 253—254, p. p.
Capillaria fringillae	Travassos 1915, p. 159.
Capillaria fringillae	Yorke & Maplestone 1926, p. 26.
Capillaria fringillae	Sprehn 1932, p. 772.

In the intestines of Fringilla coelebs.

Capillaria gallina (Goeze 1782) =
Capillaria longicollis (Mehlis 1831) (?).

Capillaria gallina (Kowalewski 1895) =
Capillaria longicollis (Mehlis 1831).

Capillaria hirundinis (Rud. 1819) nom. nud.

Trichosoma hirundinis	Rudolphi 1819, p. 15.
Trichosomum curvicauda	Diesing 1851, II, 253, p. p.
Capillaria hirundinis	Travassos 1915, p. 159.
Capillaria hirundinis	Yorke & Maplestone 1926, p. 26.
Capillaria hirundinis	Sprehn 1932, p. 772.

In the intestines of Hirundo rustica.

Capillaria inflexa (Rud. 1819).

Trichosoma inflexum	Rudolphi 1819, p. 13.
Trichosoma inflexum	Bremser 1824, pl. 1, fig. 12—15.

Trichosomum inflexum	Dujardin 1845, p. 14—15.
Trichosomum inflexum	Diesing 1851, II, p. 252—253, p. p.
Trichosoma inflexum	v. Linstow 1878, p. 89, 91.
Trichosoma inflexum	Stossich 1890, p. 10.
Capillaria inflexa	Travassos 1915, p. 148.
Capillaria inflexa	Yorke & Maplestone 1926, p. 26.
Capillaria inflexa	Sprehn 1932, p. 772.

In the intestine of *Turdus viscivorus* and *Monticola solitarius*.

Capillaria laricola (Wassilkowa & Gouchanskaja 1930).

<i>Eucoleus laricola</i>	Wassilkowa & Gouchanskaja 1930, p. 620.
<i>Capillaria laricola</i>	Baylis 1931, p. 542.
<i>Capillaria laricola</i>	Freitas & Almeida 1935, p. 136—137.
<i>Capillaria laricola</i>	Cram 1936, p. 21.

In the intestine of *Larus canus*, *L. argentatus*, *L. ridibundus*, *Sterna hirundo*, *Chlidonias nigra*.

Capillaria leidyella Travassos 1915.

<i>Trichosoma picorum</i>	Leidy 1856, p. 55, nec. <i>Tr. picorum</i> . Rud. 1819.
<i>Trichosoma picorum</i>	v. Linstow 1878, p. 74, p. p.
<i>Trichosoma picorum</i>	Stossich 1890, p. 10—11, p. p.
<i>Capillaria leidyella</i>	Travassos 1915, p. 153.
<i>Capillaria leidyella</i>	Yorke & Maplestone 1926, p. 26.

In the intestine of *Colaptes mexicanus*. Very inadequately described.

Capillaria longevaginata (v. Linstow 1879) =

Capillaria alaudae (Rud. 1819), after v. Linstow 1889, p. 33.

Capillaria longicollis (Rud. 1819) auctt. nov. =

Capillaria longicollis (Mehlis 1831).

For synonymy etc. see above p. 11.

Capillaria longicollis (Duj. 1845) =

Capillaria collaris (v. Linstow 1873) p. p. (?).

Capillaria longicollis (Eberth 1863) =

Capillaria collaris (v. Linstow 1873).

Capillaria longicollis (Parona 1886) =

Capillaria cadovulvata n. sp. p. (?).

Species of *Capillaria*

Capillaria longifila (Duj. 1845).

- | | |
|-------------------------------|---------------------------------|
| <i>Calodium longifilum</i> | Dujardin 1845, p. 27. |
| <i>Trichosomum longifilum</i> | Diesing 1851, II, p. 256. |
| <i>Trichosoma longifilum</i> | v. Linstow 1878, p. 88. |
| <i>Trichosoma longifilum</i> | Stossich 1890, p. 9. |
| <i>Capillaria longifila</i> | Travassos 1915, p. 151. |
| <i>Capillaria longifila</i> | Yorke & Maplestone 1926, p. 26. |
| <i>Capillaria longifila</i> | Sprehn 1932, p. 774. |

In the intestines of *Prunella modularis*.

Capillaria longistriata Walton 1923.

- | | |
|--------------------------------|---|
| <i>Capillaria longistriata</i> | Walton 1923, p. 65-67, pl. VI, fig. 1, 6, 7,
9-12, orig. |
| <i>Capillaria longistriata</i> | Yorke & Maplestone 1926, p. 26. |

In small intestine of *Colaptes auratus*.

Capillaria lophortygis Baylis 1934 =

Capillaria contorta (Creplin 1839).

Capillaria manica (Duj. 1845).

- | | |
|---------------------------|---------------------------------|
| <i>Thominx manica</i> | Dujardin 1845, p. 22. |
| <i>Trichosomum manica</i> | Diesing 1851, II, p. 257. |
| <i>Trichosoma manica</i> | v. Linstow 1878, p. 83. |
| <i>Trichosoma manica</i> | Stossich 1890, p. 25. |
| <i>Capillaria manica</i> | Travassos 1915, p. 155. |
| <i>Capillaria manica</i> | Yorke & Maplestone 1926, p. 26. |
| <i>Capillaria manica</i> | Sprehn 1932, p. 774. |

In the intestines of *Fringilla coelebs*.

Capillaria meleagris-gallopavo (Barile 1912) =

Capillaria longicollis (Mehlis 1831).

Capillaria mergi nom. nov.

For synonymy etc. see above p. 59.

Capillaria montevidensis Calzada 1937.

Literature has not been available.

In coeca of fowl.

Holger Madsen

Capillaria nodulosa (Rud. 1808) =
Capillaria longicollis (Mehlis 1831) (?).

Capillaria nyrocinarum n. sp.

For particulars see above p. 61.

Capillaria obsignata nom. nov.

See above p. 26.

Capillaria obtusa (Rud. 1819) =
Capillaria tenuissima (Rud. 1803).

Capillaria obtusa (v. Linstow 1877) nomen solutum.

Trichosoma obtusum	v. Linstow 1877 ² , p. 177, nec Tr. obtusum Rud. 1819.
Trichosoma obtusa	v. Linstow 1878, p. 103.
Trichosoma obtusa	Stossich 1890, p. 21, p. p.
Capillaria tenuissima	Travassos 1915, p. 153—154, p. p.
Capillaria obtusa	Freitas & Almeida 1935 ¹ , p. 124.

In the oesophagus of *Asio otus*.

Quite inadequately described species. A single larva found. The name can be used when a species is found in the same place.

Capillaria obtusiuscula (Rud. 1819).

Trichosoma obtusiusculum	Rudolphi 1819, p. 13.
Trichosomum obtusiusculum	Diesing 1851, II, p. 254.
Trichosoma obtusiusculum	Mehlis 1831, p. 74, pl. 2, fig. 3, orig.
Trichosomum obtusiusculum	Dujardin 1845, p. 20—21.
Trichosoma obtusiusculum	v. Linstow 1878, p. 140.
Trichosoma obtusiusculum	Stossich 1890, p. 6.
Trichosoma obtusiusculum	Jägerskjöld 1901, p. 49—67, fig. 7—8, pl. 5, fig. 1—9, pl. 6, fig. 1—4, orig.
Capillaria obtusiuscula	Travassos 1915, p. 140.
Capillaria obtusiuscula	Yorke & Maplestone 1926, p. 26.
Capillaria obtusiuscula	Sprehn 1932, p. 775.
Capillaria obtusiuscula	Cram 1936, p. 22, fig. 11, non orig.

In ventriculus of *Grus grus* and *Vanellus vanellus*. Only specimens from *Grus grus* have been *described*.

Species of *Capillaria*

Capillaria ornata (Duj. 1843).

- Trichosomum ornatum* Dujardin 1843, p. 347, pl. 14, fig. B 1-7, orig.
Calodium ornatum Dujardin 1845, p. 28, pl. 1, fig. B 1-7¹), non orig.
Trichosomum ornatum Diesing 1851, II, p. 256.
Trichosoma ornatum v. Linstow 1878, p. 85.
Trichosoma ornatum Stossich 1890, p. 6-7.
Capillaria ornata Travassos 1915, p. 149.
Capillaria ornata Yorke & Maplestone 1926, p. 26.
Capillaria ornata Sprehn 1932, p. 776.

In the intestines of *Anthus pratensis*.

Capillaria ovopunctata (v. Linstow 1873).

- Trichosoma ovopunctatum* v. Linstow 1873, p. 296, pl. 13, fig. 2, orig.
Trichosoma ovopunctatum v. Linstow 1878, p. 98.
Trichosoma ovopunctatum Stossich 1890, p. 12.
Capillaria ovopunctata Travassos 1915, p. 151.
Capillaria ovopunctata Yorke & Maplestone 1926, p. 26.
Capillaria ovopunctata Sprehn 1932, p. 776.

In the intestines of *Sturnus vulgaris*.

Capillaria pachyderma (v. Linstow 1877).

- Trichosoma pachyderma* v. Linstow 1877², p. 177-178.
Trichosoma pachyderma v. Linstow 1878, p. 173.
Trichosoma pachyderma Stossich 1890, p. 22.
Capillaria pachyderma Travassos 1915, p. 155.
Capillaria pachyderma Yorke & Maplestone 1926, p. 26.
Capillaria pachyderma Sprehn 1932, p. 776.
Capillaria pachyderma Freitas & Almeida 1935¹, p. 135.

In the oesophagus of *Poliocephalus ruficollis*.

Capillaria papillifer (v. Linstow 1877).

- Trichosoma papillifer* v. Linstow 1877¹, p. 7, pl. 1, fig. 11, orig.
Trichosoma papillifer v. Linstow 1878, p. 92.
Trichosoma papillifer Stossich 1890, p. 22.
Capillaria papillifer Travassos 1915, p. 155.
Capillaria papillifer Yorke & Maplestone 1926, p. 27.
Capillaria papillifer Sprehn 1932, p. 776.

In the intestines of *Gelochelidon urbica* and (?) *Hirundo rustica* (Travassos 1915).

¹) See footnote to *C. dispar*.

Capillaria papilligera (Railliet & Henry 1911) =

Capillaria papillosum (Blome 1909) =

Capillaria longicollis (Mehlis 1831).

Capillaria parilis (Kow. 1903).

Trichosoma parile Kowalewski 1904, p. 517, figs. 7-9, orig.
Capillaria parilis Travassos 1915, p. 156.
Capillaria parilis Yorke & Maplestone 1926, p. 27.

In the intestines of *Bubo bubo*.

Capillaria penidoi (Freitas & Almeida 1935).

Capillaria penidoi Freitas & Almeida 1935, p. 138, pl. 2, figs.
11-15, orig.

In the oesophagus of *Nothura maculosa*.

Capillaria perezii (Freitas & Lent 1937).

Capillaria perezii Freitas & Lent 1937, p. 92, pl. 1, figs. 1-3,
pl. 2, figs. 4-8, orig.

In the oesophagus of *Anhinga anhinga*.

Capillaria parvumspinosa (Railliet & Henry 1911).

Trichosoma parvumspinosa Railliet & Henry 1911, p. 573.
Capillaria parvumspinosa Yorke and Maplestone 1926, p. 27.
Capillaria parvumspinosa Neveu-Lemaire 1936, p. 1316.

In the upper digestive tract of *Rhea americana*. Original literature has not been accessible.

Capillaria perforans Kotlan & Orosz 1931 =

Capillaria contorta (Creplin 1839).

Capillaria phasiani (Frølich 1791) =

Capillaria longicollis (Mehlis 1831) (?).

Capillaria picorum (Rud. 1819).

Trichosoma picorum Rudolphi 1819, p. 15, nec *Tr. picorum* Leidy
1857 (= *C. leidyella* Trav. 1915).
Trichosome des pics Dujardin 1845, p. 18-19.

Species of *Capillaria*

<i>Trichosomum picorum</i>	Diesing 1851, II, p. 261.
<i>Trichosoma picorum</i>	v. Linstow 1879, p. 335.
<i>Trichosoma picorum</i>	v. Linstow 1878, p. 74, 75, 76, p. p.
<i>Trichosoma picorum</i>	v. Linstow 1889, p. 30.
<i>Trichosoma picorum</i>	Stossich 1890, p. 10—11, p. p.
<i>Trichosoma picorum</i>	Wolffhügel 1900, p. 43.
<i>Capillaria picorum</i>	Travassos 1915, p. 159.
<i>Capillaria picorum</i>	Yorke & Maplestone 1926, p. 27.
<i>Capillaria picorum</i>	Sprehn 1932, p. 776.

In the intestine of *Picus canus*, *Picus viridis*, and *Dryobates major*.

Capillaria protracta (Duj. 1845).

<i>Trichosomum protractum</i>	Dujardin 1845, p. 20.
<i>Trichosomum protractum</i>	Diesing 1851, II, p. 262, p. p.
<i>Trichosoma protractum</i>	v. Linstow 1878, p. 134.
<i>Trichosoma protractum</i>	Stossich 1890, p. 30.
<i>Capillaria protracta</i>	Travassos 1915, p. 157.
<i>Capillaria protracta</i>	Yorke & Maplestone 1926, p. 27.
<i>Capillaria protracta</i>	Sprehn 1932, p. 777.

In the intestine of *Vanellus vanellus*.

Capillaria vasilis nom. nov.

<i>Trichosoma exile</i>	Eberth 1863, p. 57, pl. 7, fig. 7, orig. nec. Tr. exile Duj. 1845.
<i>Trichosoma exile</i>	v. Linstow 1878, p. 90, p. p.
<i>Trichosoma exile</i>	Stossich 1890, p. 14, p. p.
<i>Capillaria exilis</i>	Travassos 1915, p. 151, p. p.
<i>Capillaria exilis</i>	Yorke & Maplestone 1926, p. 26, p. p.
<i>Capillaria exilis</i>	Sprehn 1932, p. 771, p. p.

In small intestine of *Turdus merula*.

Capillaria resecta (Duj. 1843).

<i>Trichosomum resectum</i>	Dujardin 1843, p. 347—348, pl. 14, figs. D 1—3, orig.
<i>Trichosomum resectum</i>	Dujardin 1845, p. 17—18, pl. 2, figs. B 1—4 ¹⁾ , C, D 1—3, orig. part.
<i>Trichosomum resectum</i>	Diesing 1851, II, p. 254, p. p.

¹⁾ See footnote to *C. dispar*.

Trichosoma resectum	Baird 1853, p. 2.
Trichosoma resectum	Eberth 1863, p. 56, pl. 6, figs. 15 & 18, pl. 7, figs. 5 & 12, orig.
Trichosoma resecta	v. Linstow 1877 ² , p. 177.
Trichosoma resecta	v. Linstow 1878, p. 100, 101, 102.
Trichosoma resectum	Stossich 1890, p. 14—15.
Trichosoma resectum	Wolffhügel 1900, p. 19, 20, 25, 26, 30, 33, 34, 35, 36, 37, 38 & 39, p. p. (?).
Trichosoma resecta	Kowalewski 1904, p. 517, fig. 3—6.
Capillaria resecta	Travassos 1915, p. 150.
Capillaria resecta	Yorke & Maplestone 1926, p. 27.
Capillaria resecta	Sprehn 1932, p. 778.
Capillaria resecta	Markowski 1933, p. 40—42, figs. 19—20, orig.

In small intestine of *Corvus frugilegus*, *Corvus corax*, *Corvus corone cornix*, *Coloeus monedula*, *Nucifraga caryocatactes* and *Garrulus glandarius*.

The specimens found in the stomach of *Corvus c. corone* by Wolffhügel (1900) certainly do not belong to this species.

Capillaria retusa (Railliet 1893) =
Capillaria collaris (v. Linstow 1873).

Capillaria rigidula (Duj. 1845).

Trichosomum rigidulum	Dujardin 1845, p. 15—16.
Trichosomum rigidulum	Diesing 1851, II, p. 253.
Trichosoma rigidulum	v. Linstow 1878, p. 88.
Trichosoma rigidula	Stossich 1890, p. 10.
Capillaria rigidula	Travassos 1915, p. 151.
Capillaria rigidula	Yorke & Maplestone 1926, p. 27.
Capillaria rigidula	Sprehn 1932, p. 778.

In the intestines of *Prunella modularis*.

Capillaria (?) *rubra* (Linton 1892).

Trichosoma rubrum	Linton 1892, p. 705—707, figs. 1—5, orig.
Capillaria rubra	Travassos 1915, p. 157.
Capillaria rubra	Yorke and Maplestone 1926, p. 27.

In the thoracic cavity of *Spizilla socialis*.

It is very doubtful whether it is a species of *Capillaria* altogether.

Species of Capillaria

Capillaria rudolphi Freitas 1934.

Capillaria rudolphi Freitas 1934, p. 260, pl. 48, figs. 1-4, orig.

In small intestine of *Tinamus solitarius*.

(See above at *C. crypturi*).

Capillaria semiteres Zeder 1803 =

Capillaria longicollis (Mehlis 1891) (?).

Capillaria similis (Kow. 1904).

Trichosoma simile Kowalewski 1904, p. 518, fig. 10-11, orig.

Capillaria similis Travassos 1915, p. 152.

Capillaria similis Yorke & Mapleton 1926, p. 27.

Capillaria similis Sprehn 1932, p. 779.

In the intestine of *Turdus pilaris*.

Capillaria spiculata Freitas 1933.

Capillaria spiculata Freitas 1933, p. 963-964, fig. 3-4, orig.

In the cloaca of *Phalacrocorax olivaceus*.

Capillaria spinulosa (v. Linstow 1890).

For synonymy etc. see above p. 64.

Capillaria spiralis (Molin 1859).

Trichosomum spirale Molin 1859, p. 301.

Trichosomum spirale Molin 1861, p. 321.

Trichosoma spirale Eberth 1863, p. 61, pl. 7, fig. 14.

Trichosoma spirale Stossich 1890, p. 30-31.

Trichosoma spirale v. Linstow 1878, p. 148.

Capillaria spiralis Travassos 1915, p. 157.

Capillaria spiralis Yorke & Mapleton 1926, p. 27.

Capillaria spiralis Freitas & Almeida 1935, p. 133-134, pl. 5, fig. 33, non orig.

In the oesophagus of *Plegadis falcinellus*.

Capillaria striata (v. Linstow 1879) =

Capillaria falconum (Rud. 1819) (?).

In the intestine of *Accipiter nisus*. Inadequately described.

Capillaria strumosa (Reibisch 1893) =
Capillaria annulata (Molin 1858).

Capillaria tenuis (Dujardin 1845) (*Calodium tenue* nec *Trichosoma*
tenuis Duj. 1845) =

Capillaria columbae (Rud. 1819)

Capillaria tenuissima (Rud. 1803).

<i>Trichocephalus tenuissimus</i>	Rudolphi 1803, p. 4.
<i>Trichosoma obtusum</i>	Rudolphi 1819, p. 13.
<i>Trichosomum obtusum</i>	Mehlis 1831, p. 74, p. p.
<i>Trichosomum obtusum</i>	Dujardin 1845, p. 14.
<i>Trichosomum obtusum</i>	Diesing 1851, II, p. 252.
<i>Trichosoma obtusum</i>	Eberth 1863, p. 59, pl. 6, figs. 14 & 16, orig.
<i>Trichosoma obtusum</i>	v. Linstow 1878, pl. 103, 104, 105, 106, 112 (?), p. p.
<i>Trichosoma obtusum</i>	Stossich 1890, p. 21, p. p.
<i>Trichosoma obtusum</i>	Wolffhügel 1900, p. 16 & 17.
<i>Capillaria tenuissima</i>	Travassos 1915, p. 153—154, p. p.
<i>Capillaria tenuissima</i>	Yorke & Maplestone 1926, p. 27.
<i>Capillaria tenuissima</i>	Sprehn 1932, p. 779—780.

In the coeca of *Buteo lagopus* (?), *Ægolius funereus*, *Strix aluco*, *Asio flammeus*, *Asio otus*, *Athene noctua* and *Glaucidium passerinum*.

Capillaria tenuissima (Diesing 1851), (nec *C. tenuissima* (Rud. 1803)) =
Capillaria columbae (Rud. 1819), p. p.

Capillaria tenuissima (Eberth 1863) =
Capillaria dujardini Travassos 1915.

Capillaria tetricis (Froelich 1802) =
Capillaria longicollis (Mehlis 1831) (?).

Capillaria tiaras nov. spec.

Concerning particulars see above p. 26.

Capillaria totani (v. Linstow 1875).

<i>Trichosoma totani</i>	v. Linstow 1875, p. 200.
<i>Trichosoma totani</i>	v. Linstow 1878, p. 131.
<i>Trichosoma totani</i>	Stossich 1890, p. 26.
<i>Capillari totani</i>	Travassos 1915, p. 155.

Species of *Capillaria*

- Capillaria totani* Yorke & Maplestone 1926, p. 27.
Capillaria totani Sprehn 1932, p. 780.

In the coeca of *Actitis hypoleuca*.

Capillaria tridens (Duj. 1845).

- Thominx tridens Dujardin 1845, p. 23.
 Trichosomum tridens Diesing 1851, II, p. 257.
 Trichosoma tridens v. Linstow 1878, p. 87.
 Trichosoma tridens Stossich 1890, p. 26.
 Capillaria tridens Travassos 1915, p. 155.
 Capillaria tridens Yorke & Maplestone 1926, p. 27.
 Capillaria tridens Sprehn 1932, p. 780.

In the intestines of *Luscinia luscinia*.

Capillaria triloba (v. Linstow 1875).

- Trichosoma trilobum v. Linstow 1875, p. 198—200.
 Trichosoma trilobum v. Linstow 1878, p. 134.
 Trichosoma trilobum Stossich 1890, p. 24.
 Capillaria triloba Travassos 1915, p. 155.
 Capillaria triloba Skrjabin 1916, p. 553.
 Capillaria triloba Yorke & Maplestone 1926, p. 27.
 Capillaria triloba Sprehn 1932, p. 780.
 Capillaria triloba Cram 1936, p. 23—24.

In the gizzard of *Vanellus vanellus*.

Capillaria tumida Zeder 1803 =

Capillaria anatis (Schranck 1790) (?).

Capillaria turdi (Rud. 1819) nom. nud.

- Trichosoma turdi Rudolphi 1819, p. 15.
 Trichosomum inflexum Diesing 1851, II, p. 252—253, p. p.
 Capillaria turdi Travassos 1915, p. 159.
 Capillaria turdi Yorke & Maplestone 1926, p. 27.

In the intestines of *Turdus viscivorus* and (?) *Geocicla mollissima* (Travassos 1915). It is quite puzzling to me which source Travassos has to this latter statement.

Capillaria unilinguis (Schranck 1796) =

Capillaria longicollis (Mehlis 1831) (?).

Capillaria uruguayensis Calzada 1937.

The literature has not been accessible to me.
In the coeca of fowl.

Capillaria uropapillata Freitas & Almeida 1935.

- Capillaria uropapillata* Freitas & Almeida 1935₁, p. 140, pl. 5, figs.
35—40, orig.
Capillaria uropapillata Freitas & Almeida 1935₂, p. 339, pl. 8, figs.
40—41, non orig.

In oesophagus of pheasant.

Capillaria vanelli (Rud. 1819), nom. nud.

- Trichosoma vanelli* Rudolphi 1819, p. 15.
Trichosomum protractum Diesing 1851, II, p. 262, p. p.
Capillaria vanelli Travassos 1915, p. 159.
Capillaria vanelli Yorke and Maplestone 1926, p. 27.
Capillaria vanelli Sprehn 1932, p. 780.

In the intestines of *Vanellus vanellus*.

Capillaria vanelli Yamaguti 1935 =
Capillaria contorta (Creplin 1839).

Capillaria vazi Freitas 1933.

- Capillaria vazi* Freitas 1933₂, p. 962—963, fig. 1—2, orig.

In the intestines of *Odontophorus capueira*.

Capillaria venteli Freitas & Almeida 1935.

- Capillaria venteli* Freitas & Almeida 1935₁, p. 139, pl. 4, figs.
26—32, orig.

In the oesophagus of *Cochlearius cochlearius* and *Ajaja ajaja*.

LIST OF BIRDS IN WHICH SPECIES OF CAPILLARIA HAVE BEEN
FOUND

(The systematic order and the nomenclature is notably after Peters (1931—1937) and Regan (1936). The names of *Capillaria* in brackets represent nomina nuda).

Species of *Capillaria*

Rheiformes		<i>Rhea americana</i> (L),
	<i>C. parvumspinosa</i> .	
Tinamiformes.		<i>Tinamus solitarius</i> (Vieill).
	<i>C. rudolphi</i> .	<i>Tinamus tao</i> Temm.
	(<i>C. crypturi</i>).	<i>Nothura maculosa</i> (Temm.).
	<i>C. penidoi</i> .	
Colymbiformes.		<i>Polioccephalus ruficollis</i> (Pall.).
	<i>C. pachyderma</i> .	
Procellariiformes.		<i>Macronectes giganteus</i> (Gmel.).
	<i>C. convoluta</i> .	
Pelecaniformes.		<i>Phalacrocorax carbo</i> (L.).
	(<i>C. carbonis</i>).	<i>Phalacrocorax olivaceus</i> (Humb.).
	<i>C. spiculata</i> , <i>C. appendiculata</i> .	<i>Anhinga anhinga</i> (L.).
	<i>C. perezii</i> .	
Ciconiiformes.		<i>Nycticorax nycticorax</i> (L.).
	<i>C. brasiliana</i> .	<i>Mycteria americana</i> L.
	<i>C. avellari</i> .	<i>Cochlearius cochlearius</i> (L.).
	<i>C. venteli</i> .	<i>Plegadis falcinellus</i> (L.).
	<i>C. spiralis</i> .	<i>Ajaja ajaja</i> (L.).
	<i>C. venteli</i> .	
Anseriformes.		
Anatidae		
Cyginae.		<i>Cygnus melanocoryphus</i> (Molina).
	<i>C. droummondi</i> .	
Anserinae.		<i>Anser anser</i> (L.) <i>domesticus</i> .
	<i>C. anseris</i> .	<i>Nesochen sandvicensis</i> (Vigers).
	<i>C. anseris</i> (?).	
Anatinae.		<i>Cairina moschata</i> (L.) <i>domestica</i> .
	<i>C. cairinae</i> .	<i>Tadorna tadorna</i> .
	<i>C. contorta</i> .	

- Anas platyrhynchos* L.
C. anatis, C. contorta, C. spinulosa.
Anas platyrhynchos L. *domestica*.
C. anatis, C. contorta.
Anas discors L.
C. anatis (?).
Anas querquedula L.
C. anatis, C. contorta, C. spinulosa.
Anas crecca L.
C. anatis, C. contorta.
Anas acuta L.
C. contorta.
Anas bahamensis L.
C. spec. ?
Mareca penelope (L.).
C. spinulosa.
Chaulelasmus streperus (L.).
C. contorta.
Spatula clypeata (L.).
C. contorta, C. spinulosa.
Nyrocinae.
Nyroca ferina (L.).
C. spinulosa.
Nyroca fuligula (L.).
C. contorta, C. nyrocinarum, C. spinulosa.
Nyroca marila (L.).
C. nyrocinarum, C. spinulosa.
Bucephala clangula (L.).
C. mergi, C. nyrocinarum, C. spinulosa.
Clangula hyemalis (L.).
C. mergi, C. nyrocinarum.
Somateria mollissima (L.).
C. mergi, C. nyrocinarum.
Somateria spectabilis (L.).
C. nyrocinarum.
Oidemia nigra (L.).
C. nyrocinarum.
Melanitta fusca (L.).
C. mergi, C. nyrocinarum.
Merginae.
Mergus merganser L.
C. mergi.

Species of *Capillaria*

- Mergus serrator* L.
- Falconiformes.
Accipitridae
- C. mergi.
- Accipiter nisus* (L.).
- C. contorta (?), C. falconis-nisi, C. falconum.
- Buteo buteo* (L.).
- C. contorta, C. cylindrica C. dispar, C. falconum.
- Buteo lagopus* (Pont.).
- C. tenuissima (?).
- Circus cyaneus* (L.).
- C. falconum (?).
- Circus pygargus*.
- C. falconum.
- Falco subbuteo* L.
- C. dispar.
- Falco peregrinus* Tunst.
- C. dispar (?).
- Falco rusticolus obsoletus* Gmel.
- C. contorta.
- Galliformes.
Tetraonidae.
- Tetrao urogallus* L.
- C. annulata, C. longicollis.
- Lyrurus tetrix* (L.).
- C. annulata, C. longicollis.
- Lagopus lagopus* (L.).
- C. longicollis.
- Lagopus mutus* (Montin).
- C. longicollis.
- Bonasa umbellus* (L.).
- C. annulata, C. contorta.
- Phasianidae.
- Oreortyx picta* (Daugl.).
- C. contorta.
- Lophortyx californicus* (Shaw).
- C. contorta.
- Colinus virginianus* (L.).
- C. annulata, C. contorta.
- Odontophorus capueira* (Spix).
- C. vazi.
- Alectoris graeca* (Merton).
- C. longicollis.

- Alectoris rufa* (L.).
 C. longicollis.
Perdix perdix (L.).
 C. annulata, C. cadovulvata, C. collaris,
 C. contorta, C. dujardini, C. longicollis, C. tiaras.
Coturnix coturnix (L.).
 C. longicollis.
Crossoptilon mantchuricum Swinhoe.
 C. contorta.
Gallus gallus (L.) *domesticus*.
 C. annulata, C. bursata, C. collaris, C. columbae, C. longi-
 collis, C. montevidensis, C. obsignata, C. urugayensis.
Phasianus colchicus L. *formae div.*
 C. annulata, C. cf. bursata, C. cadovulvata, C. collaris,
 C. contorta, C. cf. dujardini, C. longicollis, C. uropapillata.
Syrmaticus reevesi (Gray).
 C. annulata.
Chrysolophus pictus (L.).
 C. annulata.
Numida sp.
 C. annulata.
 Numididae.
Meleagris gallopavo L. *domesticus*.
 Meleagrididae.
 C. annulata, C. contorta, C. longicollis, C. obsignata.
 Gruiformes.
 Gruidae.
Grus grus (L.).
 C. obtusiuscula.
 Rallidae.
Aramides cajanea (P. L. S. Müll.).
 C. confusa.
Aramides sp. ?
 C. aramidesi.
Fulica atra L.
 C. anatis.
 Otidae.
Otis tarda L.
 C. anatis (??).
 Charadriiformes
 Charadrii.
Vanellus vanellus (L.).
 C. contorta, C. obtusiuscula, C. protracta, C. triloba (C. vanelli).
Charadrius dubius curonicus (Gmel).
 (C. charadrii).
Charadrius hiaticula L.
 C. contorta.

Species of Capillaria

		<i>Eudromias morinellus</i> L.
	C. contorta.	
		<i>Erolia alpina</i> (L.).
	C. contorta.	
		<i>Tringa erythropus</i> (Pall.).
	C. brevis.	
		<i>Actitis hypoleuca</i> (L.).
	C. totani.	
		<i>Capella gallinago</i> (L.).
	C. contorta.	
		<i>Philomachus pugnax</i> (L.).
	C. contorta.	
		<i>Himantopus himantopus</i> (L.).
	(C. charadrii).	
		<i>Recurvirostra avosetta</i> L.
	C. contorta.	
Laridae.		<i>Larus canus</i> L.
	C. contorta, C. laricola.	
		<i>Larus argentatus</i> Pont.
	C. contorta, C. laricola.	
		<i>Larus ridibundus</i> L.
	C. contorta, C. laricola.	
		<i>Sterna hirundo</i> L.
	C. contorta, C. laricola.	
		<i>Chlidonias nigra</i> (L.).
	C. laricola.	
		<i>Gelochelidon nilotica</i> (Gmel.).
	C. contorta.	
		<i>Thalasseus maximus</i> (Bodd.).
	C. contorta.	
Alcae.		<i>Plautus alle</i> (L.).
	C. contorta (??) error!	
		<i>Cephus grylle</i> (L.).
	C. contorta (?).	
Columbiformes		<i>Columba livia</i> L. <i>domestica</i> .
	C. columbae, C. dujardini, C. longicollis, C. obsignata.	
		<i>Columba palumbus</i> L.
	C. longicollis.	
Psittaciformes.		<i>Amazona amazonica</i> (L.).
	C. chrysotidis.	

Strigiformes.	<i>Ægolius funereus</i> (L.).
C. tenuissima.	<i>Strix aluco</i> L.
C. tenuissima.	<i>Asio flammeus</i> (Pont.).
C. tenuissima.	<i>Asio otus</i> (L.).
C. obtusa, C. tenuissima.	<i>Athene noctua</i> (Scop.).
C. tenuissima.	<i>Glaucidium passerinum</i> (L.).
C. tenuissima.	<i>Bubo bubo</i> (L.).
C. parilis.	
Caprimulgiformes.	<i>Caprimulgus europaeus</i> L.
(C. caprimulgi).	
Micropodiformes.	<i>Apus apus</i> (L.).
C. curvicauda.	
Piciformes.	<i>Picus canus</i> Gmel.
C. picorum.	<i>Picus viridis</i> L.
C. picorum.	<i>Colaptes auratus</i> (Temm.).
C. longistriata.	<i>Colaptes mexicanus</i> .
C. leidyella.	<i>Dryobates major</i> (L.).
C. picorum.	
Passeriformes.	
Cotingidae.	<i>Lathria cinerea</i> (Vieill.).
C. dubia.	
Hirundinidae.	<i>Hirundo rustica</i> L.
C. curvicauda, (C. hirundinis), C. papillifer (?).	<i>Delichon urbica</i> (L.).
C. papillifer.	
Prunellidae.	<i>Prunella modularis</i> (L.).
C. longifila, C. rigidula.	
Turdidae.	<i>Turdus viscivorus</i> L.
C. inflexa, (C. turdi).	<i>Turdus pilaris</i> L.
C. similis.	

Species of Capillaria

- Turdus merula* L.
 C. exilis, C. rasilis.
Geocicla mollissima (Blyth).
 (C. turdi) (? error?)
Monticola solitarius L.
 C. inflexa.
Luscinia luscinia (L.).
 C. tridens.
Erithacus rubecula (L.).
 C. contorta.
Phoenicurus ochrurus.
 C. contorta.
Oenanthe oenanthe (L.).
 C. contorta (?).
 Motacillidae. *Anthus pratensis* (L.).
 C. ornata.
 Alaudidae. *Alauda arvensis* (L.).
 C. alaudae.
 Fringillidae. *Fringilla coelebs* L.
 C. angusta, (C. fringillae), C. manica.
Spizilla socialis (Wils).
 Sturnidae. C. ? rubrum.
Sturnus vulgaris L.
 C. contorta, C. ovopunctata, C. dujardini var. sturni.
 Corvidae. *Corvus corax* L.
 C. contorta (?), C. resecta.
Corvus corone (L.).
 C. contorta, C. corvicola, C. resecta.
Corvus frugilegus L.
 C. contorta, C. resecta.
Corvus brachyrhynchos Br.
 C. contorta (?).
Coloemus monedula (L.).
 C. contorta (C. corvorum), C. resecta.
Nucifraga caryocatactes (L.).
 (C. corvorum), C. resecta.
Pica pica (L.).
 (C. corvorum), C. corvicola.
Garrulus glandarius (L.).
 C. corvicola, C. resecta.
Pyrrhocorax graculus (L.).
 C. resecta.

Table 12. Important features of species of *Capillaria* in birds.

	Length of male (in mm)	Length of female (in mm)	Size of spicule (in mm)	Shape of spicule in cross section	Characteristics of spicule sheath	Length of spicule sheath (in mm)	Index length/vulva distance from front	Vulva with (+) or without (-) appendage	Shape of vulva aperture	Length of eggs (in μ)	Special remarks (The figures indicate breath in lateral bands according to late relation to total breath)	Spicule adequately figured	Egg adequately figured	Other characteristic figured
<i>C. sp.</i>	—	25,5–31,9	—	—	—	—	—	+	circ.	—	Vagina with many spines	—	+	Vagina
<i>C. alaudae</i>	11	13	1,7	—	tr. str.	1,4	—	+	—	52	Lateral bands 1/3. Cells of oesophagus very short.	+	+	+
<i>C. anatis</i>	7,9–13,1	8,4–26,4	1,22–1,83	△	smooth to tr. str.	—	2,1–2,7	+	tr. slit	42–62	Egg shell undulated plug w. collar	+	+	Vulv. male tail.
<i>C. angusta</i>	11	14	1,4 × 0,017	△	smooth	0,2	2,5	+	—	55	—	+	+	+
<i>C. annulata</i>	10–37	15–80	÷ or inconspic.	—	spiny	1,12–1,63	ab. 4	÷ + ? in young fem.	circ.	54–66	Cuticular swelling at head end. Broad ventral band	—	+	+
<i>C. anseris</i>	9,7–13,2	14,7–17,0	1,45–1,99 × 0,01	○	tr. str.	—	—	+	tr. slit	52–60	Egg shell w. point shaped hollows.	+	+	Vulv. male tail
<i>C. appendiculata</i>	—	22,8	1,77 × 0,01	—	smooth	1,02	4,7	+	—	56	2 vulvar membranes. Male tail w. great wings.	+	+	Vulv. male tail

When the names are italicised the parasite occurs in the upper digestive tract. — Abbreviations: circ., circular; cut., cuticular; long., longitudinal; obl., oblique; oes., oesophagus; sm., small; str., striated; tr., transverse; w., with.

(Table 12).

	Length of male (in mm)	Length of female (in mm)	Size of spicule (in mm)	Shape of spicule in cross section	Characteristics of spicule sheath	Length of spicule sheath (in mm)	Index length/vulva distance from front	Vulva with (+) or without (÷) appendage	Shape of vulva aperture	Length of eggs (in μ)	Special remarks (The figures according to lateral bands indicate breath in relation to total breath)	Spicule adequately figured	Egg adequately figured	Other characteristic figured
<i>C. cylindrica</i>	—	6	—	—	—	—	—	+	—	—	Lateral bands 1/3	+	+	Vulv.
<i>C. dispar</i> (Duj.)	—	27	—	—	—	—	3,9	÷	—	65	Ventral band 1/1 only in the foremost part of body	—	+	÷
<i>C. dispar</i> (Eberth)	—	—	—	—	spiny	—	—	÷	circ.	—	Lateral band 1/2, ventral band 1/5.	÷	+	Lat. band
<i>C. droumondi</i>	—	8-9	0,86 × 0,006	○	smooth	—	—	÷	—	48-52	Vagina short, vulva somewhat protruding	+	+	Male tail
<i>C. dubia</i>	11,3-11,7	14,8-14,9	÷	—	spiny	—	2,7	÷	—	54-56	Vagina short, anus subterminal	—	÷	Male tail
<i>C. dujardini</i>	6,1-11,7	10,0-19,0	1,08-1,57 × 0,007 (40,0)	○	tr. str.	—	2-2,5	÷	slit	41-72	Egg plug without collar	+	+	Vulv. male tail
<i>C. exilis</i>	9,5	9,6	1,0 × 0,009	○	—	—	—	÷	—	72	Spicule and tail bent, w. membr. bursa	÷	÷	÷

When the names are italicised the parasite occurs in the upper digestive tract. —
Abbreviations:
circ., circular;
cut., cuticular;
long., longitudinal;
obl., oblique;
oes, oesophagus;
sm., small;
str., striated;
tr., transverse;
w., with.

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<i>C. falconum</i> (see also <i>C. striata</i>).	15	—	—	—	—	—	—	—	—	tr. str.	65	Egg shell longitudinally str. Bands narrow.	÷	÷	Vulv.
<i>C. falconis-nisi</i>	13	—	0,72 × 0,02	△	—	smooth	—	—	—	—	—	—	+	—	Male tail
<i>C. inflexa</i>	13-18	25-28	—	—	—	smooth	—	—	—	—	—	—	+	—	÷
<i>C. laricola</i>	10,4-13,1	14,6-17,5	÷	—	—	spiny	0,47-0,60	3-4	÷	—	56-60	Vulva protruding, resembling lips.	÷	÷	÷
<i>C. leidyella</i>	—	14,8	—	—	—	—	—	—	—	—	—	Anus termin.	÷	÷	÷
<i>C. longicollis</i>	7-25	9,3-45	0,67-1,89 (2,52)	○	—	smooth to tr. str.	—	1,6-5,8	+	tr. slit	46-57	Cuticular alae at male tail, notch before vulva.	+	+	Vulva, male tail
<i>C. longifila</i>	14,5	—	2,0 × 0,007	—	—	tr. str.	1,5	—	—	—	—	Cuticula not striated.	÷	÷	÷
<i>C. longistriata</i>	20	19	1,5 × 0,01	∪	—	tr. str.	—	2,5	÷	tr. slit	45	Eggs long. str. Tail of male w. wings w. hooklike pap. Opening of spicule sheath w. cut. ring.	÷	(+)	Male tail
<i>C. manica</i>	13,2	—	0,25 × 0,012-0,017	△	—	finely spiny	—	—	—	—	—	—	÷	÷	÷
<i>C. mergi</i>	5,6-9,3	7,0-13,0	0,92-1,53	○	—	tr. str.	—	2,0-4,0	+	tr. slit	41-54	Egg shell w. grains, plug bent to collar	+	+	Vulva, male tail
<i>C. nyrocinarum</i>	4,7-11,6	8,4-17,2	0,92-2,02	△	—	coarsely spiny	—	2,1-4,0	+	oval	57-68	Egg shell thick, plug without collar.	+	+	Vulva, male tail

(Table 12).

	Length of male (in mm)	Length of female (in mm)	Size of spicule (in mm)	Shape of spicule in cross section	Characteristics of spicule sheath	Length of spicule sheath (in mm)	Index length/vulva distance from front	Vulva with (+) or without (÷) appendage	Shape of vulva aperture	Length of eggs (in μ)	Special remarks (The figures according to lateral bands indicate breath in relation to total breath)	Spicule adequately figured	Egg adequately figured	Other characteristic figured
<i>C. obsignata</i>	8,6- 10,0	10,0- 12,7	1,2- 1,58 × 0,008	O	finely tr. str.	—	1,9- 2,2	÷	slit	50-62	Egg shell w. collar, spic. prox. w. curled border.	+	+	Vulva male tail
<i>C. obtusistula</i>	20,5- 23	27-42	0,22- 0,8 × 0,008?	O?	w. small tuberc.	0,6- 4,4- 5,4?	4-6	÷	circ.	60-64	Dorsal band 4/5	÷	+	Vulva male tail
<i>C. ornata</i>	11	18	0,1 × 0,009	O	w. fine folds	0,93	2,4	+	—	51	Bursa large.	+	+	Vulva male tail
<i>C. ovopunctata</i>	6,2	9,5	0,9	—	finely undul- lated	—	2,4	+	—	59	Egg shell w. dots.	÷	÷	Male tail w. spicule point
<i>C. pachyderma</i>	12	19	—	—	spiny	—	5	÷	—	52	Dorsal band 5/7, ventral band 1/10, egg shell smooth.	÷	÷	÷
<i>C. papillifer</i>	21,8	—	1,38	—	spiny	—	—	—	—	—	Ventral band 1/3, dorsal band 1/7.	÷	÷	Male tail w. spicule point
<i>C. parilis</i>	16,1	20,0	0,935	—	finely spiny	—	2,5	—	—	64	Female tail end conical, anus subterminal. Bands 1/6-1/4	÷	÷	Male & female tail

When the names are italicised the parasite occurs in the upper digestive tract. —

Abbreviations:

- circ., circular;
- cut., cuticular;
- long., longitudinal;
- obl., oblique;
- oes., oesophagus;
- sm., small;
- str., striated;
- tr., transverse;
- w., with.

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<i>C. penitoidi</i>	—	15,1	÷	—	spiny	0,58	4	÷	—	44-60	Special cuticular at the male tail; anus in female term.	—	÷	Male tail
<i>C. perezii</i>	19,8	—	1,136 × 0,008	○	tr. str.	—	—	÷	tr. slit w. projecting lip	46-54	Vagina short. Anus of the female terminal.	+	+	Vulva male tail
<i>C. piconum</i>	14	21,7	1,0-1,6 × 0,023	△	smooth	0,09	2,3	+?	—	43	Vulva everted, egg shell w. long. ridges, spicule twisted.	÷	÷	÷
<i>C. protracta</i>	—	30,6	—	—	—	—	8,4	÷	—	56	Cuticular band 1/3	÷	÷	÷
<i>C. rasilis</i>	—	—	—	△	smooth	—	—	—	—	—	Male tail end w. 2 knobs, lat. bands 1/2. ventr. band very narrow.	(+)	÷	÷
<i>C. resecta</i>	10-14,7	13,5-22,7	1,10-1,26 × 0,011-0,015	△	smooth	0,10-0,15	2,4-3,9	÷	tr. slit	52-65	Spicule prox. funnelshaped, egg shell w. long. striat. at the ends.	+	+	Vulva, male & female tail
<i>C. rigidula</i>	12	24	1,05 × 0,017	△	smooth	0,07	3,7	÷	prominent bordered	57	Egg shell granulated, plug striated.	÷	÷	÷
<i>C. ? rubrum</i>	25,0	—	0,42 × 0,01	○	?	—	—	—	—	—	Very thick, 0,9 mm. Doubtful whether it is a Capillaria.	+	—	Male tail
<i>C. rudolphii</i>	—	27,5	3,28 × 0,012-0,027	○	tr. str.	0,43	3,2	+	—	48-56	Postanal papillae in female, spicule prox. funnelshaped.	+	÷	Vulva, male tail

(Table 12).

	Length of male (in mm)	Length of female (in mm)	Size of spicule (in mm)	Shape of spicule in cross section	Characteristics of spicule sheath	Length of spicule sheath (in mm)	Index length/vulva distance from front	Vulva with (+) or without (÷) appendage	Shape of vulva aperture	Length of eggs (in μ)	Special remarks (The figures according to lateral bands indicate breath in relation to total breath)	Spicule adequately figured	Egg adequately figured	Other characteristic figured
When the names are italicised the parasite occurs in the upper digestive tract. — Abbreviations: circ., circular; cut., cuticular; long., longitudinal; obl., oblique; oes., oesophagus; sm., small; str., striated; tr., transverse; w., with.														
<i>C. similis</i>	7	12,8	0,5	—	—	—	2,2	÷	—	66-68	Egg surface finely reticulated, lateral bands 1/4-1/3, ventr. bands 1/7-1/5.	+	+	Male tail
<i>C. spiculata</i>	16	28	2,33 × 0,01- 0,02	—	spiral-ly str.	—	6,3	+	—	48	—	+	+	Vulva, male tail
<i>C. spinulosa</i>	5,6- 11,6	8,4- 14,9	0,61- 1,04	△	spiny	—	2,4- 4,2	÷	tr. slit	46-62	Egg shell thick, plug without collar	+	+	Vulva, male tail
<i>C. spiralis</i>	—	11	—	—	—	—	—	÷	circ.	36	Ventral band 3/4, dorsal 1/3 Anus of female terminal.	÷	÷	÷
<i>C. striata</i>	8,3	15,7	0,66	—	spiny	—	2,7	÷	—	69	Egg shell reticulated, lateral bands 1/3.	÷	÷	÷
<i>C. tenuissima</i>	13,0	18-27	0,65 × 0,023	△	spiny, bell shaped	—	—	÷	tr. slit	66	Egg shell long. striated, plug broad.	÷	÷	÷

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	14- 15,5	—	2,075- 2,38 × 0,01	△	tr. str.	—	—	—	—	—	—	—	—	+	—	Male tail
<i>C. tiaras</i>	7,6	—	1,3	—	spiny	0,7	—	—	—	—	—	—	—	÷	—	÷
<i>C. totani</i>	10,1	—	1,12 × 0,019	△	—	—	—	—	—	—	—	—	—	÷	—	÷
<i>C. tridens</i>	8,7	23	—	—	coarsely spiny	0,43	3	÷	—	74	Dorsal band $\frac{2}{3}$, ventral $\frac{1}{3}$	—	—	÷	—	÷
<i>C. triloba</i>	—	47-55	—	—	—	—	7	÷	slit w. protru- ding lips	50-57	Small papillae at cone shaped tail end of female	—	—	+	—	Vulva, tail of female
<i>C. uropapillata</i>	15,5	24,4	1,07 × 0,013	—	finely spiny	—	4,2	+	—	59	Resembles <i>C. cadovulvata</i> .	—	—	÷	—	Vulva, male tail w. spi- cule tip
<i>C. vazi</i>	10,1	13,2- 14,7	0,41 × 0,01	○	spiny, at end w. greater spines	0,21	3,5	÷	slit	40-52	Vagina long w. spines, anus term.	—	—	+	—	Vulva, male tail

SUMMARY.

1) The species found in gallinaceous birds were the following: *Capillaria longicollis* (Mehlis 1831) in the small intestine of partridge (20 per cent) pheasant (24 per cent) and black grouse (4 per cent). *Capillaria dujardini* Travassos 1915 (*C. columbae* auctt. nov.), in the small intestine of partridge and pheasant, in a few cases. *Capillaria tiaras* n. sp. in the small intestine of partridge chicks, in two cases. *Capillaria cadovulvata* n. sp., in the coeca of partridge (2 per cent) and pheasant (48 per cent). *Capillaria collaris* (v. Linst. 1873), in the coeca of partridge and pheasant, in some few cases. (Table 2). The *Capillaria columbae* of Graybill (1924) has proved to be a separate species, *Capillaria obsignata* nom. nov. The most important characteristics of the species treated are given in table 4, p. 36.

2) In a large collection of *Capillaria longicollis* (300 specimens) and *Capillaria cadovulvata* (700 specimens) the extent of the variation is demonstrated and the following characters of special systematic importance are stressed: for the males: size and shape of the spicule, the appearance of the spicule sheath, the shape of the tail end. For the females: the presence or non-presence of vulvar appendage, the shape of this latter, and the shape of the eggs. To some extent also the shape of the tail end. The validity of those characters have been further investigated in a collection of about 1000 specimens of *Capillaria* especially from anatine birds.

3) Materials as a contribution to the knowledge of the variability of *Capillaria contorta* (Creplin 1839) is given in diagrams and drawings, based on almost 300 specimens. The characteristics of species of *Capillaria* in the upper digestive tract of gallinaceous and anatine birds are given in table 6, p. 45.

4) *C. contorta* was most frequent in pheasants (41 per cent). In swimming ducks the frequency varied from 29 to 38 per cent (Table 7, p. 47). In the freshwater diving ducks it was rare, only occurring in a few per cent. In a considerable number of marine diving ducks it was not found. The same was the case in the partridge.

5) In the lower digestive tract of anatine birds in a collection of about 650 worms 2 new species have been found, viz. *Capillaria mergi* (= *Trichosoma brevicolle* Ebert 1863) and *Capillaria nyrocinarum*. Two earlier, but very incompletely known species have been described in detail, viz. *Capillaria anatis* (Schranck 1790) and *Capillaria spinulosa* (v. Linstow 1890). Further the "Capillaria anatis" of Gorchkov (1937) has been shown to be a new species, called *C. anseris* nom. nov. The most important characteristics of all known species of *Capillaria* from the lower digestive tract of anatine birds are given in table 11, p. 67.

6) The frequency and distribution of the species found are characteristic: *C. anatis* is found in river and pond ducks and the coot, *C. spinulosa* in river and pond and freshwater diving ducks. *C. nyrocinarum* is only found in diving ducks, and most frequent in the marine species. *C. mergi* is notably found in fish ducks, but more rarely also in diving ducks. For the individual species the distribution is summarized in table 7, p. 47.

7) The synonymy and the host occurrence of the species found have been critically revised. Besides the new species the following host occurrences are new: *Capillaria longicollis* in *Columba palumbus*, *Capillaria dujardini* in *Perdix perdix* and *Phasianus colchicus* and *Capillaria collaris* in *Phasianus colchicus*. *Capillaria contorta* in *Nyroca fuligula*, *Bucephala clangula*, *Eudromias morinellus*, *Erolia alpina* and *Capella gallinago*, *Capillaria mergi* in *Somateria mollissima* and *Bucephala clangula*, *Capillaria spinulosa* in *Anas querquedula*, *Anas penelope*, *Anas platyrhynchos*, *Spatula clypeata*, *Nyroca fuligula*, *Nyroca marila* and *Bucephala clangula*. The host occurrences of *Capillaria anatis* have been critically revised, now comprising the following species: *Anas querquedula*, *Anas crecca*, *Anas platyrhynchos*, *A. p. domesticus* and *Fulica atra*.

8) A critical revision of the species of *Capillaria* in birds is given in an alphabetical list, and a host list, at the last part of the paper. As separate species are recognized Diesing's *Capillaria falconis-nisi* and Eberth's *Capillaria exilis* = *Capillaria rasilis* nom. nov. The table 12, p. 96 enumerates the most important features known for all species of *Capillaria* described from birds.

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