

Capillaria

(helminth: nematode)

Overview

Nematodes are triploblastic pseudocoelomate unsegmented worms that undergo protostomial embryonic cleavage and grow by cuticular moulting (ecdysis). Two groups identified by the presence/absence of sensory phasmids have partly been ratified by molecular studies recognising three subclasses: Enoplia and Dorylaimia (both without phasmids) and Chromadoria (most with phasmids). Most aphasmid nematodes are free-living, although some are parasitic on plants and animals. They possess a non-muscular stichosome oesophagus (slender thin-walled tube) and their life-cycles involve infective L1 (rather than L3) which have a buccal stylet (very common for plant parasites). The males lack a bursa and have only one spicule when present. Three major families of animal parasites are grouped together in the dorylaimian order Trichinellida: trichurids in the caecum/colon of mammals, capillarids in the gut/lungs of mammals/birds, and trichinellids in the intestines and muscles of mammals. Capillarids are small uniformly-slender hairworms frequently embedded in host tissues. Many species have simple direct life-cycles involving the faecal-oral transmission of eggs, whereas other species have indirect cycles using earthworms as paratenic or intermediate hosts for L1. Eggs have a characteristic barrel-shape with mucoid polar plugs at each end. Capillarids have recently been divided between different genera, but most texts provide both old and new names to facilitate comprehension. Infections in birds and fish have been associated with unthriftiness, sometimes involving anaemia and diarrhoea, while infections in mammals range from asymptomatic to causing severe enteric, respiratory, urinary and hepatic diseases.

Classification:

Domain: Eukaryota (membrane-bound nucleus)
Supergroup: Amorphea (unikonts with single flagellum, or nonflagellated amoebae)
Kingdom: Metazoa (multicellular eukaryotes, heterotrophs, notably animals)
Group: Protostomia (triploblastic, spiral cleavage)
Subgroup: Ecdysozoa (cuticle moulted = ecdysis)
Phylum: Nematoda (unsegmented, pseudocoelomate roundworms, tubular digestive tract, dioecious)
Class: Enoplea (Aphasmidea, Adenophorea) (gland-bearers, cylindrical oesophagus, no phasmids, setae, two testes)
Subclass: Dorylaimia (five or more oesophageal glands, buccal stylet (odontostyle), free-living or parasitic)
Order: Trichinellida (Trichocephalida, Trichurida) (single spicule, stichosome oesophagus, L1 with buccal stylet)
Superfamily: Trichinelloidea (oesophagus with short muscular anterior portion and long glandular posterior portion)
Family: Capillariidae (gradual transition in width, in gut/respiratory tract of mammals/birds, eggs with polar plugs)
Genus: *Capillaria* (parasitic in tissues of mammals/birds)
Species: various species cause enteric, respiratory, hepatic, urinary diseases in mammals, birds and fish

Parasite biodiversity and host range: Most Metazoa are multicellular triploblastic animals with differentiated tissues, many being bilaterally symmetrical with a body cavity. Most invertebrate animals are protostomes as their embryonic development involves spiral determinate cleavage. Those that moult their external cuticles during their life-cycles (process known as ecdysis) are grouped together in the unique clade Ecdysozoa, including the nematodes (roundworms), onychophorans (velvet worms), tardigrades (water bears) and arthropods (myriapods, chelicerates, crustaceans and hexapods, all with jointed limbs). Nematodes (roundworms) are unsegmented tubular worms with a fluid-filled body cavity (pseudocoelom) that acts as a hydrostatic skeleton. They have longitudinal muscles and typically exhibit a sideways thrashing motion. They have well developed digestive tracts with various partitions: the foregut comprising the mouth (often with lips and papillae), buccal capsule (sometimes with ridges, rods, plates, spears, stylets or teeth) and oesophagus (glandular, muscular or both); the midgut (nonmuscular absorptive section); and hindgut (rectum) emptying through a subterminal anus (cloaca in males). Most nematodes are dioecious and form separate sexes. Male worms have a single testis (sometimes 2), an elongate vas deferens often equipped with a seminal vesicle and ejaculatory duct (glandular and/or muscular), 1-2 copulatory spicules (sometimes with an accessory gubernaculum), and bursate species with elaborate posterior claspers. Female worms are usually didelphic (some monodelphic or polydelphic) with 2 ovaries, 2 oviducts usually with spermatheca, 2 uteri opening into a common vagina and a vulva often equipped with a muscular ovejector. Female worms are oviparous or viviparous and produce numerous eggs or larvae, respectively. Larval stages undergo several moults (L1-L4) before maturing into adult worms. Some nematodes have direct life-cycles where eggs or larvae infect definitive hosts (per os or per cutaneous), but many have indirect cycles where larvae first develop in invertebrate intermediate hosts before infecting definitive hosts (by ingestion, injection or deposition). Many nematode species are free-living in terrestrial and aquatic habitats, while some species from diverse groups have become plant or animal parasites. Two nematode groups identified by the presence/absence of sensory phasmids have partly been ratified by molecular studies recognising three subclasses: Enoplia and Dorylaimia (both without phasmids) and Chromadoria (most with phasmids). Most Enoplia are free-living marine organisms but some are found in freshwater, and on land as plant parasites. The Dorylaimia comprise numerous freshwater and terrestrial species, including major groups of plant and animal parasites. The Chromadoria is represented by many marine groups as well as a

terrestrial group of plant and animal parasites. The taxonomic ranks of many nematode assemblages vary considerably depending on which classification system has been followed. Molecular phylogenetic studies, however, have supported the separate classification of most groups, particularly at the level of superfamily. Collectively, species from at least 16 superfamilies are considered to pose serious threats to human and animal health as infectious diseases.

CLASSIFICATION* OF SUPERFAMILIES OF PARASITIC NEMATODES
Class: Enoplea (Aphasmidea, Adenophorea) (gland-bearers, cylindrical oesophagus, no phasmids, setae, two testes)
Subclass: Dorylaimia (five or more oesophageal glands, buccal stylet (odontostyle), free-living or parasitic)[clade I(2)]
Order: Trichinellida (Trichocephalida, Trichurida) (single spicule, stichosome oesophagus, L1 with buccal stylet)
Superfamily: Trichinelloidea (oesophagus with short anterior muscular and long posterior glandular portions)
Class: Chromadorea (spiral amphids, 3 oesophageal glands, usually annulated bodies, free-living and parasitic)
Order: Rhabditida (Secernentea, Phasmidea) (secretors, phasmids present, amphids anterior, bulbous oesophagus)
Suborder: Rhabditina (free-living or parasitic in invertebrates/lower vertebrates)[clade V(9)]
Infraorder: Rhabditomorpha ('rod-shaped' buccal cavity)
Superfamily: Rhabditoidea (open tube stoma, excretory system with lateral canals)
Superfamily: Strongyloidea (bursate males, prominent buccal capsules, parasites of mammals, birds, reptiles)
Suborder: Spirurina (animal parasites, many use invertebrate intermediate hosts (IH))[clade III(8)]
<i>Incertae sedis</i> Superfamily: Dracunculoidea (elongate parasites of vertebrate tissues, freshwater crustacean IH)
Infraorder: Ascaridomorpha (large roundworms, three large lips, numerous caudal papillae)
Superfamily: Ascaridoidea (ascarids, eggs thick-shelled, larvae may undertake hepato-pulmonary migration)
Superfamily: Heterakoidea (preanal sucker anterior to cloaca in males, direct cycle, infection by egg ingestion)
Infraorder: Gnathostomatomorpha ('jaw-mouthed' due to unique bulbous armed heads)
Superfamily: Gnathostomatoidea (first IH copepod, often use paratenic hosts)
Infraorder: Oxyuridomorpha (pinworms, pointed tails, oesophagus with terminal bulb, males with single spicule)
Superfamily: Oxyuroidea (common in mammals, birds, reptiles, amphibians)
Infraorder: Spiruromorpha (enigmatic clade linked by molecular characters, indirect cycles with IHs)
Superfamily: Acuarioidea (small parasites mostly of birds, with cephalic cordons, ptilina or serrated shields)
Superfamily: Camallanoidea (conspicuous phasmids, L1 with dorsal tooth, ovoviviparous, L1-L3 in copepod)
Superfamily: Filarioidea (tissue-dwelling filarial parasites, lack lips, infect tissues/vessels, arthropod IH)
Superfamily: Habronematoidea (unique head structures with small pseudolabia and median lips)
Superfamily: Physalopteroidea (stomach worms in mammals, insect IH)
Superfamily: Spiruroidea (pseudolabia, bipartite oesophagus, infect birds (crop/gizzard), arthropod IHs)
Superfamily: Thelazioidea (eye-worms of birds and mammals, transmitted by insects)
Suborder: Tylenchina (fungal, plant and animal parasites)[clade IV(10,11,12)]
Infraorder: Panagrolaimomorpha (free-living or parasitic (insects, reptiles, amphibians, mammals))
Superfamily: Strongyloidoidea (dauer stages, lip region without processes, striated cuticle)

*Contemporary genotypic classification schemes recognize strong monophyletic clades at the level of superfamily and infraorder, while previous phenotypic classification schemes had ranked many as separate orders.

The superfamily Trichinelloidea is characterised by worms having a distinctive oesophagus consisting of a short anterior muscular section and a long posterior glandular section (stichosome) encircled by 1-3 rows of unicellular glands (stichocytes). Adult worms generally have long narrow anterior necks (containing only the stichosome) and stouter posterior bodies (containing the reproductive organs). Female worms produce thick-shelled eggs with bipolar mucoïd plugs giving them a lemon- or barrel-shape. Most genera pass unembryonated eggs, but those of some groups (Trichinellidae, Trichosomoididae) embryonate *in utero*. The first-stage larvae (L1) have an oral stylet, similar to their presumed soil-dwelling dorylaimid ancestors. Unlike other parasitic nematodes, the L1 of trichinelloids (rather than L3) is used to infect their final hosts, sometimes after a brief period in an invertebrate intermediate host (such as earthworms) to become infective. Adults worms are endoparasites in most classes of vertebrates, generally occurring within the intestinal mucosa but some infecting epithelia of the urinary, respiratory or integumentary systems. An increasing number of genera have been recognised but their higher classification is confounded as some authorities distinguish 6 families while others have demoted several to subfamily status. The former ranking has been retained in this resource to better help the reader differentiate genera on the basis of recognised apomorphic characters, although future studies may reveal different phylogenetic relationships. The 6 trichinelloid families include: Capillariidae in birds, mammals and fish; Trichuridae (syn. Trichuroididae), Trichinellidae, Anatrachosomatidae and Trichosomoididae primarily in mammals; and Cystoosidae in fish and reptiles.

The family Capillariidae contains small slender worms (often called hair-worms) which show a gradual transition in width with the anterior end being narrowest. Mature worms have 1-3 stichosomes composed of 20-60 stichocytes. The entire adult worm is embedded in the intestinal, urinary or respiratory mucosa, sometimes the liver, spleen or skin, of hosts belonging to all vertebrate groups (birds, mammals, reptiles, amphibians, fish). Many capillariid taxa have been described primarily on the basis of parasite morphology and host occurrence, with over 400 species assigned to over 35 genera. Several attempts have been made to revise their

classification, but no consensus has yet been achieved and comparative molecular phylogenetic studies are in their infancy. Some authorities attempt to list all species in the single genus *Capillaria sensu lato* (in the broadest sense), but most continue to list both old and new names under various synonyms; including *Aonchotheca* (with 3 subgenera *Aonchotheca*, *Avesaonchotheca/Avescapillaria*, *Armocapillaria*), *Baruscapillaria*, *Brevithominx*, *Calodium* (syn. *Hepaticola*), *Capillaria sensu stricto* (syn. *Trichosoma*, *Trichosomum*, *Thominx*, *Orthothominx*, *Nematoideum p.p.*) (with 6 subgenera *Capillaria*, *Capillaroides*, *Hepatocapillaria*, *Neocapillaria*, *Procapillaria*, *Tridentocapillaria*), *Capillostrongyloides*, *Crocodylocapillaria*, *Echinocoleus*, *Eucoleus* (syn. *Ritaklossia*), *Freitascapillaria*, *Gessyella*, *Hepatospina*, *Liniscus*, *Lobocapillaria*, *Ornithocapillaria*, *Paracapillaria* (with 3 subgenera *Paracapillaria*, *Crossicapillaria*, *Ophidocapillaria*), *Paracapillaroides*, *Paratrichosoma*, *Pearsonema*, *Pseudocapillaria* (with 4 subgenera *Pseudocapillaria*, *Ichthyocapillaria*, *Indocapillaria*, *Discocapillaria*), *Pseudocapillaroides*, *Pterothominx* (syn. *Armocapillaria*), *Schulmanella* (with 4 subgenera *Schulmanella*, *Piscicapillaria*, *Lomakinella*, *Amphibiocapillaria*), *Skrjabinocapillaria*, and *Tenoranema*. Some other *Capillaria* species parasitic in fish are now included in the genus *Huffmanella* in the family Trichosomoididae. Female capillariid worms produce distinctive eggs with bipolar mucoid plugs which are excreted with host faeces or urine, with the exception of those species living in internal organs which are only liberated only after infected tissues are eaten by carnivores or scavengers which then excrete intact eggs. In the external environment, most eggs embryonate to contain a small first-stage larva (L1) with a well-defined stylet. The eggs of most species are directly infective to the final host, whereas those of some other species must first be ingested by intermediate hosts (mostly earthworms, but some fish) where they hatch releasing the L1 which becomes infective after some modest growth. Many species infect the digestive tracts of birds and some species have been associated with clinical disease involving catarrhal or fibrinous enteritis and mild anaemia. Other species infect the intestines or airways of mammals, some causing gastroenteric or respiratory perturbances. To date, 4 species are known to infect humans: most cases involving *Aonchotheca philippinensis* infecting the intestines after being acquired by eating undercooked fish; and some sporadic cases involving *Calodium hepaticum* infecting the liver, *Eucoleus aerophilus* infecting the respiratory tract, and *Pearsonema plica* infecting the urinary tract, after the accidental consumption of eggs.

Parasite species	Definitive Hosts [plus Intermediate Hosts (IH) as applicable]	Site of infection (clinical signs)	Distribution
<i>Aonchotheca</i> (male tail with caudal lateral alae and membranous bursa supported by lateral projections, spicule with nonspiny sheath, parasites of digestive tracts of mammals, birds and amphibia)			
<i>A. (Avesaonchotheca) alpina</i> (syn. <i>Pterothominx</i>)	Galliformes: phasianid (black grouse, western capercaillie)		Europe
<i>A. annulosa</i> (<i>annulosum</i>) (syn. <i>Trichosoma</i> , <i>Capillaria</i>)	Rodentia: murid (brown rat, black rat, house mouse, wood mouse, Korean field mouse, yellow-necked mouse), cricetid (bank vole, Lusitanian pine vole); Eulipotyphla: erinaceid (Algerian hedgehog)	intestines	Eurasia, Africa
<i>A. armeniaca</i>	Rodentia: sciurid (European ground squirrel, long-tailed ground squirrel)		Europe
<i>A. baylisi</i>	Rodentia: murid (rusty-bellied brush-furred rat)		Africa
<i>A. bilobata</i> (syn. <i>C. bisonis</i> , <i>megrelica</i>)	Artiodactyla: bovid (cattle, zebu, European bison, sheep, mouflon, goat), cervid (roe deer)	intestines	Europe
<i>A. bovis</i> (syn. <i>A. brevipes</i>)	Artiodactyla: bovid (cattle, water buffalo, yak, muskox, American bison, European bison, sheep, bighorn sheep, mouflon, chamois, Barbary sheep, argali, goat, ibex, Himalayan goral, East Caucasian tur, Japanese serow), antilocaprid (pronghorn), cervid (roe deer, fallow deer, red deer, sika deer, Pere David's deer, water deer, white-tailed deer, chital, Javan rusa, reindeer, moose), giraffid (okapi), camelid (dromedary)	intestines	worldwide
<i>A. brochieri</i>	Primates: hominid (bonobo)	intestines	Africa
<i>A. brosetti</i>	Chiroptera: rhinolophid (Lander's horseshoe bat)		Africa
<i>A. buccalis</i>	Anura: bufonid (common toad, Japanese common toad), dicroglossid (large-headed frog)		Asia
<i>A. (Avesaonchotheca) bursata</i> (syn. <i>Pterothominx</i>)	Galliformes: phasianid (chicken, turkey, ring-necked pheasant, chukar partridge, grey partridge, hazel grouse, western capercaillie, black-billed capercaillie), numidid (helmeted guineafowl); Columbiformes: columbid (pigeon); Anseriformes: anatid (greylag goose) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	small intestine (bloody diarrhoea)	worldwide
<i>A. caprae</i>	Artiodactyla: bovid (goat)		India
<i>A. (Avesaonchotheca)</i>	Galliformes: phasianid (chicken, turkey, ring-necked pheasant,	small	worldwide

<i>caudinflata</i> (syn. <i>Pterothominx</i>)	golden pheasant, green pheasant, grey partridge, chukar partridge, rock partridge, red-legged partridge, common quail, northern bobwhite quail, willow ptarmigan, rock ptarmigan, black grouse, hazel grouse, red grouse, Caucasian grouse, western capercaillie, black-billed capercaillie), numidid (helmeted guineafowl, vulturine guineafowl); Anseriformes: anatid (greylag goose, mallard, muscovy duck); Columbiformes: columbid (pigeon, rock dove, European collared dove, Eurasian collared dove, Oriental turtle dove); Tinamiformes: tinamid (Chilean tinamou); Passeriformes: passerid (sparrow), emberizid (common reed bunting), sturnid (common starling), turdid (American robin, redwing, common blackbird, song thrush, mistle thrush, fieldfare), muscicapid (European robin), corvid (Eurasian jay), lariid (red-backed shrike), sittid (Eurasian nuthatch), thraupid (red-crested cardinal bird); Otidiformes: otidid (little bustard); Bucerotiformes: bucertid (northern red-billed hornbill, western red-billed hornbill); Falconiformes: falconid (common kestrel) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	intestine (bloody diarrhoea)	
<i>A. chabaudi</i>	Chiroptera: rhinolophid (forest horseshoe bat)		Africa
<i>A. corneti</i>	Eulipotyphla: soricid (hero shrew)		Africa
<i>A. crociduri</i>	Eulipotyphla: soricid (Dsinezumi shrew)		Africa
<i>A. cubana</i>	Chiroptera: molossid (Bonda mastiff bat, velvety free-tailed bat)		South America
<i>A. dessetae</i>	Lagomorpha: ochotonid (Royle's pika)		Nepal
<i>A. europaea</i>	Eulipotyphla: soricid (greater white-toothed shrew, lesser white-toothed shrew), talpid (Spanish mole)		Europe, Africa
<i>A. euryali</i>	Chiroptera: rhinolophid (Mediterranean horseshoe bat)		Europe
<i>A. (Avesaonchotheca) exile</i> (<i>exilis</i>) (syn. <i>Pterothominx</i>)	Passeriformes: sturnid (common starling), turdid (song thrush, mistle thrush, red-throated thrush, Swainson's thrush, common blackbird, eastern bluebird, redwing, American robin, ring ouzel), alaudid (Eurasian skylark), fringillid (European greenfinch, brambling), corvid (rook, Eurasian jay, alpine chough), emberizid (common reed bunting), passerid (house sparrow); Galliformes: phasianid (ring-necked pheasant); Anseriformes: anatid (wood duck); Coraciiformes: coraciid (European roller)		Europe
<i>A. forresteri</i>	Rodentia: cricetid (marsh rice rat)	stomach	North America
<i>A. gabonensis</i>	Chiroptera: rhinolophid (forest horseshoe bat)		Africa
<i>A. gastrovuis</i>	Artiodactyla: suid (pig)	stomach	Europe
<i>A. italica</i>	Chiroptera: vespertilionid (brown long-eared bat, Bechstein's bat, long-fingered bat, pond bat, Daubenton's bat, Natterer's bat, lesser noctule, common pipistrelle)		Eurasia
<i>A. kashmirensis</i>	Chiroptera: vespertilionid (wall-roosting mouse-eared bat)	stomach	India
<i>A. landauae</i>	Chiroptera: rhinolophid (Lander's horseshoe bat)		Africa
<i>A. legerae</i>	Rodentia: glirid (garden dormouse)	intestines	Europe
<i>A. (Avesaonchotheca) longifilla</i> (<i>longifila</i>) (syn. <i>Pterothominx</i>)	Passeriformes: prunellid (dunnock, alpine accentor), alaudid (Eurasian skylark), corvid (alpine chough, black-chested jay), sittid (Eurasian nuthatch), muscicapid (Siberian rubythroat), leiotherichid (white-eared sibia), thraupid (red-crested cardinal bird), zosteropid (Taiwan yuhina); Galliformes: phasianid (common quail); Bucerotiformes: bucerotid (northern red-billed hornbill, western red-billed hornbill); Anseriformes: anatid (wood duck, bar-headed goose)		Europe, Africa
<i>A. martinezi</i>	Chiroptera: natalid (Mexican greater funnel-eared bat)		North America
<i>A. mergelica</i>	Artiodactyla: bovid (sheep)		Europe
<i>A. minuta</i>	Eulipotyphla: soricid (common shrew, Laxmann's shrew, Eurasian pygmy shrew)		Eurasia
<i>A. moraveci</i>	Chiroptera: vespertilionid (lesser mouse-eared bat, greater mouse-eared bat, long-fingered bat)	stomach	Europe
<i>A. murissylvatici</i>	Rodentia: murid (house mouse, striped field mouse, yellow-necked	intestines	Eurasia

(syn. <i>Trichosomum</i>)	mouse, Korean field mouse, small Japanese field mouse, wood mouse, brown rat, black rat), cricetid (common vole, field vole, bank vole, tundra vole, social vole, grey red-backed vole, northern red-backed vole, Hokkaido red-backed vole, Baluchistan vole, Sikkim Mountain vole, grey dwarf hamster, Turkish hamster)		
<i>A. musimon</i>	Artiodactyla: bovid (mouflon)		Europe
<i>A. mustelorum</i>	Carnivora: mustelid (European badger, American mink, least weasel)		Europe, North America
<i>A. myoxinitelae</i>	Rodentia: glirid (garden dormouse)	intestines	Europe
<i>A. nycticeiysi</i>	Chiroptera: vespertilionid (Kuhl's pipistrelle)	intestines	India
<i>A. okapi</i>	Artiodactyla: giraffid (okapi)		Africa
<i>A. palmata</i>	Chiroptera: vespertilionid (big brown bat, little brown bat, evening bat, tricolored bat, southeastern myotis)		North America
<i>A. papuensis</i>	Artiodactyla: suid (pig)	intestines	New Guinea
<i>A. paranalis</i>	Carnivora: mustelid (beech marten)		Europe
<i>A. parca</i>	Chiroptera: phyllostomid (Pallas's long-tongued bat)		Americas
<i>A. petrovi</i>	Eulipotyphla: soricid (bicolored shrew, common shrew, Eurasian pygmy shrew, Eurasian water shrew, Mediterranean water shrew)		Eurasia
<i>A. philippinensis</i> (<i>Capillaria</i> , <i>Calodium</i> , <i>Paracapillaria</i> , <i>P.</i> (<i>Crossicapillaria</i>))	Primates: hominid (human), cercopithecoid (rhesus macaque, crab-eating macaque, Formosan rock macaque); Rodentia: murid (mouse, brown rat, Natal multimammate mouse, Mongolian gerbil); Gruiformes: rallid (white-breasted waterhen, common waterhen); Pelecaniformes: ardeid (Chinese pond heron, western cattle egret, yellow bittern, black-crowned night heron); Charadriiformes: rostratulid (greater painted-snipe); Columbiformes: columbid (pigeon); Galliformes: phasianid (chicken); Anseriformes: anatid (mallard) [plus L1 in IH: Perciformes: ambassid (flag-tailed glassfish, Commerson's glassy); Gobiiformes: oxudercid (large snout goby, stream goby), eleotrid (dusky sleeper, tropical carp-gudgeon, apagon); Anabantiformes: osphronemid (croaking gourami); Cyprinodontiformes: poeciliid (rainbow fish, eastern mosquitofish, guppy), aplocheilid (blue panchax); Cypriniformes: cyprinid (common carp, mirror carp, Java barb, red-tailed rasbora, blackline rasbora)] [plus embryonated auto-infective eggs]	intestines (wasting disease, intractable diarrhoea)	Eurasia
<i>A. phyllonycteris</i>	Chiroptera: phyllostomid (Cuban flower bat)		Americas
<i>A. plathyspicula</i>	Artiodactyla: suid (boar)	urinary bladder	Russia
<i>A. praeputialis</i>	Rodentia: murid (bush rat)	preputial gland	Australia
<i>A. putorii</i>	Carnivora: canid (coyote, dog, raccoon dog, red fox), mustelid (American marten, beech marten, European pine marten, Japanese marten, European polecat, American mink, European mink, Eurasian otter, fisher, sable, stoat, Japanese weasel, Siberian weasel, least weasel, ferret, European badger), felid (cat), memphitid (striped skunk), procyonid (raccoon), ursid (American black bear) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	stomach, small intestines (anorexia, bloody vomitus)	Europe, New Zealand
<i>A. ransomia</i> (syn. <i>Baruscapillaria</i>)	Rodentia: cricetid (muskrat)	intestines	Americas
<i>A. rara</i>	Chiroptera: rhinolophid (greater horseshoe bat)		Eurasia
<i>A. rhinolophi</i>	Chiroptera: rhinolophid (Chinese rufous horseshoe bat)		Asia
<i>A. riukuensis</i>	Artiodactyla: suid (wild boar)		Asia
<i>A. romana</i>	Chiroptera: vespertilionid (Bechstein's bat, pond bat, Daubenton's bat, greater mouse-eared bat, whiskered bat, lesser noctule, common pipistrelle, Mediterranean horseshoe bat, greater horseshoe bat)		Europe
<i>A. soricis</i>	Eulipotyphla: talpid (Kobe mole, Sado mole), soricid (Eurasian pygmy shrew, Shinto shrew, long-clawed shrew)	stomach	Asia

<i>A. speciosa</i>	Chiroptera: vespertilionid (northern bat, serotine bat, Bechstein's bat, pond bat, Daubenton's bat, Natterer's bat, greater mouse-eared bat, whiskered bat, common noctule, parti-colored bat), miniopterid (common bentwing bat), rhinolophid (Mediterranean horseshoe bat, greater horseshoe bat, lesser horseshoe bat)		Eurasia, Africa, North America
<i>A. tamiastriati</i>	Rodentia: sciurid (North American chipmunk)	intestines	North America
<i>A. viguerasi</i>	Chiroptera: phyllostomid (Waterhouse's leaf-nosed bat)	intestines	Cuba
<i>A. vietnamensis</i>	Chiroptera: vespertilionid (lesser Asiatic yellow bat)	stomach, intestines	Asia
<i>A. violetti</i>	Rodentia: cricetid (European water vole)	stomach	Europe
<i>Baruscapillaria</i> (male tail without caudal lateral alae, with well-developed membranous bursa supported by lateral lobes, spicule with nonspiny sheath, parasites of digestive tract of birds and mammals)			
<i>B. angusta</i>	Passeriformes: fringillid (common chaffinch), passerid (house sparrow)		Europe
<i>B. anseris</i>	Anseriformes: anatid (mallard, northern pintail, long-tailed duck, common merganser, greater white-fronted goose, snow goose, bean goose, Egyptian goose)		Europe
<i>B. appendiculata</i>	Atheriniformes: atheropsid (pike silverside); Cypriniformes: cyprinid (common carp)		Europe
<i>B. belopolskaiae</i>	Charadriiformes: scolopacid (common snipe), recurvirostrid (black-winged stilt)		Eurasia
<i>B. calliopsis</i>	Passeriformes: muscicapid (Siberian rubythroat)		Russia
<i>B. carbonis</i> (syn. <i>Trichosoma</i> , <i>Capillaria</i>)	Charadriiformes: larid (common gull, slender-billed gull, European herring gull, common tern, black tern, gull-billed tern), charadriid (European golden plover, grey plover); Pelecaniformes: pelecanid (great white pelican, Dalmatian pelican), ardeid (great egret, little egret, grey heron, purple heron, squacco heron, black-crowned night heron), threskiornithid (glossy ibis); Podicipediformes: podicipedid (red-necked grebe, black-necked grebe); Gaviiformes: gaviid (black-throated loon, Pacific loon); Siluriformes: phalacrocoracid (double-crested cormorant, great cormorant, pygmy cormorant); Serpentes: viperid (Russell's viper)		Eurasia
<i>B. cincli</i>	Passeriformes: cinclid (white-throated dipper)		Eurasia
<i>B. conspecta</i>	Rodentia: murid (bush rat, Cape York rat, Australian water rat); Diprotodontia: hysiprymnodontid (musky rat-kangaroo)	intestines	Australia
<i>B. corvorum</i> (syn. <i>Pseudocapillaria</i>)	Passeriformes: corvid (western jackdaw, common raven, carrion crow, hooded crow, large-billed crow, rook, Eurasian jay, blue jay, Eurasian magpie, spotted nutcracker, alpine chough), motacillid (white wagtail), turdid (common blackbird, song thrush, mistle thrush), sturnid (rosy starling), emberizid (yellowhammer), passerid (house sparrow, Eurasian tree sparrow) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]		Eurasia, North America
<i>B. cylindrica</i>	Accipitriformes: accipitrid (common buzzard); Falconiformes: falconid (American kestrel); Strigiformes: strigid (tawny owl)		Palaearctic
<i>B. emberizae</i>	Passeriformes: emberizid (bunting, grey bunting); motacillid (tree pipit), sturnid (bed-cheeked starling)		Eurasia
<i>B. grallinae</i>	Passeriformes: monarchid (magpie-lark)		Australia
<i>B. herodiae</i>	Pelecaniformes: ardeid (grey heron, great egret, great blue heron)		cosmopolitan
<i>B. inflexa</i>	Passeriformes: turdid (blue rock thrush, song thrush), sturnid (common starling)		Europe
<i>B. kutori</i> (syn. <i>Aonchotheca</i>)	Eulipotyphla: soricid (common shrew, tundra shrew, alpine shrew, Tien Shan shrew, Laxmann's shrew, Eurasian water shrew, Eurasian pygmy shrew)		Eurasia
<i>B. longevaginata</i>	Passeriformes: alaudid (Eurasian skylark)		Eurasia
<i>B. multicellularis</i>	Rodentia: murid (brown rat)	intestines	Asia
<i>B. obsignata</i> (syn. <i>C. columbae</i> , <i>droummondi</i> , <i>dujardini</i> , <i>gigantotecta</i>)	Columbiformes: columbid (pigeon, common wood pigeon, white-winged dove, mourning dove, stock dove, Eurasian collared dove, European turtle dove); Galliformes: phasianid (chicken, turkey, common quail, northern bobwhite quail, ring-necked pheasant, grey partridge, red-legged partridge, black grouse, western	intestines (diarrhoea, emaciation)	worldwide

	capercaillie, Congo peafowl), numidid (helmeted guinea fowl); Anseriformes: anatid (mallard, American black duck, garganey, nene, common pochard, Cape teal, yellow-billed pintail, greylag goose, snow goose, black swan, black-necked swan); Piciformes: ramphastid (Toco toucan); Podicipediformes: podicipedid (great crested grebe, western grebe, horned grebe, red-necked grebe, black-necked grebe); Bucerotiformes: bucerotid (Malabar pied hornbill); Pelecaniformes: ardeid (great blue heron, snowy egret), pelecanid (grey pelican); Cuculiformes: cuculid (greater coucal); Charadriiformes: recurvirostrid (black-necked stilt); Passeriformes: fringillid (European greenfinch), sturnid (great myna, common starling), turdid (American robin, varied thrush), passerid (house sparrow)		
<i>B. ovopunctata</i>	Passeriformes: turdid (oriental magpie-robin, song thrush, red-throated thrush, mistle thrush, grey-cheeked thrush, wood thrush, thrush nightingale, common blackbird, redwing, American robin, fieldfare), sturnid (rosy starling, common starling), muscicapid (European robin, white-capped redstart), motacillid (meadow pipit), passerid (rock sparrow), prunellid (alpine accentor), icterid (common grackle, red-winged blackbird), alaudid (Eurasian skylark), corvid (rook, Eurasian jay)		Eurasia
<i>B. pachykeramota</i>	Carnivora: felid (cheetah)		Africa
<i>B. phalacrocoraxi</i>	Siluriformes: phalacrocoracid (pygmy cormorant)		Eurasia
<i>B. pitti</i>	Passeriformes: pittid (hooded pitta), muscicapid (white-vented shama, oriental magpie-robin); Columbiformes: columbid (common emerald dove)	intestines	Asia
<i>B. podicipitis</i>	Podicipediformes: podicipedid (horned grebe, little grebe, pied-billed grebe, great crested grebe, red-necked grebe, black-necked grebe); Charadriiformes: larid (black-headed gull); Anseriformes: anatid (mallard, northern pintail, long-tailed duck, Indian spot-billed duck, tufted duck, greater scaup, garganey, northern shoveler, common pochard, Eurasian teal, Eurasian wigeon, greylag goose, bean goose, greater white-fronted goose, smew, common merganser)		Eurasia
<i>B. prashadi</i>	Rodentia: murid (brown rat)	urinary bladder	India
<i>B. quisquali</i>	Passeriformes: turdid (varied thrush, American robin)		North America
<i>B. rauschi</i>	Eulipotyphla: soricid (cinereous shrew, vagrant shrew)	intestines	North America
<i>B. resecta</i>	Passeriformes: corvid (common raven, rook, western jackdaw, carrion crow, hooded crow, Eurasian magpie, Eurasian jay, blue jay, alpine chough, spotted nutcracker), motacillid (white wagtail), turdid (common blackbird, song thrush, fieldfare); Galliformes: phasianid (chicken)		Palaearctic
<i>B. rudolphii</i>	Suliformes: phalacrocoracid (great cormorant)	intestines	Europe
<i>B. ryzhikovi</i>	Podicipediformes: podicipedid (little grebe, red-necked grebe, black-necked grebe)		Europe
<i>B. saurotherae</i>	Cuculiformes: cuculid (lizard-cuckoo)	intestines	Cuba
<i>B. spiculata</i> (<i>spiculatus</i>)	Suliformes: phalacrocoracid (double-breasted cormorant, neotropical cormorant)		Americas
<i>B. tiaras</i>	Galliformes: phasianid (grey partridge)		Europe
<i>B. traverae</i>	Rodentia: murid (Pacific rat, black rat)	intestines	Asia
<i>Calodium</i> (syn. <i>Hepaticola</i>) (male tail rounded with caudal lateral alae, spicule with nonspiny sheath, parasites of internal organs of mammals)			
<i>C. alatum</i>	Carnivora: mustelid (ferret)		Europe
<i>C. cholidicola</i> (syn. <i>Hepaticola</i>)	Eulipotyphla: soricid (common shrew)		Europe
<i>C. hepaticum</i> (<i>hepatica</i>) (syn. <i>Capillaria</i> , <i>Eucoleus</i> , <i>Hepaticola</i> , <i>H. anthropopitheci</i> ,	Carnivora: canid (dog, coyote, wolf, maned wolf), felid (cat), castorid (Eurasian beaver), memphitid (skunk), mustelid (weasel, stoat); Didelphimorphia: didelphid (opossum); Rodentia: murid (brown rat, black rat, ricefield rat, Annandale's rat, Bartel's spiny rat, Kaiser's rock rat, African grass rat, African marsh rat, long-	liver (often subclinical, sometimes hepatitis)	worldwide

<p><i>Trichocephalus</i>, <i>Trichosoma</i>)</p>	<p>tailed giant rat, giant white-tailed rat, Edward's swamp rat, Edward's long-tailed giant rat, Hellwald's rat, Hoffman's rat, Malayan field rat, Musschenbroek's spiny rat, Pacific rat, South African viel rat, Plains rat, white-bellied rat, yellow-breasted rat, bush rat, opossum rat, greater bandicoot rat, lesser bandicoot rat, fawn-footed mosaic-tailed rat, house mouse, Florida mouse, striped field mouse, typical striped grass mouse, white-footed mouse, yellow-necked mouse, eastern broad-toothed field mouse, small Japanese field mouse, large Japanese field mouse, Korean field mouse, Ethiopian white-footed mouse, Jackson's soft-furred mouse, Natal multimammate mouse, wood mouse, Campana field mouse, savanna gerbil), dipodid (woodland jumping mouse), cricetid (cotton mouse, white-footed mouse, deer mouse, hispid cotton rat, muskrat, marsh rice rat, tundra vole, Venezuelan vole mouse, European water vole, European snow vole, common red-backed vole, southern red-backed vole, northern red-backed vole, grey red-backed vole, bank vole, field vole, common vole, meadow vole, Major's pine vole, tundra vole, social vole, southern bog lemming, grey dwarf hamster), sciurid (woodchuck, eastern chipmunk, American red squirrel, Caucasian squirrel, Brazilian squirrel, Franklin's ground squirrel, Richardson's ground squirrel, groundhog), geomyid (northern pocket gopher), nesomyid (Emin's pouched rat, Gambian pouched rat), echimyid (coypu), erethizontid (North American porcupine), caviid (guinea pig, Brazilian guinea pig); Hyracoidea: procaviid (hyrax); Diprotodontia: phalangerid (common brushtail possum); Eulipotyphla: soricid (Asian house shrew), erinaceid (European hedgehog); Lagomorpha: leporid (rabbit, European hare, mountain hare); Artiodactyla: bovid (Kirk's dik-dik), antilocaprid (pronghorn), tayassuid (peccary); Perissodactyla: equid (horse); Primates: atelid (Geoffrey's spider monkey), cercopithecoid (grivet), hominid (mountain gorilla, chimpanzee, human)</p> <p>[plus IH: Diptera: calliphoridae (latrine fly)]</p>		
<p><i>C. soricicola</i> (syn. <i>Hepaticola</i>)</p>	<p>Eulipotyphla: soricid (common shrew, greater white-toothed shrew, lesser white-toothed shrew, bicolored shrew, Laxmann's shrew, Tien Shan shrew, Eurasian pygmy shrew, Eurasian water shrew, Mediterranean water shrew), talpid (European mole)</p>		<p>Europe, Africa</p>
<p><i>C. splenaecum</i></p>	<p>Eulipotyphla: soricid (greater white-toothed shrew)</p>		<p>Europe</p>
<p><i>Capillaria s.s.</i> (syn. <i>Trichosoma</i>, <i>Trichosomum</i>, <i>Thominx</i>, <i>Orthothominx</i>) (male tail without membranous bursa or pseudobursa but rounded with 2 lateral lobes, spicule with spiny sheath, parasites of digestive tract of fish, amphibia, reptiles, birds and mammals)</p>			
<p><i>C. acanthopagri</i></p>	<p>Perciformes: sparid (blackhead seabream)</p>	<p>intestines</p>	<p>Asia</p>
<p><i>C. alainchabaudi</i></p>	<p>Rodentia: cricetid (Argentine swamp rat)</p>	<p>intestines</p>	<p>South America</p>
<p><i>C. anatis</i> (syn. <i>C. tumida</i>, <i>collare</i>, <i>collaris</i>, <i>semiteres</i>, <i>uruguayensis</i>, <i>Trichosoma</i> <i>brevicolle</i>, <i>dubium</i>, <i>longicolle</i>, <i>retusum</i>, <i>Thominx</i>)</p>	<p>Anseriformes: anatid (mallard, mandarin duck, Muscovy duck, wood duck, mottled duck, falcated duck, Baikal duck, American black duck, tufted duck, bronze-winged duck, ring-necked duck, long-tailed duck, ferruginous duck, European sea duck, ruddy duck, white-headed duck, Australian shelduck, velvet scoter, common scoter, surf scoter, merganser, red-breasted merganser, hooded merganser, canvasback, common pochard, red-crested pochard, bufflehead, common goldeneye, spectacled eider, common eider, greater scaup, lesser scaup, New Zealand scaup, garganey, gadwall, northern shoveler, northern pintail, ringed teal, chesnut teal, cinnamon teal, Eurasian teal, Cape teal, Eurasian wigeon, American wigeon, Chiloe wigeon, smew, greylag goose, snow goose, bean goose, red-breasted goose, greater white-fronted goose, lesser white-fronted goose, Canada goose, Egyptian goose, goosander, black swan, whooper swan, mute swan); Charadriiformes: charadriid (Kentish plover), larid (black tern, little tern, sandwich tern, Caspian tern, European herring gull, black-headed gull, lesser black-headed gull, slender-billed gull, little gull), recurvirostrid (black-necked stilt, American avoset),</p>	<p>crop, oesophagus, intestines, caeca (bloody diarrhoea)</p>	<p>worldwide</p>

	scolopacid (solitary snipe); Gruiformes: rallid (Eurasian coot); Phoenicopteriformes: phoenicopterid (American flamingo); Podicipediformes: podicipedid (red-necked grebe); Galliformes: phasianid (chicken, Indian peafowl, turkey, golden pheasant, ring- necked pheasant, red-legged partridge, grey partridge, hazel grouse, black grouse, Japanese quail, spot-winged wood quail, willow ptarmigan, rock ptarmigan), numidid (helmeted guineafowl) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]		
<i>C. appendigera</i>	Perciformes: lutjanid (gold-banded jobfish)	intestines	Australia
<i>C. aramidisi</i>	Gruiformes: rallid (grey-necked wood rail)	caeca	South America
<i>C. ariusi</i> (syn. <i>Thominx</i>)	Siluriformes: ariid (catfish)		Eurasia
<i>C. blarinae</i>	Eulipotyphla: soricid (northern short-tailed shrew)	oesophagus	North America
<i>C. bohmi</i> (syn. <i>Thominx</i>)	Carnivora: canid (red fox, wolf)		Europe
<i>C. bombinatoris</i> (syn. <i>Trichosoma</i>)	Anura: bombinatorid (European fire-bellied toad)		Europe
<i>C. brasiliana</i>	Pelecaniformes: ardeid (black-crowned night heron)	intestines	South America
<i>C. bursata</i> (syn. <i>Piscicapillaria</i>)	Carcharhiniformes: sphyrnid (great hammerhead, scalloped hammerhead)		Australia
<i>C. (Neocapillaria)</i> <i>carioca</i>	Tetraodontiformes: tetraodontid (checkered puffer fish)	intestines	Pacific
<i>C. catenata</i> (syn. <i>Thominx</i> , <i>Capillaria</i> , <i>Capillaroides</i> , <i>Capillostrongyloides</i>)	Salmoniformes: salmonid (cutthroat trout, sockeye salmon); Perciformes: centrarchid (rock bass, largemouth bass, green sunfish, pumpkinseed, bluegill, black crappie), percid (yellow perch, walleye)	intestine	North America
<i>C. cecumitis</i> (syn. <i>Thominx</i>)	Charadriiformes: scolopacid (red knot, dunlin, willet)		Eurasia
<i>C. chandleri</i>	Rodentia: sciurid (Franklin's ground squirrel)	intestines	North America
<i>C. (Hepatocapillaria)</i> <i>cichlasomae</i>	Cichliformes: cichlid (Mayan cichlid)	liver	South America
<i>C. (Neocapillaria)</i> <i>cooperi</i> (syn. <i>Pseudocapillaria</i>)	Callionymiformes: callionymid (crook-spined dragonet); Tetraodontiformes: monacanthid (horseshoe leatherjacket)		Australasia
<i>C. (Hepatocapillaria)</i> <i>cyprinodonticola</i> (syn. <i>Schulmanela</i>)	Cyprinodontiformes: goodeid (goldbreast splitfin, Balsas splitfin), poeciliid (common molly, sailfin molly, shortfin molly, porthole livebearer), cyprinodontid (sheepshead minnow, gold-spotted killifish), fundulid (Gulf killifish); Characiformes: characid (Mexican tetra); Cichliformes: cichlid (convict cichlid)	liver	worldwide
<i>C. dicruri</i> (syn. <i>Thominx</i>)	Passeriformes: dicrurid (hair-crested drongo)		Asia
<i>C. (Tridentocapillaria)</i> <i>eurycerca</i> (<i>eurycercus</i>) (syn. <i>Echinocoleus</i>)	Piciformes: picid (grey-headed woodpecker)		Europe
<i>C. fulicae</i> (syn. <i>Thominx</i>)	Gruiformes: rallid (American coot, Eurasian coot, American purple gallinule, common moorhen), gruid (whooping crane)		Eurasia, North America
<i>C. (Procapillaria) gracilis</i> (<i>gracile</i>) (syn. <i>Thominx</i> , <i>C.</i> <i>kabatai</i>)	Gadiformes: gadid (Atlantic cod, poor cod, haddock, merling, whiting-pout), phycid (red hake, Boston hake), macrourid (roughhead grenadier, marlin-spike grenadier), merluciid (offshore hake, silver hake, European hake, shallow-water Cape hake, deep- water Cape hake), lotid (common ling, shore rockling, four beard rockling); Pleuronectiformes: pleuronectid (European flounder, American plaice, Atlantic halibut); Scorpaeniformes: cottid (longhorn sculpin), agonid (hooknose), scorpaenid (red scorpionfish); Callionymiformes: callionymid (common dragonet); Perciformes: anarhichadid (Atlantic wolffish), percid (greenside darter); Carangiformes: carangid (Florida pompano);	intestines	Paleartic

	Trachiniformes: trachinid (weever fish) [plus L1 in IH: Oligochaeta: lumbricid (earthworms): Diptera: chironomid (lake fly)]		
<i>C. (Neocapillaria) hakofugu</i>	Tetraodontiformes: ostraciid (blue-spotted boxfish)	rectum	Asia
<i>C. (Tridentocapillaria) hirundinis</i>	Apodiformes: apodid (common swift); Caprimulgiformes: capramulgid (European nightjar); Passeriformes: hirundinid (common house martin, sand martin), muscicapid (spotted flycatcher)	intestines	Eurasia
<i>C. indica</i> (syn. <i>Pseudocapillaria</i>)	Anabantiformes: channid (dwarf snakehead)	intestines	Asia
<i>C. (Tridentocapillaria) javanensis</i>	Piciformes: picid (common flameback, buff-necked woodpecker), megalaimid (golden-whiskered barbet)	intestines	Asia
<i>C. longistriata</i>	Piciformes: picid (northern flicker, pileated woodpecker)	intestines	North America
<i>C. madnesi</i>	Passeriformes: corvid (large-billed crow)	stomach, intestines	Asia
<i>C. manica</i>	Passeriformes: fringillid (common chaffinch)	intestines	Europe
<i>C. (Procapillaria) margolisi</i> (syn. <i>Pseudocapillaria (Discocapillaria)</i>)	Pleuronectoformes: pleuronectid (Pacific halibut); Scorpaeniformes: cottid (cabezon); Cypriniformes: cyprinid (mola carplet, rosy barb, pool barb)	caeca	Asia
<i>C. michiganensis</i>	Rodentia: cricetid (muskrat)	intestines	North America
<i>C. (Procapillaria) navoneae</i>	Anguilliformes: congrid (Argentine conger)	intestines	South America
<i>C. nyrocinarum</i>	Anseriformes: anatid (mallard, garganey, tufted duck, greater scaup, common goldeneye, long-tailed duck, white-winged scoter, velvet scoter, common scoter, surf scoter, common eider, king eider, mute swan); Charadriiformes: scolopacid (Eurasian whimbrel)	intestines, caeca	
<i>C. orectolobi</i> (syn. <i>Piscicapillaria</i>)	Orectolobiformes: orectolobid (ornate wobbegong)		Australia
<i>C. ornamentata</i>	Dasyuromorphia: dasyurid (agile antechinus, dusky antechinus)	nasal sinus	Australia
<i>C. (Tridentocapillaria) parusi</i>	Passeriformes: parid (green-backed tit), sittid (Eurasian nuthatch)	intestines	Eurasia
<i>C. patzcuarensis</i>	Cypriniformes: cyprinid (Patzauaro chub, common carp); Cyprinodontiformes: goodeid (blackfin goodea); Atheriniformes: atherinopsid (slender silverside, pike silverside)	intestines	South America
<i>C. phasianina</i> (syn. <i>Thominx</i>)	Galliformes: phasianid (chicken, Indian peafowl, turkey, golden pheasant, blood pheasant, ring-necked pheasant, grey partridge, chukar partridge, Himalayan snowcock, Tibetan snowcock, Temminck's tragopan), numidid (helmeted guineafowl); Passeriformes: corvid (Eurasian jay)	intestines, caeca	Eurasia
<i>C. (Neocapillaria) phoxini</i>	Cypriniformes: cyprinid (Amur minnow)		Asia
<i>C. platyrrhinorum</i> (syn. <i>Thominx</i>)	Primates: cebid (capuchin monkey)	intestines	Americas
<i>C. plectropomi</i>	Perciformes: serranid (coral trout)	intestines	New Caledonia
<i>C. (Neocapillaria) pterophylli</i>	Cichliformes: cichlid (Jack Dempsey, Altum angelfish, freshwater angelfish, blue discus, red discus, uaru); Cypriniformes: cyprinid (tiger barb, White Cloud Mountain minnow); Anabantiformes: osphronemid (dwarf gourami)	intestines	Americas, Asia
<i>C. recondita</i>	Anura: hylodid (Gaudichaud's frog)	intestines	South America
<i>C. recurvirostrae</i>	Charadriiformes: recurvirostrid (American avocet)	intestines	Americas
<i>C. rhinobati</i> (syn. <i>Piscicapillaria</i>)	Rajiformes: rhinobatid (shovelnose ray)		Asia
<i>C. rigidula</i>	Passeriformes: prunellid (dunnock, alpine collaris), passerid (Spanish sparrow)	intestines	Eurasia
<i>C. (Procapillaria)</i>	Rajiformes: rajid (thorny skate)	intestines	Atlantic

<i>schmidtii</i>			
<i>C. serpentina</i> (syn. <i>Amphibiocapillaria</i>)	Testudines: chelydrid (common snapping turtle), emydid (painted turtle, Cuban slider), kinosternid (common musk turtle)	intestines	Americas
<i>C. similis</i> (syn. <i>Thominx</i>)	Passeriformes: fringillid (common chaffinch), corvid (Eurasian jay), muscicapid (common redstart, Guidenstadt's redstart), sturnid (common starling), turdid (common blackbird, song thrush, Neumann's thrush, song thrush, mistle thrush, fieldfare); Anseriformes: anatid (red-crested pochard)		Eurasia
<i>C. skrjabini</i>	Anseriformes: anatid (mute swan)	caeca	Russia
<i>C. spinulosa</i> (<i>spinulosum</i>) (syn. <i>Thominx</i>)	Anseriformes: anatid (mallard, ring-necked duck, ferruginous duck, falcated duck, mottled duck, tufted duck, American black duck, long-tailed duck, gadwall, velvet scoter, common scoter, greater scaup, common goldeneye, garganey, Eurasian wigeon, common pochard, red-crested pochard, northern shoveler, northern pintail, dunbird, Eurasian teal, Baikal teal, whooper swan, mute swan); Gruiformes: rallid (Eurasian coot)	caeca	Palaearctic
<i>C. spirale</i> (syn. <i>Thominx</i>)	Pelecaniformes: threskiornithid (Eurasian spoonbill)		Eurasia
<i>C. talpae</i> (syn. <i>Nematoideum talpae</i>) (<i>sp. inq.?</i>)	Eulipotyphla: talpid (European mole, Caucasian mole, Spanish mole, Roman mole)		Europe
<i>C. tenuissima</i> (syn. <i>Thominx</i>)	Strigiformes: strigid (boreal owl, short-eared owl, long-eared owl, little owl, Eurasian eagle-owl, Eurasian pygmy owl, Ural owl, barred owl, great horned owl, barn owl, snowy owl, oriental scops owl, tawny owl); Accipitriformes: accipitrid (Eurasian sparrowhawk, common buzzard, rough-legged buzzard) [plus IH: Salmoniformes: salmonid (grayling)]	gizzard, intestines	Palaearctic
<i>C. totani</i> (syn. <i>Pterothominx</i>)	Charadriiformes: scolopacid (common sandpiper, Terek sandpiper), charadriid (common ringed plover)	caeca	Europe
<i>C. (Tridentocapillaria) tridens</i> (syn. <i>Thominx</i> , <i>C. pirangae</i>)	Passeriformes: passerid (house sparrow, Eurasian tree sparrow), passerellid (eastern towhee), parid (great tit, green-backed tit), parulid (yellow-throated warbler, hooded warbler, blackburnian warbler, black and white warbler), sturnid (spotless starling, rosy starling), cardinalid (scarlet tanager, summer tanager), leiothricid (Taiwan barwing, Steere's liocichla), emberizid (red-headed bunting), laniid (long-tailed shrike), icterid (red-winged blackbird), turdid (common nightingale), pectorneid (grey-cheeked fulvetta), cinclid (brown dipper), sylviid (garden warbler, vinous-throated parrotbill), timaliid (streak-breasted scimitar babbler), vireonid (white-eyed vireo), pycnonotid (collared finchbill), muscicapid (spotted flycatcher), corvid (large-billed crow, Sumatran treepie, spotted nutcracker), zosteropid (warbling white-eye); Piciformes: picid (northern flicker, maroon woodpecker, red-bellied woodpecker); Caprimulgiformes: caprimulgid (large-tailed nightjar); Coraciiformes: coraciid (European roller); Galliformes: phasianid (turkey)	oesophagus, stomach, intestines, mesentery, body cavity	Americas, Eurasia
<i>C. uruguayensis</i>	Galliformes: phasianid (chicken)	intestines, caeca	South America
<i>C. vazi</i>	Galliformes: odontophorid (spot-winged wood quail)	intestine	South America
<i>C. venusta</i>	Piciformes: picid (northern flicker), ramphastid (black-necked aracari, toco toucan, channel-billed toucan)		South America
<i>C. (Neocapillaria) wickinsi</i>	Pleuronectiformes: pleuronectid (European plaice)	intestines, rectum	North Sea
<i>Capillostrongyloides</i> (male tail with membranous bursa-like structure supported by subventral lobes, spicule with nonspiny sheath, parasites of stomach of freshwater fish)			
<i>C. ancistri</i>	Siluriformes: loricariid (bushy mouth catfish)	intestines	South America
<i>C. congiopodi</i>	Scorpaeniformes: congiopodid (horsefish)	gall bladder	South America
<i>C. fritschi</i>	Siluriformes: bagrid (bayad, semutundu), malapterurid (electric		Africa

	catfish)		
<i>C. minima</i>	Characiformes: anostomid (banded leporinus)		South America
<i>C. morae</i>	Gadiformes: morid (common mora)	stomach	Europe
<i>C. norvegica</i>	Gadiformes: gadid (four-bearded rockling)	stomach	Atlantic
<i>C. physiculi</i>	Gadiformes: morid (southern bastard codling)		Australia
<i>C. sentiosa</i>	Characiformes: characid (Mexican tetra), erythrinid (wolf fish)		Americas
<i>C. tandani</i>	Siluriformes: plotosid (eel-tailed catfish)		Australia
<i>C. tasmanica</i>	Gadiformes: macrourid (javelinfinch), merlucciid (blue grenadier)	stomach	Australasia
<i>C. zederi</i>	Characiformes: erythrinid (wolf fish)		Americas
<i>Crocodylocapillaria</i> (male tail without caudal alae, without pseudobursa, with 2 posterior lobes, spicule with spinose sheath, parasites of digestive tract of crocodiles)			
<i>C. longiovata</i>	Crocodylia: crocodylid (freshwater crocodile, New Guinea crocodile, saltwater crocodile)	stomach	Australasia
<i>Echinocoleus</i> (male tail with small membranous bursa-like structure supported by 2 lobular projections, spicule with spiny sheath, parasites of digestive tract of birds and mammals)			
<i>E. auritae</i>	Didelphimorphia: didelphid (common opossum, gray four-eyed opossum)		Americas
<i>E. confusus</i> (syn. <i>Capillaria</i> , <i>Thominx</i>)	Gruiformes: rallid (wood rail)	oesophagus	South America
<i>E. cyanopicae</i>	Passeriformes: corvid (azure-winged magpie, Eurasian magpie)		Asia
<i>E. ellisi</i> (syn. <i>Thominx</i>)	Anseriformes: anatid (black swan)		Australia
<i>E. hydrochoeri</i> (syn. <i>Capillaria</i> , <i>Eucoleus</i>)	Rodentia: caviid (capybara)	stomach, intestines	South America
<i>Eucoleus</i> (syn. <i>Ritaklossia</i>) (male tail with rudimentary pseudobursa formed by 2 tiny lobes connected by dorsal cuticular membrane, slender spicule with long spiny sheath, parasites of digestive and respiratory tracts of birds and mammals)			
<i>E. aerophilus</i> (<i>aerophila</i>) (syn. <i>Thominx</i> , <i>Capillaria</i>) (tracheal worm)	Carnivora: canid (dog, wolf, coyote, red fox, Arctic fox, gray fox, kit fox, crab-eating fox, golden jackal, raccoon dog), felid (cat, Iriomote cat, Eurasian lynx, Iberian lynx, bobcat, wildcat, leopard cat, Florida panther), mustelid (American pine marten, European pine marten, beech marten, Japanese marten, European badger, European polecat, sable, Eurasian otter, stoat, least weasel, ferret), herpestid (Egyptian mongoose), procyonid (raccoon), ursid (American black bear, brown bear); Didelphimorphia: didelphid (Virginia opossum); Eulipotyphla: erinaceid (European hedgehog); Primates: hominid (human) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	trachea, bronchi, nasal passages (nasal discharge, wheezing cough, sneezing)	worldwide
<i>E. annulatus</i> (<i>annulata</i>)	Columbiformes: columbid (pigeon); Galliformes: phasianid (chicken, turkey, jungle fowl, ring-necked pheasant, ruffed grouse, black grouse, northern bobwhite quail, golden pheasant, Reeve's pheasant, grey partridge, willow ptarmigan, western capercaillie, black-billed capercaillie, Himalayan snowcock), numidid (helmeted guineafowl, crested guineafowl); Anseriformes: anatid (mallard, northern shoveler) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	oesophagus, crop (inappetence)	worldwide
<i>E. bacillatus</i> (<i>bacillata</i>)	Rodentia: murid (mouse, wood mouse, yellow-necked mouse, Algerian mouse, black rat, brown rat, ricefield rat), cricetid (common vole, Major's pine vole, southwestern water vole, European water vole, bank vole)	oesophagus	Europe
<i>E. baskakowi</i>	Rodentia: sciurid (Caucasian Mountain ground squirrel)	trachea, oesophagus	Europe
<i>E. bernardi</i>	Eulipotyphla: soricid (Eurasian water shrew, Mediterranean water shrew)		Europe
<i>E. boehemi</i>	Carnivora: canid (wolf, red fox, dog)	sinuses, nasal passages	Eurasia
<i>E. breviductus</i>	Dasyuromorphia: dasyurid (eastern quoll, northern quoll, spotted-tailed quoll, kowari, agile antechinus, fawn antechinus, brown	tongue, stomach,	Australia

	antechinus, yellow-footed antechinus, dusky antechinus, sandstone antechinus, white-footed dunnart)	intestines	
<i>E. buckenbourensis</i>	Peramelemorphia: peramelid (long-nosed bandicoot)	lips	Australia
<i>E. cairinae</i>	Anseriformes: anatid (muscovy duck)	oesophagus	South America
<i>E. contortus</i> (<i>contorta</i>) (syn. <i>Thominx</i> , <i>Capillaria</i>) (syn. <i>C. oesophagealis</i> , <i>C. laricola</i> , <i>C. venteli</i> , <i>E. lophortygis</i> , <i>E. thomascameroni</i> , <i>E. spirale</i>)	Anseriformes: anatid (mallard, wood duck, ring-necked duck, mandarin duck, mottled duck, falcated duck, tufted duck, ruddy duck, marbled duck, ferruginous duck, long-tailed duck, American black duck, northern pintail, northern shoveler, common eider, Eurasian teal, Baikal teal, blue-winged teal, green-winged teal, cinnamon teal, Eurasian wigeon, garganey, gadwall, lesser scaup, greater scaup, canvasback, redhead, common pochard, red-crested pochard, bufflehead, common goldeneye, common shelduck, greylag goose, smew); Galliformes: phasianid (chicken, turkey, red-legged partridge, Barbary partridge, ring-necked pheasant, bobwhite quail, western capercaillie); Accipitriformes: accipitrid (bald eagle, common buzzard, eastern buzzard, red-tailed hawk, red-shouldered hawk, northern goshawk); Strigiformes: strigid (tawny owl); Charadriiformes: scolopacid (dunlin, common snipe, common redshank, spotted redshank, ruff, green sandpiper, Terek sandpiper, ruddy turnstone, red knot, Temminck's stint, black-tailed godwit, European woodcock), charadriid (common ringed plover, little ringed plover, European golden plover, white-tailed lapwing, northern lapwing, common sandpiper, Eurasian dotterel), recurvirostrid (black-necked stilt, pied avocet), alcid (little auk, black guillemot, thick-billed murre), larid (black-legged kittiwake, European herring gull, common gull, little gull, silver gull, slender-billed gull, Pallas's gull, great black-backed gull, black-headed gull, black-tailed gull, lesser black-backed gull, great black-backed gull, slaty-backed gull, glaucous gull, Caspian gull, Mediterranean gull, common tern, white-winged tern, black tern, gull-billed tern, little tern, royal tern, sandwich tern, Arctic tern, Aleutian tern, Caspian tern); Podicipediformes: podicipedid (horned grebe, great crested grebe, red-necked grebe, black-necked grebe, little grebe); Pelecaniformes: pelecanid (brown pelican), ardeid (black-crowned night heron, Eurasian bittern), threskiornithid (American white ibis, Eurasian spoonbill, roseate spoonbill, glossy ibis); Siluriformes: phalacrocoracid (double-breasted cormorant, neotropical cormorant, great cormorant); Gruiformes: rallid (common crane, corn crane, spotted crane, Eurasian coot, common moorhen, water rail); Passeriformes: corvid (blue jay, Eurasian jay, Eurasian magpie, carrion crow, American crow, carrion crow, rook, western jackdaw), passerid (fox sparrow, rock sparrow), sturnid (common starling, spotless starling), turdid (common blackbird, song thrush, fieldfare), acrocephalid (sedge warbler), alaudid (Eurasian skylark, crested lark), muscicapid (European robin, blue throat, northern wheatear, black redstart), oridid (Eurasian golden oriole), prunellid (dunnock) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	oesophagus, crop (anaemia, inappetence)	worldwide
<i>E. corvicola</i>	Passeriformes: corvid (hooded crow)		Europe
<i>E. didelphis</i>	Didelphimorphia: didelphid (Virginia opossum)		North America
<i>E. dispar</i> (syn. <i>Thominx</i>)	Accipitriformes: accipitrid (common buzzard, long-legged buzzard, northern goshawk, Eurasian sparrowhawk, black kite); Falconiformes: falconid (saker falcon, merlin, peregrine falcon, Eurasian hobby, common kestrel); Strigiformes: strigid (barred owl, boreal owl, short-eared owl, long-eared owl); Galliformes: phasianid (chukar partridge, grey partridge, Barbary partridge, common quail, ring-necked pheasant, western capercaillie, Altai snowcock, Himalayan snowcock); Anseriformes: anatid (mallard); Passeriformes: acrocephalid (sedge warbler), corvid (carrion crow, hooded crow, rook, Eurasian jay, Eurasian magpie), sturnid		Eurasia, North America

	(common starling)		
<i>E. dubia (dubius)</i>	Chiroptera: vespertilionid (Brandt's bat)		Asia
<i>E. eberthi</i>	Didelphimorphia: didelphid (grey four-eyed opossum)		Americas
<i>E. fluminensis</i>	Didelphimorphia: didelphid (common opossum, big-eared opossum)		Americas
<i>E. fluvidus</i>	Peramelemorphia: peramelid (long-nosed bandicoot, eastern barred bandicoot)	tongue, oesophagus, stomach	Australia
<i>E. frugilegi</i>	Passeriformes: corvid (carrion crow, rook) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	oesophagus	Europe
<i>E. garfiai</i>	Artiodactyla: suid (pig) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	tongue	Europe
<i>E. gastricus (gastrica)</i> (syn. <i>Thominx</i> , <i>Capillaria</i> , <i>C. muris</i> , <i>Hepaticola</i> , <i>H. cancerogena</i>)	Rodentia: cricetid (common vole, Gunther's vole, European water vole, muskrat, marsh rice rat), murid (brown rat, black rat, Pacific rat, bush rat, Australian swamp rat, Cape York rat, dusky field rat, house mouse, Natal multimammate mouse, striped field mouse, yellow-necked mouse, wood mouse, alpine field mouse, yellow-necked mouse), spalacid (lesser mole-rat); Dasyuromorphia: dasyurid (dusky antechinus)	stomach, oesophagus	Eurasia, Americas, Australia
<i>E. lemni</i>	Rodentia: cricetid (northern red-backed vole, muskrat)	stomach	Eurasia
<i>E. longiductus</i>	Peramelemorphia: peramelid (long-nosed bandicoot, eastern barred bandicoot, southern brown bandicoot, northern brown bandicoot); Dasyuromorphia: dasyurid (agile antechinus, fawn antechinus, dusky antechinus, northern quoll)	lips, tongue, oesophagus, stomach	Australia
<i>E. marii</i> (syn. <i>Thominx</i> , <i>Capillaria</i>)	Eulipotyphla: talpid (Russian desman)		Russia
<i>E. medjerdae</i>	Rodentia: murid (mouse)		Europe
<i>E. obtusiuscula</i>	Charadriiformes: scolopacid (common sandpiper, little stint, Temminck's stint, common snipe, great snipe, ruff, grey-tailed tattler, wandering tattler, common sandpiper, wood sandpiper, marsh sandpiper, common redshank), charadriid (common ringed plover, little ringed plover, lesser sand plover, grey plover, northern lapwing, white-tailed lapwing, Eurasian dotterel), recurvirostrid (black-winged stilt), haematopodid (Eurasian oystercatcher); Anseriformes: anatid (garganey); Gruiformes: gruid (common crane, blue crane, black-crowned crane, whooping crane, great gray crane)		Eurasia, Africa
<i>E. oesophagicola</i> (syn. <i>Thominx</i>)	Eulipotyphla: soricid (common shrew, bicolored shrew, lesser white-toothed shrew, Eurasian pygmy shrew, Eurasian water shrew, Mediterranean water shrew, northern short-tailed shrew, vagrant shrew), talpid (European mole)	oesophagus, stomach	Eurasia, North America
<i>E. parvulus</i>	Peramelemorphia: peramelid (southern brown bandicoot, northern brown bandicoot, eastern barred bandicoot, long-nosed bandicoot)	stomach, intestines	Australia
<i>E. penidoi</i>	Tinamiformes: tinamid (spotted nothura)	oesophagus, oral cavity	South America
<i>E. perforans</i> (syn. <i>Thominx</i>)	Galliformes: phasianid (turkey, chukar partridge, grey partridge, ring-necked pheasant, western capercaillie), numidid (vulturine guineafowl, helmeted guineafowl); Anseriformes: anatid (mallard, northern pintail); Gruiformes: pallid (common moorhen)	oesophagus, crop	worldwide
<i>E. perplexus</i>	Peramelemorphia: peramelid (long-nosed bandicoot)	lips	Australia
<i>E. plumosus</i>	Rodentia: murid (bush rat, swamp rat, house mouse)	intestines	Australia
<i>E. posterus</i>	Peramelemorphia: peramelid (long-nosed bandicoot)	lips, scrotum	Australia
<i>E. procyonis</i>	Carnivora: procyonid (raccoon), memphitid (striped skunk)		North America
<i>E. pseudoplumosus</i>	Peramelemorphia: peramelid (southern brown bandicoot, northern brown bandicoot, eastern barred bandicoot, long-nosed bandicoot); Dasyuromorphia: dasyurid (agile antechinus, brown antechinus, dusky antechinus, white-footed dunnart)	stomach, intestines	Australia
<i>E. raillieti</i>	Anseriformes: anatid (mallard)		Europe

(syn. <i>Thominx</i> , <i>Capillaria</i>)			
<i>E. rickardi</i>	Dasyuromorphia: dasyurid (brown antechinus, dusky antechinus, agile antechinus, white-footed dunnart)	stomach, intestines	Australia
<i>E. schvalovoj</i>	Carnivora: mustelid (Eurasian otter)		Europe
<i>E. strumosus</i>	Galliformes: phasianid (chicken)		Europe
<i>E. suppereri</i>	Accipitriformes: accipitrid (common buzzard)		Eurasia
<i>E. tenuis</i>	Eulipotyphla: erinaceid (southern white-breasted hedgehog, northern white-breasted hedgehog, European hedgehog)		Europe
<i>E. trilobus</i>	Charadriiformes: charadriid (grey-headed lapwing, grey plover)		Europe
<i>E. tringae</i>	Charadriiformes: scolopacid (spotted redshank)		Asia
<i>E. trophimenkovi</i>	Carnivora: mustelid (European pine marten)		Europe
<i>E. urotrichi</i> (syn. <i>Thominx</i>)	Eulipotyphla: talpid (Japanese shrew mole)		Asia
<i>E. vanelli</i> (syn. <i>Thominx</i> , <i>Capillaria</i>)	Charadriiformes: charadriid (killdeer, northern lapwing, grey-headed lapwing)		Holarctic
<i>Freitascapillaria</i> (male tail laterally expanded, spicule absent, nonspiny sheath, parasites of digestive tract of freshwater fish)			
<i>F. laticauda</i>	Scorpaeniformes: cottid (blue ridge sculpin)	intestines	North America
<i>F. maxillosa</i> (syn. <i>Capillaria maxillosa</i> , <i>Pseudocapillaria nuda</i>)	Characiformes: characid (dorado)	stomach, pyloric caeca	South America
<i>Gessyella</i> (male tail with caudal lateral alae, eggs enclosed in special capsules, parasites of digestive tract of fish)			
<i>G. latridopsis</i>	Perciformes: latrid (bastard trumpeter)		Australia
<i>Liniscus</i> (male tail with membranous pseudobursa supported by 2 short projections, long thin spicule with nonspiny sheath, parasites of urinary tract of small mammals)			
<i>L. capillaris</i>	Eulipotyphla: soricid (common shrew, Laxmann's shrew), talpid (European mole, Spanish mole)		Eurasia
<i>L. diazae</i>	Rodentia: cricetid (red hocicudo, Azara's akodont)	urinary bladder	South America
<i>L. himizu</i>	Eulipotyphla: talpid (Japanese shrew mole)	urinary bladder	Asia
<i>L. hokkaidensis</i>	Eulipotyphla: soricid (Eurasian pygmy shrew, Shinto shrew, long-clawed shrew)	urinary bladder	Asia
<i>L. incrassatus</i> (<i>incrassata</i>) (syn. <i>L. exilis</i> , <i>Trichosoma</i> , <i>T. capillare</i> , <i>Capillaria</i> , <i>C. linstowi</i> , <i>sunci</i> , <i>urinicola</i>)	Eulipotyphla: soricid (common shrew, bicolored shrew, greater white-toothed shrew, lesser white-toothed shrew, Radde's shrew, Mediterranean water shrew, Eurasian water shrew, Eurasian pygmy shrew, Radde's shrew, Tien Shan shrew, Asian house shrew), talpid (European mole, Caucasian mole, Roman mole)	intestine, urinary bladder	Eurasia
<i>L. maseri</i>	Eulipotyphla: soricid (Pacific shrew, marsh shrew, Trowbridge's shrew, vagrant shrew), talpid (American shrew mole)	urinary bladder	North America
<i>L. papillosus</i> (<i>papillosa</i> , <i>papillosum</i>) (syn. <i>Trichosoma</i> , <i>T. schmidtii</i> , <i>Capillaria</i> , <i>Calodium</i> , <i>Aonchotheca</i>)	Rodentia: murid (brown rat, black rat), cricetid (common vole, grey dwarf hamster)	urinary bladder	Eurasia
<i>Lobocapillaria</i> (male tail rounded with 2 large elongate lateral caudal lobes, flat grooved spicule with long nonspiny sheath, parasites of digestive tract of fish)			
<i>L. austropacifica</i>	Perciformes: sphyraenid (obtuse barracuda)	gall bladder	Australia
<i>L. sphyraeni</i> (syn. <i>Capillaria</i> , <i>Pseudocapillaria</i>)	Scombriformes: sphyraenid (blackfin barracuda)	gall bladder	Atlantic
<i>Paracapillaria</i> (male tail with membranous bursa-like structure supported by rays, spicule with undivided nonspiny sheath, parasites of digestive tract of fish, amphibia and reptiles)			
<i>P. (Paracapillaria) argentinensis</i>	Trachiniformes: pinguipedid (Brazilian sandperch)	stomach	South America
<i>P. bufonis</i> (syn. <i>Amphibiocapillaria</i>)	Anura: bufonid (Japanese common toad), ranid (dark-spotted frog)	intestines	Asia
<i>P. colubra</i>	Serpentes: colubrid (southern black racer)	oviducts	North

			America
<i>P. (Ophidiocapillaria) congolensis</i>	Serpentes: colubrid (ornate water snake)		Africa
<i>P. (Paracapillaria) epinepheli</i>	Perciformes: serranid (red grouper)		Atlantic
<i>P. (Paracapillaria) gibsoni</i> (syn. <i>Pseudocapillaria (Ichthyocapillaria)</i>)	Pleuronectiformes: pleuronectid (European flounder); Perciformes: sillaganid (Gangetic whiting)	stomach	Eurasia
<i>P. (Paracapillaria) helenae</i>	Perciformes: stichaeid (Japanese warbonnet)		Asia
<i>P. heterodontis</i>	Serpentes: viperid (cottonmouth), colubrid (banded water snake)		North America
<i>P. (Ophidiocapillaria) huffmani</i>	Serpentes: colubrid (diamondback water snake)	urinary bladder	North America
<i>P. (Ophidiocapillaria) kuntzi</i>	Serpentes: colubrid (Japanese striped snake, tiger keelback, greater green snake)	intestines	Asia
<i>P. (Ophidiocapillaria) longispicula</i> (<i>longispiculum</i>) (syn. <i>Trichosoma, Capillaria</i>)	Serpentes: pythonid (amethystine python, carpet python, Indian python, Burmese python)		Asia, Australia
<i>P. (Ophidiocapillaria) madagascariensis</i>	Serpentes: lamprophiid (Madagascar weater snake)		Madagascar
<i>P. (Paracapillaria) malayensis</i>	Anura: bufonid (Asian common toad)	intestines	Asia
<i>P. mingazzinii</i>	Serpentes: colubrid (viperine ater snake)		Asia
<i>P. (Ophidiocapillaria) modiglianii</i> (syn. <i>Trichosoma</i>)	Serpentes: viperid (Sumatran pit viper)		Asia
<i>P. (Ophidiocapillaria) murinae</i>	Serpentes: boid (green anaconda)		South America
<i>P. (Ophidiocapillaria) najae</i>	Serpentes: elapid (Indian cobra)		India
<i>P. (Paracapillaria) parophrysi</i>	Pleuronectiformes: pleuronectid (Pacific halibut, English sole)		Atlantic, Pacific
<i>P. (Paracapillaria) piscicola</i>	Characiformes: characid (characin, dorado, golden dorado, dientudo jorobado), erythrinid (wolf fish), acestrorhynchid (red-tailed freshwater barracuda), anostomid (head stander, three-point leporinus)		South America
<i>P. (Paracapillaria) plectroplites</i>	Perciformes: terapontid (silver perch), percichthyid (bluenose cod, golden perch, Estuary perch)		Australia
<i>P. ptyasi</i>	Serpentes: colubrid (oriental ratsnake); Anura: ranid (Gunther's frog)		Asia
<i>P. (Paracapillaria) rhamdiae</i>	Siluriformes: heptapterid (pale catfish)	stomach	Americas
<i>P. (Paracapillaria) sesokoensis</i>	Syngnathiformes: fistulariid (red cornetfish)		Americas
<i>P. (Ophidiocapillaria) sonsinoi</i>	Serpentes: colubrid (southern black racer, green whip snake, viperine water snake, eastern water snake, northern water snake, plain-bellied water snake, banded water snake, grass snake, blackbelly garter snake, oriental rat snake), viperid (horned viper)		Europe, Africa
<i>P. (Paracapillaria) spratti</i>	Anura: microhylid (rubber frog, burrowing Papuan frog)	intestines	New Guinea
<i>P. (Paracapillaria) teixeirafreitasi</i>	Perciformes: eleotrid (bigmouth sleeper, Pacific sleeper, finescale sleeper)	intestines	Americas
<i>P. viperae</i>	Serpentes: viperid (horned viper)		Europe
<i>P. (Paracapillaria) xenentodoni</i>	Beloniformes: belonid (freshwater garfish)		Asia
<i>Paracapillaroides</i> (male tail without caudal alae, with membranous pseudobursa with 2 projections, short spicule with sheath divided into spiny proximal portion and nonspined distal portion, parasites of digestive tract of fish)			
<i>P. acanthocotylus</i>	Perciformes: latrid (castaneta)	stomach	South America

<i>P. agonostomi</i>	Mugiliformes: mugilid (mountain mullet)	stomach	Americas
<i>Paratrichosoma</i> (male tail without spicules or sheath, parasites of crocodiles)			
<i>P. crocodilus</i> (<i>crocodylus</i>)	Crocodila: crocodylid (freshwater crocodile, saltwater crocodile, American crocodile, New Guinea crocodile)		Australasia, Americas
<i>P. recurvum</i>	Crocodila: crocodylid (American crocodile, Morelet's crocodile)		Americas
<i>Pearsonema</i> (male tail with small membranous pseudobursa supported by 2 long projections, long thin spicule with nonspiny sheath, parasites of urinary tract of carnivorous mammals)			
<i>P. feliscati</i>	Carnivora: felid (cat, wildcat, African wildcat, Tsushima cat, ocelot), herpestid (Egyptian mongoose)	urinary system	Asia, Africa, Americas
<i>P. linsi</i> (syn. <i>Pseudocapillaria</i>)	Rodentia: caviid (capybara); Carnivora: mustelid (greater grison)		Americas
<i>P. mucronata</i>	Carnivora: mustelid (European otter, beech marten, stoat, least weasel, ferret, American mink) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]		Europe
<i>P. pearsoni</i> (syn. <i>Pseudocapillaria</i>)	Carnivora: procyonid (crab-eating raccoon)		South America
<i>P. plica</i> (syn. <i>Calodium</i>) (bladder hairworm)	Carnivora: canid (dog, wolf, coyote, red fox, American red fox, gray fox, Arctic fox, raccoon dog), felid (wildcat, bobcat, leopard, serval), mustelid (fisher, American pine marten, European pine marten, Japanese marten, beech marten, European badger, North American river otter), memphitid (striped skunk), procyonid (raccoon); Eulipotyphla: soricid (common shrew); Primates: hominid (human) [plus L1 in IH: Oligochaeta: lumbricid (earthworms)]	bladder, sometimes kidney (cystitis)	worldwide
<i>Pseudocapillaria</i> (male tail with 2 large round lobes, spicule with nonspiny sheath, parasites of digestive tract of fish, reptiles, birds and mammals)			
<i>P. (Ichthyocapillaria) adriatica</i>	Perciformes: sparid (bogue)		Atlantic
<i>P. (Pseudocapillaria) amarali</i>	Serpentes: colubrid (military ground snake)		South America
<i>P. (Pseudocapillaria) americana</i>	Rodentia: geomyid (Plains pocket gopher), sciurid (southern flying squirrel, eastern gray squirrel), cricetid (white-footed mouse, North American deer mouse)	intestines	North America
<i>P. (Pseudocapillaria) bainaie</i>	Blenniiformes: blennid (tompot blenny)		Atlantic
<i>P. (Pseudocapillaria) carangi</i>	Carangiformes: carangid (shrimp scad, razorbelly scad, yellowtail scad, round scad, torpedo scad, bigeye scad, black-banded trevally, white trevally, cleftbelly trevally, longfin trevally, Malabar trevally, Atlantic horse mackerel)		Atlantic
<i>P. (Pseudocapillaria) catostomi</i> (syn. <i>Hepaticola bakeri</i> , <i>Skrjabinocapillaria bakeri</i>)	Gadiformes: lotid (burbot); Cypriniformes: catostomatid (white sucker), cyprinid (common carp); Salmoniformes: salmonid (cutthroat trout)		Holarctic
<i>P. (Pseudocapillaria) cesarpintoi</i> (syn. <i>Paracapillaria (Ophidiocapillaria)</i>)	Serpentes: colubrid (military ground snake, yellow-bellied water snake)		South America
<i>P. (Ichthyocapillaria) delamurei</i>	Carnivora: phocid (Caspian seal)		Russia
<i>P. (Pseudocapillaria) echenei</i>	Carangiformes: echeneid (live sharksucker)		New Caledonia
<i>P. (Pseudocapillaria) falconis</i>	Accipitriformes: accipitrid (white-tailed eagle, bald eagle, steppe eagle, lesser spotted eagle, tawny eagle, northern goshawk, Eurasian sparrowhawk, red kite, common European kite, black kite, red-tailed hawk, red-shouldered hawk, western marsh harrier, hen harrier, Montagu's harrier, common buzzard, Himalayan buzzard, rough-legged buzzard), pandionid (osprey); Falconiformes: falconid (common kestrel, American kestrel, red-footed falcon); Strigiformes: strigid (boreal owl, Ural owl, short-eared owl, long-eared owl, little owl, Eurasian eagle-owl, Eurasian pygmy owl, northern hawk-owl, great horned owl, tawny owl,		worldwide

	spotted owl, barred owl, northern saw-whet owl)		
<i>P. (Pseudocapillaria) gobionina</i>	Gobiiformes: gobiid (monkey goby)	intestines	Caspian Sea
<i>P. (Pseudocapillaria) leptocephali</i>	Cypriniformes: cobitid (Guntea loach)		Asia
<i>P. (Pseudocapillaria) magalhaesi</i>	Perciformes: sciaenid (Atlantic croaker)		Atlantic
<i>P. (Ichthyocapillaria) maricaensis</i>	Sauria: liolaemid (Lutz's tree iguana)		South America
<i>P. (Pseudocapillaria) mergi</i>	Pelecaniformes: threskiornithid (roseate spoonbill), ardeid (little blue heron, grey heron), pelecanid (American white pelican, brown pelican); Charadriiformes: recurvirostrid (black-necked stilt); Podicipediformes: podicipedid (little grebe); Gaviiformes: gaviid (black-throated loon, red-throated loon, common loon); Ciconiiformes: ciconiid (wood stork); Passeriformes: turdid (red-throated thrush); Anseriformes: anatid (tufted duck, long-tailed duck, canvasback, common goldeneye, common merganser, scaly-sided merganser, red-breasted merganser, common eider, Eurasian teal, velvet scoter, smew, whooper swan)		Palaearctic
<i>P. (Pseudocapillaria) microspicula</i>	Pleuronectiformes: pleuronectid (starry flounder)		Atlantic
<i>P. moravecii</i>	Gobiiformes: gobiid (rock goby)	stomach	Europe
<i>P. (Ichthyocapillaria) nannupensis</i>	Siluriformes: plotosid (freshwater cobbler)	intestines	Australia
<i>P. novaecaledoniensis</i>	Perciformes: lutjanid (ornate jobfish)	gut	New Caledonia
<i>P. (Ichthyocapillaria) ophisterni</i>	Synbranchiformes: synbranchid (obscure swamp eel)	intestines	Asia
<i>P. parablennii</i>	Blenniiformes: blennid (tompot blenny)	intestines	Europe
<i>P. (Ichthyocapillaria) pearsei</i>	Rodentia: sciurid (red-cheeked rope squirrel), murid (Tullberg's soft-furred mouse)		Africa
<i>P. (Pseudocapillaria) petiti</i>	Anura: bufonid (cane toad)		South America
<i>P. (Pseudocapillaria) picorum</i>	Piciformes: picid (northern flicker, great spotted woodpecker, black woodpecker, grey-headed woodpecker, European green woodpecker)		Palaearctic
<i>P. (Pseudocapillaria) pusilla</i>	Chiroptera: phyllostomid (orange nectar bat, little yellow-shouldered bat)	intestines	South America
<i>P. (Ichthyocapillaria) salvelini</i>	Salmoniformes: salmonid (pink salmon, Atlantic salmon, Adriatic salmon, coho salmon, masu salmon, chinook salmon, grayling, Arctic grayling, Arctic char, Russian char, white-spotted char, white char, Dolly Varden trout, lake trout, rainbow trout, brown trout, brook trout, marble trout, Biwa trout, sharp-snouted lenok, blunt-snouted lenok, vendace, lake whitefish, broad whitefish, humpback whitefish, common whitefish, round whitefish, neiva, beloribitsa); Gadiformes: gadid (burbot); Scorpaeniformes: cottid (slimy sculpin, prickly sculpin, Anadyr sculpin, szanaga sculpin), cottocomphorid (stone sculpin, bighead sculpin); Cypriniformes: cyprinid (grass carp); Osmeriformes: osmerid (European smelt, rainbow smelt); Siluriformes: silurid (Amur catfish); Esociformes: esocid (northern pike)		Palaearctic
<i>P. (Pseudocapillaria) tomentosa</i> (syn. <i>P. brevispicula</i>)	Cypriniformes: cyprinid (common bream, white bream, blue bream, white-eye bream, vimba bream, goldfish, tench, common nase, common carp, grass carp, black carp, Crucian carp, sabre carp, predatory carp, common minnow, gudgeon, common chub, bleak, ide, rudd, ziege, asp, tench, pike asp, common dace, common roach, dwarf Altai osman, common barbel, Aral barbel, Bulatmai barbel, Tyberian barbel, tiger barb, common minnow, Amur bitterling, Sattar snowtrout, eastern shiner, golden shiner, creek chub, sharpray, naked osman, false osman, gudgeon, white-finned gudgeon, sharpbelly, moramec, redfin, Pacific redfin, big-scaled redfin, stone moroko, rovella), alburnid (spirlin), cobitid (European weather loach, spined loach), nemacheilid (stone loach,	intestines (anaemia, emaciation)	worldwide

	Tibetan stone loach), catostomid (longnose sucker, white sucker); Cyprinodontiformes: poeciliid (guppy), goodeid (bulldog goodeid, blackfin goodea); Siluriformes: silurid (Wels catfish); Scorpaeniformes: cottid (European bullhead); Gadiformes: lotid (burbot); Osmeriformes: osmerid (European smelt); Atheriniformes: atherinopsid (slender silverside, pike silverside); Gobiiformes: gobiid (tubenose goby, Kessler's goby, double- spotted goby, Caspian bighead goby); Anguilliformes: anguillid (European eel); Blenniformes: blennid (freshwater blenny); Salmoniformes: salmonid (lake whitefish, brown trout); Esociformes: esocid (northern pike); Perciformes: centrarchid (green sunfish, blue gill, pumpkinseed), percid (Volga pikeperch) [plus L1 in IH: Oligochaeta: lumbricid (earthworms), naidid (tubificids)]		
<i>P. (Pseudocapillaria) yucatanensis</i>	Siluriformes: heptapterid (pale catfish)	intestines	South America
<i>P. (Pseudocapillaria) xochimilcensis</i> (syn. <i>Paracapillaria</i>)	Serpentes: colubrid (blackbelly garter snake)		North America
<i>Pseudocapillaroides</i> (male tail rounded with 2 small lobes, spicule with nonspiny sheath, parasites of skin of amphibians)			
<i>P. xenopi</i> (syn. <i>C. xenopodis</i>)	Anura: pipid (African clawed frog)	skin (lesions, wasting)	Africa
<i>Pterothominx</i> (syn. <i>Armocapillaria</i>) (male tail with caudal lateral alae and large membranous bursa-like structure supported by lateral projections, spicule with sheath covered in minute spines or sclerotized protuberances, parasites of digestive tracts of birds and mammals)			
<i>P. angrensis</i>	Chiroptera: molossid (black mastiff bat)	small intestines	South America
<i>P. blomei</i>	Galliformes: phasianid (hazel grouse, black grouse, grey partridge, ring-necked pheasant, western capercaillie, black-billed capercaillie)		Eurasia
<i>P. brevidelphis</i>	Chiroptera: vespertilionid (black myotis)		South America
<i>P. erinacei</i> (syn. <i>Aonchotheca</i>)	Eulipotyphla: erinaceid (North African hedgehog, southern white- breasted hedgehog, European hedgehog); Carnivora: mustelid (European badger); Rodentia: cricetid (Mediterranean water shrew)		Europe, Africa
<i>P. meleagridis</i> (syn. <i>Thominx</i> , <i>Capillaria</i>)	Galliformes: phasianid (turkey, ring-necked pheasant)		Europe
<i>P. meleagrisgallopavo</i>	Galliformes: phasianid (turkey, ring-necked pheasant)		Europe
<i>P. moraveci</i>	Psittaciformes: psittaculid (Australian ringneck parrot)	intestines	Australia
<i>P. moschiferi</i> (syn. <i>Aonchotheca</i> , <i>Armocapillaria</i>)	Artiodactyla: moschid (Siberian musk deer)		Russia
<i>P. neopulchra</i> (syn. <i>Thominx</i>)	Chiroptera: miniopterid (common bentwing bat), vespertilionid (brown long-eared bat, grey long-eared bat, Bechstein's bat, greater mouse-eared bat, lesser mouse-eared bat, long-fingered bat, pond bat, Natterer's bat, Daubenton's bat, common noctule, lesser noctule, Nathusius's pipistrelle)		Eurasia
<i>P. pulchra</i> (syn. <i>Aonchotheca</i>)	Chiroptera: miniopterid (common bentwing bat), molossid (Mexican free-tailed bat, big free-tailed bat, broad-eared bat)	stomach	Asia, Americas
<i>P. sadovskoi</i> (syn. <i>Thominx</i> , <i>Capillaria</i> , <i>Armocapillaria</i>)	Rodentia: murid (brown rat, yellow-necked mouse, wood mouse), cricetid (bank vole, grey red-backed vole, northern red-backed vole), sciurid (red squirrel, Siberian chipmunk)		Eurasia
<i>P. wavilovoi</i>	Galliformes: phasianid (chicken, black grouse, hazel grouse, ring- necked pheasant), western capercaillie; Columbiformes: columbid (pigeon); Otidiformes: otidid (little bustard)		Eurasia
<i>Schulmanela</i> (male tail with small membranous bursa-like structure supported by rays, spicule with transverse grooves, spiny sheath, parasites of digestive tract of fish and amphibia)			
<i>S. (Piscicapillaria) baylisi</i>	Carcharhiniformes: scyliorhinid (small spotted catshark, nursehound)		Atlantic
<i>S. (Amphibiocapillaria)</i>	Urodela: salamandrid (Corsican brook salamander)		Europe

<i>combesi</i>			
<i>S. (Amphibiocapillaria) costacruzi</i>	Anura: ranid (Perez's frog, edible frog)		Americas
<i>S. (Piscicapillaria) freemani</i>	Rajiformes: arhynchobatid (sandpaper skate), rajid (longnose skate, Pacific starry skate)	intestines	Pacific
<i>S. (Amphibiocapillaria) freitaslenti</i>	Sauria: tropidurid (Amazon lava lizard)		South America
<i>S. (Piscicapillaria) hathawayi</i>	Squaliformes: squalid (spiny dogfish)		Pacific
<i>S. (Amphibiocapillaria) inequalis</i> (probable syn. of <i>S. tritonispunctati</i>)	Urodela: ambystomatid (woodland salamander, grotto salamander, mole salamander, dusky salamander, seal salamander, Allegheny Mountain dusky salamander, blackbelly salamander, eastern newt), plethodontid (spotted tail salamander, shovelnose salamander)		North America
<i>S. (Schulmanella) petruschewskii</i> (syn. <i>Thominx</i> , <i>Capillaria</i> , <i>Hepaticola</i>) (syn. <i>Hepatospina acerinae</i>)	Perciformes: percid (European perch, ruffe, zander, schraetzer), centrarchid (pumpkinseed); Cypriniformes: cyprinid (common carp, gibel carp, grass carp, Crucian carp, goldfish, common barbel, round-scaled barbel, Aral barbel, common bream, silver bream, white bream, vimba bream, white-eye bream, spiralin, common roach, common chub, common minnow, stone moroko, Amur bitterling, rudd, ide, souffia, tench, gudgeon), cobitid (spiny loach, spined loach), nemacheilid (stone loach); Salmoniformes: salmonid (rainbow trout, brown trout, grayling, common whitefish, beloribitsa); Siluriformes: silurid (wels catfish), ictalurid (brown bullhead); Anguilliformes: anguillid (European eel); Gasterosteiformes: gasterosteid (three-spined stickleback); Cichliformes: cichlid (blue tilapia) [plus L1 in IH: Oligochaeta: lumbricid (earthworms), naidid (tubificids)]	liver	Europe
<i>S. (Amphibiocapillaria) tenua</i> (probable syn. of <i>S. tritonispunctati</i>)	Urodela: salamandrid (eastern newt); Anura: ranid (Pickerel frog)		North America
<i>S. (Amphibiocapillaria) texensis</i>	Urodela: plethodontid (Texas blind salamander)	intestines	North America
<i>S. (Amphibiocapillaria) tritoniscristati</i> (syn. <i>Trichosomum tritonis cristati</i> , <i>T. tritonis p.p.</i> , <i>Capillaria fagei</i> , <i>C. hepatophila</i>)	Urodela: salamandrid (northern crested newt, smooth newt, palmate newt)	liver	Europe
<i>S. (Amphibiocapillaria) tritonispunctati</i> (syn. <i>Capillaria</i> , <i>C. brevicollis</i> , <i>brachyauchenia</i> , <i>Trichosomum tritonis punctati</i> , <i>T. tritonis p.p.</i> , <i>Trichosoma filiforme</i>)	Urodela: salamandrid (eastern newt, northern crested newt, southern banded newt, alpine newt, smooth newt, Caucasian salamander, Japanese firebelly newt, Japanese clawed salamander, sword-tail newt), hynobiid (Mitsjama salamander, amber-coloured salamander, Tokyo salamander), ambystomatid (marbled salamander), cryptobranchid (Japanese giant salamander), plethodontid (northern dusky salamander, seal salamander, Allegheny Mountain dusky salamander, blackbelly salamander, spotted-tail salamander, spring salamander, shovelnose salamander, northern slimy salamander, red salamander, grotto salamander) [plus Malacostraca: odontodactylid (mantis shrimp)]	intestines	Eurasia, North America
<i>S. (Piscicapillaria) tuberculata</i> (syn. <i>Piscicapillaria</i> (<i>Lomakinela</i>))	Acipenseriformes: acipenserid (Russian sturgeon, bastard sturgeon, starry sturgeon, beluga, sterlet, European sea sturgeon)	intestines	Eurasia
<i>Skrjabinocapillaria</i> (male tail with caudal lateral alae, spicule absent, nonspiny sheath, parasites of digestive tract of bats)			
<i>S. chandigarhensis</i>	Chiroptera: vespertilionid (Dormer's pipistrelle)		India
<i>S. eubursata</i>	Chiroptera: vespertilionid (serotine bat, Bechstein's bat, Daubenton's bat, Geoffroy's bat, little brown bat, whiskered bat, Natterer's bat, common noctule, lesser noctule, brown long-eared bat, lesser mouse-eared bat, parti-colored bat), rhinolophid (lesser		Eurasia

	horseshoe bat)		
<i>S. giganteus</i>	Cypriniformes: cyprinid (Amur minnow)		Russia
Tenoranema (male tail with caudal lateral alae ventrally bent, small membranous caudal bursa, spicule with nonspiny sheath, parasites of digestive tract of terrestrial mammals)			
<i>T. alcoveri</i>	Rodentia: glirid (garden dormouse)	intestines	Europe
<i>T. magnifica</i> (syn. <i>Aonchotheca</i>)	Chiroptera: molossid (black mastiff bat)		South America
<i>T. rivarolai</i>	Chiroptera: molossid (broad-eared bat)	small intestines	South America
Capillaria sensu latu			
<i>C. africana</i> (syn. <i>Skrjabinocapillaria</i>)	Eulipotyphla: soricid (smoky white-toothed shrew)		Africa
<i>C. alaudae</i>	Passeriformes: alaudid (greater short-toed lark)		Europe
<i>C. anthracocerosi</i>	Bucerotiformes: bucerotid (Palawan hornbill)	intestines	Asia
<i>C. avellari</i>	Ciconiiformes: ciconiid (wood stork)		America
<i>C. baicalensis</i>	Salmoniformes: salmonid (sharp-snouted lenok)		Atlantic
<i>C. bonnevilliei</i>	Rodentia: heteromyid (Ord's kangaroo rat)		North America
<i>S. caballeroi</i> (syn. <i>Skrjabinocapillaria</i>)	Carnivora: herpestid (Javan mongoose)	gut	Caribbean
<i>C. cadovulvata</i>	Galliformes: phasianid (grey partridge)	caeca	Europe
<i>C. chauhani</i>	Ciconiiformes: ciconiid (painted stork)		India
<i>C. coeca</i>	Eulipotyphla: talpid (blind mole)		Europe
<i>C. combologiodes</i>	Galliformes: phasianid (turkey)	crop	Europe
<i>C. coregoni</i>	Salmoniformes: salmonid (brown trout)		North America
<i>C. crossostomae</i>	Cypriniformes: balitorid (river loach)		Asia
<i>C. dessatae</i>	Lagomorpha: ochotonid (Royle's pika)		Asia
<i>C. diesingi</i>	Chiroptera: vespertilionid (greater mouse-eared bat, lesser mouse-eared bat, Bechstein's bat)		Eurasia
<i>C. euproctus</i>	Carnivora: felid (bobcat)		North America
<i>C. exigua</i>	Eulipotyphla: soricid (common shrew, bicolored shrew, greater white-toothed shrew, lesser white-toothed shrew, Mediterranean water shrew, Eurasian water shrew, Eurasian pygmy shrew), erinaceid (northern white-breasted hedgehog, southern white-breasted hedgehog, European hedgehog)		Eurasia
<i>C. falconis-nisi</i>	Strigiformes: strigid (great horned owl)		North America
<i>C. fudingensis</i>	Scombriformes: stromateid (silver pomfret)		Asia
<i>C. fujianensis</i>	Anura: bufonid (Asian common toad)	intestines	Asia
<i>C. fuzhouensis</i>	Cypriniformes: cyprinid (silver carp)		Asia
<i>C. gallinae</i>	Galliformes: phasianid (chicken, ring-necked pheasant); Columbiformes: columbid (pigeon)		Asia
<i>C. honghuensis</i>	Synbranchiformes: mastacembelid (Asian spiny eel)		Asia
<i>C. jaenschi</i>	Siluriformes: phalacrocoracid (great cormorant)	intestines	Australia
<i>C. khalili</i>	Rajiformes: rajid (thorny skate)		Atlantic
<i>C. konstantini</i>	Eulipotyphla: soricid (Eurasian water shrew, Mediterranean water shrew)		Eurasia
<i>C. lepidopodis</i> (sp. inq.)	Perciformes: trichiurid (silver scabbardfish)		Atlantic
<i>C. leucisci</i>	Cypriniformes: cyprinid (asp)		Europe
<i>C. lewaschoffi</i>	Cypriniformes: cyprinid (ziege)		Europe
<i>C. limicolae</i>	Charadriiformes: scolopacid (common sandpiper, common redshank, Terek sandpiper, ruddy turnstone, dunlin, little stint, common snipe, pin-tailed snipe, little curlew, ruff, Eurasian woodcock), charadriid (common ringed plover, American golden plover, grey plover), recurvirostrid (pied avocet, red-necked avocet)		Palaearctic
<i>C. liuyangensis</i>	Passeriformes: leiothrichid (Chinese hwamei, red-billed leiothrix)		Asia
<i>C. longicauda</i>	Didelphimorphia: didelphid (Virginia opossum, gray four-eyed opossum)		Americas

<i>C. longipes</i>	Artiodactyla: bovid (sheep, goat)	small intestines	worldwide
<i>C. magnova</i>	Chiroptera: miniopterid (greater long-fingered bat)		Africa
<i>C. merluccii</i>	Gadiformes: merlucciid (shallow-water Cape hake, deep-water Cape hake)	rectum	Africa
<i>C. miniopterae</i>	Chiroptera: miniopterid (common bentwing bat)		cosmopolitan
<i>C. mogurndae</i>	Gobiiformes: eleotrid (Japanese freshwater goby)		Asia
<i>C. montevidensis</i>	Galliformes: phasianid (chicken)		Europe
<i>C. murismusculi</i>	Rodentia: murid (brown rat)		Europe
<i>C. murisnitedula</i>	Rodentia: glirid (forest dormouse)		Europe
<i>C. myotisi</i>	Chiroptera: vespertilionid (greater mouse-eared bat)		
<i>C. namibiensis</i>	Gadiformes: merlucciid (shallow-water Cape hake, deep-water Cape hake)		Africa
<i>C. ohbayashii</i>	Eulipotyphla: soricid (Asian house shrew, Himalayan shrew, Himalayan water shrew, Hodgson's brown-toothed shrew)		Asia
<i>C. ovis</i>	Artiodactyla: bovid (sheep)		
<i>C. ovoreticulata</i>	Eulipotyphla: erinaceid (European hedgehog)		Europe
<i>C. pipistrelli</i>	Chiroptera: vespertilionid (Japanese pipistrelle, Java pipistrelle, long-fingered bat, bird-like noctule), rhinolophid (greater horseshoe bat)	intestines	Eurasia
<i>C. piscatori</i>	Serpentes: colubrid (checkered keelback)		Asia
<i>C. plagiaticia</i>	Psittaciformes: nestorid (kea)	intestines	New Zealand
<i>C. pseudorasbora</i>	Cypriniformes: cyprinid (stone moroko)		Asia
<i>C. pudendotecta</i>	Anseriformes: anatid (swan)		Asia
<i>C. ranae</i>	Anura: ranid (Gunther's frog)		Asia
<i>C. rangiferi</i>	Artiodactyla: cervid (reindeer)		Europe
<i>C. retusa</i>	Galliformes: phasianid (chicken); Passeriformes: corvid (Eurasian jay)		Eurasia
<i>C. sibirica</i>	Rodentia: sciurid (long-tailed ground squirrel, Siberian chipmunk)		Asia
<i>C. sinipercae</i>	Perciformes: siniperid (Chinese perch)		Asia
<i>C. spinosa</i>	Pleuronectiformes: cynoglossid (Nigerian tongue sole)		Africa
<i>C. splenacea</i>	Eulipotyphla: soricid (greater white-toothed shrew, Eurasian water shrew)		Eurasia
<i>C. strigis</i>	Strigiformes: strigid (tawny owl)		Palaearctic
<i>C. pigolkini</i> (syn. <i>C. suis</i>)	Artiodactyla: suid (pig)		
<i>C. tavernae</i>	Rodentia: murid (rat)	intestines	Europe
<i>C. vespertilionis</i>	Chiroptera: vespertilionid (greater noctule bat, common noctule, parti-coloured bat)		Eurasia
<i>C. yamagutii</i>	Siluriformes: bagrid (bayad)		Africa

Parasite morphology: All capillariids form 3 different morphological stages in their developmental cycles: eggs; larvae; and adult worms. Gravid female worms produce unembryonated (uncleaved) ellipsoidal eggs measuring from 36-81 x 14-43 μm depending on species (e.g. those of *Calodium hepaticum* measure 48-66 x 28-37 μm , *Aonchotheca philippinensis* 35-45 x 20-25 μm , and *Eucoleus aerophilus* 80-98 x 30-40 μm). The eggs have a characteristic lemon- or barrel-shape with 2 mucoid polar plugs (less conspicuous than those of *Trichuris* spp.) and are surrounded by a thick wall with radial striations and a pitted (*C. hepaticum*) or smooth (*A. philippinensis*) surface. A few species, including *A. philippinensis*, have also been found to form thin-shelled eggs which embryonate and hatch *in utero* or within the host gut lumen releasing larvae which may be autoinfective. There are 4 larval stages (designated L1-4) which undergo successive moults before forming adults. First-stage larvae (L1) are elongate, measuring 0.14-0.25 mm in length, are bluntly rounded at both ends with a small buccal stylet and possess conspicuous genital primordia. L2 measure from 0.16-0.55 mm in length and have an elongate oesophagus ringed by stichocytes. L3 are longer (0.20-1.56 mm) and the anterior genital column is well-developed while the posterior genitalia are still developing. L4 measure up to 3.6 mm in length and their sexual differentiation is well progressed, although the male spicule is not as sclerotized as in adult worms and is usually sheathed. Adults appear as white slender hair-like worms ranging in size from 4-100 mm in length by 10-400 μm in cross-sectional diameter depending on species (their length can be difficult to determine as adults are frequently embedded in host tissues). They are surrounded by a tough flexible cuticle with longitudinal bacillary bands (rows of specialised glandular and nonglandular hyodermal cells) and they exhibit a gradual transition in width becoming thicker posteriorly. They possess a characteristic non-muscular stichosome oesophagus evident as a slender thin-walled tube with 1-3 rows of 20-60 stichocytes. Adults worms are sexually dimorphic with females being larger than males. For most species, females measure 23-80 mm x 29-105 μm while males measure 15-39 mm x 23-62 μm , although those of *Calodium hepaticum* in rodents and other mammals can be larger (females 52-104 mm x 100-400 μm , males 15-37 mm x 40-100 μm), those of *Pseudocapillaria tomentosa* in ornamental fish being smaller (females 7-12

mm, males 4-7 mm), and those of *A. philippinensis* being tiny (females 2.3-5.3 mm x 29-47 µm, males 1.5-3.9 mm x 23-28 µm). Mature females possess a single ovary connected to a coiled uterus which opens into a conspicuous vulva located anteriorly near the oesophageal-intestinal junction. The uterus may contain a few to many developing ova often arranged in elongate strands. Adult males have blunted rounded tails, some with caudal lateral alae, and many with a pair of papillae located near the cloacal aperture. Males are non-bursate but many species have a membranous pseudobursa or a primitive bursa-like structure with a pair of subventral lobes often supported by lateral projections (rays). Males of most capillariid species have a single prominent elongate sclerotized spicule (sometimes up to 500 µm long) with an eversible sheath (up to 400 µm long) often covered with small spines.

Site of infection: Adult worms of most capillariid species infect the intestinal, urinary or respiratory epithelia of their vertebrate definitive hosts where they become embedded in the mucosa. Infections in the alimentary tract have been recorded along the entire length from the oesophagus to the rectum, but are most common in the small and large intestines (e.g. *A. philippinensis* larval and adult worms infect the small intestine). Infections in the respiratory tract are found in the nasal passages and upper airways mostly of avian hosts, while infections in the urinary system may occur in the bladder, and rarely the kidneys, of rodents and insectivores. Female worms produce unembryonated eggs which are excreted with host faeces or urine. Eggs embryonate in the external environment to contain first-stage larvae (L1) which are infective to new definitive hosts. Alternatively, the eggs of some species only become infective when ingested by oligochaetes (sometimes fish) in which L1 are released into tissues (these hosts are known variously as intermediate hosts or paratenic (transport) hosts as the larvae do not moult or develop further but may exhibit modest growth). A notable variation occurs for a few species which infect the internal organs of their definitive hosts, particularly the liver, but also including the spleen and skin (e.g. *C. hepaticum* larvae migrate from the intestines to the liver where they mature into adults in the hepatic parenchyma). In these cases, eggs released by female worms become tissue-bound and only make their way to the external environment when ingested by predators or scavengers and subsequently voided intact without undergoing further development in these hosts.

Pathogenesis: While larval and adult worms cause tissue trauma and inflammation in their Definitive hosts due to their burrowing and feeding activities, the clinical consequences depend on the intensity of infection (worm burden) and tissue tropism (site of infection). Most infections are mild and remain asymptomatic, but heavier infections result in greater cumulative damage which may manifest in clinical disease. Infections in the digestive tract disrupt the mucosa leading to structural and functional deficits, usually involving villous atrophy, localized inflammation with cellular infiltrates, ulcerative and degenerative lesions and malabsorption with loss of fluids, protein and electrolytes. Malabsorption of sugars and fats also appears to be exacerbated by proteolytic substances released by worms. The onset of symptoms is often benign with vague abdominal pains and borborygmi but may progress to episodic or persistent diarrhoea with bulky or watery faeces, steatorrhea, nausea, vomiting, hypotension, oedema, anorexia, malaise, poor growth and wasting. Shifts in clinical parameters include hypoproteinemia and low serum levels of potassium, sodium, calcium and carotene, but eosinophilia is not a feature. Heavy worm burdens in mammals may cause protracted malabsorption and cachexia which can prove fatal within 4-6 months if left untreated (death may occur from pneumonia, cerebral oedema, hypokalaemia and heart failure). Infections by *A. philippinensis* in humans are progressive and eventually cause disease as female worms may switch from being oviparous to larviparous, resulting in auto- and hyper-infections. Gastrointestinal infections in birds have also been associated with severe oesophagitis or enteritis resulting in poor growth, wasting and death (e.g. *A. bursata*, *A. caudinflata*, *B. obsignata*, *C. anatis*, *E. annulatus*, *E. contortus*). Heavy infections in the gut of fishes may cause severe debilitating disease involving cellulitis, hepatomegaly, anaemia, lethargy, emaciation and death, particularly in farmed cyprinids or aquarium fish infected with *P. tomentosa*. Infections of the respiratory tract may cause rhinitis, tracheitis, bronchitis and pulmonary capillariasis in birds, particularly young birds infected with *E. aerophilus*. Animals may produce purulent expectorates, mucoid or bloody sputum with dyspnoea, sneezing, coughing, fever, pneumonia, eosinophilia, anorexia, fatigue and secondary bacterial infections. Infections of the urinary tract have only occasionally been associated with clinical disease, with *P. plica* sometimes causing cystitis in companion animals. Those species that infect internal organs cause more invasive tissue damage and provoke stronger host inflammatory responses. *C. hepaticum* adult worms become enclosed in syncytial (multinucleate) masses in the liver parenchyma where they feed on host cell cytoplasm. Female worms move along sinuous tracts depositing numerous clusters of eggs before dying after several months. The dead worms and egg masses become encapsulated in fibrotic connective tissues with granuloma formation, leucocytic infiltrates, periportal inflammation and eventual mineralization and calcification of the parasites within the lesions. Clinical signs are similar to those found in toxocariasis (visceral larval migrans) and include chronic fever, hepatomegaly, splenomegaly, anorexia and weight loss. Changes in clinical parameters include hyperglobulinaemia (esp. IgE), leucocytosis with pronounced eosinophilia, and elevated plasma levels of liver enzymes (alanine and aspartate aminotransferases and sometimes glutamic dehydrogenase). Several mortalities have been attributed to hepatic failure with severe granulomatous hepatitis, hepatocyte lysis and cirrhosis. Most clinical infections in humans occur in children less than 8 years old who exhibit poor personal hygiene and/or consume soil (pica). Clinical signs are uncommon in larger mammals but infections in smaller (rodent-sized) animals may include matted fur, lethargy, hepatomegaly and splenomegaly.

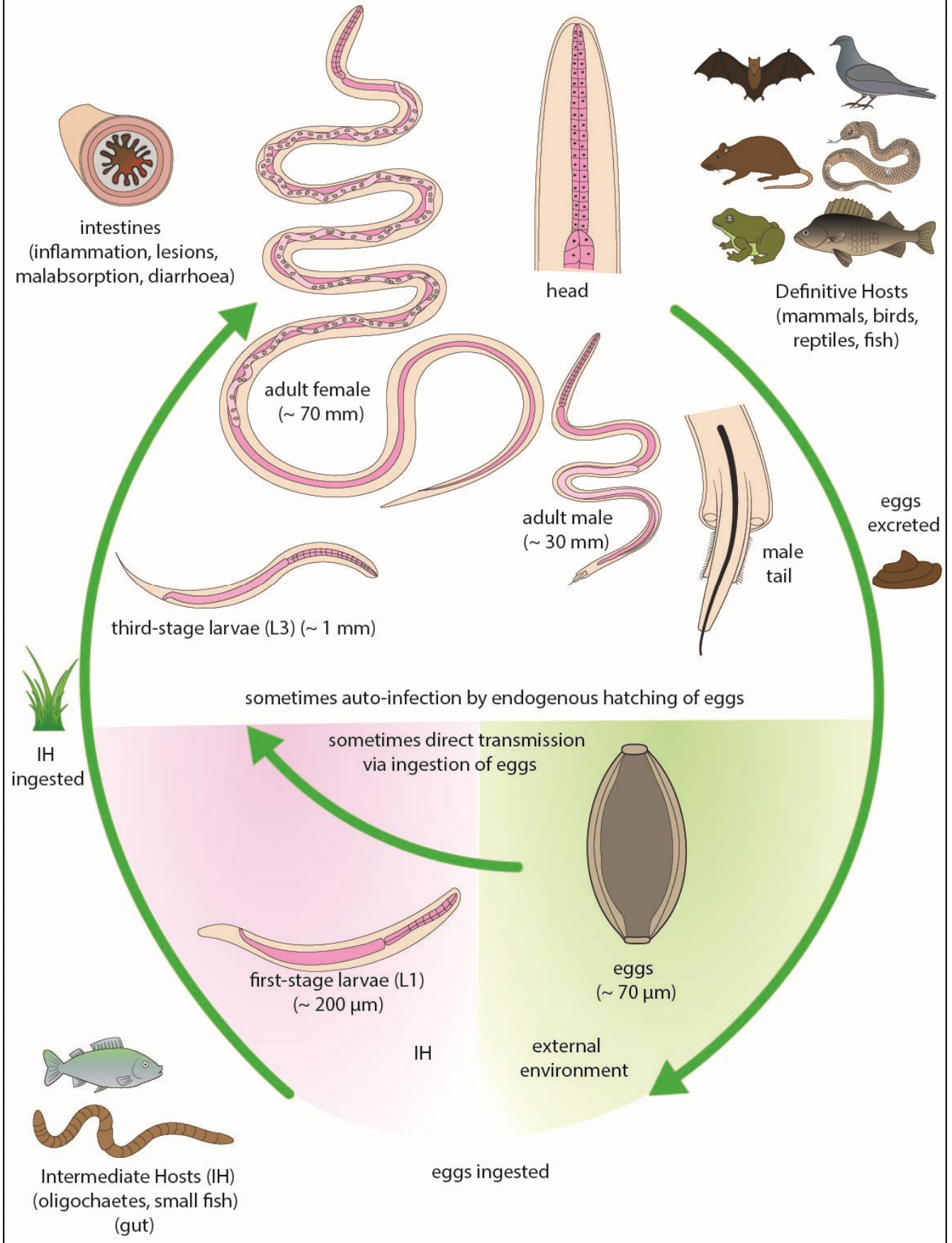
Developmental cycle and mode of transmission: Capillariid species have been found to undergo either of 2 types of transmission: one type being homoxenous and direct involving the faecal-oral transmission of eggs (sometimes including the passage of eggs through paratenic hosts e.g. *C. hepaticum*); and the other type being heteroxenous and indirect involving the consumption of infective larvae in intermediate hosts (such as oligochaetes and fish). Several species have been found to be able to undergo both

homoxenous and heteroxenous transmission. In all cases, the infective stages are first-stage larvae (L1) located either within embryonated eggs or within the tissues of intermediate hosts (rather than L3 like most other parasitic nematodes). Direct transmission occurs when gravid female worms deposit eggs in mucosal tissues where they are subsequently excreted with host faeces or urine. Eggs deposited in respiratory epithelia are coughed up, swallowed and excreted with faeces. Eggs deposited in internal organs (e.g. *C. hepaticum* in the liver) remain tissue-bound until the organ is eaten by a predator or scavenger which then excretes the eggs essentially unchanged in their faeces (thus acting as a paratenic host). Voided eggs are typically uncleaved and not infective but must embryonate in the external environment to produce infective L1. Depending on species and prevailing environmental conditions, eggs embryonate in 5-42 days given adequate moisture and oxygen. Development takes longer at lower temperatures and may be arrested below 10°C. Embryonated eggs containing infective L1 may remain viable for over a year. When ingested by susceptible definitive hosts, the eggs hatch in the intestines releasing the L1 which invade the mucosa, migrate to their predilection sites and moult 4 times over 12-16 days to form adult worms. The prepatent period (time from infection to first egg production) ranges from 16-30 days and female worms remain fecund before dying after several months. Indirect transmission occurs when embryonated eggs are ingested by suitable intermediate hosts, especially oligochaetes such as earthworms and tubificids (cf. *E. annulatus*, *E. contortus*), or small fish species (*A. philippinensis*). The eggs hatch releasing their L1 which invade intestinal tissues and undergo modest growth over several weeks but do not moult or develop further. Infections are acquired by final hosts when they eat infected intermediate hosts releasing the infective L1 which migrate to their predilection sites and develop into adult worms over several weeks. Infections by *A. philippinensis* are acquired by humans when they eat raw fish too small to eviscerate and are so eaten whole, often as a traditional delicacy. *A. philippinensis* is also unusual in that adult worms that are normally oviparous producing thick-shelled unembryonated eggs may start producing thin-shelled embryonated eggs which may hatch endogenously soon after release, and sometimes even hatching *in uteri* making the worms larviparous (birthing live larvae). The larvae may infect the same individual host (process of auto-infection) resulting in the rapid amplification of worm numbers (hyper-infections). Unless treated, many people may develop progressively worsening disease which often proves fatal.

Differential diagnosis: Infections are difficult to diagnose on clinical grounds, as many infections are asymptomatic and when present, symptoms are relatively nonspecific and may be referable to other disease conditions. Even liver infections presenting with the classical triad of hepatomegaly, eosinophilia and fever may be due to acute viral hepatitis, granulomatous hepatitis or hepatic cancer. Definitive diagnosis is dependent on the microscopic detection of characteristic unembryonated eggs (sometimes larvae) in faeces, urine, sputum, nasal or tracheal lavage, either in wet mounts, dried smears or concentrates following centrifugal floatation in saturated sugar or heavy metal salt solutions (taking care not to mis-identify *Trichuris* eggs). Adult worms have sometimes been observed upon endoscopy (gastroduodenoscopy, sometimes colonoscopy) and worm fragments and/or egg masses may be detected histologically in biopsy or necropsy samples of intestinal or pulmonary mucosa or hepatic parenchyma. Several serological tests have been developed to detect host antibodies against infections, including immunoprecipitation, haemagglutination, fluorescent-antibody tests and enzyme immunoassays, but it was difficult to differentiate active infections from prior exposure. Molecular biological techniques have also recently been used to detect parasite DNA in clinical samples following the polymerase chain reaction (PCR) amplification of nuclear or mitochondrial gene sequences (ribosomal RNA and cytochrome c oxidase subunit 1, respectively).

Treatment and control: Several anthelmintic drugs have been used to successfully treat infections, notably the benzimidazoles (albendazole, mebendazole and thiabendazole) which were effective against all parasite developmental stages but produced several side-effects including fever, dizziness, nausea and hair loss. Other anthelmintics were less effective in that they mainly suppressed egg production, including the imidazothiazoles (levamisole), halogenated monophenols (disophenol), other benzimidazoles (fenbendazole), macrocyclic lactones (ivermectin) and tetrahydropyrimidines (pyrantel and oxantel), all of which also produced various side-effects, such as skin rash, diarrhoea, nausea, and vomiting. Infections in fish responded well to treatment with ivermectin, but the drug proved toxic to various fish species. Bath treatments in levamisole and fenbendazole were also used but found to be ineffective for some hosts (such as golden shiners) or caused sterility in others (such as zebrafish). Chemotherapy was more effective in mammals and birds when complemented with supportive therapies such as anti-diarrhoeal and anti-inflammatory agents, fluid and electrolyte replacements and high protein diets. Timely diagnosis and treatment have proven critical for many infections, particularly *A. philippinensis* infections in humans which worsens in left untreated due to repeated auto-infection. Various control strategies have been devised to break transmission cycles by reducing faecal contamination of food and water sources (improved sanitation, enhanced hygiene), educating people against geophagia (soil-eating), restricting access of potential paratenic hosts to carcasses (especially by rodent control in fauna parks), preventing hosts from foraging for earthworms (notably in poultry units and aviaries), eliminating oligochaetes as food sources (particularly in aquaculture), and advocating cooking fish properly prior to consumption (hard to achieve in communities with strong culinary traditions). Health-education campaigns proved invaluable in curbing epidemics in the Philippines associated with poor hygiene and inadequate food preparation.

Capillaria



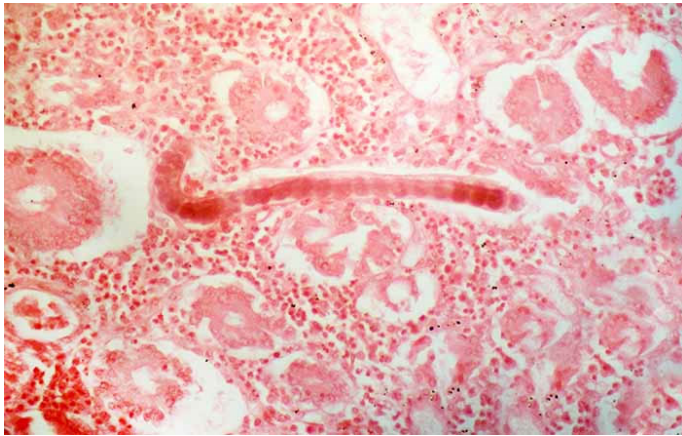


Capillaria adult worm

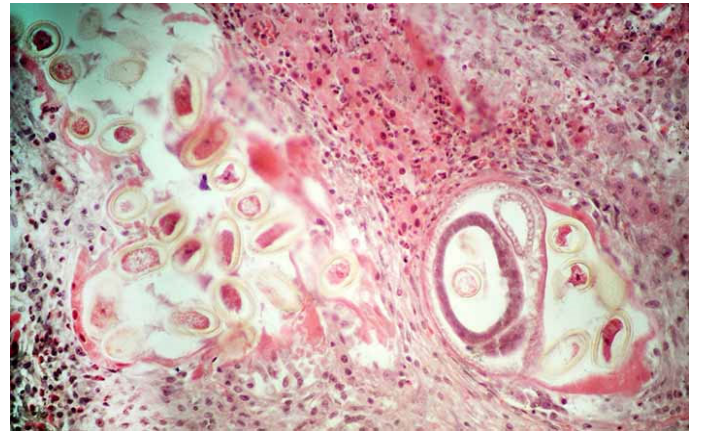


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Capillaria worm egg



Capillaria larva in intestinal section



Capillaria in liver section