HELMINTH PARASITES OF THE DOMESTIC CAT, FELIS DOMESTICUS LINN.

By

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Title of Study: HELMINTH PARASITES OF THE DOMESTIC CAT FELIS DOMESTICUS LINN.

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Major Field: Veterinary Parasitology

Scope of Study: The helminth parasites of the domestic cat, Felis domesticus, which have been reported have been collected for this report. They are listed under the Class Nematoda Cestoda, Trematoda and Phylum Acanthocephla. The list includes 43 nematodes, 40 trematodes, 24 cestodes and 6 acanthocephalids. In addition to the listings of these, description of each has been given as well as the location of the parasite in the host, distribution in the world and the essential life cycle data insofar as they are known.

ADVISER'S APPROVAL _____

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TABLE OF CONTENTS

INTRODUCTION

Among the pathogenic organisms affecting pet animals, including cats, helminth parasites are considered to be exceedingly important from several standpoints. Most of them are distributed widely geographically, affect sizable numbers of the pet animal population and are cross transmissible between host species. Many of them are very capable of debilitating animals and several invariably produce lethal effects when conditions are favorable for extensive infections. At least 2 of them are important from the standpoint of malignancy studies because their presence apparently prompts the development of growths similar to, if not identical with, tumors. Still others are important from the public health standpoint since either larvae or adult worms, or both, affect human beings.

Some that occur as adults in both man and cats are cestodes: Dipylidium caninum, Diphyllobothrium latum; Nematodes: Ancylostoma braziliense, Strongyloides species, Gnathostoma spinigerum, Dracunculus medinensis, Dioctophyma renale, Trichinella spiralis, Wuchereria malayi, W. pahangi; Trematodes: Troglotrema salmincola, Fasciola hepatica, Schistosoma japonicum, Paragonimus westermanni, P. kellicotti, Opisthorchis felineus, O. viverini, Heterophyes heterophyes, Metagonimus yokogawai, Metorchis conjunctus, and others. Larvae of other parasites in cats also are found in man and livestock such as some bladderworms (larval tapeworms) and certain roundworms.

One should not be interested in these parasites for the sake of the

cat alone but also for the sake of health and welfare of the livestock industry. The preservation of the health of cats is essential to the safety of the community and is a useful factor in maintaining the morale and happiness of the population.

Discussions of helminth parasites of Felis domesticus Linn. are scattered in various periodicals of the world. So far, little has been done by workers in listing the helminths of domestic cats in different countries. The amount of work done is not as extensive as that done for other domestic animals such as dogs, pigs, sheep, cattle and horses. On the advice of my committee chairman, Dr. Wendell H. Krull, Professor and Head of the Department of Parasitology, the available literature on the species of parasites of cats was reviewed.

The helminths of Felis domesticus Linn. are listed under the Classes Nematoda, Cestoda and Trematoda and Phylum Acanthocephala. Family names are used in all the groups and Orders are included in the class Nematoda because of the heterogenicity of the group.

Progress in veterinary parasitology has been rapid in recent years. Although considerable literature has been covered in this report, not all publications have been reviewed, particularly those in foreign languages. A number of publications were reviewed through English abstracts. Many of the common helminths have numerous synonyms and only some of the important ones are listed.

NEMATODES OF DOMESTIC CAT, FELIS DOMESTICUS LINN.

I. ORDER ASCAROIDEA:

A. Family Ascaridae:

1. Toxocara canis
2. T. cati
3. Toxascaris leonina

B. Family Rhabditidae:

4. Strongyloides stercoralis
5. S. cati
6. S. tumefaciens

II. ORDER STRONGYLOIDEA:

C. Family Syngamidae:

7. Syngamus ierei
8. S. auris
9. S. megaughei

D. Family Ancylostomidae:

10. Ancylostoma caninum
11. A. tubaeforme
12. A. longispiculatum
13. A. braziliense
14. Uncinaria stenocephala

E. Family Trichostrongylidae:

15. Ollulanus tricuspis

F. Family Filaroididae:

16. Aelurostrongylus abstrusus

17. Anafilaroides rostratus

18. Bronchostrongylus subcrenatus

19. Vogeloides ramanujacharii

20. V. massinoi

21. Gurltia paralysans

III. ORDER SPIRUROIDEA:

G. Family Spiruridae:

22. Spirocerca lupi

23. Spirura rytipleurites

H. Family Physalopteridae:

24. Physaloptera rara

25. P. canis

26. P. praeputialis

27. P. gemina

28. P. pacitae

I. Family Thelaziidae:

29. Thelazia californiensis

J. Family Gnathostomidae:

30. Gnathostoma spinigerum

IV. ORDER FILARIOIDEA:

K. Family Filariidae:

31. Dirofilaria immitis

32. Wuchereria malayi

33. W. pahangi

L. Family Dracunculidae:

34. Dracunculus medinensis

V. ORDER TRICHINELLOIDEA:

M. Family Trichuridae:

35. Trichuris felis

36. T. serrata

37. Capillaria aerophila

38. C. plica

39. C. linearae

40. C. felis-cati

41. C. putorii

N. Family Trichinellidae:

42. Trichinella spiralis

VI. ORDER DIOCTOPHYMOIDEA:

O. Family Dioctophymidae:

43. Dioctophyma renale

Phylum Nemathelminthes: Unsegmented worms, without appendages; bilaterally symmetrical, usually elongated, cylindrical or filariform; 2 openings to digestive tract, with a perienteric space between body wall and digestive tract which contains other visceral organs. Sexes usually separate, but a few species are hermaphroditic. No actively moving cilia in any stage of cycle.

Class Nematoda: Characteristics of the nemathelminthes; with digestive tract but without a proboscis.

Order Ascaroidea: Relatively stout worms with 3 large lips at anterior end; lips vestigeal or absent in some. Life cycle direct; in parasitic forms, eggs usually do not hatch until eaten by host.

Family Ascaridae: Large stout nematodes with 3 lips and papillae; buccal capsule and pharynx absent. Esophagus club shaped or with a posterior bulb. Caudal alae usually absent or poorly developed in male. Females oviparous. Parasites in the alimentary tracts of vertebrates.

Toxocara canis (Werner, 1782)

Synonyms: Lumbricus canis Werner, 1782; Ascaris werneri Rudulphi, 1793; Belascaris marginata (Rudolphi, 1802); Toxascaris canis (Werner, 1782); Belascaris canis (Werner, 1782) and numerous others.

Morphology: Male 40-100 mm., female 50-180 mm. long. Large stout worms. Tail ends in small finger-like process in males. Eggs subglobular, single celled, thick shelled, pitted, 75-85 u.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Direct. Eggs passed in feces; larvae develop and become infective in eggs in 2 days. Cat infected by ingesting eggs containing infective larvae. Larvae hatch and penetrate intestinal wall and reach lung through blood stream; they are coughed up, swallowed and develop to maturity in the small intestine.

Toxocara cati (Schrank, 1788)

Synonyms: Toxocara mystax (Zeder, 1800); Ascaris mystax (Zeder, 1800); Ascaris felis Glaue, 1909; Belascaris mystax (Zeder, 1800); Belascaris cati (Schrank, 1788); and numerous others.

Morphology: Male 30-70 mm., female 40-120 mm. long. Large muscular worms. Cervical alae heart shaped or arrowhead shaped in both sexes. Tail ends in small finger-like process in male. Eggs subglobular, thin shelled, delicately pitted, 65-75 μ.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Direct. Similar to T. canis.

Toxascaris leonina (von Linstow, 1902)

Synonyms: Ascaris leonina von Linstow, 1920; Toxascaris marginata (Rudolphi, 1802); Toxascaris limbata Railliet and Henry, 1911.

Morphology: Male 20-70 mm., female 20-100 mm. long. Small stout worm. Tail does not end in finger-like process in male. Eggs slightly oval, smooth shelled, 75-85 by 60-75 μ.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Direct. Eggs passed in feces; larvae develop and become infective in eggs in 2 days. Cat infected by ingesting eggs containing infective larvae. Larvae penetrate deeply in intestinal mucosa; no migration; in 10 days they return to lumen and mature..

Family Rhabditidae: Small, slender nematodes with a rhabditiform esophagus. Many are nonparasitic. Parasitic species in the genus Strongyloides; some or all may produce free-living as well as parasitic generations. Females either oviparous or ovoviviparous. Some parthenogenetic or hermaphroditic species. Parasites of alimentary tracts of vertebrates and mammals.

Strongyloides stercoralis (Bavay, 1876)

Synonyms: Anguillula stercoralis Bavay, 1877; Strongyloides intestinalis (Bavay, 1877) Grassi 1879.

Morphology: Free living male 0.7 mm. by 0.04 mm.; free living female 1 mm. by 0.06 mm. and parasitic female 2.2 mm. by 0.04 mm. Small slender worms. Uteri of parasitic female contain a single file of 8-12 thin shelled, transparent segmented eggs, 50-58 by 30-34 μ.

Location and distribution: Intestine. Cosmopolitan.

Life cycle: Direct. Larvae passed in feces. They develop either into parasitic or non-parasitic generation. The larva of the non-parasitic generation has a rhabditiform esophagus and is called a rhabditiform

larva. The infective larva of the parasitic generation has a filariform esophagus and is called a filariform larva. The filariform larvae are infective to the cat either orally or by skin penetration.

Strongyloides cati Rogers, 1939

Morphology: Free living male 0.57-0.9 mm., free living female 0.85-1.48 mm. and parasitic female 2.37-3.33 mm. Minute slender worms. Other particulars not available. Eggs 32-40 by 58-64 μ. Eggs, not larvae, occur in fresh feces.

Location and distribution: Small intestine. Tropical countries.

Life cycle: Direct. Similar to S. stercoralis.

Strongyloides tumefaciens Price and Dikmans, 1941

Morphology: Parasitic female 5 mm. long. Small slender worms. Uterus branched, containing an egg in each branch. Eggs containing fully developed larvae, 114-124 by 62-68 μ.

Location and distribution: Tumors of large intestine - United States.

Life cycle: Not known.

Order Strongyloidea: Worms with well developed buccal capsule; male with bursa supported by rays; usually 2 spicules with a gubernaculum and sometimes a telamon. Life cycle direct or indirect.

Family Syngamidae: Buccal capsule well developed with leaf-crowns and variable number of small triangular teeth. Male smaller than female; permanently attached to vulva of female by its bursa. Posterior

extremity conical in female. Oviparous. Parasites of respiratory tract of birds and mammals.

Syngamus ierei Buckley, 1934

Morphology: Male 5-5.9 mm., female 20.3-23.8 mm. Small worms, reddish in color. Buccal capsule broader than long with 6 oral papillae and 8 prominent teeth. Excretory pore at level of posterior end of esophagus. Spicules in male subequal, right longer than left. Caudal end of female tapers posteriorly from vulvar region; a pair of papillae situated at tip of tail. Eggs with fine irregular transverse striations, without a polar cap 4-6 cell stage, 92 by 49.5 μ.

Location and distribution: Pharynx and nasal passage. Trinidad and British West Indies.

Life cycle: Not known.

Syngamus megaughei Seneviratna, 1954

Morphology: Measurements and description of the worms not-available. Differs from S. ierei and S. auris in that the female is characterized by a long tail, bent dorsad and a brandy-glass-shaped buccal capsule.

Location and distribution: Frontal and nasal sinuses and pharynx. Ceylon.

Life cycle: Not known.

Family Ancylostomidae: Hook worms with a well developed buccal capsule guarded by ventral teeth, or plates. Parasites in the alimentary canal of vertebrates.

Ancylostoma caninum (Ercolani, 1859)

Synonyms: Strongylus trigonocephalus Rudolphi, 1808; Dochmius trigonocephalus (Dujardin, 1845); Uncinaria trigonocephala (Rudolphi, 1808); Ankylostoma tubaeforme von Linstow, 1885; Sclerostoma caninum Ercolani, 1859; and numerous others.

Morphology: Male 10-12 mm., female 14-16 mm. Worms muscular, rigid, grey or reddish in color. Buccal capsule large, subglobular, and deep, ventral margin provided with 3 teeth on either side of median line with inner pair smaller than outer larger pair. There is a pair of small triangular dorsal teeth on the dorsal margin of cavity. Male bursa well developed. Spicules long and slender. Vulva slightly posterior to the middle of body. Eggs ellipsoidal, thin shelled, transparent, 8 cell stage, 74-84 by 48-54 μ.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Direct. Eggs passed in feces. Rhabditiform larva hatches in 3 days. Molts to second stage larva after 3 days, molts again in 8 days to third stage infective larva. Cat may be infected through 3 routes: (1) ingestion of infective larvae with the food (2) larval penetration through the skin (3) by prenatal infection. Migration occurs in the last 2 routes.

Ancylostoma tubaeforme (Zeder, 1800)

Morphology: Male 9.5-11.00 mm., female 12.0-15.0 mm. Smaller worms, grey in color. Buccal capsule smaller, ventral margin provided with 3 teeth that are larger than A. caninum. Triangular teeth on dorsal margin are also larger than those of A. canium. Tail end of female short,

narrow and curved ventrally. Eggs ellipsoidal, thin shelled, 55-75 by 34-44 u.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Direct Similar to A. caninum.

Ancylostoma longispiculatum (Monnig, 1938) Noda, 1952

Synonyms: Ancylostoma longispiculata Monnig, 1938.

Morphology: Male 7-10 mm., female 11-13 mm. Worms similar to A. caninum, but smaller, spicules longer, ventral teeth more strongly developed, pair of triangular dorsal teeth longer, and cervical papillae longer than wide and sharply pointed. Measurements of eggs not available.

Location and distribution: Small intestine. Naniwa.

Life cycle: Not known.

Ancylostoma braziliense Cyomez de Faria, 1910

Synonyms: Ancylostoma ceylanicum Looss, 1911; Agamonematodum migrans Kirby-Smith, Dove and White, 1926.

Morphology: Male 7.75-8.5 mm., female 9-10.5 mm. Worm similar to A. caninum but differs in the number of ventral teeth. It has a single pair of large and a single pair of small teeth with inner pair smaller than outer pair. Eggs, 75-95 by 41-45 μ.

Location and distribution: Small intestine. United States, India, Burma, Ceylon, East Indies and Australia.

Life cycle: Direct. Similar to A. caninum.

Uncinaria stenocephala (Railliet, 1884)

Synonyms: Dochmius stenocephala Railliet, 1884; Ancylostoma stenocephalum (Railliet 1884); Uncinarai polaris Looss, 1911; Dochmoides stenocephala (Railliet, 1884).

Morphology: Male 5-8.5 mm., female 7-12 mm. Small muscular greyish worms. Buccal capsule with 2 ventral cutting plates instead of teeth. Bursa large. Eggs 71-93 by 37-55 μ.

Location and distribution: Small intestine. United States, Canada and Europe.

Life cycle: Direct. Similar to A. caninum.

Trichostrongylidae: Small slender worms; buccal capsule small or absent; male with well developed copulatory bursa. Parasites in alimentary tracts of vertebrates.

Ollulanus tricuspis Leuckart, 1865

Synonym: Olulanus tricuspis Cobbold, 1873.

Morphology: Male 0.7-0.8 mm., female 0.8-1 mm. Minute worms with transverse and longitudinal striations. Small buccal cavity with no teeth. Excretory pore comparatively large and posterior to esophagus. In male, bursa well developed; spicule split part of its length. Female with single ovary and uterus, tail ending in 3 or more cusps. Females are viviparous. Larva develops to infective stage inside uterus of female worm.

Location and distribution: Stomach. England, Germany, Italy, Switzerland, South Africa, Canada and Australia.

Life cycle: Direct. Worms are viviparous. Third stage infective larvae develop in the uterus and hyper-infection occurs. Infection spread to another cat by eating the vomitus of an infected animal.

Family Filaroididae: Lung worms, body generally filiform; buccal capsule simple, absent or traces of it. The rays in copulatory bursa of male are either fused or reduced. Life cycle may be direct or indirect. Parasites of respiratory or circulatory systems of mammals.

Aelurostrongylus abstrusus (Railliet 1898) Cameron 1927

Synonyms: Strongylus pusillus Mueller, 1890; Strongylus abstrusus Railliet, 1898; Synthetocalus abstrusus (Railliet, 1898).

Morphology: Male 4.5-7.00 mm., female 7.0-10.00 mm. Minute slender worms with an hour-glass-shaped esophagus. Male with well developed bursa with indistinct lobes and short well separated rays. Spicules equal, similar, curved, wider at anterior than posterior end. Small gubernaculum present. Tail of female tapered and blunt with vulva opening in front of anus. Eggs unsegmented, 71-105 by 62-101 μ.

Location and distribution: Lungs. America, Europe and Australia.

Life cycle: Indirect. Eggs laid in pulmonary artery; arrested by capillaries and develop. Larvae swallowed along with mucus and passed in feces. Snails, the intermediate hosts, infected either by ingestion or by penetration of larvae and 2 ecdyses occur in them. Cats infected by ingesting infected molluscs accidentally. Transfer hosts such as mice, frogs, lizards and birds in which larvae encyst, may be sources

of infection of cat.

Anafilaroides rostratus Gerichter, 1949

Synonym: Filaroides rostratus (Gerichter, 1949) Dougherty, 1951.

Morphology: Male 30 mm., female 50 mm. Slender worms, covered with a tegumentary sheath forming numerous folds. Oral opening triangular with a rostrum. Buccal cavity absent. Esophagus club shaped with posterior part 4 times wider. Caudal end in males with no bursa or rays. Spicules equal. Gubernaculum spongy. Vagina with a sphincter like structure at distal end. Uteri contain eggs and larvae. Eggs 80-90 μ.

Location and distribution: Lung. Palestine and Ceylon.

Life cycle: Indirect. Similar to A. abstrusus.

Bronchostrongylus subcrenatus (Railliet and Henry, 1913) Fitzsimmons, 1961

Morphology: Male 10-12.5 mm., female 20-23 mm. Small filiform worms. Cephalic end inflated with 6 lips, without buccal capsule. Spicule finely striated and slender. Gubernaculum absent. Bursa inconspicuous, supported by short stumpy rays. Tail end of female conical and bluntly pointed. Embryonated eggs 75-85 by 45-54 μ.

Location and distribution: Lung, Nyasaland.

Life cycle: Indirect. First stage larvae appear in feces of cat; they enter a molluscan intermediate host and infective larvae appear on eighth day. First stage larvae again appear in cat in twenty-eight days after it has ingested the infected snail. Mice may act as a transfer host.

Vogeloides ramanujacharii Alvar, Lalitha, and Seneviratna, 1958

Morphology: Male 7.5-15.3 mm., female 13.4-30.6 mm. Slender worms with delicate cuticle which is wrinkled quite often. Mouth with 6 lips and 10 papillae. Excretory opening near head end. Caudal end of male spirally coiled and without bursa. Spicules short, equal; proximal end hooked, distal end blunt. Short gubernaculum present. Caudal end with 2 pairs of post- and pre-anal papillae. Uterus occupies three-fourth or four-fifth of worm containing numerous eggs. Eggs in terminal portion of uterus are embryonated, thick shelled, oval 40-45 by 25-32 μ.

Location and distribution: Lung. India.

Life cycle: Not known.

Vogeloides massinoi (Davtian, 1933)

Synonyms: Osleroides massino Davtian, 1933; Metathelazia massino (Davtian, 1933) Dougherty, 1943.

Morphology: Male 8-14 mm., female 26-40 mm. Slender capillary worms with hexagonal oral opening. Bursa lacking at caudal end of male, but papillary rays extend along either side of anus. Spicules longer than in V. ramanujacharii. Gubernaculum present. Caudal end with 3 pairs of preanal and 5 pairs of postanal papillae. Uterus with numerous eggs containing developed larvae. Eggs 38-58 by 25-34 μ.

Location and distribution: Lung. Armenia.

Life cycle: Not known.

Gurltia paralisans Wolffhugel, 1934

Morphology: Male 14-18 mm., female 18-21 mm. Slender worms with delicate

cuticle. Mouth with 6 lips and no buccal capsule. In bursa of male, externolateral ray separate from mediolateral ray. Spicules equal, long and delicate. Gubernaculum absent. Vulva behind middle of body. Oviparous.

Location and distribution: Veins of lumbar region. Chile and Argentina.

Life cycle: Indirect. Not known, but local opinion is that cats are crippled through eating liazrds. The eggs may be swallowed by insect larvae after the death of the host, the insects by lizards and the lizards by a cat, to become infected.

Order Spiruroidea: Worms with 2 lateral lips; chitinous buccal capsule or vestibule usually present. Esophagus divided into a short anterior muscular part and a long glandular posterior part. Posterior end of male spirally coiled and never bursate. Spiracles unequal and dissimilar. Vulva usually in middle third of body. Eggs with thick shells contain larvae when laid. Life cycle indirect.

Family Spiruridae: Long worms; mouth with or without definite lips. Males with broad caudal alae and usually with 4 pairs of (rarely more) large, preanal papillae, which are almost invariably pedunculated. Parasites in the alimentary tracts of vertebrates.

Spirocerca lupi (Rudolphi, 1809)

Synonyms: Spiroptera sanguinolenta Rudolphi, 1819; Spirocerca sanguinol-

enta (Rudolphi, 1819); Filaria sanguinolenta (Rudolphi, 1819).

Morphology: Male 30-54 mm., female 54-80 mm. Large thick stout worms, blood red in color, coiled in a spiral. Spicules disimilar, left 2.4-2.8 mm., right 0.45-0.75 mm. long. Vulva opens near posterior end of esophagus. Eggs thick shelled, contain larvae when laid, 30-37 by 11-15 μ.

Location and distribution: In nodules of trachea, aorta, esophagus, stomach and other organs. Cosmopolitan.

Life cycle: Indirect. Eggs passed in feces and hatch if ingested by coprophagus beetle, larvae develop into infective stage in 2 months. If beetles are ingested by an unsuitable host, they may again encyst in transfer hosts, which are usually amphibians, reptiles, birds and small mammals. Cat is infected by swallowing infected beetle or transfer host containing third stage infective larvae.

Spirura rytipleurites (Deslongchamps, 1824) Stefanski, 1934

Synonym: Filaria gastrophila Mueller, 1894.

Morphology: Male 12-18 mm., female 16-32 mm. Small worms with posterior part of body thicker than anterior and spirally coiled. Anterior extremity with a prominent ventral hump of 2 mm. Excretory pore behind esophagus. Tail end in male conical, supported by rays. Right spicule long and narrow, left broader and winged. Gubernaculum present. Egg thick shelled, containing an embryo when laid. Size not available.

Location and distribution: Esophageal mucosa. Yugoslavia.

Life cycle: Not known.

Family Physalopteridae: Large thick muscular worms that superficially resemble ascarid worms. Mouth with 2 large trilobed pseudolips armed with single or more teeth; usually with a large cephalic collarette and without a vestibule. Males with large caudal alae supported by papillae. Parasites in alimentary tracts of vertebrates.

Physaloptera rara Hall and Wigdor, 1918

Synonyms: Physaloptera cerdocyona Sprehn, 1932; Physaloptera felidis Ackert, 1936; Physalopters clausa Caballero and Peregrina, 1938; Physaloptera turgida Leigh, 1940.

Morphology: Male 25-30 mm., female 27-45 mm. Stout worms with cuticle forming a collar-like projection at anterior end. Spicules unequal, curved, left 740-924 μ., right 477-700 u. in length. Vulva anterior to middle of body. Eggs embryonated, oval, smooth, thick shelled, 42-46 by 29-35 μ.

Location and distribution: Stomach and duodenum. United States.

Life cycle: Not known.

Physaloptera canis Monnig, 1928

Morphology: Male 13-42 mm., female 15-49 mm. Stout worms with cuticle extending posteriorly to form a sheath. Cephalic end with 3 lips, each bearing a set of 3 flattened internal teeth. Vulva in fertilized female covered by a conspicuous ring of brown cement material. Eggs 49-58 by

30-40 u.

Location and distribution: Stomach and duodenum. South Africa.

Life cycle: Not known, but cockroaches, crickets and beetles are suspected as intermediate hosts.

Physaloptera praeputialis von Linstow, 1899

Synonyms: Chlamydonema felineum Hegt, 1910; Chlamydonema praeputialis von Linstow, 1889.

Morphology: Male 13-45 mm., female 15-58 mm. Stout muscular worms with cuticula extending posteriorly to form a sheath which projects beyond caudal end of body. Spicules unequal, left 1-1.2 mm., right 0.34-0.9 mm. long. In fertilized female vulva covered by a conspicuous ring of brown cement material. Eggs 49-58 by 30-40 μ.

Location and distribution: Stomach. North and South America, Africa, China and East Indies.

Life cycle: Not known.

Physaloptera gemina von Linstow, 1899

Morphology: Male 1-1.4 mm., female 19 mm. Small muscular worms; each lip with 3 apical teeth and a number of internal denticles. Eggs 52 by 32 u.

Location and distribution: Stomach and intestine. Egypt.

Life cycle: Not known.

Physaloptera pacitae Tubangui, 1925

Morphology: Male 19-22 mm., female 23-25 mm. Moderately stout worms; mouth with lips, each having single large external tooth and 3 smaller

internal teeth. Eggs 48 by 30 u.

Location and distribution: Stomach. Philippines.

Life cycle: Not known.

Family Thelaziidae: Worms with annulated cuticle; mouth without lips; males with or without caudal alae; preanal papillae sessile, usually numerous arranged in a linear row. Tail of female blunt. Parasites in orbital, nasal and oral cavities of mammals, birds, air bladder and intestine of fishes.

Thelazia californiensis Price, 1930

Morphology: Male 7-13 mm., female 12-18 mm. Slender, whitish, translucent worms with cuticula pleated and serrated. Cephalic end with no lips. Esophagus short, uniform in diameter. Tail end of male blunt and recurved. Spicules unequal. Vulva opens anteriorly near end of esophagus. Uterus may contain either sheathed larvae or embryonated eggs 51-29 μ.

Location and distribution: Lacrimal duct, conjunctival sac and nictitating membrane of eye. United States.

Life cycle: Not known.

Family Gnathostomidae: Worms with cuticular head bulb; mouth with 2 large lateral trilobed lips, each having cuticle of its inner surface thickened and raised into tooth-like ridges which interlock with those of opposite lip. Parasites of the gastrointestinal tracts of fishes, reptiles and mammals.

Gnathostoma spinigerum Owen, 1836

Synonym: Gnathostoma siamense (Levinsen, 1890) Railliet 1893.

Morphology: Male 10-25 mm., female 9-31 mm. Stout reddish colored, slightly transparent worms. Head bulb armed with 6-11 transverse rows of hooks. Body armed with cuticular spines. Caudal end of male bears spines and 4 pairs of pedunculated papillae. Spicules unequal and dissimilar. Vulva behind middle of body, vagina long, uteri 2 in number. Oviparous. Eggs oval, greenish, ornamented, with a thin cap at one pole, passed in single cell stage, 69 by 37 μ.

Location and distribution: Stomach and rarely in liver. England, India, Malaya, Burma, Ceylon, China, Japan and Philippines.

Life cycle: Indirect. Eggs passed in feces and hatch in water within 6 days. Sheathed larvae if ingested by a cyclops, develop in 7 days. Fresh water fish ingest cyclops and parasites encyst in muscles of fish. Cats infected by eating infected fish. Parasite reaches maturity in 6 months.

Order Filarioidea: Long, thin filiform worms; without lips and with a rudimentary buccal capsule. Esophagus divided into 2 parts, anterior muscular and posterior glandular. Males with unequal and dissimilar spicules. Females much longer than male with the vulva in esophageal region. Ovoviparous. Larvae known as microfilariae. Life cycle indirect.

Family Filariidae: Long, thin, filariform worm with smooth cuticle sometimes reinforced with annular

thickenings. Mouth simple or with 2 insignificant lateral lips. Spicules unequal and dissimilar. Vulva posterior to esophagus. Parasites of circulatory and lymphatic systems and connective tissues of vertebrates.

Dirofilaria immitis (Leidy, 1856)

Synonyms: Filaria immitis Leidy, 1856; Dirofilaria louisianensis (Faust, Thomas and Jones, 1941).

Morphology: Male 120-200 mm., female 250-300 mm. by 1 mm. Slender, delicate worms. Males with small caudal alae, tail end spirally coiled and terminates bluntly. Spicules dissimilar; left longer than right. Gubernaculum absent. Microfilariae hatch from eggs before escaping from vulva and are unsheathed.

Location and distribution: Right ventricle and pulmonary artery. America, South Europe, India, China, Japan, and Australia.

Life cycle: Indirect. Microfilaria circulates in blood. Mosquitoes serve as intermediate host by feeding on blood of infected host. Larvae develop into infectious third stage in mosquitoes. Cats infected when "bitten" by infected intermediate host.

Wuchereria malayi (Brug, 1927) Buckley and Edeson, 1956

Synonyms: Filaria malayi Brug, 1927; Filaria bancrofti Cobbold, 1877; Microfilaria malayi (Brug, 1927) Faust, 1929.

Morphology: Male 22-23 mm., female 40-42 mm. by 1-1.5 mm. Delicate thread-like worms usually seen in pairs in spiral coil. Cephalic end

bears 2 minute papillae. Caudal end of male has 3 complete turns with a pair of large papillae in front and a pair behind cloaca. Caudal end of female blunt, vulva near anterior tip. Microfilaria has 2 nuclei at tip of tail.

Location and distribution: Lymphatics of scrotum. Malaya.

Life cycle: Not known.

Wuchereria pahangi Buckley and Edeson, 1956

Morphology: Male 14.5 mm., female 28 mm. by 1 mm. Worms slender and smaller than W. malayi. Cuticle unstriated throughout. Distal part of left spicule much shorter and thinner. Uterus bifurcated. Vulva near midpoint of esophagus.

Location and distribution: Lymphatics. Malaya.

Life cycle: Not known.

Family Dracunculidae: Long slender worms with cephalic end dome shaped. Males practically unknown. Females much larger than males. Vulva near anterior end. Ovoviviparous. Larvae provided with long pointed tails. Parasites of body tissues of vertebrates.

Dracunculus medinensis (Linnaeus, 1758) Petrov, 1955

Synonyms: Gordius medinensis (Linnaeus, 1756); Fuellebornius medinensis; Dracunculus graecorum Cruner, 1777; Dracunculus insignis (Leidy, 1858); Vermiculus capsularis Dunglison, 1895 and numerous others.

Morphology: Male 12-40 mm., female 400-900 mm. Elongated long worms with cephalic shield and coiled tail. Vulva immediately behind head

with a greatly distended uterus filled with embryos. Ovoviviparous. Uterus bursts near vulvar region to discharge embryos.

Location and distribution: Subcutaneous tissue. Africa, Nigeria, Arabia, Iran, Afganistan, Pakistan, Turkey, India, China and Georgian S. S. R.

Life cycle: Not known (in cats).

Order Trichinelloidea: Worms with anterior portion of body thinner and posterior portion thicker. Esophagus consists of a delicate tube running in part of its length, besides a chain of single cells. Males with single spicule, if present, lying in a protrusible sheath. Female with a single ovary and vulva situated at junction of narrow and wide parts of body. Life cycle direct or indirect.

Family Trichuridae: Worms with the anterior portion of body longer than, or rarely equal to the posterior part. Males with or without spicules or copulatory sheath. Vulva near termination of esophagus. Oviparous, eggs thick shelled, barrel shaped, with a plug at each end. Parasites of intestinal tract, lung, liver, kidney and bladder of mammals and birds.

Trichuris felis (Diesing, 1851)

Synonyms: Trichocephalus felis Diesing, 1851; Trichocephalus campanula v. Linstow, 1889; Trichuris campanula (v. Linstow, 1889).

Morphology: Male and female 35-65 mm. Worms resemble a whip-lash with thin anterior and thick posterior ends. Tail end of male curled dorsally with a short, simple spicule 1.5 mm. in length, surrounded by a spined sheath. Tail end of female not curled. Vulva surrounded by 2 longitudinal lips. Eggs thick-shelled, brownish, oval, plug at both ends, 72-90 by 36-40 μ.

Location and distribution: Cecum and colon. Europe.

Life cycle: Direct. Undeveloped eggs discharged in feces. Temperature and moisture are important factors affecting embryonation. Infection of cat by ingestion of embryonated egg containing first stage larvae. Larvae penetrate the small intestinal mucosa and migrate to large intestine. Development to maturity in eighty days.

Trichuris serrata (v. Linstow 1879) Clarkson and Owen, 1961

Morphology: Males 40 mm., females 48 mm. The anterior portion of body about two-thirds of total length. Male with a short simple spicule 3.9 mm. in length and its sheath covered with conical spines throughout. Vulva with a spiny protruded vagina. Eggs, with a plug at both ends, 56 by 39 μ.

Location and distribution: Cecum. Bahama Islands.

Life cycle: Direct. Similar to T. felis.

Capillaria aerophila (Creplin, 1839)

Synonyms: Eucoleus aerophilus Creplin, 1839; Trichosoma aerophilum Creplin, 1839.

Morphology: Male 15-20 mm., female 20-25 mm. Medium sized worms with no stricking difference in diameter of both ends. Spicule absent; but a spicule sheath armed with spines present. Vulva at level of esophagus. Eggs yellowish brown, oval, large plugs at both ends and surface roughened by granules or pits, 59-74 by 32-38 μ.

Location and distribution: Bronchioles, bronchi and trachea. Cosmopolitan.

Life cycle: Direct. Eggs are laid in lungs, coughed up, swallowed and passed out in feces. Larvae develop in eggs in 2 to 6 weeks. Infection occurs by ingestion of larvae in eggs. Eggs hatch in intestine and larvae migrate to site of infection and mature in forty days. Migratory route not known.

Capillaria plica (Rudolphi, 1819)

Synonym: Trichosoma plica Rudolphi, 1819.

Morphology: Male 13-30 mm., female 30-60 mm. Large, delicate worms, usually seen attached to bladder. Males with a long spicule and a spicule sheath. Vulva in female at level of posterior end of esophagus. Eggs oval, colorless, roughened and pitted with plugs at both ends, 60-65 by 20-25 μ.

Location and distribution: Bladder and pelvis of kidney. United States, England, Yugoslavia, Porto Rico and Germany.

Life cycle: Direct. Not known, but it is suspected that 2 months are

required for development in definitive host.

Capillaria lineare (Leidy, 1856)

Synonyms: Trichosoma lineare Leidy, 1856; Trichosoma felis-cati Stossich 1890; Capillaria linearis (Leidy, 1856).

Morphology: Male 3.75 mm., female 7.6 mm. Small thin worms with tail end of male conical and pointed. Tail end of female blunt and has 2 conical ventral processes at tip.

Location and distribution: Small intestine. United States.

Life cycle: Not known.

Capillaria felis-cati (Bellingham, 1844) Ehrlich, 1947

Morphology: Female 14-16 mm. in length. Description not available. Eggs 61 by 32 μ.

Location and distribution: Urinary bladder. Ireland, Egypt and Russia.

Life cycle: Not known.

Capillaria putorii (Rudolphi, 1819) Jacob, 1951

Morphology: Particulars not available.

Location and distribution: Urinary bladder. Germany.

Life cycle: Not known, but more common in domestic cats where polecats are present in vicinity.

Family Trichinellidae: Worms with the posterior end of both sexes slightly thicker than anterior end. Males without spicule or copulatory sheath. Females with a single ovary. Ovoviviparous. Parasites of

mammals; adults in intestine and larvae in muscles.

Trichinella spiralis (Owen, 1835) Railliet, 1895

Synonym: Trichina spiralis Owen, 1835.

Morphology: Male 1.4-1.6 mm., female 3-4 mm. Small, minute worms. Males with copulatory spicule and sheath absent but cloaca is everted during coitus and its opening flanked by 2 papillae. Vulva at anterior fifth of body with a single ovary near posterior end.

Location and distribution: Adult in small intestine; larvae in voluntary muscles. Cosmopolitan.

Life cycle: Cat acts both as definitive and intermediate host. Worms are ingested along with infected meat. Encapsulated worms freed from cyst get into folds of mucosa among villi. In 2 days, they reach sexual maturity, copulate and males die. Female burrows into intestinal mucosa, deposits several broods of larvae which enter lymphatics and through blood circulation reach voluntary muscles. Larvae encapsulate in sixteen days. Encystment begins 3 weeks after infection and is completed in about 7 weeks. Calcification takes place after 6 months.

Order Dioctophymoidea: Medium to large worms; esophagus without a posterior bulb. Male with a bell-shaped muscular bursa, not supported by rays. Spicule single. Female with single ovary. Eggs with thick pitted shell. Life cycle indirect. Parasites of mammals and birds.

Family Dioctophymidae: Large worms. Cephalic end not swollen; mouth simple without lips. Male bursa copulatrix bell shaped, no rays and single spicule. Female with single ovary and blunt tail. Eggs ellipsoidal, thick shelled and brown in color. Parasites of kidneys, thoracic and abdominal cavities of mammals.

Dioctophyma renale (Goeze, 1782)

Synonyms: Ascaris renalis Goeze, 1782; Eustrongylus gigas (Rudolphi, 1802); Eustrongylus visceralis (Gmelin, 1790); Ascaris visceralis Gmelin, 1790; Dioctophyma renalis Goeze, 1782 and numerous others.

Morphology: Male 140-450 mm. by 4-6 mm., female 200-1000 mm. by 5-12 mm. Large worms; simple mouth without lips, surrounded by a circle of 6 papillae. Males with bell shaped bursa containing no rays. Spicule single. Vulva of female 50-70 mm. from anterior end. Eggs ellipsoidal, brown in color, thick shelled with sculptured depressions, 64-68 by 40-44 μ.

Location and distribution: Thorax. Poland, United States, China, Japan, Holland, France, Italy, Russia and Africa.

Life cycle: Indirect. Not known (in cats).

CESTODES OF DOMESTIC CAT, FELIS DOMESTICUS LINN.

I. DIPHYLLOBOTHYRIIDAE:

1. Diphyllobothrium latum
2. D. mansonoides
3. D. erinacei

II. DIPYLIDIIDAE:

4. Dipylidium caninum
5. D. oerlyi
6. D. sexcoronatum
7. D. gracile
8. D. compactum
9. D. diffusum
10. D. longulum
11. D. halli
12. Joyeuxia cheyzeri
13. J. pasqualei
14. J. fuhrmanni
15. Diplopylidium nolleri
16. D. skrjabini
17. D. trinchesii
18. D. quinquecoronatum

III. MESOCESTOIDIDAE:

19. Mesocestoides lineatus
20. M. latus

IV. TAENIIDAE:

21. Taenia taeniaeformis

22. T. hydatigena

23. T. pisiformis

24. Echinococcus granulosus

Phylum Platyhelminthes: Multicellular tape or ribbon-like organisms with bilaterally symmetrical body of 3 layers; digestive system with single mouth opening; excretory system ends in flame cells; reproductive organs hermaphroditic.

Class Cestoidea: Parasitic worms with an indirect life cycle; non-ciliated integument, cilia present only in larval stages. Body divided into head, neck and proglottids; head composed of bothria or suckers usually surrounded by rostellar hooks. Digestive and circulatory systems absent; reproductive organs hermaphroditic in most cases.

Order Pseudophyllidea: Parasitic worms with 2 intermediate hosts. Scolex lancet or spoon shaped with narrow deep bothria or grooves; segments contain only one set of reproductive organs. Life cycle with 5 stages; eggs, coracidium, procercoid, plerocercoid and adult. Parasitic in alimentary tracts of all vertebrates.

Family Diphyllobothriidae: Large worms. Scolex with bothria or grooves; vitellaria and testes numerous, placed in the lateral fields of segments; single set of reproductive organs in each segment. Adults parasitic in alimentary tracts of vertebrates.

Diphyllobothrium latum (Linnaeus, 1758)

Synonyms: Taenia lata Linnaeus, 1758; Bothriocephalus latus (L., 1758) Bremser, 1858; Dibothriocephalus latus (L., 1758) Luhe, 1899; Bothriocephalus taenioides Leon, 1916; Dibothriocephalus minor Cholodkowsky, 1916.

Morphology: Mature specimen 8 to 10 meters in length and maximum width of strobila 20 mm. Large tapeworms with scolex unarmed, lancet shaped with dorsal and ventral bothria. Mature segments in middle third of body containing reproductive organs in each segment. Testes distributed in dorsal lateral fields, reaching excretory canals and vitellaria ventral to testes. Ovary bilobed, uterus rosette shaped with no lateral branches. Genital pore on median line anterior to uterine pore. Eggs oval, operculate with rounded ends, passed through the uterine pore, 55-76 by 41-56 μ.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Indirect. Embryo develops into ciliated coracidium in about fifteen days. Crustaceans like cyclops ingest coracidium which develops into a procercoid in body cavity. Fishes of various species act as second intermediate hosts by swallowing infested crustaceans. Procercoid penetrates through intestine of fish, migrates to muscles and develops into a plerocercoid. Cat infected by ingesting uncooked infected fish.

Diphyllobothrium mansonoides Mueller, 1935

Synonym: Spirometra mansonoides Mueller, 1937.

Morphology: Mature specimen 3 to 7 meters in length and maximum width

of strobila 5-10 mm. Medium sized tapeworms with scolex unarmed, delicate and little set off from neck. Shallow, broad and flat bottomed bothria continuous with surface of neck. Testes numerous in lateral fields with many convolutions of vas deferens. Cirrus and vagina open independently; flattened ovary with reticulate wings. Uterus with 6-8 coils posterior, and 2 coils anterior that are larger in diameter. Eggs variable in shape, with pointed ends and conical opercula, 65 by 37 u.

Location and distribution: Small intestine. United States.

Life cycle: Indirect. Similar to D. latum. Fishes, mice and snakes act as second intermediate hosts. If second intermediate hosts with infective plerocercoids are ingested by transfer hosts these larvae will penetrate intestinal wall and re-establish themselves in tissues. Cat infected by ingesting uncooked flesh of infected animal.

Diphyllobothrium erinacei (Rudolphi, 1819) Faust, 1929

Synonyms: Spirometra erinacei-europaei (Rud., 1819) Yamaguti, 1959; Bothriocephalus felis (Creplin, 1825); Dibothriocephalus felis (Creplin, 1825); Diphyllobothrium felis (Creplin, 1825) Bhalerao, 1935.

Morphology: Mature specimen 2 to 4 meters in length and maximum width of strobila 5 mm. Full morphological characters not available. Testes are joined in two groups in anterior part of each segment. Eggs smaller than D. latum, 59-66 by 36-40 μ.

Location and distribution: Small intestine. West Java, United States, British Guiana and Ceylon.

Life cycle: Indirect. Similar to D. latum but eggs hatch in 10 to twenty-eight days.

Order Cyclophyllidea: Parasitic worms with an intermediate host. Scolex with 2 pairs of suckers, with a rostellum at center of each sucker. Segments with single or double sets of reproductive organs. Vitellarium a single mass, life cycle with 4 stages, egg, oncosphere, bladder worm stage and adult. Parasites of warm blooded animals, birds and mammals.

Family Dipylidiidae: Double pored tapeworms. Rostellum present or absent, if present, armed; 4 suckers. Eggs in egg capsules or paruterine organs. Second stage larva a cysticercoid. Adults parasitic in digestive tract of mammals.

Dipylidium caninum (Linnaeus, 1758) Railliet, 1892

Synonyms: Taenia caninum Linnaeus, 1758; Taenia cucumerina Bloch, 1782; Taenia moniliformis Pallas, 1781; Alyselminthes ellypticus Batsch, 1786; Diplidium catus Gulati, 1929, and numerous others.

Morphology: Mature specimen 15 to 40 cm. in length and maximum width 2-8 mm. Scolex rhomboid, suckers oval, rostellum armed with 3-4 crowns of hooks. Length of anterior and posterior crowns of hooks 12-15 and 5-7 μ. respectively. Mature proglottids cucumber seed shaped with double set of reproductive organs. Testes 100-200 in number, cirrus-sac not reaching lateral excretory canals. Gravid segment contains numerous egg capsules. Egg capsules vary in both size and number of contained hexacanth.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Indirect. Eggs passed either in gravid proglottids or in egg capsules with feces. Larval fleas, Ctenocephalides canis and C. felis, act as intermediate hosts by ingesting eggs when they feed on debris among hairs and on the skin of cat and dirty premises. In flea larvae develop into infective cysticeroids and if cat ingests flea with cysticercoids while licking the fur, freed cysticercoids attach themselves to intestinal wall and develop into mature worms in twenty days.

Dipylidium oerleyi v. Ratz, 1900

Morphology: Mature specimen 5 to 11 cm. in length and maximum width 2 mm. Rostellum armed with 5 crowns of hooks. Testes 90-100 in number, cirrus-sac reaching beyond excretory canals. Gravid segment contains numerous egg capsules.

Location and distribution: Small intestine. Hungary and Philippines.

Life cycle: Indirect. Similar to D. caninum.

Dipylidium sexcoronatum v. Ratz, 1900

Morphology: Mature specimens 10 to 30 cm. in length and maximum width 2 mm. Rostellum armed with 6 crowns of hooks. Length of anterior and posterior crowns of hooks 11 and 4 μ. respectively. Testes 130-175 in number. Cirrus-sac extends as far as excretory canals. Gravid segment contains 2-15 egg capsules.

Location and distribution: Small intestine. Europe, India, North America, and Philippines.

Life cycle: Indirect. Similar to D. caninum.

Dipylidium gracile Millzner, 1926

Morphology: Mature specimen 20 cm. in length and maximum width 2 mm. Rostellum armed with 5-7 crowns of hooks. Length of anterior and posterior crowns of hooks 8 and 5 μ respectively. Testes 200-250 in number; cirrus-sac extends as far as, or slightly beyond, excretory canals. Gravid segment contains 3-10 egg capsules.

Location and distribution: Small intestine. North America.

Life cycle: Indirect. Similar to D. caninum.

Dipylidium compactum Millzner, 1926

Morphology: Mature specimen 5-15 cm. in length and maximum width 2 mm. Rostellum armed with 6 crowns of hooks. Length of anterior and posterior rows of hooks 5 and 15 u respectively. Testes 140-200 in number; cirrus-sac not reaching excretory canals. Gravid segment contains 2-10 egg capsules.

Location and distribution: Small intestine. North America.

Life cycle: Indirect. Similar to D. caninum.

Dipylidium diffusum Millzner, 1926

Morphology: Mature specimen 70-150 cm. in length and maximum width 2.5 mm. Rostellum armed with 6-8 crowns of hooks. Length of anterior and posterior rows of hooks 8 and 5 u respectively. Testes 160-250 in number; cirrus-sac reaching but usually not crossing excretory canals. Gravid segment contains 3-10 egg capsules.

Location and distribution: Small intestine. North America.

Life cycle: Indirect. Similar to D. caninum.

Dipylidium longulum Millzner, 1926

Morphology: Mature specimen 5-12 cm. in length and maximum width 2-3 mm. Rostellum armed with 5 crowns of hooks. Length of anterior and posterior rows of hooks 7 and 5 μ respectively. Testes 180-240 in number. Cirrus-sac nearly reaching the excretory canals. Gravid segment contains 1-12 egg capsules.

Location and distribution: Intestine. North America.

Life cycle: Indirect. Similar to D. caninum.

Dipylidium halli Tubangui, 1925

Morphology: Length measurement not available. Maximum width of strobila 1 mm. Rostellum armed with 8 crowns of hooks. Testes 100-140 in number. Cirrus-sac extends considerably beyond excretory canal. Gravid segment contains 5-7 egg capsules.

Location and distribution: Small intestine. Philippines.

Life cycle: Indirect. Similar to D. caninum.

Joyeuxia cheyzeri (v. Ratz, 1897)

Morphology: Mature specimen 15-50 cm. in length and maximum width 1.2-2 mm. Scolex and the suckers smaller than D. caninum; rostellum armed with 13-14 rows of hooks. Length of anterior and posterior crowns of hooks 14 and 10.5 μ respectively. Testes 45-50 in number. Cirrus-sac extends beyond excretory canals. Gravid segment with a thin walled egg capsule containing a single egg.

Location and distribution: Small intestine. India.

Life cycle: Indirect. Similar to D. caninum.

Joyeuxia pasqualei (Diamere, 1893) Fitzsimmons, 1961

Synonym: Joyeuxiella pasqualei Fitzsimmons, 1961.

Morphology: Mature specimen 20-30 cm. in length and maximum width 1-2 mm. Rostellum armed with 16 crowns of hooks. Length of hooks 7 μ. Testes about 50 in number. Cirrus-sac does not extend beyond excretory canals. Egg capsule contains a single egg.

Location and distribution: Small intestine. Egypt.

Life cycle: Indirect. Cysticercoids occur in snakes and lizards. Cats prey upon infected reptiles and secure infection.

Joyeuxia fuhrmanni (Baer, 1924) Ortlepp, 1933

Morphology: Mature specimen 13-14 cm. in length and maximum width 1-2 mm. Worm similar to J. pasqualei, but rostellum armed with 12 crowns of hooks and testes extend in a zone anterior to vasa deferentia. Egg capsule contains single egg.

Location and distribution: Small intestine. South Africa.

Life cycle: Not known.

Diplopylidium nolleri Skrjabin, 1924

Morphology: Mature specimen 4-5 cm. in length and maximum width 0.85-1.1 mm. Rostellum armed with 3 to 4 crowns of hooks. Length of anterior and posterior rows of hooks 53 and 10 μ respectively. Testes 12-16 in number. Cirrus-sac extends to midline of segment. Egg capsule contains a single egg.

Location and distribution: Small intestine. India and Turkey.

Life cycle: Indirect. Cysticercoids occur in small cold blooded vertebrates. Cats infected by eating these vertebrates.

Diplopylidium skrjabini Popov, 1935

Morphology: Length measurements and descriptions not available. Similar to D. nolleri but differs chiefly in size of the scolex and suckers and in the color of the living specimens.

Location and distribution: Small intestine. U.S.S.R.

Life cycle: Indirect. Cysticercoids occur in peritoneum of garden lizard. Cats become infected by eating these lizards.

Diplopylidium trinchesii (Diamare, 1892)

Morphology: Mature specimen 1-7.5 cm. in length and maximum width 0.7 mm. Rostellum armed with 4 crowns of hooks. Length of hooks 36 μ. Testes 25-32 in number. Cirrus-sac nearly extend to middle line of segment. Egg capsule contains a single egg.

Location and distribution: Small intestine. Europe and Egypt.

Life cycle: Indirect. Similar to D. nolleri.

Diplopylidium quinquecoronatum (Rodriguez and Munoz, 1922)

Morphology: Mature specimen 3-6.5 cm. in length and maximum width 0.75 mm. Rostellum armed with 5 crowns of hooks. Length of anterior and posterior rows of hooks 68-71 and 12.2-16 μ respectively. Testes 46-58 in number. Cirrus-sac extends nearly to middle line of segment. Egg capsule contains a single egg.

Location and distribution: Small intestine. Spain.

Life cycle: Indirect. Similar to D. nolleri.

Family Mesocestoididae: Large tapeworms; suckers present but hooks and rostellum absent. Single set of reproductive organs, uterus blind tube, genital pore median, eggs stored in true par-uterine organ. Larval stage known as a tetrathyridium. Adults parasitic in gastrointestinal tracts of carnivorous mammals.

Mesocestoides lineatus (Goeze, 1782)

Synonyms: Taenia lineata Goeze, 1782; Halysis lineata Zeder, 1803; Taenia litterata Batsch, 1786; Mesocestoides lateratus (Batsch, 1786) and numerous others.

Morphology: Mature specimen 30-250 cm. in length and maximum width 3 mm. Large tapeworms, with scolex large and 4 elongated oval suckers. Ovary and vitellaria bilobed. Eggs develop in stout walled uterine capsule, oval in shape, 40-60 by 35-43 μ.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Indirect. Not known. Larval forms, tetrathyridia, have been found in various parts of body of reptiles, birds and small mammals. Cat may harbor both adult and larval stages simultaneously.

Mesocestoides latus Mueller, 1927

Morphology: Mature specimen 12-30 cm. in length and maximum width 2 mm. Medium sized tapeworms with scolex medium sized and 4 oval suckers. Vitellaria bilobed. Genital opening flattened on median and ventral aspects. Eggs develop in a common uterine capsule and measure 18 μ in diameter.

Location and distribution: Small intestine. United States, England, Africa, India, Burma, Malaya, Ceylon and Pakistan.

Life Cycle: Indirect. Not known. Flat thread-like contractile tapeworm larva with knob-like thickenings on body and 4 unarmed suckers, but no rostellum, were found free in serous cavities or in cysts in various parts of bodies of reptiles and birds. Cat may harbor adult and larval stages simultaneously.

Family Taeniidae: Long tapeworms with scolex armed or unarmed, uterus with median longitudinal stem bearing lateral branches; genital pores irregularly alternating. Testes numerous; ovary bilobed. Larval phase may be either cysticercus, strobilocercus coenurus or echinococcus. Adults parasitic in intestinal tract of mammals and birds.

Taenia taeniaeformis (Batsch, 1786) Wolffhugel, 1911)

Synonyms: Taenia serrata Goeze, 1782; Taenia felina Goeze, 1782; Hydatigena taeniaeformis Batsch, 1786; Cysticercus fasciolaris Rudolphi, 1808; Taenia infantis Bacigalupo, 1922 and numerous others.

Morphology: Mature specimen 20-60 cm. in length and maximum width 3-5 mm. Scolex with prominent suckers facing outward and forward. Rostellum large with 26-52 hooks, usually 34 hooks. Worm has no neck, gravid segments bell shaped.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Indirect. Intermediate hosts are rodents, chiefly rats, mice, squirrels, etc. They ingest eggs, onchospheres penetrate mucosa

of stomach and are carried to liver through blood stream, where bladder worm, cysticerus fasciolaris, develops. Cat infected by eating infected liver of rodents.

Taenia hydatigena Pallas, 1766

Synonyms: Cysticercus taeniahydatigena (Pallas, 1766); Taenia marginata Batsch, 1786; Taenia lupina Schrank, 1788; Taenia ovilla Gemelin, 1790; Cysticercus tenuicollis Rudolphi, 1810 and numerous others.

Morphology: Mature specimen 300-500 cm. in length and maximum width 4-6 mm. Large tapeworms with rostellar hooks that number 26-44, usually 33, arranged in rows. Uterus with 5-10 branches on lateral sides.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Indirect. Intermediate hosts are domestic and wild ruminents. They ingest gravid proglottids; onchosphere penetrates mucosa of stomach or intestine and is carried to omentum, mesentery and liver through blood stream, where bladder worm, Cysticercus tenuicollis, develops. Cat infected by eating infected organs.

Taenia pisiformis (Bloch, 1780)

Synonyms: Hydatis pisiformis (Bloch, 1780); Cysticercus pisiformis Bloch, 1780; Taenia cucurbitina Palla, 1766; Taenia utriculatus Hall, 1912; Vesicaria pisiformis Bloch, 1780; Taenia serrata.

Morphology: Mature specimen 200 cm. in length and maximum width 3-5 mm. Rostellar hooks number 34-48; uterus with 8-14 lateral branches arranged in 2 rows. Eggs 36-40 by 31-36 μ.

Location and distribution: Small intestine. Cosmopolitan.

Life cycle: Indirect. Intermediate hosts are lagomorphs, chiefly rabbits

and hares. They ingest gravid proglottids or free eggs; onchosphere penetrates the mucosa of stomach or intestine and is carried to liver through blood. Bladder worm, Cysticercus pisiformis, is found in peritoneal cavity, attached to viscera. Cat infected by ingestion of cysticercus from infected viscera.

Echinoccoccus granulosus (Batsch, 1786)

Synonyms: Hydatigena granulosus (Batsch, 1786); Taenia granulosus (Batsch, 1786); Taenia echinococcus (Zeder, 1803); Echinococcus multilocularis Leuckart, 1863; Echinococcus alveolaris Klemm, 1883 and numerous others.

Morphology: Mature specimen 3-8.5 mm. in length consisting of scolex, neck and 3 segments. Rostellum with 30-36 hooks in 2 rows and 4 suckers. Neck present. Initial segment immature; middle segment with fully developed reproductive organs; terminal segment gravid with median uterine stem and 12-15 lateral branches filled with eggs. Genital pores irregularly alternate. Eggs typical taenia-like, usually spherical, 32-36 by 25-30 μ.

Location and distribution: Cycts usually in liver and lung. Cosmopolitan.

Life cycle: Indirect. Definitive hosts like dogs, wolves, jackals, coyotes, and other canidae, ingest the viscera of intermediate hosts to become infected. Intermediate hosts like pigs, swallows eggs passed in feces of definitive hosts and infection with hydatid cyst occurs in various parts of body, mainly liver or lungs.

TREMATODES OF DOMESTIC CAT, FELIS DOMESTICUS LINN.

Family Fasciolidae:

1. Fasciola hepatica

Family Cyathocotylidae:

2. Mesostephanus appendiculatum

3. Pharyngostomum cordatum

Family Dicrocoeliidae:

4. Platynosomum concinnum

5. Euparadistomum heischi

Family Diplostomatidae:

6. Alaria americana

7. A. minnesotae

8. Cynodiplostomum namrui

Family Echinostomatidae:

9. Euparyphium melis

10. Heterechinostomum magnovatum

11. Echinochasmus perfoliatus

12. Stephanoprora denticulatoides

Family Schistosomatidae:

13. Schistosoma japonicum

14. Ornithobilharzia turkestanicum

Family Troglotrematidae:

15. Troglotrema salmincola

16. Paragonimus westermanni

17. P. kellicotti

Family Ophisthorchiidae:

18. Amphimerus pseudofelineus
19. Opisthorchis felineus
20. O. tenuicollis
21. O. sinensis
22. Metorchis conjunctus
23. M. albidus
24. Pseudoamphistomum truncatum

Family Heterophyidae:

25. Heterophyes heterophyes
26. Haplorchis yokogawai
27. H. milvi
28. H. pumilio
29. H. calderoni
30. H. sisoni
31. Apophallus venustus
32. Cryptocotyle lingua
33. Phagicola longicollis
34. P. longa
35. Monorchotrema taichui
36. Metagonimus yokogawai
37. Strictodora caballeroi
38. Adleria minutissima
39. Stellantchasmus amplicaecalis
40. Pygidiopsis genata

Phylum Platyhelminthes: Organisms compressed dorsoventrally, bilaterally symmetrical; digestive system with single opening; excretory ducts ending in flame cells; reproductive system hermaphroditic and very rarely unisexual; species either parasitic or free living.

Class Trematoda: Flattened organisms living as ecto or endo-parasites, larval stages ciliated, digestive system well developed and the intestine generally bifurcate. Holdfast organ or suckers characteristic of this group. Eggs operculate. Adults parasitic on or in vertebrates.

Sub-class Digenea: Trematodes endo-parasitic, mostly in but a few on, vertebrates. Characterized by the presence of suckers; well developed reproductive systems; uterus usually containing numerous eggs. Alternation hosts and alternation of sexual generation with 2 or more asexual generations. Life cycle with 2 or more hosts, one of which is usually a mollusk.

Order Prosostomata: Digenetic trematodes with mouth surrounded by an oral sucker; body flattened.

Family Fasciolidae: Large, flattened, ovate-shaped trematodes, with spiny cuticle. Oral and ventral suckers close together. Ovary, testes and Vitellaria much branched. Uterus with few transverse folds in front of ovary. Parasitic in liver and bile ducts of vertebrates.

Fasciola hepatica Linnaeus, 1758

Synonyms: Distoma hepaticum Ratzius, 1786; Planaria latiuscula, 1782; Fasciola humana Gmelin, 1789; Cladocoelium hepaticum (Linnaeus, 1758); Fasciola californica Sinitsin, 1933; Fasciola halli Sinitsin, 1933 and numerous others.

Morphology: Length 20-30 mm., width 8-15 mm. Body flattened, large, ovate shaped with a cephalic cone. Cuticle spiny. Oral sucker at end of cephalic cone, acetabulum at level of shoulders. Testes and ovary extensively branched. Vitellaria in fine follicles filling lateral and posterior fields. Eggs yellow to brown, operculate, undeveloped, 130-150 by 63-90 μ.

Location and distribution: Bile duct. Cosmopolitan.

Life cycle: Indirect. Eggs escape in feces and hatch in 9 days. Ciliated miracidium penetrates a snail, metamorphoses into sporocyst. A number of rediae and daughter rediae are produced asexually from sporocyst. Each daughter redia produces either rediae or numerous cercariae asexually and cercariae leave snail in 4 to 7 weeks. Cercariae settle on blades of grass to become metacercariae and they are infective to cats.

Family Cyathocotylidae: Flukes of rounded outline; body not divided into anterior and posterior regions. Large holdfast organ situated in mid-body behind ventral sucker. Parasitic in intestine of reptiles, birds and mammals.

Mesostephanus appendiculatum (Ciurea, 1916) Lutz, 1935

Synonym: Prohemistomum appendiculatum Ciurea, 1916.

Morphology: Length 1-1.75 mm., width 0.05-0.6 mm. Body somewhat elongated with tongue shaped anterior and posterior regions. Oral sucker small. Holdfast organ small. Acetabulum small. Testes oval and tandem. Ovary rounded, in front of anterior testis. Uterus short containing 4 or 5 large golden eggs, 100-117 by 63-68 μ.

Location and distribution: Small intestine. United States and Roumania.

Life cycle: Indirect. Snail and fish act as first and second intermediate hosts respectively. Cat infected by eating infected fish.

Pharyngostomum cordatum (Diesing, 1850) Ciurea, 1922

Synonyms: Hemistomum cordatum Diesing, 1850; Alaria cordata Railliet, 1919; Hemistomum kordatum Schneidemuhl, 1898; Holostomum linguaeformis Dubois, 1938; Diplostomum putorii Linstow, 1877, and numerous others.

Morphology: Length 2.6-3.8 mm., width 1.6-2.0 mm. Body with oval outline or heart shaped. Holdfast organ conceals large oral sucker and smaller acetabulum, later at times absent. Testes large, deeply lobed, side by side. Ovary small, situated in front of testes. Measurement of egg not available.

Location and distribution: Intestine. Europe, Asia and China.

Life cycle: Indirect. Snails acts as first intermediate host. Tadpoles, frogs, toads and rarely snakes act as second intermediate hosts. Metacercaria is of diplostomum type and matures in the intestine when cat ingests infected second intermediate host.

Family Dicrocoeliidae: Elongate, flattened, delicate, translucent medium sized distomes with suckers close together and genital pore in front of acetabulum. Parasites in biliary ducts and gall bladder of amphibians, reptiles, birds and mammals.

Platynosomum concinnum (Braun, 1901) Bhalerao, 1936

Synonym: Platynosomum fastosum.

Morphology: Length 4.8 mm. width 1.5-2.5 mm. Body lanceolate with smooth cuticle. Pharynx and esophagus present. Testes horizontal in position. Ovary posterior to testes. Uterus with extensive convolutions. Eggs brown, oval, contain a miracidium when laid, 35-40 by 20-35 u.

Location and distribution: Liver. Malaya, British Guiana, Brazil, West Indies and United States.

Life cycle: Indirect. Detailed life cycle not known.

Euparadistomum heischi Buckley, 1958

Morphology: Length 4.5-6.5 mm., width 2.5-3.4 mm. Body broad, flat and attenuated at both extremities. Cuticle smooth. Oral sucker larger than acetabulum, latter centrally located. Testes oval, symmetrical, inter-cecal and anterior to acetabulum. Ovary spherical and posterior to testes. Uterus with extensive convolutions occupying nearly whole length of body. Eggs oval, operculate, 50-63 by 29-33 μ.

Location and distributinn: Gall bladder. Kenya.

Life cycle: Not known.

Family Diplostomatidae: Body divided by a constriction into anterior flattened and posterior conical or cylindrical parts. Ear-like processes sometimes present in anterio-lateral parts of body. Hold-fast organ short, circular and sometimes containing part of uterus. Parasitic in intestine of birds and mammals.

Alaria americana Hall and Wigdor, 1918

Synonyms: Planaria alata Goeze, 1782; Alaria vulpis Schrank, 1788; Holostomum alatum Nitzsch, 1819; Hemistomum alatum Diesing, 1850; Diplostomum alatum Parona, 1894; Conchosomum alatum Railliet, 1896.

Morphology: Length 3-6 mm., width 1-2 mm. Body flat, disc-like anterior and cylindrical posterior region with lateral tentacle-like processes. Testes large, bilobed and posterior. Ovary at the constriction of body, in front of testes. Uterus with an ascending limb to level of adhesive organ and a descending loop. Eggs oval, thin shelled, non-embryonated, 106-134 by 64-80 μ.

Location and distribution: Small intestine. United States, Europe and Australia.

Life cycle: Not known

Alaria minnesotae Chandler, 1954

Synonym: Tetra cotyle bonasa Chandler, 1954.

Morphology: Length 1.5-1.9 mm., width not available. Forebody broader than hind body. Acetabulum smaller than oral sucker and holdfast often overlaps ventral sucker. Other particulars not available.

Location and distribution: Intestine. United States.

Life cycle: Not known.

Cynodiplostomum namrui Kuntz and Chandler, 1956

Morphology: Length 0.7-1.2 mm., width 0.25-0.45 mm. Body distinctly divided. Oral sucker and pharynx well developed. Acetabulum present. Anterior testis variously shaped with a single lateral lobe. Posterior testis much larger, both lobes symmetrical. Ovary round, overlapping anterior testis, in middle of body. Uterus broad and thin walled. Eggs large, oval, 100-110 by 60-67 μ.

Location and distribution: Small intestine. Egypt.

Life cycle: Indirect. Eggs hatch, miracidia penetrate snail. Cercaria escapes from snail, penetrates fish and encysts as metacercaria in muscles of fish. Cat infected by eating infected fish.

Family Echinostomatidae: Elongate, spinous distomes of variable size. Head crowns and head spines present. Testes slightly lobed and oval, ovary in front of testes. Vitellaria in posterior region. Parasitic in intestine and rarely in bile ducts of birds and mammals.

Euparyphium melis (Schrank, 1788) Dietz, 1909

Synonyms: Echinostoma mehlis Dietz, 1909; Fascida putorii Gmelin, 1790; Fasciola melis Schrank, 1788; Fasciola trigonocephala Rudolphi, 1802; Distoma trigonocephalum Rudolhi, 1809; Isthmiophora melis Luhe, 1909 and numerous others.

Morphology: Length 3.5-11.2 mm., width 1.3-1.6 mm. Body lancet shaped, fleshy, head collar with 27 collar spines. Cuticle spiny. Oral sucker much smaller than acetabulum. Cirrus spinous. Testes ovoid, entire or slightly lobed, tandem. Ovary globular, in front of testes. Uterus short containing very large eggs, 120-125 by 91-94 μ.

Location and distribution: Small intestine. Europe.

Life cycle: Indirect. Snail and tadpoles of frogs serve as first and second intermediate hosts respectively. Cat infected by ingestion of tadpoles or frogs infected with metacercariae.

Heterechinostomum magnovatum (Stunkard and Haviland, 1925) Gogate, 1932

Morphology: Length 1.34-1.44 mm., width 0.476 mm. Body elongated, broadest posteriorly. Head collar well developed with single dorsal row of 24 spines. Oral sucker terminal, pharynx globular, esophagus narrow and intestinal ceca traceable to level of acetabulum. Testes tandem, posterior one smaller than anterior. Ovary oval; uterus short, eggs large, 100-110 by 75-85 μ.

Location and distribution: Intestine. Malaya.

Life cycle: Not known.

Echinochasmus perfoliatus (Ratz, 1908) Dietz, 1909

Synonyms: Echinostoma perfoliatum Ratz, 1908; Echinostoma gregale Railliet and Henry, 1909.

Morphology: Length 2-4 mm., width 0.4-0.8 mm. Body elongate fleshy, head collar with 24 spines, 3 small ones on either side forming corner spines and remainder in a row. Acetabulum twice as large as oral sucker. Vitellaria distributed along the course of cecae, confluent behind testes. Ovary sub-median and pretesticular. Eggs variable in size, 92-135 by 57-94 μ.

Location and distribution: Intestine. Hungary and Roumania.

Life cycle: Indirect. Snail and fish act as first and second intermediate hosts respectively.

Stephanoprora denticulatoides Isaichikoff, 1925

Morphology: Length 3.3-4.2 mm., width 0.32-0.41 mm. Body much elongated, spined anteriorly. Head collar with 22 spines. Acetabulum in anterior third of body. Pharynx present. Testes tandem, slightly elongated. Ovary round, in front of anterior testis. Uterus undulant rather than indistinct. Eggs oval, operculate, 76 by 52 μ.

Location and distribution: Intestine. Egypt and Mediterranian Coast.

Life cycle: Not known.

Family Schistosomatidae: Rather elongate, unisexual flukes, female longer than male and carries male in gynaecophoric canal. Suckers poorly developed or absent. Male with

4	4 or more testes; female with a single compact ovary. Uterus with few eggs, thin shelled, non-operculate, occasionally with a terminal spine. Redial stage absent in the life cycle. Cercaria furcocercus type. Parasitic in blood vascular system of birds and mammals.

Schistosoma japonicum Katsurada, 1904

Morphology: Length, male 9.5-20 mm., width 0.55-0.967 mm; female 12-26 mm., width 0.3-0.5 mm. Body elongate, worm-like, unisexual, dimorphic flukes. Suckers close together. Cuticle spiny on suckers and gynaecophoric canal. Esophagus surrounded by glands, intestine bifurcates anterior to acetabulum and anastomoses at posterior end. Testes lobed, 6-8 in number. Ovary compact; uterus long, containing short oval eggs with lateral spines. Eggs 70-100 by 50-80 μ.

Location and distribution: Hepatic portal and mesenteric veins. Japan, Formosa and Philippines.

Life cycle: Females lay eggs in capillaries. They are carried by blood stream to liver and other organs and are normally passed into intestinal lumen by rupturing wall and eliminated in feces. Snails act as intermediate hosts. There are 2 generations of sporocysts, second forming furcocerus cercariae, which leave snail, swim, and penetrate skin of definitive host.

Ornithobilharzia turkestanicum (Skrjabin, 1913)

Synonym: Ornithobilharzia turkestanica Skrjabin, 1913.

Morphology: Male 4-8 mm., female 3.4-8 mm. Body long, worm-like similar to S. japonicum but intestinal limbs long with tendency to form anastomoses before finally continuing a short distance posterior to acetabulum. Testes numerous. In female, intestinal cecum 3 times longer and the ovary spirally coiled as compared with S. japonicum. Uterus short, contains one egg at a time. Egg with terminal spine has short appendage at end, 72-77 by 18-26 μ.

Location and distribution: Mesenteric veins. Turkey, Mongolia, Iraq and France.

Life cycle: Indirect. Similar to S. japonicum.

Family Troglotrematidae: Flattened fleshy spinous flukes of medium size. Suckers feebly developed. Acetabulum may be absent. Testes elongate and deeply lobed with ovary in front. Parasitic in intestinal and respiratory tracts of carnivorous birds and mammals.

Troglotrema salmincola (Chapin, 1926)

Synonyms: Nanophyes salmincola Chapin, 1926; Nonophyetus salmincola Chapin, 1926; Nanophyetus schikhobalowi Schrajabin, 1936.

Morphology: Length 0.5-1.1 mm., width 0.052-0.5 mm. Body minute, pyriform and cream colored, oral sucker and acetabulum same size. Testes oval and posterior to intestinal ceca. Ovary spherical, behind

acetabulum. Uterus with 2 coils. Eggs yellowish brown and with an indistinct operculum, 64-80 by 34-50 μ.

Location and distribution: Small intestine. United States.

Life cycle: Indirect. Snails and fish act as first and second intermediate hosts respectively. Eggs from feces hatch in 2-3 months. Miracidia penetrate snails. The cercariae encyst as metacercariae in the kidneys, muscles, and gills of salmon. Cat infected by eating infected salmon containing metacercariae.

Paragonimus westermanni (Kerbert, 1878)

Synonyms: Distoma westermanni Kerbert, 1878; Distoma ringeri Cobbold, 1880; Distoma pulmonum Baelz, 1880.

Morphology: Length 7.5-16.3mm., width 4-6 mm. Body plump, ovoid with spiny cuticle. Oral sucker and acetabulum subequal. Testes elongate and deeply lobate. Ovary large, lobate, between acetabulum and right testis. Uterus in form of tightly coiled rosette. Eggs yellowish brown, operculate, poles thickened, 80-118 by 48-60 μ.

Location and distribution: Lung. India, China, Japan, Africa and South America.

Life cycle: Indirect. Eggs with sputum swallowed and recovered in feces. They hatch in 2-7 weeks, miracidia escape and penetrate into snails. Cercaria escapes from snail, swims in water and penetrates second intermediate host, a crab or crayfish. Cercaria similar to that of P. kellicotti. Cat infected by eating infected crustacea or by drinking water in which metacercariae occur after they have escaped from the second intermediate host.

Paragonimus kellicotti Ward, 1908

Morphology: Length 4-16 mm., width 4-8 mm. Body oval, fleshy with chisel-shaped spines and serrated free edges. Testes irregularly lobed. Ovary lobed. Uterus forms a group of coils behind acetabulum. Eggs operculate, undeveloped, surrounded by a thickened collar and provided with a small nodule at one pole, 75-118 by 48-65 μ.

Location and distribution: Lung. United States.

Life cycle: Indirect. Eggs hatch in 2-3 weeks from feces. Pyriform miracidia penetrate snails and microcercous cercariae are produced within 2 months. They leave the snail penetrate the crayfish and encyst. Cat infected by ingestion of crayfish containing metacercariae.

Family Opisthorchiidae: Elongate, flattened, lanceolate flukes; suckers weakly developed and close together. Testes diagonal or tandem. Ovary pretesticular and rarely postesticular. Uterus with folds in front of ovary, containing numerous eggs. Parasitic in gall bladder, bile ducts of reptiles, birds and mammals.

Amphimerus pseudofelineus (Ward, 1901)

Synonyms: Distoma felineum Ward, 1895; Opisthorchis pseudofelineus Ward, 1901.

Morphology: Length 12-22 mm., width 1-2.5 mm. Body translucent. Testes lobed, tandem, placed near posterior end of body. Uterus with an ascending limb, filling area between ceca from ovary to region of

acetabulum. Vitelline glands lateral to ceca, interrupted at level of ovary on each side. Eggs oval, operculate, 25-35 by 12-15 μ.

Location and distribution: Bile duct. United States.

Life cycle: Not known.

Opisthorchis felineus (Rivolta, 1884)

Synonyms: Distoma conus Gurlt, 1831; Distoma lanceolatum felis cati Siebold, 1836; Distoma felineum Revolta, 1884; Distoma sibiricum Winogradoff, 1892; Dicrocoelium felineus Moniez, 1896; Distoma winogradoffi Jaksch, 1897; Opisthorchis tenuicollis felineus Erhardt, 1935; Opisthorchis wardi Wharton, 1921 and numerous others.

Morphology: Length 7-12 mm., width 1.5-2.5 mm. Body flattened and lanceolate, with pointed anterior and rounded posterior end. Anterior testis, with 4 lobes, posterior testis with 5 lobes, testes diagonally placed. Ovary oval, anterior to testes. Uterus with single ascending limb and numerous transverse folds. Eggs small, 28-30 by 11-15 μ.

Location and distribution: Bile and pancreatic ducts. Europe, Asia and Canada.

Life cycle: Indirect. Snail and fish serve as first and second intermediate hosts respectively. Snail infected by penetration of miracidium. Liberated cercariae develop into metacercariae in the muscles of fish. Cat infected by eating infected fish.

Opisthorchis tenuicollis (Rudolhi, 1819) Stiles and Hassall, 1896

Synonyms: Distoma tenuicollis Rudolphi, 1819; Distoma viverrini Poirier, 1886; Opisthorchis viverrini Stiles and Hassall, 1896; Opisthorchis tenuicollis-felineus Looss, 1899.

Morphology: Length 7-12 mm., width 1.5-2.5 mm. Body with narrow anterior and broad posterior end. Flukes reddish in color. Other particulars not available. Very similar to O. felineus in morphology. Eggs small, 26-30 by 11-15 μ.

Location and distribution: Bile duct. Europe and India.

Life cycle: Indirect. Similar to O. felineus.

Opisthorchis sinensis (Cobbold, 1878)

Synonym: Clonorchis sinensis.

Morphology: Length 20-25 mm., width 3-5 mm. Body pear shaped and translucent. Cuticle spiny in immature specimens and smooth in mature ones. Other particulars not available. Eggs, contain a miracidium when laid, 27-35 by 12-20 μ.

Location and distribution: Bile duct, pancreatic duct and duodenum. South Eastern part of Asia and Japan.

Life cycle: Indirect. Snail and fish act as first and second intermediate hosts respectively. Snail infected by ingestion of egg. Cercariae escape from snail and develop into metacercariae in muscles of fish. Metacercariae are liberated in the duodenum of cat when cat eats infected fish.

Metorchis conjunctus (Cobbold, 1860)

Synonyms: Distoma conjunctum Cobbold, 1880; Opisthorchis conjunctus Cobbold, 1860; Parametorchis conjunctus (Cobbold, 1860); Parametorchis canadensis Price, 1929 and Parametorchis manitobensis Allen and Wardle, 1934.

Morphology: Length 1.5-6.6 mm., width 0.35-2.6 mm. Body linguiform

in shape with spiny cuticle. Suckers are of same size. Posterior extremity rounded. Intestinal ceca reach level of posterior extremity. Testes spherical or slightly lobed, tandem. Cirrus absent. Ovary lobed, uterus large occupying space anterior to ovary. Eggs embryonated, operculate, 22-32 by 11-18 μ.

Location and distribution: Gall bladder and bile duct. Canada and the United States.

Life cycle: Indirect. Snail and fish serve as first and second intermediate hosts respectively. Snail infected by ingestion of the egg. Liberated cercariae develop into metacercariae in musculature of fish. Eggs found in feces of cat 2 months after infection.

Metorchis albidus (Brawn, 1893)

Synonyms: Distoma complexum Stiles and Hassal, 1894; Opisthorchis complexus (Stiles and Hassal, 1894); Metorchis complexus Stiles and Hassal, 1894; Parametorchis complexus Stiles and Hassal, 1894.

Morphology: Length 3-10 mm., width 1.5-2 mm. Body linguiform. Cuticle spiny. Suckers equal in size. Pharynx very small, esophagus very short and ceca long. Testes round, tandem. Uterus rosette shaped occupying anterior half of body. Eggs 24 by 12 μ.

Location and distribution: Bile duct, gall bladder. Alaska and Europe.

Life cycle: Not known.

Pseudamphistomum truncatum (Rudolphi, 1819) Luhe, 1909

Synonyms: Amphistomum truncatum Rudolphi, 1819; Distoma lanceolatum Mehlis, 1858; Distoma campanulatum Ercolani, 1875; Distoma truncatum Railliet, 1886; Opisthorchis truncatus Railliet, 1896; Metorchis

truncatus Looss, 1899; Pseudamphistomum danubiense Ciurea, 1913.

Morphology: Length 2-2.5 mm., and width 0.6-0.8 mm. Body conical with pointed anterior and truncated posterior region. Pharynx globular, esophagus short and ceca long. Testes spherical, horizontal and posterior. Ovary rounded, mid-way between testes and acetabulum. Uterus between testes and strongly convoluted. Eggs small, 29 by 11 μ.

Location and distribution: Bile duct. Germany, Italy, France, Holland, Russia, Roumania and India.

Life cycle: Indirect. Similar to O. sinensis.

Family Heterophyidae: Very small, ovoid, pyriform flukes with a scaly cuticle and weak suckers. Intestinal ceca not branched. Testes 1 or 2, in posterior region of body with ovary in front. Uterus with transverse folds which lie mostly between testes and genital pore. Parasitic in intestine of birds and mammals.

Heterophyes heterophyes (Siebold, 1852) Stiles and Hassall, 1900

Synonyms: Distoma heterophyes (Siebold, 1852); Dicrocoelium heterophyes Weinland, 1858; Fasciola heterophyes Moquin-Tandon, 1860; Heterophyes aegyptiae Cobbold, 1866; Cotylogonimus heterophyes Luhe, 1899; Heterophyes nocens Onjil and Nishio, 1915 and numerous others.

Morphology: Length 1-1.8 mm., width 0.3-0.7 mm. Body small, covered with rectangular scales, with a narrow anterior and broad posterior end. Oral sucker much smaller than acetabulum. Genital sucker surrounded by 70-80 radially arranged cuticular rodlets. Testes oval, side by side,

with ovary in front. Cirrus absent. Seminal vesicle between ovary and testes. Uterus with numerous folds occupying rest of space. Eggs light brown thin shelled, 26-30 by 15-17 μ.

Location and distribution: Small intestine and cecum. Egypt, Korea, China and Eastern Asia.

Life cycle: Indirect. Snail and fish serve as first and second intermediate hosts respectively. Metacercariae encyst in the muscles of fish. Cat infected by eating infected fish.

Haplorchis yokogawai (Katsuta, 1932) Chen, 1936

Synonym: Monorchotrema yokogawai Katsuta, 1932.

Morphology: Length 0.54-0.94 mm., width 0.26-0.38 mm. Body flattened dorsoventrally and rounded at both ends. Cuticle with posteriorly directed, scale-like spines. Oral sucker terminal. Acetabulum buried in parenchyma and associated with genital sucker to form ventro-genital sucker complex. Anterior border of acetabulum spiny. Pharynx present. Testis single with ovary in front. Uterus with numerous eggs. Eggs oval, often seen with a minute filament at posterior pole, 28-30 by 12-16 μ.

Location and distribution: Small intestine. Formosa, South China and Egypt.

Life cycle: Snail and fish serve as first and second intermediate hosts respectively. Cat infected by eating infected fish.

Haplorchis milvi (Gohar, 1934)

Morphology: Length 0.58-0.76 mm., width 0.27-0.42 mm. Body very small and oval. Acetabulum rudimentary. Genital orifice ornamented with 60-

70 spines arranged in a crown. Pharynx present. intestinal ceca short with bifurcation anterior to middle of body. Testis single and spherical with spherical ovary in front. Eggs medium, 27-31 by 16-18 μ.

Location and distribution: Small intestine. Far East, Formosa and China.

Life cycle: Indirect. Similar to H. yokogawai.

Haplorchis pumilio (Looss, 1896)

Synonym: Monorchotrema taihokui Faust and Nishigori, 1926

Morphology: Length 0.32-0.95 mm., width 0.16-0.36 mm. Body transparent with posteriorly directed spines. Genital sucker with 36-40 characteristic spines. Prepharynx and pharynx present. Testis single, large, smooth and spherical. Ovary spherical, in front of testis and to right side. Uterus with several loops. Vitellaria occupying region behind testis. Eggs characteristic, with a minute filament at posterior pole, 24-32 by 14-17 μ.

Location and distribution: Small intestine. Formosa and Far East.

Life cycle: Indirect. Similar to H. yokogawai.

Haplorchis calderoni (Africa and Garcia, 1935)

Morphology: Length 0.47-0.55 mm., width 0.25-0.26 mm. Body pear shaped, covered with spines in anterior region. Prepharynx short, pharynx ovoid, esophagus long and capillary; ceca extending to posterior region. Genital sac ring-like situated at intestinal bifurcation. Testis single, spherical and median. Ovary in front of testis on right side. Eggs 20-25 by 11-15 μ.

Location and distribution: Small intestine. Philippines.

Life cycle: Not known.

Haplorchis sisoni Africa, 1938

Morphology: Length 0.3-0.36 mm., width 0.22-0.31 mm. Body pyriform, covered with scale-like spines in anterior region. Prepharynx and pharynx present. Intestinal ceca short and bulky. Testis single, oval, median in posterior third. Ovary elongate, anterior to testis on right side. Eggs oval, 26 by 14 μ.

Location and distribution: Small intestine. Philippines.

Life cycle: Not known.

Apophallus venustus (Ransom, 1920)

Synonyms: Cotylophallus venustus Ransom, 1920; Cotylophallus similis Ransom, 1920; Rossicotrema donicum Skrjabin and Lindtrop, 1919; Apophallus donicus Skrjabin and Lindtrop, 1919.

Morphology: Length 1-1.8 mm., width 0.4-0.8 mm. Body oval to elongated with spines covering anterior half. Acetabulum enclosed in a non-muscular genital sinus. Testes spherical, tandem or oblique, in posterior third of body. Ovary anterior to testes. Vitellaria in lateral field of hind body. Uterus with many loops between testes and genital pore. Eggs 26-32 by 18-22 μ.

Location and distribution: Small intestine. United States, Canada and Europe.

Life cycle: Indirect. Eggs hatch in digestive tract of snail, after they are swallowed. Liberated cercariae from snail enter second intermediate host, a bullhead and encyst in muscles. Cat infected by eating uncooked, infected fish.

Cryptocotyle lingua (Creplin, 1825)

Synonyms: Apophallus imperator Lyster, 1940; Tocotrema lingua Looss, 1899; Dermocystis ctenolabri Stafford, 1905; Hallus caninum Wigdor, 1918.

Morphology: Length 0.5-2.0 mm., width 0.2-0.9 mm. Body small flat, spatulate. Oral sucker subterminal, acetabulum large, anterior to middle of body. Cuticle spiny in anterior region. Testes oblique in posterior exremity. Ovary on median line, anterior to posterior testis. Vitellaria in lateral fields. Uterus between ovary and acetabulum. Eggs oval, nonembryonated, 32-48 by 18-20 μ.

Location and distribution: Intestine. Quebec and Canada.

Life cycle: Indirect. Similar to A. venustus.

Phagicola longicollis Kuntz and Chandler, 1956

Morphology: Length 0.61-1.00 mm., width 0.12-0.27 mm. Body pyriform or like an elongated sac gradually decreasing in width towards anterior end. Oral sucker surrounded by single crown of 14-15 spines. Prepharynx and pharynx well developed. Ceca extend to ovary. Testes oval or rounded and symmetrical. Ovary smaller than testes, anterior to right testis. Vitellaria form 6-8 large lateral follicles around outer boundaries of testes. Uterus in 3 or 4 transverse loops. Eggs oval, operculate, 18-20 by 10 u.

Location and distribution: Intestine. Egypt.

Life cycle: Indirect Eggs hatch out, miracidia penetrate snail. Cercariae escape from snail, penetrate fish and encyst as metacercariae in the muscles. Cat infected by eating infected fish.

Phagicola longa (Ransom, 1920)

Synonyms: Ascocotyle longa Ransom, 1920; Parascocotyle longa Ransom, 1920.

Morphology: Length 0.5-1 mm., width 0.08-0.35 mm. Body pyriform. Oral suckers surrounded by double crown of 16 spines. Prepharynx short when compared to P. longicollis. Ceca very long. Testes small, oval, side by side in posterior part of body. Ovary oval, in front of right testes. Eggs 18 by 9 μ.

Location and distribution: Small intestine. United States and Palestine.

Life cycle: Indirect. Similar to P. longicollis.

Monorchotrema taichui (Nishigori, 1924)

Synonyms: Haplorchis taichui (Nishigori, 1924) Chen, 1936; Monorchotrema microrchia Katsuta, 1932.

Morphology: Length 0.58-0.76 mm., width 0.27-0.42 mm. Body minute, flattened with narrow anterior and cylindrical posterior region. Cuticle covered with scales. Acetabulum buried in parenchyma and associated with genital sucker. Anterior region of acetabulum armed with 14-20; usually 15 spines. Testis, single large with ovary in front. Prostate duct large and on right side. Uterus coiled, containing numerous eggs. Vitellaria with numerous small follicles on lateral sides. Eggs 29 by 14-17 μ.

Location and distribution: Small intestine. Egypt, Palestine, Formosa and China.

Life cycle: Indirect. Similar to P. longicollis.

Metagonimus yokogawai (Katsurada, 1912)

Synonyms: Heterophyes yokogawai Katsurada, 1912; Matagonimus ovatus Yokogawa, 1913; Yokogawa yokogawai Leiper, 1913; Loossia romanica Ciurea, 1915 and numerous others.

Morphology: Length 1-2.5 mm., width 0.4-0.7 mm. Body pyriform, cuticle spiny. Acetabulum right of median line. Genital pore opens into a sinus, surrounded by a muscular ring. Prepharynx and pharynx present. Testes diagonal, posterior end of body with ovary in middle, anterior to testes. Eggs measure 27-38 by 15-17 μ.

Location and distribution: Small intestine. Eastern Asia, Balkans, Japan, Korea, Formosa and Roumania.

Life cycle: Indirect. Similar to M. taichui.

Strictodora caballeroi Martin, 1955

Synonym: Pelecanus conspicillatus

Morphology: Measurements not available. Body pyriform, cuticle with scale-like spines. Pharynx present, globular in shape. Intestinal ceca extending to mid-testicular level. Testis single, oval, posterior to midbody, seminal vesicle with 2 large and one small chamber. Ovary anterior to testis, vitelline glands post-testicular. Eggs yellow, oval, operculate, 22-25 by 13-16 μ.

Location and distribution: Small intestine. Egypt and Australia.

Life cycle: Not known.

Adleria minutissima (Wittenberg, 1929)

Synonym: Adleriella minutissima Wittenberg, 1929.

Morphology: Length 0.27-0.47 mm., width 0.09-0.15. Body pyriform with

spiny cuticle. Acetabulum absent. Pharynx large with a short esophagus. Testis single, oval. Ovary median, posterior to testis. Vitellaria posterior to testis. Uterus folded with ascending and descending limbs. Eggs 24 by 12-14 μ.

Location and distribution: Duodenum. Palestine.

Life cycle: Not known.

Stellantchasmus amplicaecalis Katsuta, 1932

Morphology: Measurements not available. Body small and oval, covered with scale-like spines. Acetabulum small and enclosed in a small genital sinus. Esophagus large. Testes symmetrical, near posterior extremity. Ovary median to sub-meidan, anterior to testes. Eggs small, measurements not available.

Location and distribution: Small intestine. Formosa.

Life cycle: Not known.

Pygidiopsis genata Looss, 1907

Synonym: Ascocotyle plana Linton, 1928.

Morphology: Length 0.4-0.7 mm., width 0.2-0.4 mm. Body small, pyriform, with a ventral concavity at anterior end. Cuticle spiny. Acetabulum small, in mid-body region. Prepharynx long, pharynx present, esophagus short and ceca long. Testes side by side near posterior region. Receptaculum seminis large and median. Ovary sub-median and anterior to testes. Vitellaria lateral to testes. Uterus with wide fold between ovary and testes. Eggs 18-22 by 9-12 μ.

Location and distribution: Intestine. Europe, Asia, Africa and United States.

Life cycle: Not known.

ACANTHOCEPHALIDS OF DOMESTIC CAT, FELIS DOMESTICUS LINN.

Family Echinorhynchidae:

1. Corynosoma strumosum
2. Centrorhynchus erraticus
3. C. aluconis

Family Gigantorhynchidae:

4. Echinopardalis pardalis

Family Oligacanthorhynchidae:

5. Oncicola canis

Family (not specified)

6. Pseudopororchis hydromuris

Phylum Acanthocephala: Worms resembling nematodes and cestodes. Thorny headed worms, characterized by absence of mouth and alimentary tract. Sexes separate. Life cycle indirect.

Family Echinorhynchidae: Large cylindrical worms with cephalic end containing a spined proboscis. Hooks of proboscis have a single (posterior) root. Males with 6 cement glands and 2 testes. Females with single ovary and without oviduct or uterus. Eggs pass into body cavity and escape through genital opening. Parasites in alimentary tract of fishes, birds and mammals.

Corynosoma strumosum (Rudolphi, 1802)

Synonyms: Echinorhynchus strumosus Rudolphi, 1802; Echinorhynchus hystrix Bremser, 1824; Echinorhynchus striatus Villot, 1876; Corynosoma osmeri Fujita 1921 and numerous others.

Morphology: Length 5-9 mm. Worms broad anteriorly and narrow posteriorly. Cuticle spiny in anterior part. Proboscis cylindrical, armed with 18 longitudinal rows of 10 to 11 hooks each. In both sexes, genital opening surrounded by spines.

Location and distribution: Intestine. United States.

Life cycle: Seals are definitive hosts and larvae occur in fishes. The cat apparently is an incidental host.

Centrorhynchus erraticus Chandler, 1925

Morphology: Length 7.5-8.5 mm. Worms with thick anterior and thin posterior ends. Cuticle spiny. Proboscis oval in shape, armed with 45 transverse rows of hooks.

Location and distribution: Small intestine. India.

Life cycle: Birds are definitive hosts and larvae occur in snakes. The cat apparently is an incidental host.

Centrorhynchus aluconis Muller, 1925

Morphology: Measurements and description not available.

Location and distribution: Small intestine. Europe.

Life cycle: Birds, like owls and hawks, are definitive hosts with larval forms occuring in amphibians and reptiles. The cat apparently is an incidental host.

Family Gigantorhynchidae: Cylindrical worms with oval proboscis. The hooks of proboscis have a double (posterior) root. Males with 8 cement glands. Females with single ovary and without oviduct or uterus. Eggs pass into body cavity. Parasitic in alimentary tract of mammals.

Echinopardalis pardalis (Westrumbe, 1821)

Synonyms: Echinopardalis campanulatus Diesing, 1851; Echinopardalis ovatus Leidy, 1851.

Morphology: Length 30-40 mm. Worms with short body, moderately heavy

and tapering posteriorly. Proboscis globular, armed with 5 to 6 transverse rows of hooks.

Location and distribution: Small intestine. South and North America and Egypt.

Life cycle: Not known. But definitive hosts are dogs, cats and lynx.

Family Oligacanthorhynchidae: Worms fairly thick with short body. Proboscis short and globular. Males with 8 cement glands, which are ovoidal to elongated. Parasitic in alimentary tract of mammals.

Oncicola canis (Kaupp, 1909)

Synonyms: Echinorhynchus canis Kaupp, 1909; Gigantorhynchus canis (Kaupp, 1909) Hall and Wigdor, 1918.

Morphology: Length 8-14 mm. Elongated worms with tapering posterior ends. Dark gray in color. Proboscis short, globular, armed with 6 rows of hooks, with those at apex larger than those towards base. Eggs containing larvae with hooks at one end, 59-71 by 40-50 u.

Location and distribution: Small intestine. United States.

Life cycle: Dogs, coyotes and cats rarely are definitive hosts. Larval forms occur in armadillo, poultry and insects.

Family (not specified)

Pseudopororchis hydromuris (Edmonds, 1957) Bearup, 1960

Morphology: Measurements and description not available.

Location and distribution: Small intestine. Australia.

Life cycle: Australian water rat is the definitive host and larvae occur in crustacea. The cat apparently is an incidental host.

SUMMARY

Forty-three nematodes, 40 trematodes, 24 cestodes and 6 acanthocephalids are recorded in this report.

The most widely distributed parasites of domestic cats are those that have a direct life cycle. The hookworms, ancylostomids; the large intestinal round worms, ascarids; and the whipworms, trichurids, are the most common in tropical countries. Parasites requiring intermediate hosts for their perpetuation, such as the eyeworm, Thelazia californiensis; esophageal worm, Spirocerca lupi; salmon poisoning fluke, Troglotrema salmincola; and the double-pored tapeworm, Dipylidium caninum, are more restricted in their distribution in cats.

The cat is not a definitive host for many of the acanthocephalids, and most acanthocephalid infections in the cat are only accidental. It appears that few authors have been interested in working out the life cycle of parasites in cats and very few cycles are known in any detail.

The cestode species in the genus Dipylidium, Diplopylidium and Joyeuxia are not common in domestic cats, even though species belonging in these genera are recorded in North America, South Africa, Egypt, Spain, Turkey, India and the Philippines. The domestic cat is a host for a number of additional species of tapeworms in other genera and Diphyllobothrium, Taenia, and Echinococcus are involved. In general, the life cycle of most of the tapeworms in cats have been described.

Since cats are very fond of fish, the life cycle work which has been done shows that they are involved as several intermediate hosts in

quite a number of species of trematodes particularly in countries like Egypt, India, Ceylon, Malaya, Philippines, Formosa, Japan and China, where cats have easy access to the open fish markets.

The lungworm in the Order Strongyloidea, Class Nematoda have been re-classified and re-erected under the Family Filaroididae by Schulz, 1951 and separated from the Family Metastrongylidae. Of the 6 lungworms recorded in the cat, no life cycles for species in the new genera Vogeloides and Gurltia have been determined.

Species of stomach worms in the Family Physalopteridae are quite pathogenic and sometimes cause death. Five species are recorded but to date only one life cycle has been partially determined by using an experimental intermediate host.

Hookworms are common in cats throughout the world and 5 species have been recorded in the family Ancylostomidae. The life cycle has been determined for all except Ancylostoma longispiculatum.

It is unusual that Dracunculus medinensis has been recorded on one occasion in Georgian S. S. R. Whether this is a usual or unusual occurrence in that country among cats is not known. The report of the occurrence of Dioctophyma renale in the thoracic cavity of a cat in Poland is relatively unusual as far as the location is concerned.

Authors from many parts of the world including Britain, Australia, America, India, Ceylon, Japan and China have contributed in the study of the parasites of this small pet animal. There is much to be desired concerning the life cycle of many species and many contributions could be made which would be of scientific importance, essential in the control of these parasites and permit decisions concerning their public health importance.

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