

PARASITIC NEMATODES FROM CHINA

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The following report is based largely on a collection of parasitic nematodes submitted for identification to the Zoological Division of the Bureau of Animal Industry by Dr. E. C. Faust of the Peking Union Medical College, Peking, China. In addition to the records based on the specimens submitted by Doctor Faust, many of which are new to China, two records based on China material in the Helminthological Collections of the U. S. National Museum as well as a number of records published by other investigators are included in this paper.

Heretofore our knowledge concerning parasitic nematodes from China has been largely limited to forms occurring in man, the parasitic nematode fauna of wild and domesticated animals having been practically unknown. The list of species given in the following pages contain not only many new records, but also represents an attempt to systematize our knowledge of these parasites from China.

Superfamily ASCAROIDEA Railliet and Henry, 1915

Family ASCARIDAE Cobbold, 1864

Genus ASCARIS Linnaeus, 1758

ASCARIS LUMBRICOIDES Linnaeus, 1758

Several immature specimens from the intestine of swine, collected in Peking in 1920 (No. 26403 U.S.N.M.). This species has been reported from man and from swine in various parts of China. Maxwell (1921) lists *Ascaris suilla* (= *Ascaris lumbricoides*) from *Canis familiaris* in China, this being the second report of the occurrence of this species in dogs, the first report being that of Leiper (1913) and the most recent record that has come to light being that of Ando and Asai, published in 1924 and reviewed recently (1925) in the Japan Medical World. These writers say that three dogs out of one hundred that were examined showed human *Ascaris* eggs in the feces.

ASCARIS VITULORUM Goeze, 1782

Several immature specimens from the intestine of a cow (*Bos*, species) collected in Yang Chun in 1920 (No. 26461, U. S. N. M.). This species has heretofore been reported from several localities in Asia, from Europe and from Africa. It is also known from the United States and from Cuba.

ASCARIS EQUORUM Goeze, 1782

Several immature specimens from the small intestine of a mule (*Equus mulus*) collected in Peking, in 1920 (No. 26426, U.S.N.M.).

Genus TOXOCARA Stiles, 1905

Synonym.—*Belascaris* Leiper, 1907.

TOXOCARA CANIS (Werner, 1782)

Synonym.—*Belascaris marginata* (Rudolphi, 1802).

A large number of specimens of this species were collected from the small intestine of foxes (*Canis vulpes*) in Mongolia in 1921 (No. 26408, U.S.N.M.). Maxwell (1921) reports *Ascaris canis* (probably *Toxocara canis*) from dogs in south Fukien. Faust (1921) reports this parasite from dogs in north China.

Family HETERAKIDAE Railliet and Henry, 1914**Genus SUBULURA** Molin, 1860

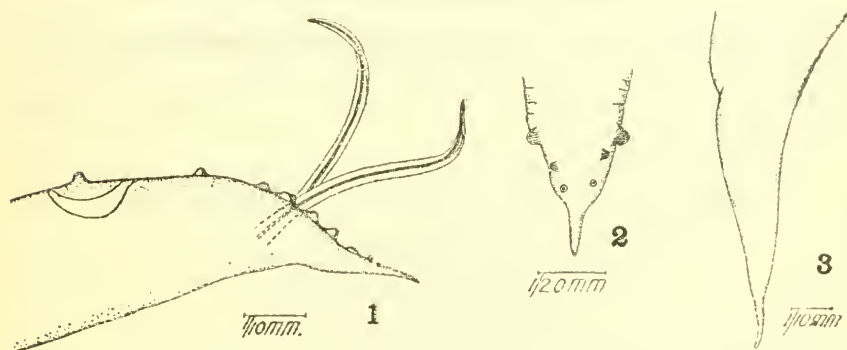
Railliet and Henry (1914) characterize this genus as follows:

Mouth, rarely with three lips, sometimes round, more often oval or hexagonal, the long axis being dorso-ventral. Buccal capsule with three teeth. Esophagus contains a distinct bulb. There are six cephalic papillae and often two lateral alae. Males may be provided with feebly developed caudal wings. Spicules equal; accessory piece present. Preanal sucker fusiform, without a chitinous ring. Vulva located in the region of the middle of the body. Eggs, subglobular, nearly always segmented when discharged.

SUBULURA CHINENSIS, new species

Cuticle transversely striated. Mouth apparently with three lips; buccal capsule about 63μ deep containing three small teeth at the base. The width of the anterior end of the buccal capsule is about 27μ and its maximum diameter is about 45μ . Lateral alae originate in the region of the lips and extend to a distance of from about 665 to 720μ from the cephalic extremity. The esophagus is from 1.3 to 1.4 mm. long and terminates in a slight prebulbous enlargement followed by a bulbous swelling about 225μ long by 180 to 225μ in diameter. The nerve ring is from 225 to 250μ , and the excretory pore about 430μ from the cephalic extremity.

Male.—The male is slightly over 10 mm long by about 360μ in maximum width. The spicules are filiform, equal, from 1.17 to 1.2 mm. long, and terminate in more or less sharp points (fig. 1). The gubernaculum is approximately 150μ long. There are 10 pairs of caudal papillae (fig. 1) of which five are pre and five post-anal. Of the former, the third is ventral in position, the remaining papillae having a lateral direction. The first and second papillae are isolated, the former being in the region of the sucker and the latter some distance from it. The three remaining preanal papillae are fairly close together. Of the postanal papillae, the last appears to have a ventral direction (fig. 2) whereas the first four are lateral. The first papilla in this group is very close to the anus. The longitudinal diameter of the sucker varies from 145 to 180μ . The tail ends in a slender tip.



FIGS. 1-3.—*SUBULURA CHINENSIS*. 1, POSTERIOR END OF MALE (LATERAL VIEW); 2, VENTRAL VIEW OF POSTERIOR END OF MALE; 3, POSTERIOR END OF FEMALE (LATERAL VIEW).

Female.—The females are from 12 to 14.7 mm. long by 450μ in maximum width. The vulva is located in the second third of the body dividing the latter into two parts whose proportions in two specimens are approximately as 7 is to 8, and as 10 is to 13, respectively. The vagina runs cephalad for a distance of 1.5 mm. and then turns dorsad where it joins the uterus. The tail is from 630 to 700μ long and tapers gradually (fig. 3). The eggs are from 72 to 81μ long by 45 to 51μ wide.

Host.—*Scops stictonotus*.

Location.—Intestine.

Locality.—Peking, China.

Type specimen.—U. S. National Museum Helminthological Collections, Cat. No. 26446.

Two species of *Subulura* heretofore described are known to occur in the genus *Scops*, one species (*Subulura acutissima* Molin) being from *Scops brasiliensis* from Brazil, and the other species (*Subulura similis* Gendré) being from *Scops leucotis* from Africa. These two species are incompletely described, and so far as can be judged from

available figures they are different from the form described in this paper as shown by the position and arrangement of the papillae on the tail of male, although the number of papillae in these two species correspond to those in *S. chinensis*. The terminal portion of the male tail in *S. acutissima* is quite different from that of *S. chinensis* although the number of pre and postanal papillae are identical. While the terminal portion of the tail in *S. similis* resembles that of *S. chinensis* the arrangement and position of the papillae in the two species are different.

Family OXYURIDAE Cobbold, 1864

Genus ENTEROBIUS Leach in Baird, 1853

ENTEROBIUS VERMICULARIS (Linnaeus, 1758)

This parasite has been reported from man by various workers in China.

According to Faust (1922) oxyurids occur in practically all groups of vertebrates in China.

Superfamily FILARIOIDEA Weinland, 1858

Family FILARIIDAE Claus, 1885

Genus THELAZIA Bosc, 1819

THELAZIA CALLIPAEDA Railliet and Henry, 1910

Synonym.—*Filaria circumocularis* Ward, 1918.

According to Faust (1921) this worm has been reported from the eye of man and the dog from Chihli, north China, and from Fukien. Faust adds a third record from the dog in Anking, Anhwei, the parasite having been removed from the conjunctival sac of a dog. Barlow (1921) reports that he collected a live female specimen of *Thelazia callipaeda* from the feces of a Chinaman after the administration of an anthelmintic.

FILARIA BANCROFTI Cobbold, 1877

This species has been reported from man in China by various workers.

Genus DIROFILARIA Railliet and Henry, 1911

DIROFILARIA IMMITIS (Leidy 1856)

A single female from the heart of a fox (*Canis vulpes*) collected in Peking in 1922 (Cat. No. 26425, U.S.N.M.). According to Faust (1921) this species is of common occurrence in dogs in north China, 50 per cent of the animals being infected. Faust (1921) also reports this parasite from dogs in central Yangtze Valley.

Genus SETARIA Viborg, 1795**SETARIA EQUINA (Abildgaard, 1789)**

Specimens from the small intestine of a mule (*Equus mulus*) collected in Peking in 1922 (Cat. No. 26428, U.S.N.M.). This parasite normally occurs in the peritoneal cavity, but has also been reported from other parts of the body including the intestine. The occurrence of this parasite in the intestine should, however, be viewed with suspicion owing to the possibility of accidental transfer in the course of necropsy.

SETARIA LABIATO-PAPILLOSA (Alessandrini, 1838 or Perroncito, 1882)

A single female from the "honeycomb" (reticulum) of *Bos taurus*, collected in Peking in 1921 (Cat. No. 26414, U.S.N.M.). So far as the writer is aware this is the first record of the occurrence of this parasite in the digestive tract. In view of the possibility of accidental transfer at necropsy this unusual location of the parasite is open to suspicion.

Superfamily SPIRUROIDEA Railliet and Henry, 1915**Family PHYSALOPTERIDAE Leiper, 1908****Genus PHYSALOPTERA Rudolphi, 1819****PHYSALOPTERA, species (larvae)**

In addition to two presumably undescribed species of *Physaloptera* which are being studied by Dr. A. E. Chapin of this bureau, several larval *Physaloptera* from the liver of a badger, *Meles leptorhynchus*, collected in Peking in 1921, were examined by the present writer (Cat. No. 26413, U.S.N.M.). These larvae are about 8 mm. long by 414μ wide. The esophagus is 2 mm. long by 162μ in maximum width. The distance from the anterior extremity to the cervical papillae is 540μ , the nerve ring being half way between these points. The excretory pore is posterior to the cervical papillae. The tail is 270μ long.

Family SPIRURIDAE Oerley, 1885**Genus SPIROCERCA Railliet and Henry, 1911****SPIROCERCA SANGUINOLENTA (Rudolphi, 1819)**

Adults specimens of this species were collected in 1921 from a "boil of the stomach" of a fox (*Canis vulpes*) in Mongolia (Cat. No. 26409, U.S.N.M.). Larval forms of this species from the mesentery of *Erinaceus dealbatus* were collected in Peking in 1922 (Cat. Nos. 26437, 26438, and 26441, U.S.N.M.). These larvae agree in all respects with Seurat's description of the larvae of *S. sanguinolenta*.

Seurat (1916) reports encysted larvae of *Spirocerca sanguinolenta* from a large variety of hosts in Algeria including *Erinaceus algirus*.

Genus ARDUENNA Railliet and Henry, 1911

ARDUENNA STRONGYLINA (Rudolphi, 1819)

One male specimen of this species, collected from *Sus scrofa domestica* in Kalgan in 1922 (Cat. No. 26433, U.S.N.M.). Location given in the original bottle is mesentery. Normally this parasite occurs in the stomach of swine, and its occurrence in the mesentery is probably due to an accidental transfer during necropsy.

ARDUENNA DENTATA (Linstow 1904)

Specimens were collected from the intestine of swine in Kuling in 1921 (Cat. No. 26452, U.S.N.M.). This species was described by von Linstow (1904) as *Spiroptera dentata* from *Sus cristatus*. Railliet and Henry (1911) transferred it to the genus *Arduenna* referring to its specimens collected from domestic swine in Annam, Indo-China.

Genus GONGYLONEMA Molin, 1857

GONGYLONEMA SCUTATUM (Leuckart, 1873)

These specimens were collected from the esophagus of *Ovis aries* in Peking in 1921 (Cat. No. 26421, U.S.N.M.).

Family GNATHOSTOMIDAE R. Blanchard, 1895'

Genus GNATHOSTOMA Owen, 1836

GNATHOSTOMA SPINIGERUM Owen, 1836

These specimens were collected from *Felis domestica* in Peking in 1922 (Cat. No. 26431, U.S.N.M.). The location of these specimens as given on the label is "kidney wall."

Faust (1921) reports 4 specimens of this species from a gastric tumor in a cat in Wuchang. Faust (1921) also states that a related species was taken from a dog in the same locality. Inasmuch as *Gnathostoma spinigerum* also occurs in dogs, it is probable that the form from the dog in Wuchang belongs to the same species. Recently Morishita and Faust (1925) report two cases of human gnathostomiasis from China, one case being associated with "creeping disease." The parasites in question are probably *G. spinigerum*. Morishita and Faust (1925) also refer to three cases of *Gnathostoma spinigerum* in cats and to one case in a dog from central and north China.

GNATHOSTOMA HISPIDUM Fedtschenko, 1872

Maxwell (1921) reports this species from the stomach of the pig in south Fukien.

Superfamily STRONGYLOIDEA Weinland, 1858

Family STRONGYLIDAE Baird, 1853

Genus MONODONTUS Molin, 1861

MONODONTUS TRIGONOCEPHALUS (Rudolphi, 1805)

Numerous specimens of this species (8 lots) from the intestine of *Ovis aries*, the material having been collected in Peking in 1920 and 1921, in Wuchang in 1924 (Cat. Nos. 26401, 25416, 25417, 26422, 26424, 26455, 26458, and 26460, U.S.N.M.).

Genus AGRIOSTOMUM Railliet, 1902

AGRIOSTOMUM VRYBURGI Railliet, 1902

Several specimens from the intestine of a cow were collected in Yang Chun in 1920 (Cat. No. 26450, U.S.N.M.). This species is only known to occur in the Orient.

Genus ANCYLOSTOMA (Dubini, 1843)

ANCYLOSTOMA DUODENALE (Dubini, 1843)

This species has been reported from man by various workers in China.

ANCYLOSTOMA CANINUM (Ercolani, 1859)

Numerous specimens from the small intestine of domestic cat (*Felis domestica*) collected in Peking in 1920 and in 1922 (Cat. Nos. 26406, 26407, 26427, 26429, U.S.N.M.) and in Yu Tao Ho in 1920, also several specimens from the intestine of a wild cat (*Felis*, species) collected in Peking in 1921 (Cat. No. 26423, U.S.N.M.). Specimens from a dog (*Canis familiaris*) from China are present in the helminthological collections of the United States National Museum (Cat. 18681), this material having been collected by Doctor Shields. Maxwell reports this species from dogs in south Fukien. Faust (1921) reports this species from dogs in China.

Genus NECATOR Stiles, 1903

NECATOR AMERICANUS (Stiles, 1902)

This species has been reported from man in various parts of China.

Genus STRONGYLUS Goeze, 1782

STRONGYLUS EDENTATUS (Looss, 1900)

Specimens of this species were collected from the intestine of a donkey (*Equus asinus*) in Peking in 1922 (Cat. No. 26434, U.S.N.M.).

STRONGYLUS VULGARIS (Looss, 1900)

A number of specimens from the intestine of a horse (*Equus caballus*) were collected in Peking in 1922 (Cat. No. 26432, U.S.N.M.).

Genus OESOPHAGOSTOMUM Molin, 1861**OESOPHAGOSTOMUM APIOSTOMUM (Willach, 1891)**

Several specimens from the intestine of a monkey (*Macacus tcheliensis*) collected in Peking in 1922 (Cat. No. 26448, U.S.N.M.).

OESOPHAGOSTOMUM DENTATUM (Rudolphi, 1803)

Specimens of this species from the large intestine and rectum of swine were collected in Changsha in 1921 in Wuchang in 1921, and in Peking in 1920 (Cat. Nos. 26404, 26451, and 26454, U.S.N.M.). Maxwell (1921) reports this parasite from the duodenum of swine in south Fukien. Faust (1921) reports this parasite from pigs in north China.

OESOPHAGOSTOMUM LONGICAUDUM Goodey, 1925

This species was described by Goodey from domestic swine in New Guinea. It is present in the China specimens of *Oesophagostomum* from swine forwarded by Doctor Faust. *O. dentatum* and *O. longicaudum* are present in the same bottles and presumably the two species occur in the same host animal. Specimens of *Oesophagostomum longicaudum* were also found by the present writer in material collected in Tonkin, Indo-China, in the Philippine Islands, in the Fiji Islands, and in the United States. *O. longicaudum* is probably of world-wide distribution.

OESOPHAGOSTOMUM COLUMBIANUM Curtice, 1893

This species is reported from the ileum of the goat in south Fukien by Maxwell (1921).

OESOPHAGOSTOMUM VENULOSUM (Rudolphi, 1809)

This species is reported from the jejunum, ileum, and large intestine of the goat in south Fukien by Maxwell (1921).

Family TRICHOSTRONGYLIDAE Leiper, 1912**Genus TRICHOSTRONGYLUS Looss, 1905****TRICHOSTRONGYLUS PROBOLURUS (Railliet, 1896)**

Numerous specimens were collected from the small intestine of sheep (*Ovis*, species) in Peking in 1920 (Cat. Nos. 26418, 26419, and 26420, U.S.N.M.).

Genus HAEMONCHUS Cobb, 1898**HAEMONCHUS CONTORTUS (Rudolphi, 1803)**

Specimens of this species from sheep collected by Doctor Shields in China are in the helminthological collections of the United States National Museum (Cat. No. 18682). Maxwell (1921) reports this species from the intestine of goats and from the stomach of a calf (*Bos*, species) in south Fukien.

Genus **NEMATODIRUS** Ransom, 1907**NEMATODIRUS FILICOLLIS** (Radolphi, 1802)

Specimens of this species were collected from the small intestine of sheep (*Ovis*, species) in Wuchang in 1920 and in Peking in 1921 (Cat. No. 26459, U.S.N.M.).

Family **METASTRONGYLIDAE** Leiper, 1908Genus **METASTRONGYLUS** Molin, 1861**METASTRONGYLUS ELONGATUS** (Dujardin, 1845)

This species was collected from the lungs of swine in Peking in 1920 and in Wuchang in 1921 (Cat. Nos. 26405, 26453, U.S.N.M.).

Genus **CRENOSOMA** Molin, 1861**CRENOSOMA VULPIS** (Dujardin, 1845)

Specimens were collected from the lungs of a fox (*Canis vulpes*) in Mongolia 1921 (Cat. No. 26410, U.S.N.M.).

Superfamily **TRICHUROIDEA** Railliet, 1916Family **TRICHINELLIDAE** Stiles and Crane, 1910Genus **TRICHINELLA** Railliet, 1895**TRICHINELLA SPIRALIS** (Owen, 1835)

Faust (1921) reports *Trichinella spiralis* from man in Peking and states that this parasite has not been found in hogs in Korea.

Family **TRICHURIDAE** Railliet, 1916Genus **TRICHURIS** Roederer, 1761**TRICHURIS TRICHIURA** (Linnaeus, 1771)

This species has been reported from man by various workers in China.

TRICHURIS OVIS (Abildgaard, 1795)

This species is reported from the caecum and large intestine of the goat by Maxwell (1921).

According to Faust (1922) trichurids occur in dogs, monkeys, hogs and hares in north China. The occurrence of *Hepaticola hepatica* (Bancroft, 1893) in rats in north China may be inferred from Faust's statements that "the liver of rats is sometimes packed with sandy patches of sediment, which on examination are found to be immense quantities of whipworm eggs."

Family **ANGIOSTOMIDAE** Braun, 1895Genus **STRONGYLOIDES** Grassi, 1879**STRONGYLOIDES STERCORALIS** (Bavay, 1876)

This species has been reported from man by various workers in China.

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¹This paper was not consulted.