Some Digenetic Trematodes of Mammals from Taiwan¹

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ABSTRACT: Twenty-three digenetic trematodes of mammals are reported from Taiwan. Five new species are described: Notocotylidae, Ogmocotyle ratti; Lecithodendriidae, Eingenotrema ratti; Dicrocoeliidae, Brachylecum taiwancense, Lypersosomum taiwancense; Troglo trematidae, Stephanolecithus taiwancensis. Previously known species reported are: Paramphistomidae, Homalogaster paloniae; Gastrothylacidae, Fischoederius elongatus; Notocotylidae, Ogmocotyle ailuri, O. capricorni; Plagiorchiidae, Plagiorchis muris; Mesocoeliidae, Mesocoelium brevicaecum; Lecithodendriidae, Prosthodendrum cordiforme, P. glandulosum; Echinostomatidae, Echinostoma aegyptiacum, E. cinetorchis, E. maci'orchis, E. revolutum; Dicrocoeliidae, Enrytrema coelomaticum, E. pancreaticum, Platynosomidites muris; Ophisthorchiidae, Clonorchis sinensis; Heterophyidae, Haplorchis pumillo; Diplostomatidae, Pharyngostomum cordatum.

The trematodes of this paper are part of a collection made by the junior author while a member of the United States Naval Medical Research Unit No. 2, Taipei, Taiwan, Republic of China. Parasites were washed in saline, killed in hot water, and transferred immediately to FAA fixative; after 4–8 hr they were stored in 70% alcohol plus 2% glycerin; staining was with carmine or hematoxylin. Host names recorded herein are those listed by Kuntz and Dien (1970). Host names preceded by an asterisk (*) represent new host records. Specimens of each trematode species have been deposited in the United States National Museum Helminthological Collection as noted. All measurements are in microns.

Ogmocotyle ratti sp. n. (Fig. 1)

HOST: Rattus culturatus Thomas, Formosan white-bellied rat (Rodentia: Muridae).

HABITAT: Small intestine.

LOCALITY: Ali-shan, Chia-I Prefecture.

DATE: 14 February 1962.

SPECIMENS DEPOSITED: No. 73705 (holotype); No. 73706 (paratypes).

Description

Notocotylidae. Body elongate, oval to pyriform, with lateral margins turned over ventrally and frequently overlapping, appearing canoe-like, ventral groove extending to ovarian level, part of body bearing cirrus sac and uterus bulging dorsally, extremities rounded, 525–750 long by 320–370 wide. Oral sucker ventral, usually wider than long, 70–87 by 74–93, lying 5–10 from anterior extremity. Esophagus emerging from oral sucker dorsum, 70–102 long; cecal bifurcation lying 70–116 anterior to cirrus sac; ceca narrow, terminating median to testes.

Testes two, symmetrical, lateral near posterior extremity, deeply lobed, 121–172 by 85–97. Cirrus sac entirely transversely oriented (without any part of it extending posteriorly), preuterine, large, 210–250 by 83–97; bipartite, proximal part bulbous and containing...
seminal and prostatic vesicles and part of muscular ejaculatory duct, distal part narrower, directed ventrally, containing remainder of ejaculatory duct and cirrus. Seminal vesicle round to elongate oval, 30–69 by 25–53. Prostatic vesicle elongate, 87–116 by 35–53. Prostate cells surrounding anterior part of seminal vesicle, prostatic vesicle, and posterior part of ejaculatory duct. Cirrus muscular, thick, bearing papillae but number of rows not discernible as cirrus not everted. Genital pore sinistral, opening within ventral body groove. Ovary 5–8-lobed, median, at posterior end of body, 60–90 by 138–170. Vitellaria U-shaped; follicles large, arms lateral, commencing short distance pretesticular, passing dorsal to testes, uniting medianly anterior to ovary. Uterus coiling from one side of body to other between ovary and cirrus sac. Metraterm thick-walled, lying posterolateral to distal part of cirrus sac. Eggs numerous, operculate, 20 measuring 19–22 (20.9) by 10–12 (11), with single filament at each end, anopercular filament thicker than opercular one, length and thickness increasing as eggs pass through uterus.

Discussion

Our collection contains 103 adult worms from one rat; eight were measured. Our new species differs from all others in the genus in being considerably smaller, and in the cirrus sac being entirely transversely oriented. While in O. ailuri (Price, 1954) Price, 1960, much of the cirrus sac is transversely oriented, the proximal part containing the seminal vesicle is posteriorly or postmedianly directed. Additionally, O. ailuri differs in having a proportionately much larger cirrus sac and seminal and prostatic vesicles.

Odeningotrema ratti sp. n.
(Fig. 2)

Host: Rattus rattus (L.), house rat (Rodentia: Muridae).
Habitat: Small intestine.
Locality: Hung T‘ou Ts‘un, Lan Yii or Orchid Island.
Date: 11 March 1959.
Specimens deposited: No. 73707 (holotype); No. 73708 (paratypes).

Description

Lecithodendriidae. Body elongate oval to spindle-shaped, slightly narrower anteriorly, extremities rounded, entirely spined, 252–287 long by 106–158 wide at acetalabular level. Forebody 104–120 long; hindbody 108–123 long; forebody–hindbody length ratio 1 : 0.96–1.05. Oral sucker ventrotterminal, somewhat flattened posteriorly, 46–58 by 46–59. Acetalabulum round, 44–56 by 42–58, smaller than oral sucker. Sucker length ratio 1 : 0.90–0.97, width ratio 1 : 0.88–0.98. Prepharynx very short; pharynx diameter 22–26; esophagus 13–20 long; cecal bifurcation close to acetalabulum; ceca inverted V-shaped, extending to acetalabular level. Excretory vesicle Y-shaped, arms extending to testes; pore terminal.


Discussion

Our collection contains seven adult worms (three measured); all but the holotype were somewhat macerated. Three species, all from Malaya, are known in the genus: O. hivesticus-

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lare Rohde, 1962, from a lorisid primate and molossid bat; O. hypergenitale Rohde, 1962, from an Erinaceidae insectivore; O. apiion Dunn, 1964, from a Tupaiidae primate. Our new hocked and lying dorsal to the acetabulum. Apidion differs further in having a pyriform-lum smaller than the oral sucker. O. hire Rohde, 1962, from a Lorisid primate and laria interrupted at the testicular level, and longer eggs (34–39). O. hypergenitale differs further in having the ovary dextral, and longer eggs (34–39). O. apiion differs further in having a pyriform-shaped body, the ovary dextral, and the vitellaria interrupted at the testicular level, and the terminal male genitalia being curved or hooked and lying dorsal to the acetabulum.

**Brachylecithum taiwanense** sp. n. (Figs. 3, 4)

**Host:** Hipposideros armiger terasensis Kishida, large leaf-nosed bat (Chiroptera: Hipposideridae).

**Habitat:** Small intestine.

**Locality:** Ping-tung, Ping-tung Prefecture.

**Date:** 9 July 1959.

**Specimen deposited:** No. 73709 (holotype).

**Description**

Dicrocoelidae. Body elongate, threadlike, widest at acetalabular level, extremities rounded, 3,615 long by 275 wide. Forebody 610 long; hindbody 2,780 long; forebody–hindbody length ratio 1 : 4.6. Oral sucker ventroterminal, 198 by 188; preoral space 5 long. Acetabulum slightly wider than body at its level, 225 by 275. Sucker length ratio 1 : 1.14, width ratio 1 : 1.45. Prepharynx absent; pharynx 61 by 73, overlapping oral sucker dorsally; esophagus 249 long; cecal bifurcation 138 preacetabular; ceca narrow, posterior extent obscured by eggs. Excretory vesicle tubular, anterior extent obscured by eggs; pore terminal.

Testes two, smooth, tandem, 26 apart, with single dorsoventral uterine coil between them; anterior testis 145 by 167, contiguous with acetabulum; posterior testis 145 by 157. Cirrus sac elongate oval, thick-walled, muscular, filling intercecal space, 165 by 90, commencing 10 preacetabular, terminating at cecal bifurcation. Seminal vesicle coiling, filling most of cirrus sac, 138 (longitudinal extent) by 41. Prostatic vesicle 53 by 58, surrounded by prostate cells. Cirrus muscular, protruded through genital pore at cecal bifurcation. Ovary smooth, median, in tandem with testes, 110 by 198, lying 85 posterior to posterior testis and with three uterine loops between them. Seminal receptacle small, postovarian. Mehlis' gland postovarian. Vitelline follicles large, right field 380 long, follicles numbering 9, commencing 20 postovarian, left field 480 long, follicles 8, commencing 60 postovarian; postvitelline space 1,720 long, distance 61.9% of hindbody length. Uterine coils extensive, filling most of hindbody, ascending dorsal to gonads and acetabulum. Metraterm shorter than cirrus sac, muscular, ventral to cirrus sac. Eggs numerous, operculate, 10 measuring 33–36 (34.8) by 16–22 (18.6).

**Discussion**

Our collection contains only the holotype specimen. This is the first report of the genus from bats. Only two species are known from mammals: B. aetechini Dollfus, 1951, from an Erinaceidae insectivore from Morocco; B. rodentini Agapova, 1955, from a Microtidae rodent from Kazakh SSR. Both species differ from ours in being much longer, and having the testes much larger than the ovary. B. aetechini differs further in having a pyriform cirrus sac, the ovary contiguous with or very close to the posterior testis, and larger eggs (41–53 by 26–35), and in the uterine pathway relative to the gonads. B. rodentini differs further in having a relatively wider body, a forebody–hindbody length ratio of about 1 : 8.6 (in worm illustrated), the acetabulum narrower than the body at its level, and a relatively narrower cirrus sac.

**Lyperosomum taipeiense** sp. n. (Figs. 5–7)

**Host:** Melogale moschata subaurantiaca Swinhoe, Formosan ferret badger (Carnivora: Mustelidae).

**Habitat:** Small intestine.

**Locality:** Wu-lai, Taipei Prefecture.

**Date:** 13 December 1958.

**Specimens deposited:** No. 73712 (holotype and paratypes).
Description


Discussion

Our collection contains three entire adult worms plus fragments of three others from one host. Our new species is closest to L. armenicum Shcherbakova, 1942, from a glirid rodent from Armenian SSR. The latter species differs from ours in having a wider body, a greater forebody–hindbody length ratio (1:4.3) and sucker ratio (1:2), a pharynx wider than long, a longer postcecal space (28.5% of hindbody length), larger testes, and a wider cirrus sac, and in lacking a body protuberance bearing the acetabulum.

Stephanolecithus taiwanensis sp. n.  
(Figs. 8, 9)

Host: Rattus rattus (L.), house rat (Rodentia: Muridae).
Habitat: Liver.
Locality: Hung T'ou Ts'un, Lan Yü or Orchid Island.
Date: 14 March 1959.

Figures 1–9. Ogmocotyle ratti sp. n. 1. Whole mount, holotype, dorsal view. Odeningotrema ratti sp. n. 2. Whole mount, holotype, ventral view. Brachylecithium taiwanense sp. n. 3. Whole mount, holotype, dorsal view. 4. Terminal genitalia, holotype. Lyperosomum taipeiense sp. n. 5. Whole mount, holotype, dorsal view. 6. Acetabular region of body showing protuberance bearing acetabulum, paratype, dextrolateral view. 7. Terminal genitalia, holotype. Stephanolecithus taiwanensis sp. n. 8. Whole mount, holotype, dorsal view. 9. Terminal genitalia, holotype. C, cirrus; CP, protruded cirrus; CS, cirrus sac; E, egg; GP, genital pore; M, metraterm; PC, prostate cells; PV, prostatic vesicle; SV, seminal vesicle; U, uterus.
Specimens deposited: No. 73713 (holotype and fragment of paratype).

Description

Trogloctematidae. Body phylliform, 2,940 long by 1,495 wide at testicular level; anterior extremity rounded, posterior flat to concave; spinose, spines longer posteriorly, 27 long at body margin just posttesticular. Forebody 545 long; hindbody 2,115 long; forebody–hindbody length ratio 1:3.9. Oral sucker ventroterminal, 230 by 240; preoral space 15 long. Acetabulum 280 by 295. Sucker length ratio 1:1.22, width ratio 1:1.23. Prepharynx very short; pharynx 195 by 145, overlapping oral sucker dorsally; esophagus short; cecal bifurcation preacetabular; ceca wide, sinuous, conspicuously cell-lined, terminating subequally; postcecal space 100 long. Excretory vesicle Y-shaped, tubular, intertesticular, without muscular sphincter at terminal pore, bifurcating near anterior part of testes; arms short, extending to level of posterior margin of ovary.

Testes two, symmetrical to subsymmetrical, intercecal, deeply lobed; right testis 770 by 330, lying 55 postovarian and 555 postacetabular; left testis 745 by 415; posttesticular space 795 long. Cirrus sac large, appearing tripartite, middle part widest; posterior part dorsomedian to acetabulum, commencing 80 posterior to latter, filled with vesicular cells; turning sharply ventrally between acetabulum and arch of cecal bifurcation as middle part, also filled with vesicular cells except for prostate cells around prostatic vesicle; anterior part ventral, extending anteriorly ventral to pharynx, filled with smaller and more darkly staining cells. Seminal vesicle tubular, extending from proximal part of cirrus into middle part, 470 (longitudinal extent) by 77. Prostatic vesicle tubular, transversely oriented, 63 by 26. Cirrus muscular, commencing in middle part of cirrus sac and extending into anterior part. Genital pore ventral to sinistral part of pharynx at about its midlength. Ovary deeply lobed, in tandem with right testis, 330 by 260, lying 170 postacetabular. Seminal receptacle large, between ovary and right testis, overlapping both dorsally, 148 by 136. Laurer’s canal not discernible. Mehlis’ gland median to ovary. Vitellaria follicular to dendritic, in lateral fields but invading intercecal space slightly from short distance postacetabular to posterior part of testes, in extra- and intercecal fields from latter level to posterior extremity. Uterus coiling between anteroventral part of left testis and acetabular level, extending extracecal anteriorly. Metraterm short, muscular, dorsal to cirrus sac. Eggs numerous, yellow–brown, with anopercular thickening, 10 measuring 36–45 (40.5) by 20–24 (21.4).

Discussion

Our collection from one host contains one complete adult worm (holotype) and another with the body anterior to the testes missing. Three species are known in this genus: S. parvus Nakagawa, 1919, from experimentally infected mouse, cat, and dog from Japan; S. beaveri (Lee, 1965) Yamaguti, 1971, from a rat from Malaya; S. microacetabulum (Lee, 1965) Yamaguti, 1971, from a rat from North Borneo. All differ from our species in the nature of the cirrus sac. S. parvus differs further from ours in having a much rounder body, a greater sucker ratio, smooth gonads, and vitellaria extending preacetabular. S. beaveri differs further in having a more oval body with a postmedian notch, a muscular sphincter at the excretory pore, the cirrus sac widest posteriorly, the genital pore at the oral sucker level, in the cirrus sac commencing dorsal to the acetabulum and the vitellaria preacetabular, and in the vitelline fields not being confluent posttesticular. S. microacetabulum differs further in having the acetabulum smaller than the oral sucker, the cecal bifurcation at the acetabular level, the testes smaller than the ovary, the cirrus sac widest posteriorly, and the genital pore at the oral sucker level.

Previously Described Species


2. Fischoederius elongatus (Poirier, 1883) Stiles and Goldberger, 1910 (Gastrothylacidae) from the stomach of domestic cattle collected 4 September 1959 at the Taipei
slaughterhouse. Specimens deposited: No. 73715.

3. Ogmocotyle ailuri (Price, 1954) Price, 1960 (Notocotylidae) from the small intestine of the Formosan macaque, Macaca cyclopis Swinhoe (Primates: Cercopithecidae), collected 14 December 1957, 11 May, 29 November 1960, and 10 January 1962 at Taipei; Pu-li, Nan-tou Prefecture; Chia-I, Chia-I Prefecture; and South Taiwan. Specimens deposited: No. 73716. Yoshimura et al. (1969) reported, with illustrations, this trematode trematode (USNM Helm. Coll. No. 73717) reveals evidence of at least five rows of papillae, possibly six, on the everted cirrus, and the eggs usually with one filament, rarely two, rather than two as described. Examination by us of Price's holotype worm (USNM Helm. Coll. No. 27777) confirms that it differed from Price's (1960) description, based on the holotype only from the lesser panda, Ailurus fulgens (Cuvier) (Carnivora: Procyonidae), in the cirrus showing six rows of papillae rather than being unarmed, and the opercular end of the egg usually with only one filament, rarely two, rather than two as described. Examination by us of Price's holotype worm (USNM Helm. Coll. No. 27777) reveals evidence of at least five rows of papillae, possibly six, on the everted cirrus, and the eggs usually with one filament, rarely two, on the opercular end. Examination of 170 worms from three hosts in our collection show without exception that the cirrus sac is transversely oriented with the part containing the seminal vesicle posteriorly or posteriorly medianly directed as originally described for this species and as redescribed by Yoshimura et al. Additionally, the everted cirrus may show six rows of papillae. Yoshimura et al. (1969) noted that their report of Ogmocotyle species is the first from the Formosan macaque. Actually, Coil (1966) first reported it as O. indica (Bhalerao, 1842) Ruiz, 1946, from this host species and Capricornis swinhoei from Taiwan from specimens which are part of the same collection as ours. It is possible that O. indica reported, without description or illustration, by Bezubik and Furnuga (1959) from Macaca rhesus Audeb. (M. mulatta Zimmermann, according to Yoshimura et al.) from China actually is O. ailuri.

4. Ogmocotyle capricorni Machida, 1970, from the small intestine and stomach of the Formosan serow, Capricornis swinhoei Gray (Artiodactyla: Bovidae), collected 11 May, 26 October 1960, and 27 January 1961 at Wulai, Taipei Prefecture; Pu-li, Nan-tou Prefecture; I-lan, I-lan Prefecture; and Tai-chung Prefecture. Specimens deposited: No. 73717. Machida (1970) did not indicate whether the cirrus had papillae. Our worms show six rows of papillae similar to that described by Yoshimura et al. (1969) for O. ailuri. Also, the eggs, usually with one filament on the opercular end, rarely have two. Coil's (1966) O. indica, a part of the same collection as our worms from the same host species and locality, is actually O. capricorni; Machida did not refer to this paper.

5. Plagiorchis (Multiglandularis) muris (Tanabe, 1922) Shults and Skvortsov, 1931 (Plagiorchiidae), from the small intestine of Rattus rattus collected 10, 11, 14, 15, 18, 21, 27 March 1959 and 1 September 1960 at Taitung Prefecture and at Hung T’ou Ts’un, Lan Yi or Orchid Island. Specimens deposited: No. 73718.

6. Mesocoelium brevicaecum Ochi in Goto and Ozaki, 1929 (Mesocoelidiidae), from the small intestine of the small Formosan civet, *Viverricula indica pallida* Gray (Carnivora: Viverridae), collected 11 December 1959 at Lo-tung, I-lan Prefecture. Specimen deposited: No. 73719. This is the first record of this genus from mammals; it is usually found in amphibians and reptiles, but has been reported twice from marine fishes. *B. brevicaecum* has been reported in amphibians from Japan and Korea. It probably is an accidental infection in the civet.

7. Prosthodendrium (Prosthodendrium) cordiforme (Braun, 1900) Macy, 1936 (Lecithodendridae), from the small intestine of the long-winged bat, Minopterus schrebersii Kuhl (Chiroptera: Vespertilionidae), and *Hipposideros armiger terasensis* collected 9 July 1959 and 2, 3 March 1960 at Hsin-shih, Tai-chung Prefecture and Ping-tung, Ping-tung Prefecture. Specimens deposited: No. 73721 (M. schrebersii); No. 73710 (H. armiger).


9. Echinostoma aegypticum Khalil and Abaza, 1924 (Echinostomatidae) from the small intestine and stomach of the Formosan brown country rat, *Rattus losea* Swinhoe; the Norway rat, *R. norvegicus*; and *R. rattus* col-

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12. *Echinostoma revolutum* (Froelich, 1802) Looss, 1899, from the small intestine of *Viverricula indica pallida* collected 11 December 1958 and 11 December 1959 at Wulai, Taipei Prefecture, and Lo-tung, I-lan Prefecture. Specimens deposited: Nos. 73730, 73720. Our collection contains 10 worms from one host and 13 from another with 37 collar spines. It was most difficult allocating them to species as they closely resemble *E. lindoense* Sandground and Bonne, 1940. Most of our worms have weakly lobed testes, but in some they are smooth. In *E. lindoense* the testes are always lobed, even in young specimens not yet producing eggs. Most importantly, life cycle studies are necessary to determine whether our specimens are indeed *E. revolutum*. There are other species with 37 collar spines very similar to ours in adult morphology which have been separated from one another by differences in larval characters.


15. *Platynosomoides muris* (Shcherbakova, 1942) Yamaguti, 1971 (Dicrocoeliidae), from the liver of the Formosan striped field mouse, *Apodemus agrarius insulaeius* Tokuda (Rodentia: Muridae), *Rattus losea*, and *R. rattus* collected 3, 4 May and 11 August 1960 at Ali-lou and Ali-lao, Taipei Prefecture. Specimens deposited: No. 73733 (A. agrarius); No. 73734 (R. losea); No. 73735 (R. rattus). One worm was obtained from each host species. Those from the first two listed hosts are more like those compared by Uzhakhov (1963) from *Apodemus sylvaticus* L. from Armenian and Dagestan SSR, but differ in having a larger pharynx (165–170 by 147–165 rather than 90–110 by 90–120), and the testes and ovary approximately the same size (testes 155–220 by 175–190; ovary 195–230 by 180–200) rather than the testes being larger than the ovary (testes 300–420 by 180–520; ovary 150–210 by 150–300). The worm from *R. rattus* is a large one (about 6,700 by 1,625), more like that illustrated by Lee (1965) from feral rats from Malaya.


Acknowledgments

Appreciation is due Mr. Dien Zuh Ming, Taiwan Museum, Taipei, Taiwan, and Dr. David H. Johnson, Research Curator, Division of Mammals, U. S. National Museum, Washington, D. C., for host identifications.

Initial work for this study was supported by funding under Public Law 480, Section 104(c), by funds provided by the U. S. Bureau of Medicine and Surgery, Navy Department Work Unit MR005.20–0098, and by con-
tract NR103–690/N0014–66–C0094 between the U. S. Office of Naval Research, Department of the Navy, and Southwest Foundation for Research and Education.

Additional support was by a Faculty Research Fellowship (No. 0001–01–040–73) awarded to the senior author by The Research Foundation of State University of New York.

Literature Cited


The Metazoan Parasites of Green-winged Teal (Anas crecca L.) and Blue-winged Teal (Anas discors L.) from Eastern Canada¹

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ABSTRACT: One hundred and forty-eight ducks (87 Anas crecca Linnaeus, 61 Anas discors Linnaeus) collected from three localities in eastern Canada were examined for parasites. Ninety-five per cent of the A. crecca were infected, 23 parasite species being represented. Four are new host records and six are new records for A. crecca in North America. One hundred per cent of the A. discors were infected, 21 parasite species being represented, including eight new host records.

The number and percentage of each sex and age group of both host species infected, and mean and range of parasite numbers per infected bird is given. Parasite species are discussed with regard to incidence and intensity of infection, location of parasites within host, host records, authorities used in specific determination, and minor variations, if any, from previous descriptions. Infections in the two hosts are compared and differences, if any, are discussed.

Due to the economic and aesthetic value of waterfowl, many aspects of their biology have been studied, including their helminth fauna. Anatid helminths have been investigated by workers in many parts of the world and the published literature is extensive. Lapage (1961) and McDonald (1969a, b) have provided host–parasite and parasite–host lists, respectively, and both reviews include a bibliography.

The green-winged teal (Anas crecca Linnaeus) and blue-winged teal (Anas discors Linnaeus), closely related and sympatric over

¹ This paper consists largely of material submitted by the senior author in partial fulfillment of the requirements for the degree of M.Sc., Memorial University.

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