Brachylaimid and Dicrocoeliid Trematodes of Birds from Palawan Island, Philippines

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ABSTRACT: New species of brachylaimid trematodes of birds from Palawan Island, Philippines, are Leucochloridium palawanense and L. philippinense; new dicrocoelids are Brachylecithum palawanense, B. philippinense, Lycoperosum ducale, L. palawanense, and Zonorchis philippinensis. Leucochloridium sp. and Brachylecithum spp. are reported but not allocated to species as the specimens are immature or incomplete. Previously reported species briefly redescribed are the brachylaimid Brachylaima fuscata (Rudolphi, 1819) and the dicrocoelid Conspicicum aenigma (Gvozdev, 1956) comb. n. (syn. Skrjabinits aenigma Gvozdev, 1956). Skrjabinits indicus Jaiswal, 1957, from India is transferred to Conspicicum as C. indicum (Jaiswal, 1957) comb. n.

The trematodes of this report were part of a collection made by the junior author while a member of the U. S. Naval Medical Research Unit No. 2, Taipei, Taiwan, and serving as a guest investigator on the Silliman University–Bishop Museum Expedition to Palawan Island, Republic of the Philippines. Host names are those reported by Kuntz (1969). The trematodes were washed in saline, killed in hot water, and transferred immediately to FAA fixative. After 4 to 8 hr they were stored in 70% alcohol plus 2% glycerine; staining was in Harris' hematoxylin or carmalum and fast green; all were mounted in balsam. Specimens have been deposited in the U. S. National Museum Helminthological Collection as noted. All measurements are in microns. New host records are indicated by an asterisk (*).

**Family Brachylaimidae**

*Brachylaima fuscata* (Rudolphi, 1819)

Joyceux, Baer, and Timon-David, 1932

**Hosts:** *Anthracoceros marchei* Oustalet, Palawan hornbill (Coraciformes: Bucerotidae); *Aplonis panayensis panayensis* (Scopoli), Philippine glossy starling (Passeriformes: Sturnidae).

**Habitat:** Small intestine.

**Locality:** Tarabanan Concepción, Palawan Island, Philippines.

**Date:** 14 May 1962.

**Specimen deposited:** No. 72164.

**Measurements and some pertinent data based on one adult worm from A. marchei:**

Body 2,250 long by 600 wide at acetalubar level; forebody 720 long; hindbody 1,275 long; forebody–hindbody length ratio 1:1.77; preoral space 24 long; oral sucker 245 by 215; acetalubar 255 by 250, center at anterior 38% of body length; sucker length ratio 1:1.04, width ratio 1:1.16; pharynx 125 by 145; esophagus 36 by 26; postcecal space 63 long; anterior testis 225 by 270, lying 650 postacetabular; posterior testis 185 by 220; posttesticular space 145 long; seminal vesicle 58 in maximum width, extending anteriorly and then looping posteriorly; pars prostatica with loop; cirrus sac 98 by 36; genital pore ventral to anterior testis, 100 from its anterior margin; ovary 175 by 225, overlapping both testes dorsally; vitellaria extending from posterior part of acetabulum to anterior testis; uterus probably not fully developed as few coils present, extending 162 preacetabular, 167 postbifurcal; metraterm C-shaped, dextral to cirrus sac, longer than latter; 10 eggs measuring 24–31 (27.5) by 15–19 (16.4); excretory bladder thick-walled, bifurcating between cecal ends.

**Discussion:** From *Aplonis p. panayensis*...
were recovered one worm just beginning egg production (most abnormal) and one immature. In all probability Tubangui’s (1928) immature *Harmostomum* sp. from the rough-crested cuckoo, *Dasylophon superciliosus* (Cuvier) (Cuculiformes: Cuculidae), from Luzon Island, Philippines, is *Brachylaima fuscata*.

**Leucochloridium palawanense** sp. n. (Figs. 1, 2)

*Host:* *Pitta sordida sordida* (P. L. S. Müller), black-headed pitta (Passeriformes: Pittidae).

*Habitat:* Small intestine.

*Locality:* Puerto Princesa, Palawan Island, Philippines.

*Date:* 22 May 1962.

*Specimens deposited:* No. 72165 (holotype); No. 72166 (paratypes).

*Diagnosis* (based on seven adult worms; six measured): Body elongate, relatively narrow, usually widest at acetalubar level, extremities rounded, tegument entirely spined, 1,325–1,535 long by 415–600 wide. Forebody 630–795 long; hindbody 495–525 long; forebody–hindbody length ratio 1:0.65–0.79. Black pigment granules scattered throughout parenchyma. Oral sucker subterminal ventral, longer and slightly convex posteroventrally, somewhat shorter and slightly concave posterodorsally, rounded anteriorly, 235–270 by 190–235; preoral space 18–20 long in two slightly macerated specimens, 47–53 in normal specimens. Acetalubar round to longitudinally or transversely elongate, not filling intercecal space, 200–240 by 180–240, center at anterior four-sevenths of body length; sucker length ratio 1:0.79–0.91, width ratio 1:0.91–1.05. Prepharynx very short, not always apparent; pharynx usually contiguous with concave posterodorsal part of oral sucker, round to slightly longitudinally or transversely elongate, 131–148 by 118–153; esophagus thick-walled, muscular, 41–44 by 20–30, opening into expanded, thick-walled prececal sac (53–97 by 75–92); ceca surrounded by layer of cuboidal cells, lined internally with layer of columnar cells, constricted at point of emergence from prececal sac, passing dorsally and then anteriorly to sides of oral sucker (which it may overlap) before looping posteriorly, extending posttesticularly; postcecal space 36–77 long.

Gonads smooth, usually longitudinally elongate but one occasionally round, postacetabular, in triangular arrangement, testes usually contiguous with ovary but sometimes anterior testis separated by uterus. Anterior testis ventrosinistral, 104–130 by 90–109, lying 73–152 postacetabular; posterior testis dorsomedian, lying anterior to cecal ends by which it is more or less embraced, 114–130 by 94–125; posttesticular space 78–128 long. Seminal vesicle dextral, tubular, very thick-walled (5–13) with thin inner longitudinal muscle layer and thick outer circular muscle layer, winding, passing posteriorly ventral or just median to ovary. Pars prostatica straight, narrower and shorter than seminal vesicle, 60–110 by 26–28, walls thick (4–6) and muscular as for seminal vesicle, surrounded by large mass of gland cells, prostate cells numerous at junction with cirrus sac and smaller than gland cells. Cirrus sac thick-

Abbreviations: BW, body wall; C, cirrus; CS, cirrus sac; GA, genital atrium; GC, gland cells; GP, genital pore; M, metraterm; PC, prostate cells; PP, pars prostatica; SV, seminal vesicle; U, uterus; VS, vas deferens; VE, vas efferens.

walled, muscular, longitudinally oval, 77–99 by 44–53, surrounded by gland cells. Cirrus muscular, sinuous posteriorly, anterior part inverted within cirrus sac, chamberlike, with long, slightly curved spines (8–19 by 2 at base), longest spines at bottom of chamber (at anterior end of cirrus when everted) and shortest anteriorly. Genital atrium shallow, small. Genital pore ventral, median to slightly submedian, 63–80 from posterior extremity, usually posttesticular but occasionally at posterior margin of posterior testis, at or just posterior to cecal ends.

Ovary dorsal, at same depth level as posterior testis, lying posterodextral to anterior testis and anterodextral to posterior testis, occasionally smaller or same size as either testis to larger than anterior testis, 106–123 by 92–111. Oviduct emerging from sinistrolateral margin of ovary. Ootype complex median to ovary and intertesticular. Vitellaria in lateral extracecal fields, extending from level of posterior margin of oral sucker or pharyngeal level to posterior testis level, terminating 153–225 from posterior extremity, well anterior to cecal ends, follicles ventral and lateral to ceca but not dorsal; transverse vitelline ducts emerging from near posterior end of each vitellarian field, uniting to form relatively large vitelline reservoir lying anterosinistral to posterior testis. Uterus with single ascending and descending limbs passing dorsal to acetabulum, ascending on right (rarely on left), descending on opposite side, coils many between posterior testis and oral sucker, without anterolateral loops extending prececaally, transverse coils overlapping pharynx ventrally. Metraterm thick-walled, muscular, straight, longer than cirrus sac, lying sinistral to latter, opening into genital atrium. Eggs numerous, yellow near ovary, becoming slightly darker as they progress through uterus, operculate, 18 measuring 21–27 (23) by 12–14 (13).

Excretory bladder thick-walled, tubular, short, posttesticular; pore subterminal dorsal.

Discussion: The distribution of the uterine coils separates our new species from all those that can be included in Kagan’s (1952) concept of the genus Urogonimus Monticelli, 1888 (syn. of Leucochloridium Carus, 1835). Our form differs from Kagan’s concept of Leucochloridium in lacking lateral prececal uterine loops. It differs from Kagan’s new genus Neoleucochloridium (syn. of Leucochloridium) in lacking a pustulated cirrus and in having the uterine coils extending anterior to the cecal bifurcation. L. palawanense sp. n. differs from all known species in the genus in the shape of the oral sucker and presence of a thick-walled, muscular seminal vesicle, and from all but L. cyanocittae McIntosh, 1932 (syn. of L. actitis McIntosh, 1932) in having a spined cirrus. The latter species differs further in possessing prececal uterine loops on the sides of the oral sucker, the vitellaria extending postcecaally or nearly so, and the anterior testis being near the posterior margin of the acetabulum.

Leucochloridium philippinense sp. n. (Fig. 3)

Host: Pitta s. sordida.

Habitat: Small intestine.

Locality: Puerto Princesa.

Date: 22 May 1962.

Specimen deposited: No. 72167 (holotype).

Diagnosis (based on one worm): Body elongate, somewhat broad, widest at acetabular level, extremities rounded, tegument entirely spined, 1,452 by 650 wide. Forebody 660 long; hindbody 410 long; forebody–hindbody length ratio 1:0.62. No black pigment granules in parenchyma. Oral sucker subterminal ventral, nearly round, 302 by 290; preoral space 70 long; acetabulum round, nearly filling intercecal space, separated from ceca by uterine coils, 382 by 385, center at anterior three-fifths of body length; sucker length ratio 1:1.26, width ratio 1:1.33. Prepharynx not apparent; pharynx nearly round, 100 by 110, overlapping oral sucker dorsally; esophagus very short; no prececal sac; ceca surrounded by layer of cuboidal cells, lined internally with layer of columnar cells, slightly ascending sides of oral sucker, extending to near posterior extremity; postcecal space 77 long.

Gonads smooth, longitudinally elongate, at same depth level; ovary and anterior testis lying just postacetabular, symmetrical; posterior testis mediadiagonal to other gonads; anterior testis sinistral, 155 by 116; posterior
testis dextral, lying anterior to cecal ends, 142 by 107; posttesticular space 130 long. Seminal vesicle intertesticular, mediosinistral, tubular, very thick-walled (6–14) with thin inner longitudinal muscle layer and very thick outer circular muscle layer, slightly curved, 143 by 46, commencing at overy–anterior testis level. Pars prostatica elongate oval, 41 by 24, walls thick (5) and muscular as for seminal vesicle, narrowing for short distance before entering cirrus sac, surrounded by large mass of gland cells. Margins of cirrus sac obscured by eggs. Cirrus muscular, unspined, smooth. Genital atrium shallow, small. Genital pore ventral, median, postcecal, 60 from posterior extremity.

Ovary dextral, 109 by 82. Oviduct emerging from sinistrolateral margin of ovary. Ootype complex median to ovary, intertesticular. Vitellaria in lateral extracecal fields, extending from level of posterior part of oral sucker to level of anterior part of posterior testis, terminating 250 from posterior extremity, well anterior to cecal ends, follicles ventrolateral to ceca but not dorsolateral or dorsal; transverse vitelline ducts emerging from near posterior end of each vitelline field, uniting to form large vitelline reservoir lying intertesticular. Uterus with single dextral ascending and sinistral descending limbs passing dorsal to acetabulum, coils many between acetabulum and posterior margin of oral sucker, without anterolateral coils extending prececally, with few coils postacetabularly, ascending and descending between ovary and anterior testis, descending further intertesticularly, much coiled sinistral to posterior testis, with coils between latter, cecal ends, and posterior extremity. Metraterm thick-walled, muscular, partly posterior to left cecum, lying sinistral to cirrus sac, surrounded by gland cells. Eggs numerous, yellow-brown, operculated, 10 measuring 21–27 (24) by 12–14 (13).

Excretory bladder thick-walled, tubular, short, posttesticular; pore subterminal dorsal.

Discussion: This species differs from Kagan’s concepts of the genera Urogonimus, Neoleucochloridium, and Leucochloridium as discussed for L. palawanense. In having a thick-walled, muscular seminal vesicle the present form differs from all species of the genus except L. palawanense. L. philippinense differs from the latter in the shape of the oral sucker, having the acetabulum larger than the oral sucker, lacking a prececal sac, the ovary and anterior testis being just postacetabular, and possessing an unspined cirrus and posttesticular uterine coils. Our form closely resembles L. turdi Yamaguti, 1939, which differs further in its more posteriorly placed genital pore and the anterior most extent of the uterine coils being at the cecal bifurcation. In the posttesticular extension of the uterine coils and posterior extent of the vitellaria in relation to the cecal ends, our form also resembles L. dasylophi Tubangui, 1928, L. hypotaenidiarum Tubangui, 1927, and L. nainitalensis Baugh, 1962; these species differ further from our form in having the acetabulum equatorial and the gonads lying far posterior to the acetabulum. L. dasylophi also differs in having a dorsal genital pore and larger eggs; L. hypotaenidiarum in the posterior testis being far anterior to the cecal ends, the genital pore dorsal, and the vitellaria extending posttesticularly; and L. nainitalensis in the vitelline fields commencing postpharyngeally.

Leucochloridium sp. (Fig. 4)

Host: Anthus gustavi gustavi Swinhoe, wagtai (Passeriformes: Motacillidae).

Habitat: Small intestine.

Locality: Tarabanan Concepción.

Date: 14 May 1962.

Specimens deposited: No. 72168.

Description (based on 10 immature worms; four measured): Body elongate oval, widest just preacetabular, extremities rounded, tegument spined, 450–550 long by 182–285 wide. Forebody 222–295 long; hindbody 111–162 long; forebody–hindbody length ratio 1:0.49–0.56. Oral sucker subterminal ventral, slightly longitudinally elongate, 143–172 by 136–160; preoral space 10–24 long; acetabulum round to slightly longitudinally or transversely elongate, postequatorial, filling intercecal space, 97–123 by 92–121, center at anterior 61–64% of body length; sucker length ratio 1:0.68–0.76, width ratio 1:0.68–0.78. Prepharynx very short, often not apparent; pharynx not overlapping oral sucker, round to slightly longitudinally elongate, 75–92 by 65–90; esophagus thick-walled, very short, opening into thick-walled prececal...
sac; ceca thick-walled, passing dorsally and then anteriorly to sides of posterior part of oral sucker before looping posteriorly, extending posttesticularly to within 24–44 of posterior extremity.

Gonads smooth, usually longitudinally elongate but occasionally transversely elongate, contiguous to overlapping one another, tending to go from dorsal (anterior testis) to mid-depth (ovary) to ventral (posterior testis) position, usually with anterior testis sinistral and with ovary and posterior testis median to mediolateral and tandem to diagonal, sometimes all three tandem or with anterior testis dextral, in two worms ovary entirely posttesticular in position normally occupied by posterior testis. Anterior testis overlapping acetabulum dorsally, 52–66 by 41–75; posterior testis 53–69 by 44–69; posttesticular space 34–73 long. Seminal vesicle sinuous, walls appearing thick and cellular; pars prostatica elongate oval, narrowing to short duct before entering elongate oval, posttesticular cirrus sac, both structures surrounded by gland cells; cirrus smooth, unspined. Genital pore median to slightly submedian, ventral, very near posterior extremity. Ovary 39–48 by 34–53. Vitellaria in lateral fields, extending from posterior part of oral sucker to posterior testis level, terminating 76–97 from posterior extremity, well anterior to cecal ends, follicles only ventral and ventrolateral to ceca. Uterus only with single sinuous ascending and descending limbs extending anteriorly to pharynx, passing dorsal to acetabulum; metraterm thick-walled, longer than and sinistral to cirrus sac.

Discussion: The present form differs from *L. palawanense* in having an unspined cirrus and the cirrus sac lying entirely posttesticular, and from *L. philippinense*, *L. dasylophi*, and *L. hypotaenidiarum* in having the acetabulum considerably smaller than the oral sucker. Because the coiling of the uterus and the body proportions are not fully developed, the worms cannot be identified.

**Family Dicrocoeliidae**

*Brachylecithum palawanense* sp. n.  
(Figs. 5, 6)

Hosts: Type, *Halcyon chloris collaris* (Scopoli), white-collared kingfisher; *Ceyx rufidorsus* Strickland, red-backed kingfisher (Coraciiformes: Alcedinidae).

Habitat: Small intestine (P).

Locality: Tarabanan Concepción.

Dates: 12, 14 May 1962.

Specimens deposited: No. 72169 (holotype, from *Halcyon*); No. 72170 (paratypes, *Halcyon*); No. 72171 (paratypes, *Ceyx*).

Diagnosis (based on seven adult worms in dorsal or ventral view from *Halcyon*, measurements of six given below; and five adults in lateral view from *Ceyx*, measurements not included below): Body elongate, narrow, extremities rounded, 3,305–4,535 long by 270–485 wide at testicular level. Forebody 535–695 long; hindbody 2,535–3,365 long; forebody–hindbody length ratio 1:4.3–6.2. Oral sucker subterminal ventral, longitudinally elongate, somewhat inverted pear-shaped, truncate or nearly so posteriorly, in ventral or dorsal view with compact layer of muscles just within posterior and posterolateral margins, in lateral view muscle layer posterior, posterodorsal and posteroverentral, 148–177 by 114–153; preoral lip prominent, 31–61 long; acetabulum usually somewhat transversely elongate but occasionally round, 173–235 by 186–252; sucker length ratio 1:1.05–1.33, width ratio 1:1.47–2.41. Prepharynx absent; pharynx round or nearly so, sometimes with nipplelike projection at anterior end, 51–61 by 47–58; esophagus 121–230 long; cecal bifurcation 130–180 preacetabular; ceca extending short distance into posterior third of body.

Gonads smooth, transversely oval, separated from one another by uterine coils. Anterior testis slightly sinistral in four worms and slightly dextral in two, 90–270 by 120–285, lying 170–315 postacetabular in worms from *Halcyon*, lying closer to acetabulum in worms form *Ceyx*; posterior testis slightly dextral in four worms but slightly sinistral in two when anterior testis dextral, 110–242 by 118–310, lying 22–110 posterior to anterior testis. Cirrus sac elongate oval, straight, thick-walled, muscular, commencing dorsal to anteriormost part of acetabulum or entirely preacetabular, 157–196 by 65–78. Seminal vesicle winding, somewhat coiled, filling most of cirrus sac when cirrus protruded, 125–180 by 40–70. Pars prostatica roundish, small, surrounded by few
prostate cells. Cirrus large, muscular, usually protruded, opening into posterior part of genital atrium. Genital pore median, at cecal bifurcation.

Ovary in tandem with posterior testis, slightly dextral in four worms but slightly sinistral in two when posterior testis sinistral, 97–120 by 127–170, lying 35–143 posterior to posterior testis. Seminal receptacle very large, 97–148 by 116–155, lying postovarian and slightly more lateral than latter. Mehlis' gland well developed, lying posteromedian to seminal receptacle at or near anterior limits of vitellaria. Latter follicular, in two short, subequal, lateral fields; field on ovarian side 335–430 long, with eight follicles in one worm, nine in five; opposite field 350–605 long, with 10 follicles in one worm, 12 in five; anterior-most follicle lying 93–190 postovarian; post-vitellarian space 1,130–2,015 long. Uterus filling most of hindbody, extending to near posterior extremity, ascending median to ovary and posterior testis with single loop between them, crossing (with several loops) between testis to median side of anterior testis. Metraterm thick-walled, muscular, shorter than and lying dorsal to cirrus sac, opening into shallow genital atrium anterior to male opening. Eggs numerous, operculate, 25 measuring 29–37 (32.3) by 15–19 (17.9).

Excretory bladder tubular, sometimes dilated, where visible posteriorly; narrowing to short duct before opening through terminal pore.

DISCUSSION: This form keyed to the genus Brachylecithum Strom, 1940, in the key given by Odening (1964). While some of the five specimens from Ceyx were smaller than those from the other host, the morphology, measurements, and ratios of all were basically similar. It differs from all others in the genus in the shape of the oral sucker. It is closest to B. halecyonis (Yamaguti, 1941) Skrjabin and Evranova, 1953, B. tetraogalli Gvozdev, 1953, B. bubo Chibichenko, 1959, and B. indicum Singh, 1962. The latter species differs further in the shape of the gonads, the testes being tandem, very close to each other, and separated by only a single uterine coil, and the extent of the vitellaria never being more than twice the length of the ovary rather than three to four times its length. B. halecyonis differs further in the shape of the gonads, and in having tandem testes and larger eggs (42 by 21–22). B. bubo differs further in having tandem testes, an S-shaped cirrus sac, and somewhat larger eggs (36–40 by 18–20). B. tetraogalli differs further in having a postbifurcal genital pore and larger eggs (47 by 26–30).

**Brachylecithum philippinense** sp. n. (Figs. 7, 8)

HOST: *Tersiphone cyanescens* (Sharpe), blue paradise flycatcher (Passeriformes: Musicipidae).

HABITAT: Small intestine (?).

LOCALITY: Tarabanan Concepción.


SPECIMEN DEPOSITED: No. 72172 (holotype).

DIAGNOSIS (based on one worm in dextro-lateral view; measurements are length by depth): Body elongate, narrow, extremities rounded, 2,563 by 143 at vitellarian level. Forebody 420 long; hindbody 2,005 long; fore-body–hindbody length ratio 1:4.8. Oral sucker subterminal ventral, 141 by 100, with compact muscle layer inside posterior, posterodorsal, and posteroverentral margins; preoral space 8 long; acetabulum 138 by 95; sucker length ratio 1:0.98, depth ratio 1:0.95. Prepharynx absent; pharynx very small, 29 by 32; esophagus 115 long; cecal bifurcation 120 precacetabular.

Testes two, smooth, round, tandem, 36 apart, both 75 in diameter, anterior testis lying 95 postacetabular. Cirrus sac thick-walled, muscular, somewhat oval with narrower part anteriorly, 172 by 52. Seminal vesicle filling most of cirrus sac, sinuous. Pars prostatica small, surrounded by few prostate cells. Cirrus large, protruded. Genital atrium shallow. Genital pore median, at cecal bifurcation.

Ovary smooth, in tandem with testes, 77 by 90, lying 97 posterior to posterior testis. Vitellaria follicular, in two short lateral fields 350 long, anteriormost limit at posterior margin of ovary. Uterus filling most of hindbody, with several loops between ovary and posterior testis and one loop between testes. Metraterm thick-walled, muscular, slightly shorter than cirrus sac, opening into genital atrium just anterior to male opening. Eggs numerous,
operculate, 10 measuring 40–46 (43.1) by 20–26 (23.2).

Discussion: This form appears closest to B. baskokowi (Ivanitsky, 1927) Strom, 1940, B. filum (Dujardin, 1845) Strom and Sondak, 1935, and B. vanellicola (Layman, 1922) Strom, 1940. B. baskokowi differs in having a larger sucker length ratio (1:1.43), and much larger pharynx (74 in diameter) and gonads even though the adult worm is smaller (2,059 long). B. filum differs in its much greater size (7 mm long) with all structures correspondingly much larger, and in having larger eggs (49–58 by 26–37). B. vanellicola differs in having longitudinally elongate testes, the ovary smaller than the testes, and eggs significantly smaller (22–31 by 18).

Brachylecithum spp.

Hosts: Streptopelia chinensis tigrina (Temminck), spotted neck dove (Columbiformes: Columbidae); Pitta erythrogaster thompsoni Ripley and Rabor, red-breasted pitta (Passeriformes: Pittidae); Pitta s. sordida; Pycnonotus plumosus cinereifrons (Tweeddale), large olive bulb (Passeriformes: Pycnonotidae).

Habitat: Small intestine (?).
Locality: Tarabanan Concepción.
Dates: 12, 14, 15 May 1962.
Discussion: Two incomplete worms were recovered from one P. sordida and one incomplete worm from each of the other host species. More than one species of trematode appear to be present, but allocations are not possible.

Lyperosomum duculae sp. n.

(Figs. 9, 10)

Host: Ducula aenea palawanensis (Blasius), green imperial pigeon (Columbiformes: Columbidae).

Habitat: Small intestine (?).
Locality: Tarabanan Concepción.
Date: 15 May 1962.
Specimen deposited: No. 72173 (holotype).

Diagnosis (based on one complete adult worm with body from just postacetabular anteriorly in sinistrolateral view and remainder in dorsal view, and another with body missing anterior to middle of posterior testis; both measured): Body elongate, narrow, extremities rounded, 5,815 long by 565 wide. Forebody 875 long; hindbody 4,630 long; forebody–hindbody length ratio 1:5.3. Oral sucker subterminal ventral, with compact muscle layer just within posterior, posterodorsal, and posteroventral margins, 280 long by 265 deep; preoral space 17 long; acetabulum 310 long by 345 deep; sucker length ratio 1:1.11. Prepharynx absent; pharynx 84 in diameter; esophagus 255 long; cecal bifurcation 435 preacetabular; ceca conspicuously cell-lined, terminating about 1,175 from posterior extremity in partial worm with 3,010 long postvitellarian space.

Testes two, slightly lobed, pyriform, tandem–diagonal; anterior testis sinistromedian, 365 by 180, lying 180 postacetabular; posterior testis dextromedian, 365 by 225, lying 215 posterior to anterior testis. Cirrus sac elongate, thick-walled, muscular, 305 long by 73 deep, commencing 60 preacetabular. Seminal vesicle sinuous, thick-walled, muscular, 290 long by 65 deep. Pars prostatica very short, tubular, surrounded by few prostate cells. Cirrus muscular, protrusible, opening into posterior part of shallow genital atrium. Genital pore at level of posterior part of esophagus.

Ovary smooth to slightly lobed, median, diagonally oriented, 240–275 by 215–243, lying 150–210 posterior to posterior testis. Seminal receptacle posterolateral to ovary, 205 by 90. Mehlis’ gland well developed, postovarian. Vitellaria follicular to dendritic, in lateral fields, anteriormost level of fields nearly equal and lying 120–125 preovarian, posterior level subequal with right field extending 620–825 postovarian and left field 840–1,100, right field 920–1,225 long, left 1,125–1,500 long; vitelline reservoir small; postvitellarian space 2,460–3,010 long. Uterus filling most of hindbody, separating gonads. Metraterm thick-walled, muscular, slightly shorter than cirrus sac, entering genital atrium anterior to male opening. Eggs numerous, operculate, 20 measuring 26–32 (29.8) by 19–21 (20.2).

Discussion: Our form keyed to Lyperosomum Looss, 1899, in the keys given by Odening (1964) and Yamaguti (1971). It differs from all others in the genus in having
pyriform testes, and from all but *L. turdii* (Ku, 1938) Travassos, 1944, and *L. anatis* Belogurov and Leonov, 1963, in having lobed testes. *L. turdii* differs further from our species in having a much wider body, vitellaria commencing at the testicular level, and a much shorter posttesticular space. *L. anatis* differs further from our species in having the vitellaria commencing at the testicular level and a much shorter posttesticular space.

**Lyperosomum palawanense** sp. n.  
(Figs. 11, 12)

**Host:** *Dinopium javanense everetti* (Tweeddale), golden-backed three-toed woodpecker (Piciformes: Picidae).

**Habitat:** Small intestine (?).

**Locality:** Tarabanan Concepción.

**Date:** 14 May 1962.

**Specimen deposited:** No. 72174 (holotype).

**Diagnosis** (based on one worm): Body elongate, lancet-shaped, extremities rounded, 3,740 long by 1,305 wide at level between ovary and posterior testis. Forebody 605 long; hindbody 2,540 long; forebody–hindbody length ratio 1:4.2. Oral sucker subterminal ventral, 290 by 295; preoral space 47 long; acetabulum 595 by 670, center at anterior one-fourth of body length, at posterior part of anterior third of body; sucker length ratio 1:2.05, width ratio 1:2.27. Prepharynx absent; pharynx 140 by 170; esophagus thick-walled, muscular; cecal bifurcation somewhat closer to acetabulum than pharynx; ceca thick-walled, cell-lined; postcecal space 710 long.

Testes two, diagonal, well separated by uterus, intercecal, smooth, transversely elongate; anterior testis dextral, 100 by 150, lying 75 postacetabular; posterior testis sinistral, 120 by 185, lying 410 postacetabular. Cirrus sac thin-walled, slightly muscular, elongate, somewhat pyriform, 205 by 150, commencing 8 preacetabular, terminating ventral to posterior part of pharynx, occupying 5.5% of body length. Seminal vesicle bipartite, sinusous, saccular, walls cellular internally; posterior chamber 85 by 97; anterior chamber 97 by 94. Pars prostatica very short, tubular. Cirrus elongate, muscular. Prostate cells few, surrounding pars prostatica, anterior part of seminal vesicle, and posterior part of cirrus. Genital atrium small. Genital pore median, ventral to posterior part of pharynx.

Ovary smooth, 236 by 245, lying 750 postacetabular and 225 posterior to posterior testis. Seminal receptacle posterior to ovary. Laurer’s canal present. Mehlis’ gland well developed, posteromedian to ovary. Vitellarium follicular, in extracecal fields up to 960 long, may overlap ceca, commencing 455 postacetabular at level of posterior testis, extending 285 postovarian, in middle third of body; postvitellarian space 1,225 long. Uterus filling most of hindbody intercecaally but may overlap ceca, descending postcecaally to near posterior extremity, ascending median to ovary and between testes. Metraterm thick-walled, muscular, shorter than cirrus sac, lying sinistral to latter, surrounded by gland cells. Eggs many, operculate, 10 measuring 32–39 (36.1) by 22–26 (23.5).

Excretory bladder tubular where visible posteriorly; pore terminal.

**Discussion:** This species appears close to *L. turdii* (Ku, 1938) Travassos, 1944, and *L. indosinense* (Odening, 1964) Yamaguti, 1971. *L. turdii* differs by having testes larger than the ovary, the ovary located immediately or only slightly posterior to the posterior testis, and the cirrus sac relatively longer (occupying 9.5–14% of body length). *L. indosinense* differs in having the cecal bifurcation at the anterior margin of the acetabulum, the gonads of about equal size, the cirrus sac entirely prebifurcal, the genital pore lateral to the pharynx, the vitellaria commencing at the anterior testis level, and smaller eggs (28–32 by 16–21).

**Conspicuum aenigma** (Gvozdev, 1956) comb. n.

(Fig. 13)

**Host:** *Turnix susitator fasciata* (Temminck), barred button quail (Gruiformes: Turnicidae).

**Habitat:** Gall bladder.

**Locality:** Puerto Princesa.

**Date:** 22 May 1962.

**Specimens deposited:** No. 72175.

**Measurements and some pertinent data** (based on six adult worms; five measured): Body 3,705–7,275 long by 600–3,265 wide.
at gonadal level; forebody 625–1,385 long; hindbody 2,685–5,410 long; forebody—hindbody length ratio 1:3.8–4.5; oral sucker 344–595 by 285–600; preoral space 23–65 long; acetabulum 320–610 by 285–620, center at anterior 21–23% of body length; sucker length ratio 1:0.83–1.14, width ratio 1:1.00–1.23; pharynx 114–165 by 128–200; esophagus narrow but sometimes dilated, 133–390 by 48–130; cecal bifurcation 22–280 preacetabular; gland cells at posterior edge of pharynx, along esophagus, cecal bifurcation, and very beginning of cea; latter narrow near bifurcation, becoming dilated short distance preacetabular; testes symmetrical to slightly oblique, right testis 105–405 by 125–495, left testis 123–425 by 111–455; vas efferens emerging from anterodorsal surface of each testis, usually entering cirrus sac side by side, sometimes joining to form short vas deferens up to 31 long before entering cirrus sac; latter 168–303 by 73–125, relatively thin-walled, slightly muscular, dextral or sinistral to esophagus, entirely prebifurcal, terminating at pharyngeal level or just post-pharyngeal; seminal vesicle bipartite, posterior chamber elongate, usually straight, saccular, lined internally with long, flat cells, 47–162 by 26–67, anterior chamber elongate, thick-walled, with cells larger and more cuboidal, 42–92 by 37–58; pars prostatica very short, tubular to slightly bulbous; cirrus very muscular, protractile, 80–88 by 37–58 when within cirrus sac (in two largest worms) and 97–115 by 23–36 when protruded (in two smallest worms); prostate cells relatively few, surrounding anterior part of seminal vesicle, pars prostatica, and posterior part of cirrus; genital atrium large; genital pore submedian dextral or sinistral, at pharyngeal level or just post-pharyngeal; ovary dextral or sinistral in four worms, sinistromedian in two, 109–300 by 125–420, lying 463–1,120 postacetabular; seminal receptacle 80–150 by 83–245; Laurer's canal muscular, sinuous, median to seminal receptacle and ovary; Mehlis' gland well developed, posterior to postmedian to ovary; vitellaria commencing at level of posterior part of acetabulum, terminating 960–1,895 from posterior extremity, fields may be subequal anteriorly and posteriorly, lying in middle third to half of body length; transverse vitelline ducts postovarian, uniting to form short common vitelline duct; uterus ascending sinistral to ovary if latter dextral and dextral if sinistral; metraterm thick-walled, slightly muscular, surrounded by gland cells, shorter than cirrus sac, lying dextral to latter if uterus ascending dextral to ovary and sinistral if ascending sinistral to ovary; eggs operculate, 30 measuring 27–35 (30.7) by 16–20 (17.7); excretory bladder tubular where visible posteriorly, narrowing to muscular duct surrounded by gland cells before opening through terminal pore.

**Discussion:** This species was described from *Coturnix coturnix* L. (Galliformes: Phasianidae) from Kazakh SSR as Skrjabinus aenigma. In the key to the genera of Eurytrematini from birds given by Yamaguti (1971) this species keyed to *Conspicuum* (Blaherao, 1936) Strom, 1940, as the vitellaria commences at the acetabular level rather than in the preovarian zone. Therefore, we are transferring it to this genus as *Conspicuum aenigma* (Gvozdev, 1956) comb. n. (syn. Skrjabinus aenigma Gvozdev, 1956). Similarly, Skrjabinus indicus Jaiswal, 1957, should be transferred to this genus as *Conspicuum indicum* (Jaiswal, 1957) comb. n.

**Zonorchis philippinensis** sp. n.

(Figs. 14, 15)

**Host:** *Gallus gallus* L., red jungle fowl (Galliformes: Phasianidae).

**Habitat:** Small intestine (?).

**Locality:** Puerto Princesa.

**Data:** 24 May 1962.

**Specimens deposited:** No. 72176 (holotype); No. 72177 (paratype).

**Diagnosis** (based on two adult worms): Body elongate, phylliform, with distinct shoulderlike expansions at acetabular level, extremities rounded, 2,680–4,090 long by 895–1,100 wide at testicular level. Forebody relatively narrow, 510 long; hindbody wide anteriorly, tapering gradually posteriorly, 1,850–2,690 long; forebody–hindbody length ratio 1:3.6–5.3. Suckers round to longitudinally elongate; oral sucker subterminal ventral, 245–250 by 230–245; preoral space 22–23 long; acetabulum 320–505 by 320–425, center at anterior 19–25% of body length; sucker length ratio 1:1.30–2.02, width ratio 1:1.39–1.73. Prepharynx ab-
sent; pharynx overlapping oral sucker dorsally, 107–130 by 114–115; esophagus thick-walled, muscular; cecal bifurcation 30–58 preacetabular, somewhat closer to acetabulum than oral sucker; ceca thick-walled, conspicuously cell-lined; postcecal space 500–745 long.


Ovary transversely elongate, smooth, posterior to and contiguous with or very slightly separated from posterior testis, 155–157 by 180–184, lying 235–290 postacetabular. Seminal receptacle posterior to and contiguous with ovary, 73–128 by 82–106. Laurer's canal present. Mehlis' gland well developed, posteriorly median to ovary, median to seminal receptacle. Vitellaria follicular, in extracecal fields, occasionally overlapping ceca, commencing 120–250 postacetabular at testicular level, extending 810–975 postovarian, occupying middle third of body length; postvitellarian space 945–1,630 long. Uterus filling most of hindbody intercecally, occasionally overlapping ceca, descending postcecaally to near posterior extremity, ascending median to ovary and between testes. Metraterm thick-walled, muscular, shorter than cirrus sac, lying dextrodorsal to latter if ovary sinistral or sinistrodorsal if ovary dextral, surrounded by gland cells. Eggs numerous, operculate, 10 measuring 36–45 (39.5) by 22–25 (23.8).

Excretory bladder tubular where visible posteriorly; pore terminal.

**Discussion:** Our form differs from all others in the genus *Zonorchis* Travassos, 1944, in its phylliform body resulting from the presence of distinct shoulderlike expansions of the body at the acetabular level. It is closest to *Z. panduriformis* (Railliet, 1900) Timon-David, 1953, and *Z. petiolatus* (Railliet, 1900) Denton and Byrd, 1951. The latter species differs further in having the cecal bifurcation closer to the oral sucker, the testes more nearly symmetrically placed, the ovary well separated from the posterior testis by the uterus, and the cirrus sac well anterior to the acetabulum and oval to pyriform. *Z. panduriformis* differs further in having a submedian, more anteriorly placed genital pore, and the cirrus sac pyriform.

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**Literature Cited**


The Life Cycle and Notes on the Developmental Stages of *Microtetrameres corax* Schell, 1953 (Nematoda: Tetrameridae)\(^1\)

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**ABSTRACT:** The life cycle and development of *Microtetrameres corax* Schell, 1953, are described. Experimentally, grasshoppers (*Melanoplus* spp.) served as intermediate hosts. Black-billed magpies (*Pica pica hudsonia*), which are natural hosts in northeastern Colorado, were raised from nestlings in the laboratory and used as definitive hosts. After ingestion of embryonated eggs by a grasshopper, first-stage larvae emerge from the shell within 6 hr and migrate to the hemocoel within 24 hr. Second-stage larvae appear in the hemocoel after 10 to 14 days. Third-stage larvae were recovered 27 to 56 days in the thoracic region of the hemocoel and among the fat bodies in the abdominal region. Grasshoppers containing third-stage larvae were fed to magpies; at necropsy, 48 days later, 110 females and 18 males were found in one bird and 74 females and 11 males were found in the other. Fourth-stage larvae were not recovered. The pathological effects of female *M. corax* are discussed.

Schell (1953) described *Microtetrameres corax* from the raven in Bovill, Idaho, and attempted to continue the life cycle by feeding eggs to mealworm larvae, *Tenebrio* spp., and German cockroaches, *Blattella germanica*. At necropsy, 32 to 38 days later, the mealworm larvae were negative, but in the cockroaches he found encysted larvae, assumed to be third-stage *M. corax*, which were then fed to chicks. The chicks, however, were not infected when examined 50 to 56 days later.

Cram's (1934) notes on larvae of *M. helix* Cram, 1927, and a more complete investigation by Ellis (1969a, b) on the life history and larval morphology of *M. centuri* Barus, 1966, are the only other existing reports of experimental life cycle studies on *Microtetrameres*.

*Microtetrameres corax* is a common helminth in black-billed magpies (*Pica pica hudsonia*) in northeastern Colorado (Wacha, 1966; Wacha and Schmidt, 1971). The abundance of material and the lack of experimental knowledge about this interesting genus prompted this study.

**Materials and Methods**

Adult *M. corax* males were obtained from the mucus and females from the proventricular glands of magpies. Seventy birds were collected from various sites in the vicinity of Greeley, Colorado, between April and November 1967. Magpie nestlings were raised in the laboratory for experimental use as definitive hosts. Grasshoppers (*Melanoplus* spp.) were collected at early nymphaal stages from an area in which little or no magpie activity had been observed, and used experimentally as intermediate hosts. Preliminary necropsies of several of these revealed no natural infections of parasitic helminths. Embryonated eggs from gravid females were

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