Life Cycles of Lacunovermis conspicua n. gen., n. sp. and Meiogymnophallus multigemmulus n. gen., n. sp. (Gymnophallidae: Trematoda) from Macoma inconspicua and Diving Ducks from Vancouver, Canada

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Stunkard and Uzmann (1958) reviewed the historical background and James (1964) the distinguishing features of species of the genera Gymnophallus Odhner, 1900; Gymnophalloides Fujita, 1925; and Parvatrema Cable, 1953. Stunkard and Uzmann considered the taxonomic status of both adult and larval forms to be chaotic and confusing. At that time, 12 adults had been named but not clearly distinguished from each other, and gymnophallid metacercariae and cercariae, frequently mistaken for each other, had little or no correlation with adults. James redistributed 16 gymnophallid species into the three named genera, but in doing so had to redefine the genera, the subfamilies, and the family Gymnophallidae. Although James acknowledged the affinities of the gymnophallids with the family Fellochlotomatidae, which Cable (1953) had convincingly pointed out, he preferred Morozov’s (1955) placement of the group into a separate family.

Few gymnophallid life cycles are known but those that have been worked out exhibit wide variation. Cable demonstrated the first life cycle of the group for Parvatrema borinquenae in Puerto Rico. Sporocysts in the clam, Gemma purpurea, gave rise to small, furocercous cercariae which invaded gastropods, Cerithidea costata, and became unencysted metacercariae. Adults were obtained experimentally from chicks, but the natural hosts were thought to be migrating ducks. From the White Sea, Zelikman (1953) reported that metacercariae in sporocysts from Macoma baltica were fed to Sterna paradisea, Haematopus ostralegus, Larus argentatus, and Felis domestica, and the adults recovered from these hosts were identified to Gymnophallus affinis Jameson and Nicoll, 1913. At Boothbay Harbor, Maine, Stunkard and Uzmann described the life cycle of Parvatrema borealis: sporocysts and cercariae were found in Gemma gemma; metacercariae encysted in the same molluscan host and in polychaetes (Stunkard, 1962); and adults were recovered experimentally from the intestine of the eider duck, Somateria mollissima. James (1960, 1964) described from Wales, the unique life cycle of Parvatrema homoeotecnum which involved: a primary germinal sac with ventral and oral suckers, pharynx, esophagus, and bifid gut; a tailless daughter germinal sac with the same morphology as the primary germinal sac; cercaria; and metacercaria; all stages were found in the same intermediate host, Littorina saxatilis tenebrosa. The definitive host, Haematopus ostralegus occidentalis, became infected with the adults upon eating the snail hosts. Szidat (1962) described from the mussel, Mytilus platensis in Argentina, various developmental stages of Gymnophallus australis. These included: a single specimen of a redia in which germ balls were developing into tailless cercariae, a typical gymnophallid metacercaria (unencysted), an encysted metacercaria, and a metacercaria containing germ balls. The last stage had an oral sucker, pharynx, bifid gut, ventral sucker, and ovary, but no testes or vitellaria. The germ balls developed into cercariae but a few had rudimentary tails.

Hopkins (1958) described the cercaria and metacercaria of Paratrematodes donaci from Donax variabilis in Texas while Holiman (1991) found five new gymnophallid larvae from mollusks in Florida. Paine (1962) noted the presence of metacercariae of gymnophallids in brachiopods from Florida. Ryjikov (1962) described Gymnophallus minor from Somateria mollissima and (1963b) G. skrjabini from S. fisheri and S. spectabilis from the Russian far east. Ryjikov (1963a) also transferred Cestotrema mollissimus Morosov, 1960 to the genus Gymnophallus. Tcimbalk and Leonov

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(1963) named *G. ceratostomus* from *Athyra marila* and *Melanitta americana* from Kamchatka, U.S.S.R.

**Methods and Materials**

During the summer of 1963, 1,138 specimens of *Macoma inconspicua* (Broderip and Sowerby) were collected on sandy mud flats at Spanish Banks, Vancouver, Canada and examined for trematodes. Four species were found; two are to be described as new and men of 54 PROCEEDINGS OF THE [VOL. 32, No. 1

chatka, U.S.S.R. made on living worms dissected from the clams; the trematodes were then fixed in hot seawater and stained with Semichon's carmine for permanent mounts. Measurements were made on at least ten preserved specimens of each stage of the two species except where noted otherwise. Maximum and minimum ranges were recorded in millimeters with averages in parentheses. Camera lucida drawings of live and preserved trematodes were made; however, flame cells and some glands were sketched in freehand.

To study the growth of the metacercariae of *Lacunovermis conspicuus* (description to follow), two sets of clams, about 25 each, were exposed to cercariae which had been dissected from sporocysts in naturally infected clams. A third set of 25 clams was maintained as a control; all clams were kept for 3 months in closed containers with regular changes of seawater, and were examined weekly for developing metacercariae. Although the clams used experimentally were collected in the same area as naturally infected clams, they were one-third of the size and had very few metacercariae.

Metacercariae of *L. conspicuus* were fed to six ducklings, six chicks, and two field mice, *Peromyscus maniculatus* (Wagner) which had been trapped on campus and had no previous contact with marine life. Metacercariae of *Melogynophallus multigemmulus* (to be described as new) were fed to one duckling and two field mice.

1. *Lacunovermis conspicuus* n. gen., n. sp.

**A. Generic Diagnosis of *Lacunovermis***


**Type species**: *L. conspicuus*.

**Type specimen**: U.S.N.M. Helm. Coll. No. 60467.

B. **Stages in the life cycle of *L. conspicuus***:

1. **Adult** (Fig. 1).

**Description** (based on seven specimens): Body oval, with rounded anterior end, pointed posterior end, length 0.388–0.496 (0.431), width at acetabular level 0.165–0.256 (0.196). Transverse rows of spines on entire body, decreasing in number posteriorly. Forebody 0.205–0.279 (0.234). Oral sucker round, its transverse diameter 0.114–0.154 (0.131); lateral papillae present. Acetabulum round, with crenulated opening, diameter 0.068–0.091 (0.074). Sucker ratio 1.43–2.45:1 (9:5). Pharynx oblong, 0.039–0.052 by 0.035–0.039 (0.047 by 0.037). Esophagus inconspicuous, often dorsally directed. Ceca usually small, widely bifurcate, lined with cells, lumen small and empty. Ventral median pit present anterior to genital pore. Genital pore, a transverse opening some distance anterior to acetabulum. Genital atrium shallow, wide, receiving uterus and ejaculatory duct. Ejaculatory duct short, surrounded by prostate cells, leading to seminal vesicle. Seminal vesicle small, round, dorsally placed on anterior edge of acetabulum or extending to midacetabular level. Testes oval, symmetrical, posterolateral to acetabulum, 0.052–0.066 by 0.026–0.049 (0.059–0.033). Ovary ovoid, larger than testes, 0.060–0.068 by 0.039–0.049 (0.065–0.044), anterior to right testis, slightly anterior to acetabular level.

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Vitellaria consisting of two compact, slightly lobed masses dorsal to and overlapping acetabulum, or slightly posterior to acetabulum, each mass 0.039–0.065 by 0.026–0.045 (0.056 by 0.038). Between vitellaria, common viteline mass uniting with ootype. Mehlis’ gland posterior to acetabulum. Laurer’s canal arising from ootype, opening on dorsal surface. Seminal receptacle not observed. Uterus arising from ootype, looping to left and arching anteriorly to level of genital pore. Eggs 0.038. Between vitellaria, common vitelline mass uniting with ootype. Eggs 9–33 in number, very large, 0.026–0.034 by 0.012–0.016. Excretory pore terminal.

LOCATION: Intestine of all hosts.

HOSTS: Peromyscus maniculatus (Wagner), experimental from 2 after 5 days infection; Oidemia nigra (Linn.), from 1, 19 mature specimens, from the collection of Dr. D. N. Jensen; Aythya marila (Linn.), from 1, 18 immature specimens, also from Dr. Jensen’s collection.

MORPHOLOGICAL VARIATIONS: The description is based on adults recovered from experimental animals which are somewhat smaller than the metacercariae measured. However, the specimens are in a well-relaxed condition with an unobscured view of the genitalia. In contrast, ten specimens from O. nigra were larger, 0.399–0.533 (0.483) by 0.199–0.262 (0.235); the extent of the uterus was greater anteriorly but still restricted to the posterior half of the body; the acetabulum appeared abnormally placed farther posteriorly, and thus the seminal vesicle was in a more anterior position; the vitellaria were scattered and not distinct as compact glands. These differences are most likely due to methods of fixation and age of the worms.

As noted in the description, sensory papillae on the anterior surface and lateral extensions of the oral sucker are living features of the worm; the lateral lips are often not visible in preserved specimens. The pharynx may appear round but is usually oblong in well-relaxed specimens. The intestinal ceca may be highly inflated and filled with granular material, or deflated in both metacercariae and adults; thus the cecal extent is variable. The extent of the uterus depends on the number of eggs and state of contraction of the animal but is restricted to the posterior half of the body. The openings of the genital pore and ventral pit may be transverse slits when the animal is contracted or a transversely oval orifice and a semilunar opening, respectively, when the animal is relaxed. If the surface of the trematode is not taken into consideration, the genital pore may appear to open just anterior to the ventral sucker. However, a bulge of the body wall generally separates the genital pore from the acetabulum, and shows especially well on lateral view or in sagittal sections (see Figs. 3 and 4 of metacercaria).

COMPARISONS: The presence of a ventral pit anterior to the genital pore and acetabulum distinguishes Lacunovermis from all other gymnophallid genera. The strongly developed muscles of the ventral surface which act as sphincters around the pit may be of generic significance. The ventral pit is similar to the preacetabular pit of the hemiurid genus Lecithochirium Lühe, 1901 and since it is easily seen, should be as dependable as internal structures. Lacunovermis is most similar to Paratrematodes in possessing a wide genital pore that is usually located some distance from the acetabulum, and a shallow genital atrium, but differs from this genus chiefly in body size, extent of uterus, and presence of a ventral pit.

Two gymnophallid specimens loaned by Dr. S. Debloc of Lille, France were observed to have a ventral pit, and Gymnophallus ceratostomus Tchimbaluk and Leonov, 1963 may also have this characteristic. Although not described in the text, “spindles” surround the genital pore and are located in smaller numbers anterior to the genital pore in their figure of this species. These “spindles” could represent muscular lines of the body surrounding the genital pore and ventral pit as in L. conspicus. Gymnophallus ceratostomus is distinguished from other species by a pair of cuticular spines along the sides of the oral sucker, but if these are lateral lips commonly observed for gymnophallids, then this becomes a nonspecific characteristic. Until the cuticular spines and “spindles” can be clarified, G. ceratostomus must be regarded as different from L. conspicus.

Although a ventral pit was not mentioned for Metacercaria mutabilis Markowski, 1936 from Macoma balthica, there is close resemblance to the metacercaria of L. conspicus in the wide genital pore surrounded by sphinc-
2. Metacercaria (Figs. 2–4):

Description: Body cream or pink in color, covered entirely with fine spines arranged in transverse rows. Body oval, with rounded anterior end, pointed posterior end; length 0.393–0.541 (0.479); width at acetabular level 0.199–0.291 (0.230). Forebody length 0.228–0.336 (0.288); with sensory papillae. Oral sucker round, transverse diameter 0.112–0.154 (0.127), with lateral papillae seen best in life, surrounded by gland cells. Mouth opening terminal to subterminal. Acetabulum round with crenulated edge, 0.068–0.078 (0.072). Sucker ratio 1.3–2.1:1 (7:4). Pharynx barrel-shaped, longer than wide, 0.039–0.065 by 0.029–0.045 (0.049 by 0.036). Esophagus variable in length depending on contractions of ceca, lined with thickened refractive material. Ceca, oval sacs with inner edges closely opposed, lined with large, delicate cells, sometimes enormously inflated, filled with granular substance in lumen, extending posteriorly to level of midacetabulum. Genital pore, a wide opening with two sensory papillae on lower surface, leading to shallow genital atrium, varying in position but usually 0.013 anterior to acetabulum. Ventral median pit present (Fig. 3) anterior to genital pore with genital pore equidistant from pit and acetabulum; pit ventral to inner edges of ceca, supported by muscles of body but not connecting with parenchyma internally. In sagittal sections (Figs. 3–4) the genital pore and ventral pit are indentations; the body wall bulging between acetabulum and genital pore. Muscles of ventral surface of body strongly developed and functioning as sphincter muscles around pit and genital pore. Testes ovoid, nearly symmetrical, posterolateral to acetabulum, 0.032–0.062 by 0.026–0.056 (0.051 by 0.037). Ovary usually dextral, anterior to right testis at level of acetabulum, oval to round and slightly larger than testes, 0.045–0.073 by 0.032–0.052 (0.058 by 0.039). Oviduct originating from anterior end of ovary, leading posteriorly to Mehlis' gland. Mehlis' gland with darkly stained cells, directly posterior to acetabulum. Vitelline glands bilobed or paired oval compact masses, directly dorsal and overlapping acetabulum or posterior to acetabulum, each gland 0.032–0.058 by 0.023–0.039 (0.047 by 0.032), common vitelline duct joining Mehlis' gland. Initial portion of uterus ciliated, coils of uterus winding to the left before joining ejaculatory duct at genital pore. Excretory bladder V-shaped with short stem, simple arms extending to pharyngeal level, filled with refractive granules 0.004–0.010 in diameter. Flame cell pattern same as in cercaria, \[2(2 + 2) + (2 + 2)\].

Location: Between mantle and shell of host, most often near umbo, unencysted or covered with thin membranous layer which adheres to shell; old infections found in single pits in shell with membranous layer still exposed, or covered with nacre secreted by host. No calcareous layer or pearl formations present such as those reported in *Mytilus edulis* Linn., 1758 and other bivalves.

Frequency: About 72% of clams infected with 1–7 but as many as 26 metacercariae in a single clam.

3. Sporocyst: Thirteen of 1,138 clams were infected with sporocysts of this species. Only sporocysts containing the cercariae were studied and measured because they otherwise could not be distinguished from sporocysts of three other trematodes infecting the same host species. Sporocysts oval to elongate, with attenuated ends, active anterior end drawn to a neck. Birth pore present, no shedding of cercariae from clams observed. Number of

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Fig. 1. Adult of *Lacunovermis conspicuus*, experimentally recovered from *Peromyscus maniculatus* after 5 days, ventral view.

Figs. 2–4. Metacercaria of *L. conspicuus* from *Macoma inconspicua*.

Fig. 2. Whole mount, dorsal view.

Fig. 3. Sagittal section showing genital pore, ventral pit.

Fig. 4. Sagittal section showing genital pore.

Abbreviations: CE = ceca, GP = genital pore, SV = seminal vesicle, UT = uterus, VP = ventral pit. All measurements on scales indicate millimeters.
cercariae in 20 sporocysts, 7–37. Sporocyst length and width 0.513–0.798 by 0.160–0.211 (0.589 by 0.179).

4. Cercaria (Fig. 5):

Description: Small, furcate, gymnophallid type. Body and tail finely spined. Body elongate with tapered ends, curled ventrally when swimming with tail furcae extended in horizontal position. Body length 0.160–0.256 (0.208). Body width at level of acetabulum 0.068–0.108 (0.090). Tail, from body attachment to furcal notch, 0.038–0.081 long by 0.021–0.026 wide (0.062 by 0.024). Tail furca 0.059–0.099 (0.084) long and 0.013–0.019 (0.016) wide at point of bifurcation. Oral sucker oval, 0.042–0.052 long by 0.034–0.042 wide (0.049 by 0.038). No sensory papillae on oral sucker. Mouth small, directed terminally. Prepharynx absent; pharynx well developed, longer than wide, 0.021–0.032 by 0.016–0.021 (0.027 by 0.019). Esophagus variable in length, length of pharynx when extended. Ceca, oval inflated sacs lined with large granular cells, their posterior edges 0.045–0.097 (0.068) from posterior end of body, extending to mid- or postacetabulum. Two pairs of penetration glands present; one pair located dorsal to inner posterior edges of ceca; one pair at outer edges of esophagus; their refractive, pointed terminal openings at anterior lip of oral sucker. Forebody 0.090–0.133 (0.188) long, filled with many gland cells especially laterally. Acetabulum round, 0.032–0.039 (0.037), slightly raised with crenulated edge; no sensory papillae. Genital anlagen forming an arc dorsal to acetabulum. Excretory bladder V-shaped, simple arms reaching anterior to ceca. Excretory tube in stem divided in furcae, terminating just before tips of furcae on posteroventral surface. Flame cell formula 2[(2 + 2) + (2 + 2)].

Comparisons: The cercaria of *L. conspicus* is most like *Cercaria pusilla* Holliman, 1961 in the anterior extent of the excretory bladder, location of openings of caudal excretory tubules, and number of penetration glands. However, the newly described cercaria differs in the location and composition of the penetration glands, greater number of flame cells, and larger ceca lined with large, granular cells. The cercaria differs from that of *Parvatrema horreais* Stunkard and Uzmann, 1958 and of *Parvatrema donacis* Hopkins, 1958 in the larger body size, granular ceca, and greater number of flame cells.

5. Experimental results of cercarial infections:

Clams exposed to the cercariae were examined at regular intervals and after 3 months, 23 experimental clams contained a total of 416 worms while for the same period, 25 control clams had 21 worms. Tailless young worms resembling the cercariae were observed to increase in size until at 2 months, the location of gonads and genital pore could be discerned. The oral sucker and intestinal ceca increased in size with the latter filled with granular material, presumably nutritive substances from the host clam. The oral to ventral sucker ratio at 2 months is approximately 1.6–2:1. At 3 months the metacercariae appeared similar in size to those found in natural infections of the clam and produced 1 to 2 eggs in seawater cultures at 37°C after 48 hours; the same egg production resulted in *in vitro* culture of metacercariae taken from natural infections.

II. *Meiogymnophallus multigemmulus* n. gen., n. sp.

A. Need for new generic name:

Both *Gymnophalloides* and *Parvatrema* were originally described with a wide, genital pore with shallow atrium located some distance from the acetabulum. James (1964) chose to emend the definition of *Gymnophalloides* to read: "Genital atrium tubular. Genital pore very small, usually on anterior lip of ventral sucker." His basis for the completely new characterization of the genus, using *Gymnophallus macrostomus* Yamaguti, 1939 as the model, was this statement: "Yamaguti (1939) suggested that *Gymnophallus macrostomus*, now called *Gymnophalloides macrostomus*, is the adult of the metacercaria *G. tokiensis*. The adult and metacercaria are so similar that specific identity is probable and generic identity cannot be doubted." Yamaguti’s own words on the resemblance of *G. macrostoma* were: "This species differs from the related *Gymnophallus affinis* and *G. macroporus*, both described by Jameson and Nicoll, in egg size as well as in the position of the ovary. In this latter respect it resembles *Gymnophalloides tokiensis* Fujita, 1925, but the identity with this larval form is...
unable to determine in the absence of experimental evidences.” It is improbable that the location and size of the genital pore could vary from that figured for G. tokiensis to that described for G. macrostoma. Both species have been reported only once, G. macrostoma from Melanitta nigra americana in Korea and G. tokiensis from the oyster, Crassostrea gigas in Japan. It seems premature at this time to assume that G. macrostoma and G. tokiensis are the same species without experimental evidence, and to change the concept of the genus upon this assumption. Because the original description of Gymnophalloides is replete with errors of interpretation, some of which were mentioned by Dollfus, the translator, G. tokiensis should be described again from the metacercarial stage. Adults from definitive hosts should be recovered and studied. When Gymnophalloides has been found again, the author believes that Parvatrema as originally defined by Cable will be considered synonymous with it. Differences between the two genera as mentioned by Cable (form of vitellaria and type of molluscan host) have already been nullified by the descriptions of Parvatrema borealis and P. homoeotecnum. Yamaguti (1958) regarded Gymnophalloides as a subgenus of Gymnophallus; however, for the time being, the genus should be regarded as distinct and belonging to the subfamily Parvatremini.

Since the genus emended as Gymnophalloides by James is essentially new, it should be renamed. Meiogymnophallus, with M. multigemmulus designated as the type species, is the name suggested. The diagnosis presented here is essentially the same that James presented for Gymnophalloides Fujita, 1925 emended.

Meiogymnophallus n. gen.

Gynmophallidae: Gymnophallinae. Body very small, oval to pyriform, spinose. Oral sucker subterminal, moderately large to large, usually twice as large as ventral sucker. Ventral sucker in posterior third of body. Ceca dilated, very short, never reaching anterior border of ventral sucker. Vesicula seminalis voluminous, usually undivided. Pars prostatica opens into genital atrium. Genital atrium tubular. Genital pore very small, usually on anterior lip of ventral sucker. Vitelline glands large, paired, compact, close to ventral sucker. Uterus fills fore, mid, or hind body. Excretory vesicle Y-shaped, arms long, stem short or very short. Flame cell formula \(2[(2 + 2) + (2 + 2)] \) or \(2[(2 + 2) + (2 + 2) + (2 + 2)] \). Parasites of intestine of shore birds.

Type species: Meiogymnophallus multigemmulus n. sp.

Type specimen: U.S.N.M. Helm. Coll. No. 60468.

Other species: M. somateriae (Levisen, 1881) n. comb. (= Gymnophalloides s.); M. macroporus (Jameson and Nicoll, 1913) n. comb. (= Gymnophalloides m.); M. oedemiae (Jameson and Nicoll, 1913) n. comb. (= Gymnophalloides o.); M. macrostomus (Yamaguti, 1939) n. comb. (= Gymnophalloides m.).

B. Stages in the Life Cycle of M. multigemmulus.

1. Adult (Fig. 6):

Description: Body minute, oval with rounded anterior end, pointed posterior end, length 0.171-0.199 (0.179); width 0.074-0.091 (0.082). Cuticle transversely spined. Forebody length 0.096-0.117 (0.103). Oral sucker round, 0.044-0.058 (0.050), glands surrounding oral sucker, sensory papillae and lateral lips present as in metacercariae. Acetabulum round, 0.026-0.032 (0.030). Sucker ratio 1.4-1.9 : 1 (1.7 : 1). Pharynx round, 0.013-0.019 by 0.013-0.016 (0.016 by 0.014). Ceca widely divergent, dorsally directed, lined with small cells. Seminal vesicle small, globular with short ejaculatory duct curving anteriorly before terminating at genital pore. Prostate cells scarce. Genital pore directly anterior to acetabulum, inconspicuous. Gonads as described in metacercariae but located more anteriorly, with ovary anterior to acetabulum; testes at acetabular level. Vitellaria anterodorsal to acetabulum, common vitelline duct often a compact mass. Uterus with left loop obscuring left gonads, extending anteriorly to level of ceca in relaxed specimens. Eggs 8-15 in number, very large, 0.021-0.029 by 0.009-0.014; ten eggs measured in fresh state 0.024-0.030 by 0.016-0.019.

Location: Intestine of all hosts.

Hosts: Peromyscus maniculatus (Wagner) experimental, from 2, after 3 and 5 days. Melanitta perspicillata (Linn.) numerous speci-
mens in the collection of Dr. D. N. Jensen. *Oidemia nigra* (Linn.) numerous specimens collected by Dr. Jensen.

Though resembling specimens recovered experimentally, specimens from natural hosts were often filled with eggs from the oral sucker posteriorly and the genitalia were difficult to discern or poorly stained. The shape of the vitellaria was usually compact but some disintegration occurred. The range of ten specimens was greater, $0.142-0.274$ (0.212) by $0.080-0.160$ (0.116), but sucker ratios, egg size, location of the genital pore were similar to specimens from experimental infections.

2. **Metacercara** (Fig. 7):

**Description:** Body cream-colored, entire surface heavily decorated with transverse rows of flat, thick spines decreasing in size posteriorly. Body rounded, in contracted specimens, to oval with rounded anterior and pointed posterior ends in extended specimens. Body minute, length $0.125-0.142$ (0.131), width at level of acetabulum $0.099-0.109$ (0.103). Forebody length $0.065-0.083$ (0.076).

Oral sucker powerful, round, about two-thirds larger than acetabulum, transverse diameter $0.055-0.071$ (0.059), lateral papillae and about 14 sensory papillae present in living specimens. Mouth opening small, subterminal to terminal. Gland cells surround oral sucker and occupy forebody. Acetabulum round, with crenulated edge, about ten sensory papillae around opening, diameter $0.032-0.039$ (0.036). Sucker ratio $1.4-1.8 : 1$ ($5 : 3$). Pharynx round to oblong, in life with keyhole-shaped lumen, diameter $0.013-0.016$ (0.014), leading to highly divergent ceca. Ceca sometimes extending to anterior level of acetabulum. Ovary round to oval, $0.019-0.026$ (0.023), anterior to right testis, at level of acetabulum. Testes oval, symmetrical, or diagonal, posterolateral to acetabulum, approximately same size, $0.019-0.032$ by $0.014-0.023$ (0.026-0.017). Vitellaria slightly lobed, compact, dorsal to acetabulum, each gland $0.016-0.032$ by $0.013-0.019$ (0.021 by 0.016). Excretory bladder V-shaped with bicornuate arms extending to sides of oral sucker. Flame cell formula $2[(2 + 2 + 2) + (2 + 2 + 2)]$.

3. **Sporocyst and cercaria** (Fig. 8):

Three infections of this species were encountered in 1,138 clams examined. The sporocysts occupied almost all the tissues of the clam except for the muscular foot and siphons. Although tightly packed when the clam is dissected, the sporocysts separate readily and appear like pink grains of sand. Ten oval sporocysts measured $0.675-0.945$ (0.783) by $0.375-0.540$ (0.460). Twenty sporocysts contained 37 to 108 metacercariae and a very small number of cercariae. These cercariae were readily distinguished from the metacercariae by the presence of degenerating tails, smaller body size, thinly lined ceca, and fine granules in the excretory bladder. The cercariae did not swim and showed only weak movement. Two flame cells were seen along each side of the cercaria (Fig. 8).

**Comparisons:** Species reported with the metacercarial stage in the sporocyst include *Metacercaria morula* Markowski, 1936, *Cercaria discursata* Sinitsin, 1911, *C. fulbrighti* Hutton, 1953, the cercaria of *M. somateriae* (Levinsen, 1881), that of *Paraturama affine* (Jameson and Nicoll, 1913) as reported by Zelikman (1953), and *C. granosa* Holliman, 1961. These species may have a cercarial stage whose tail degenerates; the metacercaria may remain in or leave the sporocyst. Hence, there is confusion as to whether a sporocyst contains a tailless cercaria or a metacercaria. *Cercaria discursata*, *C. fulbrighti*, *P. affine*, and *M. multigemmulus* have a furcate stage. In contrast to *C. discursata* and *C. granosa*, the larvae of *M. multigemmulus* remain in the sporocyst; the sporocysts contain a much larger number of metacercariae than those of *C. fulbrighti* and *C. granosa*. Measurements of *M. morula* from *Macoma baltica* are very similar to *M. multigemmulus*. Unfortunately, nothing is known.
of the excretory system, arrangement of sensory papillae on the suckers, or the number of metacercariae per sporocyst. The figure of *M. morula* shows a sucker-like structure at the genital pore which indicates that its adult may represent another genus of the subfamily Gymnophallinae, according to Cable (1953). The new species differs from *P. affine* as described by Zelikman in the greater number of metacercariae per sporocyst, in the inconspicuous instead of large, semilunar genital pore, and in the bicornuate instead of multicornuate excretory bladder. It differs from the description of the smaller specimens of *P. affine* as given by Jameson and Nicoll in the shape of the vitellaria and less anterior extent of the uterus. From other species in the genus, it differs by its combination of minute size, large eggs, and abbreviated life cycle. From *P. obscurum* (Ching, 1960) in the same locality, *M. multigemmulus* can be differentiated by its inconspicuous genital pore, minute size, large eggs, and proportionately smaller gonads.

**Summary**

*Lacunovermis* gen. n. is distinguished from all gymnophallid genera by the presence of a ventral pit anterior to a wide, genital pore. The life cycle of *L. conspicus* sp. n. involves sporocysts, cercariae, and metacercariae in the clam, *Macoma inconspicua*, and adults recovered from experimental feedings of the metacercariae to field mice, *Peromyscus maniculatus*. Adults were also found in natural hosts, diving ducks, *Aythya marila* and *Oidemia nigra*.

*Meiogymnophallus* is a new name recommended for the genus *Gymnophalloides* as emended by James (1964), with *M. multigemmulus* designated as the type species. The life cycle of *M. multigemmulus* sp. n. includes cercariae which lose their tails in the sporocysts and become metacercariae in *Littorina saxatilis*. Adults were obtained after experimental feedings of the metacercariae to field mice and were also found in natural infections of the intestine of *Oidemia nigra* and *Melanitta perspicillata*. The new species differs from *Paratrema affine* (Jameson and Nicoll, 1913) in the number of metacercariae per sporocyst, shape of the vitellaria, and extent of the uterus.

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The trematodes of this report were part of a collection of parasites made by the junior author while a member of the U. S. Naval Medical Research Unit No. 2, Taipei, Taiwan. Parasites were washed in saline, killed in hot water, and transferred immediately to FAA fixative. After 4–8 hours they were stored in 70% alcohol plus 2% glycerine. Staining was variable, and all were mounted in balsam. Measurements are in microns.

**Family Angiодictyidae**

**Hexangium sigani** Goto and Ozaki, 1929

**Synonyms:** *Hexangium affinum* Tubangui and Masilungan, 1944; *H. secundum* Ammer-

**Measurments of Eight Specimens:** Body 3,004 to 4,602 by 982 to 1,427; preoral body 22 to 40 long; oral sucker 213 to 307 by 228 to 340; prepharynx 184 to 419 long; pharynx 144 to 265 by 147 to 206; right testis 430 to 644 by 414 to 537, distance to posterior body end 206 to 460; left testis 430 to 613 by 350 to 591, distance to posterior body end 305 to 721; cirrus sac 51 to 85 by 63 to 99; oral sucker to genital pore 133 to 331; ovary 166 to 262 by 180 to 269, distance to posterior body end 236 to 314; oral sucker to beginning of vitellaria 614 to 1,150; 30 eggs measuring 82 to 95 by 49 to 60.

**Discussion:** Five specimens were collected from *S. oramin*, ten from *S. guttatus*, and two from *C. erythrogaster*; the latter two hosts represent new records. Fischthal and Kuntz (1964)