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Some Species of *Lecithaster* Lühe, 1901 (Digenea: Hemiuridae) and Related Genera from Fishes in the Northern Gulf of Mexico

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Some Species of *Lecithaster* Lühe, 1901 (Digenea: Hemiuridae) and Related Genera from Fishes in the Northern Gulf of Mexico

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Abstract

Lecithaster helodes n. sp. is described from *Mugil curema* and *M. cephalus*. It differs from the closely related *L. mugilis* Yamaguti, 1970 by having four rather than three ovarian lobes and other minor differences. Discussions and measurements are presented for *L. confusus* Odhner, 1905, *L. leiostomi* Overstreet, 1970, *Hysterolecitha elongata* Manter, 1931, *Aponurus pyriformis* (Linton, 1910) n. comb., and *A. elongatus* Siddiqi & Cable, 1960. *Branchadena* Linton, 1910 is considered a synonym of *Aponurus* Looss, 1907. New host records are listed for some of the above hemiurid trematodes. *Leurodera ocyri* Travassos, Frietas & Bihrnheim, 1965 and *L. inaequalis* Travassos, Freitas & Biihrnheim, 1965 are considered synonyms of *A. pyriformis*.

Species of *Lecithaster* Lühe, 1901 and related genera of trematodes from the Gulf of Mexico have been mentioned in only a few references. This study, however, reveals these hemiurids are common in the estuarine environment of Mississippi.

The trematodes were fixed in hot AFA solution under minimal coverslip pressure and stained with Van Cleave's hematoxylin. Figures were drawn from mounted material with the aid of a camera lucida, and measurements are given on the figures, and in the text as well, in micra. Use of an asterisk (*) in front of names of hosts, in the following accounts, indicates a new host record.

***Lecithaster confusus* Odhner, 1905**
(Figure 1)

Data based on 27 mounted specimens from *Micropogon undulatus*: Body 379–1,299 long by 155–485 wide; widest at acetabular level. Oral sucker 49–126 long by 55–122 wide. Acetabulum 110–252 by 102–232. Sucker width ratio 1:1.7–2.3. Ratio of acetabular width to body length 1:3–6. Forebody 21–37% of body length. Pharynx 32–73 long by 33–73 wide. Esophagus usually shorter but occasionally longer than pharynx. Left testis 38–157 long by 36–116 wide. Right testis 44–139 by 38–133. Seminal vesicle saccular, extending to or beyond acetabulum. Sinus sac 29–67 long by 19–49 wide. Ovary 67–255 long by 57–177 wide, its center 54–79% of body length from anterior end. Vitellarium usually smaller than ovary; vitelline lobes usually smaller than those of ovary, rarely two times longer than wide. Seminal receptacle often larger than seminal vesicle or testis. Postvitelline space 6–28% of body length. Eggs 15–23 long by 9–15 wide.

Measurements of six mounted specimens from *Alosa chrysochloris*: Body 1,282–1,695 long by 580–754 wide. Oral sucker 136–162 long by 139–171 wide. Acetabulum 291–360 by 261–316. Sucker width ratio 1:1.8–2.0. Pharynx 70–90 by 73–87. Left testis 116–218 by 106–220. Right testis 128–197 by 102–212. Sinus sac 55–110 by 46–73. Ovary 194–316 by 93–249. Eggs 15–22 long by 9–14 wide.

Hosts: **Micropogon undulatus* (Linnaeus), Atlantic croaker (Sciaenidae); **Bairdiella chrysura* (Lacépède), silver perch (Sciaenidae); **Urophycis floridanus* (Bean & Dresel), southern hake (Gadidae); **Morone mississippiensis* Jordan & Eigenmann, yellow bass (Percichthyidae); **Alosa chrysochloris* (Rafinesque), skipjack herring (Clupeidae); and *Lagodon rhomboides* (Linnaeus), pinfish (Sparidae).

Site: Intestine.

Localities: Mississippi Sound and adjacent waters (all hosts); Cedar Key, Florida (*L. rhomboides*); Joseph Canal, near Grand Chenier, Louisiana (*M. undulatus*).

Specimens deposited: USNM Helm. Coll. No. 72304 (from *M. undulatus*), No. 72305 (from *A. chrysochloris*).

Discussion

Specimens from all hosts listed above are basically the same. Except for a slight overlap, those from *Alosa chrysochloris* are larger and, consequently, their measurements are listed separately. Measurements of the remaining worms agree, excluding minor differences, with measurements listed for those from *Micropogon undulatus*. Whether the larger size of the worms from the skipjack herring is because of being older, affected by the host or environment, or a different species from that in the other hosts is unknown. Specimens were collected from individuals of *M. undulatus* on a monthly basis for a year and one-half and from a single 26-cm-long *A. chrysochloris*. A difference in age between the flukes from the two hosts is possible. Five slides of specimens reported from *Lagodon rhomboides* from Alligator Harbor along the Gulf of Mexico in Florida by Nahhas & Short (1965) were lent by Dr. Robert B. Short. They resemble closely my specimens from the same host. Specimens of *Lecithaster confusus* reported from the northeastern United States match in size my spec-

imens from *A. chrysochloris*. Hunninen & Cable (1943) described nine-day-old metacercariae, presumably not yet infective, averaging 0.39 mm, or just larger than the smallest mature worm from *M. undulatus*. They illustrated three adults 1.6–1.8 mm in length. Reimer (1970) discussed the morphology of European specimens and reported a length range from 0.60 to 1.53 mm.

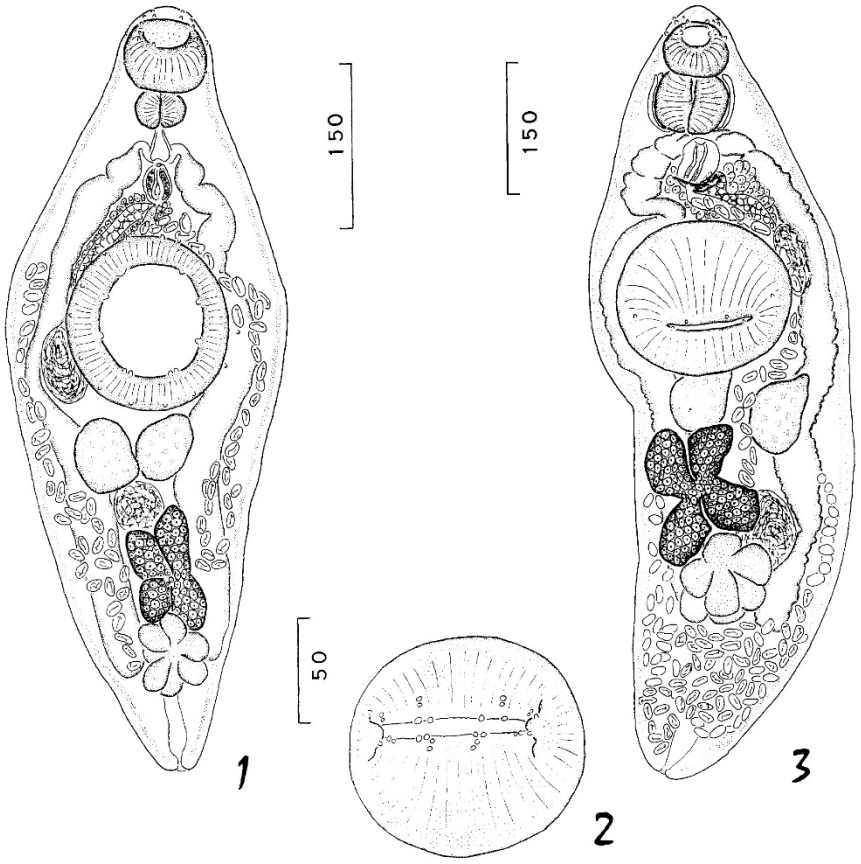

Figure 1. *Lecithaster confusus* from *Micropogon undulatus*, whole mount, ventral view. **Figure 2.** *Lecithaster leiostomi* from *Menidia beryllina*, acetabulum, ventral view. **Figure 3.** *Lecithaster helodes* from *Mugil curema*, holotype, ventral view. Scale values are micra.

The location of the seminal vesicle, a usually accepted specific diagnostic character, is anywhere from almost completely anterior to the acetabulum to entirely posterior to it in my specimens. The insignificance of the position of the vesicle was pointed out by Reimer (1970).

Yamaguti (1971) listed most of the species of *Lecithaster* Lühe, 1901 in the text and addenda; however, *L. trilobatus* Manter, 1969 should read *L. testilobatus* Manter, 1969. To his list should be added *L. africanus* Fischthal & Thomas, 1971 and *L. ghanensis* Fischthal & Thomas, 1971. In addition to the partial synonymies listed by Yamaguti (1971), a few other

synonyms should be noted. Srivastava (1966) considered *L. intermedius* Szidat, 1954 a synonym of *L. gibbosus*; Reimer (1970) considered *L. tauricus* Pigulevsky, 1938 a synonym of *L. confusus* and suggested that *L. confusus* and *L. gibbosus* (Rudolphi, 1802) Lühe, 1901 might also be identical; and Overstreet (1970) considered *L. musteli* Srivastava, 1966 a synonym of *L. confusus*. The range of egg size from *L. confusus* reported here and by Reimer (1970) corroborate the latter synonymy. Yamaguti (1971) stated that *Dichadena acuta* Linton, 1910, considered to be *L. acutus* by Manter (1947) and a synonym of *L. gibbosus* by Zhukov (1960), does not have a lobed ovary or a cyclocoel intestine and that it is distinct from the *D. acuta* reported by Siddiqi & Cable (1960) from surgeonfishes. The specimens of Linton (1910), Manter (1947), Cable & Nahhas (1963), and Nahhas & Cable (1964) also came from surgeonfishes.

***Lecithaster leiostomi* Overstreet, 1970**
(Figure 2)

Based on 20 mounted specimens from *Menidia beryllina*: Body 459–1,259 long by 116–379 wide; widest at acetabular level. Oral sucker 40–90 long by 47–120 wide. Acetabulum 67–155 by 70–177. Sucker width ratio 1:1.4–1.9. Ratio of acetabular width to body length 1:5–9. Forebody 19–35% (one specimen 45%) of body length. Pharynx 29–67 long by 30–70 wide. Left testis 37–145 long by 44–103 wide. Right testis 64–215 by 44–114. Ovary 61–229 long by 51–206 wide, its center 47–72% of body length from anterior end of body. Vitellarium either larger or smaller than ovary; lobes roughly same size as those of ovary. Postvitelline space 3–30% of body length. Eggs 17–32 long by 10–18 wide in mounted specimens, 23–29 by 15–20 in two living worms.

Hosts: **Paralichthys lethostigma* Jordan & Gilbert, southern flounder (Bothidae); **Urophycis floridanus* (Bean & Dresel), southern hake (Gadidae); *Leiostomus xanthurus* Lacépède, spot (Sciaenidae); and **Menidia beryllina* (Cope), tidewater silverside (Atherinidae).

Site: Intestine.

Localities: Mississippi Sound and adjacent waters.

Specimen deposited: USNM Helm. Coll. No. 72306 (from *M. beryllina*).

Discussion

Specimens from all hosts except *Menidia beryllina* agree with those used for the original description and have an acetabular width to body length ratio of 1:4–7. Measurements of specimens from *M. beryllina* overlap those in the original description and are listed separately above to extend the ranges and to avoid confusion should the worms later be shown to represent a separate species. All the specimens have the characteristic elongated seminal vesicle. Some measured worms from the tidewater silverside differ from those of the spot in the original description by having a longer body, shorter forebody, longer postvitelline space, and smaller average egg size. The most obvious difference is the usually longer postvitelline space.

Specimens from both hosts were examined alive to determine if differences were apparent. In those from both the silverside and spot, the wall of the sinus sac was difficult to

perceive; and male and female ducts entered a usually expanded, nonepitheliated, spherical to oval-shaped vesicle which was part of the hermaphroditic duct. There was considerable fibrous tissue surrounding the organs within the sac rather than a cavity containing the small prostatic-like cells found in some species. Overstreet (1970) in the original description stated "[prostatic] complex approximately same size as pharynx." This statement is misleading because the complex was usually larger in both the original and the present material. The lateral margins of the acetabular opening became protruded dynamic flaps when filled with body fluid. Figure 2 illustrates a fixed acetabulum with the flaps and numerous sensory papillae. The appearance was similar in worms from both hosts. The excretory vesicle in flukes from the silverside usually bifurcated at or below the testicular level rather than at the acetabular level, but the location was variable. In specimens examined alive from several silversides, the anterior portion of the ceca extending to or just posterior to the acetabular level was opaque because of a granular substance within the epithelial cells. A specimen from one spot revealed the same condition, but numerous others from two different spots at a later date did not. In fact, the only consistent difference between specimens from the two hosts was the color of live mature eggs. Eggs from worms in *M. beryllina* were golden tanned, whereas those from worms in spot were yellowish. Eggs from both sources have inconspicuous "plugs." It remains to be tested whether the differences are of specific magnitude or caused by host influence.

A specimen from *M. menidia* in North Carolina, referred to as *L. gibbosus* by Manter (1931), was lent by Mrs. Mary H. Pritchard and is considered by me to be misidentified and actually a synonym of *L. leiostomi*.

***Lecithaster helodes* n. sp.**
(Figure 3)

Description based on two living and 18 mounted mature specimens with single measurements for holotype and ranges for all specimens following in parentheses: Body fusiform, 870 (348–951) long by 293 (131–293) wide; widest at acetabular level. Tegument devoid of spines; with at least four pairs of papillae near mouth, three on anterior forebody and three on acetabulum; with wide, median, non-glandular pit between genital pore and acetabulum. Oral sucker subterminal, 64 (35–70) long by 78 (42–81) wide. Acetabulum 174 (102–239) long by 205 (113–223) wide, slightly elevated. Sucker width ratio 1:2.6 (1:2.5–3.0). Ratio of acetabular width to body length 1:4 (1:3–5). Forebody 28% (24–32%, 42% in one specimen) of body length (averaging 28%). Prepharynx absent. Pharynx 67 (39–75) long by 87 (45–87) wide, larger than oral sucker, with several elongated vesicles associated with posterior end; vesicles directed laterally and anteriorly, approximately as long as pharynx. Esophagus ranging from shorter to longer than pharynx. Intestinal bifurcation usually just posterior to pharynx. Ceca terminating 20 and 23 (between 11 and 31)%; of body length from posterior end of body, not necessarily posterior to vitellarium.

Testes ovoid, symmetrical or occasionally diagonal, separated or contiguous, at or near posterior border of acetabulum; left testis 87 (38–107) long by 67 (30–104) wide; right testis 73 (49–99) by 69 (38–104). Sperm with almost inconspicuous body; tails in living specimen 165–185 long, unmeasurable tails longer. Seminal vesicle saccular, dorsal to acetabulum,

rarely extending to posterior acetabular border. Pars prostatica often sinuous; anterior portion shorter than pharynx, epitheliated, inconspicuous in most mounted material; posterior portion longer than pharynx, lined with vesicular cells, surrounded by large but not always distinct prostatic cells; whole complex much larger than pharynx. Sinus sac oval to elongate depending on contraction; containing muscular epitheliated hermaphroditic duct without enclosed posterior prostatic vesicle; proximal portion more muscular, usually narrower; male and female ducts uniting at base of sac, minute villi on extruded duct. Genital pore median or submedian, usually near level of bifurcation of intestine.

Ovary 160 (87–177) long by 131 (52–186) wide, its center 63 (47–66)% of body length from anterior end (73% in specimen with reversed ovary and vitellarium), near or contiguous with testes and vitellarium, anterior to vitellarium in all but one specimen, deeply 4-lobed; lobes usually elongate, but rarely more than two times longer than wide. Vitellarium rosette-shaped, approximately same size as ovary, with seven lobes usually oval in shape; lobes less massive and elongate than those of ovary. Postvitelline space 20 (19–35)% of body length. Seminal receptacle ovoid, ranging in size from smaller to larger than ovary, entirely or partially in ovarian zone. Uterus filled with eggs, occupying most of hindbody, usually extending posteriorly to end of body. Eggs 17–20 (16–21) long by 9–12 (9–12) wide (17–23 by 12–15 in living material).

Excretory vesicle proper usually extending to acetabular level; arms narrow, not united, pore terminal.

Type host: *Mugil curenia* Valenciennes, white mullet (Mugilidae).

Other host: *Mugil cephalus* Linnaeus, striped mullet (Mugilidae).

Site: Intestine.

Localities: Mississippi Sound and adjacent waters.

Holotype: USNM Helm. Coll. No. 72308; paratype: No. 72309.

The specific name *helodes* refers to the marshy habitat in which the worm and its host are found even though the habitat is not unusual for hosts of other species of *Lecithaster*.

Discussion

The most distinctive characteristic of this species is the relatively large pharynx. *Lecithaster mugilis* Yamaguti, 1970 from *Mugil cephalus* in Hawaii is the most similar species. It differs from *L. helodes* primarily by possessing an ovary with three rather than four lobes and an acetabulum that usually projects itself forward beyond the oral sucker. Apparently a pit is not present in the forebody. Both trematodes are known only from mullet.

***Hysterolecitha elongata* Manter, 1931**
(Figure 4)

Host: *Mugil cephalus* Linnaeus, striped mullet (Mugilidae).

Site: Stomach.

Locality: Escatawpa River, near Pascagoula, Mississippi.

Discussion

A single 5.21-mm-long specimen has a sucker width ratio of 1:1.7 (oral sucker 284 μ long by 336 μ wide; acetabulum 494 by 557 μ), eggs 20–26 μ long by 12–14 μ wide, and a genital pore posterior to the pharynx. Some characters differ slightly from Manter's (1931) original description. Minute plications are apparent on the tegument dorsal to the oral sucker. An esophagus is present which is shorter than, and located adjacent to, the pharynx. The vitelline lobes are contiguous with the ovary and in groups of four anterior and three posterior. I noted these differences on a mounted paratype and a sectioned specimen loaned by Mrs. Mary Hanson Pritchard. The anterior end of my worm (Fig. 4) shows the tegumental plications and numerous sensory papillae. At least four large papillae are present about the acetabulum. The presence of tegumental plications, a character noted by Manter (1970) as present in both *H. elongata* and *H. trilocalis* King & Noble, 1961, makes both species atypical members of the subfamily Lecithasterinae Odhner, 1905 in the broad sense of Manter & Pritchard (1960).

Manter & Pritchard (1960) and Manter (1970) reexamined certain features of type specimens of *H. elongata*, Pearse (1949) reported its presence in *M. cephalus* from Beaufort, North Carolina, and Travassos et al. (1967) hesitantly described specimens from *M. platanus* Guenth in Brazil. The Brazilian specimens apparently differ from North American ones by having larger suckers, a longer forebody, larger eggs (27–33 μ long by 13–15 μ wide), numerous prostatic cells within the sinus sac, and a genital atrium. The description and figure by Travassos et al. (1967) suggest a true rather than uterine seminal receptacle, an organ lacking in most species of *Hysterolecitha* Linton, 1910 (see King & Noble, 1961), but not considered by Yamaguti (1971) in his treatment of this genus. I cannot determine with certainty the type of receptacle on the North American material. If the above differences remain after additional specimens from both areas are examined, the Brazilian material should be considered as a separate species.

***Aponurus pyriformis* (Linton, 1910) n. comb.**
(Figures 5–7)

Hosts: *Micropogon undulatus* (Linnaeus), Atlantic croaker (Sciaenidae); **Leiostomus xanthurus* Lacépède, spot (Sciaenidae).

Site: Stomach.

Localities: Mississippi Sound and adjacent waters.

Specimen deposited: USNM Helm. Coll. No. 72307 (from *M. undulatus*).

Discussion

Linton (1910) originally described *Brachadena pyriformis* from *Haemulon macrostomum* Gi-inther, *H. plumieri* (Lacépède), *H. sciurus* (Shaw), and *Calamus calamus* (Valenciennes) in Florida. Twelve of my specimens of *B. pyriformis* from Biscayne Bay, Florida (Overstreet, 1969), from *H. carbonarium* Poey, *H. parrai* (Desmarest), *Anisotremus virginicus* (Linnaeus), and *C. bajonado* (Bloch & Schneider) range between 0.68 and 1.58 mm long with a sucker width ratio between 1:2.2 and 1:3.4, and eggs 29–39 μ long by 17–23 μ wide. There is no genital atrium, in the sense of an area consistently separated from the sinus sac; the testes

are located symmetrically or diagonally; the hermaphroditic duct is shorter than the pars prostatica; the excretory arms unite dorsal to the oral sucker; and the vitelline lobes are not united centrally as previously assumed. The vitelline lobes are arranged in two groups, typically with four anteriorly and three posteriorly. In one of the twelve specimens these are reversed and in two there are eight lobes, one with five and three and the other with four and four. The sinus sac may be oval, pyriform, or elongate and the hermaphroditic duct straight or sinuous, with a typically evident posterior swelling lined with villi similar to that lining all but the distal-most portion of the duct, which is more muscular and eversible.

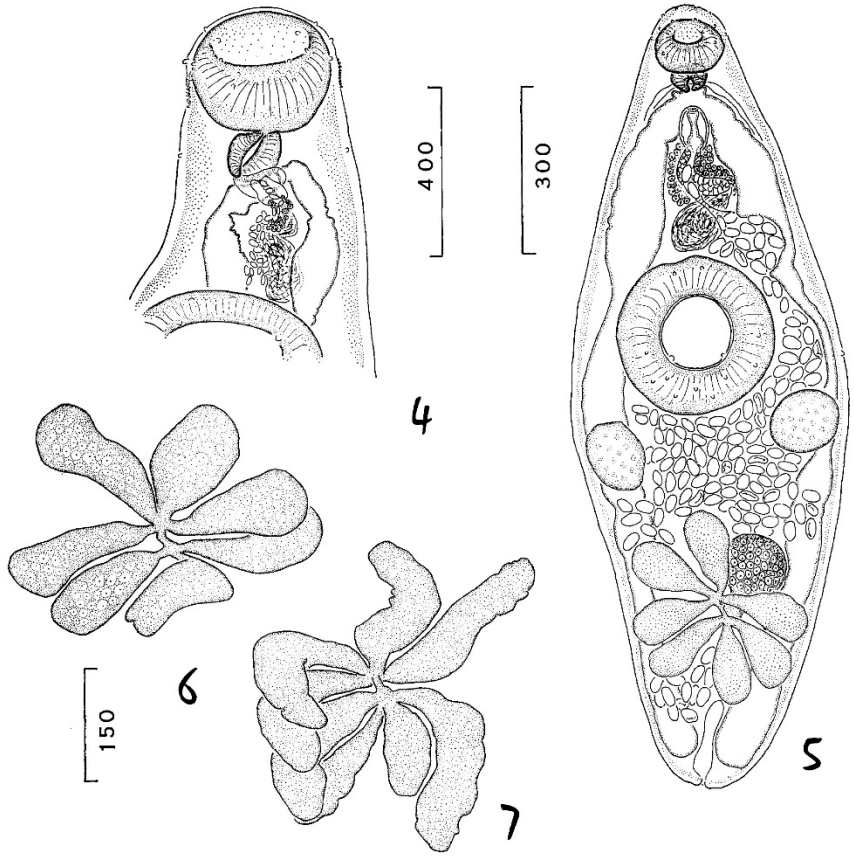

Figure 4. *Hysterolecitha elongata* from Mugil cephalus, anterior end of body, ventral view. **Figures 5–7.** *Aponurus pyriformis*. **Figure 5.** From *Micropogon undulatus*, whole mount, ventral view. **Figure 6.** From *Calamus bajonado* in Biscayne Bay, Florida, vitelline lobes, ventral view. **Figure 7.** From *Haemulon carbonarium* in Biscayne Bay, Florida, vitelline lobes, dorsal view. The last two figures are in the same scale. Scale values are micra.

Six specimens from the Atlantic croaker and one from the spot from Mississippi Sound are between 0.79 and 1.74 mm long with eggs 30–44 μ long by 14–22 μ wide. They compare

well with those from Florida except the sucker width ratio averages 1:2.3 rather than 1:3.0, and they are a little more elongated. The vitellaria in these specimens are typical.

Nahhas & Cable (1964) reexamined types of *Aponurus symmetrorchis* Siddiqi & Cable, 1960 and considered the species a synonym of *B. pyriformis* because the vitelline lobes united centrally. My specimens from Florida are from similar hosts and the lobes do not unite centrally. Fischthal & Kuntz (1964) reported observing a "very small genital atrium" in one of Linton's (1910) specimens. I found that when a worm is bent, folds of tegument appear as an atrium. In any event, the area is not elongated.

Margolis (1958) reviewed the genera *Lecithophyllum* Odhner, 1905, *Aponurus* Looss, 1907, and *Brachadena* Linton, 1910. He based *Brachadena* on its species possessing vitellaria with centrally united lobes and distinguished species of *Lecithophyllum* from those of *Aponurus* solely by their possession of a well-developed genital atrium. Using primarily this classification scheme, I transfer *B. pyriformis* to the genus *Aponurus* making *A. pyriformis* a new combination. Since *B. pyriformis* was the type species of *Brachadena*, *Brachadena* becomes a synonym of *Aponurus*. Yamaguti (1971) had previously allocated other species of the genus since he considered *A. pyriformis* in the genus *Lecithophyllum*.

Other characters that have been used in the past to distinguish species of *Aponurus* from those of *Lecithophyllum* are eggs shorter than 55 μ, a hermaphroditic duct shorter than the pars prostatica (see Manter, 1947), testes diagonal rather than symmetrical or subsymmetrical, a hermaphroditic duct without a separate proximal portion, a well-developed sinus sac (see Yamaguti, 1971), and rounded rather than club-shaped vitelline lobes (see Schell, 1970). *Lecithophyllum cheilionis* (Fischthal & Kuntz, 1964) Yamaguti, 1971 (= *B. cheilionis*) is a good example of a species with characteristics of both genera.

It would probably be most convenient to consider *Aponurus* a synonym of *Lecithophyllum*, but until more information is known about species of the two genera, as well as those of *Lecithaster* and *Hysterolecitha*, I accept all the genera.

The characters used by Yamaguti (1971) to differentiate subfamilies encompassed as Lecithasterinae Odhner, 1905 by Manter & Pritchard (1960) do not form natural nor morphologically consistent units. On the other hand, Manter & Pritchard (1960) probably include too many genera in the subfamily. Below is an illustration of some of the confusion that exists at the subfamilial level. Yamaguti (1970, p. 146) examined specimens of *A. acanthuri* Manter & Pritchard, 1960, described a short genital atrium in that species, and transferred it to *Lecithophyllum* on the basis of its possessing a hermaphroditic vesicle. Earlier, on pages 143 and 144, he described *A. priacanthi* Yamaguti, 1970 in the subfamily Hysterolecithinae Yamaguti, 1958 and considered that species most closely related to *A. acanthuri*, the species he later transferred to the subfamily Lecithophyllinae Skrjabin & Guschanskaja, 1954.

Aponurus pyriformis has been reported from, and in waters adjacent to, the Atlantic Ocean, Pacific Ocean, Caribbean Sea (see ICMVZ, 1963 for some of the references), and the Gulf of Mexico (Corkum, 1959; Nikolaeva & Parukhin, 1968). Manter (1931) reported it from the Atlantic croaker in North Carolina. After examining the descriptions and illustrations of *Leurodera ocyri* Travassos, Freitas & Biihrnheim, 1965 and *L. inaequalis* Travassos, Freitas & Biihrnheim, 1966, I consider both to be synonyms of *A. pyriformis*. Members of

the genus *Leurodera* Linton, 1910 should have vitellaria comprised of two compact masses and a seminal vesicle which is elongated.

Aponurus elongatus Siddiqi & Cable, 1960

Host: *Chaetodipterus faber* (Broussonet), Atlantic spadefish (Ephippidae).
Site: Stomach.
Locality: Mississippi Sound, Mississippi.

Discussion

A single specimen 1.36 mm long was found. It is slightly unusual in having a forebody 30% and postovarian space 28% of the body length and a sucker width ratio of 1:1.8. There is a short genital atrium and the posterior portion of the hermaphroditic duct is swollen and lined with microvilli, characters which suggest the species belongs in the genus *Lecithophyllum*. Since, however, the sinus sac has a thick wall and contains small prostatic-like cells, as well as the worm possessing small eggs, diagonal testes, and other minor characteristics of "Aponurus," I see no reason to transfer the species.

Nahhas & Short (1965) and Overstreet (1969) discussed variation in this trematode.

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