NINE DIGENETIC TREMATODES OF MARINE FISHES FROM THE ATLANTIC COAST OF PANAMA[1]

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Studies of the geographical distribution of marine Digenea in recent years have given rise to speculation regarding similarities of the trematode faunas from both American continental oceans. The first important studies attempting to explain the geographical distribution of American marine Digenea were by Manter (1934, 1940a, 1947, 1954, 1955). Several workers, mainly Hanson (1950), Siddiqi and Cable (1960), Sogandares (1959), Sparks (1957, 1958, 1960), and others, have also studied the geographical distribution of American marine trematodes. The area of the formerly submerged Isthmus of Panama, the most recent continuity between the American Atlantic and Pacific Oceans, has figured prominently in explanations regarding the similarities of the trematode faunas.

Previous collections of marine Digenea from Panama were made on the Pacific coast only. Almost the entire body of literature on Atlantic Digenea, on which comparisons with the Pacific Digenea are based, represents studies in coastal waters of Maine, Massachusetts, North Carolina, Florida, and Louisiana; and in the islands of Bermuda; Tortguas, Florida; Bimini and Nassau, Bahamas; and Puerto Rico. In view of the relatively recent connection of the two oceans at the Isthmus of Panama we made at least a preliminary sampling of the Digenea of the Atlantic coast in this area.

The following digenetic trematodes were collected from the Atlantic coast of Panama during August, 1960. Unless otherwise specified all measurements are in millimeters.

Family BUCEPHALIDAE

Bucephaloides arcuatus (Linton, 1900) Hopkins, 1954

(figs. 1 to 7)

Host.—*Sphyraena barracuda* (Walbaum); great barracuda; family Sphyraenidae.

Incidence of infection.—In 1 of 1 host.

Location.—Pyloric ceca.

Locality.—Colon Reef, Republic of Panama [new locality record].

Discussion.—Linton (1900) named and described *Gasterostomum arcuatum* from *Sarda sarda* (Bloch) in Woods Hole, Massachusetts. He also (1905) reported the species from *Scomberomorus regalis* (Bloch) in Beaufort, North Carolina. In another report Linton (1910) briefly described (pp. 80-81; figs. 223-225) three species under the name *Gasterostomum* sp. from the great barracuda in Tortugas, Florida. Manter (1940b) reported *Bucephalopsis arcuatus* (Linton, 1900) Eckmann, 1932 from *Sphyraena barracuda* in Tortguas, Florida, pointing out that Linton's (1910) *Gasterostomum* sp. from the barracuda was confused with at least two species, *Bucephalopsis longoviferus* Manter, 1940 and *Bucephalopsis arcuatus*. Linton (1910) had confused three species under the name *Gasterostomum* sp. His figures 223 and 224 respectively probably represent *Bucephaloides arcuatus* (Linton, 1900) Hopkins, 1954 and *Bucephaloides longoviferus* (Manter, 1940b) Hopkins, 1954, while his figure 225 is probably a species of *Bucephalus* Baer, 1826. In 1932 Eckmann transferred *Gasterostomum arcuatum* Linton, 1900 to the genus *Bucephalopsis* Diesing, 1855. Apparently unaware of Eckmann's (1932) combination, Linton (1940) subsequently reported *Gasterostomum arcuatum* from *Sarda sarda, Scomber scombrus* Linn., *Trichiurus lepturus* Linn., and *Gadus morrhua* Linn., in Woods Hole, Massachusetts. Hopkins (1954) reserved the genus *Bucephalopsis* for a larval bucephalid trematode, *Cercaria haimeana* La Caze-Duthiers, naming the genus *Bucephaloides* for all other species formerly in *Bucephalopsis*. Sogandares (1959) reported *Bucephaloides arcuatus* from *Sphyraena barracuda* in Bimini, Bahamas. Siddiqi and Cable (1960) reported *Bucephalopsis arcuatus* from the same host in Puerto Rico. Yama-

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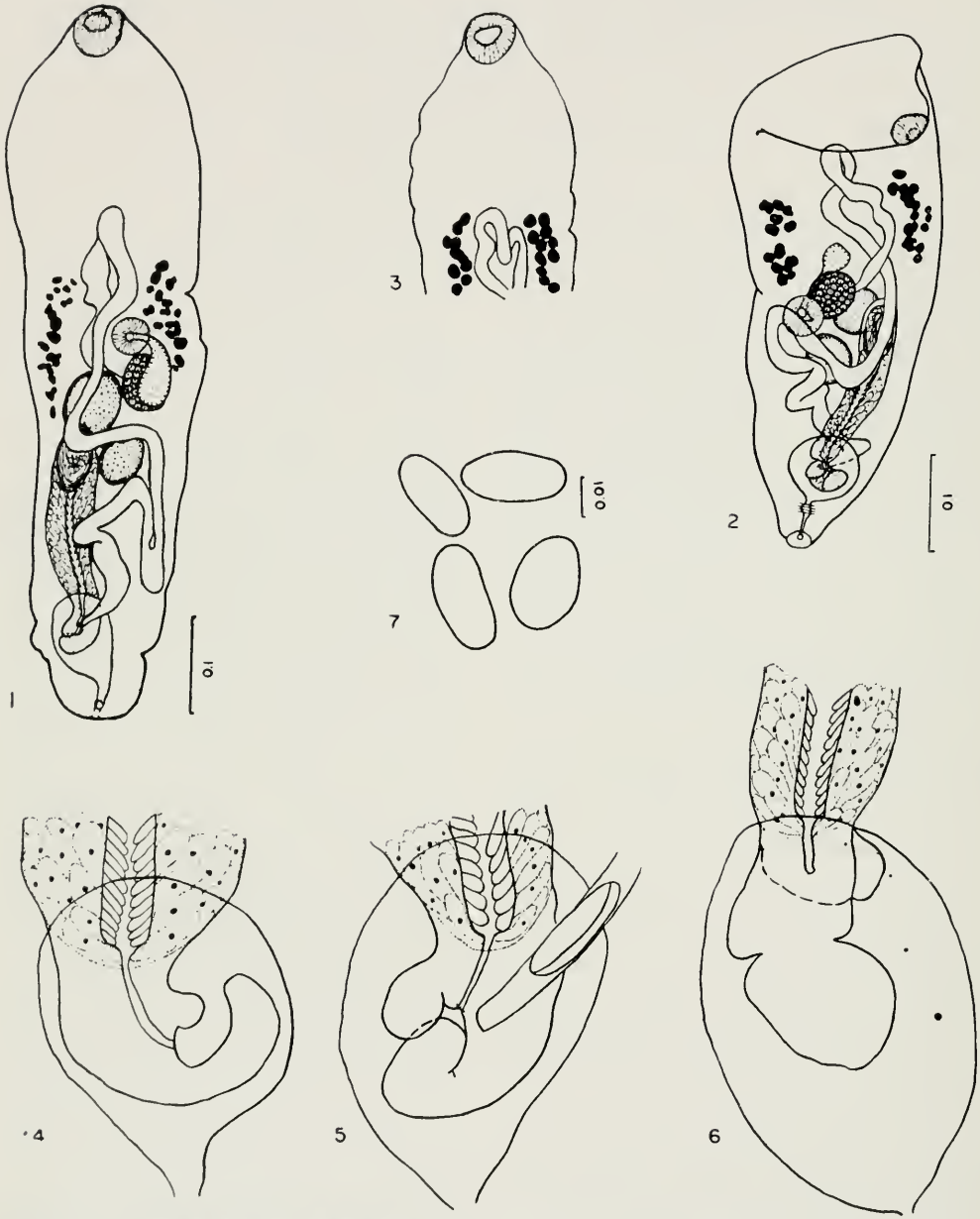


Figures 1-7. *Bucephaloides arcuatus.* **1, 2.** Dorsal and ventral views of whole mounts. **3.** Ventral view of anterior portion of forebody. **4, 5.** Central and dorsal views of genital atrium showing genital lobe and portion of cirrus sac. **6.** Dextrolateral view of genital atrium showing genital lobe and portion of cirrus sac. **7.** Uterine eggs. Unless otherwise specified, all figures were drawn with the aid of a Leitz camera lucida for inclined microscopes. The projected scale has the approximate value in millimeters.

guti (1958) regarded *Bucephaloides* a synonym of *Bucephalopsis.* Since we do not know into what genus *Cercaria haimeana* will develop, Hopkins' (1954) views will be followed until evidence proves otherwise.

The Panama specimens of *B. arcuatus* have eggs resembling those of *B. longoviferus,* most eggs (fig. 7) measuring from

26 to 29 by 9 microns. One egg (fig. 7) measured about 24 by 17 microns. The Panama specimens differ from *B. longoviferus* in details of the genital lobes (figs. 4-6) and a uterus that never extends posteriorly beyond the genital atrium (figs. 1, 2) or to the anterior sucker (figs. 1-3). The Panama specimens differ from Manter's (1940b) redescription of *B. arcuatus* mainly in egg size, in the more anterior extent of the uterus, and by possessing more vitelline follicles. Egg size is a variable character in certain bucephalids and cannot usually be relied upon to show species differences. The anterior extent of the uterus is sometimes a more reliable systematic character. The anterior uterine extent of our specimens (figs. 1-3) intergrades with Manter's (1940b) redescription of *B. arcuatus* and extends the range. The number of vitelline follicles is difficult to count in our material because we cannot be sure if what frequently appears to be a separate follicle overlapping another follicle, is in reality a single branched follicle, or one which is cytolized. Further study of live *B. arcuatus* from the Panama Atlantic and more northern waters may show that there are actually three species of *Bucephaloides* in *Sphyraena barracuda*. The present evidence seems to indicate that we are probably dealing with a different population of *B. arcuatus*.

Family OPECOELIDAE
Subfamily Plagioporinae
Hamacreadium mutabile Linton, 1910
(figs. 8 to 15)

Host.—*Ocyurus chrysurus* (Bloch); yellow-tail; family Lutjanidae.

Incidence of infection.—In 2 of 2 hosts.

Location.—Intestine.

Locality.—Galeta Point, Republic of Panama [new locality record].

Discussion.—*Hamacreadium mutabile* was reported from *Lutjanus griseus* (Linn.), *L. apodus* (Walbaum), and *Anisotremus virginicus* (Linn.) at Tortugas, Florida by Linton (1910). While at Tortugas, McCoy (1929, 1930) experimentally obtained adults of *H. mutabile* from *Lutjanus griseus* and *Ocyurus chrysurus*. Manter (1947) also reported the following additional hosts for *H. mutabile* at Tortugas: *Lutjanus jocu* (Bloch and Schneider), *L. analis* (Cuv. and Val.), and *L. synagris* (Linn.). In another paper Manter (1940c) reported *H. mutabile* from *Lutjanus viridis* (Val.) and ? *Mycteroperca xenarcha* Jordan in the Galapagos Islands. Sogandarés (1959) reported *H. mutabile* from *Epinephelus striatus* (Bloch), *Haemulon sciurus* (Shaw), *Lutjanus synagris*, and *Petrometopon cruentatus* (Lacépède) in Bimini, Bahamas. Siddiqi and Cable (1960) reported *H. mutabile* from *Lutjanus analis*, *L. jocu*, *L. griseus*, *L. apodus*, and *Ocyurus chrysurus* in Puerto Rico. They also described two new species, *Hamacreadium lintoni* from *Epinephelus striatus* and *Cephalopholis fulvus*, and *H. longisaccum* from *Epinephelus adscensionis* in Puerto Rico. The descriptions of *H. lintoni* and *H. longisaccum* both fall within the range of variation observed for *H. mutabile*. Furthermore, *H. mutabile* is known from *Epinephelus striatus* in Bimini, Bahamas. Nagaty (1941) reported *H. mutabile* from *Serranus merra* (Bloch) (= *Epinephelus merra*), *Lethrinus mahsena* Forsk., *L. nebulosus* Cuv. and Val., *Teuthis marmorata* Günther, and *Lutjanus fluviflamma* (Forsk.) (= *Diacope fluviflamma*) in the Red Sea. He also believed *Hamacreadium epinepheli* Yamaguti, 1934, from *Epinephelus akaara* Temm. and Schl. and *Lethrinus haematopterus* Temm. and Schl. in Japan, to be a synonym of *H. mutabile*.

H. mutabile has been reported from at least nineteen different host species of which about 42 percent are in the family Lutjanidae, 26 percent in the Serranidae, 15.7 percent in the Lethrinidae, 10.52 percent in the Pomadasyidae, and 5.25 percent in the Acanthuridae. The major host groups are the lutjanids, serranids and lethrinid fishes. The pomadasyids and acanthurids are possibly accidental hosts of *H. mutabile*, though the pomadasyids are related to the lutjanids, serranids and lethrinids.

Our specimens of *H. mutabile* have only slightly lobed or smooth testes and the ovaries are either smooth or deeply lobed (figs. 8-15). The cirrus sac does not overlap the acetabulum in one preadult (fig. 12) and usually comes into contact with or overlaps the acetabulum by about half its length in adults (figs. 8-10), and preadults (figs. 11, 13-14), extending to beyond the posterior border of the acetabulum in one adult contracted specimen (fig. 15). The genital pore position of our 12 *H. mutabile*

Figures 8-14. *Hamacreadium mutabile*. **8, 9.** Ventral views of whole mounts. **10.** Dorsal view of much contracted specimen. **11-14.** Ventral views of preadults showing variation in posterior extent of cirrus sac.

specimens is sinistral. The esophagus varies considerably in length, depending mainly upon the degree of contraction of the forebody (figs. 8-15). The vitellaria of our specimens are almost always confluent in the region of the cecal bifurcation. The excretory vesicle usually extends to the cecal bifurcation.

Yamaguti (1958) lumped several families of trematodes under the name Allocreadiidae. We are not following Yamaguti because the opecoelid trematodes, while showing similarities with adult allocreadiids, are a well defined group with cotylomicrocercous cercariae. Also, we are not entirely in agreement with the more recent views of Dollfus

(1960) who split the Opecoelidae into several families. The more conservative views of Manter (1947) and of Cable (1956) are followed here.

Family HAPLOSPLANCHNIDAE
Haplosplanchnus (Schikhobalotrema) acutus
(Linton, 1910) Manter, 1937
(fig. 16)

Host.—*Abudefduf saxatilis* (Linn.); sergeant-major; new host record; family Pomacentridae.

Incidence of infection.—In 1 of 1 host.

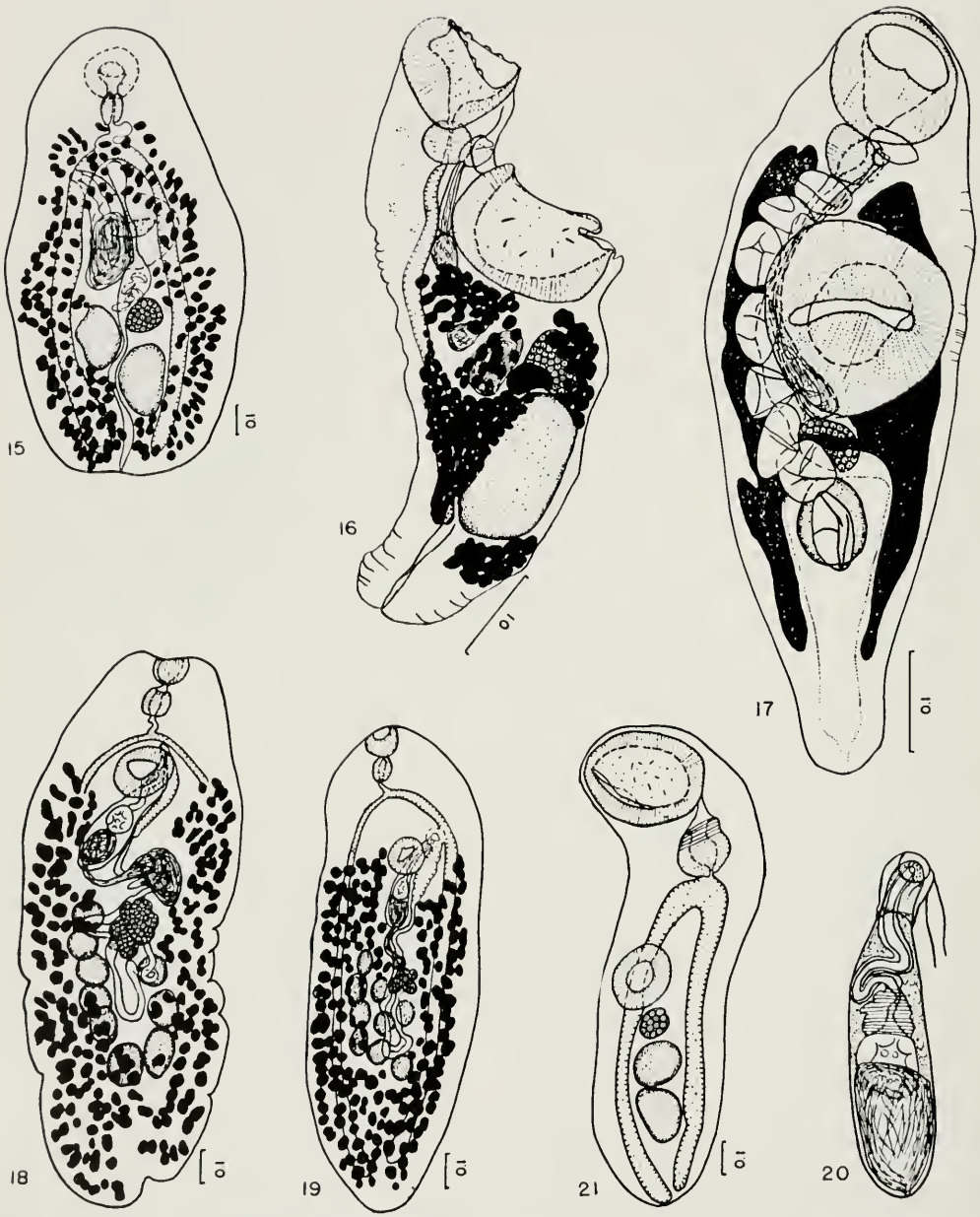
Location.—Intestine.

Locality.—Galeta Point, Republic of Panama [new locality record].

Discussion.—Sogandares (1959) pointed out that *H. acutus* is a parasite of needlefishes (family Belonidae) and reviewed the occurrence of this species in different hosts and localities. The record of *H. acutus* by Manter (1940c) from *Kyphosus elegans* (Peters) in the Galapagos Islands, by Sogandares (1959) from *Thyrinops pachylepis* (Günther) in Panama Bay, and from *Abudefduf saxatilis* in the Panama Atlantic probably represent accidental infections since only one specimen was found in each case.

Our specimen from *A. saxatilis* had no eggs in the uterus, though it agreed in all details with material of the same species from Bimini, Bahamas and Panama Bay.

The Russian workers Skrjabin and Guschanskaja (1955) named the genus *Schikhobalotrema* for *Haplosplanchnus acutus* (Linton, 1910) Manter, 1937, and synonymized *Laruea* Srivastava, 1939 with *Haplosplanchnus* Looss, 1902. Manter (1957) independently arrived at the same conclusions utilizing somewhat different criteria from those of Skrjabin and Guschanskaja (1955). Yamaguti (1958) recognized *Schikhobalotrema*, but regarded *Laruea* a valid genus. Siddiqi and Cable 1960 recognized *Schikhobalotrema* with some reservations even though they named two new species and reported three others in this genus. These authors stated that, while they accepted Skrjabin's and Guschanskaja's arrangement, it would not be surprising to find intermediate species which would invalidate *Schikhobalotrema*. Skrjabin and Guschanskaja (1955) believed that *Schikhobalotrema* could be separated from *Haplosplanchnus* on the basis of the anterior reduction of the vitellaria, presence of a ventral acetabular peduncle, and a poorly developed seminal vesicle in the latter genus. Manter's (1957) views were that *Haplosplanchnus pachysomus* (Eysenhardt, 1829) Looss, 1902 (type species), *H. purii* Srivastava, 1939, and *H. caudatum* (Srivastava, 1939) Skrjabin and Guschanskaja, 1955 (= *Laruea caudata*), all occur in mullets (genus *Mugil* Linn.), possess uterine eggs with occulate miracidia, and have greatly reduced vitellaria. He also suggested that the other species of *Haplosplanchnus*, forms occurring in acanthurid, spariosomid (= family Scaridae), scarid and girellid fishes, with extensive follicular vitellaria, "(which tend to become tubular as happens in the Haploporidae)", and have uterine eggs with undeveloped embryos, should probably be placed in a separate genus. He did not name a new genus for these forms. Manter (1957) was unaware of Skrjabin and Guschanskaja (1955) because at that time political boundaries precluded free exchange of scientific information between Russian and American scientists. The fact remains that the different authors arrived at the same conclusions independently and through the use of different criteria. We have examined many live and preserved specimens of *H. acutus*, (type species of *Schikhobalotrema*), from needlefishes in Bimini, Bahamas. The vitellaria of *H. acutus* are frequently diffuse and poorly developed anteriorly. While there is a tendency for the vitellaria to become tubular in some species of *Haplosplanchnus*, as Manter (1957) suggests, the species of this genus show various degrees of intergradation of this character. We do not believe that the developmental rate of uterine eggs with occulate miracidia should have generic value, at least until we know if fully developed and passed eggs of *H. acutus* also possess occulate miracidia. The fact that the species with occulate miracidia in the uterine eggs coincidentally occur in *Mugil* spp. may indeed be suggestive that these species are closely related, yet not necessarily generically distinct from other species in which the miracidia in the uterine eggs have not developed completely. The only life history study in the Haplosplanchnidae is that of *H. acutus* by Cable (1954) and he was unable to observe (or at least did not report) fully embryonated eggs of this species. The



Figures 15-21. **15.** *Hamacreadium mutabile,* dorsal view of much contracted specimen. **16.** *Haplosplanchnus* (*Schikhobalotrema*) *acutus,* dextrolateral view of whole mount. **17.** *Haplosplanchnus* (*Schikhobaloterma*) *pomacentri,* ventral view of whole mount. **18.** *Multitestis chaetodoni* from *Chaetodon ocellatus,* ventral view. **19.** *Multitestis chaetodoni* from *Chaetodon capistratus,* ventral view. **20.** *Multitestis chaetodoni* from *Chaetodon capistratus,* sketch of cirrus sac showing preprostatic muscular bulb when confused with anterior prostatic vesicle. **21.** *Neoapocreadium coili,* ventral view of a mechanically excysted metacercaria.

length of the acetabular peduncle and poorly developed seminal vesicle are characters which vary in degree only, thus could hardly be considered generic. Another view is that the overlap of certain characters between the species of *Schikhobalotrema* and *Haplosplanchnus* gives further evidence of the closeness of relationship between the two genera. The question remains at present a matter of opinion.

Precluding a knowledge of life histories, when closely allied species groups of adult trematodes show morphological intergradation allowing partial but not complete segregation of these groups (clear-cut characters found in only one species group), we prefer to regard these species groups as subgenera. A moderate approach in naming genera eliminates the need of hastily erecting higher categories (often with insufficient evidence) such as subfamilies which may later tend to confuse the issue. Subgenera have permanent status in nomenclature and show relationships of the species groups without the necessity of creating higher categories.

We presently recognize the following disposition of the species of *Haplosplanchnus:* (1) subgenus *Haplosplanchnus, H. (H.) pachysomus* (Eysenhardt, 1829) Looss, 1902, *H. (H.) purii* Srivastava, 1939; (2) subgenus *Laruea, H. (L.) caudatum* Srivastava, 1939; and (3) subgenus *Schikhobalotrema, H. (S.) acutus* (Linton, 1910) Manter, 1937, *H. (S.) adacutum* Manter, 1937, *H. (S.) brachyurus* Manter, 1937, *H. (S.) girellae* Manter and Van Cleave, 1951, *H. (S.) kyphosi* Manter, 1947, *H. (S.) obtusum* (Linton, 1910) Manter, 1937, *H. (S.) pomacentri* Manter, 1937, and *H. (S.) spariosomae* Manter, 1937.

As Manter (1957) suggested, the haploporids may be related with the haplosplanchnids. Adult specimens of both families sometimes possess sensory papillae on the oral suckers, and except for the presence of a single cecum in *Haplosplanchnus* and a hermaphroditic sac in *Haploporus* Looss, 1902, are similar. We do not know the significance of the similarities between these families. The similarities may represent convergence which is frequently encountered in the Digenea.

Haplosplanchnus (Schikhobalotrema) pomacentri Manter, 1937
(fig. 17)

Host.—Pomacentrus leucostictus Müller and Troschel, beau gregoire; and *Pomacentrus planifrons* (Cuv. and Val.); *petite jacquette*, new host record; family Pomacentridae.

Incidence of infection.—In 1 of 4 *P. leucostictus* and 2 of 2 *P. planifrons.*

Location.—Intestine.

Locality.—Galeta Point, Republic of Panama [new locality record].

Discussion.—H. pomacentri formerly was known only from fishes of the genus *Pomacentrus;* from Tortugas, Florida, in *P. leucostictus* and *P. xanthurus* Poey, (Manter, 1937, Manter, 1947), and from Galapagos Islands, in *P. rectifraenum* Gill, (Manter, 1940c).

One specimen of *H. pomacentri* in our collection lacks a testis.

Family LEPOCREADIIDAE
Subfamily Lepocreadiinae
Multitestis chaetodoni Manter, 1947
(figs. 18-20)

Hosts.—Chaetodon capistratus Linn.; four-eyed butterfly fish; and *Chaetodon ocellatus* Bloch; common butterfly fish; family Chaetodontidae.

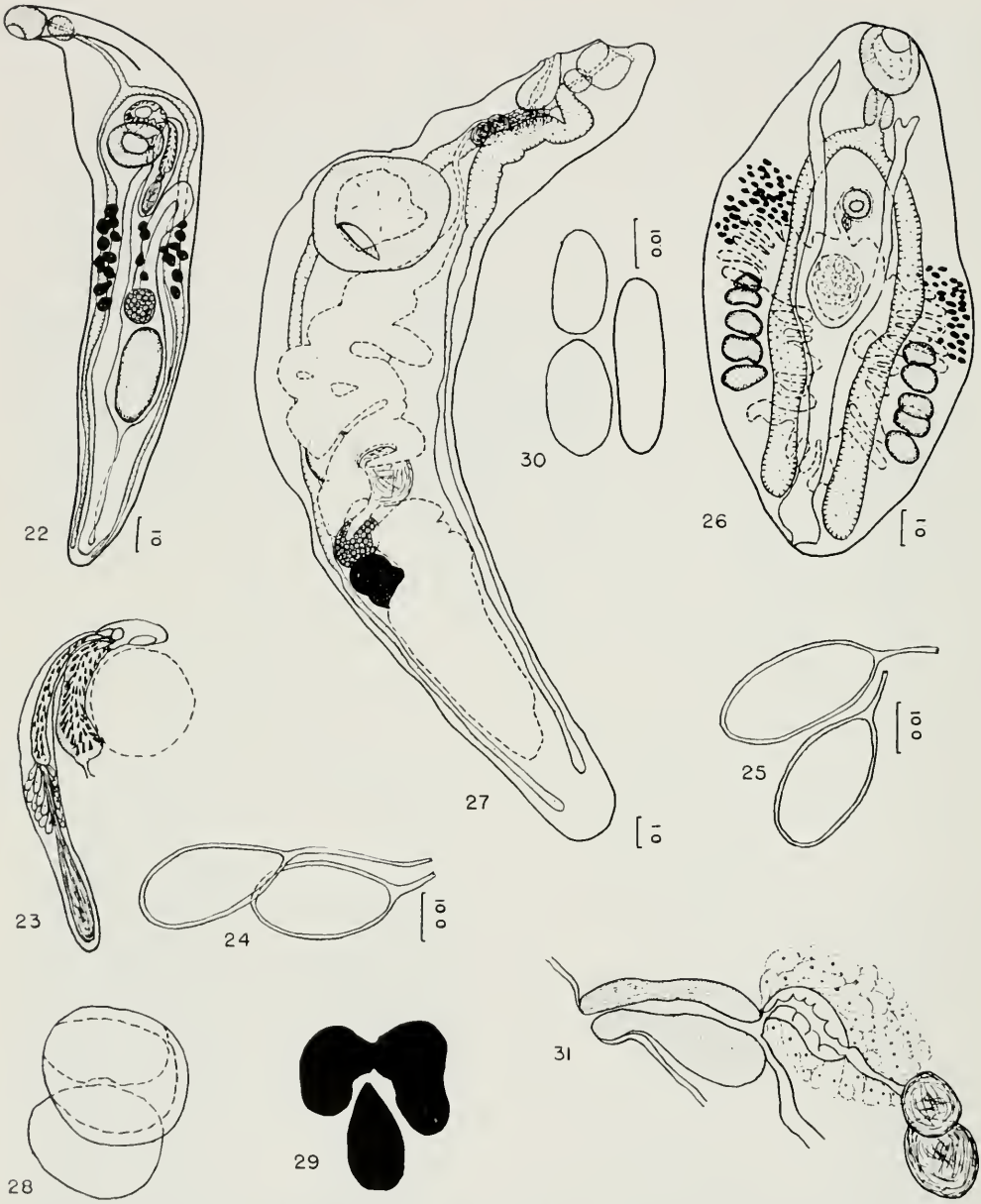
Incidence of infection.—In 4 of 5 *C. capistratus* and 2 of 2 *C. ocellatus.*

Location.—Intestine.

Locality.—Galeta Point, Republic of Panama [new locality record].

Discussion.—The only other record of *Multitestis chaetodoni* Manter, 1947, is the original description of specimens from *Chaetodon capistratus* and *C. ocellatus* in Tortugas, Florida. According to Manter (1947), Linton's (1910; p. 115) *Distomum* sp. is *M. chaetodoni.*

Manter (1947) described a bipartite prostatic vesicle for *M. chaetodoni.* Some of our specimens which are darkly stained appear to have a bipartite prostatic vesicle. We obtained a series of 24 specimens of *M. chaetodoni* from *C. ocellatus* and 6 from *C. capistratus,* and have observed that what appears to be the anterior prostatic vesicle in darkly stained specimens is a sphincter muscle at the junction of the prostatic vesicle with the base of the cirrus (fig. 20). If the anterior border of this sphincter muscle



Figures 22-31. **22.** *Hurleytrematoides chaetodoni* from *Chaetodon striatus*, ventral view. **23.** *H. chaetodoni* from *C. striatus*, sketch of dorsal view of terminal genitalia, dashed lines represent outline of acetabulum. **24.** *H.chaetodoni* from *C. striatus*, eggs with polar filaments partially omitted. **25.** *H. chaetodoni* from *C. ocellatus*, eggs with polar filaments partially omitted. **26.** *Siphodera vinaledwardsi*, ventral view of whole mount. **27.** *Theletrum magnasaccum*, sp. nov., ventro-lateral view of holotype, dashed lines represent the position occupied by the uterus. **28.** *T. magnasaccum*, lateral view of vitelline follicles, dashed lines represent optical sections of anterior and posterior follicles. **29.** *T. magnasaccum*, optical reconstruction of vitelline follicles as they would presumably appear in ventral view. **30.** *T. magnasaccum*, uterine eggs. **31.** *T. magnasaccum*, lateral view of terminal genitalia.

is contracted, allowing sperm to collect and swell its internal sperm duct, the muscular bulb could easily be confused with a prostatic vesicle. The cytological details of the wall of the sphincter bulb further suggest that this structure is not a prostatic vesicle. Our specimens had from 9 to 11 testes.

Subfamily Homalometrinae
Neoapocreadium coili (Sogandares, 1959) Siddiqi and Cable, 1960
(fig. 21)

Host.—*Halichoeres bivitattus* (Bloch); slippery dick; family *Labridae.*

Incidence of infection.—In 1 of 2 hosts.

Location.—Intestine.

Locality.—Galeta Point, Republic of Panama [new locality record].

Discussion.—The metacercariae of *N. coili* reported here were encysted in muscle fragments of a crustacean (probably a small snapping shrimp) found in the intestine of *H. bivittatus.* The cysts were teased apart with a needle and the metacercariae fixed with A.F.A. between a coverslip and slide. Since we did not have a compound microscope with us, the flame cell pattern and other important details of the live specimens were unobserved.

Sogandares (1959) noted that certain species of *Apocreadium* (*A. bravoi* Sogandares, 1959, *A. coili* Sogandares, 1959, and *A. angustum* Sogandares, 1959) possessed oral suckers with 2 lateral fleshy lobes, and vitellaria confluent anterior to the acetabulum. Siddiqi and Cable (1960) named the genus *Neoapocreadium* for these species. The distinctive oral sucker immediately related our specimens to the genus *Neoapocreadium.* Comparison of our Panama specimens with preadults of *A. coili* and other *Neoapocreadium* spp. collected by one of us (F.S.) in Bimini, Bahamas, leaves little doubt of the specific identity of specimens in the present collection. The type material of *A. coili* is from *Balistes capriscus* Gmelin and *B. vetula* Linn., in Bimini, Bahamas. Siddiqi and Cable (1960) reported *N. coili* from *B. vetula* in Puerto Rico.

Family MONORCHIIDAE
Hurleytrematoides chaetodoni (Manter, 1942) Yamaguti, 1953
(figs. 22-25)

Hosts.—*Chaetodon capistratus* Linn.; four-eyed butterfly fish; *Chaetodon ocellatus* Bloch; common butterfly fish; and *Chaetodon striatus* Linn., banded butterfly fish; new host record; family *Chaetodontidae.*

Incidence of infection.—In 2 of 5 *C. capistratus;* 1 of 2 *C. ocellatus;* and 1 of 1 *C. striatus.*

Location.—Intestine.

Locality.—Galeta Point, Republic of Panama [new locality record].

Discussion.—Manter (1942, 1947) described and reported *Hurleytrema chaetodoni* from *Chaetodon ocellatus* and *C. capistratus* in Tortugas, Florida. The metraterm of his type specimens was about 3/4 length of the cirrus sac. The metraterm in our material shows considerable extension or contraction (figs. 22, 23), sometimes agreeing in proportion with the type description. The egg sizes of *H. chaetodoni* from *Chaetodon striatus* and *C. ocellatus* (figs. 24, 25) overlap, though they are considerably shorter (about 30 to 32 *vs.* 40 to 46 microns) than those reported by Manter (1942). The unipolar filament-egg ratio of our specimens agrees with Manter's (1942) description. Although we have no material of *H. chaetodoni* from localities intermediate between Tortugas and Panama, these variations in egg size may represent population differences. Siddiqi and Cable (1960) reported *H. chaetodoni* from *Chaetodon capistratus* in Puerto Rico.

Yamaguti (1953) erected a new genus *Hurleytrematoides* for *H. chaetodoni.* The description of the type species of *Hurleytrema, H. ovocaudatum* Srivastava, 1938, seems to differ from that of *H. chaetodoni* mainly in the type of cirrus and metraterm spines, in egg size, and in a more posterior distribution of the vitelline follicles. Professor H. W. Manter (personal communication) adds another distinguishing character and recognizes *Hurleytrematoides* on the basis of a bipartite seminal vesicle. We are following his views here in recognizing *Hurleytrematoides.*

Family CRYPTOGONIMIDAE
Subfamily Siphoderinae
Siphodera vinaledwardsi (Linton, 1901) Linton, 1910
(fig. 26)

Host.—*Lutjanus synagris* (Linn.); lane snapper; and *Ocyurus chrysurus* (Bloch); yellow-tail; family Lutjanidae.

Incidence of infection.—In 2 of 2 *L. synagris* and 2 of 2 *O. chrysurus.*

Location.—Intestine.

Locality.—*L. synagris* from Cristobal Yacht Club basin and Galeta Point and *O. chrysurus* from Galeta Point, Republic of Panama [new locality record].

Discussion.—The distribution of *S. vinaledwardsi* was recently reviewed by Sogandares and Hutton (1959). These authors neglected to cite the following records: Bravo (1956) in *Lutjanus guttatus* (Steindachner) from Baja California, Mexico; Sparks (1957) in *Ocyurus chrysurus* from Nassau, Bahamas; and Sogandares (1959) in *Lutjanus synagris* from Bimini, Bahamas. Siddiqi and Cable (1960) reported *S. vinaledwardsi* from *Lutjanus synagris* and *L. analis* from Puerto Rico.

S. vinaledwardsi is a widespread species in the American Atlantic and utilizes various carnivorous definitive hosts, mainly lutjanid, batrachoidid, and pomadasyid fishes.

Our specimens from the Atlantic coast of Panama compare favorably with those collected in other localities in Florida and Bimini, Bahamas.

Family HEMIURIDAE
Subfamily Lecithasterinae
Theletrum **magnasaccum,** sp. nov.
(figs. 27-31)

Host.—*Abudefduf saxatilis* (Linn.); sergeant-major; family pomacentridae.

Incidence of infection.—In 1 of 1 host.

Location.—Stomach.

Locality.—Galeta Point, Republic of Panama.

Holotype.—U. S. Nat. Mus. Helm. Coll. No. 39500.

Diagnosis (based on one specimen).—*Theletrum:* Body elongate, approximately 3.15 long by 0.59 wide at midbody. Cuticle smooth, bearing no papillae. Forebody 0.66 long. Oral sucker subterminal, 0.16 long by 0.17 wide. Preoral lip present. Acetabulum 0.44 long by 0.42 wide. Sucker ratio about 1:2.4. Prepharynx so short that it appears absent. Pharynx roundish, 0.07 long by 0.10 wide. Esophagus very short, almost appearing absent. Ceca extending, one on each side of body, to posterior end of body. Genital pore ventral, median, at level of midpharynx. Sinus sac connecting directly with genital pore, muscular, pear-shaped; 0.10 long by 0.10 at widest portion. Testes equatorial, oblique; sinistral testis anteriormost, 1/7 distance from acetabulum to posterior end of body, oval in shape, about 0.14 long by 0.19 wide; dextral testis posteriormost, about 1/3 distance from acetabulum to posterior end of body, roundish in shape, about 0.15 long by 0.17 wide. Seminal vesicle intercecal, about 1/3 distance from acetabulum to anterior end of body, bipartite; connecting with a short prostatic vesicle which is surrounded by prostate cells and is about 1/2 length of the sinus sac with which it connects (fig. 31). Ovary slightly less than 1/2 distance from acetabulum to posterior end of body, oblong in shape, about 0.12 long by 0.13 wide. Seminal receptacle conspicuous between posterior testis and dorsal aspect of ovary, spherical and larger than ovary. Vitellaria of two compact lobes (figs. 28, 29), anterior vitellarium bilobed, posterior vitellarium unlobed; immediately posterior to and in contact with ovary. Uterus with large sac-like coils which are difficult to trace, mainly intercecal, descending from ovarian complex to fill most of postovarian area, ascending to cover partially the vitellaria, seminal receptacle, ovary, and testes, intruding between ovary and posterior testis and foretestis, the sac-like coils disappearing anterior to acetabulum where uterus perforates the sinus sac adjacent to the connection with prostatic vesicle. Eggs thick-shelled, varible in shape and size (fig. 29), about 17.4 to 31.9 microns long by 11.6 to 14.0 microns wide. Excretory vesicle not observed.

Discussion.—The genus *Theletrum* Linton, 1910 resembles *Aponurus* Looss, 1907, differing mainly by possessing 2 or 3 instead of 7 or 8 prominent vitelline lobes. Studies of additional species may show that these two genera are synonymous or that *Theletrum* is a subgenus at best. At present the vitelline lobation appears to be a stable, though sometimes difficult to observe, character. Yamaguti (1958) reexamined Linton's type material of *T. fustiforme* and believed that, "the ejaculatory duct and metraterm open into a genital atrium." Yamaguti also stated, ". . . the cirrus pouch could not be made out with certainty." Manter (1947) studied specimens of *T. fustiforme* from the type host and locality and did not report or picture a genital atrium. Instead he stated,

TABLE 1.
Nine digenetic trematodes from the Atlantic coast of Panama and their distribution in the American Pacific and Atlantic [2]

Species	Localities		
	Tropical American Pacific	Tropical American Atlantic other than Panama	American Atlantic from Woods Hole, Mass. to Beaufort, N. C.
Bucephaloides arcuatus	—	+	+
Hamacreadium mutabile	+	+	—
Haplosplanchnus acutus	+	+	—
Haplosplanchnus pomacentri	+	+	—
Multitestis chaetodoni	—	+	—
Neoapocreadium coili	—	+	—
Hurleytrema chaetodoni	—	+	—
Siphodera vinaledwardsi	+	+	+
Theletrum magnasaccum	—	—	—

[2] (+) denotes presence and (—) absence of the species.

"The seminal vesicle is a long coiled tube, slightly overlapping the acetabulum; the pars prostatica is rather short, its distal half surrounded by a compact but conspicuous prostatic gland. The sinus sac is cylindrical, almost straight, with thick walls, containing a few gland cells." Our study of the terminal genitalia of *T. magnasaccum* lends allied support to Manter's (1947) observations and redescription of the terminal genitalia of *T. fustiforme*. The "prostate gland" described by Manter is doubtless a prostatic vesicle surrounded by prostate cells. There are three species in *Theletrum*, *T. fustiforme* Linton, 1910 (type species), *T. lissosomum* Manter, 1940 and *T. gravidum* Manter, 1940. *T. magnasaccum* resembles *T. gravidum* and *T. lissosomum* but differs by possessing a conspicuous hermaphroditic sac, two vitelline lobes, a bipartite seminal vesicle, and other small differences which are at present difficult to evaluate due to the present shortage of material. *T. magnasaccum* differs from *T. fustiforme* by lacking the postacetabular ventral folds and papillae as described by Manter (1947), in genital pore position and by possessing a bipartite seminal vesicle which does not overlap the acetabulum.

T. magnasaccum is closely related with *T. gravidum*, from the same host genus (*Adudefduf*) in the Pacific, and probably represents its geminate species in the Atlantic.

The vitelline lobes of *T. magnasaccum* initially resembled those of *Aponurus* when viewed laterally. Careful focussing with the microscope showed that the mass is composed of two follicles (fig. 28), the anteriormost is apparently bilobed. Figure 29 shows an optical reconstruction as the vitelline lobes would presumably appear in frontal view.

One striking feature about *T. magnasaccum* is the size and shape of the eggs. Figure 30 shows three different types of eggs, from the same portion of the uterus, which we observed. Care was taken to assure that

TABLE 2.
Host species examined and trematodes found.

Abudefduf saxatilis (Linn.)
  Haplosplanchnus acutus (Linton, 1910) Manter, 1937
  Theletrum magnasaccum (this paper)
Acanthurus chirurgus (Bloch)
  no trematodes found
Chaetodon capistratus Linn.
  Hurleytrematoides chaetodoni (Manter, 1942) Yamaguti, 1953
  Multitestis chaetodoni Manter, 1947
Chaetodon ocellatus Bloch
  Hurleytrematoides chaetodoni (Manter, 1942) Yamaguti, 1953
  Multitestis chaetodoni Manter, 1947
Chaetodon striatus Linn.
  Hurleytrematoides chaetodoni (Manter, 1942) Yamaguti, 1953
Eucinostomus californiensis (Gill)
  no trematodes found
Gymnothorax funebris Ranzani
  no trematodes found
Halichoeres bivittatus (Bloch)
  Neoapocreadium coili (Sogandares, 1959) Siddiqi and Cable, 1960
Lutjanus griseus (Linn.)
  one trematode found but lost by maceration, probably a *Mctadena* sp.
Lutjanus synagris (Linn.)
  Siphodera vinaledwardsi (Linton, 1901) Linton, 1910
Ocyurus chrysurus (Bloch)
  Hamacreadium mutabile Linton, 1910
Pomacentrus leucostictus Müller and Troschel
  Haplosplanchnus pomacentri Manter, 1937
Pomacentrus planifrons (Cuvier and Valenciennes)
  Haplosplanchnus pomacentri Manter, 1937
Sphyraena barracuda (Walbaum)
  Bucephaloides arcuatus (Linton, 1900) Hopkins, 1954
Thalassoma bifasciatum (Bloch)
  no trematodes found

these eggs were not tilted, creating an illusion of shortness. The majority of the uterine eggs were of the narrow, elongate, sausage-shaped type.

The name *magnasaccum* is for the large sinus sac (*magna* = large) (*saccum* = sac).

Manter's and Pritchard's (1960) views regarding the higher categories of the Hemiuridae have been followed in placing *Theletrum* in the Lecithasterinae.

The Geographic Distribution of Digenea Reported in this Paper

Table 1 shows the American distribution of the Digenea reported here. Six species are known only from the Atlantic Ocean, while four are shared with the Pacific. Eight species are found in other tropical American Atlantic localities, two of these species as far north as Woods Hole, Massachusetts.

The present sample is too small to determine significant faunal differences. We believe that the digenetic trematode fauna from the Atlantic coast of Panama will reveal a closer resemblance to that of Tortugas, Florida, and the Bahamas Islands than to that from the Pacific coast of Panama. The fish and molluscan fauna of Tortugas, Florida, and the Bahamas Islands is more like that of the Atlantic than the Pacific side of Panama. Even though our sample was small, every fish host, except *Pomacentrus planifrons* occurs in Tortugas, Florida, and the Bahamas Islands. Table 2 lists the host species examined and trematodes found.

Summary

Nine digenetic trematodes, including the description of a new species, *Theletrum magnasaccum*, (Hemiuridae: Lecithasterinae), are reported from fifteen species of marine fishes of the Atlantic coast of Panama. The systematic status, distribution, hosts, and new information on the morphology of each trematode species is discussed.

References Cited

Bravo-Hollis, M. 1956. Trematodos de peces marinos de Aguas Mexicanas. XI. Estudio de 17 digeneos de las costas del Pacifico, incluyendo seis especies nuevas y un genero nuevo. *Ann. Inst. Biol. (Mexico)*, *27* (1): 245-277.

Cable, R. M. 1954. Studies on marine digenetic trematodes of Puerto Rico. The life cycle in the family Haplosplanchnidae. *Jour. Parasit.*, *40*: 71-76.

———— 1956. *Opistholebes diodontis* n. sp., its development in the final host, the affinities of some amphistomatous trematodes from marine fishes and the allocreadioid problem. *Parasitology*, *46*: 1-13.

Dollfus, R. Ph. 1960. Recherches expérimentales sur *Nicolla gallica* (R. Ph. Dollfus 1941) R. Ph. Dollfus 1958, sa cercaire cotylicerque et sa métacercaire progénétique. Observations sur la famille des Coitocaecidae Y. Ozaki 1928, s. f. Coitocaecinae F. Poche 1926, Trematoda Podocotyloidea et sur les cercaires cotylicerques d'eau douce et marines. *Ann. Parasit. Hum. et Comp.*, *34*: 595-622; *35*: 65-117.

Eckmann, F. 1932. Beiträge zur Kenntnis des Trematodenfamilie Bucephalidae. *Zeitschr. Parasit.*, *5*: 94-111.

Hanson, M. L. 1950. Some digenetic trematodes of marine fishes from Bermuda. *Proc. Helm. Soc. Wash.*, *17*: 74-88.

Hopkins, S. H. 1954. The American species of trematode confused with *Bucephalus* (*Bucephalopsis*) *haimeanus*. *Parasitology*, 44: 353-370.

Linton, E. 1900. Fish parasites collected at Woods Hole in 1898. *Bull. U. S. Fish. Comm.* (1899), 19: 267-304, 121 figs.

———— 1905. Parasites of fishes of Beaufort, North Carolina. *Bull. U. S. Bur. Fish.* (1904), 24: 31-428, 249 figs.

———— 1910. Helminth fauna of Dry Tortugas. 2. Trematodes. *Carnegie Inst. Wash., Publ. No.* 133 (Papers Tortugas Lab. 4:) 11-98, 241 figs.

———— 1940. Trematodes from fishes mainly from the Woods Hole region Massachusetts. *Proc. U. S. Nat. Mus.*, *88*: 11-72, 351 figs.

Manter, H. W. 1934. Some digenetic trematodes of deep-water fish of Tortugas, Florida. *Carnegie Inst. Wash. Publ. No.* 435 (Papers Tortugas Lab. *27*): 257-345.

———— 1937. The status of the trematode genus *Deradena* Linton with a description of six species of *Haplosplanchnus* Looss (Trematoda). *Skrjabin Jub. Vol.* (Moscow: U.S.S.R.): 381-387.

———— 1940a. The geographical distribution of digenetic trematodes of marine fishes of the tropical American Pacific. *Allan Hancock Pac. Exp.*, *2*: 531-547.

———— 1940b. Gasterostomes (Trematoda) of Tortugas, Florida. *Carnegie Inst. Wash. Publ. No.* 524 (Papers Tortugas Lab., *33*): 1-19.

———— 1940c. Digenetic trematodes of fishes from the Galapagos Islands and Neighboring Pacific. *Allan Hancock Pac. Exp.*, *2*: 329-497, 136 figs.

———— 1942. Monorchidae (Trem-

atoda) fishes of Tortugas, Florida. *Trans. Amer. Micros. Soc., 61*: 349-360.

1947. Digenetic trematodes of marine fishes of Tortugas, Florida. *Amer. Midl. Nat., 38*: 257-416.

1954. Some digenetic trematodes of fishes from New Zealand. *Trans. Roy. Soc.* N. Z., *85*: 475-568.

1955. The zoogeography of trematodes of marine fishes. *Exp. Parasit., 4*: 62-86.

1957. Host specificity and other host relationships among the digenetic trematodes of marine fishes. *Premier Symposium sur la Spécificité Parasitaire des Parasites de Vertebres* (Neuchatel: Suisse): 185-196.

and PRITCHARD, M. H. 1960. Some hemiurid trematodes from Hawaiian fishes. *Proc. Helm. Soc. Wash., 27*: 87-102.

MCCOY, O. R. 1929. The life history of a marine trematode, *Hamacreadium mutabile* Linton, 1910. *Parasitology, 21*: 220-225.

1930. Experimental studies on two fishes trematodes of the genus *Hamacreadium* (family Allocreadiidae). *Jour. Parasit., 17*: 220-225.

NAGATY, H. F. 1941. Trematodes of fishes from the Red Sea. Part 2. The genus *Hamacreadium* Linton, 1910 (fam. Allocreadiidae) with a description of two new species. *Jour. Egypt. Med. Assoc., 24*: 330-310.

SIDDIQI, A. H. and CABLE, R. M. 1960. Digenetic trematodes of marine fishes of Puerto Rico. *N. Y. Acad. Sci., Sci. Survey Porto Rico, 17*: 258-368, 139 figs.

SKRJABIN, K. J. and GUSCHANSKAJA, L. K. 1955. *Trematodes of Animals and Man.* Vol. II. Movska, U.S.S.R.

SOGANDARES-BERNAL, F. 1959. Digenetic trematodes of marine fishes from the Gulf of Panama and Bimini, British West Indies. *Tulane Stud. Zool., 7*: 70-117.

and HUTTON, R. F. 1959. Studies on helminth parasites of the Coast of Florida. I. Digenetic trematodes of marine fishes from Tampa and Boca Ciega Bays with descriptions of two new species. *Bull. Mar. Sci. Gulf Carib., 9*: 53-68.

SPARKS, A. K. 1957. Some digenetic trematodes of marine fishes of the Bahama Islands. *Ibid., 7*: 253-265.

1958. Some digenetic trematodes of Grand Isle, Louisiana. *Proc. La. Acad. Sci., 20*: 71-82.

1960. Some aspects of the zoogeography of the digenetic trematodes of shallow-water fishes of the Gulf of Mexico. *Lib. Homm. Caballero, Inst. Polytecnico Nacional (Mexico)*, pp. 285-298.

YAMAGUTI, S. 1953. *Systema Helminthum.* Part I. Digenetic trematodes of fishes. Tokyo, 405 pp.

1958. *Systema Helminthum.* Vol. I. The digenetic trematodes of vertebrates. Parts I and II. Interscience Publishers, 1575 pp.

ABSTRACT

Nine digenetic trematodes of marine fishes from the Atlantic coast of Panama are reported: *Bucephaloides arcuatus* (Linton, 1900) (*Bucephalidae*), from the pyloric ceca of *Sphyraena barracuda* (Walbaum) (*Sphyraenidae*); *Hamacreadium mutabile* Linton, 1910 (Opecoelidae), from the intestine of *Ocyurus chrysurus* (Bloch) (Lutjanidae); *Haplosplanchnus* (*Schikhobalotrema*) *acutus* (Linton, 1910) (Haplosplanchnidae), from the intestine of *Abudefduf saxatilis* (Linn.) (Pomacentridae); *Haplosplanchnus* (*Schikhobalotrema*) *pomacentri* Manter, 1937 (Haplosplanchnidae), from the intestines of *Pomacentrus leucostictus* Müller and Troschel, and *P. planifrons* (Cuv. and Val.) (Pomacentridae); *Multitestis chaetodoni* Manter, 1947 (Lepocreadiidae), from the intestines of *Chaetodon capistratus* Linn. and *C. ocellatus* Bloch (Chaetodontidae); the metacercaria of *Neoapocreadium coili* (Sogandares, 1959) (Lepocreadiidae), encysted in crustacean muscle remains from the intestine of *Halichoeres bivitattus* (Bloch) (Labridae); *Hurleytrematoides chaetodoni* (Manter, 1942) (Monorchiidae), from the intestines of *Chaetodon capistratus* Linn., *C. ocellatus* Bloch, and *C. striatus* Linn. (Chaetodontidae); *Siphodera vinaledwardsi* (Linton, 1901) (*Cryptogonimidae*), from the intestines of *Lutjanus synagris* (Linn.) and *Ocyurus chrysurus* (Bloch) (Lutjanidae); and *Theletrum magnasuccum* (this paper) (Hemiuridae), from the stomach of *Abudefduf saxatilis* (Linn.) (Pomacentridae). The systematic status, distribution, hosts and new information on the morphology of each trematode species is discussed.