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DIGENETIC TREMATODES OF FISHES FROM PALAWAN ISLAND, PHILIPPINES.  
 IV. SOME IMMATURE DIDYMOZOIDAE, A BUCEPHALID; A NEW HEMIUIROID GENUS AND SUBFAMILY

RESEARCH REPORT

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# Digenetic Trematodes of Fishes from Palawan Island, Philippines. IV. Some Immature Didymozoidae, a Bucephalid; a New Hemiuroid Genus and Subfamily

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**ABSTRACT:** Three immature didymozoids are reported from fishes of Palawan Island, Philippines: *Torticaecum nipponicum* Yamaguti, 1942, from *Elcotris fusca*; Immature Didymozoid A from *Puntius binotatus*; and Immature Didymozoid B from *Euthynnus yaito*. A review of didymozoids listed as *Distomum fenestratum* Linton, 1907, in the U. S. National Museum Helminthological Collection resulted in their separation into two distinct forms: *D. fenestratum* from *Gymnothorax moringa*, *Haemulon plumieri*, *H. sciurus*, *H. parra*, *Remora remora*, *Scorpaena* sp., and *Pseudupeneus maculatus*; and Immature Didymozoid C from *Brecoortia tyrannus*, *Ammodytes americanus*, and *Etrumeus sadina*. *Bucephaloides sibi* (Yamaguti, 1940) Hopkins, 1954 (Bucephalidae) is reported from *Euthynnus yaito*; and *Peloroelminis palawanensis* gen. n., sp. n. (Hemiuroidea) from *Gazza minuta* is described. A new subfamily, Peloroelminthinae, is created for the latter genus and appears to be most closely related to the family Isoparorchiiidae.

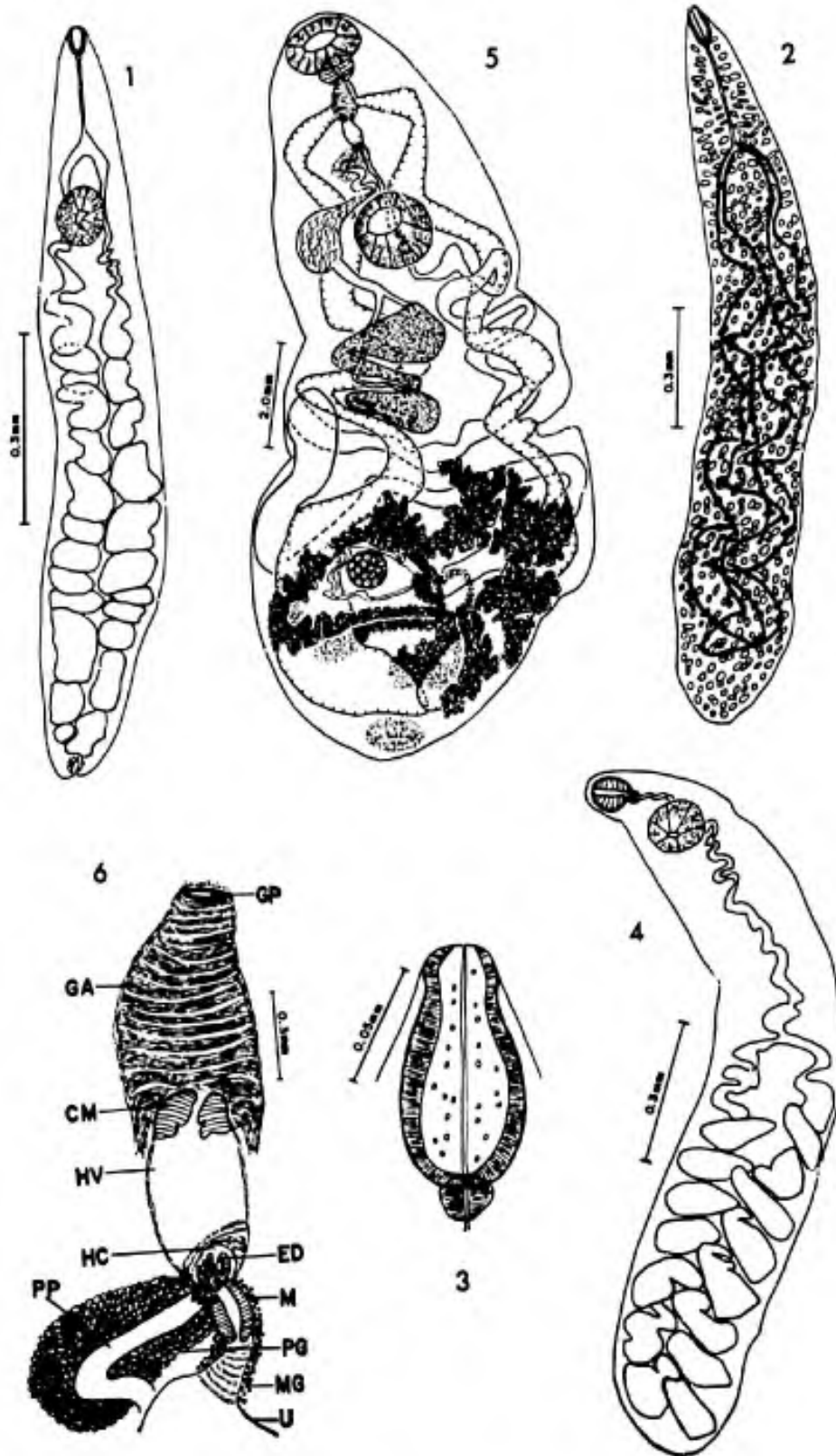
This is the final report on a collection of digenetic trematodes of fishes made by the junior author while a member of the U. S. Naval Medical Research Unit No. 2, Taipei, Taiwan, and a guest investigator on the Silliman University-Bishop Museum Expedition to Palawan Island, Republic of the Philippines. Parasites were washed in saline, killed in hot water, and transferred immediately to FAA fixative. After 4 to 8 hr they were stored in 70% alcohol plus 2% glycerine. Staining was in Harris' hematoxylin, carmalum, carmalum and fast green, or acidified carmine and fast green. All were mounted in balsam. Measurements are in microns. Specimens have been deposited in the U. S. National Museum Helminthological Collection.

## FAMILY DIDYMOZOIDAE

Three different immature didymozoids are in our Palawan collection. Cable (1956) discussed evidence, supporting Manter's (1932, 1934) opinion, that the immature trematodes variously known as *Distomum fenestratum* Linton, 1907, and as species of *Monilicaecum* Yamaguti, 1942, and *Torticaecum* Yamaguti,

1942, were immature didymozoids whose adults live mostly in large pelagic fishes that feed on smaller ones. For this reason Cable believed that Yamaguti (1942) inadvisedly erected the above two genera. Cable also presented data indicating a close relationship between Didymozoidae and Hemiuridae. Cable and Nahhas (1962) reported many small *Torticaecum* from a crustacean (goose barnacle) being fed upon by a dolphin (*Coryphaena hippurus* L.). They concluded that crustaceans may serve as second intermediate hosts in Didymozoidae as well as in families of Hemiuroidea; further, small fishes may acquire their immature didymozoids by eating crustaceans and thereby serve as paratenic hosts that play a significant but not indispensable role in the life histories of certain didymozoids. From fishes of the Mediterranean and adjacent seas, Black Sea, Red Sea, and Gulf of Aden, Nikolaeva (1962) briefly re-described *Didymozoon* larvae Chulkova, 1939, as "*Nematobothrium* sp. larvae (Chulkova, 1939) nov. comb." and very briefly described as didymozoid metacercariae six new forms under the designations "*Didymozoidae* gen. sp. larvae I (nov. sp.)," etc. through "larvae VI"; none were illustrated. The seven forms were differentiated from each other in body size,

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ABBREVIATIONS: CM, distal muscular portion of genital cone; ED, ejaculatory duct; GA, genital atrium; GP, genital pore; HC, proximal hermaphroditic chamber of genital cone; HV, middle hermaphroditic vesicle of genital cone; M, metraterm; MG, metraterm glands; PG, prostate glands; PP, pars prostatica; U, uterus.

the body length to width ratio, the distance between suckers, and in parasitizing different hosts. Such characteristics are extremely variable and unreliable for separating these immature forms. The structure of the oral sucker was not noted for any; the cecal bifurcation level was indicated only for IV and V, being preacetabular; all possessed an acetabulum. Stunkard (1963) reviewed the status of the Didymozoidae.

**Immature Didymozoid A**  
(Fig. 1)

*Host:* *Puntius binotatus* (Cuvier and Valenciennes) (Cyprinidae).

*Habitat:* Small intestine.

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

*Date:* 16 May 1962.

*Specimen:* USNM Helm. Coll. No. 60294.

*Description* (based on one specimen): Body unarmed, elongate, 1,213 by 201. Forebody 261; hindbody 859. Parenchyma vesicular. No eyespots or eyespot pigment. Mouth terminal. Oral sucker 42 by 30, within body, composed of weak outer longitudinal and strong inner circular muscles and greater inner area of large, vesicular, transparent cells. Acetabulum 93 by 81, muscular, embedded in body parenchyma, at level of anterior body fourth. Sucker length ratio 1 : 2.21. Pharynx 12 by 13, muscular, contiguous with oral sucker. Esophagus 138 long, narrow, bifurcation posterior to midforebody. "Stomach" absent. Cecae with narrow and inflated areas, descending in undulating fashion, terminating 44 from posterior extremity. Parenchymal glands fill entire body in zone beneath thin subcuticular longitudinal muscle layer. No reproductive fundaments. Excretory bladder postcecal, thick walled, lumen 32 by 18, pore terminal.

*Discussion:* This form differs from those described as *Torticaecum* and *Distomum fenestratum*, but resembles *Monilicaecum* in having its oral sucker composed of muscular and non-muscular elements rather than being entirely muscular. It differs from *Monilicaecum* in lacking a "stomach" at the cecal bifurcation.

**Immature Didymozoid B**  
(Figs. 2 and 3)

*Host:* *Euthymus yaito* Kishinouye (Scombridae).

*Habitat:* Small intestine.

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

*Date:* 20 May 1962.

*Specimens:* USNM Helm. Coll. No. 60296 (three slides with one specimen each).

*Discussion:* This form closely resembles Immature Didymozoid A, possessing most of its features but lacking an acetabulum. In the latter respect it differs from all previously described immature didymozoids with the exception of *Didymocystis katsuwoncola* (Okada, 1926) (syn. of *D. wedli* Ariola, 1902) described by Ishii (1935). Adults of most didymozoid genera lack an acetabulum. The structure of the oral sucker is as described for Immature Didymozoid A and *Monilicaecum*, and unlike the entirely muscular one of *Didymocystis wedli*.

*Measurements and some pertinent data* (based on five specimens): Body 1,420 to 2,455 by 305 to 410. Parenchyma especially vesicular anteriorly. Oral sucker 57 to 82 by 40 to 50. Acetabulum absent. Pharynx 11 to 21 by 18 to 23. Esophagus 215 to 264 long, 11 to 26 maximum width, thin walled, straight, rarely slightly undulating, width gradually increasing toward bifurcation. Cecae terminating 85 to 180 from posterior extremity.

***Torticaecum nipponicum* Yamaguti, 1942**

*Host:* *Eleotris fusca* (Bloch and Schneider) (Eleotridae).

*Habitat:* Small intestine.

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

*Date:* 20 May 1962.

*Specimen:* USNM Helm Coll. No. 60295.

*Discussion:* This immature didymozoid was originally described by Yamaguti (1942) from the small intestine of various marine fishes from Japan. Yamaguti noted neither a pharynx nor parenchymal glands, and he erroneously referred to the oral sucker as a pharynx. Cable (1956) noted the lack of a pharynx or, at most, an embryonic one, in an immature didymozoid from Puerto Rican fishes. *Torticaecum nipponicum* possesses most of the features of Immature Didymozoid A, differing significantly in having an entirely muscular oral sucker. The structure of the latter and the sucker length ratio of *T. nipponicum* suggest a relationship

←  
FIGURES 1 TO 6. Philippine fish trematodes. 1. Immature Didymozoid A, ventral view. 2. Immature Didymozoid B. Note extensive parenchymal glands. 3. Same. Oral sucker and pharynx. 4. Immature Didymozoid C, ventral view of specimen designated as USNM Helm. Coll. No. 8407. 5. *Peloroelminius palawanensis*, ventral view of holotype. 6. Same. Terminal genitalia of holotype.

to *Gonapodasmius pristipomatis* (Yamaguti, 1934) Yamaguti, 1938, or *G. pacificus* Yamaguti, 1938, from Japan.

*Measurements and some pertinent data* (based on one specimen): Body 1,926 by 160. Forebody 310; hindbody 1,485. Oral sucker 44 by 38, entirely muscular, composed of weak outer layer of longitudinal and much wider inner circular muscles, without vesicular cells. Acetabulum 131 by 126, one-fifth body length from anterior end. Sucker length ratio 1:2.98. Pharynx 27 by 16. Esophagus 201 long, bifurcation preacetabular. Ceca terminating 44 and 102 from posterior extremity. Excretory bladder 71 by 23, saccular.

***Distomum fenestratum* Linton, 1907**

*Discussion:* The immature forms reported by various authors as *D. fenestratum* occurred in a variety of marine fishes from the Atlantic Ocean (Massachusetts, North Carolina, Bermuda, Bahama Islands), Gulf of Mexico (Florida, Louisiana), and the Caribbean Sea (Puerto Rico, Curaçao). Yamaguti (1942) placed *D. fenestratum* in his newly created genus *Torticaecum*, noting that Linton's (1905) figures 213 and 214 of this fauna from *Coryphaena hippurus* and *C. equisetis* L. (Coryphaenidae) from North Carolina appeared specifically different from each other. We concur. Figure 213 with a sucker length ratio of about 1:2.40 appears to be *D. fenestratum*; but the specimen in figure 214 is different, having a sucker length ratio of about 1:0.77. Manter (1932) reported that there are at least two other species at Tortugas, Florida, related to *D. fenestratum* but with much smaller ventral suckers. Sparks (personal communication) recovered one specimen of *D. fenestratum* from *Coryphaena hippurus* near Grande Isle, Louisiana. Cable's (1956) figure 89 appears to be *D. fenestratum*.

Examination of specimens listed as *Distomum fenestratum* in the U. S. National Museum Helminthological Collection indicated that at least two different species are involved. In our opinion the following with a preacetabular cecal bifurcation are *D. fenestratum*: 7061 (five specimens), 36350 (two specimens from swim bladder and intestine), 36503 (one specimen from swim bladder), from *Gymnothorax* (= *Lycodontis*) *moringa* (Cuvier) (Muraenidae); 8484 (one partial specimen and one in serial cross section), 36368 (one slide of one specimen from gills), from *Haemulon plumieri*

(Lacépède) (Pomadasyidae); 8485 (one complete and one partial specimen), from *H. sciurus* (Shaw); 36091 (four complete and two partial specimens from intestine), 36368 (one slide with two specimens from gills), from *H. parra* (Desmarest); 8409 (one specimen encysted in stomach wall), 36090 (seven specimens from intestine), from *Remora* (= *Echeneis*) *remora* (L.) (Echeneidae); 36279 (six complete and five partial specimens), from *Scorpaena* sp. (Scorpaenidae). No. 7061 was described by Linton (1907) and erroneously listed by him as No. 5804 (personal communication from USNM); 8484 and 8485 by Linton (1910); 8409 by Linton (1940); the remainder were collected by G. A. MacCallum at the New York Aquarium. Linton (1905, 1907, 1910, 1940) did not note a pharynx in his descriptions of *D. fenestratum*, although examination of his specimens listed above showed most with one present. Through the courtesy of Dr. A. K. Sparks we were able to study three whole mounts of *D. fenestratum* reported by him (1957) from the spleen and the kidneys or dorsal aorta of *Pseudupeneus maculatus* (Bloch) (Mullidae) from the Bahama Islands, and one he reported (1958) from the viscera of *Gymnothorax moringa* from Louisiana. Some specimens were considerably contracted, others considerably attenuated, so that measurements of body portions and structures dependent on the state of contraction of the worms varied considerably. If the specimens we are designating as *D. fenestratum* were known in mature form, it is possible that more than one species would be represented.

*Description* [based on 44 specimens, 29 measured from *G. moringa* (6), *H. plumieri* (1), *H. sciurus* (1), *H. parra* (6), *R. remora* (8), *Scorpaena* sp. (6), and *P. maculatus* (1)]: Body unarmed, elongate, 1,219 to 5,157 by 225 to 450. Forebody 227 to 1,080; hindbody 810 to 3,065. No eyespots or eyespot pigment. Mouth terminal. Oral sucker 59 to 109 by 46 to 143, within body, entirely muscular, composed of weak outer layer of longitudinal and much wider inner circular muscles, without vesicular cells. Acetabulum 148 to 244 by 152 to 235, muscular, embedded in body parenchyma, at level of anterior body seventh to third. Sucker length ratio 1:1.69 to 3.16. Pharyngeal development variable, from none to slight trace to well formed, 25 to 62 by 22 to 52, muscular, contiguous with oral sucker. Esophagus 138 to 675 long, narrow, bifurcation preacetabular. "Stomach" absent. Ceca with narrow and inflated areas, descending to near posterior extremity in

undulating fashion. Parenchymal glands visible in many, filling entire body in zone beneath subcuticular longitudinal muscles. No reproductive fundaments. Excretory bladder tubular to saccular, thick walled, pore terminal.

**Immature Didymozoid C**  
(Fig. 4)

*Synonym:* *Distomum fenestratum* Linton, 1907 (in part).

*Hosts:* *Brevoortia tyrannus* (Latrobe) (Clupeidae); *Ammodytes americanus* DeKay (Ammodytidae); *Etrumeus sadina* (Mitchill) (Dussumieridae).

*Locality:* Woods Hole, Massachusetts.

*Specimens on deposit:* USNM Helm. Coll. Nos. 8407 (one specimen) and 36135 (one specimen) from *B. tyrannus*; 8406 (two specimens) from *A. americanus*; 8408 (one specimen) from *E. sadina*.

*Discussion:* This form closely resembles *Distomum fenestratum* but differs significantly in having the cecal bifurcation considerably postacetabular. In two of the above specimens the exact level of cecal bifurcation could not be seen, but the esophagus definitely extended postacetabular. Numbers 8406, 8407, and 8408 were described by Linton (1940) as *Distoma fenestratum* Linton, 1907; 36135 was collected by G. A. MacCallum, the label bearing the designation *D. fenestratum*. *Nematobothrium* sp. larvae (Chulkova, 1939) Nikolaeva, 1962 (syn. *Didymozoon* larvae Chulkova, 1939) may be a synonym of Immature Didymozoid C; Chulkova (1939) showed the esophagus extending considerably postacetabular. There is no evidence to indicate that their form belongs to *Didymozoon* or to *Nematobothrium*.

*Measurements* (based on five specimens): Body 1,572 to 2,280 (in four) by 315 to 360 (in two), depth (in one) 218; forebody (in four) 165 to 273, hindbody (in four) 1,305 to 1,980; oral sucker 53 to 94 (in four) by 56 (in two), depth (in one) 43; acetabulum 85 to 123 (in five) by 109 to 119 (in three), depth 75 to 104 (in two); sucker length ratio (in four) 1:1.27 to 1.92; pharynx (in two) 22 to 24 by 16 to 20; esophagus very long, cecal bifurcation (in three) 126 to 460 postacetabular.

**FAMILY BUCEPHALIDAE**

***Bucephaloides sibi* (Yamaguti, 1940)  
Hopkins, 1954**

*Host:* *Euthynnus yaito* (Scombridae).

*Habitat:* Small intestine.

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

*Date:* 20 May 1962.

*Specimens:* USNM Helm. Coll. No. 60180 (two slides with one specimen each).

*Measurements* (based on two specimens): Body 1,448 to 2,252 by 385 to 475; anterior end to pharynx 640 to 925, pharynx to posterior end 735 to 1,235; rhynchus 83 to 130 by 78 (in one); pharynx 73 to 91 in diameter; anterior testis 135 to 201 by 155 to 189; posterior testis 130 to 182 by 155 to 182; cirrus sac 332 to 750 by 106 to 123; ovary 97 to 148 in diameter; vitelline follicles 13-15 and 16-16 in number; 15 eggs measuring 15 to 23 by 10 to 15; anterior extremity to vitelline fields 420 to 425; pharynx to ovary 10 to 60, to anterior testis 118 to 125, to posterior testis 225 to 295, to anterior end of cirrus sac 270 to 395.

*Discussion:* This species was originally described from *Thunnus thynnus* (L.) from Japan. In our specimens the forebody is attenuated and the hindbody contracted which appears to be the opposite of that figured by Yamaguti (1940). As a result in our specimens the pharynx is near the posterior end of the vitelline fields, the ovary is in contact with the anterior testis and the latter with the posterior testis, and the cirrus sac commences at the posterior testis level.

**Superfamily Hemiuroidea**  
***Peiorohelminis* gen. n.**

**Diagnosis**

Hemiuroidea. Body large, cuticle thick, unarmed. Preoral body present. Oral sucker subterminal ventral. Prepharynx absent. Pharynx large, partly overlapping oral sucker. Esophagus present. Cecae winding to posterior extremity. Acetabulum in anterior body third. Testes two, postacetabular, tandem. Seminal vesicle at acetabular level. Pars prostatica surrounded by prostate gland cells. Ejaculatory duct muscular, eversible. Genital cone in three parts: proximal hermaphroditic chamber into which ejaculatory duct and metraterm project and open independently; middle hermaphroditic vesicle; distal very muscular portion projecting into genital atrium. Genital atrium large, with inner ladderlike arrangement of circular muscle bundles and outer similarly arranged longitudinal muscles extending posteriorly beyond genital cone. Genital pore median, ventral to pharynx. Ovary round, in tandem with and considerably posterior to testes. Mehlis' gland well developed. Vitellaria dendritic, multilobed, inter- and extracecal, extending across body in posttesticular space. Uterus postacetabular, inter- and extracecal. Metraterm bipartite, distal part more muscular, surrounded by gland cells. Eggs very small, numerous. Parasitic in intestine of marine fish sometimes found in fresh water.

***Peloroelminis palawanensis* sp. n.**

(Figs. 5 and 6)

*Host:* *Cazza minuta* (Bloch) (Leiognathidae).*Habitat:* Small intestine.*Locality:* Puerto Princesa, Palawan Island, Philippines.*Date:* 19 May 1962.*Holotype:* USNM Helm. Coll. No. 60181.**Diagnosis** (based on one specimen)

Body very large, 14,322 by 6,903; cuticle thick, unarmed; forebody slightly tapered, hindbody wide and bluntly rounded. Preoral body 77 long; forebody 3,452, hindbody 9,397, forebody to hindbody ratio 1:2.72. Oral sucker subterminal ventral, 1,074 by 1,511; acetabulum 1,473 by 1,534, aperture round, in anterior body third; sucker length ratio 1:1.37; oral sucker to acetabulum 2,301. Prepharynx absent; pharynx 560 by 675, anterior half overlapping oral sucker dorsally; esophagus 313 long, bifurcation dorsal to posterior end of genital atrium; bifurcation to acetabulum 1,849; ceca winding to near posterior extremity, tips overlapping slightly. Excretory pore posterodorsal, surrounded by large sphincter muscle, 307 from posterior extremity.

Testes two, postacetabular, dextral, tandem, tadpole shaped with "tail" extending from right side along posterior of "body"; body of anterior testis 1,174 by 2,263, of posterior testis 890 by 1,779; acetabulum to anterior testis 629, to posterior testis 2,302. Vas efferens arising from anterodorsal region of body of each testis, joining anterior to testes to form broad vas deferens entering seminal vesicle. Seminal vesicle large, saccular, dextral to acetabulum, ventral to cecum; preacetabularly vesicle tubular, winding, intercecal, dextral to uterus. Pars prostatica tubular, with proximal loop, surrounded by thick layer of prostate gland cells. Ejaculatory duct short, very muscular, partly inverted into pars prostatica. Genital cone (Fig. 6) considerably modified into three parts: proximal part round, muscular hermaphroditic chamber 184 in diameter into which ejaculatory duct and metraterm project and open independently; middle part large, elongate, thinly muscular, sperm-filled hermaphroditic vesicle 598 by 384; and distal part very muscular, sphincter-like portion 156 by 316, projecting into genital atrium. Genital atrium large, 821 by 499, muscular, with inner ladderlike arrangement of strong circular muscle bundles and outer, more widely spaced, similarly arranged, longitudinal muscles, some of circular muscle fibers join with longitudinal fibers and proceed posteriorly beyond genital cone. Genital pore a transverse slit, median, prebifurcal, ventral to posterior portion of pharynx, 138 from oral sucker.

Ovary 759 by 775, round, dextral, intercecal, in tandem with testes, 2,263 posttesticular, postovarian space 3,183. Laurer's canal not seen. Mehli's gland well developed, 331 sinistral to ovary. Vitellaria dendritic, with multilobed branches, inter- and extracecal, surrounding ovary and ootype com-

plex, mostly ventral to ceca, extending from 365 posttesticular to cecal ends, three yolk ducts entering ootype complex. Uterus coiled in hindbody from ovarian level to acetabulum, mostly ventral to ceca and vitellaria, ascending dorsal to acetabulum; metraterm of two muscular portions, distal (283 by 162) more muscular than proximal (239 by 110), entering hermaphroditic chamber ventral to ejaculatory duct, gland cells surrounding metraterm. Eggs small, numerous, 10 measuring 13 to 16 by 10 to 13.

*Discussion:* The generic name *Peloroelminis* (*G. peloros*, monstrous) refers to the large size of the trematode. *Peloroelminis* differs from all hemiuroid genera in the morphology of its genital cone. It could not be fitted into any hemiuroid family by using the keys given by Skrjabin and Guschanskaja (1960) and Mehra (1962). It resembles *Isoparorchis* Poche, 1926, in the structure and distribution of the vitellaria, and the cecal and uterine windings; examination of two specimens of *Isoparorchis hypselobagri* (Billet, 1898) Odhner, 1927 (USNM Helm. Coll. No. 51674) also indicated a basic similarity in structure of the genital atrium. *Isoparorchis* differs further in possessing a vermiform ovary, symmetrical testis, and postbifurcal genital pore. *Peloroelminis* resembles *Sclerodistomidae* Dollfus, 1932, in the form of the ovary; the latter family differs further in having a prominent acetabulum, tubular vitellaria in lateral fields, intercecal uterus, symmetrical or slightly diagonal testes, and genital pore at the cecal bifurcation or postbifurcal.

We propose establishing a new subfamily *Peloroelminthinae* for the new genus herein described.

***Peloroelminthinae* subfam. n.****Diagnosis**

Hemiuroidea. Body large, cuticle thick. Oral sucker subterminal, followed directly by pharynx and esophagus. Ceca winding to posterior extremity. Acetabulum in anterior body third. Testes postacetabular, tandem. Seminal vesicle, pars prostatica, prostate gland cells, and muscular ejaculatory duct present. Genital cone in three parts: proximal hermaphroditic chamber into which ejaculatory duct and metraterm project and open independently; middle hermaphroditic vesicle; distal muscular portion projecting into muscular genital atrium. Genital pore median, ventral to pharynx. Ovary round, in tandem with testes. Vitellaria dendritic, multilobed, between posterior testis and cecal ends, inter- and extracecal. Uterus postace-

tabular, inter- and extraecial. Metraterm of two muscular portions. Eggs very small, numerous.

#### ZOOGEOGRAPHICAL AFFINITIES OF PALAWAN FISH TREMATODES

Eight of the 20 species of mature digenetic trematodes are new, including two new genera. The zoogeographical distribution of the 12 previously known species is: *Stephanostomum casum* from the Red Sea, Galápagos Islands, Mexican and Canadian Pacific, Massachusetts, Florida, Puerto Rico, Bahama Islands, and Bermuda; *Hexangium sigani* from Luzon, Japan, Celebes, Red Sea, and Madagascar; *Paracryptogonimus manilensis* from Luzon; *Gyliauchen papillatus* from Japan and Celebes; *Pseudopocelooides carangis* from Japan, Ecuador, Mexican Pacific (Bravo, 1954; from *Caranx hippos*), Florida, and Gulf of Mexico; *Hamacreadium lethrini* from Japan; *Aephiidiogenes barbarus* from Japan and Australia; *Aphanurus stossichi* from Japan, Celebes, India, Spanish Atlantic, Mediterranean Sea, Tyrrhenian Sea, Adriatic Sea, and Black Sea; *Lecithocladium augustiovum* from Luzon and Celebes; *Lecithochirium magnaporum* from Hawaii (Manter and Pritchard 1960; from *Dactyloptena orientalis*), Galápagos Islands and California; *Paraplerurus sauridae* from Egypt; and *Bucephaloides sibi* from Japan. Thus of the 12 species not endemic to Palawan fishes, seven are shared with Japan, four with Luzon and Celebes, two with the Red Sea, Galápagos Islands, Mexican Pacific, and Florida, and one with each of the other named localities. In view of the zoogeography of the Philippine fish fauna stated in Part I of our study, it is not surprising to find some affinities between the Palawan trematode fauna and that of the Red Sea, east coast of Africa, Galápagos Islands, and North and South American Pacific.

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#### LITERATURE CITED

- CABLE, R. M. 1956. Marine cercariae of Puerto Rico. *Sci. Surv. Porto Rico and Virgin Is.* **16**: 489-577.
- , AND F. M. NAHHAS. 1962. *Lepas* sp., second intermediate host of a didymozoid trematode. *J. Parasit.* **48**: 34.
- CHULKOVA, V. N. 1939. Parasitofauna of marine fish in the vicinity of Batuan. *Uchen. Zap. Leningr. Gosud. Univ., Ser. 11, Biol. Nauk* **43**: 21-32. (Russian text.)
- ISHII, N. 1935. Studies on the family Didymozoidae (Monticelli, 1888). *Jap. J. Zool.* **6**: 279-335.
- LINTON, E. 1905. Parasites of fishes of Beaufort, North Carolina. *Bull. U. S. Bur. Fish.* **1904** **24**: 321-428.
- . 1907. Notes on parasites of Bermuda fishes. *Proc. U. S. Natl. Mus.* **33**: 85-126.
- . 1910. Helminth fauna of Dry Tortugas. II. Trematodes. *Pap. Tortugas Lab. Carnegie Inst. Wash.* **4**: 11-98.
- . 1940. Trematodes from fishes mainly from the Woods Hole region, Massachusetts. *Proc. U. S. Natl. Mus.* **88**: 1-172.
- MANter, H. W. 1932. Continued studies on trematodes of Tortugas. *Carnegie Inst. Wash. Year Book No.* **31**, p. 287-288.
- . 1934. Some digenetic trematodes from deep-water fish of Tortugas, Florida. *Pap. Tortugas Lab. Carnegie Inst. Wash.* **28**: 257-345.
- MEHRA, H. R. 1962. On new family Lampritremitidae of superfamily Hemiuroidea Faust, 1929, with a key to the families of the superfamily. *Proc. Natl. Acad. Sci. India, Sec. B* **32**: 408-412.

- NIKOLAËVA, V. M. 1962. Towards a study on the trematode family Didymozoidae. Tezisy Dokl. Nauch. Konf. Bsesiuz. Obsh. Gel'mint., Akad. Nauk SSSR, Moskva, 10-14 Dek. 1962, Chast' II, p. 134-138. (Russian text.)
- SKRJABIN, K. I., AND L. K. GUSCHANSKAJA. 1960. The system of trematodes of the suborder Hemiurata and their general morphological-biological characteristics. In K. I. Skrjabin, Trematodes of animals and man. Moskva 17: 533-627. (Russian text.)
- SPARKS, A. K. 1957. Some digenetic trematodes of marine fishes of the Bahama Islands. Bull. Mar. Sci. Gulf and Carib. 7: 255-265.
- . 1958. Some digenetic trematodes of fishes of Grand Isle, Louisiana. Proc. La. Acad. Sci. 20: 71-82. 1957.
- STUNKARD, H. W. 1963. Systematics, taxonomy, and nomenclature of the Trematoda. Quart. Rev. Biol. 38: 221-233.
- YAMAGUTI, S. 1940. Studies on the helminth fauna of Japan. Part 31. Trematodes of fishes, VII. Jap. J. Zool. 9: 35-108.
- . 1942. Studies on the helminth fauna of Japan. Part 38. Larval trematodes of fishes. Jap. J. Med. Sci., Pt. VI, Bact. and Parasit. 2: 131-160.

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