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Binder 056, Didymozobidae Q-Z [Trematoda Taxon Notebooks]

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Reniforma n. g.
yamaguti, 1970

GENERIC DIAGNOSIS: Didymozoidae, Reniforminae. Completely hermaphroditic, with two forebodies and two hindbodies massed together into a compact renifrom cyst, in the hilus of which is a stout stalk connecting the worm with the substratum of the gill of the host and carrying blood vessels from the host. Forebodies tapering anteriorly, with their base on the same horizontal plane as two shell gland complexes. Oral sucker and pharynx present. Esophagus and ceca not well traceable. Metraterm and ejaculatory duct well developed in forebody. Common genital pore ventrosubterminal. Hindbody divided into numerous cylindrical lobules, the surface of which is covered all over with large numbers of lobules devoid of special internal structures. Testes tubular, long, winding, definitely wider than ovary and vitelline gland, each convoluted in central lobules of hindbody near base of forebody of its own side, extending outward but stopping short of marginal area of hindbody. Seminal vesicle tubular, winding at base of its own forebody. Ovary and vitelline gland tubular, long, very narrow, extending into numerous lobules of hindbody of their own side, alone or combined with each other or with uterus, without occupying specific areas in contrast with testes. Two sets of genital junctions and shell gland complexes opposite each other on the same horizontal plane as base of two forebodies. Seminal receptacle present. Uterus occupying nearly all lobules of hindbody; no egg reservoir. Metraterm well developed. Eggs oval, small, embryonated. Attached firmly to gills of marine teleosts.

TYPE SPECIES: *R. multilobularis* n. sp., on gills of *Xiphias gladius* (type host) and *Tetrapterus angustirostris*: Hawaii.

Didymozoidae

Subfamily *RENIFORMINAE* n. subfam.

Yamaguti, 1970

SUBFAMILY DIAGNOSIS: Didymozoidae. Completely hermaphroditic, with two separate forebodies arising from ventral central portion of reniform mass of two hindbodies, which is divided into enormous numbers of cylindrical lobules. Vascular septa of host origin intruding deeply into interlobular space. Testes tubular, long, winding, in two sets of one each, extending profusely into lobules of hindbody along with uterus. Encysted on gills of marine teleosts, to which the worm is attached by a stout stalk carrying blood vessels from host fish.

297. *Reniforma multilobularis* n. g., n. sp.

(Fig. 297) Yamaguti, 1970

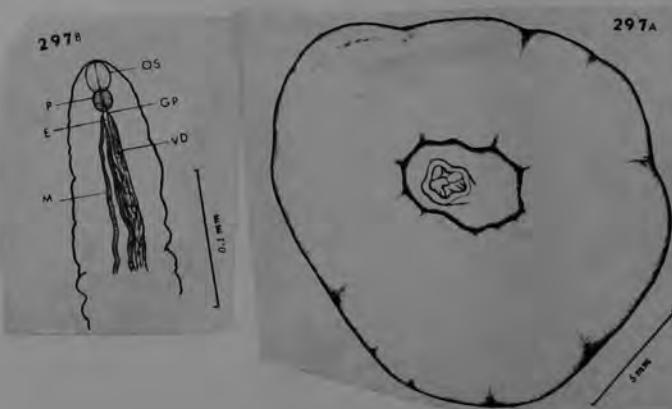
HABITAT: Attached firmly to gill filaments of *Xiphias gladius* (type host) and *Tetrapterus angustirostris*; Hawaii. **HOLOTYPE:** U. S. Nat. Mus. Helm. Coll., No. 63856. **DESCRIPTION** (based on unmounted holotype preserved in formalin and serial cross sections of two paratypes): Body flattened reniform, 18 X 15 X 5 mm, with irregularly rounded outline, covered with numerous, tubercular, parenchymatous outgrowths (Fig. 297 D, PL) reminding us of the ventral polyps of *Metadidymozoon branchiale* (*loc. cit.*). Ventral hilus nearly central, oval in outline, 5 X 3 mm; from the bottom of this hilus projects ventrad a stout stalk of host origin, by which the worm is attached to the cartilaginous substratum of the gill filaments, and through which blood vessels are supplied by the host. The entire worm is enclosed in a thin capsule which extends at the hilus over the stalk connecting the worm with the host tissue. The two separate forebodies, tapering anteriorly without cervical swelling, are attached to the ventral central portion of the hindbody in the comparatively wide space among the central lobes. Reniform body formed by conglomeration of two hindbodies, subdivided into enormous numbers of tubular lobules closely massed together, but separated one from another by the intervening interlobular septa carrying blood vessels from the host. In tangential sections the peripheral tubercles present a honeycomb-like appearance, without special internal structures. In cross sections of the deeper portion of the worm the tubular lobules are occupied by varying combinations of the reproductive organs, the distribution of which is different in different regions of the body. Oral sucker, pharynx and esophagus present; ceca not fully traceable. Seminal vesicle tubular, winding at base of forebody.

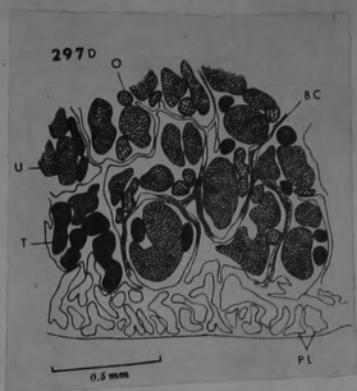
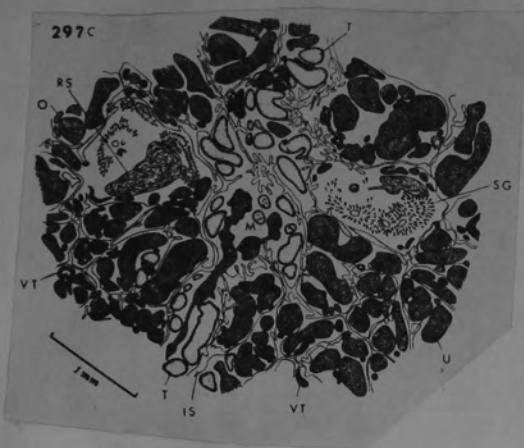
Testes two, tubular, long, winding, up to 0.18 mm wide, each convoluted near base of forebody of its own and not reaching as far outward as marginal area of hindbody. The two testes are situated opposite each other with the base of two forebodies between, on a plane at nearly right angles to the plane on which the two genital junctions are located. Ejaculatory duct and metraterm running almost straight toward common genital pore which lies midventrally at the posterior end of the pharynx.

Ovary and vitelline gland tubular, narrow, extending into numerous lobules of hindbody, accompanied by uterus or not; both organs not occupying specific area respectively, although they are undoubtedly confined to the hindbody region of their own side, and the vitelline gland is more extensive than the ovary. In some lobules there is one ovary, one vitelline gland or one testis alone, these organs are in varying combinations such as O+V, O+U, V+U, T+V, T+U, etc.,

We could not positively determine how regular these combinations are. It is certain, however, that there are a single ovary, a single vitelline gland, and a single testis for each half of the fused hindbody. Two shell gland complexes present on the same horizontal plane, separated by base of two forebodies. The distal end of the ovary, and that of the vitelline gland and seminal duct arising from tapering distal end of the seminal receptacle meet at the same point. Receptaculum seminis retort-shaped, up to 0.35 mm wide near its base, enclosed in shell gland complex; uterine duct winding in this region, surrounded by well developed shell gland cells which consist of two distinct types; those surrounding the proximal uterine duct being larger and containing more conspicuous nucleoli and coarser cytoplasmic granules, and those surrounding the distal uterine duct being smaller and a little more compact and containing less conspicuous nucleoli and cytoplasmic granules. Uterus extending into nearly all lobules of hindbody, so that the whole hindbody appears like a compact conglomerate of uterine coils. No egg reservoir. Metraterm well differentiated throughout length of forebody as well as in region of seminal vesicle, provided with a thick wall of inner circular and outer longitudinal muscles, and surrounded by accompanying cells; it describes a few windings before entering the forebody. Eggs oval, embryonated, 16-18 X 11-12 μ in sections. Excretory system unknown. The vascular septa from the host intrudes from the hilus into every interlobular space as the worm grows, and carries blood vessels of different calibers, in which abundant uninucleated red cells of the host fish are seen.

DISCUSSION: This genus bears a superficial resemblance to *Metadidymozoon branchiale* (*loc. cit.*) in lobation of the hindbody, but differs fundamentally from it in possessing a definite stalk. On the basis of this character I venture to propose a new subfamily, for which the name *Reniforminae* (*v. s.*) is suggested.





From Yamaguti, 1970

RENTIFORMA

Didymozoidae

Subfamily **SICUOTREMATINAE** n. subfam.

Yamaguti, 1970

SUBFAMILY DIAGNOSIS: Didymozoidae. Cyst elliptical, containing two free forebodies and fused hindbodies without any trace of vascular septa from the cyst wall of host origin. Forebodies arising from ventral slit in midregion of fused hindbody. Oral sucker and pharynx present. Testes tubular, in two sets of two each, peripheral, in plane at right angles to the plane connecting two genital junctions. Ovary and vitellaria tubular, long, branched, occupying peripheral area of hindbody. Receptaculum seminis and genital junctions peripheral, in equatorial region. Uterus coiled mostly longitudinally, occupying all available space of hindbody except for posterior extremity.

Didymozoidae

Sicuotrema n. g.

Yamaguti, 1970

GENERIC DIAGNOSIS: Didymozoidae, Sicuotrematinae. Cyst elliptical. Two forebodies enclosed in a slit-like cavity on ventral side of hindbody. Forebody scoop-shaped; oral sucker and pharynx present. No acetabulum. Ceca winding and swollen in hindbody, terminating at its posterior extremity. Hindbodies of two individuals completely fused into one elliptical body, with two sets of male and female reproductive organs. Testes four, in two sets, cylindrical, winding, each set situated laterally near equator of hindbody. Ovary and vitellaria long, tubular, winding, bifurcating several times, occupying peripheral area of hindbody except for rounded posterior end which appears transparent probably due to presence of excretory vesicle. Receptaculum seminis and shell gland lateral, pre-equatorial. Uterus coiled mostly longitudinally. Common genital pore ventrolateral to oral sucker. Eggs numerous, bean-shaped, embryonated. Parasitic on fins of marine teleosts.

TYPE SPECIES: *S. auxis* n. sp., on pelvic fins of *Auxis thazard*; Hawaii.

289. *Sicuotrema auxis* n. g., n. sp.

(Fig. 289) Yamaguti, 1970

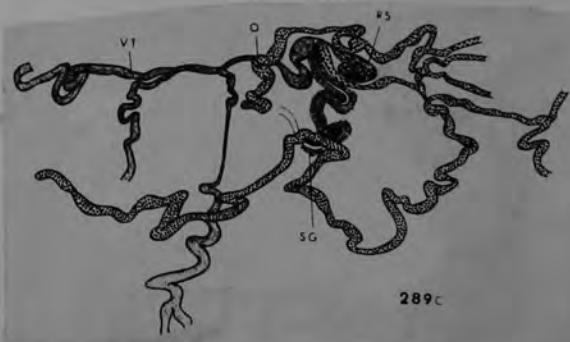
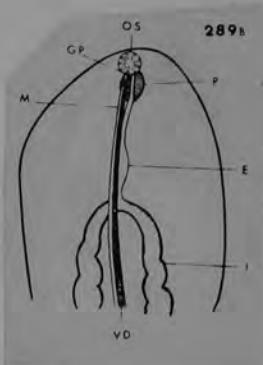
HABITAT: Enclosed in elliptical connective tissue capsule attached at posterior end of hindbody to membrane between rays of pelvic fin of *Auxis thazard* (local name "keokeo"); Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63848.
DESCRIPTION (based on five whole mounts strongly flattened dorsoventrally by wire compressorium): The two forebodies are habitually enclosed in a slit-like ventral hollow at about the middle of the common hindbody; they are scoop-shaped, 1.5-2.8 mm in length, with maximum width of 0.28-0.55 mm in esophageal region. Oral sucker ventroterminal, spherical, mostly cellular, about 50 μ long by 50 μ wide, directly followed by large pharynx which is 60-77 μ in diameter and consists exclusively of muscle fibers; esophagus 0.11-0.13 mm long; ceca narrow in forebody, but inflated and winding in hindbody, terminating at its posterior extremity. Hindbody elliptical, with rounded ends, 11-15 mm long by 3.5 mm wide, with its transparent hind end close to the point where the worm cyst is attached to the fin of the host.

Testes four, in two sets of two each, in tandem, cylindrical, winding, 0.5-1.0 X 0.15-0.22 mm; each set near lateral margin of hindbody, one set anterior to level of genital junction and the other set posterior. Vas deferens long, straight or slightly arcuate in hindbody, straight and alongside uterus in forebody. Common genital pore ventrolateral to oral sucker.

Ovary peripheral, consisting of a narrow or a distally swollen trunk which bifurcates four times at irregular intervals and a number of strongly winding terminal branches, the total number of which could not be made out. Some of the terminal branches may extend to the two extremities of the hindbody, but others terminate far away from them. Receptaculum seminis curved back on itself, about 0.2 X 0.12 mm as a whole in the type, situated at distal end of ovarian trunk close to genital junction which in the type lies near the left margin of the hindbody at a point dividing it in ratio of 2:3. Other genital junction toward middle of right margin of hindbody. Vitelline gland also peripheral and consisting of a short trunk which bifurcates four times at irregular intervals and an undetermined number of terminal branches, some of which reach to near the two extremities of the hindbody, while the others end intermediately. The total number of the terminal branches of the vitelline gland was impossible to determine. Uterus coiled irregularly, though mostly longitudinally, and filling all available space of hindbody except for transversely swollen ceca; no egg reservoir; metraterm somewhat muscular; eggs bean-shaped, embryonated, 11-14 X 8-9 μ . Excretory system not made out.

DISCUSSION: This genus is characterized by the complete fusion of the two hindbodies into an elliptical, massive, cucumber-like body, the ventral slit-like cavity of which contains two separate forebodies. The fused hindbody contains two sets of testes and two sets of female reproductive organs. Such a characteristic body shape, the origin of the two forebodies from the slit-like hollow on the ventral side of the midregion of the hindbody, and the absence of vascular septa of host origin justify the separation of this genus from any of the known subfamilies. It seems to represent a new subfamily somewhat resembling Opepherotrematinae Yamaguti, 1958. The generic name refers to the cucumber-like fused hindbody.





From Yamaguti, 1970

SICUOTREMA

2. *Torticaecum* Yamaguti, 1942

Generic diagnosis — Family unknown. Body small, elongate. Acetabulum embedded in parenchyna in anterior third of body. Mouth terminal, without oral sucker, pharynx present; esophagus long, narrow; no "stomach" portion. Ceca surrounded by large vesicular cells at straight anterior part, twisted elsewhere, terminating near posterior extremity. No genital anlagen. Excretory vesicle terminal, with a long median collecting vessel.

Genotype: *T. nipponicum* Yamaguti, 1942, in intestine of various marine fishes (*Saurida*, *Callionymus*, *Paralichthys*, *Hyperhamphus*, *Chaeturichthys*, *Leiognathus*, etc.); Japan.

Other species: *T. fenestratum* (Linton, 1907), in *Lycodontis moringa*; Bermuda.

group name - see Yamaguti, 1971

***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

to *Gonapodasimus 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.

From FISCHTHAL AND KUNTZ, 1964

Didymozoidae

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 *Torticacum*, noting that Linton's (1905) figures 213 and 214 of this form 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) (Pomadasytidae); 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 eyespot 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.

From FISCHTHAL AND KUNTZ, 1964

Torticaecum-group metacercariae SHIMAZU, 1978

(Fig. 11)

The following description is based on two specimens obtained free from the trunk coelom of *S. minima*, one parasite from one host (1-2 Nov. 1972).

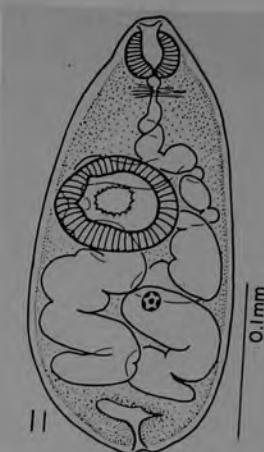
Specimen Nos. NSMT-PI-1829 and 1830.

Description. Metacercariae, not encysted. Body contracted, oval, 0.150-0.280 mm long by 0.067-0.126 mm wide. Parenchyma partly vesicular. Cuticle non-spinous, transversely wrinkled. Oral sucker nearly globular, 0.019-0.032 mm long by 0.016-0.038 mm wide, slightly embedded into anteriormost portion of body. Ventral sucker 0.025-0.063 mm long by 0.029-0.072 mm wide, embedded in body parenchyma, in front of mid-level of body. Pharynx not seen. Oesophagus winding, with a small swelling at its beginning portion. Stomach absent. Intestinal caeca tortuous or partly spiralling, very thin-walled, filled with fluid stainable with carmine, terminating within middle third of hindbody, with their bifurcation in front of ventral sucker. Genital anlagen small, three in one specimen and one in the other; in the former, anterior two smaller, tandem, submedian, dorsal to ventral sucker, and posterior one larger, median, just behind ventral sucker. Excretory vesicle saccular, small, in posterior third of hindbody; pore terminal.

Discussion. In lacking the stomach and in having the tortuous intestines, the present didymozoid metacercariae are assigned to the group *Torticaecum*, a collective larval-group of YAMAGUTI (1970), which is distinguished from the *Monilicaecum* principally by the absence of the stomach (YAMAGUTI, 1942). They cannot be identified further. YAMAGUTI (1970) found that the *Torticaecum*-group larvae in Hawaiian fishes also included several different species.

The metacercaria (NSMT-PI-1831) obtained free from the trunk coelom of *S. pacifica* (26 Sept. 1975) appeared to be lacking in the stomach and therefore to belong to the *Torticaecum*. Its measurements were: body 0.178 mm long by 0.084 mm wide; oral sucker 0.028 mm long by 0.021 mm wide; ventral sucker 0.044 mm long by 0.043 mm wide.

Didymozoid metacercariae were reported by REIMER *et al.* (1971) from a copepod, a chaetognath (*S. elegans* VERRILL), a polychaete, a ctenophore, and six coelenterates, all collected in the North Sea. The stomach's measurements were given in the morphological description of them, but they do not seem to possess the stomach from the figure 2 by REIMER *et al.* (1971). Later, they were placed in the *Torticaecum* by REIMER *et al.* (1975). The writers (1971) considered the copepod to be a second intermediate host and the others reservoir (or paratenic) hosts.



TORTICAE.COM

Tricharthen Poche, 1928

Generic diagnosis. — Didymozoidae, Koellikeriinae: Completely gonochoristic. Male filiform throughout, slightly enlarged anteriorly and tapered posteriorly. Oral sucker almost terminal, acetabulum a little smaller than oral sucker, near anterior extremity. Pharynx absent. Esophagus bifurcating about midway between two suckers. Ceca slightly undulating, terminating at posterior extremity. Testes pyriform, 4 in number, situated one after another in midregion of body. Vas deferens very strongly winding, but straightened out and somewhat tapered anterior to acetabulum, cirrus claviform, between two suckers. Female: Body divided into filiform forebody and thick, more or less lobed, reniform hindbody. Ceca not extending into hindbody, apparently ending blindly posterior to acetabulum. Ovaries tubular, winding, in anterior part of hindbody. Vitellaria? Uterus strongly coiled and occupying whole hindbody, opening between two suckers. Excretory vesicle pyriform. Parasitic in gill arch, operculum, walls of gill chamber of rays.

Genotype: *T. okenii* (Koelliker, 1849) Poche, 1926 (Pl. 102, Fig. 1241), in *Brama raji*; Naples.

TRICHARCHEN

Triplocystoides n. g.

Yamaguti, 1970

GENERIC DIAGNOSIS: Didymozoidae, Opepherotrematinae. Complete hermaphrodites, with three free forebodies and a rounded fused hindbody containing three sets of male and female gonads. Forebody enclosed in tubular canal opening into shallow cavity, which in turn opens widely at the ventral center of the hindbody. No vestibular cavity as observed in *Opepherocystis kawakawa*. Oral sucker terminal, musculocellular; pharynx strongly muscular. Ceca in hindbody diverticulate. No acetabulum. Testes in three sets of two each, at nearly equal distance one set from another, close to border of hindbody. Common genital pore ventral to oral sucker. Ovary and vitelline gland tubular, long, very narrow, irregularly ramified dichotomously into a number of terminal branches which are mainly distributed in peripheral area of hindbody, only partly overlapping one another; vitelline branches more extensive than ovarian branches. Three genital junctions situated very close to border of hindbody at different intervals. Shell gland rather poorly developed. Seminal receptacle present. Uterine coils profuse; metraterm well developed in circumference of hindbody, winding but not convoluted before entering forebody. Eggs small, bean-shaped, embryonated. Encysted in subserosa of stomach of marine teleosts.

TYPE SPECIES: *T. yaito* n. sp., in *Euthynnus yaito*; Hawaii.

Didymozoidae

295. *Triplocystoides yaito* n. g., n. sp.

(Fig. 295) Yamaguti, 1970

HABITAT: Encysted in subserosa of stomach of *Euthynnus yaito* (local name "kawakawa") and in association with *Opepherotrematoides multitubularis*; Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63854.

DESCRIPTION (based on a single gravid specimen subjected to strong cover glass pressure): Three forebodies free; three corresponding hindbodies fused into one globular body 5.5 mm in diameter.

Forebody No. 1. Projecting out of midventral pit of hindbody for its entire length and reaching beyond border of hindbody, 3.5 mm long, enlarged anteriorly up to 0.35 mm wide, 50 μ wide at its narrowest part, containing many eggs in metraterm; oral sucker musculocellular, 80 μ in diameter.

Forebody No. 2. Reaching to border of hindbody, 3.3 mm long, 0.33 mm wide in esophageal zone, with its narrow portion looped at midventral pit of hindbody, containing very few eggs in metraterm; oral sucker musculocellular, 70 μ in diameter, followed by muscular pharynx 70 μ long by 46 μ wide.

Forebody No. 3. Projecting out of midventral pit of hindbody for a short distance from head end to level of anterior part of ceca, 1.9 mm long, 0.4 mm wide at its cervical swelling, containing few eggs in metraterm; oral sucker musculocellular, 65 μ in diameter; pharynx strongly muscular, 93 X 77 μ ; esophagus 0.2 mm long; ceca narrow in forebody as in other forebodies.

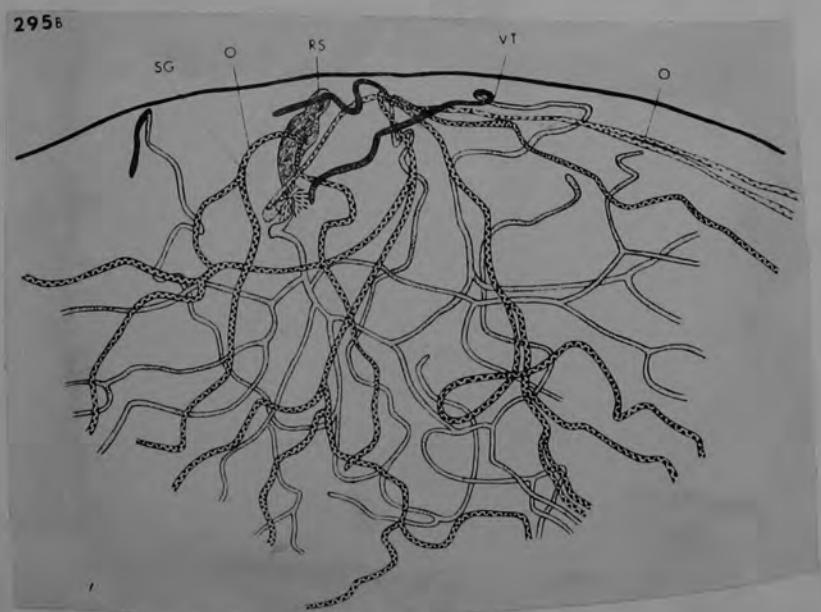
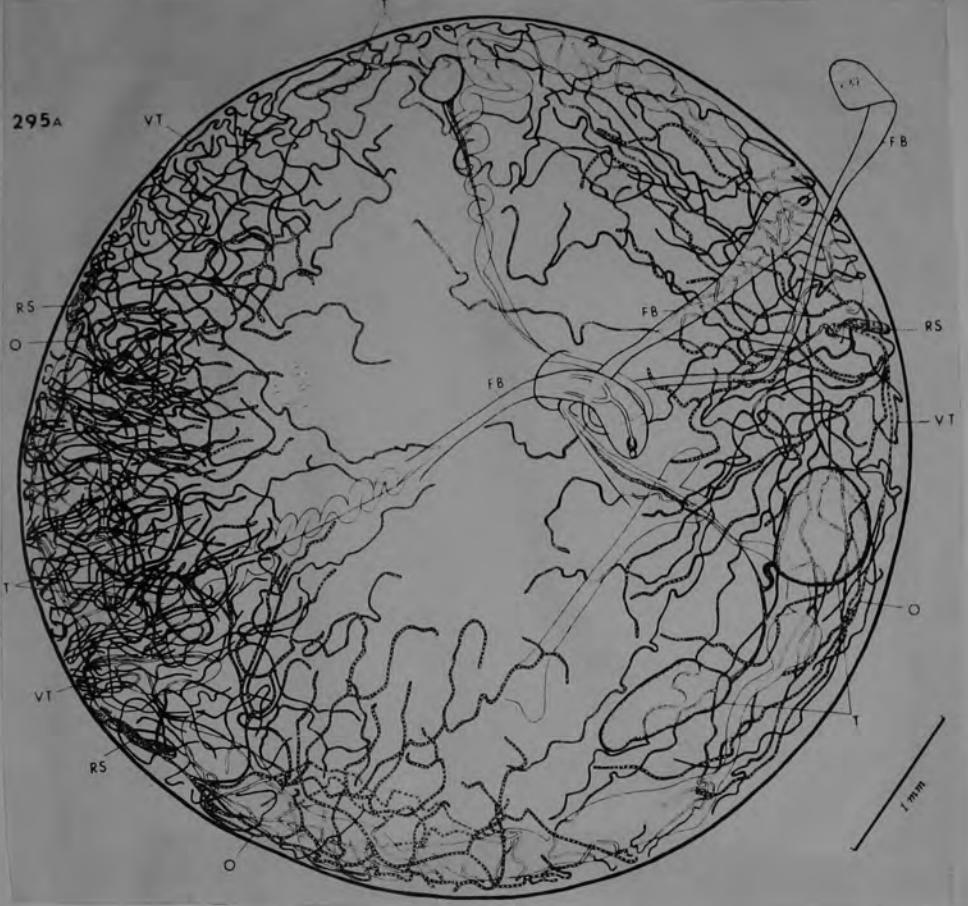
Hindbody exactly spherical, provided with strong muscle bundles radiating on ventral side from midventral pit toward periphery. Midventral pit, through which three forebodies are thrust out, is round, 0.35 X 0.3 mm, and provided with dense layer of cellulofibrous tissue but no other particular structure, leading into a shallow cavity into which project the three forebodies, as mentioned above. There is no vestibular cavity as observed in *Opepherocystis kawakawa* n. sp., although there is a tubular thin-walled sheath-like receptacle for each forebody. This receptacle is seen only when the forebody is retracted into it. Part of ceca is seen as a wide diverticulate tubule, but the whole organ could not be traced.

Testes in three sets of two each, each set situated close to border of hindbody at nearly equal interval; each testis irregular in shape, rounded or elongate, 0.3-0.9 X 0.17-0.57 mm; two vasa efferentia from each set of testes united near their origin to form straight vas deferens which runs alongside the metraterm in the forebody. Common genital pore ventral to oral sucker.

Ovary and vitelline gland extremely narrow, only up to 4-5.5 μ wide; ovary consisting of a small number of main branches which are irregularly dichotomous and finally divide into a number of terminal branches (16 for first third corresponding to forebody No. 1, 35 for second third corresponding to forebody No. 2, and 33 for last third corresponding to forebody No. 3); vitelline gland also divided into several main branches which are irregularly dichotomous like the ovary and apparently terminate in more numerous branches (44 for first third corresponding to forebody No. 1). All the ovarian and vitellarian branches are confined to the peripheral area leaving central area free for the uterus; vitelline branches more extensive than ovarian branches, partly overlapping one another. There are three genital junctions near the border of the hindbody at unequal distances one from another, as shown in the figure. Seminal receptacle elongate, 0.25-0.3 X 0.05-0.08 mm, close to genital junction of its own. Uterus coiled internal to ovariovitellarian area and in central area. Three metraterms distended with eggs, extending in whole marginal area of hindbody, winding but not forming convolutions as conspicuous as in *Opepherocystis kawakawa* n. sp. before entering forebodies. In each forebody the metraterm is rather straight, not fully distended with eggs. Eggs small, bean-shaped, embryonated, 13-16 X 9 μ . Excretory system not made out.

DISCUSSION: This genus differs from the most closely related *Opepherotrematoides* n. g. in possessing three complete sets of male and female gonads. There is a possibility that three worms became completely fused into one hindbody, with the three forebodies free, but until this triple union turns out to be an abnormality, I prefer to regard it as representing a distinct genus. The generic name refers to this triple union.

O V C A



From Yamaguti, 1970



PEN-TAB

LOOSE LEAF INDEX

SCHEDULE

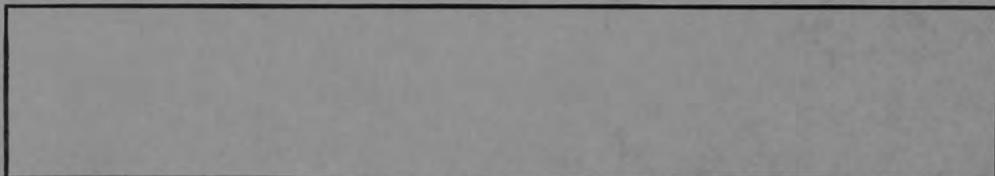
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MADE IN U. S. A.

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Unitubulotestis Yamaguti, 195¹

Generic diagnosis — Didymozoidae, Nematobothriinae: Complete hermaphrodite, sexual dimorphism may be indicated. Encysted in pairs or not. Body slender, long, Pharynx present. No acetabulum. Ceca extending to near posterior extremity, degenerate. Testes single, tubular, long or sausage-shaped, in anterior part of body. Genital pore posterior to pharynx. Ovary and vitellaria single, tubular; former anterior, latter posterior, to genital junction. Shell gland and receptaculum seminis pre- or post-equatorial. Uterus reaching to posterior extremity. Parasitic in pharyngobranchial region or gill of marine fishes.

Genotype: *U. carangis* Yamaguti, 195¹ (Pl. 26, Figs. 335—338), in pharyngobranchial region of *Caranx* sp.; Macassar, Celebes.

Other species: *U. sardae* (G. A. et W. G. MacCallum, 1916) in gills of *Sarda sarda*.

Unitubulotestis n. g. Yamaguti, 1953.

Generic diagnosis: Didymozoidae Poche, 1907; complete hermaphrodites. Encysted in pairs or not. Body slender, long, not divided into two distinct regions. Oral sucker and pharynx present. Acetabulum absent. Esophagus narrow. Ceca extending to near posterior extremity or degenerated. Testes single, tubular, long or sausage-shaped, anterior to ovary. Vas deferens sinuous or convoluted, opening with metraterm near anterior extremity. Ovary and vitellarium single, tubular, former anterior, latter posterior, to shell gland complex. Shell gland and receptaculum seminis pre- or post-equatorial. Uterus reaching to posterior extremity where it turns back on itself and runs up to the genital pore, with its terminal portion provided with well developed circular muscle or without any special musculature. Eggs comparatively small.

Genotype: *Unitubulotestis carangis*.

Other species: *U. sandae* (G. A. et W. G. MacCallum, 1916).

32. *Unitubulotestis carangis* n. g., n. sp. Yamaguti
Pl. IV, Fig. 15 (A - D).

Habitat. Pharyngobranchial region of *Caranx* sp.

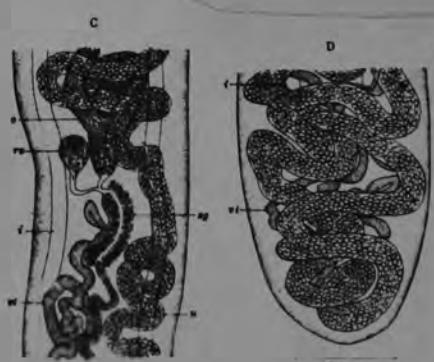
Material and locality. A single whole mount; Macassar.

Body slender, 18 mm in length, with maximum breadth of 0.92 mm at about middle, whence it tapers slowly toward the pointed anterior extremity; posterior extremity rounded and only a little enlarged. Cuticle thin, smooth; subcuticular longitudinal muscle fairly well developed, but circular muscle very fine, discernible under high power magnification only.

Oral sucker terminal $18 \times 30 \mu$, with very poorly developed musculature, directly followed by a bulbous pharynx which is 40μ long by 38μ broad and has weak musculature. Esophagus very narrow, about 0.16 mm long by 2.5μ wide; ceca dorsolateral, narrow, and strongly winding anteriorly but moderately wide for greater posterior part, rather straightened out as they approach the posterior extremity, about 1.3 mm in front of which they terminate blindly. Acetabulum lacking.

Testis single, tubular, 0.1 - 0.22 mm wide, extending sinuously dorsal to uterus for a distance of 6.3 mm, commencing at a point 3.8 mm from anterior extremity and terminating just in front of anterior end of ovary. Vas deferens arising from anterior end of testis, winding its way forward in intercecal field dorsal to metraterm, provided with fine longitudinal and circular muscle fibers and lined with a layer of epithelium, dilated bulbously to a width of $50 - 65 \mu$ at some places, varying elsewhere from 30μ to 40μ in diameter with gradual decrease toward distal end. It opens mid-ventrally together with the metraterm at a distance of 72μ from anterior end of body.

Ovary tubular, $60 - 80 \mu$ in diameter, winding irregularly dorsal to uterus from behind testis to a point 5.8 mm from posterior extremity, where it tapers abruptly to a short germiduct by which it joins the receptaculum seminis and the vitelline duct. From this point of junction arises the uterine duct surrounded by a dense cluster of shell gland cells, which runs backwards somewhat sinuously for a distance of about 0.5 mm and then passes into the uterus



proper. Receptaculum seminis retort-shaped, about 0.15 mm in diameter, situated on the right of posterior end of ovary, connected with genital junction by means of a sigmoid duct about 0.21 mm long by $12 - 15 \mu$ wide and surrounded by a thick layer of accompanying cells. The uterus descends in an irregularly winding course as far as the posterior extremity of the body, where it turns back on itself to be continued into the ascending uterus. This portion, $0.07 - 0.18$ mm in diameter, winds its way forward ventral to the vitelline gland and ceca, ventral or sinistral to the descending uterus, and then ventral to the ovary and testis, and finally tapers markedly at the level of the anterior end of the testis to pass into the well differentiated metraterm. The latter is provided with circular muscle and a thick coat of accompanying cells, with greatest diameter of about 0.1 mm near its posterior end; it makes serpentine windings ventral to the vas deferens and narrows gradually as it proceeds forwards, and attaining a minimum width of 12μ opens to the outside along with the vas deferens. Eggs elliptical, rather thin-shelled, embryonated, $27 - 30 \mu$ by $15 - 17 \mu$. Vitelline gland tubular, single, $60 - 75 \mu$ wide, originating with a blunt end near posterior extremity, winding irregularly dorsal to uterus, partly interlacing with the latter, finally running through shell gland along right side of uterine duct to join the germiduct and the receptaculum seminis at the same point. Excretory system not made out.

The present worm is characterized by the possession of a single tubular testis. In this respect as well as in general anatomy of the female reproductive organs it bears a close resemblance to *Nematobothrium sardae* G. A. et W. G. MacCallum, 1916, all the other well known members of *Nematobothrium* possessing two testes. In *Nematobothrium* species the digestive system and the acetabulum being subject to considerable variation due to retrogression cannot be utilized for taxonomic differentiation. The number and disposition of the reproductive organs are, however, characteristic of each member and apparently of more than specific significance. Though not worked out definitely in regard to these organs, *N. filarina* shows a marked tendency toward proterandrous development in smaller individuals (predominant male) in contrast with larger ones (predominant female) as in *Gonapodasmius*, and in addition to this, both genera being similar in general body shape, in

beads-like dilatation of the uterus due to uneven accumulation of eggs, and in the mode of living may turn out to be identical. Until convincing evidences are submitted by re-examination of van Beneden's original specimens, I would prefer to retain the genus *Nematobothrium* in a broad sense as defined in my paper of 1934, but the finding of the present species with a single testis compels me to separate it with *N. sardae* as representing a distinct genus, for which the name *Unitubulotestis* is proposed.

Unitubulotestis maris sp. nov. Caballero and Caballero, 1971
 (Figs. 1 y 2)

Parásitos de cuerpo alargado con extremos anterior y posterior angostos y terminados en punta roma. La longitud total del cuerpo es de 17.355 a 33.210 mm por 1.430 a 1.944 mm de anchura. En todos los ejemplares se puede distinguir una región anterior y una posterior de forma y tamaño diferentes; en la región anterior se encuentran alojados fundamentalmente las estructuras terminales de los aparatos reproductores masculino y femenino, así como la parte anterior del aparato digestivo y los ciegos intestinales que en esta región se adosan el uno al otro, separándose y haciéndose evidentes cerca del nivel en donde comienza la región posterior del cuerpo.

La región anterior es muy contráctil y mide de 1.944 a 3.380 mm de largo por 0.729 a 0.780 mm de ancho a nivel de la terminación. La porción posterior es ligeramente más angosta que el resto del cuerpo y aloja la parte terminal de los ciegos intestinales, algunas asas uterinas y de la glándula vitelógena, así como la vesícula

excretora y mide de 13.975 a 31.266 mm de largo por 1.430 a 1.879 mm de ancho a nivel del receptáculo seminal.

La cutícula es ligeramente gruesa, resistente y con escasas papillas cuticulares en la región anterior; la musculatura se presenta con perfecta claridad en esta parte del cuerpo y disminuye paulatinamente después de pasar a la región posterior hasta convertirse en una delgada capa muscular que se continúa por los bordes laterales del cuerpo para hacerse nuevamente más espesa en la extremidad posterior.

La ventosa oral es subterminal, oblonga, pequeña y musculosa, mide de 0.203 a 0.224 mm de largo por 0.152 a 0.176 mm de ancho. La abertura bucal es muy pequeña y de bordes finos y delicados; no se observó faringe; el esófago es un tubo angosto, de paredes delgadas que mide de 0.499 a 3.040 mm de largo por 0.026 a 0.048 mm de ancho. En seguida de la bifurcación intestinal los ciegos se adosan el uno al otro, pudiéndoseles observar con toda claridad cerca del límite de la región anterior con la posterior, así como en el extremo posterior del cuerpo. El esófago

y la parte más anterior de los ciegos intestinales están envueltos perfectamente por una masa de células glandulares; dentro de esta masa celular también quedan envueltos parte de los conductos de los complejos reproductores masculino y femenino. No se observó acetáculo.

El testículo es tubuloso, se inicia cerca del borde posterior del receptáculo seminal y dorsalmente a éste, forma algunas asas cortas; luego se dirige hacia el borde



lateral derecho del cuerpo constituyendo asas laterales cortas, apretadas, dispuestas en dirección ascendente; se entrelazan pasando de vez en cuando al lado opuesto del cuerpo para así formar otras tantas asas que de esta manera van llenando los campos laterales hasta resolverse en asas gruesas apelotonadas en la mitad izquierda de la parte más anterior de la región posterior del cuerpo de estos animales. El testículo se hace fino bruscamente para

continuarse después con un angosto y delicado conducto eferente, el cual más adelante constituye el conducto deferente que es de paredes ligeramente sinuosas y se abre en el poro reproductor masculino pequeño y circular, que se sitúa en el tercio posteroventral de la ventosa oral y por delante del poro reproductor femenino y los cuales distan 0.107 del borde anterior del cuerpo.

- OVER -

El ovario es también tubular y se desenvuelve en numerosas asas por delante del receptáculo seminal, desemboca en lo que se considera un gran receptáculo de óvulos, éste es dorsal en relación al receptáculo seminal y se sitúa bajo su lóbulo más posterior, cerca de la línea media del cuerpo, es de aspecto sacciforme, con el polo anterior ancho y redondeado y el posterior provisto de una estructura de bordes lobulados, levemente esclerosados y mide 0.163 mm de largo por 0.078 mm de ancho, el oviducto no fue localizado. Muy cerca del polo posterior del receptáculo ovígeno se encuentra el ootipo muy bien definido, de forma ovalada y de paredes delgadas, a él llega por su borde lateral izquierdo el viteloducto que proviene del receptáculo vitelino y de ese mismo lado sale el útero con los primeros huevecillos recién formados. Las primeras asas uterinas se desenvuelven en un área media pequeña, situada por delante del receptáculo seminal, las que se dirigen hacia el lado izquierdo del cuerpo y a partir de ahí forman asas ascendentes cortas y apretadas muy semejantes a las que forman el testículo; al alcanzar en la parte anterior, las asas más gruesas del testículo, se forma el asa descendente uterina que recorre el cuerpo del trematodo de la misma manera que el asa ascendente, llenando así todo el espacio comprendido entre los órganos del complejo reproductor femenino y el borde posterior del cuerpo; al llegar a los límites del borde posterior, el útero forma una nueva asa ascendente, la cual mediante una nueva serie de asas remonta hasta la mitad de la longitud total del cuerpo originando en ese momento y, después de un estrangulamiento, probablemente un minúsculo esfínter, una nueva estructura tubulosa que asciende directamente, sin formación de asas, hasta terminar en el poro reproductor femenino pequeño, de forma ovalada y que se abre posterior al poro masculino, también en el área de la ventosa oral; este conducto es primeramente fino, de paredes poco musculosas, paulatinamente se hace más ancho y más muscular, sobre todo en las cercanías de las asas uterinas más anteriores, a partir de donde se hace fuertemente muscular en sentido transversal. El útero contiene miles de huevecillos

pequeños, de cáscara lisa y amarillenta que miden de 0.015 a 0.017 mm de largo por 0.007 a 0.009 mm de ancho; estos huevecillos no contienen ninguna larva en desarrollo. El receptáculo seminal es voluminoso, subesférico y situado en un pequeño espacio del primer tercio del cuerpo, está limitado por asas uterinas que lo rodean por todos sus lados, además, hacia adelante por asas testiculares y hacia atrás por asas vitelinas y mide de 0.352 a 0.421 mm de largo por 0.176 a 0.324 mm de ancho. La glándula de Mehlis rodea al ootipo y es posterior al receptáculo seminal, pero se extiende hasta por delante y por el lado izquierdo de este mismo órgano formando un área triangular bien desarrollada y que se termina por delante del área ocupada por las últimas asas vitelinas y mide 0.729 mm de largo por 0.729 mm de ancho.

La glándula vitelógena es tubulosa muy larga y angosta, está constituida por un único tubo que se inicia un poco por detrás de las últimas asas uterinas que se localizan en la región posterior y se extiende por detrás de la glándula de Mehlis sin sobrepasar los límites señalados por las primeras asas testiculares; la glándula vitelógena sube desde la región posterior del cuerpo hasta su terminación, mediante asas cortas laterales y asas largas transversales que pasan al lado opuesto formando otras tantas asas cortas laterales y así sucesivamente; de la parte terminal de la glándula vitelógena sale un delgado viteloducto que se dirige oblicuamente hacia el receptáculo vitelino, lo atraviesa ventralmente y continúa su ascenso sobre el borde laterodorsal izquierdo y del receptáculo seminal; después se regresa siguiendo el mismo trayecto hasta abrirse en el receptáculo vitelino. Este último es pequeño, oval, situado por debajo del área lateral del receptáculo seminal y mide de 0.074 a 0.193 mm de largo por 0.044 a 0.107 mm de ancho.

Hospedador. "Bonito", *Sarda lineolata* (Girard, 1858). Familia: Cypridae.

Localidad. Aguas marinas de la Bahía de Todos Santos, Océano Pacífico, Ensenada, Baja California, México.

Holotipo. Colección de Helmintología del Laboratorio de Helmintología del Instituto de Biología de la Universidad Nacional Autónoma de México. N° 226-7.

DISCUSIÓN

Unitubulotestis maris sp. nov., se distingue de *U. carangis* Yamaguti, 1953; de *U. parupenei* Yamaguti, 1970; de *U. spilonotopteri* Yamaguti, 1970 y de *U. sardae* (MacCallum y MacCallum, 1916) Yamaguti, 1953, y de *U. laymani* Nikolaeva y Parukhin, 1971, las únicas especies conocidas, porque el poro reproductor se abre a nivel de la parte medioventral de la ventosa oral, por ausencia de faringe y por la presencia de un receptáculo ovígeno. Las especies descritas por S. Yamaguti se encuentran en aguas marinas de Célebes y de las Islas Hawaii, la de B. M. Nikolaeva y Parukhin, 1971, en el Océano Índico, y la especie de G. A. MacCallum

y W. G. MacCallum en aguas del Atlántico norte y sur. *Unitubulotestis maris* sp. nov., es una especie del Océano Pacífico occidental, en aguas mexicanas.

Se ha introducido una nueva designación para la subclase formada por Baer y Joyeux, Didymozoca en lugar de Didymozoidea de acuerdo con la recomendación del artículo 29 Rec. "29A. Superfamilles et tribus.—Il est recommandé d'adopter la désinence-oïde pour les noms de superfamilles et ini pour les noms de tribus" del Código Internacional de Nomenclatura Zoológica adoptado por el XV Congreso Internacional de Zoología.

ABSTRACT

The gills of the sea-fish *Sarda lineolata* (Girard, 1858) from Todos Santos Bay, Ensenada, Baja California, Mexico, are parasitized by encysted forms of a Trematode, of the family Didymozoidae, *Unitubulotestis maris* sp. nov. This trematode differs from the other five known species in the following characters: a) absence of pharynx; b) situation of reproductive pore in the medio-ventral region of the oral sucker and c) presence of an ovule-receptacle.

277. *Unitubulotestis parupenei* n. sp.

(Fig. 277) Yamaguti, 1950

HABITAT: Free in mesentery of *Parupeneus chrysopodus* (local name "moanokea"); Hawaii.

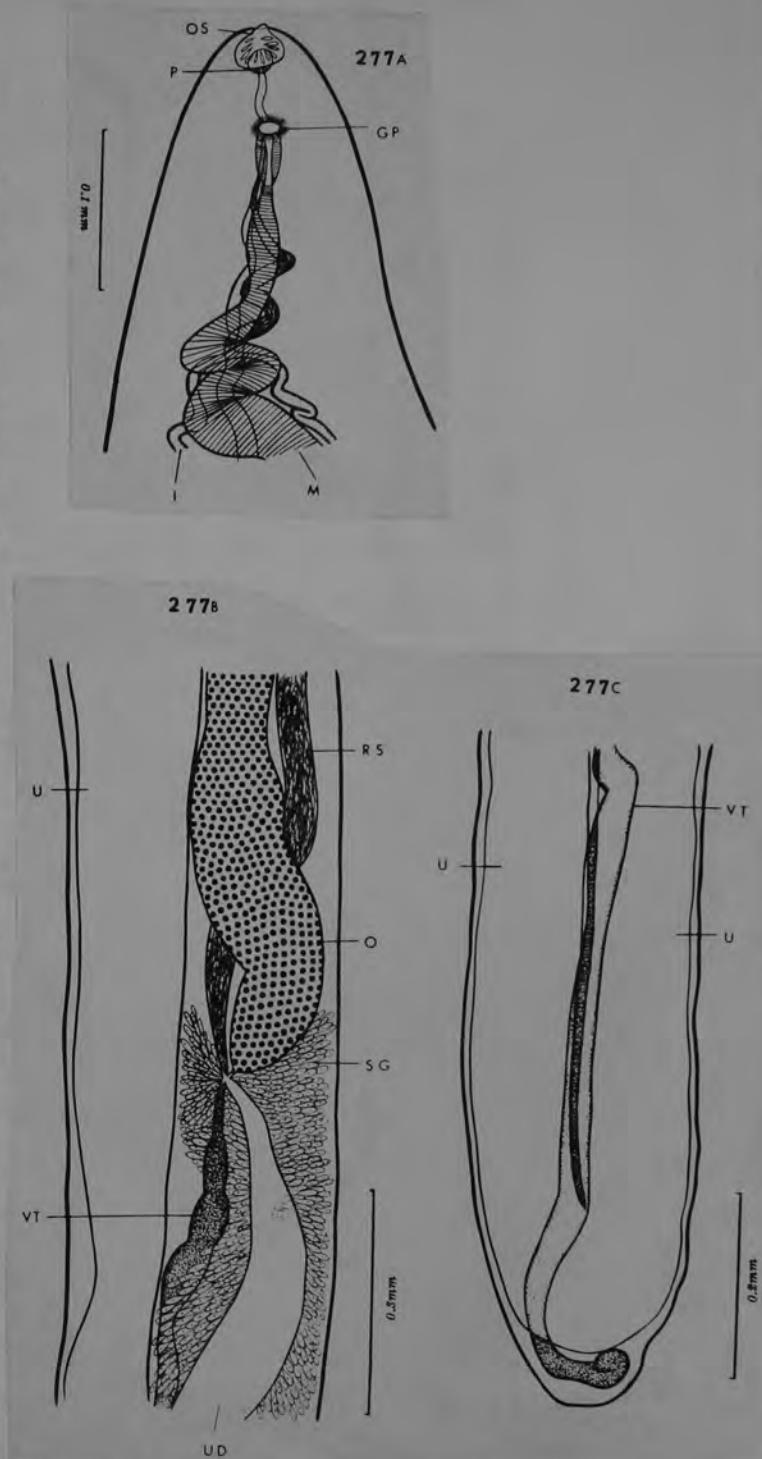
HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63839.

DESCRIPTION (based on three whole mounts): Body filiform, 74-95 mm long, 0.3-0.4 mm wide at level of distended uterus. Anterior extremity tapering to a blunt point; posterior extremity rounded. Oral sucker terminal, weakly developed, $23-35 \times 32-44 \mu$, directly followed by rudimentary pharynx; esophagus narrow, 0.3 mm long in the type 74 mm long; ceca narrow, not traceable to their posterior ends. No acetabulum.

Testes single, tubular, winding at places, 8-12.5 mm long lineally, commencing just in front of anterior end of ovary and terminating at a distance of 3.6-4.8 mm from head end. Vas deferens straight, inflated (up to 50μ) proximally, narrowed and winding alongside metraterm anteriorly. Genital pore ventromedian, a little posterior to rudimentary pharynx.

Ovary tubular, winding at places, about 10-20 mm long lineally, commencing at a distance of 13-19 mm from head end, turned back on itself at its anterior end for a length of 0.1-0.5 mm, somewhat swollen at distal end. Genital junction shortly anterior to middle of body, 34-37 mm from head end. Seminal receptacle tubular, directed forward from genital junction. Initial uterine duct narrow, but abruptly distended with immature eggs 0.25 mm posterior to genital junction in the type. Descending uterus proper containing mature eggs, turning back on itself at posterior extremity; ascending uterus distended with mature eggs, almost straight between posterior extremity and genital junction, occupying entire width of body, tapering as it approaches the anterior extremity, leading into metraterm at anterior part of testis. Metraterm winding in median field, provided with an outer layer of prominent cells well stainable with hematoxylin and an inner layer of very fine circular muscle fibers. Eggs elliptical, $23-28 \times 13-16 \mu$. Vitellarium tubular, ascending almost straight, largely in median field, from posterior extremity to genital junction without forming distinct vitelline reservoir.

DISCUSSION: This species differs from the type species of the genus, *Unitubulotestis carangis* Yamaguti, 1953, in the pharynx being rudimentary, in the uterus and vitelline gland being almost straight in the posterior part of the body, and in egg size. It differs from *U. spilonotopteri* n. sp. in the structure of the seminal receptacle, in lacking the vitelline reservoir, in the position of the genital pore, and in egg size.



Didymozoidae

Unitubulotestis sardae (MacCallum & MacCallum, 1916)
Yamaguti, 1958.

RESEARCH NOTE . . . J. Parasit. 54(1):128. 1968.

***Unitubulotestis sardae* (Trematoda: Didymozoidae) from Brazil**

Six trematode specimens were recovered from the gills of two fish *Sarda sarda* caught in Guanabara Bay, State of Guanabara, Brazil, during the summer of 1965. The trematodes, unencysted and lying intertwined among the gill branchiae, were extremely delicate and filamentous, and measured 15 to 24 mm long and 0.5 to 1 mm wide. These specimens were identical to *Unitubulotestis sardae*, a didymozoid first described by MacCallum and MacCallum (1916, Zool. Jahrb. Abt. Syst. 39: 141-168) as *Nematobothrium sardae*, except that they were shorter, which may be accounted for by differences in age or in fixation methods employed.

MacCallum and MacCallum stated that in their trematode the very short esophagus led into a "curious single intestinal canal . . . surrounded by a thick bushy mass of cells." This canal wound posteriorly for 4 to 5 mm before passing into an "extremely thin-walled tube" that could not be traced further because of its similarity to the "wide and tortuous excretory canals which are present everywhere throughout the length of the body."

In the present specimens, the esophagus extended 2 to 3 mm posteriorly, the length of the so-called "single intestinal canal," and bifurcated to form two thin-walled ceca that reached to the posterior end of the worm. Nucleated red blood cells, presumably those of the fish host, were visible in the pharynx, esophagus, and anterior part of the ceca. Since MacCallum and MacCallum could not determine where the orifice of the "excretory

canals" was located, they may have mistaken the ceca for the excretory tubes.

Four of the six specimens from Brazil were immature, and one of these four exhibited a short tube which bifurcated in the esophageal region, just posterior to the pharynx. This tube probably corresponds to a similar structure described as part of the excretory vesicle in the didymozoids *Metanematothrium guernei*, *Gonapodasmius pristipomatis*, *Gonapodasmius pacificus*, and *Paragonapodasmius managuense* by Yamaguti (1938, Jap. J. Zool. 8: 15-74).

Yamaguti (1953, Acta Med. Okayama 8: 257-295) created the genus *Unitubulotestis* to include those species that possess a single tubular testis, as opposed to the closely related *Nematobothrium* with two testes.

My findings indicate an extension of the known range of *U. sardae* southward from the North American Atlantic coast to the coastline off the State of Guanabara, Brazil.

I wish to thank Dr. Haraldo Travassos Museu Nacional, Rio de Janeiro, Brazil for identifying the fish species, and Dr. Laure Travassos and Miss Anna Kohn of the Instituto Oswaldo Cruz, Rio de Janeiro, Brazil for their help and encouragement.

This study was part of a thesis submitted to the Graduate School, University of California, Los Angeles in partial fulfillment of requirements for the Master of Arts degree (1966), and was supported by training grant AI-70 to the author from the U. S. Public Health Service.

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Didymozoidae

Unitubulotestis sardae

2796—HSU, K. C., 1968. "Unitubulotestis sardae (Trematoda: Didymozoidae) from Brazil." *J. Parasit.*, 54 (1), 128.

6 trematodes recovered from the gills of 2 *Sarda sarda* taken off Guanabara, Brazil, are briefly described and identified as *Unitubulotestis sardae*.
P.S.G.

Didymozoidae

278. *Unitubulotestis spilonotopteri* n. sp.

(Fig. 278) Yamaguti, 1970

HABITAT: Body cavity, especially underneath parietal peritoneal membrane or in mesetery, of *Cypselurus spilonotopterus*; Hawaii.

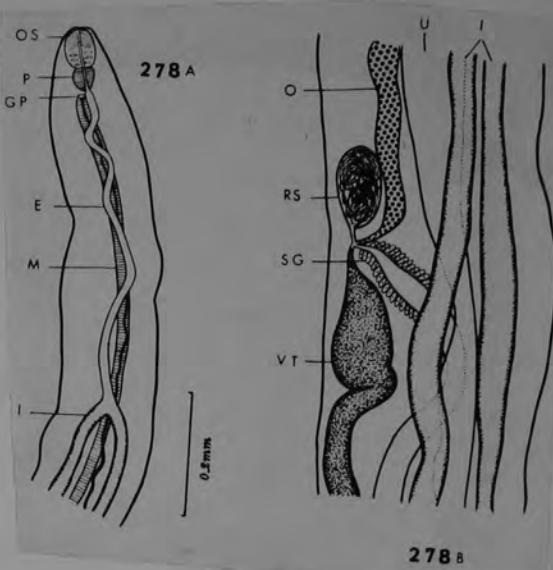
HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63840.

DESCRIPTION (based on a single entire adult 154.5 mm long by 0.2 mm wide and fragmentary paratypes): Body very slender, delicate, nearly uniform in width except in attenuated anterior region. Cuticle thin, smooth. Oral sucker terminal, $50 \times 48 \mu$, with weakly developed musculature; pharynx $25 \times 23 \mu$, smaller than oral sucker, contrary to that of *Unitubulotestis carangis* Yamaguti, 1953. Esophagus narrow, somewhat winding, 0.5 mm long; ceca narrow throughout their length, terminating at posterior extremity. Acetabulum absent.

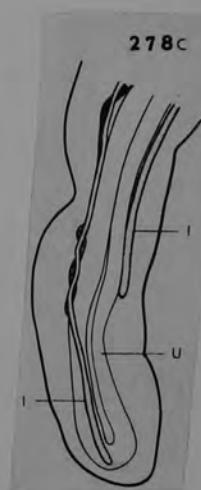
Testis tubular, winding, about 10 mm long lineally, originating 4.5 mm anterior to genital junction which lies about 110 mm from posterior extremity, terminating 30 mm from head end. Vas deferens provided with fine longitudinal and circular muscle fibers, opening ventrally by a common pore immediately behind pharynx.

Ovary tubular, wider than testis, winding, very poorly stained in the type specimen for unknown reasons, originating a little posterior to testis, about 3 mm long lineally and 60μ wide. Receptaculum seminis oval, $140 \times 60 \mu$. Descending limb of uterus distended with immature eggs at some places, turning back on itself at extreme posterior end of body; ascending limb rather narrow, containing mature eggs; metraterm provided with fine longitudinal and circular muscle fibers, intercecal, ventral to vas deferens. Eggs elliptical, $25-33 \times 20-23 \mu$. Vitellarium tubular, winding, ascending from posterior extremity to genital junction, forming a conspicuous saccular swelling 0.16 mm long by 90μ wide just before joining germiduct.

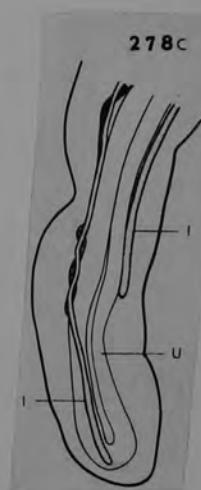
DISCUSSION: This species differs from the most closely related *Unitubulotestis carangis* Yamaguti, 1953 in the body being much slender, in the oral sucker being definitely larger than the pharynx, and in egg size.



278A



278B



278C

UNITUBULOTES TIS

Univitellocystis n. g.

Yamaguti, 1970

GENERIC DIAGNOSIS: Didymozoidae, Annulocystiinae. Enclosed singly or in pairs in vascular film of host origin. When paired, the two hindbodies are fused into a ring-like formation with a number of marginal lobes. When single, the hindbody forms a ring without distinct marginal lobation. Forebody arising from inner concave side of hindbody, opposite other forebody in fused specimens. Oral sucker terminal, musculocellular, directly followed by weakly muscular pharynx; esophagus short; ceca winding in hindbody. Testes double in single worm, in two sets of two each in fused worm. Ovary and vitelline gland tubular, long, winding; former divided at genital junction into two unequal portions, in one set in single worm, but in two sets in fused worm; latter single in single worm, but double in fused worm and winding spirally around uterus along margin of hindbody. Genital junctions at opposite ends of hindbody in fused worm, near proximal ends of testes in single worm. No seminal receptacle. Uterus running mostly along marginal area of hindbody throughout its length; metraterm poorly developed. Eggs small, bean-shaped, embryonated. Excretory system unknown. Cervical nerve commissure very conspicuous. Parasitic in villi of intestine of marine teleosts.

TYPE SPECIES: *U. katsuwoni* n. sp., in *Katsuwonus pelamys*; Hawaii.

285. *Univitellocystis katsuwonii* n. g., n. sp.
(Fig. 285) Yamaguti, 1970

HABITAT: Encysted in intestinal villi, mainly of lower portion of intestine, of *Katsuwonus pelamys*; Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63845.

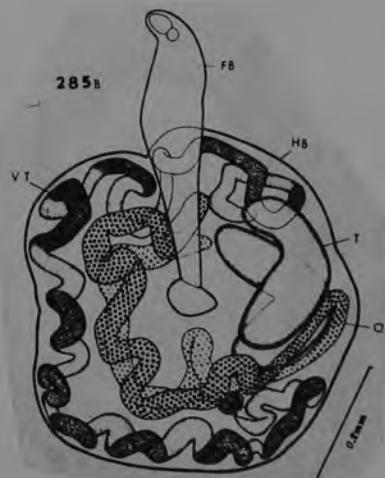
DESCRIPTION (based on four single and three fused specimens): Complete hermaphrodites, single or fused, surrounded by vascular film of host origin. Forebodies subcylindrical, rather pointed anteriorly, more or less enlarged in bifurcal region, $0.4-0.5 \times 0.08-0.16$ mm when extended in single worm, $0.18-0.4 \times 0.1-0.12$ mm in fused worm, in which the forebodies are attached oppositely on the inner wall of the annular hindbody. Hindbody about 1.3×1.0 mm in holotype, irregularly annular in outline, with variable number (up to ten) of marginal lobes, but smooth on inner surface, from which the two forebodies arise. In young single worm (Fig. 285 B) the hindbody is ring-shaped and almost unlobed marginally. Oral sucker terminal, musculocellular, $23-37 \times 25-30 \mu$, directly followed by weakly muscular pharynx $23-36 \mu$ long by $20-30 \mu$ wide, with very conspicuous broad nerve commissure immediately postero-dorsally. Esophagus narrow, $35-77 \mu$ long, bifurcating at level of widest cervical swelling; ceca narrow in forebody, winding and enlarged ($40-60 \mu$ wide) in hindbody.

Testes two, rather compact, comparatively large in single worm, but in two sets of two each in fused worm, in which they are situated near the base of their own forebody. Vas deferens may well be seen in some specimens, though indistinct in the type. Common genital pore immediately ventroposterolateral to pharynx.

Ovary tubular, long, winding, $25-40 \mu$ wide, divided at genital junction into two unequal portions, in one set in single worm, but in two sets in fused worm, each originating near testes of its own side. Vitelline gland tubular, long, single, and extending along nearly whole length of margin of hindbody in single worm. In the fused worm, however, there are two vitelline glands running spirally around uterus in opposite directions along marginal lobes of hindbody, each originating near the genital junction of the opposite side. No seminal receptacle detected. Uterus extending along marginal lobes of hindbody from genital junction to base of its own forebody, where it leads into the weakly muscular metraterm, without forming convolutions. In the type both uteri are so much distended (0.2 mm wide) with eggs as to form egg reservoirs near corresponding testes. Eggs bean-shaped, embryonated, $16-19 \times 9-12 \mu$ in balsam mounts. Excretory system unknown.

DISCUSSION: This species differs from the most closely related *Annulocystis auxis* n. g., n. sp. from gill filaments of *Auxis thazard* of Hawaii in habitat, body shape and size, in the vitelline gland being single in single worm, though double in fused worm, and in lacking a seminal receptacle. It obviously represents a new genus,

for which the name *Univitellocystis* is proposed on account of its close relationship to *Annulocystis* and the single vitelline gland.



UNIVITELLANNULOCYSTIS

Didymozoidae

Univitelloididymocystis n. g.

Yamaguti, 1970

GENERIC DIAGNOSIS: Didymozoidae, Didymozoinae. Complete hermaphrodite, enclosed in pairs in round cyst. Forebody spatulate, enlarged in esophageal region, attenuated posteriorly, attached to flat ventral surface of hindbody near its anterior end. Hindbody hemispherical, without longitudinal groove on flat side. Oral sucker well developed, with thick lamellar limiting membrane; pharynx rudimentary or practically absent; esophagus comparatively long; ceca very wide and winding in hindbody, terminating at different levels without reaching posterior extremity. No acetabulum. Testes tubular, paired, irregularly winding or not, one on each side, in anterior part of hindbody. Genital pore ventral to oral sucker. Ovary slender, tubular, paired, unbranched, extending largely in testicular fields from near anterior end of hindbody to a short distance back of posterior end of testes; seminal receptacle present; genital junction near anterior end of hindbody close to dorsal surface. Vitelline gland slender, tubular, unbranched, extending whole length and width of hindbody on dorsal and lateral sides external to uterine coils. Uterus winding transversely and occupying all available space of hindbody, eventually forming inconspicuous egg reservoir; metraterm muscular; eggs bean-shaped; embryonated. Parasitic in subcutis of particular portions of marine teleosts.

TYPE SPECIES: *U. neothunni* n. sp., in *Neothunnus macropterus* (type host) and *Parathunnus sibi*; Hawaii.

OTHER SPECIES: *U. miliaris* (Yamaguti, 1938), n. comb., syn. *Didymocystis miliaris* Yamaguti, 1938, in *Acanthocybium sara*; Pacific.

259. *Univitelloididymocystis neothunni* n. g., n. sp.
(Fig. 259) Yamaguti, 1930

HABITAT: Encysted in pairs in tissue external to maxillary bone (type location) and under membrane medial to hypophysis of *Neothunnus macropterus* (type host) and *Parathunnus sibi*; Hawaii.

HOLOTYPE: U. S. Nat. Mus. Helm. Coll., No. 63827.

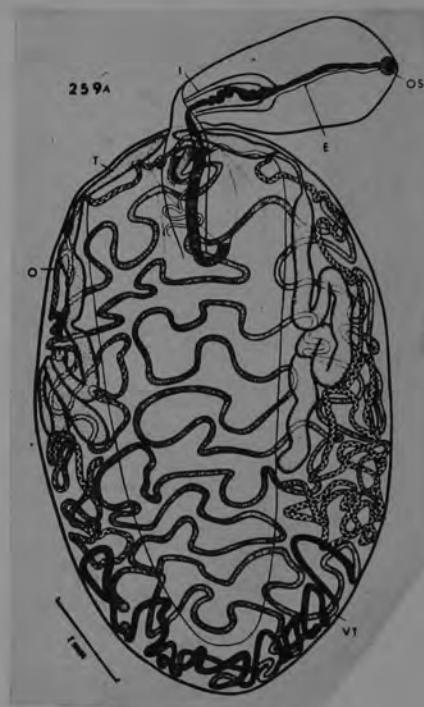
DESCRIPTION (based on 24 flattened whole mounts): Forebody spatulate, attached to near anterior end of hindbody on its ventral side, 2.5-5.3 mm long, with maximum width of 0.08-2.0 mm in esophageal region, whence it tapers posteriorly. Hindbody hemispherical, flat ventrally and convex dorsally, longer than wide, 3.9-7.5 mm long, with maximum width and thickness of 3-4 mm about middle; posterior extremity sometimes tapered and curved ventrad; anterior extremity usually rounded. Mouth with ventroterminal aperture; oral sucker subglobular, muscular, with thick lamellar limiting membrane, 0.16-0.35 mm in diameter; pharynx reduced in development if present at all. Esophagus simple, 0.5-1.65 mm long; intestinal limbs bent backward at right angles; as they enter the hindbody they become enlarged and proceed to the anterior end of the hindbody, where they bend back on themselves, and terminate, one on each side, at different levels of the hindbody after a serpentine course.

Testes tubular, 0.06-0.3 mm wide, winding irregularly, one on each side, in anterior part of hindbody; vas deferens running forward in forebody along with metraterm. Genital pore ventral to oral sucker.

Ovary paired, tubular, very fine, 10-40 μ wide, winding, extending, one on each side, longitudinally in testicular field from near anterior end of hindbody to a short distance back of posterior end of testes, or to near posterior extremity; the two ovarian tubules join together near the anterior end of the hindbody anterior to the point where the forebody is attached; the resulting short stem of the ovary receives the seminal receptacle just before uniting with the vitelline duct; shell gland cells developed around beginning of uterine duct. Receptaculum seminis elongate, 0.35 \times 0.07 mm in the type. Vitelline gland single, tubular, unbranched, very long, 20-180 μ wide, originating at posterior end of hindbody, winding forward on dorsal and lateral sides of posterior half of hindbody, from one side to the other, across middorsal field, and *vice versa*, outside of uterine coils; in the testicular zone, however, the winding gland is confined to the dorsal side between the two testes and finally joins the germiduct near the anterior end of the hindbody; no distinct vitelline reservoir. Uterus winding backward from side to side, turning forward at posterior extremity, and again winding transversely and finally entering forebody at its base; egg reservoir not conspicu-

ous. Metraterm muscular, twisted; eggs bean-shaped, embryonated, 18-21 \times 11-14 μ . Excretory system not made out; pore at posterior end of hindbody.

DISCUSSION: This genus differs from the most closely related *Didymocystis* Ariola, 1902 in the vitelline gland being single, unbranched, and extending the whole length of the hindbody and in the paired ovaries being largely confined to the testicular fields. The generic name refers to the first mentioned character of the vitellaria and the close relationship to *Didymocystis*.



UNIVITELLODIDYNOCYSTIS