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FOUR NEW PLAGIOSTOMIDAE (PROLECITHOPHORA: PLATYHELMINTHES) FROM PHUKET, THAILAND, WITH A RE-EVALUATION OF TORGEIDAE JONDELIUS, 1997, AND *PARAMULTIPENIATA* KULINICH, 1974

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ABSTRACT: Four new species of Plagiostomidae are described: *Plagiostomum lutile* sp. nov., *Plagiostomum personatum* sp. nov., *Plagiostomum gibbum* sp. nov. and *Torgea phukettensis* sp. nov., all from the area of Phuket, Thailand. To investigate the monophyly of the taxa Torgeidae, *Torgea*, and *Paramultipeniata*, a molecular phylogenetic analysis of the 18S rDNA sequences of *Torgea phukettensis* and *Paramultipeniata lemani*, in combination with all published plagiostomid 18S rDNA sequences, is performed. Torgeidae is shown to be an ingroup of the Plagiostomidae, and is therefore synonymized with Plagiostomidae. *Paramultipeniata* lacks the single character diagnostic of *Multipeniata*, and both morphology and molecular analysis suggest a placement within *Plagiostomum*. *Paramultipeniata* is therefore synonymized with *Plagiostomum*. *Torgea* similarly nestles inside *Plagiostomum*, but as *Torgea* is based on a strong apomorphy (the possession of a pharynx complex made up by the pharynx and muscular ventral buccal lining) it is provisionally retained, awaiting a complete revision of Plagiostomidae with allied taxa.

INTRODUCTION

The Plagiostomidae Graff, 1882, is a cosmopolitan group (Sluys, 1992) of mostly small, often conspicuously colored, prolecithophoran flatworms, and members of this group are often the most numerous small flatworms on hard bottoms, in gravel, and among algae. Most species are marine, although a few are found in brackish or fresh water. Plagiostomidae comprises about 100 known species, the bulk of which are described from Europe, North America, and the Sao Paolo area of Brazil. By contrast only a handful of plagiostomids have previously been recorded from the tropical Indo-Pacific, although they are known to be both common and diverse (Jondelius, pers. comm.). In an attempt to increase the knowledge concerning the diversity and distribution of plagiostomid flatworms, I collected material at the island of Phuket, Thailand, during April 2001.

Most of the sampling was done intertidally on an approximately 200 m long section of the reef flat adjacent to the Phuket Marine Biological Center (PMBC), and specimens belonging to 14 species of prolecithophorans were found. They appeared to belong to *Plagiostomum* (11 species), *Acmostomum* (1 species), *Torgea* (1 species) and *Pseudostomum* (1 species), although none could be assigned to a known species. Most of the collected worms were immature or did not yield usable material, but sufficient material for a formal description was obtained from four species .

This article is divided into two sections: the description of the new species, and a phylogenetic analysis of their position within Plagiostomidae.

MATERIALS AND METHODS

All specimens were extracted from coral rubble and algae by anaesthetation with isotonic magnesium chloride solution, followed by decantation through a 125 µm sieve. The animals were revived in seawater and studied alive, then fixed for subsequent serial sectioning. Hot Bouin's fluid was used for fixation to prevent the animals from contracting. Serial sections (4 µm) were

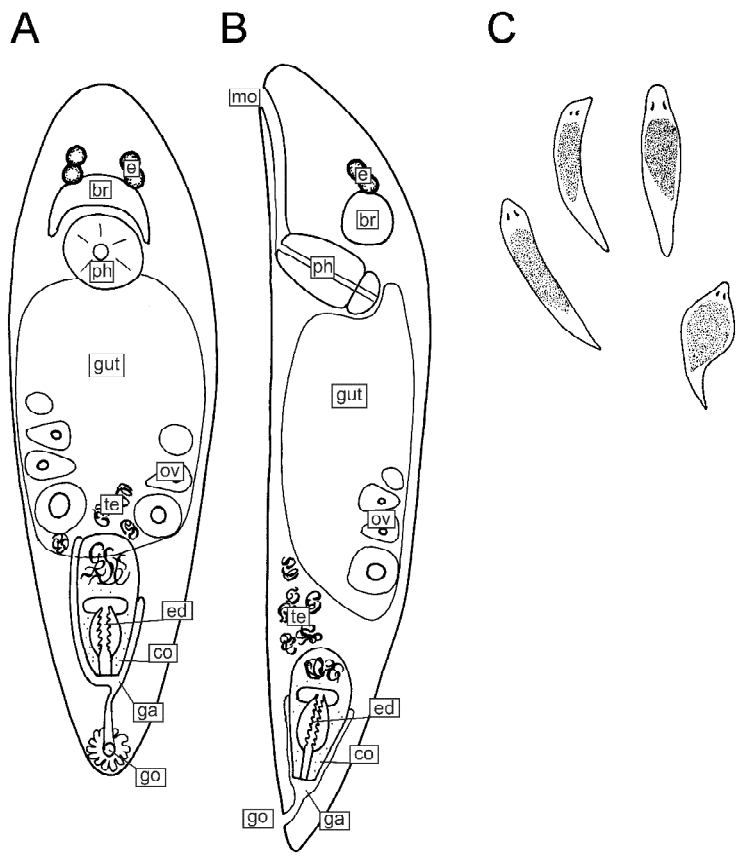

Figure 1. A: Frontal reconstruction of *Plagiostomum lutile* sp. nov., **B:** sagittal reconstruction of *Plagiostomum lutile* sp. nov., **C:** free-hand drawing of live specimens. e = eyes, br = brain, mo = mouth opening, ph = pharynx, oe = oesophagus, sv = spermatic vesicle, te = testes, ed = ejaculatory duct, co = copulatory organ, go = genital opening, ga = genital atrium, gut = gut, ov = ovary.

stained with iron hematoxylin, with eosin as counterstain. The size of structures is expressed as fractions of body length. Positions of structures are expressed as fractions of body length from the anterior end.

When numerous specimens were found, some were fixed in 96% ethanol for subsequent extraction of the nuclear ribosomal 18S gene. DNA extraction and sequencing of the nuclear ribosomal 18S gene was performed with the primers and protocol of Noren and Jondelius (2002). New sequences have been deposited at GenBank, and the accession numbers are as follows: *Acmostomum dioicum* Metschnikoff, 1865, AF503516; *Torgea phukettensis* sp. nov., AF503517; *Paramultipeniata lemani* (Forel and du Plessis, 1874), AF503518. The sequences were added to the 18S section 'Large' alignment of Noren and Jondelius (2001), after deletion of all 28S data. Specimens of *P. lemani* were collected at Rindö in the Stockholm archipelago in November 2001. Alignment of sequences was performed with ClustalX (Thomson *et al*., 2000), with the following settings: pairwise gap opening penalty 3; pairwise gap elongation penalty 0; multiple gap opening penalty 30; multiple gap elongation penalty 0; transition/transversion score 0. For accession numbers of the published taxa in the Large matrix, see Noren and Jondelius (2001). The alignment is available from the author.

Type material of the new species is deposited in the PMBC Reference Collection, Phuket, Thailand. Additional material is deposited at the Swedish Museum of Natural History (SMNH), Stockholm, Sweden.

Phylogenetic analysis was performed by parsimony jackknifing (Farris, 1996), using the software XAC (Farris, 1997), with 1000 replicates, 10 random additions per replicate, branch-swapping enabled, cut-off frequency e^{-1}. For details and discussion on parsimony jackknifing see Farris (1996). Fifty-one rhabditophoran taxa from all major groups except the Neodermata were designated as outgroups. The groups Tricladida and Fecampiida (*sensu* Noren and Jondelius, 2002) were especially densely sampled, as either or both of these appear to be the immediate sister group of the Prolecithophora (Jondelius *et al.*, 2001; Littlewood *et al*., 2001; Noren and Jondelius, 2002).

***Plagiostomum lutile* sp. nov.**

(Figs. 1, 2)

Material examined: PMBC 20002, holotype, one sagittally serial sectioned specimen. Several individuals studied alive and sectioned. Additional material deposited at SMNH.

Type locality: Cape Panwa, the reef flat between the PMBC pier and pump house, among algae and coral rubble in the lower part of the intertidal zone and subtidally down to a depth of at least 3 m below the low tide line. Numerous specimens were found; this was the second most abundant species of flatworm.

Etymology: The species epithet is derived from Latin *luteus* (yellow), and *ile* (intestine, gut), and refers to the distinctly yellow gut of this species.

Description: Living animals (Fig. 1) slender, approximately circular in cross-section, about 10 times longer than wide when fully elongated. Body about 1 mm long, widest just behind eyes, tapering towards posterior. Animals milky white to faintly yellow, with a lemon-yellow intestine and one pair of pigmented eyes, consisting of two or rarely three pigment cups, visible through body wall. Copulatory structure normally shifted laterally, so that in dorsal view the posterior end of the gut appears slanted. Animals lively, active swimmers, with plastic body shape. Eyes dorsoanterior, adjacent to encapsulated brain. Pharynx soft and extremely plastic, often difficult to observe in live specimens. One pressed live specimen was observed changing pharynx shape from tubular and 4 times longer than wide to broadly conical and 2 times wider than long. Another specimen observed with pharynx held folded. Pharynx in preserved specimens (Fig. 1; Fig. 2B) conical, length 1/5 of body length, aimed ventrally-anteriorly, located immediately posterior to brain, about 1/5 of body length from anterior end of animal. Pharynx with a proximal circular groove. Lumen of pharynx, external surface of the pharynx, and surrounding buccal cavity lack ciliation. Scattered eosinophilous gland cells associated with proximal part of pharynx. Mouth opening located just ventrally of anterior terminus. Gonads paired. Ovaries well-developed, situated dorsolaterally 1/2 body length from anterior end of animal extending to anterior part of seminal vesicle. Vitellaries diffuse, lateral, located posterior of the pharynx to just anterior of the testes. Testes poorly defined, lack tunica, located ventrally, just anterior of seminal vesicle, meeting at the midline. Gonopore posteriorly subterminal, surrounded by gland cells. Copulatory organ located in the posteriormost 1/4 of the body, length about 1/5 of total body length. Copulatory organ consisting of a penis separated from the seminal vesicle by a septum. Ejaculatory duct unciliated, appearing to have frilled or comb-like ridges in some sections (Figs. 1, 2A). An elongated prostatic gland associated with gonopore. Sclerotized structures absent.

Differential diagnosis: The extraordinarily plastic pharynx of *P. lutile* appears to be unique among plagiostomids. A foldable pharynx can be found in some Pseudostomidae, but *P. lutile* has a separate mouth and genital pore, setting it apart from all Pseudostomidae (*sensu* Noren and Jondelius, 1999) except *Ulianinia* which, however, lacks eyes, has a posteriorly-pointing

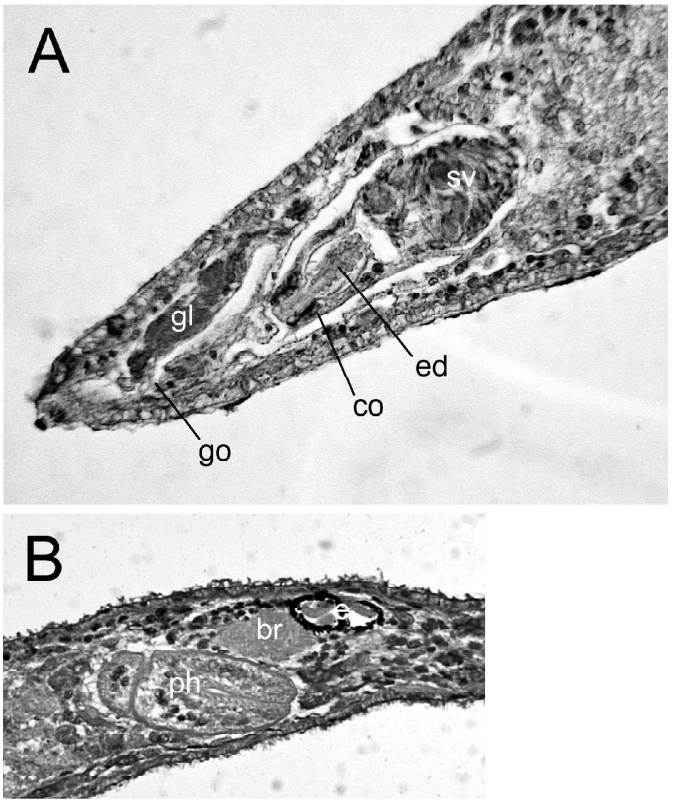

Figure 2. **A**: *Plagiostomum lutile* sp. nov. Sagittal section through anterior end. **B**: *Plagiostomum lutile* sp. nov. Frontal section through posterior end. Abbreviations as in Fig. 1.

pharynx situated behind the midline of the body, and a circular furrow. Apart from the pharynx the general morphology is similar to that of *Plagiostomum personatum* sp. nov. described below, but the bright yellow intestine, lack of epidermal pigmentation, frilled ridges in the ejaculatory duct, and proportionally larger copulatory organ (1/5 of body length in *P. lutile* compared to 1/7 in *P. personatum*) sets *P. lutile* apart from *P. personatum*. *Plagiostomum petrophilum* Brandtner, 1934, also appears to be similar to *P. lutile* with regards to the position of ovaries and ejaculatory duct with frilled ridges. However, *P. petrophilum* is a larger (up to 3.5 mm) Arctic species, greenish-white in color, with a forward-facing pharynx, and tubular and curved penis.

Accessory information: The elongated eyes give the impression of being placed approximately parallel to each other. The studied specimens exhibited negatively phototactic movement.

***Plagiostomum personatum* sp. nov.**

(Figs. 3, 4)

Material examined: PMBC 20003, holotype, one sagittally serial sectioned specimen. Several individuals studied alive and sectioned. Additional material deposited at SMNH.

Type locality: Cape Panwa, the reef flat between the PMBC pier and pump house, among algae and coral rubble in the lower part of the intertidal zone

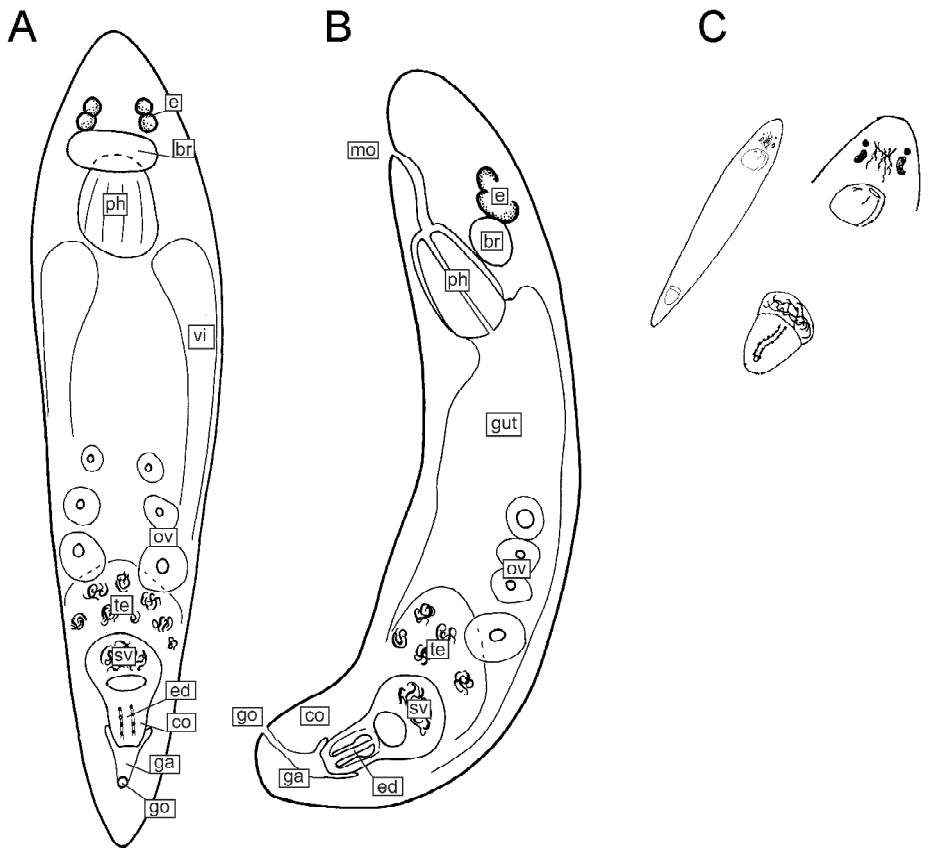

Figure 3. A: Frontal reconstruction of *Plagiostomum personatum* sp. nov., **B:** sagittal reconstruction of *Plagiostomum personatum* sp. nov., **C:** free-hand drawing of live specimen, with detail of head region and copulatory organ. e= eyes, br = brain, mo = mouth opening, ph = pharynx, oe = oesophagus, vi = vitellary, sv = spermatic vesicle, te = testes, ed = ejaculatory duct, co = copulatory organ, go = genital opening, ga = genital atrium, gut = gut, ov = ovary.

down to a depth of at least 3 m. Numerous specimens were found.

Etymology: The species epithet *personatum* (masked) refers to its pigmentation in the eye region, which resembles a mask and partly obscure the eyes.

Description: Living animals (Fig. 3) slender, approximately circular in cross-section, about 10 times longer than wide when fully elongated. Body about 1 mm long, widest just anterior to middle. Animals lively, often swimming, with plastic body shape. Animals colorless to faintly yellow, with a faintly yellow or faintly orange intestine, and normally with two pairs of pigmented eyes, visible through body wall; posterior pair of eyes consisting of two pigment cups, anterior pair of one pigment cup. In some specimens, anterior and posterior pair linked, forming a single pair with tree cups per eye. Reticulating dark-brown epidermal pigment streaks between the eyes. Circular ciliated furrow absent. Eyes located anterior and adjacent to the encapsulated brain. Pharynx (Figs. 3, 4) conical, length 1/7 of body length, oriented ventrally-anteriorly, located immediately posterior to brain, about 1/5 of body length from anterior end of animal. Pharynx lumen, external surface of the pharynx, and buccal cavity unciliated.

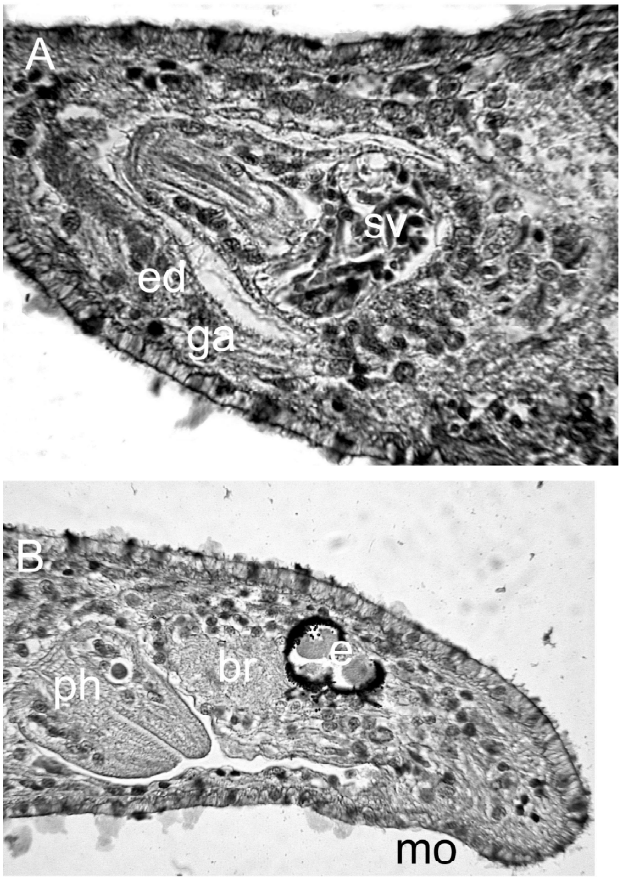

Figure 4. A: *Plagiostomum personatum* sp. nov. Sagittal section through anterior end., **B:** *Plagiostomum personatum* sp. nov. Sagittal section through posterior end. Abbreviations as in Fig. 3.

Mouth opening located just ventrally of anterior terminus. Frontal gland system well developed. Gonads paired. Ovaries well-developed, dorsolateral, situated from 1/2 body length from anterior end of animal to anterior part of seminal vesicle (Fig. 3). Vitellaries large, diffuse, lateral, situated from posterior part of the pharynx to anterior part of testes. Testes poorly defined, lack tunica, appear to be located ventrolaterally anterior of seminal vesicle. Testes separate except just anterior of seminal vesicle, where they appear to meet at ventral midline. Gonopore located ventral to posterior terminus. Copulatory organ (Figs. 3, 4) located in posteriormost 1/4 of body, its length about 1/7 of the total body length. Copulatory organ consisting of conical penis with distal part folded into proximal part, separated from seminal vesicle by septum. Seminal duct straight, smooth and unciliated. Sclerotized structures absent.

Differential diagnosis: The copulatory organ of *P. personatum* is similar to that of some of the taxa in the *Plagiostomum girardi* (Schmidt, 1857) species complex, particularly *Plagiostomum girardi hymani* (Karling, 1962). However, all members of this complex have their ovaries in the anterior half of the body, whereas in *P. personatum* the ovaries are located in the posterior half of the body. *Plagiostomum karlingi* (Kulinich, 1970), is similar in pigmentation and the placement of the testes, but has a shorter pharynx which is about

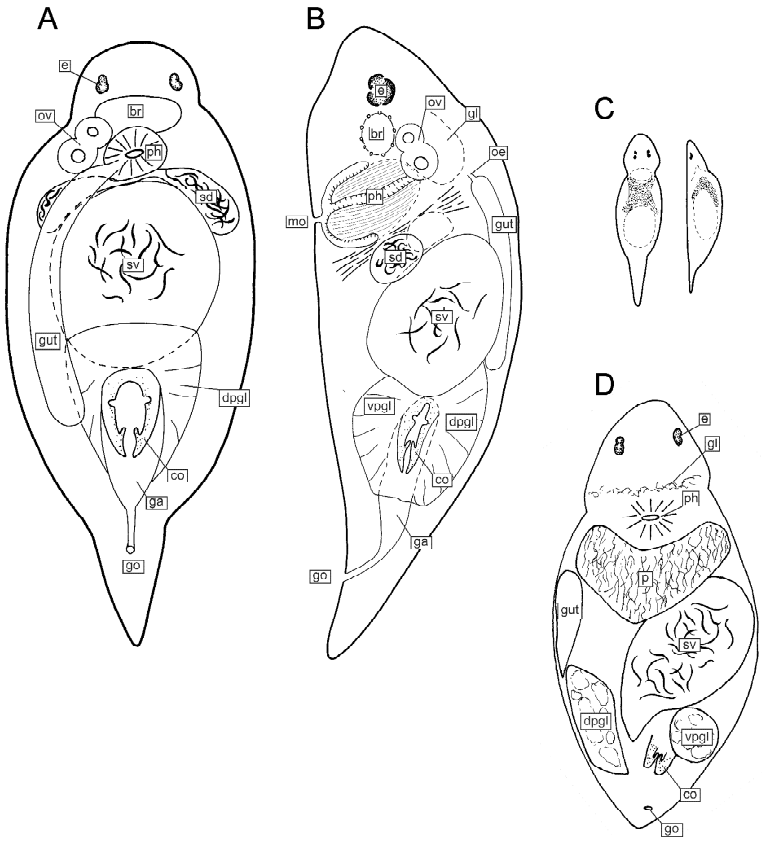

Figure 5. **A:** Frontal reconstruction of *Plagiostomum gibbum* sp. nov., **B:** sagittal reconstruction of *Plagiostomum gibbum* sp. nov., **C:** free-hand drawing of live specimens, dorsal and lateral view, **D:** free-hand drawing of pressed live specimen. e= eyes, br = brain, mo = mouth opening, ph = pharynx, oe = oesophagus, gl = glands, sd = spermatic duct, sv = spermatic vesicle, te = testes, ed = ejaculatory duct, co = copulatory organ, dpgl = dorsal prostatic gland, vpgl = ventral prostatic gland, go = genital opening, ga = genital atrium, gut = gut, ov = ovary.

as long as wide, and a copulatory organ with a thick muscular penis sheath. *Plagiostomum astrum* (Marcus, 1947), is also similar to *P. personatum* in pigmentation and the placement of the testes, but its ovaries are placed in the anterior part of the body, and the copulatory organ is much smaller (less than 1/10 of body length).

Accessory information: The amount of pigmentation between the eyes varied somewhat between individuals, although none was found completely lacking pigmentation. A mouth-fold is visible on the ventral body surface when the worm is viewed from the side.

***Plagiostomum gibbum* sp. nov.**
(Figs. 5, 6)

Material examined: PMBC 20004, holotype, one individual sagittally sectioned. Four individuals studied alive.

Type locality: Cape Panwa, the crest of the reef flat between the PMBC pier and pump house, occurring among algae and coral rubble in the lower part of the intertidal zone.

Etymology: The species epithet *gibbum* (bulging; with a protuberance on the body), refers to the

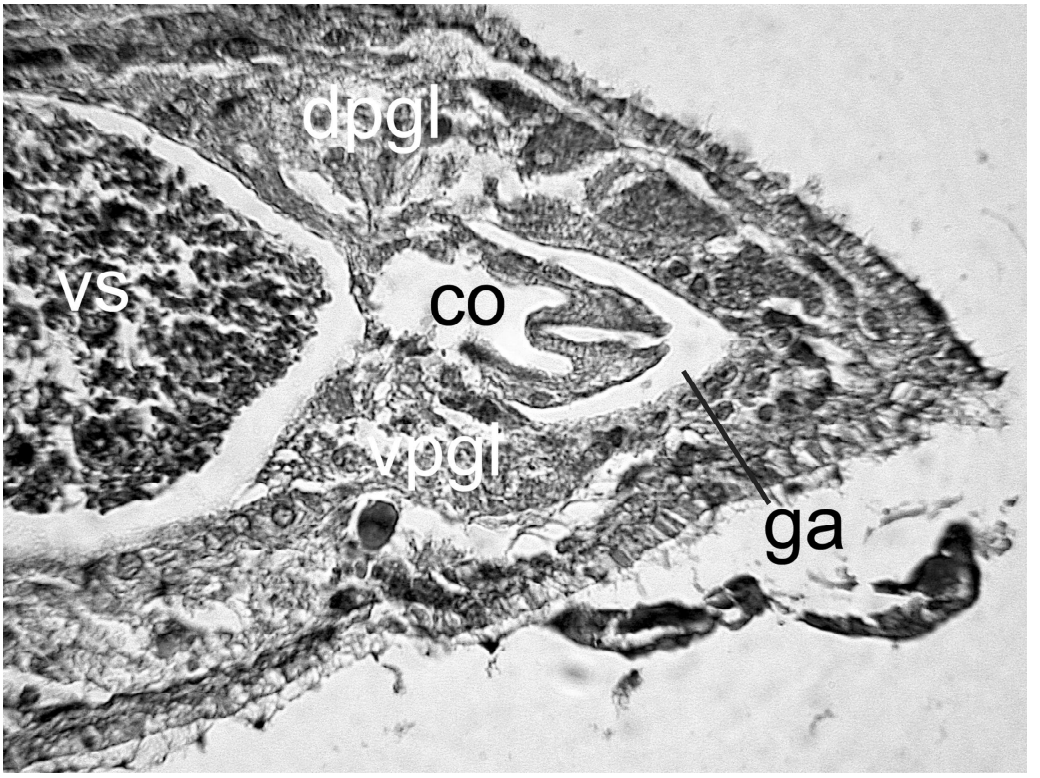

Figure 6. *Plagiostomum gibbum* sp. nov. Sagittal section through posterior end. Abbreviations as in Fig. 5.

'humpbacked' body shape of this species, caused by the extreme enlargement of the spermatic vesicle and prostatic glands.

Description: Living animals (Fig. 5) with well-developed circular groove setting bluntly triangular anterior end off from ovoid body proper, and with defined tail. Smaller individuals appeared to have narrower 'neck', and hence a more defined head, than larger individuals. Body 3 to 5 times longer than wide, total length about 1.5 mm, widest at middle. Head and tail colorless, base color of body opaque white due to mass of stored sperm, with reticulating cinnamon-brown pigmentation streaks associated with epithelial cells posterior to pharynx and covering a part of, or most of, dorsum. One pair of eyes, each eye with three pigment cups. Animals fairly lively, rarely swimming, body shape relatively constant. Eyes located anterior to the encapsulated brain. The most striking feature of animal a greatly enlarged seminal vesicle, which, together with similarly enlarged prostatic glands, takes up most of body volume, displacing all other organs. Pharynx tubular, length 1/5 of body length, oriented posterio-ventrally, located immediately posterior to brain, about 1/5 of body length from anterior end of animal. Pharynx lumen ciliated, but external surface of pharynx and buccal epithelium unciliated. Mouth opening located ventral to the brain. Gut displaced dorsally and to one side. A gland system apparently associated with pharynx, and/or circular groove is located ventrally, anteriorly, and dorsally to the brain. This gland system particularly well developed in 'neck' region of animal, adjacent to ovary, circular groove, and base of pharynx. A single small ovary situated dorsolaterally 1/4 of body length from

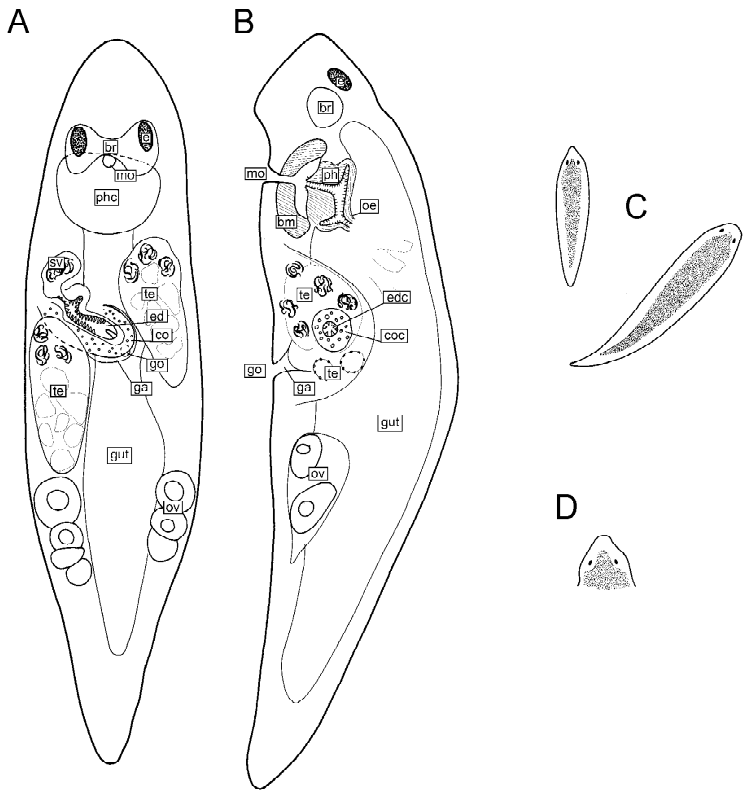

Figure 7. A: Frontal reconstruction of *Torgea phukettensis* sp. nov., **B:** sagittal reconstruction of *Torgea phukettensis* sp. nov., **C:** drawing of live specimens., **D:** detail of head region. e = eyes, br = brain, mo = mouth opening, ph = pharynx, phc = pharynx complex, bm = buccal musculature, oe = oesophagus, sv = spermatic vesicle, te = testes, ed = ejaculatory duct, edc = cross-section of ejaculatory duct, co = copulatory organ, coc = cross section of copulatory organ, go = genital opening, ga = genital atrium, gut = gut, ov = ovary.

anterior. The position of testes could not be determined. Gonopore located ventrally, at base of 'tail'. Seminal vesicle spherical, about 1/3–1/4 of entire body length, located at middle of body. Anteriolaterally to and connecting with seminal vesicle are two smaller sperm-filled sacs, interpreted as distended spermatic ducts. Copulatory organ (Figs. 5, 6) weakly developed, length about 1/10 of total body length, located in posteriormost 1/3 of body. Copulatory organ consisting of tubular penis with the small distal end folded into proximal part. One larger dorsolateral and one smaller ventral prostate gland encircle copulatory organ, and are located posterior of middle of worm, connected to the seminal vesicle, length about 1/5 of body length. Sclerotized structures absent.

Differential diagnosis: The shape of the body, with its 'humpbacked' appearance and unusually pronounced cephalization, as well as the enormous seminal vesicle and prostatic glands and the associated shifts in position of the other internal organs, are all unique. The copulatory organ and unpaired ovary are similar to those of *Plagiostomum groenlandicum* (Levinsen, 1879), but the pharynx in the latter is located anterior of the brain, and the ovary is located at the middle

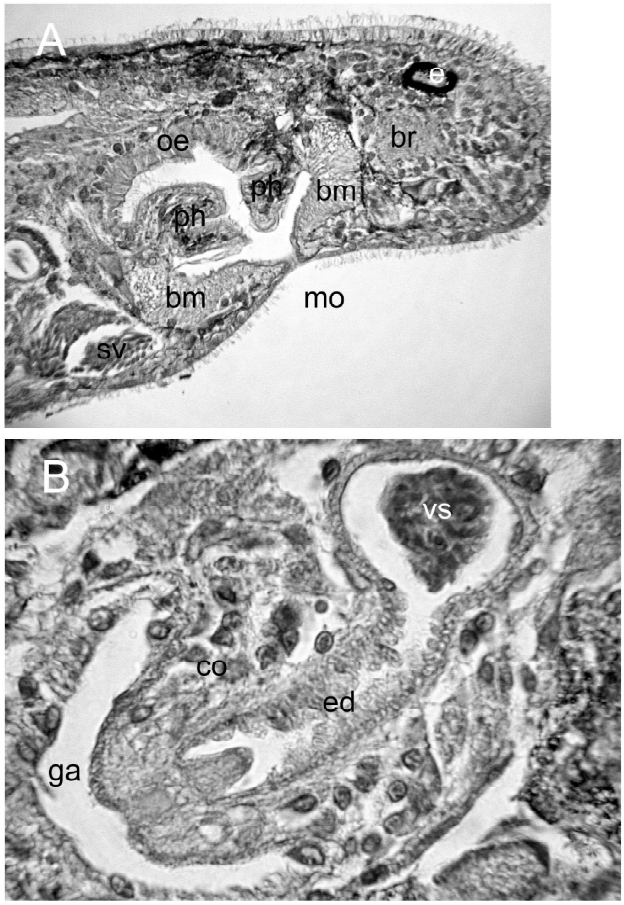

Figure 8. A: *Torgea phukettensis* sp. nov. Sagittal section through anterior end, **B:** *Torgea phukettensis* sp. nov. Frontal section through posterior end. Abbreviations as in Fig. 9.

of the body. The spermatozoa of *P. gibbum* appear smaller than those of other prolecithophorans.

Accessory information: This species can, like many plagiostomids, produce a 'lifeline' of mucus from cement glands in the tail region to help anchor itself to the substrate.

***Torgea phukettensis* sp. nov.**
(Figs. 7, 8)

Material examined: PMBC 20005, holotype, one sagittally serial sectioned specimen. Several individuals studied alive and sectioned. Additional material deposited at SMNH.

Type locality: Cape Panwa, the reef flat between the PMBC pier and pump house, occurring among algae and coral rubble in the mid-to-lower part of the intertidal zone and down to a depth of at least 3 m. Also found in tidal pools with *Padina* sp. algae and coral rubble at the east end of Yanui beach; among *Halimeda* sp. algae from about 4 m depth off Raya Yai island; and in coral rubble from the north shore of cape Panwa. It was the most abundant flatworm species on the intertidal reef flats at Phuket island.

Etymology: The species epithet *phukettensis* (originating from Phuket), is in grateful recognition of the help and support I received from the Phuket Marine Biological Center.

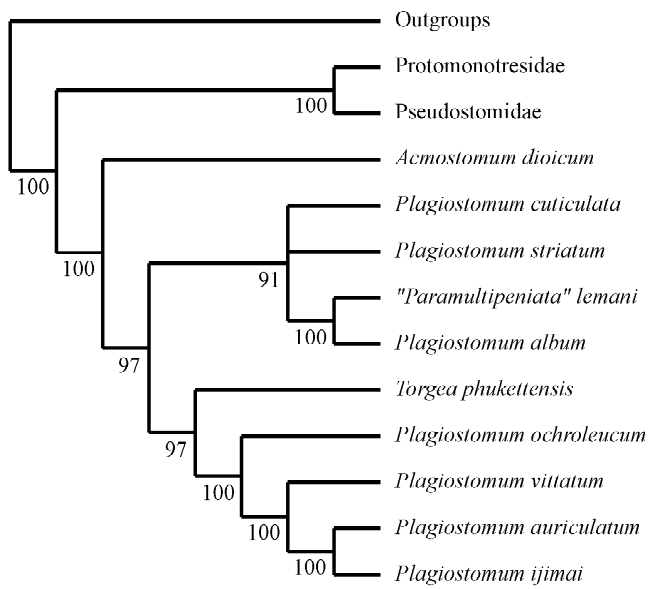

Figure 9. Parsimony jackknife analysis of nucleotide data set. Majority rule consensus tree (cut-off 50%) summarizing results of jackknife analysis of 18S alignment. Labels below left of nodes indicate jack-knife frequency (obtained using XAC with 1000 replicates, 10 random additions per replicate, branch swapping enabled, and character deletion frequency e^{-1}).

Description: Living animal (Fig. 7) shaped like slender, elongated, droplet, approximately circular in cross-section, about 8 times longer than wide when fully elongated. Animals lively, may swim but normally stay on the bottom, and have plastic body shape. Body up to 2 mm long, widest just behind the eyes. Large specimens with pointed anterior end, slightly set apart from body, resulting in a 'triangular' head reminiscent of that of *P. girardi*. Some specimens display a mouth-fold similar to that seen in many plagiostomids, *e.g.*, *P. lutile*. Animals opaque, dorsally covered by chocolate-brown pigment, but ventral surface and sides of head unpigmented. Brown pigmentation consisting of small grains, associated with basal lamina of epithelial cells in epidermis and gastrodermis. All studied specimens with one pair of oval, pigmented, eyes, clearly visible through body wall, and consisting of one large pigment cup. There is no epidermal pigmentation in the immediate vicinity of the eyes, but there are reticulating pigment streaks dorsally to the brain and between the eyes, visible in pressed specimens. Circular ciliated furrow absent. Eyes anterior to the encapsulated brain. In pressed live specimens, pharynx appears short and donut-shaped, in sectioned specimens the pharynx is broadly conical, length less than 1/10 of body length, directed ventrally, located immediately posterior to the brain, about 1/5 of body length from anterior end of animal, and ventral wall of pharynx cavity muscular, forming a false second pharynx (Figs. 7, 8A). Pharynx lumen, external surface of the distal part of pharynx, and the muscular oesophagus ciliated, while remaining external surface of pharynx and buccal epithelium are unciliated. Mouth opening located ventrally of the brain. Gastrodermis thick and folded, so that no lumen is visible in most sectioned individuals. Gonads paired. Ovaries well developed, situated ventrolaterally in second third of worm. Testes separate and located

ventrolaterally in second quarter of worm, located from posterior of pharynx to anterior of ovaries. Gonopore located ventrally, in the second quarter of the worm. Copulatory organ a thick-walled penis or penis papilla, with numerous nuclei. Distal end of penis free in genital atrium, located in second quarter of the body, oriented ventrally, length of free end about 1/10 of total body length. Ejaculatory duct a curved, muscular tube, with numerous bell-shaped internal projections from duct wall (Figs. 7, 8B). Sclerotized structures absent.

Differential diagnosis: The "double pharynx" of *T. phukettensis* is also known from *Torgea karlingi* Jondelius, 1997, described from Darwin harbour, Australia. The only other prolecithophoran with a reminiscent structure is *Plagiostomum abboti* Karling, 1961. However, the double pharynx of *P. abboti* appears to be made up by a fold in the pharynx, rather than by pharynx and buccal musculature as in *T. phukettensis*. *P. abboti* is further set apart by its coloration – it is white with normally three transverse reddish-brown stripes. *T. phukettensis* is similar to *T. karlingi* with regard to internal morphology, size, and habitat. However, *T. karlingi* is uniformly darkly colored, almost black (Jondelius, pers. comm.), rather than unpigmented with chocolate-brown dorsum as *T. phukettensis*. No variation in coloration was observed among the approximately 100 specimens of *T. phukettensis* collected. *T. karlingi* also differs from *T. phukettensis* by being plumper and having a rounded rather than triangular head; the internal surface sculpture of the ejaculatory duct is more weakly developed; and a less elongate penis whose distal part is not invaginated into the proximal part. Also, *T. karlingi* has a larger pharynx: in *T. phukettensis* the pharynx complex is about two times wider than long, whereas in *T. karlingi* it is approximately equal in length and width. For these reasons *T. phukettensis* is here considered a separate species, although clearly closely related to *T. karlingi*.

Accessory Information: An unidentified *Actinoposthia* sp. (Acoela) was observed eating *T. phukettensis*. *T. phukettensis* often attaches itself to the substrate by the tail, and stretches up with the rest of the body. It also anchors itself to glassware etc. with a mucus 'lifeline', making the handling of this animal difficult. *T. phukettensis* was typically found together with *P. lutile*, *P. personatum*, and an unidentified solenopharyngid rhabdocoel.

Phylogenetic Analysis

The result of the Jackknife analysis of the 18S sequences is depicted in Figure 9. The Prolecithophora is a strongly supported monophylum. Within it, the Plagiostomidae + *T. karlingi* + *P. lemani* forms a strongly supported monophylum, separate from a strongly supported clade consisting of representatives of most other groups of the Prolecithophora. The position of *T. phukettensis* as the sister taxon to a clade of plagiostomids, with very strong support, and with *Plagiostomum ochroleucum* Graff, 1882 as its closest relative, renders the taxa Plagiostomidae and *Plagiostomum* non-monophyletic. *P. lemani* is similarly nestled among plagiostomid taxa, in a very strongly supported position with *P. album* Hyman, 1938, as its sister taxon.

DISCUSSION

There is little doubt about the phylogenetic affinities of *Plagiostomum personatum* and *P. lutile*: their morphology suggests a placement in *Plagiostomum*, close to each other and the *P. girardi* species complex. The situation is less clear for *P. gibbum* and *Torgea phukettensis*. *P. gibbum* is clearly very divergent, not particularly similar to any presently known species, and is assigned to *Plagiostomum* because of its plagiostomid-like habit and because its copulatory organ is similar to that of *P. groenlandicum*; it is unfortunate that more specimens of this intriguing species could not be found. When Jondelius (1997) described *T. karlingi,* the internal structure of the Prolecithophora was largely unknown, and the separate mouth and gonopore, with the

gonopore in the anterior half of the body, together with the peculiar pharynx complex with pharynx-like buccal musculature, led him to erect the monotypic taxa *Torgea* and Torgeidae for the new species. In the following years several phylogenetic studies on Prolecithophora have been published (Noren and Jondelius, 1999; Jondelius *et al*., 2001; Littlewood *et al.*, 2001; Noren and Jondelius, 2002), mostly based on 18S and 28S rDNA data, but no member of the Torgeidae has, until now, been included. Also the status of *Multipeniata* relative to *Plagiostomum* needs to be clarified in order to determine the placement of the new plagiostomid taxa I describe. *Multipeniata* was originally diagnosed by the presence of multiple male copulatory organs, being otherwise wholly similar to members of *Plagiostomum*. Kulinich (1974), on the basis of a phenetic clustering analysis and perceived similarities in pharynx and penis structure, transferred what he called the "*Plagiostomum lemani* group" to the new subtaxon *Paramultipeniata* under *Multipeniata*. However none of the species transferred to *Paramultipeniata*, including the type-species *P. lemani*, have the multiple male genitalia diagnostic of the *Multipeniata*, or in fact share any unique character with the *Multipeniata*. Kulinich suggested the following characters to be characteristic of *Paramultipeniata*: 1) relatively large body size, 2) "cirrus-like copulatory organ" (tubular proximal penis), 3) relatively large, muscular, pharynx, with one sphincter, 4) one copulatory organ. None of these characters are convincing apomorphies for the *Paramultipeniata*: a large muscular pharynx is also seen in, *e.g*., *Plagiostomum nonatoi* Marcus, 1948, and *Plagiostomum parasitorum* Brandtner, 1934, and a tube-like proximal penis is found in, *e.g*., *Plagiostomum abboti* Karling, 1961, and *Plagiostomum thelotrichum* Marcus, 1951. I concur with Sluys (1992) that "the data matrix provided by Kulinich (1974) does not lend itself for a phylogenetic analysis", although it should be noted that there is no indication that Kulinich (1974) ever intended to do anything but define taxa by phenetic similarity.

In the 18S analysis *T. phukettensis* and *P. lemani* are members of the clades Plagiostomidae and *Plagiostomum*, with strong jackknife support. Morphological data do not contradict this: *P. lemani* is similar in size, morphology, and coloration to *P. album*, its sister taxon in the analysis. In the case of the highly modified *T. phukettensis* it is harder to find supporting characters, but the copulatory organ is reminiscent of that seen in a range of plagiostomids, *e.g*., *Plagiostomum striatum* Westblad, 1956.

This conflict between inferred phylogeny and present classification can be resolved in two ways: either by splitting up the Plagiostomidae and *Plagiostomum* into smaller units compatible with the Torgeidae and *Paramultipeniata*, or by including the Torgeidae in Plagiostomidae and transferring the species in *Paramultipeniata* to *Plagiostomum*. Although I suspect it will eventually prove necessary to split Plagiostomidae and *Plagiostomum*, this would require the erection of multiple new taxa, and as the phylogeny of these taxa is presently so poorly known, the new taxa would be of questionable monophyly and composition. *Multipeniata* (excluding *Paramultipeniata*) and *Torgea* appear to be monophyletic, based on obvious diagnostic apomorphies, and hence candidates for taxa which might survive a future revision. Torgeidae is therefore synonymized with Plagiostomidae, but the taxon *Torgea* is provisionally retained for plagiostomids with a pharynx complex made up by pharynx and muscular buccal body wall. There is no evidence *Paramultipeniata* is more than an artificial assemblage of species of *Plagiostomum,* and *Paramultipeniata* is therefore synonymized with *Plagiostomum*.

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