

Polycladida Acotylea from Patagonia. Redescription of *Crassiplana albatrossi* (Pseudostylochidae), lectotype designation and first record of *Notocomplana palta* (Notoplanidae)

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Abstract

Crassiplana albatrossi is redescribed on the basis of material collected in Patagonia (Argentina) and type material deposited in the USNM. The specimens have specific characters, showing tentacles; tentacular, brain and marginal eyes; genital pores in the posterior portion; male copulatory system with penis papilla; prostatic vesicle free, with strong muscular walls; internal epithelium of prostatic vesicle glandular and with conspicuous projections; seminal vesicle present; vagina very long and extending anteriorly up to pharynx; Lang's vesicle absent; genito-intestinal duct present. Known geographic range is increased to include Patagonia (Argentina). Identity of *Notocomplana palta* is confirmed based on the presence of characters in the original description including: strongly muscular seminal vesicle, long, thin and muscular ejaculatory duct stretching into prostatic vesicle, which has a high and folded epithelium; conical penis papilla. A lectotype is designated from the material studied by Marcus and housed in the SMNH. Known geographic range of *Notocomplana palta*, known only from the type locality in south Chile, is enlarged to include Patagonia (Argentina), revealing its Magellanic affinities.

Key words: Platyhelminthes, "Turbellaria", Magellanic Region, Argentina, Chile

Resumen

Basado en material colectado en la Patagonia argentina y en la observación del material tipo depositado en el USNM redescubrimos a *Crassiplana albatrossi* que presenta tentáculos, ojos tentaculares, cerebrales y marginales. Poros genitales separados, en la región posterior. Aparato copulador masculino con una papila peniana. Vesícula prostática libre, de paredes fuertemente musculares. El epitelio interno de la vesícula prostática es glandular con fuertes proyecciones. Vesícula seminal presente. La vagina es extremadamente larga y se extiende anteriormente. Ausencia de vesícula de Lang. Presencia de conducto genito-intestinal. Asimismo ampliamos su distribución a la Patagonia argentina. Confirmamos la identidad de *Notocomplana palta*, la que presenta los atributos de su descripción original, vesícula seminal fuertemente muscularizada, ducto eyaculador largo, delgado y muscular que se adentra en la vesícula prostática con epitelio alto y plegado. Papila peniana cónica. Designamos lectotipo a partir del material trabajado por Marcus y depositado en el SMNH. Ampliamos la distribución de *Notocomplana palta*, conocida hasta ahora solo para la localidad tipo del sur de Chile y la reportamos en la Patagonia argentina, demostrando su abolengo magallánico.

Introduction

Species of Polycladida in the south of Southwestern Atlantic Ocean are very poorly known, although their presence has been known for a long time (Hyman 1955). Two species of Cotylea have been recently recorded along the northern coast of Patagonia (Brusa *et al.* 2009). Only two records of Acotylea are known, both specimens collected during Antarctic expeditions at the end of the nineteenth and beginning of the twentieth centuries (Faubel 1983). These were studied in Europe and the USA (Faubel 1983, Hyman 1955). Although Marcus—in the mid-twentieth

century— studied mainly the turbellarian fauna of Brazil (including polyclads), he also studied continental and marine turbellarians from southern Chile (Marcus, 1954). He recorded seven species of Polycladida. Many of these specimens are currently housed in European museums (*e.g.*, SMNH) and have not been subsequently studied until this day.

Studies of Polycladida involve the description of several characters, and ideally these should include the morphology of live specimens, such as shape, color, eyes, and pores, and also details of the internal structure of the reproductive, digestive, muscular and nervous systems.

In this paper we re-describe *Crassiplana albatrossi* Hyman 1955, and report for the first time this species and the Magellanic species *Notocomplana palta* (Marcus 1954) Faubel, 1983, following a review of the material from museum collections and newly collected specimens along the Argentine Patagonian coast. A lectotype of *Notocomplana palta* is designated.

Material and methods

The holotype of *Crassiplana albatrossi* was provided by the United States National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (USNM) and specimens of *Notocomplana palta* were provided by the Swedish Museum of Natural History, Stockholm, Sweden (SMNH).

New specimens of *Crassiplana albatrossi* and *Notocomplana palta* were collected in 2006–2009 at different localities along the Patagonian coast (Table 1). Specimens were collected manually, observed and photographed while alive, then fixed in 10% formaldehyde and in Bouin's solution.

We wash the specimens after fixation, and the worms were preserved in 70% ethanol. Body measurements were taken from the fixed animals (measurements given as length mm x width mm) and then photographed. Segments besides and behind the pharynx containing the reproductive structures were removed. These segments were embedded in paraplast, sagittally sectioned at 7 µm, and then stained using azan solution or haematoxylin and eosin, and mounted. *In toto* mountings were made by dehydrating the worms in graded alcohols, cleared in xylene and finally mounted in synthetic Canada balsam. The reproductive system was drawn based on the sectioned material and *in toto* mountings.

Voucher specimens were lodged in the Invertebrate collection of Museo de La Plata (MLP), La Plata, Buenos Aires, Argentina.

Taxonomic identifications follow the classification system of Faubel (1983) for acotyleans, which is based on characteristics of the male reproductive system, specifically the structure of the prostatic vesicle and its orientation and relationship with the ejaculatory duct.

Legends for all figures are as follows: cg, cement gland; co, common oviduct; e, eye; ed, ejaculatory duct; gd, genito-intestinal duct; i, intestine; lv, Lang's vesicle; m, mouth; ma, male atrium; o, ovary; ov, oviduct; pc, pharynx cavity; ph, pharynx; pp, penis papilla; pv, prostatic vesicle; spb, spermiducal bulb; sv, seminal vesicle; v, vagina; ♀, female gonopore; ♂, male gonopore.

Systematics

Suborder: Acotylea

Superfamily: Craspedommatidea Bock 1913 (emend Faubel 1983)

Family: Pseudostylochidae Faubel 1983

Crassiplana Hyman 1955

Pseudostylochidae with tentacles, tentacular, brain and marginal eyes. Genital pores separate, placed posteriorly. Male copulatory apparatus with penis papilla. Free prostatic vesicle with strongly muscular wall. Internal epithelium of prostatic vesicle glandular and with conspicuous projections. Seminal vesicle present. Vagina very long and reaching anteriorly. Lang's vesicle absent. Genito-intestinal duct present.

TABLE 1. Known distribution of *Crassiplana albatrossi* and *Notocomplana palta*. The localities are with the provinces in brackets when they are in Argentina. Those of Chile are indicated in brackets too. The numbers in localities correspond to Figure 1.

Polyclads	Localities	Coordinates	Substrates	Date	Collections
<i>Crassiplana albatrossi</i>	Puerto Lobos (Chubut) (1)	42°00'04.6"S-65°04'15.8"W	Mesolitoral, under loose stones	20-09-09, 25-09-08, 14-04-08	MLP
	Playa Fracasso (Chubut) (2)	42°24'55"S-64°06'33"W	Mesolitoral, under loose stones	28-10-09	MLP
	Bahia Craker (Chubut) (3)	42°56'39.5"S-64°30'03.4"W	Mesolitoral, under loose stones	19-09-09	MLP
	Cerro Avanzado (Chubut) (4)	42°49'34.1"S-64°53'00.7"W	Mesolitoral, between corallinae algae	18-09-09	MLP
	Punta Ameghino (Chubut) (5)	42°35'41.53"S-64°48'35.71"W	Mesolitoral, between corallinae algae	06-04-08	MLP
	Punta Este (Chubut) (6)	42°47'06.61"S-64°57'10.89"W	Mesolitoral, between corallinae algae	01-12-06	MLP
	Off the mouth of the Rio de la Plata (Buenos Aires) (7)	36°47'00"S-56°23'00"W	At 19 m of depth	12-01-1888	Holotype USNM 26928
<i>Notocomplana palta</i>	Puerto Lobos (Chubut) (1)	42°00'04.6"S-65°04'15.8"W	Mesolitoral, under loose stones	20-09-09, 25-09-08, 12-04-08	MLP
	Playa Fracasso (Chubut) (2)	42°24'55"S-64°06'33"W	Mesolitoral, under loose stones	28-10-09	MLP
	Bahia Craker (Chubut) (3)	42°56'39.5"S-64°30'03.4"W	Mesolitoral, under loose stones	19-09-09	MLP
	Cerro Avanzado (Chubut) (4)	42°49'34.1"S-64°53'00.7"W	Mesolitoral, between corallinae algae	18-09-09	MLP
	Punta Cavendish (Santa Cruz) (8)	47°44'S-65°50'W	Unknown	28-11-07	MLP
	Gulf of Ancud (Chile) (9)	41°48'50"S-73°09'40"W	Little stones at 25 m	15-12-1948	Lectotype SMNH 110097-110101
	Gulf of Ancud (Chile) (9)	41°49'40"S-73°08'W	Coarse sand with valves of <i>Pecten</i> at 45 m	03-05-1949	Unknown
	Reloncavi bay (Chile) (9)	41°30'06"S-72°53'57"W	Stones sposed to waves	21.31-01-1949	Unknown
	Reloncavi bay (Chile) (9)	41°30'45"S-73°00'13"W	Stones sposed to waves	13,14-03-1949	Unknown
Gulf of Ancud (Chile) (9)	41°50'30"S-73°28'30"W	Stones at 50-60 m	05-05-1949	Unknown	
Gulf of Ancud (Chile) (9)	41°47'18"S-73°20'55"W	Coarse sand with algae at 60 m	05, 06-05-1949	Unknown	

Crassiplana albatrossi Hyman 1955

Studied material: Holotype, USNM Catalog number 26928. Three slides. Other material: Specimens from the northern coast of Patagonia, Argentina, MLP (Table 1, Figure 1).

Description. Live specimens are of a light brown color (Figure 3A–B). Body ovate, with frilled edges. Fixed specimens studied from Patagonia are approximately 23 mm long and 16 mm wide. Epidermis is ciliated and carries high cells with a strong basal membrane. Body wall contains four muscular layers from outside to inside: a thin external circular layer, a longitudinal layer, a diagonal layer formed of fibers in two orientations, and an inner circular fasciculate layer. Parenchyma showing bundles of dorsoventral muscles.

One pair of tentacles in brain region (Figure 3B). Tentacular, brain, and marginal eyes present; the latter abundant in the anterior region of body and decreasing in number posteriorly to disappear beyond mid-length of body. Sparse eyes present in region anterior to brain.

Large folded pharynx placed at mid-length of body (Figure 3A). Mouth placed near posterior end of pharynx.

Gonopores: separate, placed near posterior end of body and very close to each other.

Deferent ducts ventral, widening towards their distal end, where they twist and form the spermiductal vesicles; spermiductal vesicles thin-walled, and full with spermatozooids in adult specimens. Tubular seminal vesicle with muscular wall ventral to prostatic vesicle (Figures 2, 3G). Seminal vesicle merging into ejaculatory duct, which joins prostatic duct. Penis papilla blunt and strongly muscular, opening into male gonopore (Figure 3C). Large free prostatic vesicle strongly muscular; wall projecting towards lumen, rendering a tubular shape. Prostatic glands crossing muscular wall (Figure 3G).

Female gonopore behind male gonopore, originating a muscular vagina inlaid with numerous glands throughout its length; inner surface ciliated (Figures 2, 3C). Distal portion of vagina vertical, turning forward and then dorsal to prostatic vesicle. Anterior to the prostatic vesicle, the vagina is placed ventrally and stretches anteriorly almost to the pharynx (Figures 2, 3C–D); at this level it turns dorsally and then backwards, in a half-moon shape. Vagina receiving common oviduct (Figures 2, 3D–E). Lang's vesicle absent. Genito-intestinal duct dorsal to common oviduct. Junction of genito-intestinal duct and lumen of intestine close to prostatic vesicle (Figures 2, 3F).

Remarks. The holotype, as mentioned in the original description by Hyman (1955), is poorly preserved. However, diagnostic structures such as the presence of nuchal tentacles, tentacular, brain and marginal eyes, the structure (shape, size, lumen) of the prostatic vesicle, the dorsal vagina and the ventral seminal vesicle in the holotype (Figure 3H–K) confirm that the newly collected specimens are *Crassiplana albatrossi*. The holotype also shows spermiductal vesicles.

The internal lining of the large prostatic vesicle is not smooth—neither in the holotype (Figure 3H–J) nor in the Patagonian material (Figure 3G)—as depicted in the original description (p. 15, fig. 22), but instead projects into the lumen. The presence of a smooth lining (Hyman, 1955) originally allows the placement of this genus in the Callioplanidae (Faubel, 1983). However, the presence of well-developed crests in the holotype and the material from Patagonia suggests that *Crassiplana* does not belong to that family.

Of the female genitalia, the only part preserved in the holotype is the independent gonopore and the vagina that is dorsal and anterior to the male copulatory apparatus (Figure 3I–J). The anterior part of the vagina and its junction with the oviducts are not observed. Hyman (1955) doubtfully mentioned the junction of oviducts and the presence of Lang's vesicle. These two structures are not observed in the holotype. The material from Patagonia allows describing the anterior tract of the vagina, and also the opening of oviducts into the vagina and the presence of a genito-intestinal duct.

Contrary to what can be observed in the Patagonian material, Hyman (1955) described marginal eyes completely surrounding the body. This feature could not be observed in the holotype, as only the anterior part of the body is mounted *in toto*.

The shape and position of the pharynx as well as the male copulatory apparatus and prostatic vesicle, allow *C. albatrossi* to be placed confidently in the family Pseudostylochidae. Within this family, the genus *Idioplana* Woodworth 1898, has female genitalia dorsal to the male one. This peculiar feature is also observed in *Crassiplana*. However, *Idioplana* has an anchor-shaped Lang vesicle, while this vesicle is missing in *Crassiplana*, which has a conspicuous genito-intestinal duct.

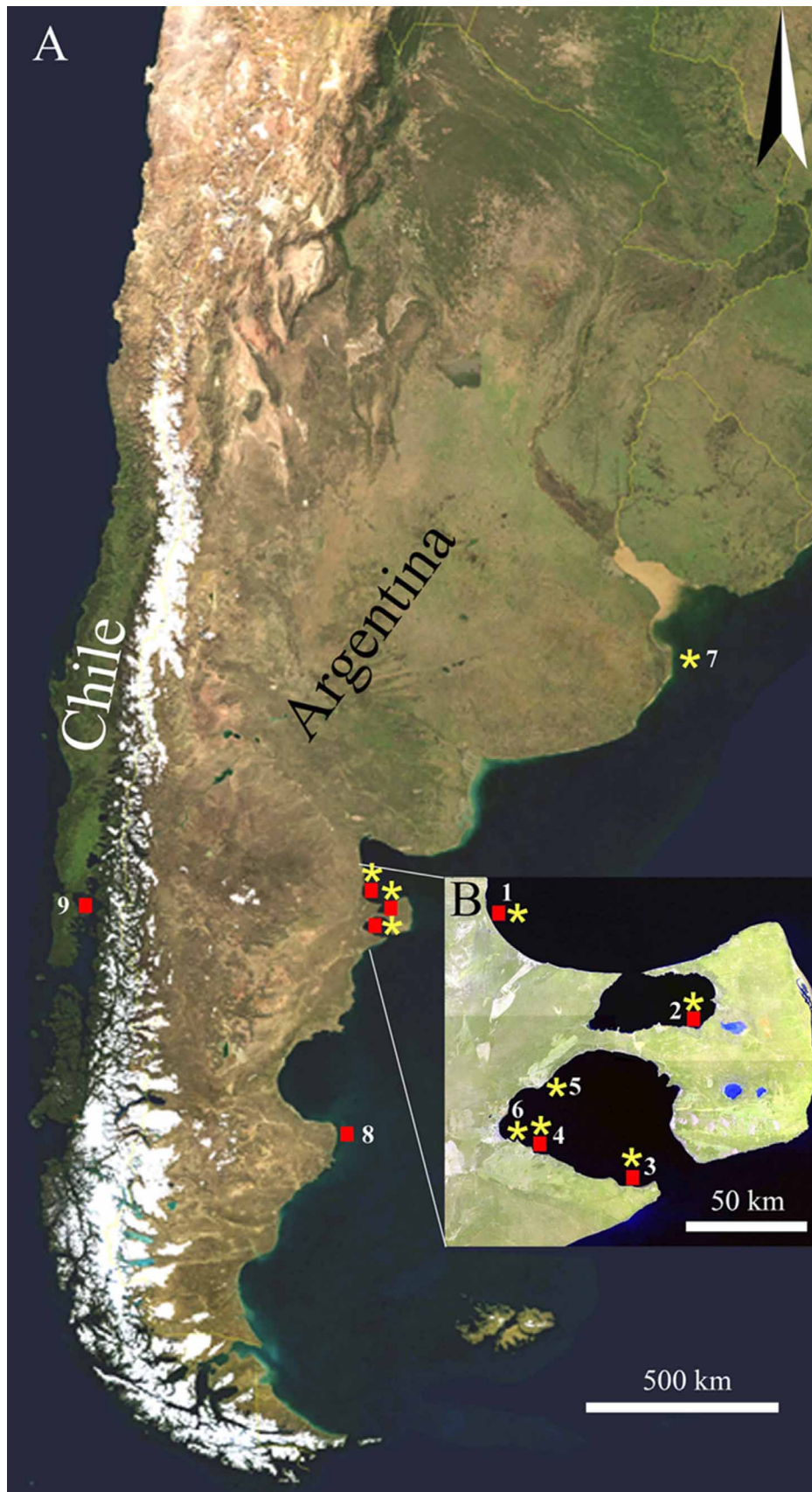


FIGURE 1. Localities where the polyclads were found. *Crassiplana albatrossi* (squares) and *Notocomplana palta* (asterisks). A, general view with the type localities and the new localities. B, details of the localities in Peninsula Valdés and neighbour zones. The numbers of the localities correspond to table 1.

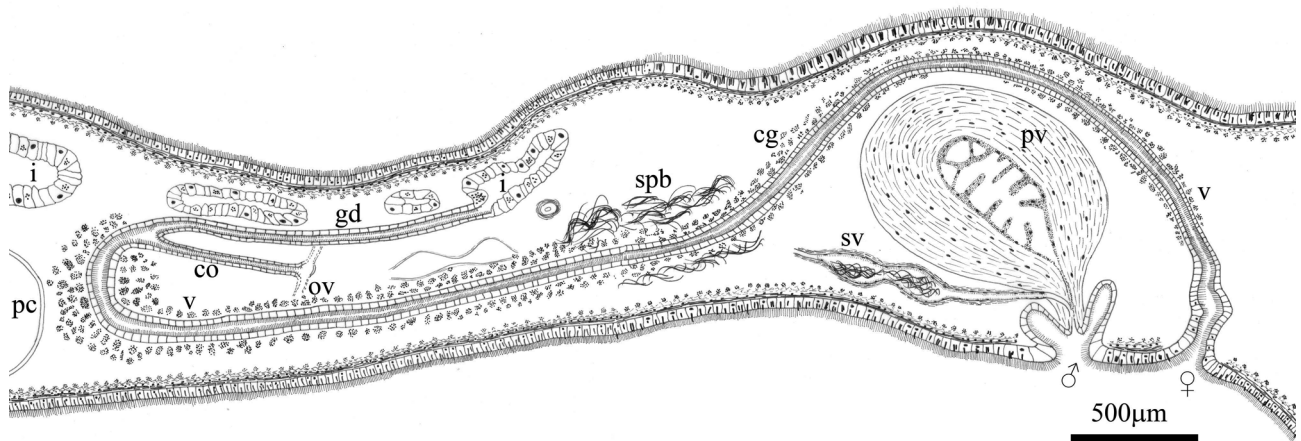


FIGURE 2. *Crassiopana albatrossi*. Sagittal reconstruction of adult specimen.

Family: Notoplanidae Faubel 1983

Notocomplana palta (Marcus 1954) Faubel 1983

Synonym: *Notoplana palta* Marcus 1954

Material examined. Specimens of *Notocomplana palta* were provided by the Swedish Museum of Natural History, Stockholm, Sweden (SMNH). We designate as lectotype the specimen SMNH 110097-110101 from the series of animals studied by Marcus (1954). New specimens were collected in 2006–2009 at different localities along the Patagonian coast; these are housed in the Invertebrate Zoology collection at the MLP (Table 1, Figure 1).

Description. Live specimens are light to dark orange-colored (Figure 5B). Central zone where pharynx is placed is darker. Body ovate and with ruffled edges. Studied specimens measure 10–20 mm long and 5–9 mm wide.

Tentacles absent. Eyes placed in medial region, associated to brain zone. Brain eyes rounded, small, numbering 35 to 40 on each side. Tentacular eyes posterior to brain eyes, larger, and approximately ten on each side. Very small eyes in parenchyma ventrally and anteriorly to brain (Figure 5A).

Ventral and dorsal epidermis ciliated. Ventral cilia longer. Rhabdites on both surfaces, more abundant on ventral epidermis. Basal membrane thick, the ventral one being thinner than the height of the epithelium; dorsal basal membrane thickness equal to the epithelium height, folded in some of the thin sections. Body-wall musculature on dorsal surface consisting of an external thin circular layer, a diagonal middle layer (the thickest) and a longitudinal internal layer; a second internal circular layer is crossed by dorso-ventral muscles. On the ventral surface of the body, musculature is longitudinal, followed internally by a thin circular layer; the latter is packed inwards.

Pharynx ruffled (approximately nine folds), placed in front of mid-length of body. Epithelium lining the pharynx cavity is ciliated. Mouth slightly behind mid-length of pharynx (Figure 5C).

Testicles ventral and ovaries dorsal, distributed throughout body length, including the region in front of the brain.

Deferent ducts (one pair) thickening and twisting before joining seminal vesicle. Seminal vesicle strongly muscular, rounded to oval. Ejaculatory duct long, thin and muscular. A short portion of ejaculatory duct projects into prostatic vesicle, which shows a tall and folded epithelium. Lumen of prostatic vesicle continuous with the lumen of penis papilla (Figure 4). Penis papilla conical, located in a male atrium and opening into a male pore (Figure 5E, H–I).

Female gonopore posterior to male pore (Figure 4). Muscular vagina inlaid with ciliate epithelium; shape sigmoidal, and lying perpendicular to surface in its first part, then running anteriorly, and later turning posteriorly. In female specimens, the portion reaching anteriorly carries abundant cement glands that open into that part of the vagina (Figures 4, 5D, F).

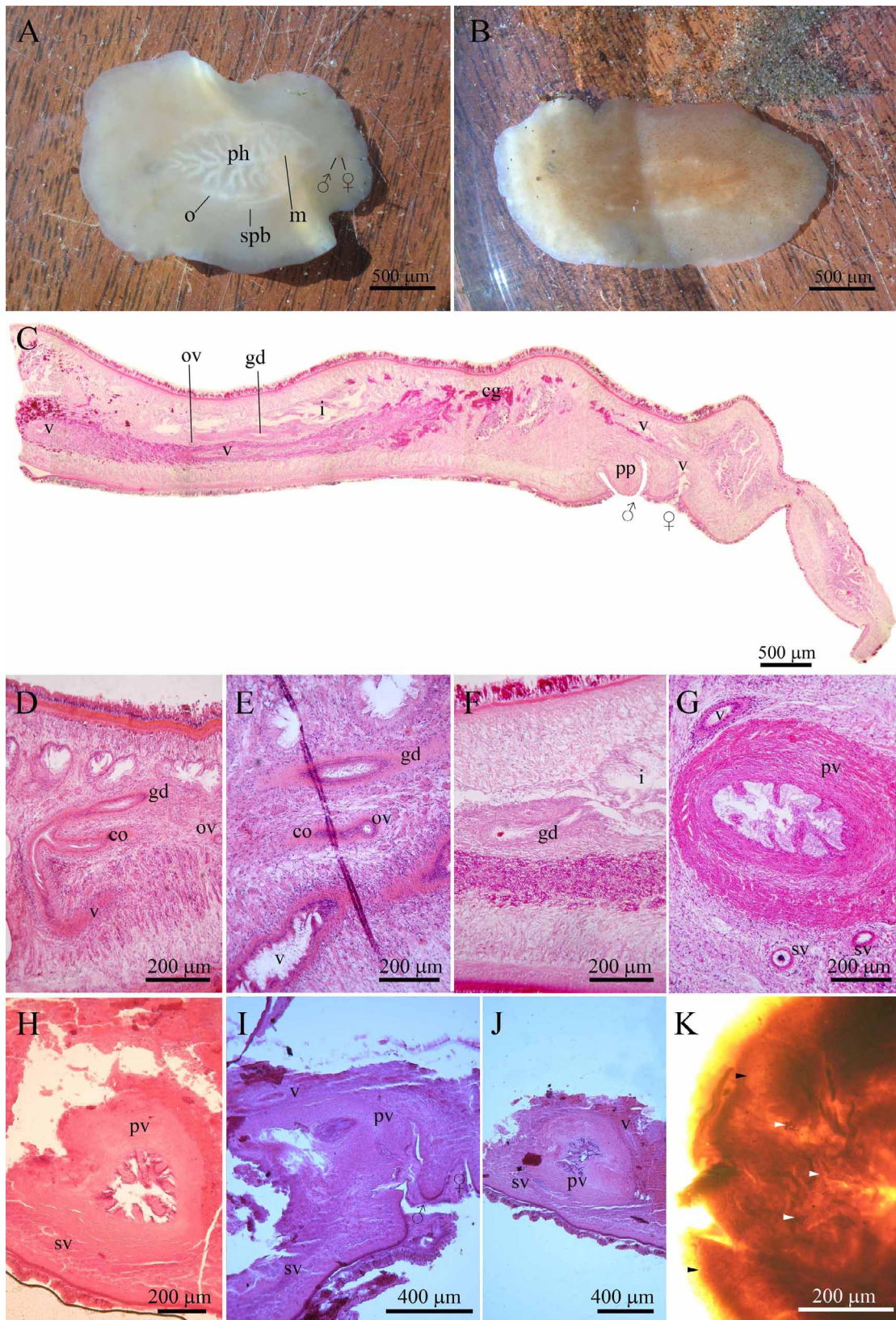


FIGURE 3. *Crassiplana albatrossi*. Live specimen. A, ventral view with details of the reproductive organs. B, dorsal view showing tentacles and tentacular, cerebral and marginal eyes. Sagittal sections. C, general view of the female organs with the anterior vagina and gonopores. D, detail of the loop of the vagina and bifurcation of the common oviduct and genito-intestinal duct. E, detail of the beginning of the oviduct from the common oviduct. F, detail of the genito-intestinal duct emptying into the intestine. G, detail of the prostatic vesicle. H–K, detail of the holotype. K, whole mount of the anterior portion with tentacular and cerebral eyes (white arrows tip) and marginal eyes (black arrows tip).

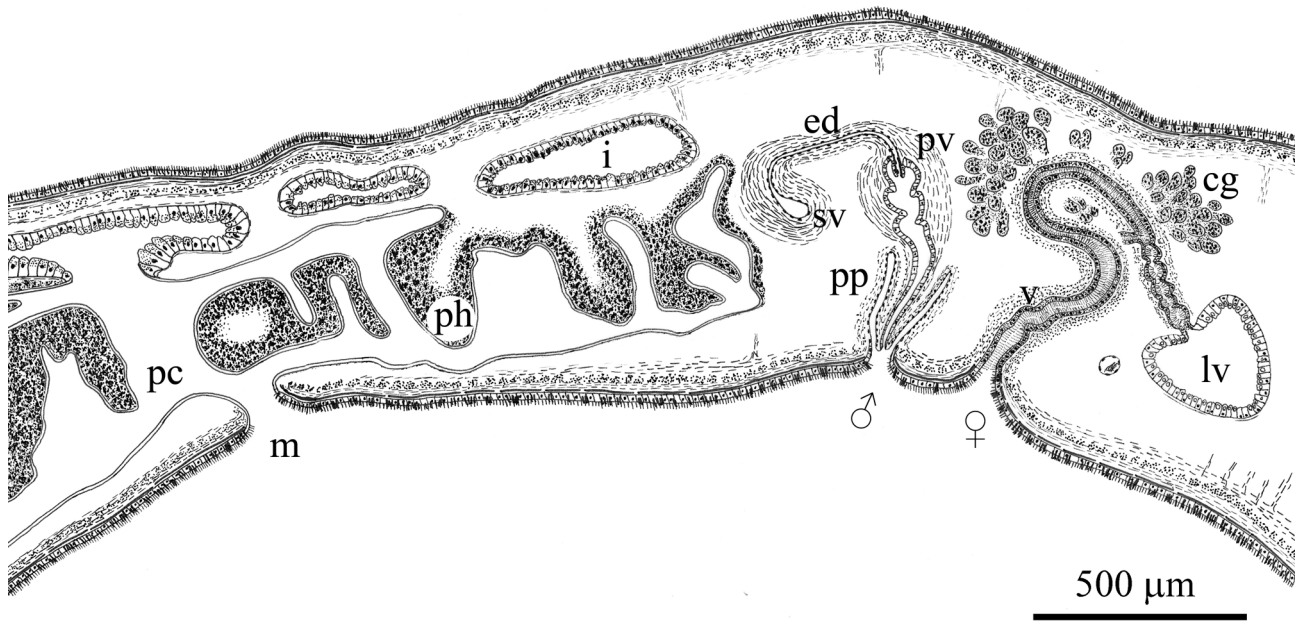


FIGURE 4. *Notocomplana palta*. Sagittal reconstruction of adult specimen.

Uteri loaded with ovocytes and continuing into two uterine ducts that join to form a single ciliate duct. The latter joins the proximal part of vagina at its ventral surface.

Lang's vesicle channel present after junction of uterus and vagina. This channel shows constrictions that give it a beaded appearance; it opens into Lang's vesicle. At the junction of vesicle and duct there is a sphincter. Vesicle rounded to ovate, lined with a tall vacuolar epithelium, with scarce muscular fibres. Sperms were observed within it (Figures 4, 5D, G).

Remarks. This species was originally described by Marcus (1954) from the fjord region in southern Chile. The Patagonian specimens clearly agree with the original description of the species (Marcus, 1954) and with the material he had available for study (SMNH110097-110101).

Bulnes (2009) recently mentioned *Notocomplana palta* in an area close to the type locality but the description given by this author does not agree with the original description (Marcus, 1954). Bulnes (2009) described small tentacles, a thin and short penis papilla, and a four-chambered seminal vesicle. These structures were not mentioned in the original description of this species (Marcus, 1954) nor are they present in the material studied by him and housed in the SMNH. Therefore, they can not be considered part of this taxon.

The material housed in the SMNH was not designated originally as type material. To avoid future misidentifications of *Notocomplana palta*, the specimen described and illustrated by Marcus in the original work (Marcus 1954; 65; figs. 99, 101) and from the type locality (as recorded on the original label *St. M 21*) is designated as the lectotype under Article 74 of the fourth edition of ICZN (1999). The presence of this species along the Patagonian coast and southern Chile suggests a Magellanic distribution similar to that of other species of invertebrates (e.g. Boschi 2000, Balech & Ehrlich 2008).

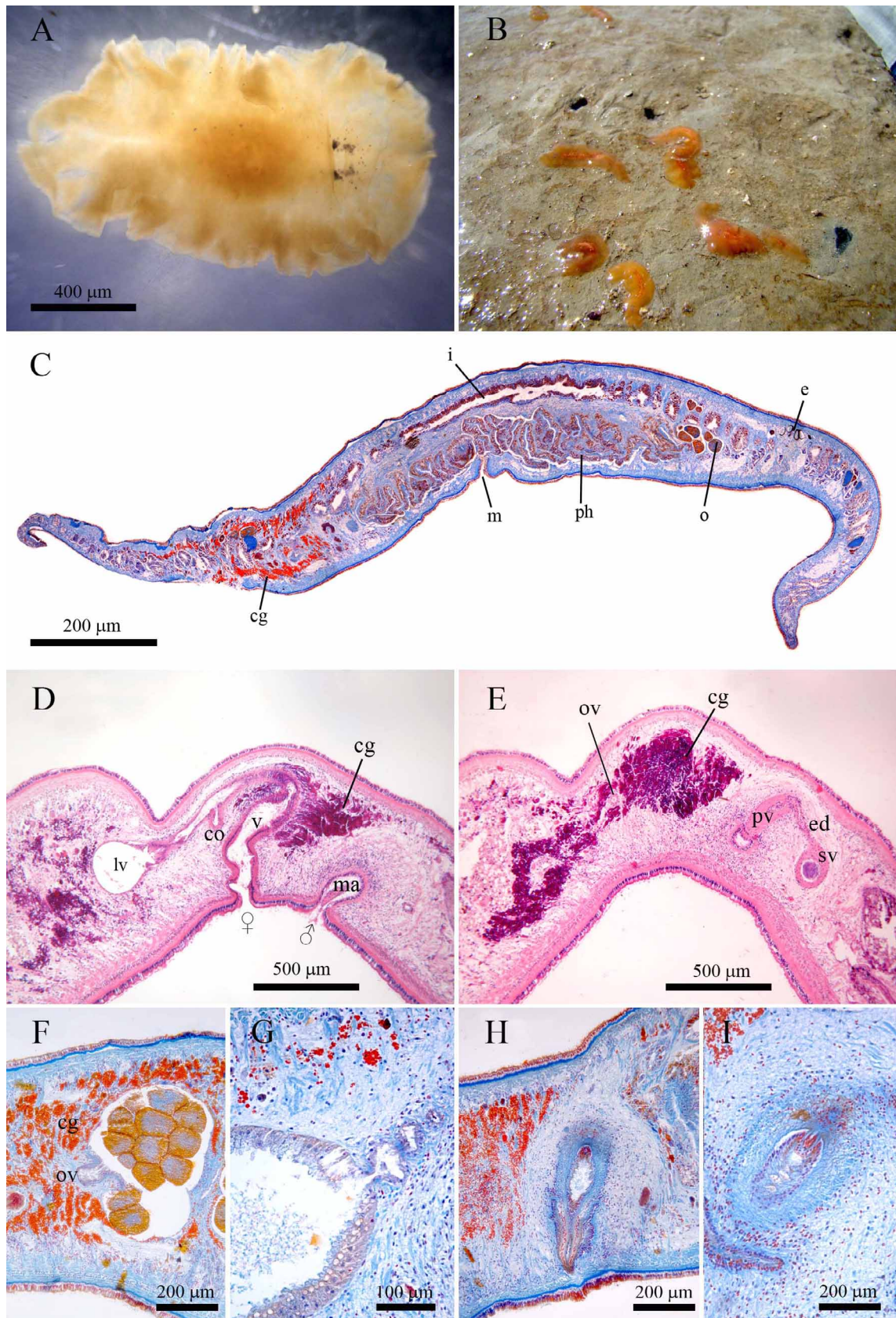


FIGURE 5. *Notocomplana palta*. A, dorsal view of adult specimen. B, live specimens on the stone. Sagittal sections. C, general view of adult specimen. D, detail of the female organs. E, detail of the male organs. F, detail of the ovary and the first portion of the oviduct. G, Lang's vesicle, detail of the sphincter and spermatozooids in the vesicle. H, penis papilla and the prostatic vesicle with the lining epithelium ridge. I, prostatic vesicle with the chambers.

Discussion

The two Patagonian species described herein are an addition to the four already known (Brusa *et al.* 2009), increasing the diversity of this group in the studied area. The presence of specimens at several localities along the Argentine coast suggests a widespread geographic range of the two Acotylean species.

Crassiplana albatrossi was known only from its original description and holotype. The latter is a poorly preserved specimen (Hyman, 1955). New material from localities south of its only previous record indicates a wider range. On the other hand, *Notocomplana palta*—known previously only from southern Chile—also shows a wider range and reveals a Magellanic distribution.

Study of the type material of both species allowed precise identification of the material. In the case of *Crassiplana albatrossi*, features of the inner lining of the prostatic vesicle were described. This character is currently considered important in family-rank taxa by some authors (Faubel 1983). Original drawings accompanying the original description of this species do not reveal the state of this character, this being the reason for its misidentification as a member of the family Callioplanidae (Faubel, 1983). New findings of specimens of *C. albatrossi* for the first time after its original description allowed recognition of certain features (*e.g.* forward-running vagina, presence of genito-intestinal duct, and absence of Lang's vesicle) described doubtfully or not described at all by Hyman (1955) that were the cause of mistakes in suprageneric assignments.

Analysis of the specimen of *Notocomplana palta* deposited in the Swedish Museum of Natural History, Stockholm, Sweden, was crucial for the correct identification of the specimens from Patagonia, different from those recorded as *N. palta* by Bulnes (2009) from southern Chile. Lectotype designation was necessary to avoid further confusion in the identification of this Magellanic species.

Aknowledgments

ANCyT (PICT 2006 1315) partly funded this study. Lic. H. Merlo helped collecting some of the specimens. The Dirección de Fauna y Flora, Ministerio de Industria Agricultura y Ganadería, and the Subsecretaría de Turismo y Áreas Protegidas, Ministerio de Comercio Exterior, Turismo e Inversiones of the province of Chubut granted the necessary permits. The United States National Museum of Natural History, Smithsonian Institution, Washington, D.C., USA (USNM) provided the holotype of *Crassiplana albatrossi* and the Swedish Museum of Natural History, Stockholm, Sweden (SMNH) provided specimens of *Notocomplana palta* studied by Marcus.

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