

Three New Species of Dorid Nudibranchs from Southern California, USA, and the Baja California Peninsula, Mexico

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Abstract. Three new species of dorid nudibranchs, one phanerobranch *Trapania goslineri*, and two cryptobranchs, *Peltodoris mullineri* and *Peltodoris lancei*, have been found in the Gulf of California and nearby Pacific waters of the Baja California peninsula, Mexico, and southern California, USA. *Trapania goslineri* can be distinguished by its white body with large black blotches and yellow tips. *Peltodoris mullineri* is a large, yellow to golden orange dorid, with speckled brown blotches. *Peltodoris lancei* is a large, dark orange dorid, which has small white-tipped papillae and a very depressed body.

INTRODUCTION

The opisthobranch fauna of Baja California, on the Pacific side and in the Gulf of California, is less known than the fauna of the more temperate zone farther to the north. Some indication of the rich diversity can be found in the opisthobranch chapter of Keen (1971), its update by Skoglund (1991), and in Bertsch (1989). Studies of the Pacific coast of the peninsula have noted the presence of several undescribed species (Gosliner et al., 1985; Bertsch, 1991b). In the waters of the Gulf of California, an ongoing survey of the ecology and abundance of opisthobranch mollusks was initiated by Hans Bertsch in the early 1980s. This study has been primarily centered at Bahía de los Angeles, Baja California, Mexico. During the course of this study, a number of rare and undescribed nudibranchs have been discovered (Bertsch, 1991a, 1995a, b). Some of these species have since been described (Gosliner & Behrens, 1986; Gosliner et al., 1999). This paper describes three additional species: *Peltodoris lancei* from the Gulf of California, *Trapania goslineri*, which is found on both coasts of the Baja California peninsula, and *Peltodoris mullineri* from the outer coast of southern California and Baja California.

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SYSTEMATICS

Family GONIODORIDIDAE H. & A. Adams, 1854

Genus *Trapania* Pruvot-Fol, 1931

Trapania goslineri Millen & Bertsch, sp. nov.

(Figures 1A, 2A-F, 3)

Trapania sp. Behrens, 1983: 19; Bertsch & Kerstitch, 1984: 264; Bertsch, 1989:63; Bertsch, 1996.

Trapania sp. 1 Behrens, 1991:47

Etymology: This species is named for our friend, the prolific opisthobranch researcher and photographer, Terrence Gosliner of the California Academy of Sciences.

Material examined: Holotype: CASIZ 118571, Punta la Gringa (29°02.56'N, 113°32.29'W), Bahía de los Angeles, Baja California, Mexico, 29 June, 1987, collected by T. Gosliner. Paratypes: CASIZ 112214, 2 specimens, one dissected, from the type locality, 29 June 1987, collected by H. Bertsch. Other material: Not deposited, 1 specimen, dissected, Cuevitas, Bahía de los Angeles, 26 May 1995, collected by H. Bertsch. Not deposited, 1 specimen and spawn mass, Bahía Tortugas, 6 October, 1996, H. Bertsch. Not deposited, 1 specimen, dissected, Punta Don Juan, Bahía de los Angeles, 5 October, 1984, H. Bertsch.

External morphology: The soft body has a limaciform shape with the mantle reduced to two pairs of posteriorly

curved lateral processes, one pair beside the gills and one lateral to each rhinophore, as is typical for the genus (Figure 1A). The measurements of a typical preserved specimen are $8.5 \times 2.5 \times 3$ mm ($l \times w \times h$). The largest living specimen had a length of 15 mm. The non-retractile rhinophores have no sheaths and 9–10 leaves. There are three non-retractile, bipinnate gills, one medial and two lateral, all anterior to the anus. The anus is on a small papilla, and the renal opening is above it, between the right and central gills. The head has digitiform oral tentacles extending antero-laterally. The narrow foot is expanded anteriorly into short, recurved, propodial tentacles and is bilabiate on its anterior edge.

The ground color is white with large, black oval spots and streaks (Figures 1A, 2A, B). There is a V-shaped, wide black mark on the head from in front of the rhinophores extending onto the base of the oral tentacles. There is a wide, longitudinal stripe extending from behind the rhinophores half way back to the gills, which may be confluent with spots in front of the gills. The branchial and rhinophoral processes have black streaks originating on the body and extending out their dorsal sides. Their tips are golden orange. The oral tentacles are white or spotted basally, golden orange distally. The rhinophores and propodial tentacles are white basally with golden orange distally. The three bipinnate gills are translucent white, sometimes with large black spots near their bases, with golden orange tips. Large oval to round black spots are irregularly distributed on the sides and midline. The tail is golden orange with a medial streak of the same color. Ventrally, the head and foot are white. There are minor variations from this pattern. One specimen had white instead of golden orange on the tail, branchial and rhinophoral processes, and oral tentacles, but not the gills and rhinophores. Several specimens had smaller, more numerous black spots. Another specimen had golden orange extending most of the length of the lateral processes.

Internal anatomy: There are simple labial glands ventral to the mouth opening. The very short, ringlike buccal tube leads to a large, round, sessile buccal bulb with no projecting radular sac. The suctorian crop has transverse muscles but no median longitudinal muscle division. Inside there are two triangular jaw plates with a triangular patch of pointed rodlets up to 27 μ m in length (Figure 2C, D). The radular formula is 37–41 (1.0.1). The teeth are elongate plates with a recurved distal edge bearing denticles. There are two small outer denticles, the second of which is sometimes subdivided, at the base of the long narrow cusp which is two-thirds of the distance to the outside of the tooth. The inner edge has seven to nine intermediate denticles varying in size, the longest of which is half the length of the cusp and just outside of center. In addition, there are a number of minor intermediate serrations which are only visible using scanning electron microscopy (SEM) (Figure 2E, F). Posteriorly,

on either side of the esophagus are two small, round, salivary glands. The esophagus is long and tubular. The striated stomach is buried in the confluent digestive glands and possesses a large, round posterior caecum, which is muscular and free of the digestive glands. The narrow, tubular intestine leaves the stomach at its junction with the caecum and travels anteriorly to the anterior edge of the digestive gland, then curves abruptly to the right and posteriorly to end on a small anal papilla.

The central nervous system has fused cerebro-pleural ganglia with large, sessile eyes. The ventral pedal ganglia are large and round. No visceral ganglia were seen. On the ventral side of the pharynx, the two large, round buccal ganglia are close together.

The triaulic reproductive system is illustrated in Figure 3, excluding the ovotestis, which lies in lateral rows along the top and sides of the digestive glands. The round female acini lie on either side of the soft, tubular male acini. Ductules join them to the median longitudinal hermaphroditic duct. This duct is free of the digestive glands for a short distance on the anterior right, then it loops dorsally alongside the hermaphroditic ampulla and enters it one-third of the way from its distal end. The large, oval ampulla lies on the female gland mass. At its distal end the ampulla bifurcates into a vas deferens and a short oviduct, which unites with the insemination duct and enters the female gland mass. The vas deferens swells into a long, tubular prostatic portion, which bends once and constricts distally before a short muscular section, terminating in a small muscular penis at the common atrium. The penis is armed with several rows of slender, slightly curved spines. The vagina is tubular, wider at the common atrium. The narrow portion bends in an S shape and extends dorsally, then gives off the insemination duct 0.1 mm before the bursa copulatrix. The bursa copulatrix is large, spherical, and dark with sperm. The narrow, tubular insemination duct runs alongside the smaller, oval receptaculum seminis, which is inserted on it by a short duct. The insemination duct continues to join with the oviduct and forms a fertilization chamber before entering the female gland mass.

The female gland mass is round and compact. It has a small granular albumen gland, a highly folded mucus gland, and a distal, saccate membrane gland. It exits ventral to the vagina and penis in the common atrium. The genital atrium is located far anterior, on the animal's right side, below and slightly posterior to the base of the rhinophore process.

Natural history: This species is found in the intertidal and shallow subtidal and is very rare. An ongoing, 6-year study by Hans Bertsch in Bahía de los Angeles shows that this species makes up less than 0.2% of the opisthobranch population. Fourteen specimens were observed, the majority on an orange sponge. This genus is thought to feed on kamptozoans which are often attached to



sponge surfaces (Picton & Morrow, 1994). Individuals ranged in length from 8–15 mm (average 10.3 mm) and were found in January (1), March (2), May (3), June (1), July (1), September (4), October (1), and December (1). Egg masses were found twice, in March and October. The spawn was a narrow, white, upright ribbon, of 1½ coils, 5–6 mm in diameter, containing approximately 2000 eggs. There was one egg per capsule (Figure 2B). These data are insufficient to clearly describe the life cycle of this species; however, it appears to be more common in spring and summer than in the colder months. This species has been found off the Baja California peninsula on the Pacific side from Isla Cedros (Behrens, 1983) to Cabo San Lucas (Bertsch & Kerstitch, 1984) and in the Gulf of California at Bahía de Los Angeles and Sonora (Bertsch, 1991b).

Discussion: There are at present 20 described species of *Trapania* worldwide, two additional undescribed species listed by Gosliner (1987), and one undescribed species from the Pacific side of Costa Rica. Sixteen of the described species have been discussed by Rudman (1987) with the exception of *T. dalva* Marcus, 1972, and three recently described species: *T. luquei* Ortea, 1989, and *T. ortei* García-Gómez & Cervera, 1989, and *T. hispalensis* Cervera & García-Gómez, 1989, both in Cervera & García-Gómez (1989). Most of these species can be easily separated by color from *Trapania goslineri* sp. nov.

The four species which share a white ground color with black markings and yellow tips or streaks are compared in greater detail in Table 1. These species all have pointed jaw rodlets, a semi-serial receptaculum seminis, and simple hooks on the penis. *Trapania japonica* (Baba, 1935) differs from *T. goslineri* externally by its much smaller, browner spots which are absent from the lateral processes. Internally it has unique radular teeth, which have an almost central cusp with 9–12 outer and 12–24 inner denticles. *Trapania luquei* can be distinguished externally from *T. goslineri* by the yellow spots on the body, yellow patch on the head, and reticulating rather than solid pattern of black blotches. Internally it has a much larger cusp on the teeth with only one outer denticle and up to 14 inner denticles. The reproductive system is not known. *Trapania toddi* Rudman, 1987, also has a reticulating pattern to its black blotches. Internally it has similar teeth to *T. luquei*. *Trapania velox* (Cockerell, 1901) can be easily distinguished by its color pattern of five black lines in-

stead of oval spots, and it has a longer tail. Internally *T. velox* has fewer rows of teeth (22–32 versus 37–41) with one or no denticles external to the cusp instead of two. The bursa copulatrix has a serial arrangement rather than the short common duct found in *T. goslineri*. *Trapania velox* is the only species whose range is partly sympatric to that of *T. goslineri*. Its range is primarily north of *T. goslineri*, from Hazard Canyon, San Luis Obispo County, California (Roller & Long, 1969). There is a slight distributional overlap in the southern portion of its range, in the region of Isla Cedros and Bahía Tortugas, Baja California (Behrens, 1991).

Family DISCODORIDIDAE Bergh, 1891

Genus *Peltodoris* Bergh, 1880

Peltodoris mullineri Millen & Bertsch, sp. nov.

(Figures 1B, 4A–F, 5)

Peltodoris sp. Behrens, 1980: 102–103.

Peltodoris sp. Lance, 1983:87; Behrens & Henderson, 1981: 128; Behrens, 1996.

Peltodoris sp. 1. Behrens 1991:69; Behrens 1997:13.

Etymology: This species is named for the opisthobranch researcher and extraordinary photographer, Dave Mulliner of San Diego, California.

Material examined: Holotype: CASIZ 074262, Isthmus Cove, Catalina Island, California, 19 October 1985. Coll. T. Gosliner. Paratype: CASIZ 74651, 1 specimen, dissected, Diablo Cove, Santa Cruz Island, California, 10–17 m, 23 August, 1984, collected by R. Van Syoc. Other material: CASIZ 069302, 1 specimen, dissected, Fisherman's Cove, Catalina Island, 14 December, 1979, collected by David Behrens. Not deposited, 1 specimen, dissected, San Clemente Island, 2 November 1985, collected by R. McPeak.

External morphology: This large dorid species reaches up to 70 mm in live length and has a depressed oval shape and rigid texture (Figure 1B, 4A). A typical preserved specimen measured 40 × 29 × 10 mm (l × w × h). The large mantle overhangs the foot by 8–10 mm all around, and the foot is 12 mm wide. The sides are very short. The mantle is covered with small, even, densely set, rounded tubercles which are supported by spicules which protrude from the corners (Figure 4B). The rhinophores

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Figure 1

Photographs of living animals. A. *Trapania goslineri*, Millen & Bertsch, sp. nov. Photo by Jeff Hamann. Specimen from San Ignacio Bay, January, 1998; not collected. B. *Peltodoris mullineri*, Millen & Bertsch, sp. nov. Photo by Jeff Hamann. Specimen from Point Loma, July 1979; not collected. C. *Peltodoris lancei*, Millen, sp. nov. Photo by Michael D. Miller, Holotype from Bahía de los Angeles, June 1996 (CASIZ 110807).

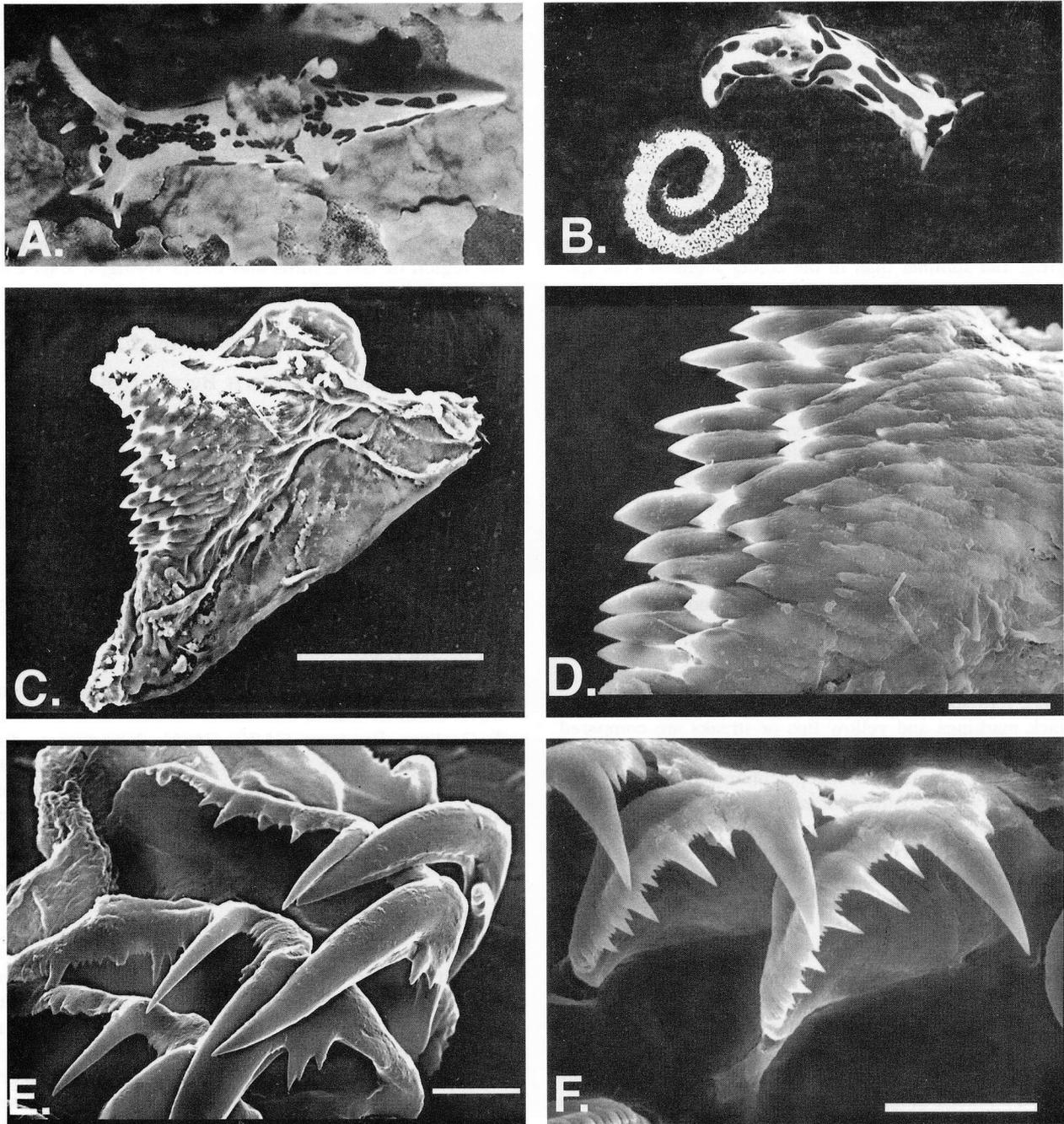


Figure 2

A. *Trapania goslineri*, Millen & Bertsch, sp. nov. with slightly smaller spots. Specimen from Punta la Gringa, March 1996. B. *Trapania goslineri*, Millen & Bertsch, sp. nov. with spawn. Specimen from Bahía Tortugas, October 1996. C. Jaw. Scale bar = 100 μm . Specimen from Bahía de los Angeles, May, 1995. D. Jaw denticles. Scale bar = 20 μm . Specimen from Bahía de los Angeles, May, 1995. E. Radular teeth. Scale bar = 10 μm . Specimen from Bahía de los Angeles, May 1995. F. Radular teeth. Scale bar = 10 μm . Specimen from Bahía de los Angeles, October, 1984.

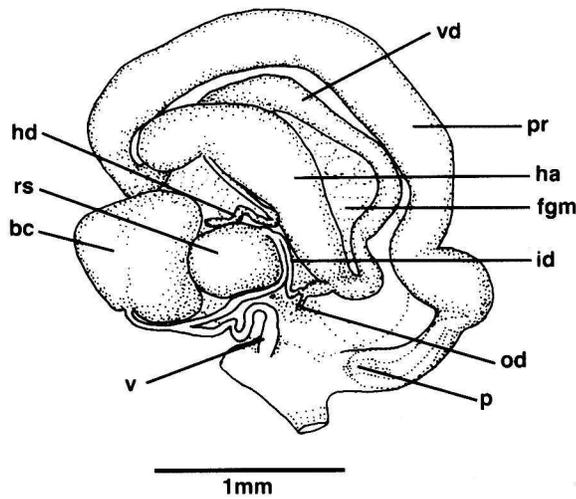


Figure 3

Reproductive system of *Trapania goslineri*, Millen & Bertsch, sp. nov. Scale bar = 1 mm. Specimen from Bahía de los Angeles, May, 1995. Key: bc = bursa copulatrix, fgm = female gland mass, ha = hermaphroditic ampulla, hd = hermaphroditic duct, id = insemination duct, od = oviduct, p = penis, pr = prostate, rs = receptaculum seminis, v = vagina, vd = muscular vas deferens.

have 24 lamellae; they are retractile and are located in the anterior one-quarter of the body. They have a slightly raised margin with tubercles similar to those on the dorsum. The gill pocket has a small, slightly raised opening with the same-sized tubercles found on the rest of the body. It contains six tripinnate gills, three per side, set in a semi-circle around the posterior anus, which is on a raised cone.

The ground color varies from pale cream to bright yellow to golden orange. There are dark brown, speckled blotches, which are formed by clusters of tubercles having dark pigment at their bases and sides, but retaining light tips. These brown blotches are irregular, but larger on the central region, smaller on the mantle where sometimes they are composed of only one pigmented tubercle. There are also brown blotches on the underside of the mantle, on the body sides, and the top of the foot. The rhinophores have cream bases and dark yellow or golden orange lamellae; the gills are yellow or golden orange.

On the ventral side, which is the same color as the ground color, the poorly defined head is small and round with a vertical mouth opening. There are digitiform tentacles on either side, 2 mm long, somewhat flattened and slightly wider at their bases. The foot is bilabiate anteriorly and notched on the upper lip. The foot is oval, not expanded anteriorly, with a leaflike tail, and is widely overhung by the mantle.

Internal anatomy: The body wall is 2–4 mm thick and spiculose, which along with the closely set spiculose tu-

Table 1

Trapania species with white ground color, black and yellow markings.

Species	Notal color	Rhinophore processes	Rhinophores	Branchial processes	Gills	Oral tentacles	Radula rows	Tooth denticles	Bursa copulatrix
<i>goslineri</i> sp. nov.	irregular large black spots and streaks, gold tail	black base, white, gold tips	white, white, gold tips	black streak, white, gold tips	3 bipinnate, white, black spots, gold tips	black base, white, gold tips	37–41	2 outer, 7–9 inner	semi-serial
<i>japonica</i> (Baba, 1935)	blackish brown random spots	yellow	white, brown clubs	yellow, black spots	3 pinnate, translucent, brown rachis	brown	24–30	9–12 outer, 12–24 inner	serial
<i>luquei</i> Ortea, 1989	yellow head, yellow spots, black reticulate flanks	yellow base, black, white tips	black, white tips	white, black specks	3 little branched, white, black & yellow spots	yellow base, white tips	?	1 outer, 10–14 inner	?
<i>toddi</i> Rudman, 1987	reticulate brown patches, yellow tail	white, yellow band	brown specks, yellow & white tips	white, yellow band, brown spots	3 bipinnate, translucent, brown cent, brown spots, yellow tips	white, yellow band	20–43	1 outer, 14 inner	semi-serial
<i>velox</i> (Cockerell, 1901)	5 black longitudinal lines, gold tail	white, black streak, gold tips	white, gold tips	black line at base, gold tips	3 bipinnate, white, black spots, gold tips	white, gold tips	22–32	0–1 outer, 8–11 inner	serial

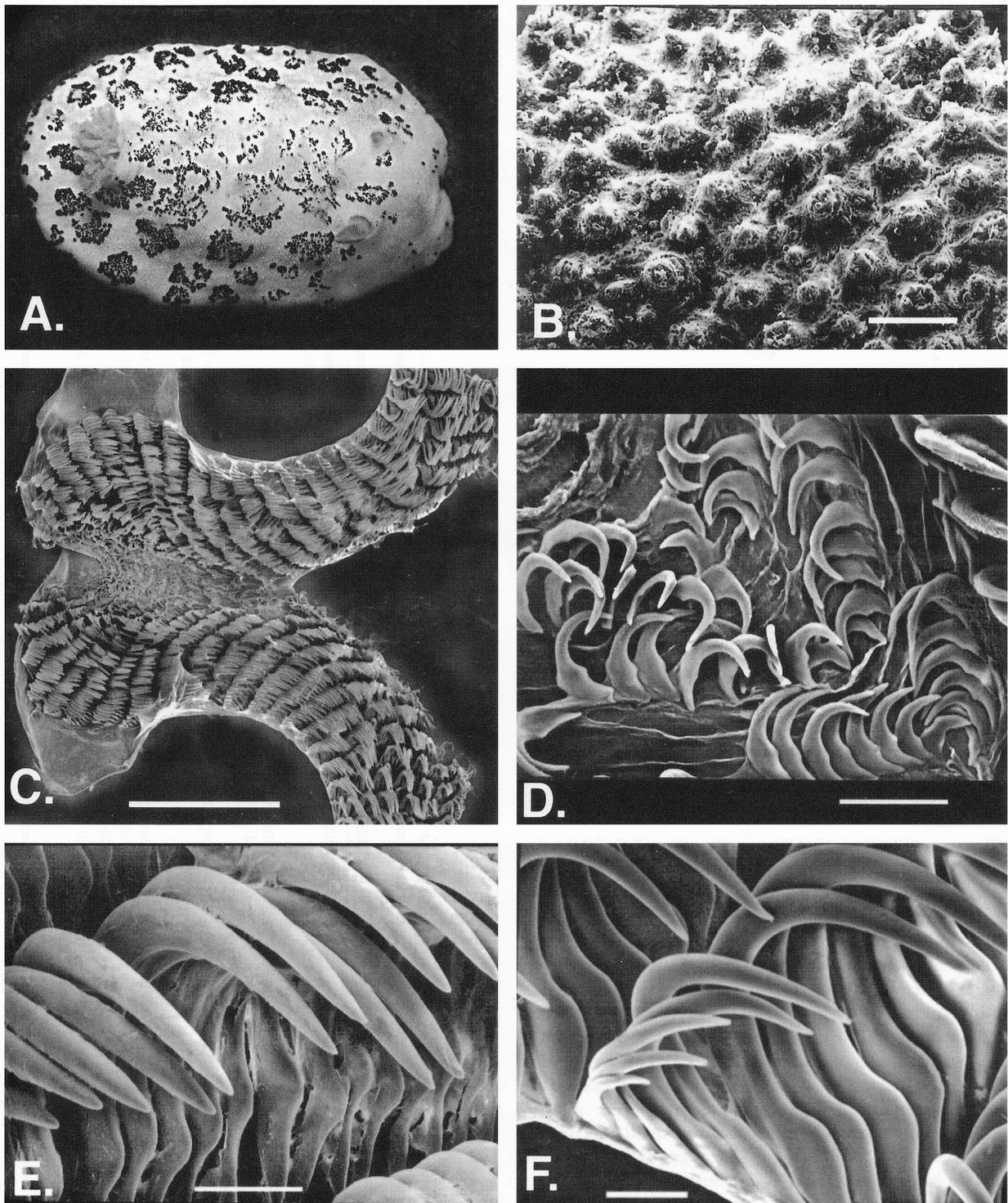


Figure 4

A. *Peltodoris mullineri*, Millen & Bertsch, sp. nov. Specimen from San Clemente Island, November 1985. B. Notal tubercles. Scale bar = 400 μ m. Paratype from Santa Cruz Island (CASIZ 74651). C. Radula. Scale bar = 1.5 mm. Specimen from San Clemente Island, November 1985. D. Small inner teeth. Scale bar = 100 μ m. Paratype from Santa Cruz Island (CASIZ 74651). E. Large medial teeth. Scale bar = 100 μ m. Paratype from Santa Cruz Island (CASIZ 74651). F. Diminishing outer teeth. Scale bar = 40 μ m. Paratype from Santa Cruz Island (CASIZ 74651).

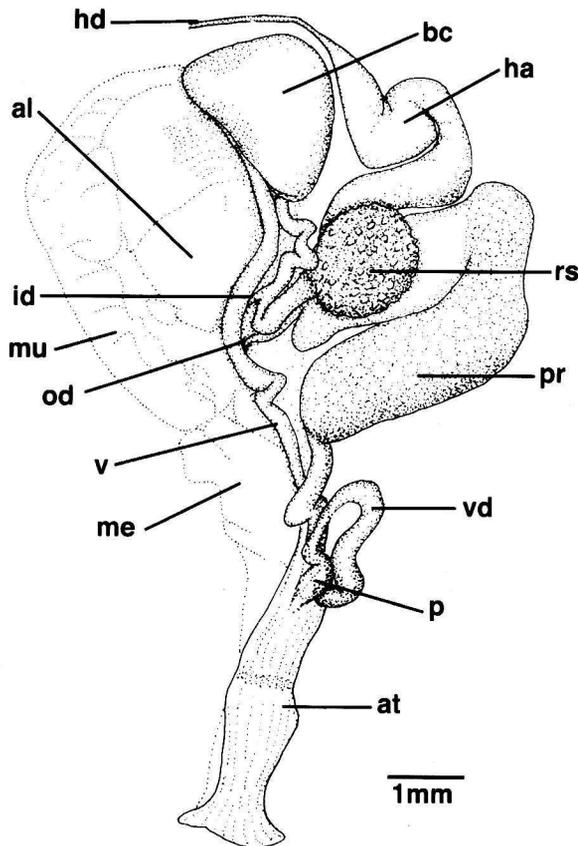


Figure 5

Reproductive system of *Peltodoris mullineri*, Millen & Bertsch, sp. nov. Scale bar = 1 mm. Specimen from Catalina Island (CASIZ 069302). Key: al = albumen gland, at = atrium, bc = bursa copulatrix, ha = hermaphroditic ampulla, hd = hermaphroditic duct, id = insemination duct, me = membrane gland, mu = mucus gland, od = oviduct, p = penis, pr = prostate, rs = receptaculum seminis, v = vagina, vd = muscular vas deferens.

bercles, gives the body its firm texture. The buccal tube is small in diameter and elongate with strong retractor muscles posteriorly. The buccal bulb is round with a long, broad, upwardly projecting radular sac emerging from the ventral posterior surface. Inside, the pale yellow lip disk is cuticular, thin, and smooth. The pale yellow radula has the formula 23–24 (42–63.0.42–63) (Figure 4C). The teeth are simple hooks, the central area has 12–15 small teeth per side (Figure 4D), which abruptly increase in size and remain constant (Figure 4E) until the last five to six which gradually diminish at the margin (Figure 4F). The salivary glands are long and ribbonlike with wide bases. The esophagus is long, wide, and tubular entering an elongate oval stomach, which is free of the digestive glands except at its posterior end. The digestive glands appear as one mass. No caecum was present. The flat intestine loops far to the right side and gradually narrows as it passes posteriorly to the anus.

The heart has a large triangular ventricle, a small elongate, diamond-shaped auricle, and blood vessels which end in two blood glands which are pink with black spots in preserved animals. The posterior gland is small, elongate oval, and located posterior to the central nervous system. The large anterior gland forms a triangle over the buccal mass. The central nervous system is granular and appears as one mass when viewed dorsally. On the ventral side, it can be seen that the small, oval cerebral ganglia are anterior and fused to the slightly narrower, granular pleural ganglia. The oval pedal ganglia are larger and more lateral. Under the salivary glands the small, round buccal ganglia lie close together.

The reproductive system (Figure 5) is triauleic. The ovotestis has several small, granular female acini peripheral to each oval male acinus. Clusters of stalked male acini coalesce into long ductules which empty into a common hermaphroditic duct. The narrow pre-ampullary duct widens into a folded, tubular ampulla. Distally the ampulla bifurcates into a short oviduct and the prostatic portion of the vas deferens. The prostate is broad and folded; proximally it is white and smooth, distally it is cream colored and granular. The non-prostatic portion of the vas deferens is a thin, muscular, coiled tube which terminates in the common atrium forming a thick, muscular, unarmed penis.

The elongate common atrium is internally plicate with a brown pigmented band near the exit. The vagina is a long, thin tube which exits the atrium and runs the length of the female gland mass to enter the large, spherical, thin-walled, orange bursa copulatrix. The insemination duct exits separately, in a serial arrangement, bending as it descends, and just before it enters the female gland mass, it is joined by the short stalk of the receptaculum seminis. The colorless receptaculum is pear-shaped and distally nodular.

The female gland mass consists of a granular, yellow albumen gland, a large, folded, white mucus gland, and a smooth, creamy white membrane gland. The membrane gland extends into a distal, tubular, glandular nidamental duct which exits next to the common atrium. The reproductive openings appear as one non-protruding, plicate, depression located high on the right side, one-third of the way back from the anterior mantle margin.

Natural history: This species has a known range from Santa Barbara and Anacapa Islands, California (Behrens, 1997) to Cabo San Lucas, Baja California, Mexico (Behrens, 1991). It has been found subtidally to 17 m in August, October, and December. It is presumed to feed on demosponges, but neither the food nor spawn mass have been identified.

Peltodoris lancei Millen, sp. nov.

(Figures 1C, 6A–F, 7)

Etymology: This species is named for Jim Lance, of San Diego, California, who was one of the first to know and love the opisthobranchs of the Gulf of California.

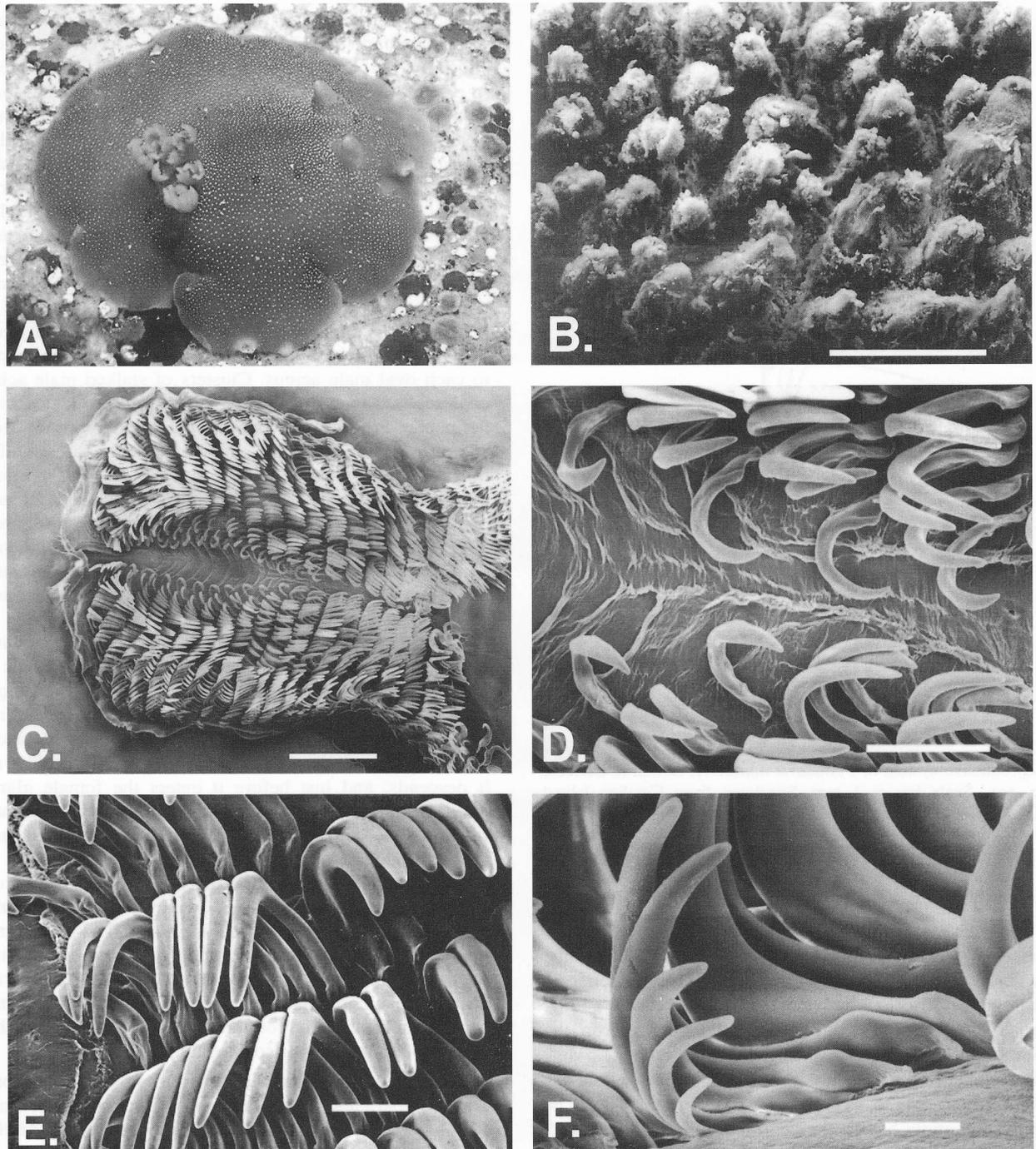


Figure 6

A. *Peltodoris lancei* Millen, sp. nov. Photo by Michael D. Miller. Paratype from Bahía de los Angeles (CASIZ 118573). B. Notal tubercles. Scale bar = 400 μ m. Paratype from Bahía de los Angeles (CASIZ 118572). C. Radula. Scale bar = 1 mm. Paratype from Bahía de los Angeles (CASIZ 118572). D. Small, inner teeth. Scale bar = 200 μ m. Paratype from Bahía de los Angeles (CASIZ 118572). E. Large medial teeth. Scale bar = 100 μ m. Paratype from Bahía de los Angeles (CASIZ 118572). F. Diminishing outer teeth. Scale bar = 40 μ m. Paratype from Bahía de los Angeles (CASIZ 118572).

Material examined: Holotype: CASIZ 110807, Punta la Gringa, Bahía de los Angeles, Gulf of California, Baja California, Mexico (29°02.56'N, 113°32.29'W), collected by Mike D. Miller, under rock, 7 m depth, on 28 June 1996, preserved length 55 mm, in Bouins solution. Paratypes: CASIZ 118572, 1 specimen, dissected, found with the holotype, preserved length 58 mm, in alcohol. CASIZ 118573, Punta la Gringa, Bahía de los Angeles, 1 specimen, 5 m depth, 30 June 1997, under rock, living length 27 mm, collected by Mike D. Miller.

External morphology: This dorid nudibranch is large, with a living length of up to 75 mm. The largest specimen had a preserved size of 58 × 50 × 16 in a partially contracted state. The body shape is oval and depressed with a large overhanging crenulate mantle 15–20 mm wider than the foot. The notum is covered all over with closely set, conical papillae which end in white tips and are stiffened with spicules embedded in their sides (Figure 6B). The lamellate rhinophores are narrower in front and slope posteriorly; they have 15 fine lamellae on each side of their anterior edge and are strengthened with vertical spicules in the posterior half. They can each retract into a raised sheath, which on the sides has the same-sized papillae as on the notum, and slightly larger papillae at the edge. The gill pocket is almost smooth at the raised edge but has papillae on the sides which are the same as those on the notum. The branchial opening is wide and contains six to eight tripinnate gills, which are arranged three or four per side around the posterior anus, which is on a raised cone. The holotype has two small pinnate branches on the anterior midline, which appear to be extensions from the anteriormost gill on each side.

The ground color is dark orange-brown to reddish orange. The top one-fourth of each papillae is opaque white giving a uniform speckling of tiny spots evenly distributed over the notum. Toward the mantle edge, the tubercles, and hence the spots, become smaller, and the ground color lightens to form a bright yellowish orange rim to the mantle. The smallest, darkest specimen had a few faint brownish spots, one in front of the rhinophores, two on each side between the rhinophores and gills, and one on the right side posterior to the gills (Figure 6A). The rhinophores and gills are dusky yellow with lighter yellow tips. On the underside, the mantle and foot are yellow. The tops of both the head and foot are orange.

Ventrally, the head is oval, hard, and granular on top with a vertical mouth and long digitiform tentacles on each side, reaching 3–3.5 mm. The sides of the body are short, up to 3 mm high, and the underside of the mantle shows light radial striations indicating the presence of spicules. The foot is elongate oval with a slightly tapered tail, which is overhung by the mantle all around. It is hard and granular dorsally; the anterior edge is deeply bilabiate and notched.

Internal anatomy: The thick body wall contains a mesh-

work of bundles of fine spicules and connective tissue. The buccal tube is short and muscular with strong retractor muscles. The buccal bulb is round and short with a round, ventral, slightly projecting radular sac. Inside, the lip disk is round, smooth, and colorless. The pale yellow radula has the formula 28(33.0.33). The rachis area is wide and bare (Figure 6C). The teeth are simple hooks, with no denticulations. There are four small teeth near the bare rachis, (Figure 6D) then they increase rapidly in size and are uniform (Figure 6E) except the four outermost teeth on each side which rapidly decrease in size (Figure 6F). The salivary glands are white and dense, forming wide straps on either side of the buccal bulb, narrowing as they go through the nerve ring, and becoming long straps bent back on themselves. The esophagus is a thin-walled wide tube, which at the notch of the digestive glands becomes a saclike stomach situated in a hollow between the otherwise confluent digestive glands. The intestine is wide and muscular where it leaves the stomach and then it loops to the right and across the top of the digestive glands to end on a small cone at the posterior edge of the gills.

The heart is large, ending in two leaf-shaped, yellow blood glands. The smaller anterior gland is slightly anterior to the central nervous system; the larger posterior gland is over the esophagus. The central nervous system is enclosed in a tough semi-transparent sheath and is smooth dorsally, granular ventrally. The elongate oval cerebro-pleural ganglia are fused; the smaller, oval pedal ganglia are posterior and slightly ventral. The common commissure is enclosed in a thick sheath. There is a small, unpaired visceral ganglion. The buccal ganglia are very small and a short distance apart, each with a small gastroesophageal ganglion connected by a short nerve.

The reproductive system (Figure 7) is triaulic. The yellow gonad covers all sides of the digestive glands. The ovotestis has round acini leading to the hermaphroditic duct, which leaves the digestive glands to the right of the esophagus. The hermaphroditic ampulla is a long, grey, sinuous tube, which narrows abruptly, dividing into a short oviduct which enters the base of the albumen gland and the vas deferens. After a short distance, the vas deferens widens into a massive, U-shaped prostate gland. The proximal portion is creamy white and finely granular; the distal one-third is yellow and coarsely granular. Following the prostatic portion, the vas deferens is a long, narrow threadlike tube, which folds a few times, then runs straight down the outer surface of the female gland mass to the penis. The penis is small, muscular, and bulbous with a pointed, colorless, lightly cuticular tip. The vagina is posterior and separate from the male opening. Internally it is soft and plicate at the atrium, then villous for a short distance before narrowing. The tubular vagina enters a large, irregular oval bursa copulatrix. In its normal position it is almost completely hidden by the prostate gland. The insemination duct leaves the bursa near the

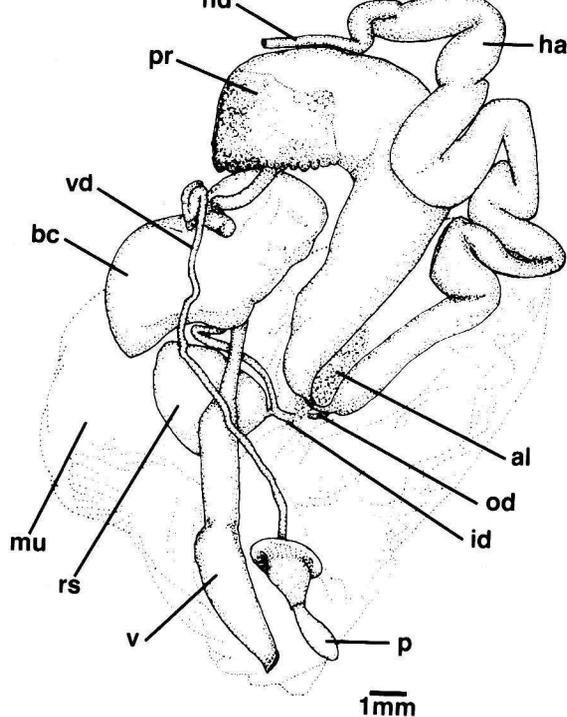


Figure 7

Reproductive system of *Peltodoris lancei* Millen, sp. nov. Paratype from Bahía de los Angeles (CASIZ 118572). Scale bar = 1 mm. Key: al = albumen gland, bc = bursa copulatrix, ha = hermaphroditic ampulla, hd = hermaphroditic duct, id = insemination duct, mu = mucus gland, od = oviduct, p = penis, pr = prostate, rs = receptaculum seminis, v = vagina, vd = muscular vas deferens.

vaginal entrance in a serial arrangement. Just before it enters the base of the albumen gland it is joined by a short duct from the almost sessile, elongate-oval receptaculum seminis. The female gland mass is hard and compact. The largest portion, the mucus gland, is dorsal and pink and cream in color. It wraps around the small, oval, yellowish albumen gland. The distal membrane gland is soft and white, wrapped around the separate nidamental opening. The genital openings are located approximately one-third of the way back from the anterior edge of the mantle. The penis opening is anterior with a posterior crescent-shaped slit leading to the vaginal opening. The ventral nidamental opening is separated by a small papilla and a ridge of tissue.

Natural history: This species is known only from Punta la Gringa, Bahía de los Angeles, Baja California, Mexico. A pair was found in June, both large and apparently mature; one smaller specimen was found in June the following year. No spawn was seen. The animals were feeding on a yellow encrusting demosponge on the undersides of rocks.

Discussion of Peltodoris. The two new species described here have the following characteristics of the genus *Peltodoris*. They have depressed, rigid bodies with a wide margin, and minute, small, evenly disposed spiculate tubercles and a small head with digitiform tentacles. Internally they have a smooth lip cuticle, simply hooked radular teeth with smaller teeth toward the center of the radula abruptly increasing in size, elongate salivary glands, and a stomach free of the digestive glands. The reproductive system has a serially arranged bursa copulatrix, an enlarged prostate gland, and an unarmed penis.

There are 14 described species of *Peltodoris*, of which all but five can be separated from the two species described here because they do not have a yellow or orange ground color. Those five are compared with the two newly described species in Table 2, and differences are pointed out in the discussion below. *Peltodoris angulata* Eliot, 1904, can be separated because it has three violet-brown spots on each side between the rhinophores and gills and a peculiar foot which is anteriorly extended into tentacular angles 3.5 mm long. *Peltodoris aurea* Eliot, 1904, has dull violet spots along the mantle edge and a spot in front of the gills and one behind the rhinophores. The tubercles are in the form of small, flat warts. The color photograph by Orr (1981:44) does not appear to fit the original description of this species. *Peltodoris nayarita* Ortea & Llera, 1981 is similar to *P. mullineri* sp. nov., but has pinnate brown gills, brown rhinophores, and smaller spots on the body. *Peltodoris noumeae* Risbec, 1937, is orange-yellow and has white-tipped tubercles like *P. lancei*, but also has irregular bright, "fiery" spots, which are not found in the latter species. *Peltodoris punctifera* (Abraham, 1877) has white-tipped tubercles like those of *P. lancei*, but it also has small violet-brown or grey spots on the notum and brown speckles on the rhinophores and gills.

In southern California and on the Pacific coast of Mexico, *Peltodoris mullineri* sp. nov., is most easily confused with *P. nayarita* and *Jorunna pardus* Behrens & Henderson, 1981. It can be separated from both of these species because it lacks dark brown on the gills and rhinophores. In the Gulf of California, *Peltodoris lancei* is easily confused with the porostome nudibranchs *Doriopsilla albopunctata* (Cooper, 1863) and *Doriopsilla gemela* (Gosliner et al., 1999). It can be distinguished externally by its firm texture, smaller and more uniform white spots, always located on conical spiculate tubercles, and continuing to the mantle edge, and the presence of long digitiform tentacles on the head.

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Table 2

Peltodoris species with yellow or orange ground color.

Species	Ground color	Tubercles	Rhinophore color	Gills	Radula	Bursa copulatrix
<i>angulata</i> Eliot, 1904	yellow? (pres.), 3 violet-brown spots each side	minutely granular	?	6 tripinnate	38 (45.0.45)	?
<i>aurea</i> Eliot, 1904	sand, dull violet spots on edges, 2 on midline	small flat, orange warts	?	8 tripinnate	20 (25.0.25)	?
<i>lancei</i> sp. nov.	red-orange	fine conical spiculose tubercles, white-tipped	red-orange	6–8 tripinnate, red-orange	28 (33.0.33)	serial
<i>mullineri</i> sp. nov.	light yellow, brown blotches	granular, spiculose tubercles	golden yellow	6 tripinnate, golden yellow	23–24 (42–63.0.42–63)	serial
<i>nayarita</i> Ortea & Llera, 1981	yellow-orange, brown flecks	fine conical spiculose tubercles	brown	8 unipinnate, brown	51 (50.0.50)	semi-serial
<i>noumeae</i> Ristic, 1937	yellow-orange, bright fiery spots	spiculose, white-tipped	yellow, white tips	4 bipinnate, 2 pinnate, yellow, white spots	? (20–35.0.20–35)	serial
<i>punctifera</i> (Abraham, 1877)	yellow, large brown or grey spots	fine conical tubercles, dark specked, largest white-tipped	white & brown	6 bi- & tripinnate, dark spots, white tips	30 (50.0.50)	serial

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LITERATURE CITED

- BEHRENS, D. W. 1980. Pacific Coast Nudibranchs, A Guide to the Opisthobranchs of the Northeastern Pacific. Sea Challengers: Los Osos, California. 112 pp.
- BEHRENS, D. W. 1983. Report of the 1982 outer Baja California expedition. *Opisthobranch Newsletter* 15(4):18–19.
- BEHRENS, D. W. 1991. Pacific Coast Nudibranchs. 2nd ed. Sea Challengers: Monterey, California. vi + 107 pp.
- BEHRENS, D. W. 1996. *Peltodoris* sp. <http://siolibrary.ucsd.edu/slugsite/nudiwkps/nudiwk27.html>
- BEHRENS, D. W. 1997. Range extensions of eight northeastern Pacific nudibranchs. *Opisthobranch Newsletter* 23(4):13.
- BEHRENS, D. W. & R. HENDERSON. 1981. Two new cryptobranch dorid nudibranchs from California. *The Veliger* 24(2):120–128.
- BERTSCH, H. 1989. Phylum Mollusca: Subclass Opisthobranchia (shell-less snails, nudibranchs) Pp. 54–68 in A. Kerstitch, Sea of Cortez Marine Invertebrates. Sea Challengers: Monterey, California.
- BERTSCH, H. 1991a. Seasonal, geographic and bathymetric distribution of opisthobranchs at Bahía de los Angeles, Baja California, México. *Western Society of Malacologists, Annual Report* 23:18.
- BERTSCH, H. 1991b. Biodiversity of the dorid nudibranch (Mollusca: Opisthobranchia) fauna of the Pacific coast of the three Californias: systematic and zoogeographic comments. Pp. 107–115 in M. Dailey & H. Bertsch (eds.), *Proceedings of the VIII International Symposium of Marine Biology, Ensenada, Baja California, México*.
- BERTSCH, H. 1995a. A three-year phenological analysis of subtidal populations of opisthobranch molluscs at Bahía de los Angeles, Baja California, Mexico. *Proceedings of the Pacific Division of the American Association for the Advancement of Science* 14(1):34.
- BERTSCH, H. 1995b. Biogeographic microcosms: ecological contrasts and variations in long-term regional faunal studies (Gulf of California, Mexico). *Western Society of Malacologists Annual Report* 27:4–5.
- BERTSCH, H. 1996. *Trapania* sp. <http://siolibrary.ucsd.edu/slugsite/nudiwk38.html>.
- BERTSCH, H. & A. KERSTITCH. 1984. Distribution and radular morphology of various nudibranchs (Gastropoda: Opisthobranchia) from the Gulf of California, Mexico. *The Veliger* 26(4):264–273.
- CERVERA, J. L. & J. C. GARCÍA-GÓMEZ. 1989. Dos nuevas especies de *Trapania* Pruvot-Fol, 1931 (Gastropoda: Nudibranchia) del sur de España. *Bolletino Malacologico* 24:189–204.
- GOSLINER, T. M. 1987. Nudibranchs of Southern Africa, a Guide to Opisthobranch Molluscs of Southern Africa. Sea Challengers: Monterey, California. 136 pp.
- GOSLINER, T. M. & D. W. BEHRENS. 1986. Two new species and genera of aeolid nudibranchs from the tropical eastern Pacific. *The Veliger* 29(1):101–113.

- GOSLINER, T. M., M. T. GHISELIN & H. BERTSCH. 1985. Opisthobranch mollusks of the Punta Eugenia region, with a discussion of biogeographical affinities. *Western Society of Malacologists Annual Report* 17:11.
- GOSLINER, T. M., M. C. SCHAEFER & S. V. MILLEN. 1999. A new species of *Doriopsilla* (Nudibranchia: Dendrodorididae) from the Pacific coast of North America, including a comparison with *Doriopsilla albopunctata* (Cooper, 1863). *The Veliger* 42(2):181-190.
- KEEN, A. M. 1971. *Sea Shells of Tropical West America; Marine Mollusks from Baja California to Peru*. Stanford University Press: Stanford, California. xiv + 1064 pp.
- LANCE, J. R. 1983. California underwater. *California Magazine* 8(3):85-89.
- ORR, J. 1981. *Hong Kong Nudibranchs*. Urban Council: Hong Kong. 82 pp.
- PICTON B. & C. C. MORRROW. 1994. *A Field Guide to the Nudibranchs of the British Isles*. Immel Publishing: London. 143 pp.
- ROLLER, R. A. & S. J. LONG. 1969. An annotated list of opisthobranchs from San Luis Obispo County, California. *The Veliger* 11(4):424-430.
- RUDMAN, W. B. 1987. The genus *Trapania* (Nudibranchia: Goniodorididae) in the Indo-West Pacific. *Journal of Molluscan Studies* 53:189-212.
- SKOGLUND C. 1991. Additions to the Panamic Province Opisthobranchia (Mollusca) literature 1971-1990. *The Festivus* 22 (Suppl. 1):iii+27 pp.