TRANSACTIONS

OF THE

SAN DIEGO SOCIETY OF NATURAL HISTORY

VOLUME 13, No. 19, pp. 377-396

ADDITIONS TO THE NUDIBRANCH FAUNA OF THE EAST PACIFIC AND THE GULF OF CALIFORNIA

BY

CLINTON L. COLLIER

San Diego State College
(Mailing address: 4374 Wilson Avenue,
San Diego, California, 92104)

AND

WESLEY M. FARMER

San Diego Natural History Museum

SAN DIEGO, CALIFORNIA

PRINTED FOR THE SOCIETY

DECEMBER 30, 1964

ADDITIONS TO THE NUDIBRANCH FAUNA OF THE EAST PACIFIC AND THE GULF OF CALIFORNIA

BY

CLINTON L. COLLIER AND WESLEY M. FARMER

The coasts of the peninsula of Baja California represent an area where the nudibranchs have been little studied. Unlike the coast of California, most of Baja California is rugged, with difficult access. Consequently, when early workers were making extensive collections all along the Pacific coast they stopped when they reached San Diego and did not continue despite an equally rich nudibranch fauna to the south. When Marcus (1961) worked on a collection of California opisthobranchs he drew the only conclusion possible: new additions to the warm-temperate and tropical water fauna could be expected south of San Diego as soon as systematic collecting was done there.

During the past few years the authors have made many trips along both coasts of Baja California to observe and collect the opisthobranch fauna of the region. We have found areas in which the animals are likely to occur and in which we may find more of the unusual forms. More importantly, we are able to obtain accurate color descriptions and measurements from the living animals and are not dependent on badly contracted specimens for descriptions. We have also made an effort to return living animals to San Diego so that they could be photographed. Such a procedure is of the utmost importance in the case of animals whose form and color are of such taxonomic significance. On extended trips, we took photographs in the field.

We would like to express our deep gratitude to those who have helped us in the preparation of this paper: Dr. Ernst Marcus and Miss Joan Steinberg answered many questions, Drs. Harold Rehder and Ronald P. Kenny sent specimens from the United States National Museum and from Australia, respectively, and Mr. James Lance gave suggestions and locality records. Mr. John Sloan of the San Diego Natural History Museum collected some of the specimens and Mrs. Rosemarie Fiebig, also of the museum, kindly translated some of the literature for us.

Special thanks are due to Mrs. Mildred Le Compte, San Diego State College interlibrary loan librarian for her untiring efforts in locating and obtaining literature. Without her assistance this paper would not have been possible.

All types have been deposited in the California Academy of Sciences Invertebrate Type Collection. Some paratypes remain in the authors' collections. We have followed the classification of Odhner (1939) as modified by the works of Marcus.

Collections were made at the following locations:

California				
Newport Bay, Los Angeles County	33°	36′N	117°	54′W
Baja California, Pacific Side				
Isla de Cedros	28°	07′N	115°	11′W
Bahía Sebastian Viscaino	27°	50′N	114°	51′W
Baja California, Gulf Side				
Isla Angel de la Guarda	29°	33′N	113°	35′W
Bahía San Luis Gonzaga	29°	49′N	114°	25′W
Puertecitos	30°	25′N	114°	40′W

Order NUDIBRANCHIA
Suborder DORIDACEA
Section EUDORIDACEA
Tribe CRYPTOBRANCHIA
Family DORIDIDAE
Subfamily GLOSSODORIDINAE
Cadlina evelinae Marcus, 1958
(Plate 1; fig. 1, A-B)

Distribution. — The type of *Cadlina evelinae* is from the upper littoral of Ilhabela and Guarujá, Brazil (Marcus, 1958). In the present collection seven specimens are from a rocky sand flat at Coloradito, 15 miles north of Puertecitos, Baja California. One specimen was collected by John Sloan at Isla Angel de la Guarda. The species has also been recorded photographically from Bahía Sebastian Viscaino, but specimens from that area have been lost.

Description. — The entire animal is white to light cream except for the dorsal surface of the notum, which is speckled with numerous light red to orange spots. The spots are more numerous around the edge of the notum than in the middle. As reported by Marcus (1958:18) these spots are glandular and fade in alcohol, leaving a smooth, slightly raised area. Animals fixed in an FAA mixture retained the color of the glands.

The body form is typical of animals of the subfamily Glossodoridinae (MacFarland, 1905). The notum is uniformly broad along its entire length. In two specimens, however, it narrowed posteriorly. Of the seven animals collected at Coloradita the largest, while actively crawling, is 18 mm. long by 7 mm. wide. In two of the animals examined closely, the rhinophores have 18 and 19 leaves on the clavi. Each animal has six bipinnate gills. The foot is bilabiate anteriorly. The oral tentacles are stout with an external fold.

There is a strong labial cuticle which is heavily armed over most of its surface. The spines are 10 to 25 μ long and bifrucate at their distal ends into two short denticles (fig. 1, A). The radular formula for the largest animal is 78 by 65.1.65 while a smaller one has the formula of the type, 75 by 65.1.65. The rachidian tooth (fig. 1, B) has either four or five cusps. There seems to be more of the five-cuspidate teeth in the older section of the radula, whereas the area that has just been formed has rachidian teeth with only four cusps. The first lateral has three denticles on each side of the large middle cusp; some have only two denticles on the inner side. The next two laterals have four small outer denticles. The rest of the teeth out to the marginals have either two or, more commonly, three denticles on the outer side of the cusp. We noted that some were without any denticles, but this condition could be due to wear. The marginals are small and have five or six inner denticles; these outer teeth are often poorly formed.

The highly variable radulae of the specimens at hand cast doubt on the validity of the idea that the radula can be separated within the genus. The number of denticles on both the rachidian and the first lateral varied from that described by Marcus, although teeth from different rows, if put together in one row, would fit his description. This also points to the variation of teeth within the one radula. Another discrepancy was in the size of the denticles. Marcus described the denticles of the laterals as fairly large, while in the present animals they were quite small and could only be seen by using a phase microscope. The same is true with the denticles of the first lateral. These variations in the teeth indicate that the radulae of other species of *Cadlina* should be re-examined before they are accepted as a valid taxonomic feature. The teeth with the most denticles are in the older part of the radula and indicate that the presence of fewer denticles is not necessarily a product of wear. The reproductive system is described by Marcus (1958:20-21).

Discussion. — Marcus (1958) differeniated *Cadlina evelinae* from the other members of the genus listed by him in 1955.

Much emphasis has been placed on the radula of the members of this genus for the separation of the species. The species *C. evelinae* is undoubtedly valid and can be separated from the other members of the genus by features other than the radula. The coloration, gills, rhinophores, and labial cuticles of our specimens agree completely with the description of the type.

This animal brings the number of *Cadlina* recorded from the Pacific coast of North America to six. *Cadlina evelinae* can be differentiated from each of five listed by Lance (1962:157) by coloration and by other features. *Cadlina evelinae* is the only member of the genus recorded from the Gulf of California.

Subfamily **CONUALEVINAE,** subfam. nov.

The body is somewhat soft, lacking noticeable spicules, with the notum depressed and either minutely papillose or smooth. The rhinophores are retractile and have neither clavi nor perfoliations. The branchial aperture is round and without a ridge; gills vary from unipinnate to tripinnate. The anterior edge of the foot is bilabiate; the oral tentacles are short and stout. The teeth are edentulate and simply hooked, and the rachidian is absent. Two seminal recepticles are present.

The type genus of the subfamily is *Conualevia,* gen. nov.

Genus **Conualevia,** gen. nov.

The primary characteristic of the genus is the presence of smooth rhinophores. The notum may be smooth or minutely papillose. The oral tentacles are short, thick, and stout. The radula lacks a rachidian tooth or plate. The teeth on each side of the radula are offset at the rachidian space to form an interlocking pattern along the center line. There is either no labial cuticle or only a very light one. The retractile gills vary from unipinnate to tripinnate. The penis is unarmed.

The female reproductive system is characterized by an X pattern at the end of a long vaginal duct. One leg of the X is the vaginal duct, one connects to the spermatocyst, one to the spermatheca, and the other is a short fertilization duct. This gives the female genital system a compact appearance.

The type species of the genus is *Conualevia marcusi,* sp. nov.

Conualevia marcusi, sp. nov.

Plate 2; fig. 1, C-H

Type. — The holotype (CASIZ 25), a whole animal, was collected 3.8 miles south of Puertecitos, Baja California, by the senior author in June, 1963. One paratype from the same locality is CASIZ 27 and one from Puerto Refugio on Isla Angel de la Guarda is CASIZ 33. A total of 9 animals was collected; others remain in the authors' collections.

Distribution. — The animals are known from one mile north of Puertecitos and from Puerto Refugio on Isla Angel de la Guarda, Baja California. They have been collected in March, June, and November.

Description. — The animals are very light orange to white when living; all are white after preservation. The dorsal surface of the notum is closely papillose, with papillae a fraction of a millimeter long, giving the animal's surface a fine textured appearance. The gills are concolorous with the rest of the animal but appear slightly darker in the colored forms because they lack the softening effect which the papillae impart to the dorsal surface.

The body form is like that of a typical dorid. The notum is high and extends over the foot (Plate 2). The preserved holotype measures 14.5 mm. long and 9 mm. wide. The retractile rhinophores are smooth (fig. 1, H) in the living animal although they appear annulated, due to contraction, in the preserved material. When only partly extended, the rhinophores may also appear annulated in living specimens. The 16 unipinnate gills arranged in a circle around the anus are completely retractile into a branchial chamber which can be closed leaving only a small dot to mark the position of the anus and gill chamber. The foot is moderately large, but does not extend beyond the notum. The anterior margin of the foot is bilabiate (fig. 1, C). The oral tentacles are short and stout.

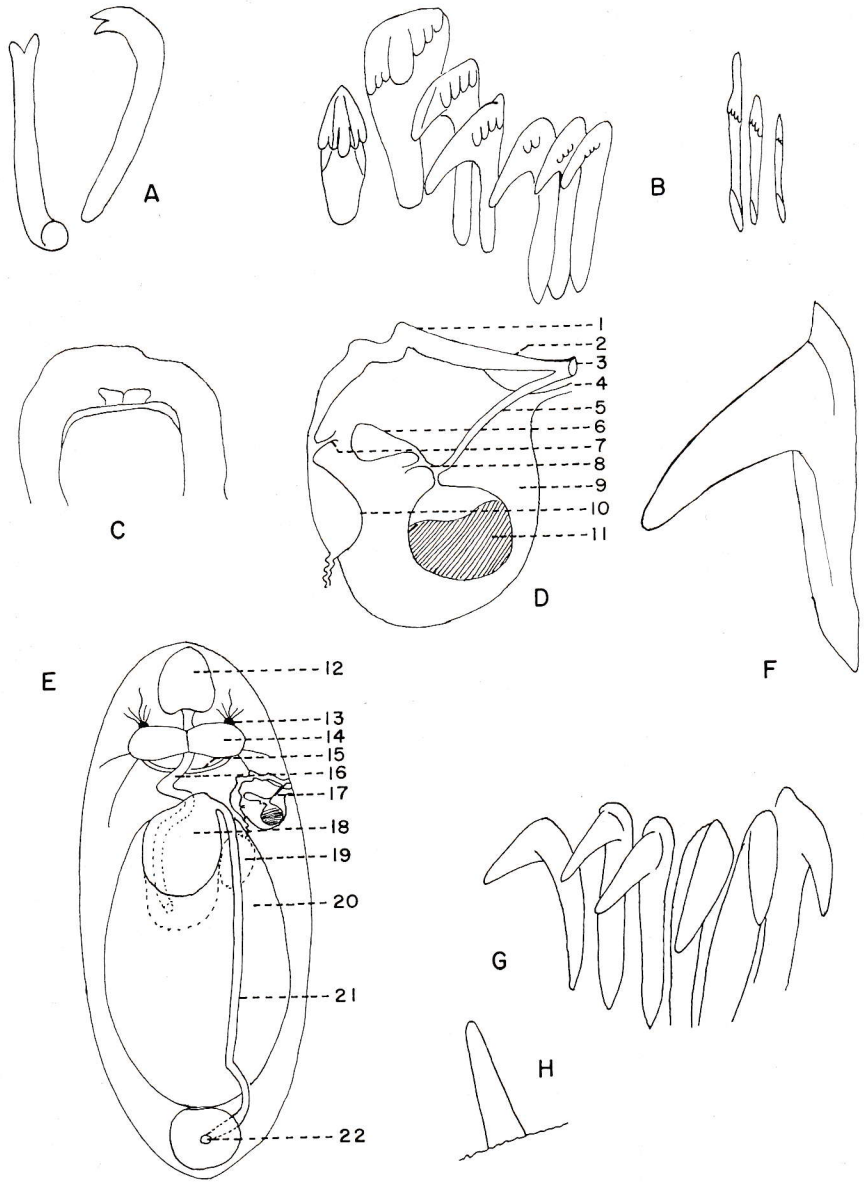

Fig. 1. A-B, *Cadlina evelinae*. A, labial spines; B, partial row of radula. C-H, *Conualevia marcusi*. C, ventral view of preserved animal; D, diagram of the reproductive system, dorsal view; E, diagrammatic dorsal view of internal anatomy; F, radular tooth; G, 1st through 6th radular teeth; H, rhinophore.

1, prostate; 2, vas deferens; 3, genital orifice; 4, nedimental opening; 5, vagina; 6, spermatocyst; 7, oviduct; 8, fertilization duct; 9, female gland mass; 10, ampulla; 11, spermatheca; 12, buccal area; 13, eye spot; 14, ganglion; 15, nerve ring; 16, esophagus; 17, reproductive system; 18, stomach; 19, hermaphrodite gland; 20, digestive gland; 21, intestine; 22, anus.

One of the specimens has the radular formula 59 by 97.0.97. All the teeth are simple hooks 40 to 60 μ long (fig. 1, F-G). There is no labial cuticle.

The buccal mass (fig. 1, E 12) is large and muscular as is suggested by the well developed polyodont radula. The esophagus (16) is surrounded by the central nervous system (14) immediately adjacent to the buccal area. It then twists slightly before passing along the left ventral side of the stomach (18). The stomach is slightly almond shaped with the small end pointing anteriorly. The intestine (21) originates on the right side of a small knob at the narrow anterior end of the stomach and runs back along the right dorsolateral side of the digestive gland. The intestine is thin walled and straight, and fits into a slight groove in the digestive gland. Just anterior to the gill cavity it dips down the side of the digestive gland to the floor of the body cavity and then rises to open to the outside by means of the anal papillae (22). The large digestive gland (20) occupies the posterior half of the body cavity. In the preserved animals it is yellow and appears granular. It partly surrounds the stomach, extending to its anterior margin along the ventral side but only covering the posterior half on the dorsal surface. It communicates with the stomach where the esophagus enters.

The heart is immediately anterior to the gill cavity. The auricle is thin walled and its boundaries are not well defined. The two ventricles are better developed and are visible along the top of the digestive gland. There is an aortic blood space which runs along the middorsal line of the digestive gland and stomach before emptying into sinal areas anterior to the stomach.

The central nervous system was not examined closely. It is composed of two prominent cerebral ganglia. There is a black eyespot (13) on the anterior dorsolateral surface of each ganglion. Many small nerve fibers extend anteriorly from this area to innervate the buccal area and rhinophores. There is a nerve ring (15) connecting the cerebral ganglia and passing under the esophagus.

The reproductive system (fig. 1, D) is compact, lying in contact with the anterior edge of the digestive gland and the right cerebral ganglion. The ampulla (10) is large, thin walled, and flattened dorso-ventrally; it lies along the back distal end of the female gland mass. A thin sinuous duct connects with the hermaphrodite gland (19), which is completely embedded in the digestive gland along the right ventral lateral line of the stomach. As it leaves the ampulla, the hermaphrodite duct bifurcates into a short oviduct (7) and the vas deferens (2). The prostate (1) is moderately large but not extremely glandular, and although twisting it is not sinuous. It lies along the left margin of the female gland mass, partly embedded in it. The vas deferens (2) proceeds directly to the genital orifice (3) after leaving the prostate. The penis is not muscular and is unarmed.

The vagina (5) is thin and long. The spermatheca (11) communicates with the vagina through a short duct of the same diameter as the vagina. The spermatheca is large and globular and lies with its lower hemisphere embedded in the female gland mass. The hemisphere above the gland is jet black while that embedded is a light yellow. The spermatocyst (6) is conical with its narrow end embedded in the gland mass. The top is rounded giving the organ a spherical appearance before it is removed from the gland. The fertilization duct (8) is short and moderately sinuous. The female gland mass (9) is dull yellow and communicates to the outside through a pore posterior to the genital oriface (4). The ducts in the female reproductive system form an X (fig. 1, D).

Conualevia alba, sp. nov.
(Plate 3; fig. 2, A-D)

Type. — The holotype (CASIZ 29) was taken on December 27, 1963, at Newport Bay, California, by the senior author. It is an entire animal. Paratypes from the same locality bear the numbers CASIZ 30 and 31. Some paratypes are retained in the authors' collections.

Distribution. — This animal occurs abundantly on a rocky mud flat at Newport Bay, California, where it is numerous at certain times of the year. In November, 1963, more than 30 specimens were collected in a matter of minutes; many others were seen. In December of

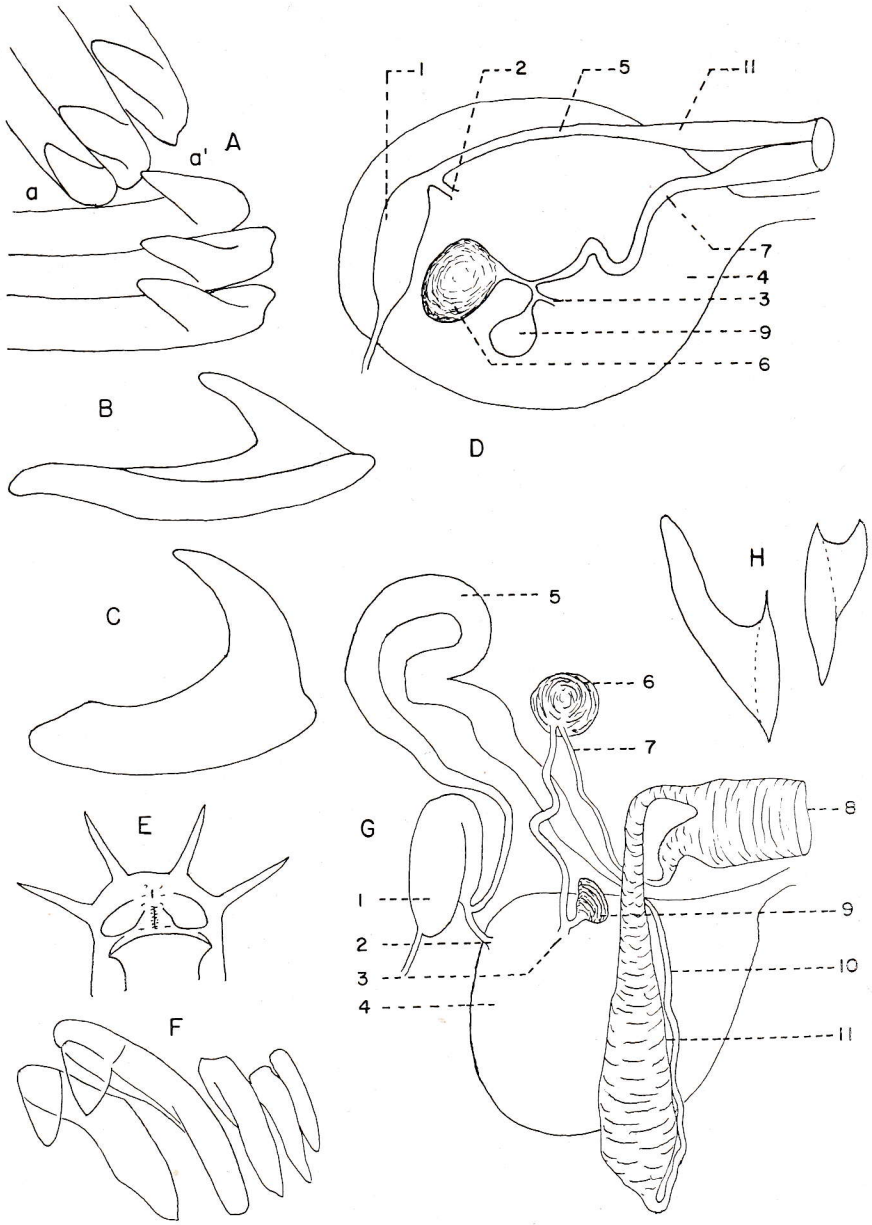

Fig. 2. A-D, *Conualevia alba*. A, radular teeth at rachidian space; B, C, radular teeth; D, diagram of reproductive system. E-F, *Polycera alabe*. E, ventral view of living animal; F, half row of radula. G-H, *Dendrodoris atropos*. G, diagram of reproductive system; H, penis spine and hook.

1, ampulla; 2, oviduct; 3, fertilization duct; 4, female gland mass; 5, prostate; 6, spermatheca; 7, vaginal duct; 8, genital vestibule; 9, spermatocyst; 10, vas deferens; 11, penis sheath.

the same year about ten more were collected, but there were fewer present than before. Mr. James Lance has found them at Point Loma in San Diego, California.

Description. — The living animals are white. Around the edge of the notum are embedded small opaque, white glands which form an unorganized row of spots (Plate 3). The rhinophores also appear white to the unaided eye, but on close observation it is seen that they are ringed by small black dots, hundreds of dots comprising each ring.

The body form is that of a typical dorid. The notum varies in height, tending to be high when the animal is crawling and flattened when at rest. One of the largest specimens measured 24 mm. long and 14 mm. wide when actively crawling. The notum covers the entire foot. The surface of the notum is also quite variable. In many animals it is entirely smooth (Plate 3), with no papillae, whereas in others, it is thickly covered with uniform papillae closely set and much less than a millimeter high. Animals of the latter phase resemble *C. marcusi* but are of less height. The anterior edge of the foot is bilabiate. The mouth is very noticeable with two small oral tentacles flanking it. These tentacles are quite short but very stout, looking almost like part of the oral area. The retractile rhinophores are smooth and, relative to other west coast dorids, are quite long and slender. There is no ridge around the opening of the rhinophoral or branchial chambers. There are eight tripinnate gills in a circle around the anus. These are retractile and when pulled in it is impossible to determine the site of the opening on a living animal because the branchial chamber is so tightly closed. The gills, like the rest of the animal, are white.

The radula of one specimen has the formula 34 by 56.0.56. The teeth (fig. 2, A-C) are simple hooks. The rows of teeth on each side of the radula are staggered (fig. 2, A) at the rachidian space (a-a′). The teeth are approximately the same size in a radular row. There is some variance between the rows, especially in the newly formed area of the radula. There is a moderately large labial cuticle but it is very thin.

The esophagus is fairly large and appears to be glandular along much of its length. It enters a small, round, muscular stomach from the ventral side. The stomach is almost completely embedded in the digestive gland; only the anterior end protrudes. The intestine leaves the stomach anteriorly.

There are two prominent black eyespots on the ganglia.

The reproductive system (fig. 2, D) is compact. A thin duct leads from the hermaphrodite gland to the thin, flat ampulla (1) which lies along the back of the female gland mass (4). The hermaphrodite duct bifurcates, after leaving the ampulla, into a thin, flattened oviduct (2) and a long, flattened vas deferens and prostate. The prostatic part of the vas deferens (5) is poorly differentiated and is almost nonglandular. The whole tract is embedded in the female gland mass but can be seen from the outside without dissecting the mass. The penis (11) is unarmed. The vagina (7) leads into a long vaginal duct which ends where a duct from the spermatheca (6) joins it. The spermatheca is round but flattened, and lies along the top of the female gland mass, not embedded in it. The spermatocyst (9) is a small round organ embedded in the female gland and connected by a short duct to a point just distal from the connection of the vaginal duct and the duct of the spermatheca. A small fertilization duct (3) bifurcates from this point. An X is formed at the junction of these ducts, as can be seen in figure 2, D.

Discussion. — *Conualevia marcusi* and *C. alba* can be separated by several important anatomical and morphological features. The most noticeable is the body form — *Conualevia alba* is a much thinner animal than *C. marcusi,* and is more delicate in appearance. Although both species have glands around the notal rim they are much more evident in *C. alba.* The rhinophores of *C. alba* are much longer relative to their width than are those of *C. marcusi. Conualevia marcusi* has a large number of unipinnate gills while *C. alba* has only about half as many tripinnate gills; this is an important external feature.

The dental formulae of the two species are quite different, but this is of unknown significance as an insufficient number of radulae were examined. The prostate of *C. marcusi* is moderately developed, that of *C. alba* is poorly so. The actual size and shape of the reproduc-

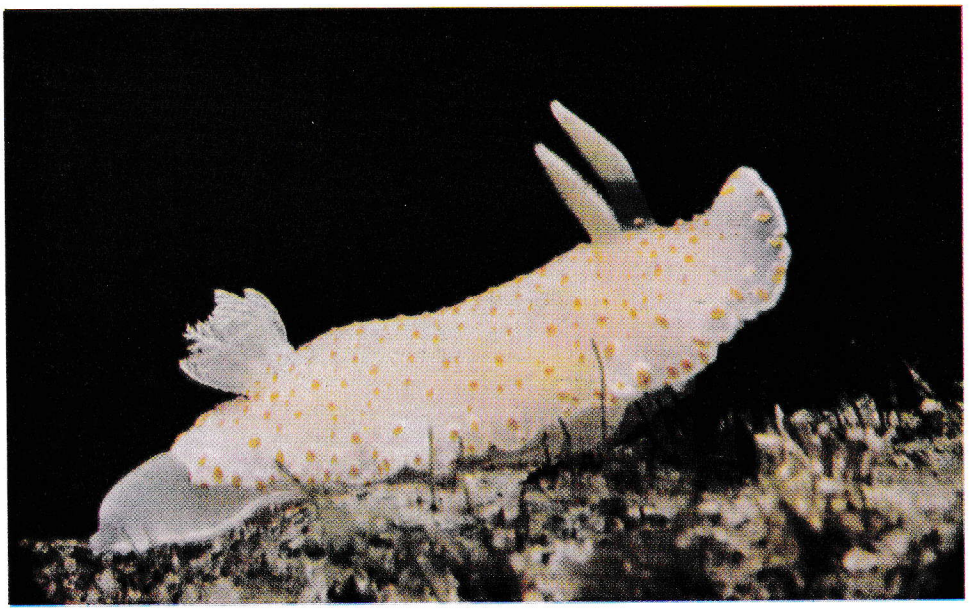

Plate 1. *Cadlina evelinae*

Plate 2. *Conualevia marcusi*, sp. nov.

Plate 3. *Conualevia alba*, sp. nov.

Plate 4. *Polycera alabe*, sp. nov.

tive organs are probably of little importance, as these features, as well as the coloration of these organs, are related to the stage of the breeding cycle. The reproductive systems can be separated by the relative position of the spermatheca and spermatocyst. In *C. marcusi* they are on opposite sides of a line drawn from the vaginal duct to the fertilization duct; that is they are on opposing sides of the X. In *C. alba* they are on the same side.

The genus *Conualevia* possesses strong affinities to the members of the family Dorididae. It is much closer to that family than to any other group within the Eudoridacea. It has gills and rhinophores that are completely retractile, conforming to the tribe Cryptobranchia as established by Odhner (1939). The body shape, reproductive system, and general form of the digestive system conform to the family Dorididae within this tribe. The radula is strikingly similar to most species of the Dorididae. The feature of the smooth rhinophores, however, is very distinct; no other cryptobranch is recorded in the literature as possessing nonperfoliate rhinophores.

Because of these affinities to the Dorididae, we have placed the genus *Conualevia* in that family. We feel, however, that the presence of smooth rhinophores indicates an evolutionary line distinct from that of the other members of the family, and have thus set the genus apart in the new subfamily Conualevinae.

It is difficult to determine how much importance should be placed on the smooth rhinophores in attempting to relate these animals to the other cryptobranchs and in placing them in the presently accepted classification. This is partly because the exact function of the rhinophores is unknown. Various workers (see Agersborg, 1922; Arey, 1917, 1918) have shown that these organs are sensitive to chemical and tactile stimulation, but to what extent and precisely how the animals use this ability is not adequately known. If the rhinophores are used to some degree as sensory receptors, it would seem that perfoliation would be an advantage tending to make the organ more sensitive simply by the increase in area.

The name *Conualevia* means "smooth horns" and was chosen to call attention to the smooth rhinophores. In recognition of the contributions that Dr. Ernst Marcus has made to the field of opisthobranch taxonomy, we take pleasure in naming the type species of the genus in his honor.

Tribe PHANEROBRANCHIA
Superfamily NONSUCTORIA
Family POLYCERIDAE
Polycera alabe, sp. nov.
(Plate 4; fig. 2, E-F)

Type. — The holotype (CASIZ 27; original number WMF 130) was taken on the southeast side of Isla de Cedros, Baja California, by John Sloan in January, 1963. The radula and jaws have been removed from the preserved animal and are mounted on a slide (Box 1, Slide 69). One of two specimens from Puerto Refugio on Isla Angel de la Guarda in the Gulf of California bears the number CASIZ 32. It consists of a serial section of the entire animal mounted on eleven slides (Box 1, Slides 71-81) and was collected in March, 1963. Plate 4 illustrates the holotype.

Distribution. — This species has been taken only in the localities mentioned above.

Description. — The living animal is blue-black and, with the exception of the bottom of the foot, is covered with orange spots arranged more or less in rows posterior to the rhinophores. The black gills and rhinophores also have orange markings on them. Two of the four processes on the velum of the holotype are black; the two lateral ones are white. All processes are black in the two animals from the Gulf of California. The edge of the foot is white. The area above the eye spots is translucent. There are 20 colorless translucent projections on the body, some with yellow tips. There are 11 close-set black projections on the tail.

The body form is typical of *Polycera,* with four processes on the velum. When actively crawling the holotype measured 25 mm. long, 5 mm. wide, and 5 mm. high in the heart region. Other individuals measured 12 and 15 mm. long, 4 mm. wide, and 5 mm. high. The foot is slightly expanded anteriorly (fig. 2, E) and is transversely grooved.

There are six centrally located gills, all unipinnate; the four anterior gills are 5 mm. high, the posterior ones smaller. The nonretractile rhinophores are perfoliate, with 11 leaves.

The radula has the formula 9 by 3.2.0.2.3. Figure 2, F shows a half row from the radula. From the center, the first two teeth each have a strong denticle at the distal end, at right angles to the main axis of the tooth. The second tooth is slightly larger than the first. The third, fourth, and fifth teeth each lack a denticle. The third tooth is about half the size of the second, and the teeth get progressively smaller laterally. The axis of all the teeth is slightly curved. Jaw plates are present.

The penis is armed.

Discussion. — Three species of *Polycera* are known from the east Pacific — *P. atra* MacFarland, 1905, *P. zosterae* O'Donoghue, 1924a, and *P. hedgpethi* Marcus, 1964. *Polycera alabe* differs from them by its color pattern and radular characteristics. The radula of *P. alabe* lacks the basal spine on the second tooth that is found on the other three species.

The name *alabe* refers to the way the bluish-black color of the animal diffused into the preservative (formalin); it is Greek for a type of ink.

Section POROSTOMATA
Family DENDRODORIDIDAE
Dendrodoris atropos (Bergh, 1879)
(Plate 5; fig. 2, G-H)

Distribution. — *Dendrodoris atropos* has been reported from Brazil by Marcus (1957). It is one of the most common nudibranchs in the Gulf of California. We have taken this animal at Coloradito, Puertecitos, and Isla Angel de la Guarda. In addition it has been found at Bahía Loreto (Gulf), Bahía de La Paz (Gulf), Bahía de los Angeles (Gulf), Bahía Sebastian Viscaino, and at Tenacatita, Jalisco, on the mainland of Mexico. Thus, it is common throughout the southern end of the peninsula on the Pacific side and the length of the Gulf. We have found it around rocks in early summer and in late November. It is apparently most abundant from late winter through late spring or early summer.

Description. — The living animal is black except for the tips of the rhinophores and gills, which are white, and the edge of the mantle ruffle, which has a red line around it. In the living animal the viscera can sometimes be seen through the notum. The foot and underside of the notum are sooty gray. The black color of the animal is moderately well retained in preservative; the red line fades but is still noticeable in most specimens.

The body is plump. The notum is smooth or slightly undulate. There is a 6 mm. broad undulating ruffle which extends around the edge of the notum. The distal edge of this ruffle is dull red (Plate 5). The clavi of the rhinophores are set on stout stalks, are retractile into simple chambers, and have 20 to 24 leaves. In one of the animals dissected there were eight retractile bipinnate to tripinnate gills. The foot is very muscular, allowing the animal to cling tenaciously to rocks; we tore several animals apart trying to remove them, leaving the foot still clinging to the substrate. The largest animal we collected measured 45 mm. long, 15 mm. wide, and 7 mm. high when living; this measurement included the notal ruffle.

The hermaphrodite duct leads into a large thick ampulla (fig. 2, G 1) which is bean shaped, bent in the middle so that it recurves on itself. The oviduct (2) is narrow and short. The vas deferens winds anteriorly and gradually widens as it becomes glandular. The prostatic part of the vas deferens (5) is highly convoluted. The vas deferens gradually narrows and loses its glandular texture to become a winding, flattened duct (10) running latero-venterally along the penial sheath. As soon as the vas deferens enters the penis it becomes enclosed in the large, muscular penial sheath, which gradually tapers and, just before entering the genital vestibule (8), bends sharply to the outside to connect with the vestibule at right angles. The penis is armed with both short hooks and long spines (fig. 2, H).

The vagina is short but muscular, and leads into a small winding duct (7) leading to the small spherical spermatheca (6). The fertilization duct (3) debouches from the vaginal

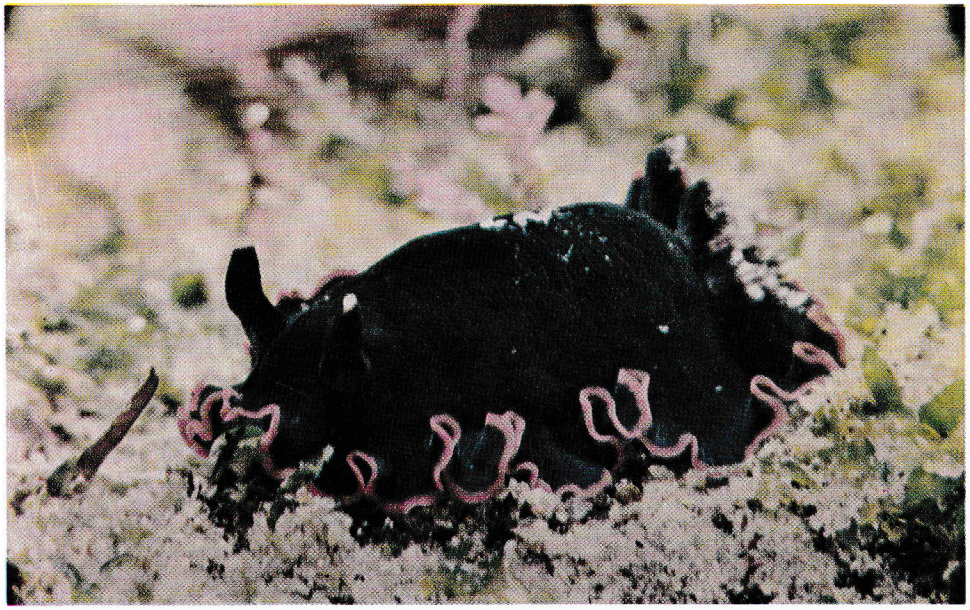

Plate 5. *Dendrodoris atropos*

Plate 6. *Cerberilla pungoarena*, sp. nov.

duct and spermatheca at this point. This duct is very long and convoluted, although not winding upon itself. It enters the female gland mass (4) just after connecting with a duct leading from the small pear-shaped spermatocyst (9). The female gland mass is not exceptionally large; it opens to the outside posterior to the genital vestibule. No accessory glands in the area of the genital vestibule were seen.

The digestive and nervous systems are as described for *D. atropos* by Marcus (1957) and Marcus and Marcus (1962). There is a large buccal bulb with a large ptyaline gland lying to the right of it, anterior to the genital area. The pharynx leaves the buccal bulb and passes through the nerve ring, doubling back to a position just posterior and ventral of the nerve ring where the buccal ganglia connect to it. There are two small glands on the esophagus at this point. The esophagus is thick and glandular with the mosaic pattern described by Marcus and Marcus (1962:474). The esophagus ends in a prominent sphincter.

Discussion. — For some time we thought that these animals were *Dendrodoris nigra.* The color seemed to agree perfectly with one of the phases of *D. nigra* and although there was a striking similarity between its digestive system and that of *D. atropos* there were enough minor differences elsewhere to allow for its being *D. nigra.* Among these is the muscular penial sheath which is so noticeable in the specimens at hand but which Marcus (1957) does not mention. Not until we were able to dissect specimens of *D. nigra* from two different locations, through the courtesy of Drs. Rehder and Kenny, were we sure that our specimens were not *D. nigra* and were indeed *Dendrodoris atropos.*

Many authors (Marcus, 1957; O'Donoghue, 1924b; Eliot, 1906) have discussed the differences in classification and the inherent difficulties encountered in this group of animals and it is not necessary to repeat them here. Color may be one of the most important factors as Marcus (1957) states, but it alone is not enough, as these animals indicate. Classification in this group must still take into account all of the organ systems together and not single out any one as "the most important."

Suborder EOLIDACEA
Tribe CLEIOPROCTA
Family AEOLIDIIDAE
Cerberilla pungoarena, sp. nov.
(Plate 6; fig. 3, A-D)

Type. — The holotype (CASIZ 28) and only specimen was collected by John Sloan at Puerto Refugio on the north end of Isla Angel de la Guarda in March, 1963. It consists of the preserved animal and a slide of the radula and jaw element (Box 1, Slide 70).

Description. — The body and foot of the living animal are translucent white with light brown or tan on the dorsal surface. The posterior edges of the oral tentacles are lined with black pigment which makes them appear dark gray. The distal end of each cerata is opaque white but has a small translucent cap at the tip. The major portion of each cerata is translucent with a thin, speckled-appearing thread of liver diverticula running up the middle.

The foot is wide (fig. 3, B) and rounded behind. It does not extend posteriorly beyond the cerata. The anterior edge of the foot is rounded and produced into lateral extensions at the corners. When viewed dorsally (fig. 3, A), the foot is very broad, extending laterally beyond the outer margins of the cerata. The animal measured 20 mm. long, 7 mm. wide and 2.5 mm. high when actively crawling. The anterior cerata are short, whereas the posterior ones are very long and extend beyond the tail when the animal is actively crawling. The cerata are dorso-venterally flattened and fit next to each other like a stack of books. The cerata trail straight behind when the animal is crawling, but when the animal stops the cerata become disoriented and thrash around. When the animal is touched or disturbed the cerata move about wildly, extending and shortening in length (Plate 6).

The rhinophores are relatively short and are perfoliate. The terminal half is white, the base, tan. There is a small black eye spot at the base of each rhinophore. The thin, pointed oral tentacles are slightly contractile and can extend to almost half the length of the animal.

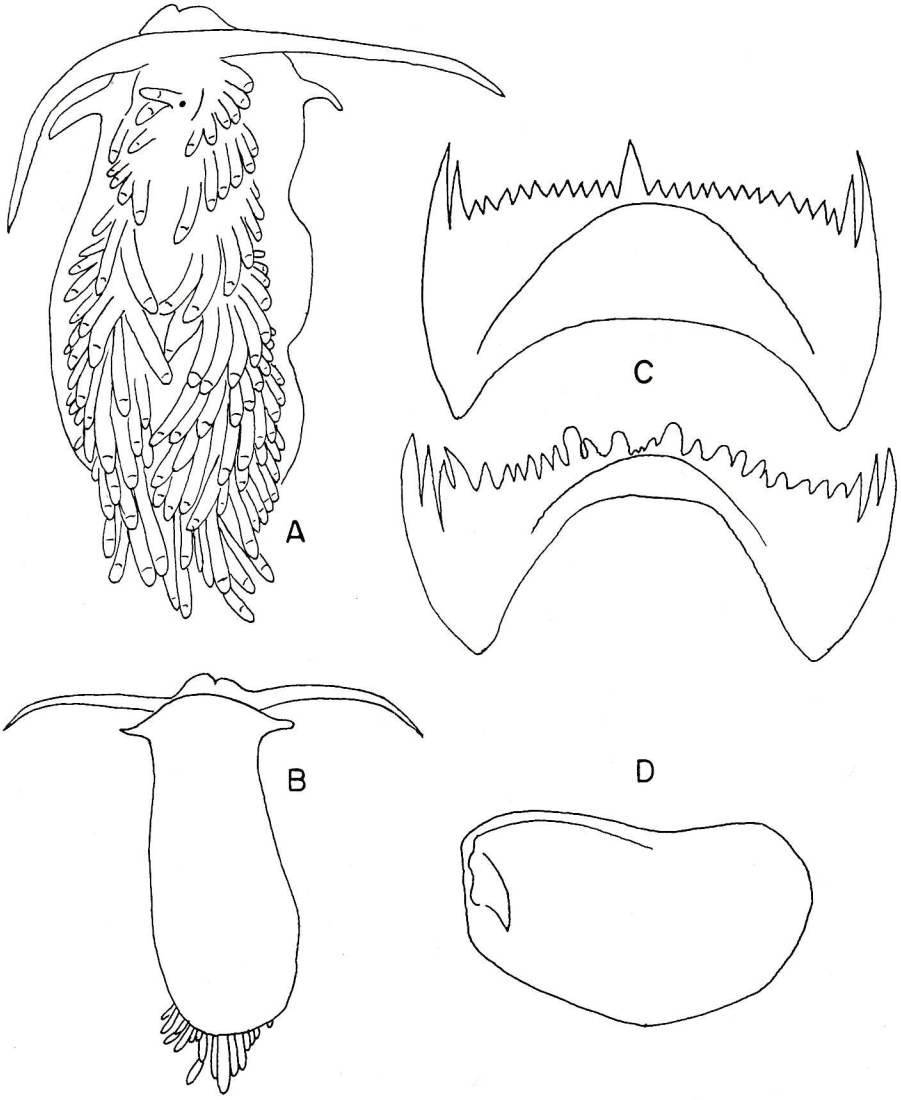

Fig. 3. *Cerberilla pungoarena*. A, dorsal view of living animal; B, ventral view of living animal; C, radular teeth; D, jaw plate.

The radula has the formula 21 by 0.1.0. A tooth from the center of the radula contained 28 denticles (fig. 3, C). There are two large lateral denticles of unequal size on each side of the tooth with many small denticles between the large ones. In some teeth there is a large central denticle. Older teeth of the radula showed considerable wear with most of the denticles worn off and rounded. The thin, smooth, oval jaw plates (fig. 3, D) are pale yellow and slightly convex, with a smooth masculatory process.

Discussion. — This animal was collected crawling on top of sandy mud, and was later observed to have definite burrowing abilities. It completely submerged into the sand in an aquarium, the sand collapsing behind the animal as it passed through. As far as we can determine, this is the first recorded observance of an aeolid burrowing in sand. We did not determine what the animal eats in this peculiar habitat. The broad foot is particularly adapted for this kind of existence and the cerata are aligned for easy passage through the sand.

It has been pointed out by Marcus and Marcus (1959:260) that *Cerberilla* is a representative genus of the Indo-West Pacific, occurring principally, but not exclusively, in warm areas. They described *C. tanna* from the coast of Texas, the first known Atlantic *Cerberilla.* The specimen at hand is the first known representative of this genus from the east Pacific.

In a discussion of *Cerberilla,* Bergh (1905) pointed out that the most important characteristic for separating the species of this genus from one another is the relationship of their colors. Marcus and Marcus later (1959) stated that the radula is the best distinguishing characteristic.

Cerberilla ambonensis Bergh 1905 (see his plate XIX) differs from *C. pungoarena* by having black tipped cerata and rhinophores. Although Marcus and Marcus (1959) did not take color notes from the living animal, they described *C. tanna* as having an orange-brown spot on the outer surface of many but not all cerata, just under the cnidosac. *Cerberilla pungoarena* can be distinguished from *C. tanna* by the presence of a large central denticle on some of the teeth. Baba (1940:110) described *C. asamusiensis* as having smooth rhinophores, a broad yellow area on the head between the oral tentacles and rhinophores, and teeth with only 6 to 8 large denticles with smaller accessory denticles, characteristics not common to *C. pungoarena.*

LITERATURE CITED

AGERSBORG, H. P. KJERSCHOV

1922. Some observations on qualatative chemical and physical stimulations in nudibranchiate mollusks with special reference to the role of the 'rhinophore.' Jour. Exper. Zool. 36:423-444.

AREY, LESLIE B.

1917. The sensory potentials of the nudibranch "rhinophore." Anat. Rec. 11:514-516.

1918. The multiple sensory activities of the so-called rhinophores of nudibranchs. Amer. Jour. Physiol. 46:526-532.

BABA, K.

1940. Some additions to the nudibranch fauna of the northern part of Japan. Bull. Biogeog. Soc. Japan 10:103-111.

BERGH, R.

1879. Die Doriopsen des Atlantischen Meeres. Jb. Dtsch. Malakozool. Ges. Jahrg. 6:42-65.

1905. Die Opisthobranchiata der Siboga Expedition. Siboga Expedite 50:1-248, pls. 1-20.

ELIOT, C. N. E.

1906. Report upon a collection of Nudibranchiata from the Cape Verd Islands, with notes by C. Crossland. Proc. Malacol. Soc. London 7:131-159, pl. 14.

LANCE, JAMES R.

1962. Two new opisthobranch mollusks from southern California. Veliger 4:155-159, pl. 38.

MACFARLAND, F. M.

1905. A preliminary account of the Dorididae of Monterey Bay, California. Proc. Biol. Soc. Wash. 18:35-54.

MARCUS, ERNST

1955. Opisthobranchia from Brazil. Bol. Fac. Fil. Univ. S. Paulo, Zool. 20:89-262, 30 pls.

1957. On Opisthobranchia from Brazil (2). Jour. Linnean Soc. London 43:390-486.

1958. On western Atlantic opisthobranchiate gastropods. Amer. Mus. Novitates 1906. 82pp.

1961. Opisthobranch mollusks from California. Veliger 3, Supplement. 85pp.

1964. A new species of *Polycera* (Nudibranchia) from California. Nautilus 77:128-131.

MARCUS, EVELINE and ERNST MARCUS

1959. Some opisthobranchs from the northwestern Gulf of Mexico. Inst. Marine Sci. 6:251-261, 19 figs.

1962. Opisthobranchs from Florida and the Virgin Islands. Bull. Marine Sci. Gulf and Carib. 12:450-488.

ODHNER, NILS H.

1939. Opisthobranchiate Mollusca from the western and northern coasts of Norway. K. Norske Vidensk. Selsk. Skr. 1939. 1. 93pp.

O'DONOGHUE, CHARLES H.

1924a. Notes on the nudibranchiate Mollusca from the Vancouver Island region. IV. Trans. Roy. Canadian Inst. 15:1-33, pls. 1-2.

1924b. Report on Opisthobranchiata from the Abrolhos Islands, western Australia, with description of a new parasitic copepod. Jour. Linnean Soc. London 35:521-579, pl. 27-30.