

**COSTASIELLA CORONATA, NEW SPECIES, AND
A REVISED DIAGNOSIS FOR THE FAMILY COSTASIELLIDAE
(MOLLUSCA: OPISTHOBRANCHIA: SACOGLOSSA)**

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ABSTRACT. - *Costasiella coronata*, new species, occurs on its food alga *Vaucheria* sp. high in the intertidal zone of mangrove forests bordering parts of the Gulf of Thailand. It differs from all previously described *Costasiella* species by having flattened cerata and a large renal shield. The external characteristics and the internal anatomy of the digestive and reproductive organs are described and depicted, and notes are given about reproduction and behaviour. The characteristics of the genus *Costasiella* Pruvot-Fol, 1951 have gradually been changed in the course of the years and have become restricted to ceratal-bearing sacoglossans with admedian eyes and digitiform or auriculate rhinophores without diverticula of the digestive gland. The described species of *Costasiella* are listed. The original characteristics of the family Costasiellidae, as given by Clark (1984), appear to include specific characteristics of only few species. This inadvertently left out the type species of the genus *Costasiella*, which is the type genus of the family, and several others. Therefore the diagnosis is shortened and changed to include all species.

KEY WORDS. – Gastropoda, Opisthobranchia, Sacoglossa, Costasiellidae, *Costasiella*, Thailand.

INTRODUCTION

All ceratal-bearing sacoglossans with the eyes situated close together between the rhinophores are usually considered to belong in the genus *Costasiella* Pruvot-Fol, 1951, within the monotypic family Costasiellidae Clark, 1984. Unfortunately the status of the genus and several of the species it contains is disputable. Luckily it concerns only 15 taxa, but several of them have been poorly described. The few described species differ in fundamental details, which forced Marcus (1982) and Jensen (1990) to suggest that the genus should be split up, but they did not provide any specific proposal.

This paper gives an extensive description of a *Costasiella* from the Gulf of Thailand. The species could not be identified with any of the previously described species and is considered new to science. While reviewing the existing descriptions of taxa, it was found that some descriptions were vague and/or likely to contain mistakes. A check of the original diagnosis of the family Costasiellidae, as given by Clark (1984), showed that it contains characteristics that only hold true for a few *Costasiella* species. This excludes several species, among which is even the type of *Costasiella*. Therefore, the family diagnosis is adapted to include all known species.

MATERIALS AND METHODS

Specimens of the new species were collected by hand from the mud and from their food algae during low tide. A number of specimens were narcotised with $MgCl_2$ in small Petri dishes in the laboratory. Specimens for dissection were temporarily stored in a solution of formaldehyde-seawater with 5% acetic acid. Dissections were undertaken by hand with the help of fine needles. Specimen was kept in water in a Petri dish under a 4-64x stereo microscope, notes and drawings of details were made, while some images were taken with a digital camera. For permanent storage, some specimens were stored for a few days in formaldehyde and thereafter transferred into 70% ethanol. Specimens were kept alive for about 1–2 weeks in trays with mud, *Vaucheria* sp. and local seawater with and without aeration in October 2003.

Costasiella coronata, new species

(Figs. 1, 2)

Material examined. – Bang Tawa, in the mangrove forest (6°51'N 101°09'E), some specimens and egg-strings, 10 Jul.2000. Same site, some tens of individuals with a length up to 7 mm, also egg-strings found, Oct.2000. Same site, some tens of individuals with a length of 4–10.5 mm, also egg-strings found, 13 Oct.2003.

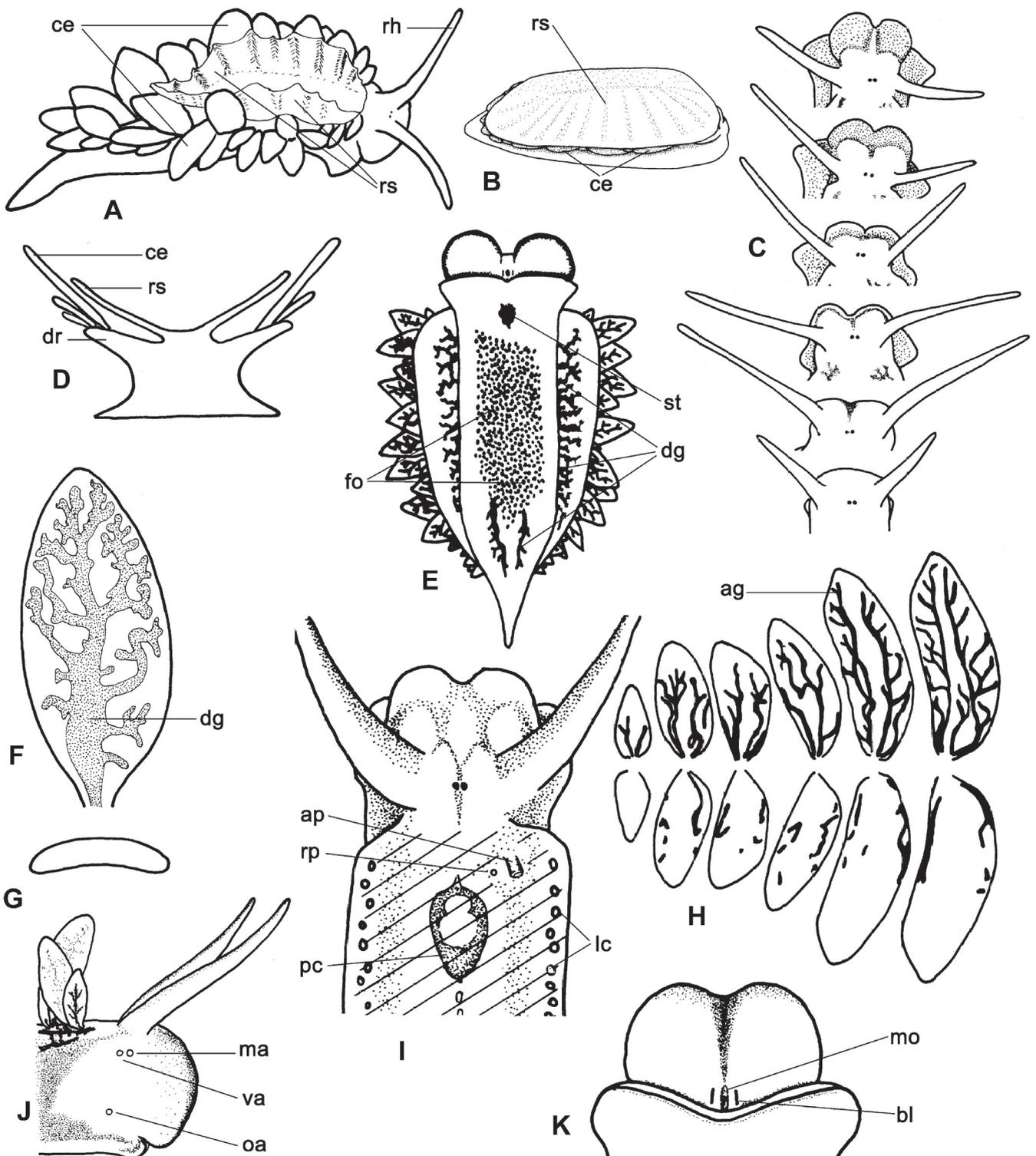


Fig. 1. *Costasiella coronata*, new species: **A**, outline of a submerged live specimen; **B**, outline of a live specimen on mud during low tide; **C**, different shapes of the anterior part of a live specimen; **D**, outline of a cross section through the cardiac area of a relaxed specimen; **E**, ventral view of a relaxed specimen showing organs shining through; **F**, branch of the digestive gland in ceras; **G**, outline of cross section of a preserved ceras; **H**, branches of the albumen gland in a series of cerata of different sizes; upper row dorsal sides, lower row ventral sides; **I**, dorsal view of the anterior body of a preserved specimen; the renal shield and cerata are removed; former position of renal shield is indicated by slashes; **J**, the genital apertures at the right anterior side of a preserved specimen with removed renal shield; **K**, ventral view of anterior area showing the mouth in a preserved specimen. Legend: **ag** – albumen gland; **ap** – anus papilla; **bl** – black line; **ce** – ceras; **dg** – digestive gland; **dr** – dorsal rim; **fo** – follicles of ovotestis; **lc** – lost cerata; **ma** – male aperture; **mo** – mouth; **oa** – oviducal aperture; **pc** – pericardium; **rh** – rhinophore; **rp** – renal pore; **rs** – renal shield; **st** – stomach; **va** – vaginal aperture.

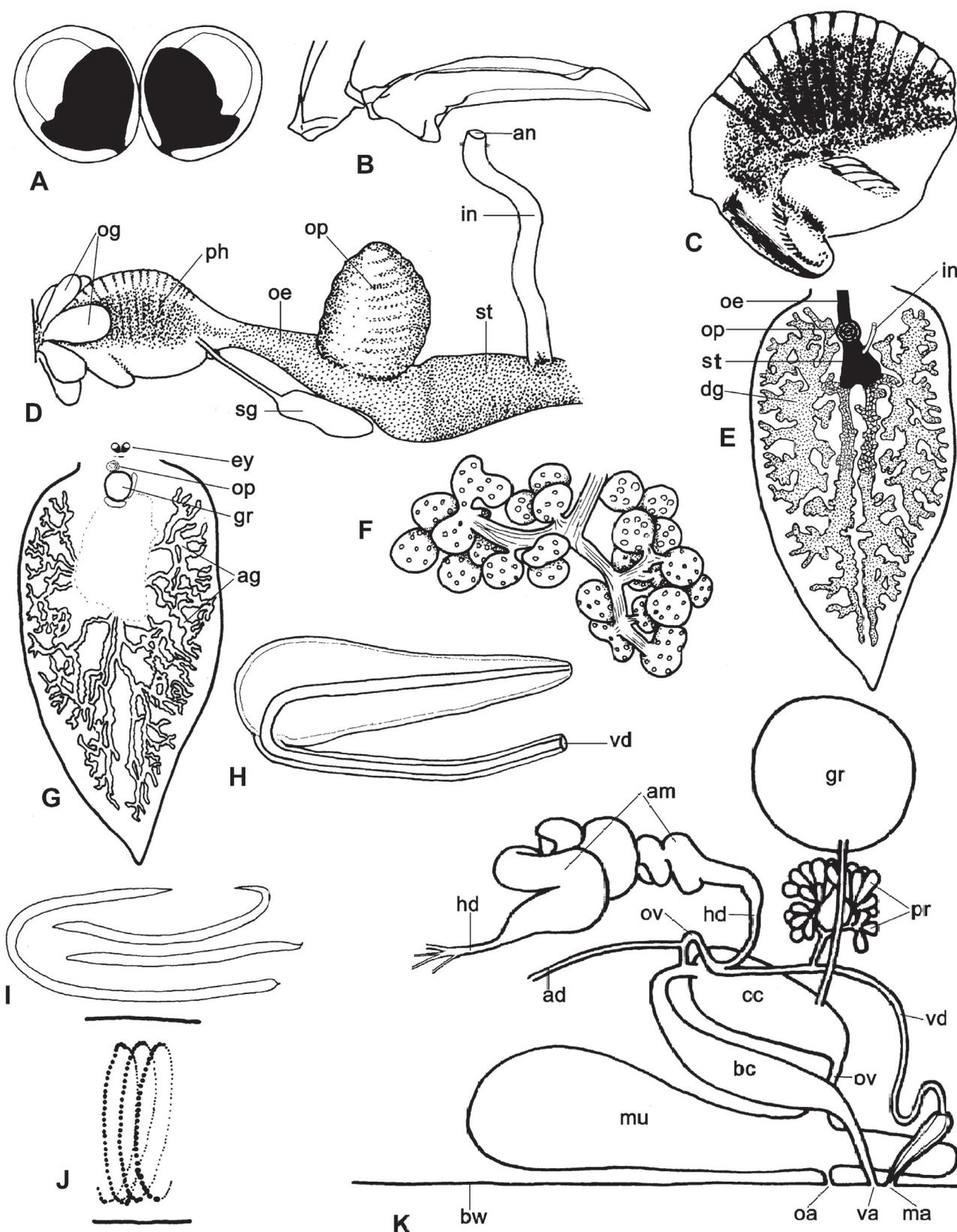


Fig. 2. *Costasiella coronata*, new species: **A**, eyes; **B**, radular tooth and connection; **C**, pharynx in lateral view; **D**, digestive system from mouth to stomach in lateral view; ring of main ganglia around anterior part of oesophagus is removed. **E**, branches of the digestive gland in the body of a preserved specimen; dorsal skin and branches of the albumen gland are removed; **F**, hermaphrodite follicles and ductules from a preserved specimen; **G**, branches of the albumen gland in the body of a preserved specimen; dorsal skin removed; the heart and some organs of the genital complex block the view in the outlined area; **H**, penis; **I**, egg-strings; **J**, arrangement of eggs in an egg-string; **K**, diagram of the genital complex. Legend: **ad** – albumen duct; **ag** – albumen gland; **am** – ampulla; **an** – anus; **bc** – bursa copulatrix; **bw** – body wall; **cc** – central canal; **dg** – digestive gland; **ey** – eyes; **gr** – genital receptacle; **hd** – hermaphrodite duct; **in** – intestine; **ma** – male aperture; **mu** – mucus gland (large oviduct); **oa** – oviducal aperture; **oe** – oesophagus; **og** – oral gland; **op** – oesophageal pouch; **ov** – oviduct; **ph** – pharynx; **pr** – prostate; **sg** – salivary gland; **st** – stomach; **va** – vaginal aperture; **vd** – vas deferens.

Tak Bay, on intertidal mud bordering a small fringe of mangroves (6°16'N 102°03'E), 2 specimens with a length of 4-5 mm, 23 Apr.2005. Both locations are in southern Thailand along the Gulf of Thailand, and all specimens were on, or in, patches of the alga *Vaucheria* sp.

The description is based on 11 specimens collected in Oct.2003, of which five were dissected and six selected as types. The holotype and three paratypes are deposited in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore, and three paratypes in the Zoological Museum, University of Amsterdam (ZMA).

External morphology. – Black eyes close together between rhinophores (Fig. 1 A, C). Renal shield large, fixed on dorsal side of small pericardium, covering dorsum from just posterior of eyes to two-third of body length; wide, free rim can be held upwards and pleated (Fig. 1 A). Rim usually covers basal parts of bordering cerata and often nearly their whole length (Fig. 1 B). Transparent renal shield contains irregular central channel with side-branches bordered by dispersed dark dots. Rhinophores smooth, wide, somewhat flattened at base, but rounded distally and tapering into blunt tips. Shape of head varies according to degree of straightening (Fig. 1 C); frontal part usually kept bilobed. Lateral areas of back wider than body by thick rims (Fig. 1 D, E). Each rim filled with maze of branches of albumen and digestive glands. Cerata in a row of up to 22 on dorsal side of each rim, starting shortly behind rhinophores; not covering central part of dorsum and posterior end of foot; strongly flattened, wide, and smooth (Fig. 1 F, G); flat sides concave-convex in preserved specimens (Fig. 1 G). Each ceras containing wide branch with side branches of digestive gland (Fig. 1 F) and in reproductive slugs also branches of albumen gland being most dense on dorsal side of ceras (Fig. 1 H).

Foot somewhat wider than dorsum in live specimens, but the opposite is true after preservation. Anterior border of foot with blunt extensions; posterior tip pointed (Fig. 1 A, E). Foot length 4-6 times width in actively crawling specimens (N = 11). Sole anteriorly with shallow central longitudinal groove continuing posteriorly as unpigmented line. Anus on small papilla anterior right of pericardium covered by renal shield (Fig. 1 I). Renal pore just left of anus papilla. Male aperture below right rhinophore, vaginal aperture just posterior of male aperture and oviductal aperture slightly posterior to and below vaginal aperture (Fig. 1 J).

Live colouration. – Colour of body and cerata is mainly determined by colour of digestive gland: bright green in well-fed individuals, and pale yellowish brown when not fed recently. Skin largely transparent with scattered iridescent blue-green dots, white or yellowish glandular dots, and angular reddish-brown dots, latter especially on renal shield. These colours only visible under specific light conditions. Moreover, fine grey-purple pigment on lateral and dorsal sides, anterior foot border, and in two longitudinal bands on sole of foot. White lines on posterior sides of rhinophores and thin dark pigment on lateral sides. Appearance of lines

and areas with grey-purple pigment on head largely depends on degree of expansion of head (Fig. 1 C, I). A small black line present on both sides of mouth (Fig. 1 K). No pigment around genital orifices and eyes. In preserved specimens content of digestive gland brownish and purple areas in epidermis grey.

Internal characteristics. – Diameter of eyeball 125–145 μm (N = 4, length of live specimen 6–8 mm). Eyeballs touching (Fig. 2 A). Clusters of oral glands besides anterior part of pharynx (Fig. 2 D). Pharynx nearly spherical, diameter 400–520 μm (N = 5) with prominent ascus, strong ascus muscle, and well developed dorsal septate muscle. Wide, internal, longitudinal band of dark pigment borders pharyngeal space (Fig. 2 C, D). Radular teeth blade-shaped, smooth and narrow, with slightly curved sharp tips (Fig. 2 B). Length of leading tooth in large specimens 85–100 μm (N = 5). In ascending row 5-8 teeth, in descending row and ascus 18–27 progressively smaller teeth (N = 5). Teeth, including 3 preradular teeth, remain fixed on radular ribbon that curls in a spiral in ascus. Length of base of first preradular tooth about 4 μm , second about 8 μm , third with minuscule blade 15 μm in total. On both sides of short oesophagus, salivary duct between pharynx and salivary gland below prominent oesophageal pouch on dorsal side of oesophagus just anterior of stomach (Fig. 2 D). Oesophagus and pouch dark pigmented; salivary glands and ducts pale. Stomach dark, ventral in body. From right dorsal side of stomach, pale coloured intestine ascends to anal papilla (Fig. 2 D). A branch of the digestive gland starts in both posterior corners of stomach. Both immediately split into a branch that goes slanting upwards and a branch that directly goes in posterior direction and then upwards (N = 5). Both branches knotty, repeatedly branching in respectively anterior and posterior dorsal parts of body. First branch reaches to just posterior of eyes, second up into tail far posterior of origins of posterior cerata (Fig. 2 E). Only some branches of digestive gland in dorsum connected with a ceras.

Extensive network of albumen gland tubules ramifying in dorsal side of body close to branches of digestive gland including in cerata (Figs. 1 H, 2 G). Tubules white and relatively thick in egg laying specimens, thin and pale in non-reproductive individuals, uniting into single albumen duct. Hermaphroditic follicles dense (Fig. 2 F), small (diameter single follicles 50-150 μm , length of compound follicles 200-300 μm), and numerous (>500), on ventral side of body cavity from near frontal border of foot to below division between anterior and posterior networks of digestive gland. Follicles yellow, connected by ductules that unite into short hermaphrodite duct. Organs of genital complex (Fig. 2 K) packed together in anterior right half of body cavity. Hermaphrodite duct widens into strongly coiled ampulla leaving it at anterior end and splitting into vas deferens and small oviduct. Vas deferens receives prostate duct coming from about 30 fusiform prostate glands in anterior part of body below spherical genital receptacle, then running anteriorly over female system to long, narrow, unarmed penis (Fig. 2 H). Male system uncoloured, but prostate glands white. Vaginal duct widens into bursa copulatrix going to posterior end of

solid, ovoid central canal. Small oviduct receives albumen duct and enters central canal together with vaginal duct. Oviduct leaves central canal in anterior end and continues as large oviduct via wide and voluminous mucous gland occupying most of ventral right of anterior body cavity. Genital receptacle spherical, pale, situated dorsally slightly right of oesophageal pouch and left of loop of bursa copulatrix (vaginal duct). Genital receptacle connected to left side of central canal by narrow tube.

Habitat and behaviour. – Specimens of *Costasiella coronata* were found on, and shallowly buried into, soft muddy sediment in and around tufts of *Vaucheria* sp. in open spaces within or bordering mangrove forests high in the intertidal zone. The slugs lived amphibiously. When the *Vaucheria* patches had emerged during low tide, more and more slugs crawled over the algae for feeding. The contracted rhinophores were firmly kept against the back and the cerata were held largely under the renal shield that seemed to increase in thickness and relative size (Fig. 1 B). The epidermis looked dirty by mud suggesting that the ciliary actions were reduced or had ceased completely. The number of visible slugs declined again by hiding in mud when the tide was out for some time. In captivity it could be seen that they fed by sucking the siphonal cells of *Vaucheria* sp. both when submerged and when emerged. In October 2000 the temperature of the water was 35°C and the salinity 29‰, but salinity fluctuates strongly over the season in the coastal zone (Swennen et al., 2001).

The slugs were difficult to keep alive in captivity for more than a few weeks. The main problem was maintaining the algae in a condition such that they could be consumed by the slugs; replacing the algae every few days was necessary. A good growth of the *Vaucheria* sp. did occur when keeping them with substrate either permanently emerged in a damp atmosphere, or submerged with some aeration, but in both cases the slugs either hardly fed or did not feed at all.

Copulation was not observed in individuals out of the water. When two submerged slugs met for mating, they erected their rhinophores and repeatedly touched each other with the swollen anterior parts of the head for about 15 seconds. Then they aligned their bodies in opposite directions with the heads just side by side for penial insertion. The duration of the copulation could not be timed precisely, but the intimate contact lasted 15 to 30 s. When mating ended the bodies shook as if the penis had to be redrawn with force out of the partner. The eggs were in colourless, transparent, gelatinous strings of a length of 9–15 mm and a width of up to 1.7 mm (Fig. 2 I). The strings contained 2000–4000 eggs in a spiral chain (Fig. 2 J). The capsules of fresh eggs were touching each other in the spiral, but not those in neighbouring curves. Fresh, still uncleaved ova yellowish; developing embryos were pale. The egg capsules measured $108.2 \pm 3.6 \mu\text{m}$ by $90.2 \pm 6 \mu\text{m}$ ($N = 36$), diameters of uncleaved ova $61.1 \pm 1.7 \mu\text{m}$ ($N = 22$). In captivity, the egg masses were deposited both by submerged and emerged individuals on the mud or on *Vaucheria* sp. The eggs developed to free-swimming veliger larvae within four days (temperature 28–35°C).

Etymology. – The specific name refers to the striking character that the dorsal side is crowned by the renal shield.

DISCUSSION

Characteristics of *C. coronata*, new species, agree with the type species of *Costasiella* such as the position of the eyes, shapes of radular teeth and penis, and several details of the genital complex as described by Marcus (1982). *C. coronata* differs from all other described *Costasiella* species by having flattened cerata and a large renal shield, both may be related to its specific habitat.

Species considered to belong to *Costasiella* with their type localities are:

1. *C. ocellifera* (Simroth, 1895); described as *Doto* (?) *ocellifera*. Transferred into *Costasiella* by Thompson (1977) after suggestion of Marcus & Marcus (1960). St. George, Bermuda, UK, North Atlantic Ocean.
2. *C. virescens* Pruvot-Fol, 1951. Type species by monotype. Monaco, Mediterranean Sea.
3. *C. formicaria* (Baba, 1959); described as *Stiliger* (*Stiliger*) *formicarius*, but transferred to *Costasiella* by Baba, (1961, in the postscript). Amakusa, Japan.
4. *C. nonatoi* Marcus & Marcus, 1960. Near Ubatuba, Brazil.
5. *C. illa* (Marcus, 1965); described as *Stiliger* (*Ercolania*) *illus* and transferred to *Costasiella* by Marcus (1982). Ifaluk Atoll, Caroline Islands, Micronesia.
6. *C. lilianae* (Marcus & Marcus, 1969); described as *Stiliger* (*Stiliger*) *lilianae* belongs to *Costasiella* according to Thompson (1977), and is a junior synonym of *C. ocellifera* according to Clark (1984). Ubatuba, Brazil.
7. *C. pallida* Jensen, 1985. Hong Kong.
8. *C. paweli* Ichikawa, 1993. Miyako, Ryukyu Islands, Japan.
9. *C. usagi* Ichikawa, 1993. Ishagika, Ryukyu Islands, Japan.
10. *C. vegae* Ichikawa, 1993. Ishagika, Ryukyu Islands, Japan.
11. *C. rubrolineata* Ichikawa, 1993. Ishagika, Ryukyu Islands, Japan.
12. *C. iridophora* Ichikawa, 1993. Kuro, Ryukyu Islands, Japan.
13. *C. kuroshimae* Ichikawa, 1993. Kuro, Ryukyu Islands, Japan.
14. *C. mandorahae* Jensen 1997. Mandorah, Darwin Harbour, Northern Territory, Australia.
15. *C. coronata*, new species. Bang Tawa, Pattani Province, Thailand.

The majority of the species are found in tropical and subtropical West Pacific waters, with only *C. virescens*, *C. nonatoi* and *C. ocellifera* occurring in the tropical and subtropical Atlantic region. Most species live in the subtidal photic zone and seem to feed on *Avrainvillea* spp. as far as is known. Only *C. coronata*, *C. formicaria* and *C. pallida* live in the intertidal zone. The food of *C. formicaria* is unknown, whereas both *C. coronata* and *C. pallida* feed

on *Vaucheria* sp. (Jensen, 1990; this paper) and occupy the same niche in the tropics as do *Alderia modesta* (Lovén, 1844) and *Limapontia depressa* (Alder & Hancock, 1862) in temperate and boreal North Atlantic coasts (Engel et al., 1940; Hartog & Swennen, 1952).

Several of the *Costasiella* species have been poorly described, but *C. formicaria*, *C. ocellifera* (= *C. liliana*), *C. paweli*, *C. usagi*, and *C. virescens* are not similar to *C. coronata* because they have tentacular anterior foot corners, while *C. illa* and *C. nonatoi* have the cerata filled with knobby diverticula, and *C. iridophora*, *C. kuroshimae*, *C. rubrolineata*, *C. vegae* and *C. mandorahae* have the whole dorsum covered with swollen cerata. In 2000 when the first specimens of *C. coronata* were found, the author believed that they belonged to *C. pallida* mainly because of their association with *Vaucheria* sp. The specimens of both samples died in the laboratory before they could be studied. When they were found again a few years later, the author prepared a description of the external and internal characters of the Thai specimens. Comparison of that description with that of *C. pallida* showed that the Thai specimens differed in a number of characters. The original description of *C. pallida* is meagre and based on a single juvenile specimen, but additions and an important correction have been published after about ten adult specimens were found (Jensen, 1990). Jensen (1985, 1990) noted for *C. pallida*: (1) scattered bright red spots all over the body; (2) a median ceras in front of the tail (also pictured); (3) the tail shaped like a ceras (also pictured in ventral view); (4) cerata moderately inflated; (5) eight teeth in the ascending limb, 14 in the descending and a heap of teeth in the ascus; (6) no oesophageal pouch observed; (7) stomach lodged between branches of mucus gland; (8) wide lateral branches of the digestive gland send diverticula out into the cerata. Several cerata receive tributaries from one lateral branch (Jensen, 1990: 429, fig. 13); (9) white branches of the albumen gland wind around digestive gland inside cerata (also pictured); (10) penial opening behind the right rhinophore and female aperture is behind penial opening; (11) dark pigment is present on penial sheath; (12) sausage-shaped egg masses contain 483.3 ± 283.9 eggs ($N = 11$); (13) egg capsules are $132.8 \pm 7.9 \mu\text{m}$ by $107.4 \pm 8.6 \mu\text{m}$ ($N = 20$); (14) fringe surrounding the pericardium has an elevated edge that disappears in preserved specimens; (15) no black stripes occur near oral opening (Jensen, 1985: fig. 5). While in *C. coronata* there are: (1) no bright red spots, but iridescent blue-green ones; (2) no median ceras occurs in front of tail; (3) tail tapers gradually to a point; (4) cerata strongly flattened; (5) teeth in ascus are in a spiral; (6) large oesophageal pouch is present; (7) stomach and mucous gland are spatially separated; (8) several side branches of lateral branches of digestive gland do not contact any ceras, and no side branch send tributaries to several cerata; (9) branches of albumen gland do not wind around digestive gland in cerata; (10) penial opening is below right rhinophore, and there are two separate openings of female system; (11) there is no dark pigment on the penial sheath or penis; (12) number of eggs in an egg mass is higher (2000–4000); (13) egg capsules are relatively smaller, measuring 108.2 by $90.2 \mu\text{m}$; (14) fringe on pericardium does not disappear in preserved specimens and this renal organ

extends more than halfway down the body and also to over more than the width of the body; it is called a renal shield; (15) two black lines alongside oral opening. These may be similar as the small lines of black pigment cells that flank the mouths in *Costasiella nonatoi* (Marcus & Marcus, 1960: 150), *Elysia evelinae* (Marcus, 1957: 411), *Stiliger evelinae* (Marcus, 1959: 23), which are reduced to a melanophore on each side in *C. liliana* (Marcus & Marcus, 1969: 10). The difference in the number and size of the eggs and details in the coloration do not necessarily indicate specific difference between *C. pallida* and *C. coronata*, but most of the others characters do indicate specific differences.

The diagnosis of the genus *Costasiella* Pruvot-Fol, 1951, and of the type species, *C. virescens* Pruvot-Fol, 1951, had a shaky start. The sample became lost before the internal characters of the type species could be studied. As striking characters for the genus were noted the large not rolled, but somewhat flattened rhinophores, and anterior corners of the foot tentaculiform and pointed. For the type species, it was stressed that the eyes are close to the median line, nearly touching each other and that the anterior part of the head is concave (Pruvot-Fol, 1951; 1954). The second species placed in the genus was *C. nonatoi* Marcus & Marcus, 1960. This species has rounded anterior foot corners and the rhinophores are grooved along their whole length, thus the main genus characters were invalidated in favour of the characters of the eyes of the type species for including the species in the genus. Marcus (1982: 22) stuck to the large size of the eyes to validate the genus. She did not accept the transfer of *Stiliger formicarius* to *Costasiella*, because the eyes are not especially large. This may be based on the figure (Baba, 1959: plate 27, fig. 3 a) where the eyes are indicated by simple dots of similar size as in the drawings of other slug species in the same paper. Baba (1959, 1961) gives no measurements of the eyes. Jensen (1990) found the eyes of her *C. pallida* were relatively smaller than those of *C. liliana*, but does not give measurements. She maintained the placement in *Costasiella* because of the position of the eyes between the rhinophores and close together. Since then, all ceratal-bearing sacoglossans with the eyes close together between the rhinophores have been considered to belong to the genus *Costasiella*.

Marcus (1982) and Jensen (1990) stated that the named species of *Costasiella* are rather diverse in several characters and the genus may have to be split up. In the mean time, eight more species have been named, but the situation remains unclear. The diversity in the reproductive systems seems large in the few species in which details are known. Two genital apertures have been noted in *C. virescens* according to Marcus (1982), *C. pallida* according to Jensen (1990), and *C. mandorahae* according to Jensen (1997). Three apertures occur in *C. nonatoi* according to Marcus & Marcus (1960) and Marcus (1982), *C. liliana* according to Marcus & Marcus (1969) and Marcus (1982), and *C. coronata* (this paper). However, in *C. virescens* the vaginal duct opens in the male atrium (Marcus, 1982), which makes it difficult to decide whether the systems principally differs from *C. coronata* in which the vaginal aperture is in the body wall

just outside the male aperture (Fig. 1 J). An extra aperture has been described that can be considered as an outlet for excess seminal fluids from the genital receptacle (Marcus & Marcus, 1969). It runs via a narrow duct to the dorsum in *C. mandorahae* according to Jensen (1997) and to the left body wall in *C. liliana* according to Marcus & Marcus (1969). It may have been overlooked in other species and does seem of diagnostic value as far I know.

The vaginal aperture is anterior to the oviducal opening in *C. coronata* and *C. virescens*. A fundamentally different character seems to occur in *C. liliana*, where the vaginal opening is posterior of the opening of the oviduct (Marcus & Marcus, 1969: 11 and Abb. 25). Contrary to the other *Costasiella* species, *C. liliana* has a short penial stylet that was unfortunately not figured ["kutikular Mundstück of 13 µm" in Marcus & Marcus (1969); "a quite short stylet" in Marcus (1982)]. Both differences suggest that *Costasiella liliana* is related to *Ercolania* (Limapontiidae). It may be that *C. formicaria* has the same characteristics because Baba (1959) noted that the genital orifice in *Costasiella formicaria* is situated roughly in the same position as in *Stiliger boodleae* (Baba, 1938). Later *S. boodleae* was placed in *Ercolania* after a careful description of its anatomy (Baba & Hamatani, 1970a, b). Note that the presence of a short, pointed penial stylet in *C. pallida* mentioned by Jensen (1985) was later retracted as a mistake (Jensen, 1990).

Up to now, the genital complex has only been described and figured by Marcus & Marcus (1969) for *C. liliana*, Marcus (1982) for *C. virescens*, and in this paper for *C. coronata*. The splitting off to a new genus of *C. liliana* or placing it in *Ercolania* has to wait on a check or redescription of *Costasiella liliana* because mistakes cannot be excluded. *C. liliana* is a junior name for *C. ocellifera* according to Clark (1984), but in the same paper is stated that the ascus is absent in *C. ocellifera* without any comment, while Marcus & Marcus (1969) has explicitly described the ascus in *C. liliana*. Clark (1984) also does not refer to the aberrant order of the genital orifices in *C. liliana*, which has the oviducal aperture frontal of the vaginal aperture while the reverse is found in other *Costasiella* species.

The reno-pericardial elevation may have diagnostic value. In *C. nonatoi* the pericardium lies below the renal tube (Marcus & Marcus, 1960: 151). In *C. pallida* the pericardium seems large, starting at the level of the first row of cerata and extending to about halfway down the body. It has a fringe in the posterior part and along the lateral sides, which disappears in preserved specimens. The fringe contains numerous white branching tubules that may be dorsal veins or renal ducts (Jensen, 1985; 1990). The pericardium is small and covered by the renal area that has a prominent fringe that remains present in preserved specimens of *C. coronata*. Nothing about these characters is known for any of the other species.

Clark (1984) erected the monogeneric family Costasiellidae because the genus *Costasiella* was difficult to place in any of the known sacoglossan families. The original family diagnosis included some species-specific characters (e.g. fusiform

non-flattened cerata, digestive diverticula usually knobby and in grape-like clusters within the cerata, genital apertures polyaulic, foot rather narrowly triangular, oesophageal diverticulum absent) (Clark, 1984). This diagnosis has as remarkable result that the type species of *Costasiella* and several other species including *C. coronata* do not meet the family description. Therefore, it is better to simplify the diagnosis of the Costasiellidae into: ceratiform sacoglossa with the eyes close together; radular teeth blade-shaped with smooth sides, gradually tapering to the tip; penis long, thin and unarmed. Jensen (1996) found the family Costasiellidae unwarranted in her cladistic analysis of the order Sacoglossa. She placed the genus *Costasiella* within the Limapontiidae Gray, 1847 (= Stiligeridae Iredale & O'Donoghue, 1923) and suggested it may deserve the status of a subfamily, thus Costasiellinae. However, even when the status and phylogenetic place of the Costasiellidae seems dubious and the various species have to be placed in different known or still to describe genera and taxa of higher order, it has an indisputable and practical function for the moment. Any change has to wait till more species have properly been described and older descriptions carefully checked.

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