

New records of nudibranchs and a sacoglossan (Gastropoda: Heterobranchia) from Sempu Strait, Indonesia

ANTHON ANDRIMIDA

Department of Marine and Fisheries of East Java Province. Jl. Ahmad Yani No.152 B, Surabaya 60235, East Java, Indonesia. Tel. +62-31-8292326,
✉email: anthonandrimida@gmail.com

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Abstract. Andrimida A. 2022. *New records of nudibranchs and a sacoglossan (Gastropoda: Heterobranchia) from Sempu Strait, Indonesia. Indo Pac J Ocean Life 6: 1-9.* This study reports the additional records of fourteen heterobranch sea slug species from Sempu Strait, East Java, Indonesia, in which thirteen species belong to the Nudibranchia order, and one species belongs to the Sacoglossa order. These species belong to seven families: Plakobranchidae (1 species), Polyceridae (1 species), Discodorididae (2 species), Chromodorididae (7 species), Flabellinidae (1 species), Eubranchidae (1 species), and Facelinidae (1 species). All of these species are recorded for the first time from the Sempu Strait. There are two species that only could be identified to its genus, which are *Chromodoris* sp. and *Eubranchus* sp. This study also found additional record of *Plocamopherus imperialis* Angas, 1864 on the tropical waters, where this species formerly believed only exclusively distributed along the subtropical waters of Eastern Australia and Northern New Zealand. Combined with the previous study on Sempu Strait, to date, 59 species of heterobranch sea slug have been reported and recorded in this area. Species identification was conducted by carefully examining the morphological features of each specimen encountered during the surveys.

Keywords: Distribution, nudibranch, sacoglossan, sea slug

INTRODUCTION

Nudibranchs is one of the most colorful tropical reef dwellers that is very attractive for divers and underwater photographers alike (Jensen 2013). This group of animals belongs to the gastropod class under the Mollusca phylum (Burn 2015). Nudibranchs and their related molluscs are also classified under the opisthobranchs group which include the Order Cephalaspidea P. Fischer, 1883; Sacoglossa Ihering, 1876; Anaspidea Fischer, 1883; Nudibranchia Cuvier, 1817; Pleurobranchomorpha Pelseener, 1906; and Umbraculida Odhner, 1939 (Nimbs and Smith 2017). While the term Ophistobranchia is widely used to address this certain group of shell-less gastropods, recent studies group them into the Heterobranchia subclass (Haszprunar 1985) as there is any precise distinction between the opisthobranchs and the pulmonates (Burn 2015). The epicenter of heterobranch sea slug diversity is located around the Indo-Pacific area, which holds around 3,000 species of heterobranch sea slug, where the highest diversity is concentrated on the Western Pacific, which borders Indonesia, Philippines, and Papua New Guinea (Gosliner et al. 2019). In Indonesia alone, the overall heterobranch sea slug's species number is still uncertain, and might indicate that it holds a higher diversity than the areas adjacent to it (Gosliner et al. 2019). This case might be caused by the surveys that haven't been evenly distributed on every part of Indonesian Waters. Recent studies about heterobranch sea slug's diversity are still heavily concentrated on the Eastern Part of Indonesia, mainly the Sulawesi, Maluku, and Ambon (Kaligis et al.

2018; Yonow and Jensen 2018; Kristiana et al. 2019; Ompi et al. 2019a,b; Undap et al. 2019).

Sempu Strait, East Java, Indonesia is a narrow strait, on which it only extends for less than 350 m at its narrowest points. This strait separates the Java mainland from Sempu Island. The island itself has area around 877 hectares and has been proclaimed as a "Nature Monument" since the Dutch Colonial Period through the *Besluit van den Gouverneur Generaal van Nederlandsch Indie van 15 Maart 1928*, No. 46 (Stsbl. 69) (Appelman 1940). The underwater around Sempu Island is known to hold a diverse marine ecosystem, from mangroves and seagrass meadow, to the coral reef (Luthfi et al. 2016; Semedi and Luthfi 2019). These diverse ecosystems provide the necessity for the heterobranch sea slug to thrive, which they are known to consume algae, sponges, coral polyps, bryozoans, and hydroids that are found in abundance when sustained by such diverse ecosystem (Purba et al. 2013). Small islands often could hold their own unique diversity of flora and fauna. However, small islands are also facing increased anthropogenic threats that risk the diversity on the surrounding area (Nimbs et al. 2020). This factor, combined with the short life of most heterobranch sea slugs which usually live less than 12 months, might affect the existence of this group of animals which is already regarded as spatio-temporary rare (Nimbs and Smith 2017).

Previous study on heterobranch sea slug's inventory on Sempu Strait found 45 species overall, on which 35 species of them belong to the Nudibranchia order, 6 species belong to the Aplysiida order, 2 species belong to the Cephalaspidea order, and 2 species belong to the

Sacoglossa order (Andrimida 2021). This study is a continuation of the survey before, in which the aim of this study is to describe additional heterobranch sea slug species found from a further survey conducted from August 2019 to December 2021. Thus, with the annexation of the previous study, this study purposes to provide documentation on the diversity of the heterobranch sea slug taxa at Sempu Strait.

MATERIALS AND METHODS

Study area

Sempu Strait, East Java, Indonesia is a 3,5 km long body of water that separates the Sempu Island Nature Reserve from Java mainland. The gap of this strait is less than 400 meters at its narrowest point. The underwater topography of this trait is dominated by patched fringing reefs on both sides of the strait. The shores are usually steep at 0 - 10 meters depth, where the deeper part of the strait is dominated by sand and silt or rocky walls. Among the nine dive sites surveyed during this study, only four dive sites come up with new records for this area (Figure 1). Those sites are Tiga Warna (8°26'22.17"S, 112°40'39.95"E), Rumah Apung (8°26'14.32"S, 112°40'47.95"E), Teluk Semut (8°26'20.6961"S, 112°40'55.9232"E), and Stumbut (8°26'34.23"S, 112°40'45.13"E).

Survey method

Surveys were conducted using SCUBA at nine dive sites on Sempu Strait between August 2019 and December 2021. This survey was conducted as a continuation of previous study on heterobranch sea slug inventory. Roving diver survey methods were conducted over the reef areas, as well as the soft-bottomed and rocky habitats adjacent to them. Roving diver technique is proven to be successful in surveying cryptic marine fauna that has unusual occurrence and usually shows up in a little number (Munro 2005; Mantiri et al. 2021). This survey method is also proven to be successful as my previous studies on Sempu Strait (Andrimida and Hermawan 2019; Andrimida 2021) also used this method. Thus, this survey method has been consistently conducted in order to search and discover the potential of new heterobranch sea slug species records in this area.

Most of these surveys are conducted during daytime, with accidental and sporadic nighttime surveys also done during the time period. The data collection is conducted by carefully documenting each species using underwater camera that capable of shooting in macro. Each specimen encountered is examined closely and photographed for identification purposes. Detailed photographs of the specimen were identified based on their external morphology compared to relevant literature (Colin and Arneson 1995; Yonow 2008; Burn 2015; Gosliner et al. 2019). Every heterobranch sea slug identified during this study has its taxon validity verified with the World Register of Marine Species.

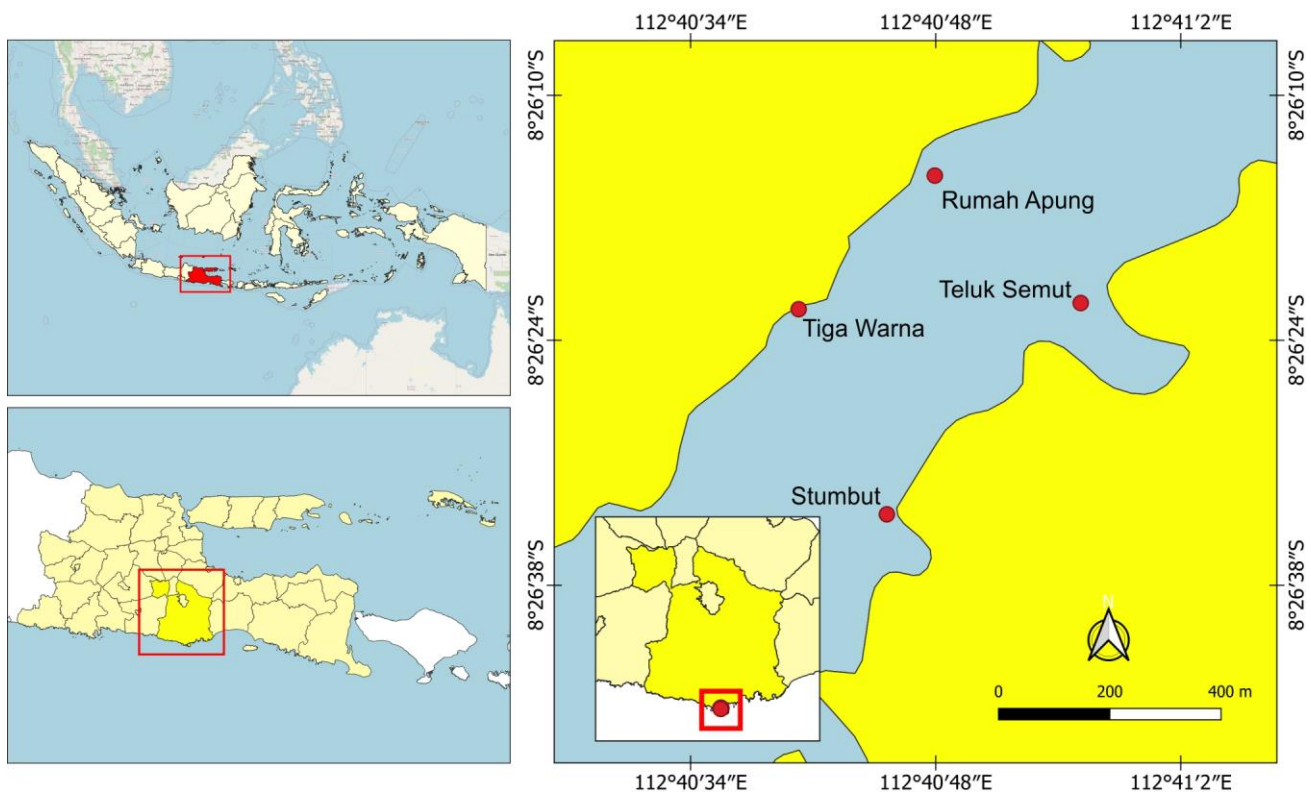


Figure 1. Location of Sempu Strait, East Java, Indonesia indicating the survey sites from this study where sites with new record(s) highlighted with black dots, while the sites that surveyed without any new record marked with white dots

RESULTS AND DISCUSSION

A total of fourteen species were recorded and identified in this study, in which all of them are new records in this area. These fourteen species consist of one sacoglossan sea slug species and thirteen nudibranch species. These species belong to seven families, which are Plakobranchidae (1 species), Polyceridae (1 species), Discodorididae (2 species), Chromodorididae (7 species), Flabellinidae (1 species), Eubranchidae (1 species), and Facelinidae (1 species). Hence, combined with all of the previous studies (Andrimida 2021), there are 59 species of heterobranch sea slug have been recorded from Sempu Strait, which consists of 48 nudibranchs species, 6 aplysiids sea hares, 2 cephalaspids, and 3 sacoglossan sea slugs species. Each species that has been identified in this study is presented here along with the diagnostic features, general geographic distribution with its recent distribution on Indonesian Waters if available. In addition, the photograph of the specimens found on this survey is also provided.

Species accounts

Class Gastropoda Cuvier, 1795

Subclass Heterobranchia Burmeister, 1837

Superorder Sacoglossa von Ihering, 1876

Family Plakobranchidae J. E. Gray, 1840

Genus *Thuridilla* Bergh, 1872

Thuridilla gracilis Risbec, 1928

Photographic record

Figure 2.A. Stumbut, Sempu Strait, East Java, Indonesia, October 2019, one individual was photographed crawling on open rocky substrates at 5 meters depth. Size approximately less than 2 cm.

Description

Long and slender-bodied sacoglossan. While moving, the notum is covered by the fold of parapodia. The mantle is greenish-black with white longitudinal lines and occasional speckles on its side. Parapodial margin on the dorsal side of the body bordered with thin orange stripe. Such orange band is also present on the tip of each rhinophore and the tip of the tail. When alerted, it opens the parapodia and shows its bluish back.

Remarks and distribution

The morphological description and coloration of the specimen stated above are in agreement with the description of this species by Yonow (2012), Gosliner et al. (2019), and Undap et al. (2019). This species is commonly seen in shallow waters, crawling in open spaces or under coral rubbles (Gosliner et al. 2019). Widely distributed in the Indian and Western Pacific Ocean (Gosliner et al. 2019), also reported as far as Lizard Island Australia and Okinawa, Japan (Furfaro et al. 2014). Indonesia: Lembah Strait (Ompi et al. 2019a,b), Sangihe Islands (Undap et al. 2019) Bangka Archipelago (Papu et al. 2020), Bunaken (Fisch et al. 2017).

Order Nudibranchia Cuvier, 1817

Family Polyceridae Alder & Hancock, 1845

Genus *Plocamopherus* Rüppell & Leuckart, 1831

Plocamopherus imperialis Angas, 1864

Photographic record

Figure 2.B. Rumah Apung, Sempu Strait, East Java, Indonesia, September 2021, one individual was photographed among green algae near the surface at low tide. Size approximately 8 cm.

Description

The body is covered with red mosaic, bordered with fine lighter red or orange lines. The anterior part of the head is flattened and bordered with small papillae. A series of paired papillae were also found down the upper edge of the mantle. Some of these papillae have a large bulb that flashes when disturbed. The tail is elongated with acute tip, but could be compressed into a paddle-like shape.

Remarks and distribution

Nudibranchs from the Genus *Plocamopherus* are known to be able to flatten their tail into a paddle-like shape, where it could use its tail for short locomotion (Morley and Hayward 2015). Inhabit intertidal rocky shores (Nimbs and Smith 2017; Gosliner et al. 2019). Known only from Eastern Australia and Northern New Zealand (Gosliner et al. 2019). Recorded in Northern Territory, Queensland, New South Wales, Victoria, Tasmania, Lord Howe's Island (Nimbs and Smith 2017) and Christmas Islands (Tan and Low 2014). It is also recorded in Numazu, Shizuoka, Japan (GBIF 2021) where it may represent a distinct species (Gosliner et al. 2019). Possibly first record from Java's Southern Sea and Indonesia.

Family Discodorididae Bergh, 1891

Genus *Halgerda* Bergh, 1880

Halgerda elegans Bergh, 1905

Photographic record

Figure 2.C. Stumbut, Sempu Strait, East Java, Indonesia, October 2019, one individual was photographed among algae and sponge-covered rock at 5 meters depth. Size approximately less than 0.8 cm.

Description

Body rigid and firm, almost oval-shaped. The body profile is high, with a series of interconnected ridges arranged on a reticulated pattern. It has no tubercles at the meeting point of the ridges. Body is whitish-translucent colored, while the ridges are orange-yellow. Around the edge of the mantle, there is a series of evenly-spaced and short black lines. Such lines are also present on the base of each rhinophore, while the rhinophores are white with black on their tip.

Remarks and distribution

This species has a similar appearance with *Halgerda albocristata* Gosliner & Fahey, 1998 where both has notum translucent and covered with yellow color and radiating black lines on the edge of the mantle (Gosliner and Fahey 1998). The difference between the species could be observed by examining the tip of the rhinophore, where *H. albocristata* has white-tipped rhinophore, as well as

radiating white line along its notum (Gosliner et al. 2019). Inhabit open reefs and rocky substrates (Gosliner and Fahey 1998; Gosliner et al. 2019). Widely distributed on the Western Pacific Ocean (Gosliner et al. 2019). Initially described from Pulau Gunung Api in Banda, Indonesia (Bergh 1905), later also recorded from Papua New Guinea and Okinawa (Gosliner and Fahey 1998).

***Halgerda wasinensis* Eliot, 1904**

Photographic record

Figure 2.D. Stumbut, Sempu Strait, East Java, Indonesia, October 2019, two individuals photographed crawling on open dead coral rubble substrates at 5 meters depth. Size approximately 5 cm.

Description

Body rigid and elongated oval-shaped. The body profile is high, with a complex network of sharp-angled ridges. The ridges near the center of the notum are more prominent than the ridges on the edge of the mantle. There are tubercles on each meeting point of the ridges. Body is bright-yellow, while the ridges are darker. The underside and the edge of the mantle are whitish and translucent. The mantle, foot, and underside of the body are covered with black spots. The tip of the rhinophores and gills are black.

Remarks and distribution

Typical *H. wasinensis* has its notum covered with black or brownish color rather than yellow (Rudman 1978). But, some specimens found in some parts Indian Ocean show that this species has a number of color variations, including the one with almost entirely white notum and the one with yellow notum and black spots, just like the specimen found on Sempu Strait (Rudman 2000). Known to be distributed on the Indian Ocean (Gosliner et al. 2019). Mainly from the East Coast of Africa (Eliot 1904), but is also reported from Christmas Islands (Tan and Low 2014) Marshall Islands (Johnson and Boucher 1983).

Family Chromodorididae Bergh, 1891

Genus *Chromodoris* Alder & Hancock, 1855

***Chromodoris magnifica* Quoy & Gaimard, 1832**

Photographic record

Figure 2.E. Tiga Warna, Sempu Strait, East Java, Indonesia, May 2021, one individual photographed crawling on open dead coral rubble substrates at 10 meters depth. Size approximately 6 cm.

Description

The mantle is elongated oval with broad mantle overlap. The body is white with a series of longitudinal black bands in the center of the notum, with shade of bluish-white between these bands. There is a broad orange sub-marginal band near the edge of the mantle, as well as the edge of the foot. The rhinophores and gills are orange.

Remarks and distribution

This species bears a close resemblance to *Chromodoris africana* Eliot, 1904, where both have white-colored notum with black elongated and orange bands on the mantle's

edge. But the difference between the two is that *C. magnifica* has a thin, white band on the outer edge of the orange band, which is absent in *C. africana* (Gosliner et al. 2019). Commonly found on outer reef walls or rocky slopes (Md. Salleh et al. 2000; Gosliner et al. 2019). Distributed on the Western Pacific Ocean (Gosliner et al. 2019). Indonesia: Ambon (Fransen and Goud 1999), Bangka (Papu et al. 2020), Bunaken (Fisch et al. 2017), Lembeh (Ompi et al. 2019a,b) Situbondo (Aunurohim and Raraswati 2010).

***Chromodoris* sp. 1**

Photographic record

Figure 2.F. Stumbut, Sempu Strait, East Java, Indonesia, October 2019, one individual photographed on top of algae-covered massive coral at 5 meters depth. Size approximately 0.5 cm.

Description

This could be the juvenile stage from one of the blue-colored *Chromodoris* nudibranch, although the exact species is still to be defined as the specimen found still having a pale coloration and a rather incomplete marking. The mantle is oval with broad mantle overlap, the edge of the mantle is also moderately undulated. The body is pale violet-blue, with three large white spots on the center of the notum. The rhinophores and gills are translucent white, with a deep-orange tip on its rhinophores and each of its gill's branches.

Remarks and distribution

The closest resemblances based on its characteristics above are *Chromodoris lochi* or *Chromodoris diana*, where both don't have any orange band on the edge of the mantle (Rudman 1982; Gosliner and Behrens 1998). However, in its current form, with still underdeveloped marking and coloration, further examination is needed to give the exact species identification of this specimen. *Chromodoris* nudibranch mainly has a widespread distribution in the Indo-Pacific (Gosliner et al. 2019)

Genus *Mexichromis* Bertsch, 1977

***Mexichromis aurora* R. F. Johnson & Gosliner, 1998**

Photographic record

Figure 2.G. Stumbut, Sempu Strait, East Java, Indonesia, October 2019, a pair of this nudibranch photographed on top of sponge-covered coral rubble at 10 meters depth. Size approximately 2 cm.

Description

The body shape is rounded-oval with broad mantle overlap. The background color of the mantle is pinkish purple, where it becomes darker towards the edge of the mantle and the tip of the foot. There are three wide parallel creamy white lines on the center of its mantle, each outlined with a thin white line. The light pink area of the mantle is covered with dark purple spots with occasional smaller white spots. The rhinophores and the gills have a dark orange base and tip, with white bar in between.

Remarks and distribution

The notum and foot are covered with light pink color and darken into maroon towards the edge with three wide whitish-yellow bands (Johnson and Gosliner 1998). Inhabit deeper parts of the reef, from 10 to 58 meters (Johnson and Gosliner 1998; Gosliner et al. 2019). The distribution of *M. aurora* is limited to the Western Pacific Ocean (Gosliner et al. 2019). In Indonesia, known to be recorded from Bangka (Papu et al. 2020) and Lembeh (Johnson and Gosliner 1998).

Genus *Verconia* Pruvot-Fol, 1931

Verconia simplex Pease, 1871

Photographic record

Figure 2.H. Tiga Warna, Sempu Strait, East Java, Indonesia, September 2020, a pair of individuals photographed on open dead coral rubble substrates at 7 meters depth. Size approximately less than 1.5 cm.

Description

The body shape is elongate-oval, with a narrow mantle overlap. Foot is elongated, has a sharp-angled tip, and extends beyond the mantle edge. The mantle is pink with white band on the edge, although it could vary from white to pink. The underside of the body is white. On the border of the mantle, sometimes edged with broken bright red or orange bands. Gill and rhinophore tipped with orange.

Remarks and distribution

Although the original description (as *Chromodoris simplex*, Pease 1871) stated that this nudibranch has pink body-color (Pease 1871), there are variations that show white body-color (Rudman 1995; Gosliner et al. 2019) as well as pale pink (Yonow 2018). These color variations might be attributed as self-defense mechanisms to fend off predators or camouflage purposes (Rudman 1991). Widespread in Indo-Pacific (Gosliner et al. 2019). Indonesia: Bangka (Papu et al. 2020), Sangihe Islands (Undap et al. 2019), also possibly Bunaken (Eisenbarth et al. 2018).

Genus *Hypselodoris* Simpson, 1855

Hypselodoris decorata Risbec, 1928

Photographic record

Figure 2.I. Teluk Semut, Sempu Strait, East Java, Indonesia, June 2021, one individual was photographed inside the crevice of algae-covered rock at 12 meters depth. Size approximately 2.5 cm.

Description

The body color is cream-yellow on the center of the notum and orange on the side to the edge of the mantle. There are thin parallel white lines along its mantle, with purple and opaque white spots between the lines. The rhinophores are cream-white, with three rhinoporal red rings. The outside of the gills is red, while the inside is white.

Remarks and distribution

This species bears a close resemblance to *Hypselodoris maculosa* described in a previous publication in Sempu Strait (Andrimida 2021). The difference is *H. maculosa* has only two rhinoporal red rings rather than three as in *H.*

decorata (Gosliner et al. 2019). Abundant in shallow reefs (Gosliner et al. 2019). Distributed on Western Pacific Ocean (Gosliner et al. 2019) Indonesia: Bangka (Papu et al. 2020), Bunaken (Eisenbarth et al. 2018).

Hypselodoris confetti Gosliner & R. Johnson, 2018

Photographic record

Figure 2.J. Stumbut, Sempu Strait, East Java, Indonesia, October 2019, two separate individuals photographed, both crawling on top of algae-covered rubble at 12 and 15 meters depth. Size approximately 4 cm.

Description

The body color is whitish to blue-gray, ornamented with numerous large yellow spots and smaller dark blue to black spots scattered on the surface of the notum. The side, underside, and foot also have the color and the pattern as the notum. Gill pocket is slightly elevated, with the gills colors are blue basally, with red line along the inner and outer edge of the gill branch, while the tip is red to orange. The outside middle portion of the gills is decorated with three to five yellow spots. The base of rhinophores is dark blue to purple, while the upper half is bright red.

Remarks and distribution

This is the first nudibranch on this paper that resembles *Hypselodoris infucata* and *H. kanga* from previous publications (Andrimida 2021) and the recently discovered *H. roo* (Epstein et al. 2018). Distributed on Western Pacific (Gosliner et al. 2019), Papua New Guinea, Philippines, Thailand, probably Hong Kong and Indonesia (Epstein et al. 2018; Mehrotra et al. 2021)

Hypselodoris roo Gosliner & R. Johnson, 2018

Photographic record

Figure 2.K. Tiga Warna, Sempu Strait, East Java, Indonesia, September 2020, one individual photographed, hanging under the crevice of algae-covered rock at 8 meters depth. Size approximately 1 cm.

Description

The body color is whitish to pale blue-gray with numerous small to large yellow spots, as well as smaller dark blue to black spots scattered irregularly on the surface of the notum. The side and underside of the body, as well as the foot also have the color and the pattern as the notum. Gills are white, with red lines along the inner and outer edge of the gill branch, while the tip is red to orange. The outside center of the gills is decorated with a single opaque white spot. Rhinopore red with white spot at the back end of the rhinophore.

Remarks and distribution

This is the second nudibranch on this paper that resembles *H. infucata* and *H. kanga* from previous publications, also with *H. confetti* (previous species). Each of these species of *Hypselodoris* could be differentiated from each other by carefully examining the pattern and the color of their gills (Epstein et al. 2018; Gosliner et al. 2019). Distributed in the Western Pacific (Gosliner et al. 2019), notably Indonesia and Philippines (Epstein et al. 2018).

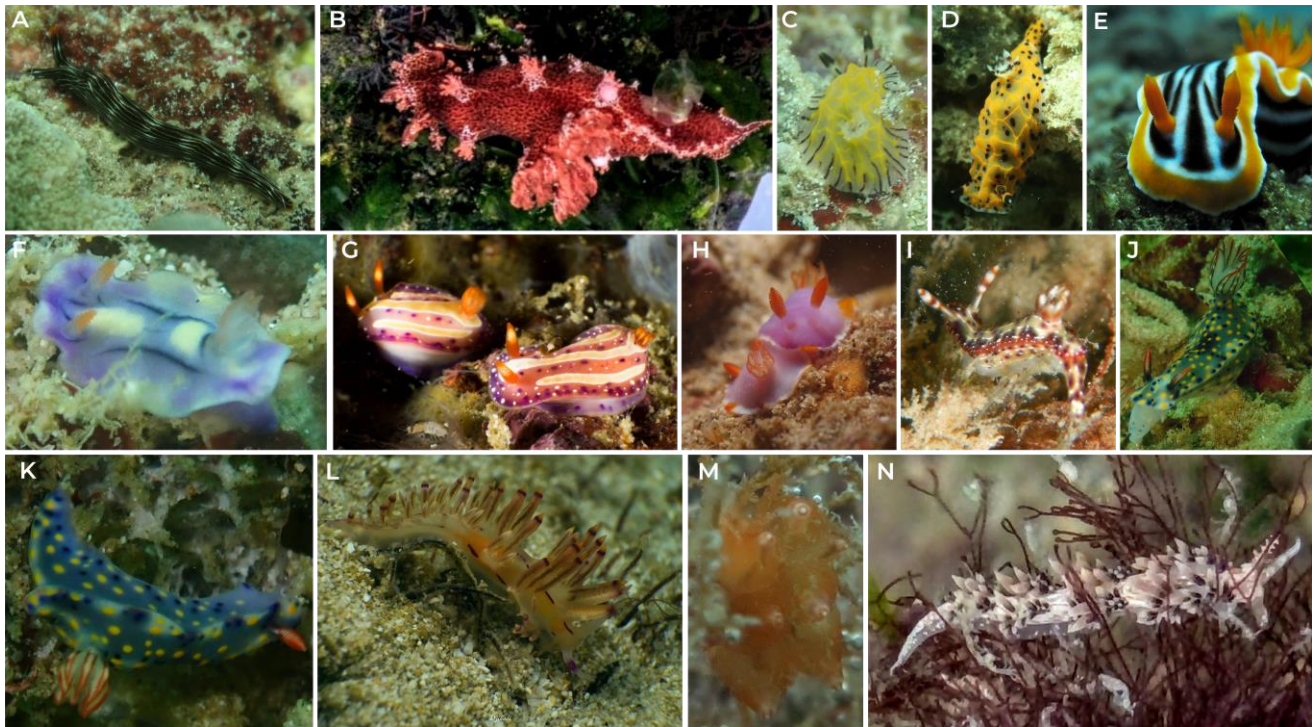


Figure 2. Heterobranchia from Sempu Strait, East Java, Indonesia. A. *Thuridilla gracilis*, B. *Plocamopherus imperialis*, C. *Halgerda elegans*, D. *Halgerda wasinensis*, E. *Chromodoris magnifica*, F. *Chromodoris* sp., G. *Mexichromis aurora*, H. *Verconia simplex*, I. *Hypselodoris decorata*, J. *Hypselodoris confetti*, K. *Hypselodoris roo*, L. *Coryphellina lotos*, M. *Eubranthus* sp., N. *Phidiana bourailli*. Photograph by Anthon Andrimida (A, C-D, F, J-K, M) Rudi Hermawan (B & N), Browy E. Untoro (E & H), Djihadi Nopoto (G & L), I Nyoman Januarsa (I)

Family Flabellinidae Bergh, 1889

Coryphellina O'Donoghue, 1929

Coryphellina lotos Korshunova et al. 2017

Photographic record

Figure 2.L. Tiga Warna, Sempu Strait, East Java, Indonesia, September 2020, one individual photographed, crawling on an open sandy substrate at 10 m depth. Size approximately less than 2 cm.

Description

Body slender and narrow, with the posterior end forming an acute point. Rhinopores are papillate and shorter than oral tentacles. It has rows of fusiform cerata with pointed tip and visible digestive gland. Background color light violet, with a series of interrupted dark violet lines in the center of notum and on each side of the notum. Oral tentacle lilac with translucent tips, while the subapical part of the rhinophore and cerata reddish with white translucent tips. The visible digestive glands are brown.

Remarks and distribution

This species is identical to *Coryphellina rubrolineata* O'Donoghue, 1929 where *C. lotos* has a series of interrupted purple lines on the center of its notum rather than a long uninterrupted line in *C. rubrolineata*. *Coryphellina lotos* also has purple subapical ring with the tip of cera has an identical color with the background coloration, rather than red-violet cera with yellow tip as in *C. rubrolineata*. Inhabit shallow to deep reef (Gosliner et al. 2019). Distributed on the Western Pacific (Gosliner et

al. 2019), no recent scientific record from Indonesia, but reported from Bali and Ambon based on some macrophotography online forum.

Family Eubranthidae Odhner, 1934

Genus *Eubranthus* Forbes, 1838

Eubranthus sp. 1

Photographic record

Figure 2.M. Rumah Apung, Sempu Strait, East Java, Indonesia, August 2020, one individual photographed among hydroids that cover the net of Rumah Apung near the surface. Size approximately 0.5 cm.

Description

Body covered with inflated cerata, each with an acute tip. Background color is deep orange and slightly transparent. Under the bright daylight, the brown digestive glands could be easily observed. Also, there are white subapical rings on each cerata, while the apices are white.

Remarks and distribution

The difference between this specimen and *Eubranthus mandapamensis* Rao, 1968 reported from Sempu Strait before (Andrimida 2021), is this specimen has smooth rhinophore rather than annulated rhinophore While some nudibranch from the *Eubranthus* Genus has a widespread distribution in Indo-Pacific, such as *E. mandapamensis*, The undescribed species that has smooth rhinophore (stated as *Eubranthus* sp. 2 in Gosliner et al. (2019) has a limited distribution in Indonesia.

Family Facelinidae Bergh, 1889**Genus *Phidiana* Gray, 1850*****Phidiana bourailli* Risbec, 1928***Photographic record*

Figure 2.N. Rumah Apung, Sempu Strait, East Java, Indonesia, August 2020, one individual photographed among hydroids and algae that covers the net of Rumah Apung near the surface. Size approximately less than 2 cm.

Description

Body profile is high and elongated, with the posterior edge of the body narrow and sharp. The tentacles are long and blunt on their tip. Rhinopores are shorter than the oral tentacles and annulated. The cerata are short, no more than the half-length of the rhinophore. Background color is translucent white, with white speckles scattered on the head and along the notum. Body decorated with occasional orange broken stripes, usually found between the rhinophores and ceratal clusters, as well as on the side of the body. The tentacles are translucent with white band covering almost half of the tentacles. Cerata is also translucent, but covered with dense brownish-black spots, covering roughly half of the cerata.

Remarks and distribution

Some nudibranchs from the Genus *Phidiana* have a nearly identical body shape, where the coloration could be the key to differentiate with one another. This species could be identified by examining the genital pore aperture and cerata cluster (Rudman 1980). Indian and Western Pacific Ocean (Gosliner et al. 2019) and reported from Australia's South East Coast (Nimbs et al. 2015).

Discussion

This research is a continuation of the preliminary heterobranch sea slug's survey in this area prior to August 2019. With fourteen additional species found during this research, combined with the publication before, thus a total of 59 heterobranch sea slug has been recorded in Sempu

Strait. The most remarkable addition to the heterobranch sea slug species checklist at Sempu Strait might be the *P. imperialis*, which this species was formerly believed to have distributed on the subtropical waters of Eastern Australia and New Zealand (Gosliner et al. 2019). Recent records from Christmas Island (Tan and Low 2014), which is located about 800 km southwest of Sempu Strait might indicate that this species might also enter the tropic waters.

Among the fourteen species recorded in this study, there are two specimens of nudibranch that only could be identified to its genus level. The first specimen, *Chromodoris* sp. was found on its juvenile stage, thus the markings on its notum were not fully developed. The examination of the general morphology concluded that this specimen indeed belongs to the Chromodorid nudibranch. The determination of the species remains unclear as there is no other blue-colored *Chromodoris* encountered in this area. The second specimen, *Eubranchus* sp. has identical morphological with *E. mandapamensis* described in the previous study. Except, this specimen has rather translucent orange-covered body with smooth rhinophore, whereas the *E. mandapamensis* has more yellowish color with purple subapical ring on its cerata and also has annulated rhinophore. Both species encountered similar substrates, on which both are found clinging on hydroid on shallow waters at Rumah Apung.

In general, the number of heterobranch sea slug species found on Sempu Strait is relatively higher than in another location in the Western Part of Indonesia, while still dwarfed by the heterobranch sea slug species number found in the Eastern Part of Indonesia. The local conditions on each location, such as the availability of prey and predators as well as natural and human disturbance, and the variety of habitats has been thought to be the main driving factors on the difference of heterobranch sea slug's species number (Ompi et al. 2019a,b; Mantiri et al. 2021). This reason could also indicate the contrast difference between the species abundance among the sites on Sempu Strait as observed by previous studies in this area (Andrimida and Hermawan 2019).

Table 1. Higher taxa of heterobranch sea slug in Sempu Strait, East Java compared to other areas in Indonesia

Sites	Expedition year	Order				Total	Source
		Cephalaspidea + Runcinida	Aplysiida	Sacoglossa	Nudibranchia + Pleurobranchida		
Sempu Strait	2018 - 2021	2	6	3	48	59	This study and [1]
Bangka Arch.	2017 - 2018	5	2	15	128	150	[2]
Ambon	2018	11	6	12	109	138	[3]
Bunaken NP	2003 & 2015	26	4	15	80	135	[4]
Lembah	2001 - 2010	2	2	6	75	85	[2]
Pasir Putih	2008	1	1	2	27	31	[5]
Tulamben	2020	0	0	5	26	31	[6]
Sangihe	2016	0	0	3	20	23	[7]
Paiton	2011	0	1	0	15	16	[5]
Humboldt Bay, Jayapura	2021	0	0	0	14	14	[8]
Malalayang	2021	0	0	0	11	11	[9]
Jepara	2020	0	0	0	6	6	[10]

Note: [1] Andrimida 2021, [2] Papu et al. 2020, [3] Yonow and Jensen 2018, [4] Kaligis et al. 2018, [5] Muzaki and Dian 2011, [6] Marchel and Yuda 2021, [7] Undap et al. 2019, [8] Paulangan et al. 2021, [9] Mantiri et al. 2021, [10] Sabdono et al. 2021

In conclusion, this study reveals fourteen additional heterobranch sea slug species found on Sempu Strait, on which thirteen species belong to the Nudibranchia order, while only one species belong to the Sacoglossa order. These species belong to seven families, which are Plakobranchidae (1 species), Polyceridae (1 species), Discodorididae (2 species), Chromodorididae (7 species), Flabellinidae (1 species), Eubranchidae (1 species), and Facelinidae (1 species). Among the species found, there are two nudibranchs that could be identified to its genus level, which are *Chromodoris* sp. and *Eubranchus* sp. While most of the sea slugs recorded have widespread distribution in Indo-Pacific, but one remarkable addition is *P. imperialis*, where various sources stated that this nudibranch is distributed on the Subtropical waters of Australia and New Zealand. This finding might indicate that this species also enters warmer tropical waters. The result of this research combined with the preliminary study of heterobranch sea slug in this area reveals that Sempu Strait has a relatively higher heterobranch species number than another location in Western Indonesia, even though further study is needed to give comprehensive information about the diversity of this certain taxon on Sempu Strait, as well as other areas adjacent to it.

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