



***Murphydoris singaporensis* (Gastropoda: Nudibranchia: Goniodorididae) found in Thailand; with external and first internal description of the specimens**

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Abstract

Specimens of the small nudibranch *Murphydoris singaporensis* Sigurdsson, 1991, monotype of the genus, were found on decaying pieces of wood along a mangrove fringe in Pattani Bay, Gulf of Thailand. This seems to be the first record of the species outside Singapore. Specimens were dissected by hand to describe the digestive and reproductive systems of the species. Only the radular teeth and buccal area had been described before. Striking details are the presence of a large buccal pouch as large as the buccal mass, flat branches of the digestive gland enveloping the hermaphrodite gland, a receptaculum and a bursa connected to the female duct. Differences were noted between the described buccal area in the original description and the present dissection.

Keywords: anatomy, digestive and reproductive systems, mangrove, *Murphydoris*, Singapore, Thailand.

Resumo

Espécimes de pequenos nudibrânquios da espécie *Murphydoris singaporensis* Sigurdsson, 1991, monotípico do gênero, foram encontrados em pedaços de Madeira em decomposição ao longo de uma borda de manguezal na Baía de Pattani, Golfo da Tailândia. Este é o primeiro registro da espécie fora de Cingapura. Os espécimes foram dissecados para descrever os sistemas digestivo e reprodutivo. Apenas os dentes da rádula e área bucal haviam sido descritos antes. Detalhes marcantes são: a presença de uma grande bolsa bucal, tão grande quanto a massa bucal, ramos achatados da glândula digestiva envolvendo da glândula hermafrodita, um receptaculum e uma bursa ligados ao ducto feminino. Foram constatadas diferenças significativas entre a descrição original e as aqui apresentadas para a região bucal.

Palavras-chave: anatomia, sistemas digestivo e reprodutivo, mangue, *Murphydoris*, Cingapura, Tailândia.

Introduction

A new genus for a tiny dorid nudibranch that was found along the north coast of Singapore has been named *Murphydoris* by Sigurdsson (1991). It was placed into the family Goniodorididae H. Adams & A. Adams, 1854. This family contains dorid species that have a reduced mantle margin, a dorsal anus usually surrounded by gills, and rhinophores with lamellae (Beesley et al. 1998). However, in *Murphydoris* the gills near the anus and the lamellae on the rhinophores are missing. *Murphydoris singaporensis* Sigurdsson, 1991 is the mono-type of the genus. Specimens of *M. singaporensis* supervisally look like very small specimens of *Goniodoris castanea* Alder & Hancock,

1845. After the description of *M. singaporensis*, no further information about the species has been published. In the meantime, some photos have been presented of other supposed *Murphydoris* species (Cobb & Willan, 2006; Debelius & Kuitert, 2007; Coleman, 2008). None of these have scientifically been named and described, but they clearly differ from *M. singaporensis* according to the photos.

During a survey in Pattani Bay, Gulf of Thailand, the present authors found specimens of *M. singaporensis* with their eggs in April 2011. This provided the opportunity to study the internal anatomy of which little was given in the original description. Added are the first photos, although not brilliant, of this apparent rare species that may easily be missed in surveys due to its small size and cryptic colouration.

Material and methods

(Figs 1-14)

Specimens were carefully searched by eye from decaying wooden sticks with some cover of bryozoans. After collection, the slugs were taken to the laboratory, placed alive in Petri dishes to see their behaviour. Then most were narcotized with $MgCl_2$ and preserved in a 7% formaldehyde - seawater solution. Seven specimens were dissected by hand aided by a 4 - 64x stereo microscope and using fine (diameter of 0.15 and 0.2 mm) metal needles. Measurements were taken of specimens under the microscope using the program Motic Images Plus 2.0 running on Window XP.

Abbreviations: **ag**, albumen gland; **am**, ampulla; **an**, anus; **bc**, bursa copulatrix; **bp**, buccal pump; **cc**, central canal; **dg**, digestive gland; **ey**, eye; **fa**, female aperture; **fg**, female glands (capsule en mucus glands); **hd** – hermaphrodite duct; **hg**, hermaphrodite gland; **in**, intestine; **lbw**, left body wall; **lo**, long oviduct; **lt**, lateral tooth; **ma**, male aperture; **mo**, mouth; **mt**, marginal tooth; **oa**, oviducal aperture; **oe**, oesophagus; **ph**, pharynx; **pr**, prostate; **ra**, radula; **rbw**, right body wall; **rs**, receptaculum seminis; **rh**, rinophore; **ri**, ridge (mantle edge); **so**, short oviduct; **st**, stomach; **va**, vaginal aperture; **vd**, vas deferens

Systematics

Family Goniodorididae Sigurdsson, 1991

Genus *Murphydoris* Sigurdsson, 1991

(Type species: *Murphydoris singaporensis* Sigurdsson, 1991, by original designation)

Murphydoris singaporensis Sigurdsson, 1991

Material examined: 11 specimens, length alive 1.7-2.4 mm, with their egg-strings. Found in Pattani Bay, Thailand, along the mangrove fringe on Leam Tachi (06°56'11.4" N, 101°14'02.7" E). Coll. Swennen & Buatip, 13 April 2011. Two were used for studying behaviour, seven were dissected and one is stored in the collection of the NCB Naturalis Leyden (ZMA.MOLL.354781) and one in the museum of the University in Pattani.

Description

External appearance (Figs 1, 2, 7 and 11). Creeping specimens were 1.70-2.37 mm long and 0.51-0.74 mm wide. The body wall was partly translucent with numerous low tubercles and several sharp spiculae (Figs 1, 2). The rhinophores were solid and had blunt tips. They were smooth to somewhat wrinkled, but not lamellate. The foot was as wide as the body with rounded frontal corners. Foot length was about 3.0-3.8 times foot width. The body was high and angular, accentuated by a small upstanding ridge (mantle edge) along the flat dorsum from besides the rhinophores up to besides the anus. There were 3-4 small appendages on each side at the end of the ridge. The fringe of the narrow ridge could be kept straight, but also kept with 3-4 extensions filled with sharp spiculae. Spiculae occurred also elsewhere in the skin including the foot (Figs 1, 2, 7). Anus dorsal on the midline in the posterior part of the dorsum; peri-anal gills were lacking. A shallow genital vestibule was found on the anterior part of the right body wall (Fig 11). In the vestibule were united the male aperture directly followed by the oviducal and vaginal apertures (Fig 11).

A nephropore could not be located.

Live colouration (Figs 1 and 2). Dorsal skin largely pale and transparent, with reddish-brown spots. In addition, several transparent spiculae and unicellular, colourless glandular cells scattered in the surface layer; these cells were flat, and round to oval, mean length 22 μm , mean width 13 μm (N=10).

Internal characteristics (Fig 6). Nerve ring yellowish with four main ganglions. Eyes (height 65 μm and width 47 μm), black with colourless, transparent lens (Fig 6). The heart is situated in front of the anus.

Digestive system (Figs 4, 8, and 13). Buccal mass (pharynx) about 300 μm long and 350 μm high with a large, muscular, buccal pouch on top (Fig 4). Radular formula about 27 x 1.1.0.1.1. Lateral teeth wide and curved [mean length 51.2 μm (49-52 μm), mean width 35.8 μm (34-37 μm), N= 5] with a row of fine denticles along the inner border of the large denticle. Marginal teeth small [mean length 16 μm (15-18 μm), mean width 12 μm (11-13 μm), N= 5] with two sharp denticles (Figs 5, 12).

The oesophagus is thin, pale with dark dots. The small stomach is central in the body (Fig 13). The intestine is pale with dark dots, and runs upwards from the dorsal side of the stomach via a large loop in frontal direction turning back as a thin tube to the anus (Figs 8, 13). A flat, wide branch of the digestive gland, pale with several dark dots, originate from both sides of the stomach. Both split up into a few branches running laterally and uniting ventrally by which they partly envelope the hermaphrodite gland (Figs 8, 13).

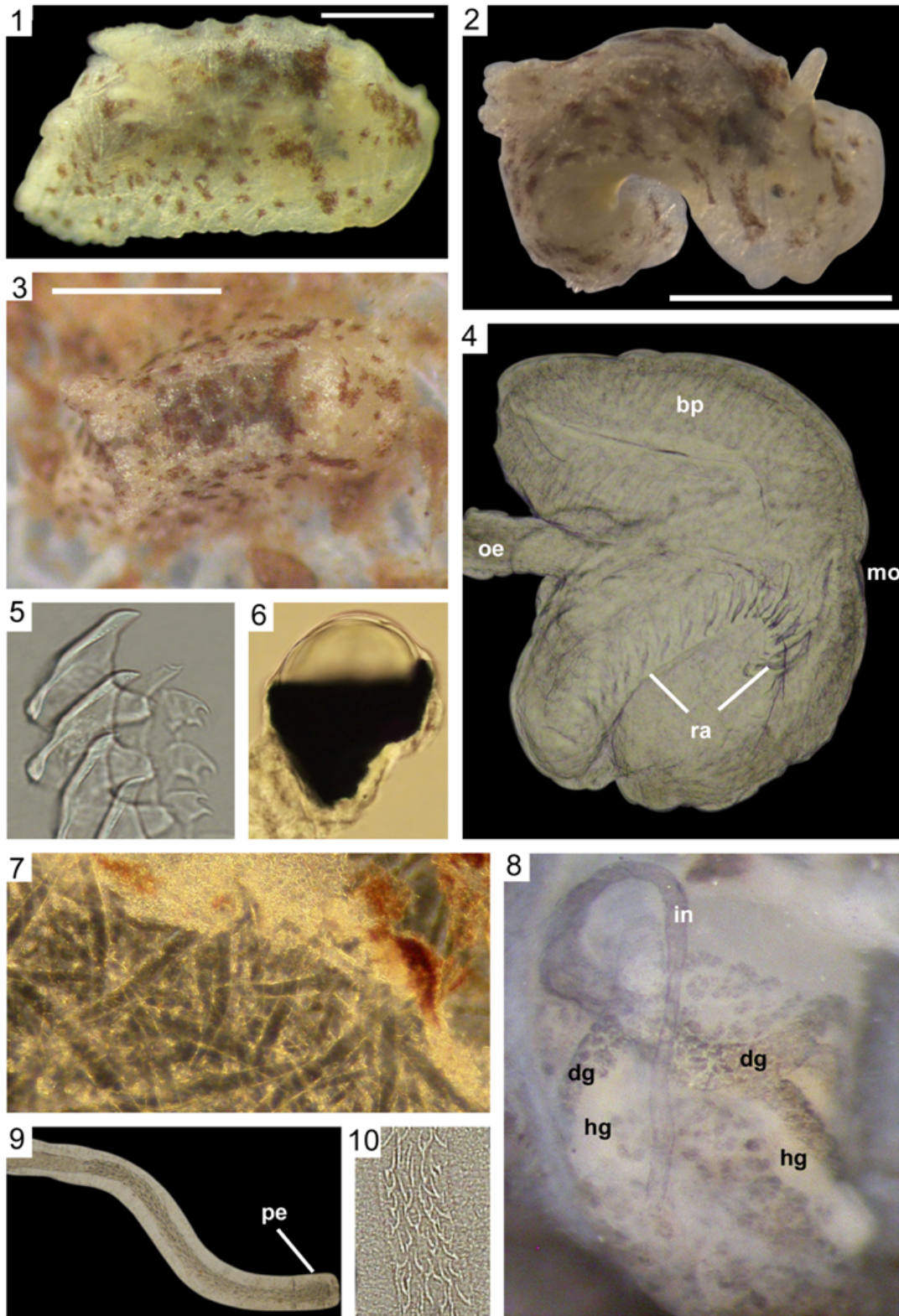
Reproductive system (Figs 9, 10, 12 and 14). The hermaphrodite gland -in fact a ball of pale yellow, hermaphrodite follicles that all can be separated-, partly enveloped in the flat, wide branches of the digestive gland. The hermaphrodite gland runs from the tail to below the stomach area. The ampulla looks blackish and is situated in the left side of the body in front of the stomach (Fig 14). After the split of the hermaphrodite duct into the vas deferens and the short oviduct, the latter contacted the pale central canal on top of the female (capsule and mucus) glands. The white albumen gland looks granular, and is largely covered by the female glands. The vaginal duct has a long, dark receptaculum seminis, and a not pigmented

bursa copulatrix (Fig 12). The vas deferens (diameter about 28 μm) soon enters the prostate at the left of the median line dorsal of the ampulla (Fig 14). The prostate (diameter about 157 μm) is yellowish with small black dots. The vas deferens after the prostate is white and goes to the right side and get internal spines in the distal part over a length of about 330 μm . The penis is short with internal and external armature (Figs 9, 10, 14).

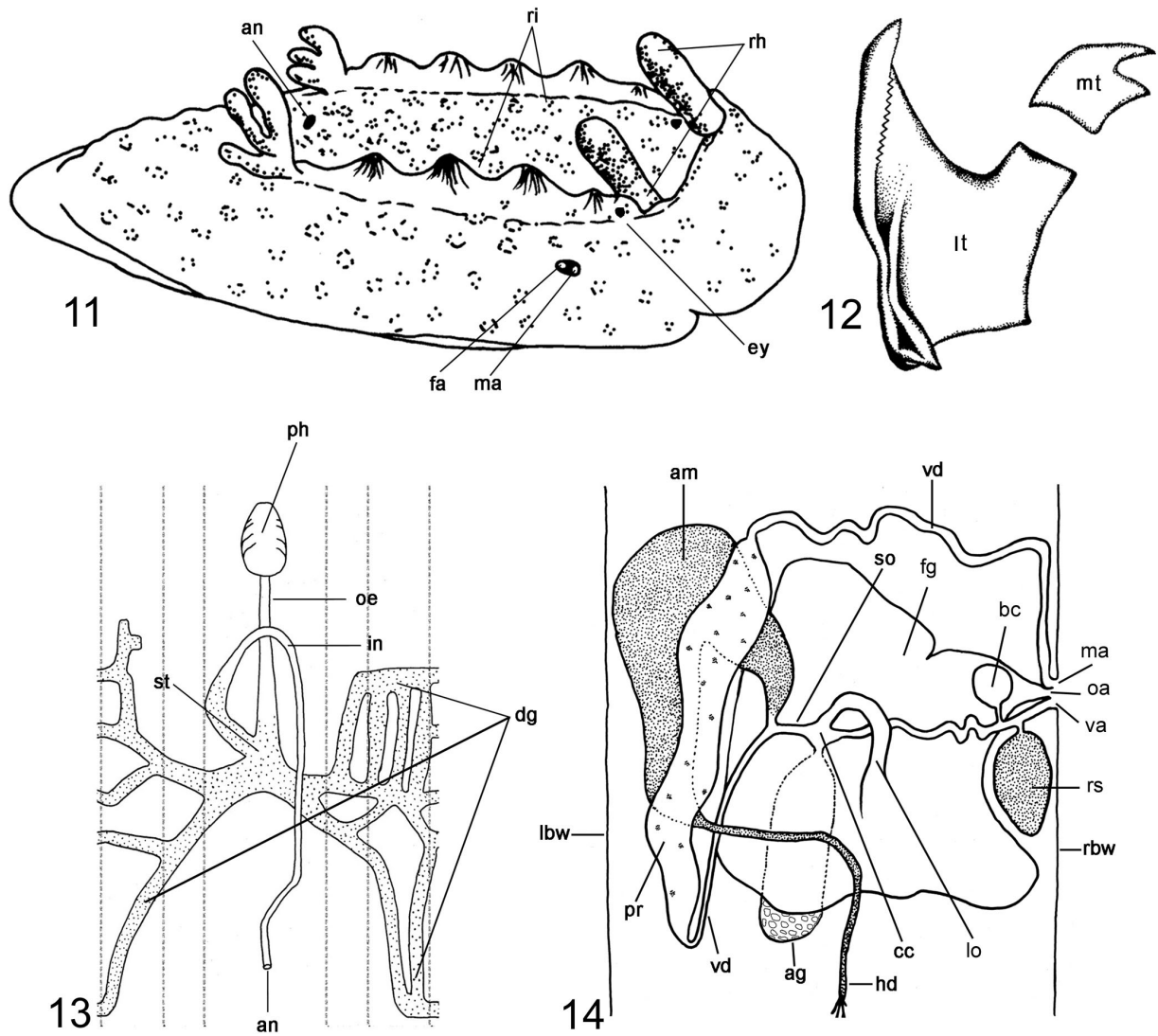
Reproduction (Fig 14). Egg bands were found in Pattani Bay on 13 April 2011. The bands were more or less circular length 2.8 mm and height 0.5 mm. Mean diameter of the egg capsules 103 μm (range 97-110 μm , N=15).

Discussion

Although the specimens could positively be identified as *Murphidoris singaporensis*, some differences were noted compared to the description given by Sigurdsson (1991). The pigment patterns appear more variable than described. The horseshoe-shaped spot behind the rhinophores and the median spot in front of the rhinophores were in most of the Thai specimens less prominent than in the original description, but some concentrations of pigment indeed were seen on these sites. The buccal mass or pharynx is very small in the description and drawing of Sigurdsson (1991: fig 1 D), while in the Thai specimens its size does not differ much with that of the dorsal buccal pump (Fig 4). The presence of an "oesophageal pump" is not clear in the figure of Sigurdsson (1991: fig 1D) and could also not be confirmed in our specimens. According to Sigurdsson (1991: 260), the genital system would be typical for the family goniodorididae, but neither details nor reference are given, and only the small spines on the penis are mentioned and depicted. Penis and spines in the vas deferens look indeed similar as in *Goniodoris nodosa* (Forbes & Goodsir, 1839) (see Pruvot-Fol, 1954). It looks that the penis is formed by a partial evagination of the spiny vas deferens. However, when the whole part with internal spines would do so, the penis would be extremely long compared to the size of the body. The function of external and internal armature in this organ is not clear. The receptaculum seminis and bursa copulatrix of



Figures 1-10. Morphology of *Murphydoris singaporensis*. **1-3.** Three different specimens from Pattani Bay, photographed in lab (bar = 500 µm), **1.** external right view; **2.** same view; **3.** Dorsal view, photographed on the bryozoans colony on which it was found; **4.** Buccal mass in lateral view made semitransparent by glycerin showing the large buccal pump and the site of the radula; **5.** Part of the radula showing lateral and marginal teeth; **6.** Eye; **7.** Part of the skin showing spiculae; **8.** Dorsal view of the body with the skin removed showing the intestine and the dotted branches of the digestive gland around the hermaphrodite; **9.** Part of the vas deferens with the small penis; **10.** Internal armature in the vas deferens (For sizes see text).



Figures 11-14. 11. Drawing of Morphology of the *Murphydoris singaporensis*. 11. Latero-dorsal view showing position of important details; 12. Radular teeth; 13. Diagram of the digestive system: central part is dorsal, the narrow parts are both lateral, and the outer ones are the ventral parts that are cut over the centre; 14. Diagram of the reproductive system in dorsal view (For sizes see text).

Goniodoris castanea Alder & Hancock, 1845 are similarly attached to the female duct as in *Murphydoris singaporensis* (Fig 14) (see Schmekel & Portmann, 1982: Abb. 7d).

Since the creation of the genus *Murphydoris* with *M. singaporensis* as mono-type (Sigurdsson, 1991), some photos have been published of other *Murphydoris* species (Cobb & Willan, 2006; Debelius & Kuitert, 2007; Coleman, 2008). None of these have scientifically been described, but these species clearly differ from *M. singaporensis*. Apparently, *M. singaporensis* has only been recorded from Singapore and no further reports have been published since its description. Therefore, the present discovery of the species in the Gulf of Thailand is an important extension of the known range.

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