

***Dictyurus purpurascens*, a New Record of Marine Red Alga from Phang Nga Coast, Western Thailand**

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ABSTRACT

This study represents the first record of the marine red alga *Dictyurus purpurascens* in Thailand. Specimens were collected from Natai Beach, Phang Nga Province, located on the Andaman Sea coast in southern Thailand. This species was commonly found in intertidal and shallow subtidal habitats, attached to the beachrock platform at depths between 3 and 5 m. The alga is characterized morphologically by a thallus arising from a discoid holdfast, spongy body supported with a spiral network of wide monosiphonous filaments, smooth-edged margin, and alternate distichous branching. The apices show network connection developed from shorter branchlets, as well as the production of the characteristic mesh structure. The color of this alga is most typically rose-red to pinkish-red in the field. The cortication is complete throughout the thallus, beginning at the tip and thickening toward the base. The occurrence of the species was previously reported from other parts of the Indian ocean. This is the first record of the Andaman Sea coast representing a marginal sea of the northeastern Indian Ocean extension of its distributional range. It may have been brought after the tsunami, but human-assisted transport may also have been involved in its arrival or dispersion. This present study contributes important information on algal distribution in Southeast Asia and provides an extension of the biogeographic distribution of this species.

Keywords: Andaman Sea, Rhodophyta, Morphology, Seaweed, Southern

INTRODUCTION

Red seaweed of the genus *Dictyurus* is commonly found in tropical areas. It is characterized by plumose leaf-like structures as sac-like networks of monosiphonous branches on the upper portion of the thallus. It is widely distributed in tropical to subtropical regions of the Indian and Western Pacific Oceans. Currently, four species are taxonomically accepted: *D. fenestratus* Dickinson, *D. maldensis* Hackett and Arengood, *D. occidentalis* and *D. purpurascens* (Guiry and Guiry, 2021). Among these species, *D. purpurascens* is likely more common than the others (Guiry and Guiry, 2021). This species was originally described based on specimens collected from Cape Comorin, Tamil Nadu, in Southeastern India (Bory de Saint-Vincent,

1834). Later reports include Sealark (Weber-van Bosse, 1913), Mauritius (Børgesen, 1945), Maldives (Silva *et al.*, 1996), Tanzania (Oliveira *et al.*, 2005) and Sri Lanka (Coppejans *et al.*, 2009). This species has now been reported from the Pacific Ocean in Japan (Yoshida, 1998; Tsuchiya and Terada, 2010), China (Chang and Xia, 1978), Northern Australia (Lewis, 1984), Queensland (Phillips, 1997; 2002), and China (Zheng *et al.*, 2001). However, there are no previous reports of this species in Thailand.

During our seaweed biodiversity survey of Phang Nga Province and adjacent areas, we collected several unknown algal specimens. Some of them formed monosiphonous branch networks, and they looked very similar to red alga *Dictyurus*. We thoroughly

examined their morpho-anatomical structure and confirmed the first record of *D. purpurascens* in Thailand; the results are presented herein.

MATERIALS AND METHODS

Algal samples were collected in March 2010 at Natai Beach, Phang Nga Province, Thailand ($8^{\circ}17'13.90''\text{N}$ $98^{\circ}16'22.70''\text{E}$) (Figure 1). Natai Beach consists of a long discontinuous beachrock platform that is exposed during low tides and hence serves as an excellent substrate for epilithic benthic marine macroalgae (Figure 1).

Algal specimens were randomly collected during low tide. Samples were later cleaned and either preserved in 4% formalin in seawater or pressed onto herbarium sheets for morphological study. Dried and formalin-fixed tissues were hand-sectioned, stained in 1% acidified aniline-blue solution and mounted on glass microscope slides in 20% Karo® corn syrup. Photographs were taken with a Nikon Eclipse E200 camera with a computer-attached digital sight, and a Canon® EOS 700D (Kiss X7i/Rebel T5i) camera. The images were edited using Photoshop CS5 (Adobe Systems, California, USA).

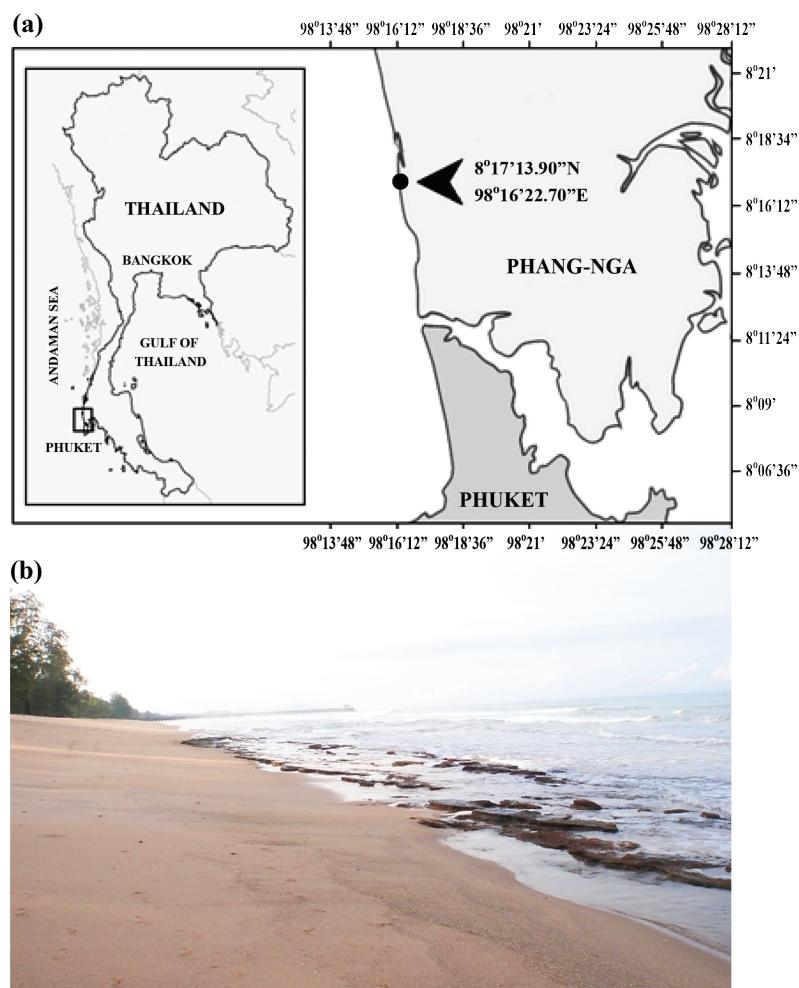


Figure 1. Map showing the collection site (a) and Natai coast, showing the exposed beachrock platform (b).

The species description was based on morphological and anatomical studies, with identity confirmed by comparison with previous descriptions as *Dictyurus purpurascens* Bory de Saint-Vincent (Svedelius and Nygren, 1946; Tanaka, 1963; Womersley, 1998; Terada *et al.*, 2000; Zheng *et al.*, 2001; Coppejans *et al.*, 2009; Tsuchiya and Terada, 2010). Voucher specimens were deposited at the Herbarium of Science and Applied Science Center, Faculty of Science and Technology, Phuket Rajabhat University (PKRU), Thailand.

RESULTS

The samples studied herein were morphologically similar to *Dictyurus purpurascens*. The full description is provided below.

Dictyurus purpurascens Bory de Saint-Vincent

References: Bory de Saint-Vincent, 1834: 170-171, plates. 15: figure. 2. Tanaka, 1963: 81-82, plates. figure. 8; Chang and Xia, 1978; Zheng *et al.*, 2001; Oliveira *et al.*, 2005: 120, + figures; Coppejans *et al.*, 2009: 206-270, plates. figure. 174;

Tsuchiya and Terada, 2010: 62, plate: figures. 1-3.

Habitat: Epilithic, with continuous and sometimes extreme wave events at low tide.

Description: Thallus grows from prostrate axes with spongy, pinkish-red, erect sections attached by discoid holdfasts at up to 1-2 cm (Figure 2). The main indeterminate axes bear determinate branches with 1-3 orders of alternate branching (Figure 3). The cylindrical main axis is cartilaginous and firm (Figure 4a-4b). In transverse section, axial cells are surrounded by four pericentral cells, with 5-6 at the basal second-order bearing third-order cell rows (Figure 4c). Determinate branches bear monosiphonous unilateral cells as reticulate subrectangular or ovoid networks (Figure 5a-5d). Their apexes show network connections developed from shorter branchlets, producing the characteristic mesh structure (Figure 5e-5f). There is no evidence of reproduction.

Voucher: PKRU130, 31 March 2010, 3-5 depth at the Natai Beach, (8°17'13.9"N 98°16'22.7"E) Phang Nga Province, Thailand.

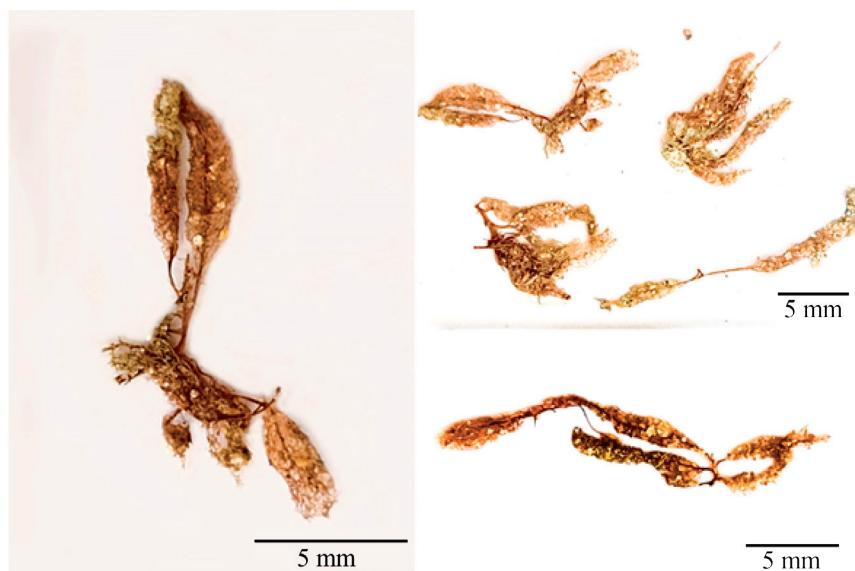


Figure 2. Herbarium specimen of *Dictyurus purpurascens* Bory de Saint-Vincent deposited in the Applied Science Center (Building 10), Faculty of Science and Technology, Phuket Rajabhat University, Thailand.



Figure 3. Indeterminate thallus and main axes (arrows) with determinate branches showing 1-3 orders of alternate branching (arrowheads) of *Dictyurus purpurascens* collected in the present study.

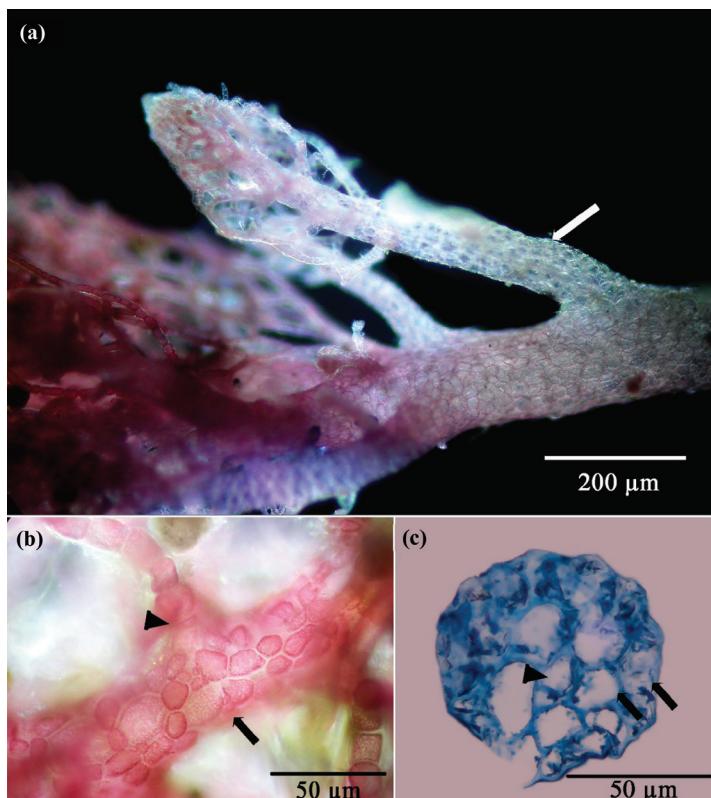


Figure 4. Taxonomically important parts of *Dictyurus purpurascens*: (a) determinate branch with polysiphonous primary branch (arrow); (b) cylindrical main cartilaginous axis of thallus (arrow) and alternate branches (arrowhead); (c) central cell (arrowhead) and pericentral cells at basal second order bearing third order cell rows (arrows).

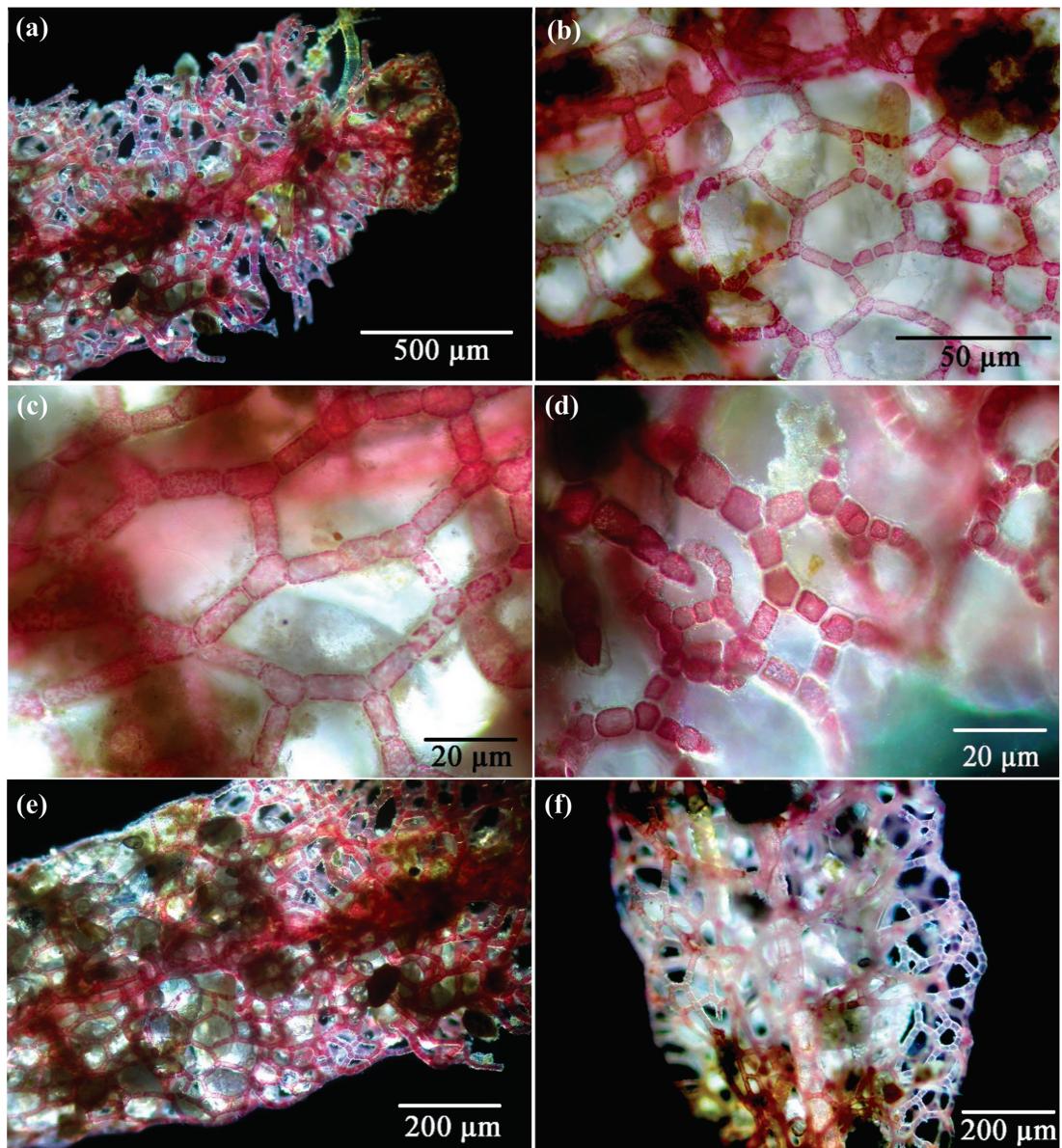


Figure 5. Histomicrographs of *Dictyurus purpurascens*: (a) apex showing the determinate axis, secondary lateral branches and monosiphonous ultimate branches; (b-d) monosiphonous ultimate branches and reticulate subrectangular network made up of ovoid cells; (e-f) close-up of a branchlet revealing net-like surface fronds.

Table 1. Comparison of morphological characters of *Dictyurus* species.

Morphological characters	<i>D. purpurascens</i>	<i>D. fenestratus</i>	<i>D. maldivensis</i>	<i>D. occidentalis</i>
Plant height (cm)	2-4	6-8	9	10-18
Color	pinkish red	rose	rose	rose to dark red
Thallus form	erect from prostrate axes, and terete	erect from prostrate axes, fan-shaped, and flattened	erect from prostrate axes, and terete	erect from prostrate axes, and terete
Main axis branching	alternate dichotomous	alternate dichotomous	alternate dichotomous	alternate dichotomous
Cortication	throughout, beginning with the apical parts, thicker at the base	throughout, beginning with the apical parts, thicker at the base	throughout, beginning with the apical parts, thicker at the base	throughout, beginning with the apical parts, thicker at the base
Pseudolateral branching	monosiphonous	monosiphonous	monosiphonous	monosiphonous
Branching	2-3 times dichotomously	2-3 times dichotomously	2-3 times dichotomously	2-3 times dichotomously
Surface views of segments	connected cells are more widely spaced, forming an irregular alternate-distichous pattern from each segment	connected cells are not widely spaced, and they alternate-distichous pattern from every all segment on a regular basis (formed in couples and alternating compartments)	connected cells are more widely spaced, forming an irregular alternate-distichous pattern from each segment	connected cells are more widely spaced, forming an irregular alternate-distichous pattern from each segment
Format of the network	reticular network in a quadrangular or spiral configuration	network of reticular spiral shows a series of oval openings on each side of the compressed mesh, margin closed, flattened, fan-shaped hollow segments	reticular network in circular configuration	closed spiral staircase network with a quadrangular or spiral arrangement
Format of margin network	short spur-like branches and smooth-edged	short spur-like branches, with a few short teeth on the edges	short spur-like branches, smooth-edged	short spur-like branches are only 2-4 cells long and have a smooth edge
Habitat	epilithic, from intertidal to subtidal (3-40 m depth) at moderate wave-exposed coast	epilithic, intertidal at wave-exposed coast	epilithic, subtidal (50-72 m depth)	epilithic, from intertidal to subtidal (10-30 m depth)
Reference	Tanaka (1963) and present study	Dickinson (1951)	Aregood and Hackett (1971)	Joly <i>et al.</i> (1965)

DISCUSSION

Based on comparative morphological observation, it is strongly confirmed that the collected specimen is *Dictyurus purpurascens* and as such, the present study has provided the first report of this species in Thailand. This species is characterized by a small terete thallus with reticular network in a quadrangular or spiral configuration. The thallus and reticular network configuration are important morphological criteria for identifying *Dictyurus* species. In general, *D. purpurascens* is commonly found at depths of 10 m or more (Tanaka, 1963; Tsuchiya and Terada, 2010). However, our Thai specimens were found on stony slabs at depths of 3-5 m during low tide.

It is a concern that among four *Dictyurus* species, *D. fenestratus* closely resembles *D. purpurascens* by having similar thallus size, cortication and branching pattern. The differences that separate these two species are the features of thallus form (terete in *D. purpurascens* and flattened in *D. fenestratus*) and margin network formation (smooth edge in *D. purpurascens*, and with few short teeth in *D. fenestratus*) (Table 1). Additionally, *D. purpurascens* shares several similar morphological features with *D. maldivensis* and *D. occidentalis*. However, plants of *D. purpurascens* are substantially smaller than *D. maldivensis* and *D. occidentalis*. The reticular network in *D. purpurascens* is nearly quadrangular or spiral, while that of *D. maldivensis* is nearly circular. On the other hand, the network in *D. occidentalis* forms a closed spiral staircase outline (Table 1).

Our present study provides a new alga record and adds to the database on seaweed diversity in Thailand. In addition, it expands the known geographic distribution of *D. purpurascens*. Continued field surveys will further contribute to the understanding of algal diversity and distribution ranges in Thailand and adjacent areas.

CONCLUSION

Our recent collection of red alga *Dictyurus purpurascens* is the first record of this species in Thailand. This alga is commonly found in the intertidal zone, attaching on the rock platform. The form of *D. purpurascens* is terete and small with quadrangular, spiral arrangement of the reticular network. Our study provides useful information for additional studies on algal diversity in Thailand.

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