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Research Article

Studies on a Rare and Exceptionally Occurring Brown Alga, *Padinopsis adriatica* Ercegović

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Abstract: A brown alga of extremely rare occurrence *Padinopsis adriatica* Ercegović, was collected from the Arabian Sea coast at Karachi, Pakistan during March 2008 and investigated for its morphology, anatomy and reproductive structures in details. This is the first report of its occurrence in the Indian Ocean. The present specimens were slightly larger in length and breadth than the type specimens. Thallus was observed to grow by a margin of apical cells and there is lack of an inrolled margin which distinguishes it from the genus *Padina*. Anatomical features and reproductive structures observed in this study are new information for this species.

Keywords: Marine algae, *Padinopsis,* Phaeophycota, morphology, anatomy, reproduction

1. INTRODUCTION

During a collection survey of marine benthic algae at the coast of Karachi, (Pakistan) from March 2006 and June 2010, a very rare alga *Padinopsis adriatica* Ercegović (family Dictyotaceae, order Dictyotales, class Dictyophyceae, phylum Phaeophycota; *fide* [1]) was found as drift material. It was not collected during previous surveys of Pakistan coast [2-6]. It was also not reported earlier from the Indian Ocean [7]. This provided a good opportunity to investigate its morphology, anatomy and reproductive structures in detail.

2. MATERIALS AND METHODS

The specimens were collected during March 2008 from Buleji, a coastal area near Karachi, Pakistan. Material was brought to the laboratory, washed thoroughly and preserved in 4 % formalin-seawater solution for further investigation. Some material was preserved in the form of herbarium sheets and kept in the herbarium, Department of Botany, Federal Urdu University, Karachi (FUU-SWH). Cross sections (C.S.) of the material were obtained by free hand cutting with the help of shaving blades, which were then stained with iodine, mounted in glycerine and sealed with the help of nail polish. Prepared slides were examined under Nikon PFX microscope, photographs were taken with F 601 camera and developed in a photolab with *hp* scanner. The photographic plates were prepared in Adop photoshop 7.0 with the help of a computer.

3. RESULTS AND DISCUSSION

The general observation and microscopic investigation of the collected specimens indicated the following characters.

***Padinopsis adriatica* Ercegović 1955: 44**

References: Ercegović 1955:44, Giaccone 1978: 92, Antolić *et al*. 2010: 12, Guiry & Guiry 2011:2427, Abbas & Shameel 2012: 110 [8-12].

3.1. Morphological Characters

Thallus olive green in colour, 4.7 cm in height, divided into two portions *i.e.* upper broad fan like portion and lower narrow stipe; upper portion 3 cm

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long and lower stipe 1.7 cm long; thallus 1.2 cm broad at the apex, 1 cm broad in the middle; stipe 5 mm broad at upper part, 4 mm broad in the middle and 1 – 2 mm broad at the base; surface smooth, margin in upper part uneven or dentate, stipe more or less smooth; oogonia present in the form of rows at upper part and scattered in the lower part; oogonia and hair-lines alternate to each other or in concentric rows (Fig. 1); at the apex, marginal incisions present (Fig. 2).

3.2. Anatomical Features

In surface view: peripheral cells light brown, small, cubical, thin-walled, arranged in vertical rows, not dorsiventrally differentiated, 5.0 – 22.5 µm in length and 5 – 20 µm in breadth; sporangial lines present alternate to the hair lines (Fig. 3).

In the apical portion: thallus consists of 4 layers *i.e.* upper and lower peripheral layers and 2 cortical layers, thallus 82.5 µm broad; peripheral cells cubical or quadratic, some cells slightly elongated, lower peripheral cells same in size and shape, but in upper epidermis some cells more or less rounded, some slightly elongated and some cubical, thick walled, cell-wall thickness 7.5 µm, with dense phaeoplasts, 25 – 35 µm in length and 25 – 35 µm in breadth; cortical cells small, cubical or quadratic, thin walled, poor in contents, 17.5 – 25.0 µm in length and 17.5 – 22.5 µm in breadth (Fig. 4).

In the middle part: two peripheral layers enclosing 2 cortical layers, thallus 100 µm broad; peripheral layers consist of cubical or quadratic, thick walled cells, cell-wall thickness 7.5 µm, with dense phaeoplasts, 17.0 – 27.5 µm in length and 22.5 – 37.5 µm in breadth; 2 layered cortex consists of cubical or quadratic, thin walled cells, poor in contents, 15 – 30 µm in length and 15.0 – 22.5 µm in breadth (Fig. 5).

In the basal portion: thallus consists of 6 layers *i.e.* upper and lower peripheral and 4 cortical layers, thallus 162.5 µm broad; peripheral cells slightly elongated, cubical, some cells at upper side become slightly rounded and appear to be dome shaped, thick walled, cell-wall thickness 7.5 µm, with dense phaeoplasts, 15 – 30 µm in length and 22.5 – 37.5 µm in breadth; cortical layers consist of cubical, thick walled cells, cell-wall thickness 7.3 µm, poor in contents, 15 – 30 µm in length and 15 – 25 µm in breadth (Fig. 6).

3.3. Reproductive Structures

Sporangia present on upper surface of thallus in the form of concentric sori, reddish brown, globular or slightly elongated, induciate, found in groups (Fig. 7), 50 – 100 µm in length and 45 – 100 µm in breadth (Fig. 8).

Growth: By margin of apical cells.

Habitat: Collected as drift material at Goth Haji Ali, Buleji (*Leg.* Alia Abbas, 14-3-2008).

Type locality: Island of Jabuka, central Adriatic Sea.

Local distribution: Karachi: Buleji.

Distribution in the Indian Ocean: Pakistan only.

3.4. Remarks

It is the type species of the genus *Padinopsis* Ercegović. This genus is being reported for the first time not only from the coast of Pakistan but from the Indian Ocean as a whole. It was not previously found in the Indian Ocean at all [7]. This species was initially collected from 50-70 m depth of central Adriatic Sea [8]. It seems to be so rare that probably its other citations from Adriatic Sea [9, 10, 13] only refer to the old publication of Ercegović, where they did not have additionally sampled new material. Some considered this species as *taxon inquirendum* [14], but others accepted it. This is not its first collection from Karachi, but during a survey in 1980s a much larger specimen of this species was collected by Shameel from Buleji coast of Karachi, and its identification was kindly confirmed by late Prof. Nizamuddin who was working at that time at Libyan coast of Mediterranean Sea. He took the sample to Libya to compare it with the type specimen but unfortunately lost it somewhere. The present record from sub-littoral depth of northern Arabian Sea appears to be the second sample at all after its type specimen.

The present specimens are slightly larger in length and breadth, originally they were found up to 3 cm tall and 3.5 cm broad [8]. Thallus was observed to grow by a margin of apical cells, there is lack of inrolled margin, which distinguishes it

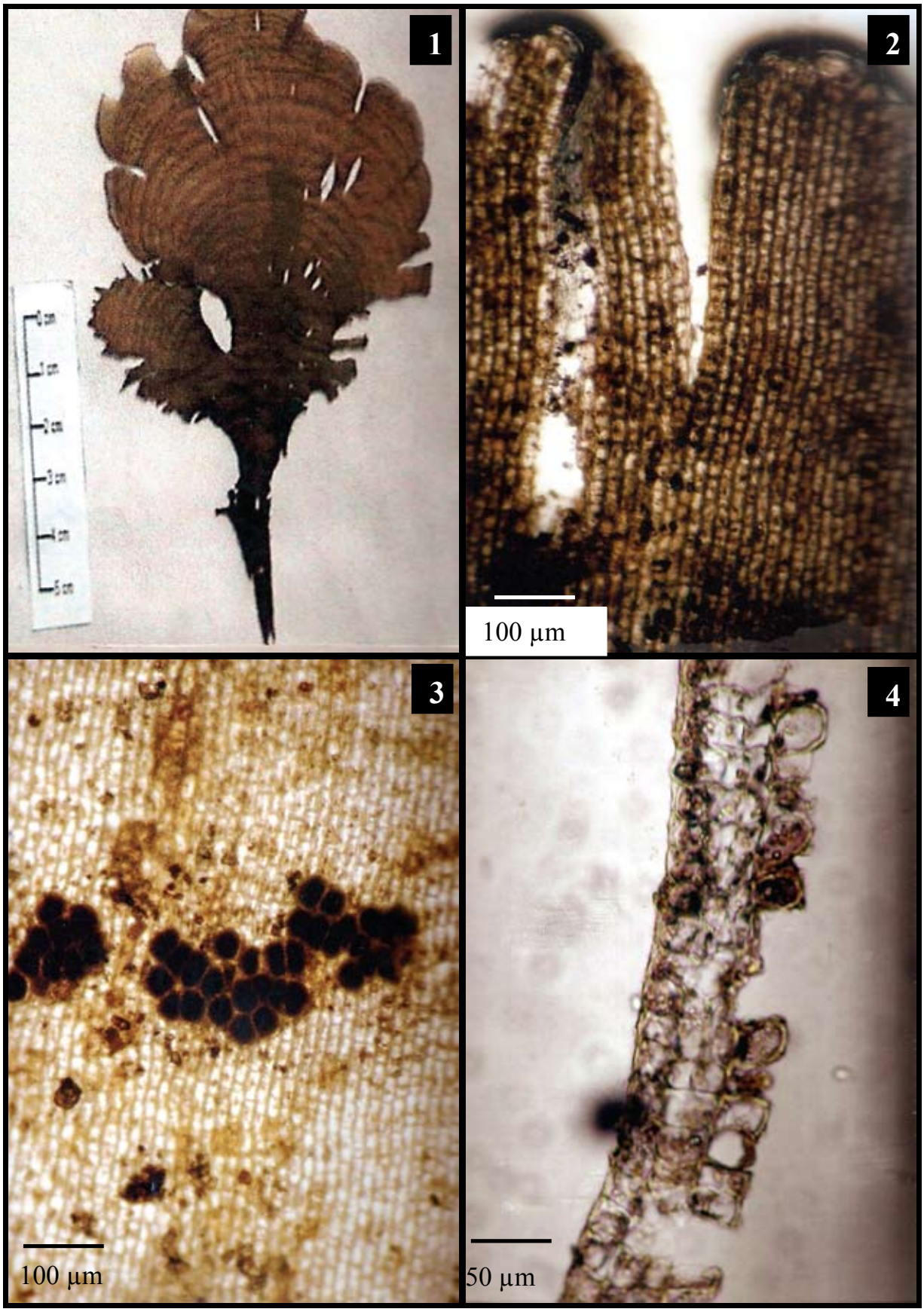

Fig. 1-4. *Padinopsis adriatica*: **1.** Habit of the thallus; **2.** Surface view of thallus showing marginal incision; **3.** Surface view with line of sporangia; **4.** C.S. of apical portion of thallus.

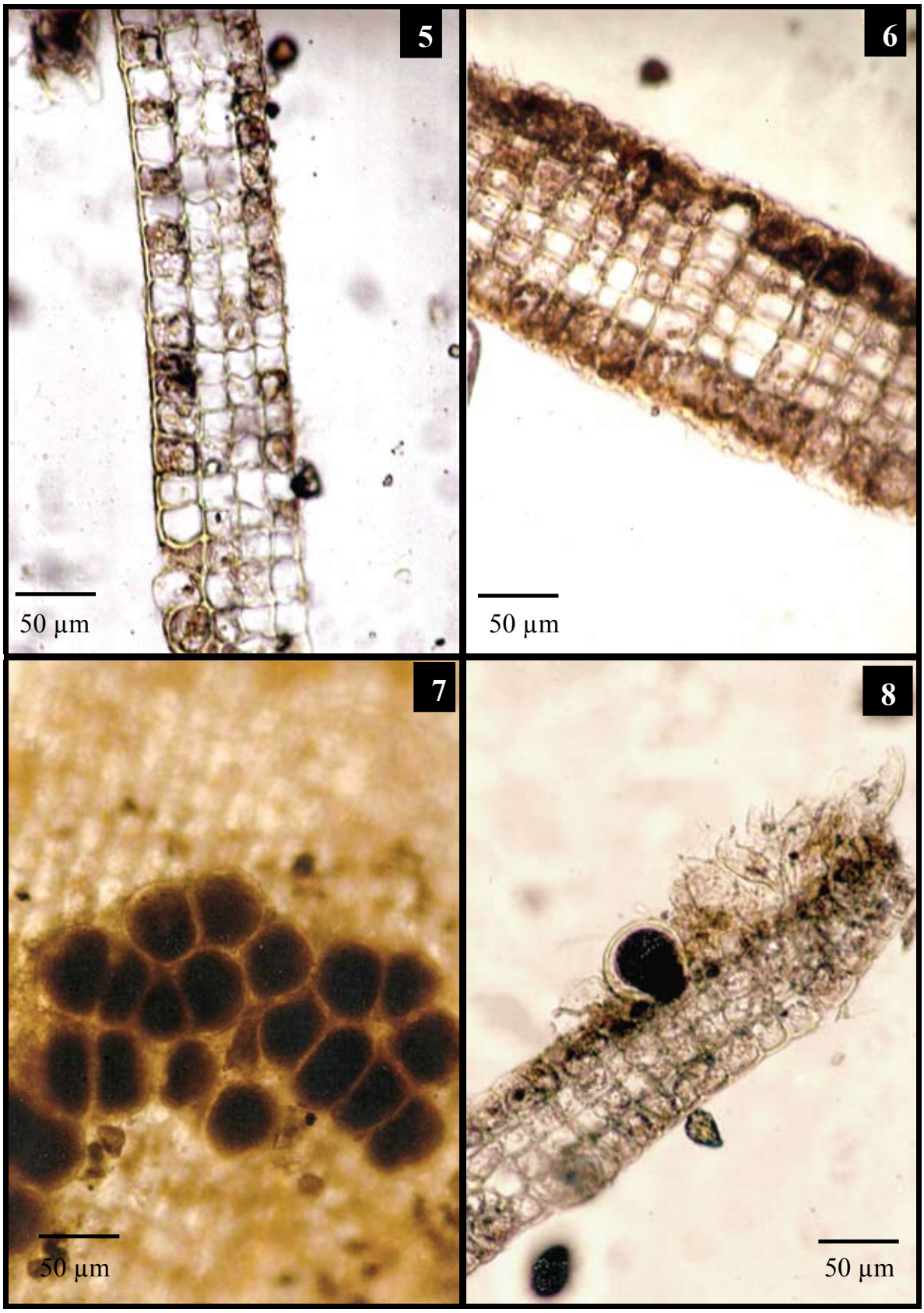

Fig. 5-8. *Padinopsis adriatica*: **5.** C.S. of middle part of thallus; **6.** C.S. of basal portion; **7.** Sporangial sori; **8.** C.S. of thallus showing a sporangium.

from the genus *Padina.* Phaeoplasts are discoid, which appear quadrangular in cross section. In this type specimen, blade margin was observed to be monostromatic, soon becoming distromatic by a longitudinal division of subapical cells [8]. Thallus of the present specimen multistromatic, where cell layers increased in the basal portion. Anatomical features and reproductive structures observed in the present study are new information for this species. The present description of the reproductive organs is the first one, as no reproductive structures were recorded previously [8-10].

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