MORPHO-ANATOMICAL STUDIES ON *DICTYOPTERIS TRIPOLITANA* (PHAEOPHYCOTA) FROM THE COAST OF KARACHI

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Abstract

Dictyopteris tripolitana Nizamuddin, a brown foliaceous alga, was collected from the coast of Karachi during March 2008 - April 2010 and investigated. This is the first detailed study of the seaweed from this area regarding its morphology and anatomy. Apart from taxonomic work, a detailed investigation was carried out on peripheral, cortical and medullary cells of various parts of the thallus, and reproductive cells were also studied.

Introduction

Occurrence of the brown algal genus *Dictyopteris* Lamouroux *nom. cons*. was first reported from the coast of Karachi by Nizamuddin and Saifullah (1967), where they described the growth of its five species. Three more species were reported by Begum and Khatoon (1988). Later on these species were found to grow in the other coastal areas of Pakistan (Shameel and Tanaka, 1992; Shaikh and Shameel, 1995; Shameel, 2000; Shameel *et al*., 2000). Among them *D. tripolitana* Nizamuddin was not investigated in detail previously, therefore, the present study was undertaken to examine its morpho-anatomy.

Materials and Methods

The specimens of *Dictyopteris tripolitana* were collected as drift material during March 2008 and April 2010 from sublittoral at Manora and Buleji, the coastal areas of Karachi (Pakistan). The specimens were brought to the laboratory, thoroughly washed and preserved in 4 % formaldehyde-seawater solution. Some of them were used for herbarium preparations, which are deposited in the Herbarium (FUU-SWH), Department of Botany, Federal Urdu University of Arts, Science and Technology, Karachi. Rest of the specimens were used for general study, where cross sections (C. S.) of the algal material were obtained free hand with the help of shaving blades, stained in aniline blue and mounted in glycerine. The slides were sealed with nail polish and examined under a Nikon PFX microscope, the seaweed sections were photographed with the help of a Nikon F601 camera.

Results

The following taxonomic characters and anatomical features were observed on general investigation and microscopic examination of the collected specimens.

***Dictyopteris tripolitana* Nizamuddin 1981:18**

References: Nizamuddin, 1981: 18; Begum and Khatoon, 1988: 294; Khatoon and Begum, 1990: 88; Shameel and Tanaka, 1992: 37; Silva *et al*., 1996: 585; Begum, 2010:154.

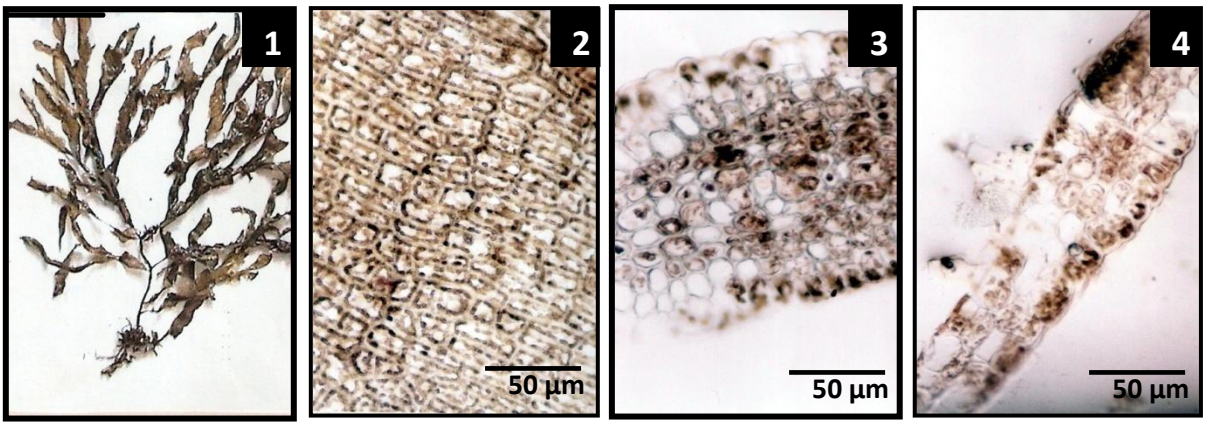
Morphological characters: Thalli greenish brown in colour, erect; dichotomously or sub-dichotomously branched, dichotomy 2.0 – 4.5 cm apart; reaching up to 35 cm in height, 0.5 – 1.5 cm broad at the apex, 1.5 – 2.5 cm broad at the middle portion and 2 – 5 mm broad at the basal part; laterally or alternately or sub-dichotomously branched at the base; thallus attached with the help of a holdfast having velvety fibrous rhizoids; surface smooth, margins entire or slightly undulate; apex bifid, acute, sinuses broadly obtuse, base attenuate; mid-rib present on ventral surface of the thallus; small proliferations arise from the mid-rib; sori reddish brown, small, rounded in shape, present on both sides of the mid-rib in transverse oblique rows, arranged on both surfaces at the middle up to upper part of the thallus (Fig. 1).

Anatomical features: In surface view: peripheral cells small, cubical or slightly elongated, light brown in colour, arranged in a regular manner, 25.0 – 57.5 µm in length and 20.0 – 47.5 µm in breadth (Fig. 2).

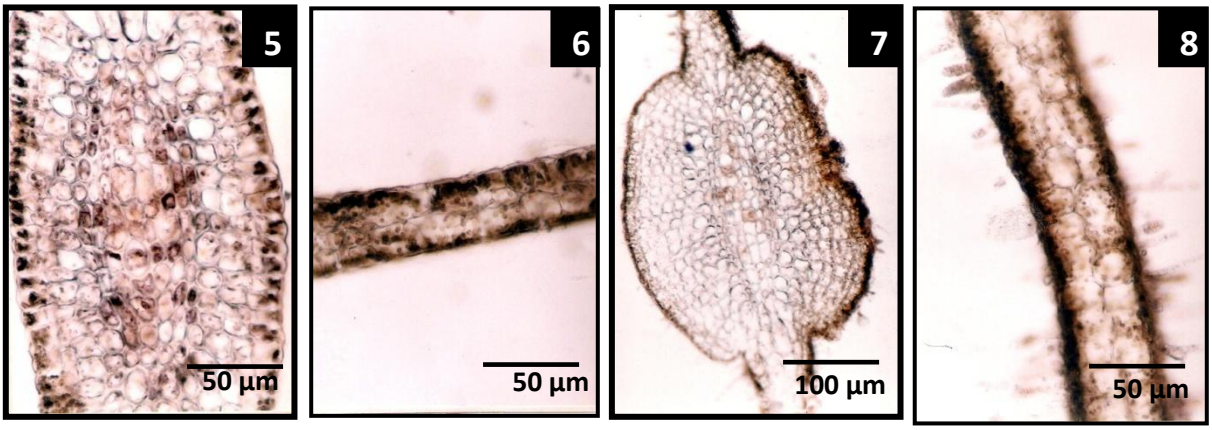
Thallus divided into three portions: central broad mid-rib and two wings; in mid-rib region thallus composed of 9 – 10 layers, in wings only two layers of cells present, number of layers increase from wings towards mid-rib.

In apical portion: mid-rib consists of peripheral layers containing quadratic or slightly palisade like cells, dark coloured, thin walled, 27.6 – 30.0 µm in length and 12.5 – 17.5 µm in breadth; below epidermis 3 – 4 layered cortex, cells large, isodiametric or polygonal, irregularly arranged, thick walled, cell-wall thickness 7.5 – 10.0 µm, intercellular spaces absent, variable in size, 32.5 – 37.5 µm in length and 15 – 50 µm in breadth; in the center 4 – 5 layered medulla, cells small, thick walled, intercellular spaces absent, dark coloured, slightly elongated, 25.0 – 2.5 µm in length and 7.5 – 15.0 µm in breadth (Fig. 3); in wings two layers of cells present, cells quadratic or cubical, both layers more or less equal in size, with dense phaeoplasts, thin walled, 12.5 – 15.0 µm in length an 7.5 – 10.0 µm in breadth, wings 25 – 30 µm broad (Fig. 4).

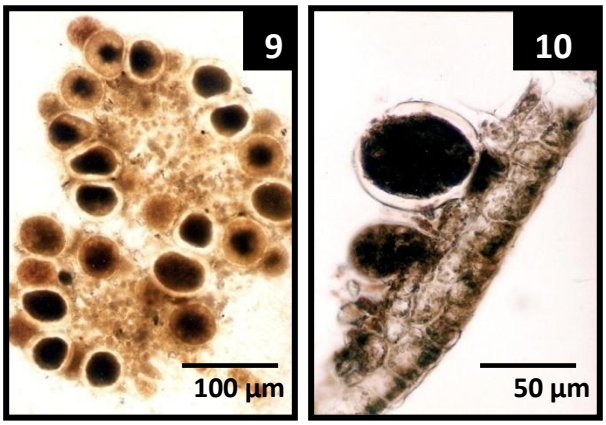
In the middle part: mid-rib consists of 2 peripheral layers, cells quadratic or slightly elongated, thin walled, poor in content, 25.0 – 37.5 µm in length and 20.25 µm in breadth; below epidermis on both sides of medulla 5 – 6 layered cortex present, cells polyhedral, parenchymatous, thin walled, poor in contents, 37.5 – 42.5 µm in length and 20 – 30 µm in breadth; in the center 3 – 4 layered medulla, cells elongated, thick walled, cell-wall thickness 5 µm, dark coloured, 20 – 50 µm in length and 12.5 – 25.0 µm in breadth (Fig. 5); in wings two layers present, cells cubical, thin walled, 25.0 – 32.5 µm in length and 25.0 – 32.5 µm in breadth, wings 87.5 µm broad (Fig. 6).



Figs. 1-4. ***Dictyopteris tripolitana*****: 1. Habit of the thallus, 2. Surface view of thallus, 3. C.S. of apical portion exhibiting mid-rib, 4. C.S. of apical part showing wing.**



Figs. 5-8. ***Dictyopteris tripolitana*****: 5. C.S. of middle part showing mid-rib, 6. C.S. of middle portion from wing, 7. C.S. of basal part exhibiting mid-rib, 8. C.S. of basal portion from wing.**



Figs. 9-10. ***Dictyopteris tripolitana: 9. Sori on the surface, 10. Tetrasporangia arising from peripheral cells.***

In the basal portion: mid-rib consists of 2 peripheral layers, cells cubical, with dense phaeoplasts, thin walled, 25 – 50 µm in length and 32.5 – 50.0 µm in breadth; below epidermis on both sides of medulla 9 – 10 layered cortex present, cells large, thick walled, no intercellular spaces present, poor in content, polygonal or isodiametric, 25.0 – 62.5 µm in length and 12.5 – 25.0 µm in breadth; in the center 3 – 4 layered medulla, cells slightly elongated or quadratic, small, thin walled, with dense phaeoplasts, 20 – 50 µm in length and 20.0 – 32.5 µm in breadth; in wings two layers present, cells cubical, large, thin walled, with dense phaeoplasts, 15 - 30 µm in length and 12.5 – 25.0 µm in breadth, wings 30 – 35 µm broad (Fig. 8).

Reproductive structures: Sori reddish brown, rounded, arranged obliquely and transversely on both sides of the mid-rib (Fig. 9); tetrasporangia rounded, stalked, reddish brown in colour, 75.0-107.5 µm in length and 60-90 µm in breadth, arise from peripheral cells (Fig. 10).

Type locality: Sciare El-Faateh, Tripoli, Libya.

Habitat: Collected as drift material at Manora (*Leg*. Alia Abbas 6-4-2009); Goth Haji Ali, Buleji (*Leg*. Alia Abbas 14-3-2008, 24-1-, 7-3- & 31-3-2009, 7-3 & 22-4-2010).

Local distribution: Karachi: Manora, Hawkes Bay and Buleji.

Distribution in the Indian Ocean: Pakistan only.

Discussion

Dictyopteris tripolitana is a foliaceous brown alga of the family Dictyotaceae (order Dictyotales, class Dictyophyceae, phylum Phaeophycota; *fide* Shameel, 2008). Nizamuddin (1981) described it as a new species from Mediterranean Sea on the basis of its tetrasporangial sori being obliquely and transversely arranged on either side of the midrib on blades. Begum and Khatoon (1988) reported for the first time its occurrence at the coast of Karachi. Later on, Khatoon and Begum (1990) described to some extent its taxonomy without much detail, where surface cells were not measured as well as number of layers in the thallus was not counted, shape of the cells was not described but only shown with the help of a diagram, presence and absence of intercellular spaces were also not mentioned. Furthermore, the measurements of assimilatory cells were given as 35 µm in length and 28 µm in breadth and those of cortical parenchymatous cells as 42 µm long and 34 µm broad (Khatoon and Begum, 1990).

In the present investigation, a detailed study of the surface view was carried out, surface cells were measured and number of layers in the thallus was also counted. In the present specimens, peripheral or assimilatory cells were measured as 25 – 50 µm long and 32.5 – 50.0 µm broad. Furthermore, shape of the cells in the mid-rib were described in detail, which measured as 20 – 50 µm in length and 20.0 – 32.5 µm in breadth, cortical cells were found to be 25.0 – 62.5 µm long and 12.5 – 25.0 µm broad. Apart from that, presence and absence of intercellular spaces in different regions of the thallus were noted and tetrasporangial sori were also described in detail.

References

Begum, A. (2010). Taxonomic study of Phaeophycota from Karachi Coast. *Kar. Univ. Seaweed Biol. & Phycochem. P.hD Thesis***,** 12: 375 pp.

Begum, M. and Khatoon, N. **(**1988). Distribution of and some ecological notes of Phaeophyta from the coast of Karachi. *Pak. J. Bot.*, 20: 291-304.

Khatoon, N. and Begum, M. (1990). Addition to the species of *Dictyopteris Lamouroux* (Dictyotales) from Karachi coast. *Pak. J. Bot*., 22: 85-93.

Nizamuddin, M. (1981). Contribution to the marine algae of Libya: Dictyotales. *Bibiloth. Phycol*., 54:122 pp.

Nizamuddin, M. and Saifullah, S.M. (1967). Studies on marine algae of Karachi, *Dictyopteris Lamourous*. *Botanica Marina* 10: 61-79.

Shaikh, W. and Shameel, M. (1995). Taxonomic study of brown algae commonly growing on the coast of Karachi, Pakistan. *Pak. J. Mar. Sci.,* 4: 9-38.

Shameel, M. (2000). Biodiversity of the seaweeds growing along Balochistan coast of the northern Arabian Sea. In: *Proceedings of National ONR Symposium on Arabian Sea as a Resource of Biological Diversity*. (Ed.): V. U. Ahmad, HEJ Res. Inst. Chem., Karachi Univ., p. 45-64.

Shameel, M. (2008). Change of divisional nomenclature in the Shameelian Classification of algae. *Int. J. Phycol. Phycochem*., 4: 225-232.

Shameel, M. and Tanaka, J. (1992). A preliminary check-list of marine algae from the coast and inshore waters of Pakistan. In: *Cryptogamic Flora of Pakistan.* Vol.1. (Eds.): T. Nakaike and S. Malik, Nat. Sci. Mus., Tokyo, p.1-64.

Shameel, M., Khan, S. H. and Husain, S.A. (2000). Biodiversity of marine benthic algae along the coast of Balochistan, Pakistan. *Pak. J. Mar. Biol*., 6: 69-100.

Silva, P.C., Basson, P. W. and Moe, R. L. (1996). *Catalogue of the Benthic Marine Algae of the Indian Ocean.* Univ. Calif. Berkeley, 1259 pp.