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ANATOMICAL STUDIES ON *COLPOMENIA SINUOSA* (PHAEOPHYCOTA) FROM KARACHI COAST OF PAKISTAN

ALIA ABBAS[1] AND MUSTAFA SHAMEEL[2]

[1]Department of Botany, Federal Urdu University of Arts, Science and Technology, Gulshan- e-Iqbal, Karachi-75300, Pakistan.
[2]Department of Botany, University of Karachi, Karachi-75270, Pakistan

Abstract

A commonly growing brown alga, *Colpomenia sinuosa* (Mertens *ex* Roth) Derbès *et* Solier *in* Castagne [= *Ulva sinuosa* Mertens *ex* Roth] was collected during November 2006 and April 2009 from intertidal rocks at the coasts of Manora and Buleji, near Karachi. The globular thalli were investigated for their morphology, anatomy and reproduction. Peripheral cells were described in detail, bunches of oil globules were observed in upper few layers of the cortex and there was a complete absence of any intercellular space and in all types of cells.

Introduction

Børgesen (1934) was the first phycologist to report the occurrence of *Colpomenia sinuosa* (Mertens *ex* Roth) Derbès e*t* Solier at the northern part of the Arabian Sea. Anand detected its presence at the coast of Karachi (Anand, 1940; Anand & Magon, 1941). Later on, it was taxonomically described by several workers (Nizamuddin & Begum, 1978; Begum & Khatoon, 1992; Shaikh & Shameel, 1995), but there was no adequate information available on its internal structure. Therefore, the present investigation was undertaken to study in detail its external and internal structures as well as its reproductive organs.

Materials and Methods

Globular thalli of *Colpomenia sinuosa* were collected from intertidal rocks at the coasts of Manora and Buleji, Near Karachi during November 2006 to April 2009 and fixed in 4% formaldehyde - seawater solution. For internal details of the thalli, cross sections (C.S.) were obtained free hand with shaving blades, then stained in aniline blue and mounted in glycerine. Semi permanent slides, so prepared, were sealed with nail polish and examined under Nikon PFX microscope. The photography was made with the help of a Nikon F601 camera. The herbarium preparations of the material have been deposited in the Herbarium (FUU-SWH), Department of Botany, Federal Urdu University of Arts, Science and Technology, Karachi, Pakistan.

Results and Discussion

The collected specimens on general observation and microscopic examination revealed the following characters.

Colpomenia sinuosa (Mertens *ex* Roth) Derbès *et* Solier *in* Castagne 1851: 95

Basionym: *Ulva sinuosa* Mertens *ex* Roth 1806: 327.

Synonyms: *Encoelium sinuosum* (Mertens *ex* Roth) C. Agardh 1820: 146, *Asperococcus sinuosus* (Mertens *ex* Roth) Bory de Saint-Vincent 1832: 326, *Hydroclathrus sinuosus* (Mertens *ex* Roth) Zanardini 1843: 39.

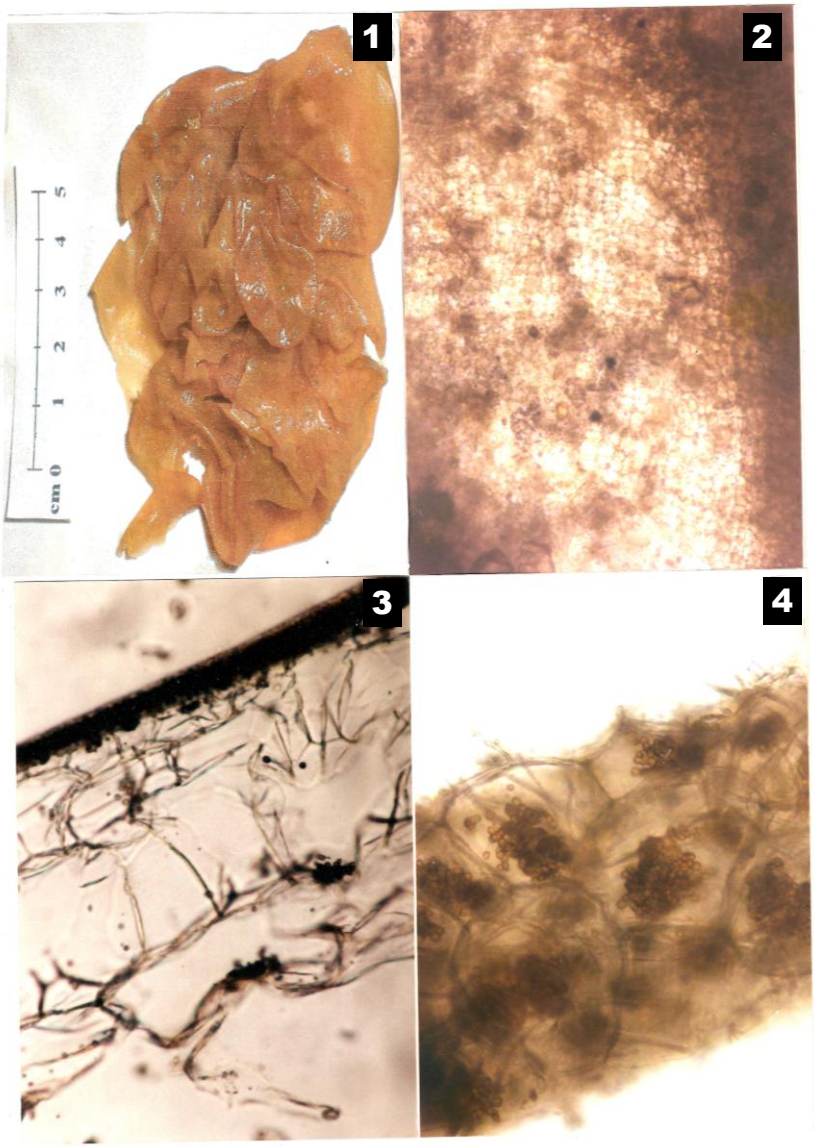
References: Børgesen, 1934: 25; Anand & Magon, 1941: 10; Durairatnum, 1961: 32; Misra, 1966: 115; Krishnamurthy & Joshi, 1970: 12; Nizamuddin & Gessner, 1970: 6; Saifullah, 1973: 141; Abbott & Hollenberg, 1976: 204; Jaasund, 1976: 47; Nizamuddin & Begum, 1978: 318; Basson, 1979: 57; Shameel, 1987: 513, 2000: 52; Shameel & Afaq-Husain, 1987: 245; Silva *et al*., 1987; 80, 1996: 627; Begum & Khatoon, 1988: 300, 1992: 23; Shameel & Tanaka, 1992: 40; Shaikh & Shameel, 1995: 27; Shameel *et al*., 2000: 86.

Morphological characters: Thalli greenish brown, surface smooth, dark brown and small spots present on surface, hollow, irregular, globular, seems to be a ball like structure, lobed and folded, membranous; sessile, attached with the help of a small disc, 4.5-64.0 cm in diameter (Fig. 1).

Anatomical features: Surface view of the thallus presents dark coloured, compactly arranged cells of variable shape (Fig. 2). In the apical portion: thallus consists of 4-8 layers i.e., a peripheral layer enclosing 3-7 layered cortical cells (Fig. 3); peripheral cells small, cubical or rectangular, dark coloured, with dense phaeoplasts, thin walled, 12.5-17.5 µm in length and 12.5-15.0 µm in breadth as they appear in surface view (Fig. 4); sub-epidermal 1-2 layers consist of very small, thin walled, iso-diametric or polygonal cells, poor in contents or some phaeoplasts of variable size are present, some cells comparatively large in size, 12.5-25.5 µm in length and bearing 1-2 bunches of large and prominent oil globules, 12.5-20.0 µm in breadth (Fig. 5), intercellular spaces absent; below these, 2-3 layers consists of large, elongated cells, thin walled, poor in contents, sometimes several layers are palisade like (Fig. 6), sometimes polyhedral or hexagonal, or iso-diametric, some cells more or less rounded, 30.0-42.5 µm in length and 12.5-42.5 µm in breadth; lowermost 1-2 layers consist of large cells, vertically elongated, poor in contents, thin walled, 10.0-82.5 µm in length and 12.5-17.5 µm breadth, intercellular spaces absent (Fig. 7).

In the middle portion: peripheral cells small, dark coloured, with dense phaeoplasts, isodiametric or cubical, 5.0-12.5 µm in length and 7.5-15.0 µm in breadth; sub-epidermal 1-2 layers consist of small, thin walled cells, poor in contents, intercellular spaces absent, polyhedral or iso-diametric with some phaeoplasts bearing 1-2 bunches of oil globules in each cell, 25-45 µm in length and 12.5-25.0 µm in breadth; 2nd and 3rd cortical layers consist of hexagonal, palisade like, or isodiametric, large, thin walled cells, intercellular spaces absent, poor in contents, 25-200 µm in length and 100-200 µm in breadth; below them one or two layers consisting of vertically arranged cells, large, thin walled, poor in contents, intercellular spaces absent, 25-225 µm in length and 25-50 µm in breadth (Fig. 8).

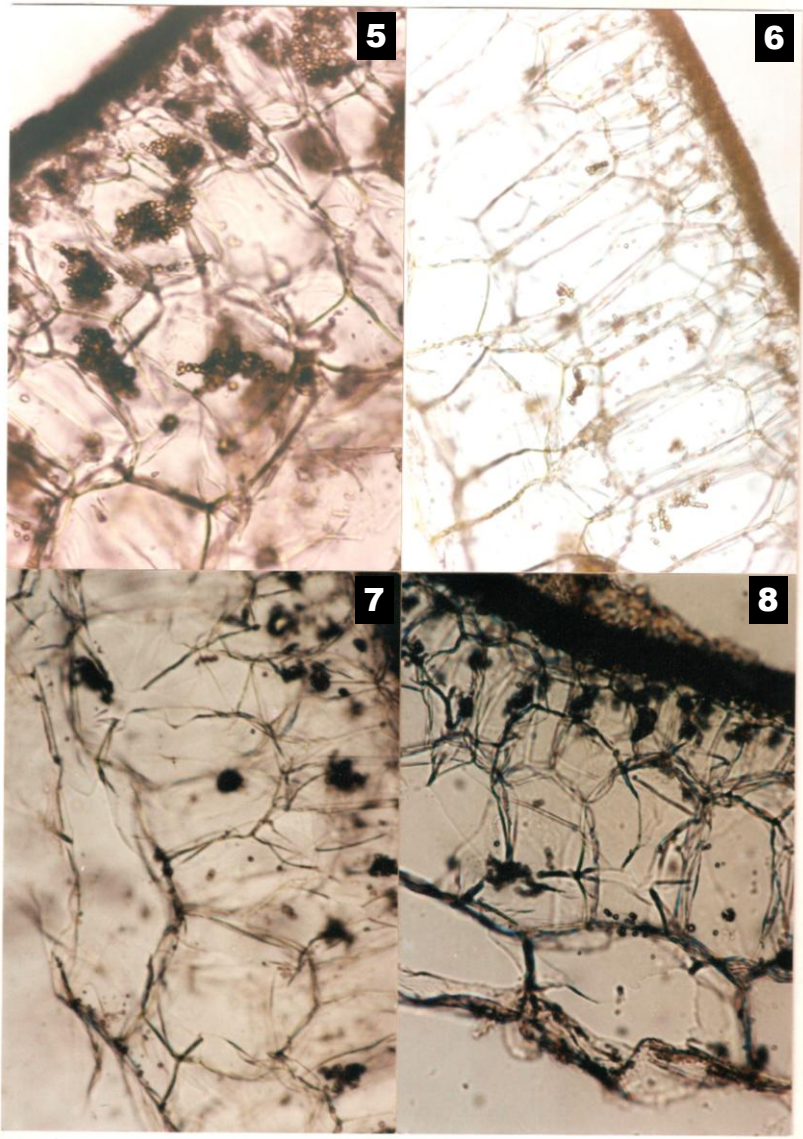
In the basal portion: peripheral cells small, thin walled, with dense phaeoplasts, bearing 1-2 bunches of large oil globules, prominant in first and 2nd layers, iso-diametric or cubical, 12.5-15.0 µm in length and 12.5-15.0 µm in breadth; sub-epidermal layer consists of very small, polyhedral or isodiametric, 25-30 µm in length and 17.5-25.0 µm in breadth with no intercellular spaces; below these, 2-3 layers consist of large, palisade like or polyhedral, thin walled cells, poor in contents, 25-20 µm in length and 12.5-100 µm in breadth; last one or two cortical layers consist of vertically arranged cells, thin walled, intercellular spaces absent, poor in contents, 35-200 µm in length and 25.0-42.5 µm in breadth (Fig. 9).



Figs. 1-4. *Colpomenia sinuosa*: 1. General morphology, 2. Surface view (dorsal) of the thallus (x 400), 3. C. S. of apical portion of thallus (x 400), 4. Peripheral cells (ventral) in surface view (x 1000).

Reproductive structures: Plurilocular sporangia present in groups, arise from epidermal layer; sori small, scattered on surface of the thallus; sporangia cylindrical, uniseriate or biseriate, dark brown in colour, 25-85 µm in length and 7.5-25.0 µm in breadth (Fig. 10).

Habitat: Benthic on lower to sub-littoral rocks, or collected as drift material at Goth Haji Ali, Buleji (*Leg.* Alia Abbas 17-3-2007, 14-3-&, 29-11-2008, 24-2-&, 31-3-2009); large rocky ledge, Manora (*Leg*. Alia Abbas 30-11-2006, 6-4-2009).

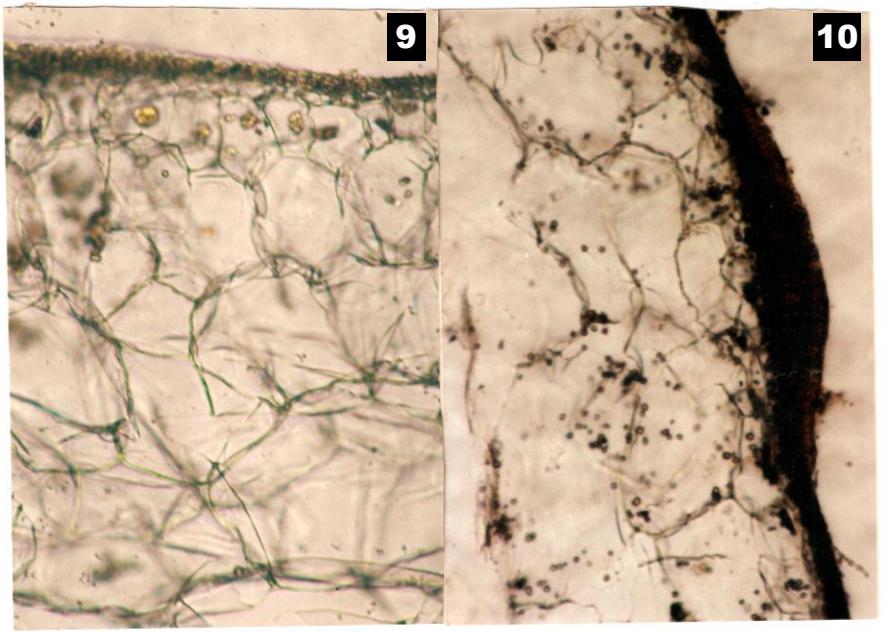


Figs. 5-8. *Colpomenia sinuosa*: 5. C. S. of apical portion of thallus showing hypodermral cells with oil globules (x 400), 6. C. S. of apical portion showing palisade like cells (x 400), 7. C. S. of apical portion showing elongated cells in the cortex (x 400), 8. C. S. of middle portion of thallus (x 400).

Type locality: Near Cádiz, Spain.

Local distribution: Manora, Hawkesbay, Buleji, Gadani, Ras Malan and Gawadar.

Distribution around Arabian Sea: Bahrain, India, Iran, Kuwait, Laccadive Islands, Pakistan, Saudi Arabia, Somalia, Sri Lanka and Yemen.



Figs. 9-10. *Colpomenia sinuosa*: 9. C. S. of basal portion of thallus (x 400), 10, C. S. showing sorus of plurilocular sporangia (x 400).

Remarks: It is a commonly growing alga of Karachi Coast of Pakistan (family Scytosiphonaceae, order Scytosiphonales, class Laminarophyceae, phylum Phaeophycota; *fide* Shameel, 2008). Anand (1940) reported *C. sinuosa* to form a belt and to develop a community at the rocky ledges of Manora (near Karachi), which was dominated by *C. sinuosa* forma *tuberculata* (Saunders) Setchell *et* Gardner 1903: 242. Later on by examining the collections of Anand, Salim (1965) reported the occurrence of *C. sinuosa* forma *expansa* Saunders 1998: 164 at the coast of Karachi. Probably he intended to refer to the forma *expansissima* Setchell *et* Gardner 1924: 726. But as we observed, all these forms do not occur at this coast. This species dominates the lower to sub-littoral rocks during November to April together with I*yengaria stellata* (Børgesen) Børgesen, which was probably mistaken by Anand (1940) as *C. S*. f. *tuberculata*.

Epidermal or peripheral layer was not described in detail by previous workers (Nizamuddin & Begum, 1978; Begum & Khatoon, 1992; Shaikh & Shameel, 1995), they only showed its presence with the help of diagrams. Similarly the presence of oil globules, which are very prominant in the first two layers of the thalli, was also not mentioned in their diagrams or the descriptions given by the previous workers. In the present investigation peripheral cells are described in detail and bunches of oil globules have been shown with the help of photographs. Presence of intercellular spaces were described in the internal tissues by Begum & Khatoon (1992), but the recent study indicated complete absence of intercellular spaces in all types of cells. In some thalli, layers of very elongated thin walled cells were found below the small isodiametric cells, which were not observed previously.

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