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SOME FRESHWATER GREEN ALGAE NEAR BALOCHISTAN COAST OF PAKISTAN

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Abstract

Five taxa including 3 species of Chlorophyta *viz., Enteromorpha intestinalis* (L.) Nees, *E. nizamuddinii* Aisha *et* Shameel sp. nov., *E. saifullahii* Aisha *et* Shameel sp. nov. and 2 forms of Charophyta *viz., Chara vulgaris* L. f. *atrovirens* (Lowe) H. *et* J. Groves and *C. vulgaris* f. *calveraensis* Wood have been described from an area close to the coast of Balochistan province. All are new records of freshwater algae from Pakistan.

Introduction

During studies on the green algae (Chlorophyta), various reports on marine species of the genus *Enteromorpha* Link have been made from the Karachi coast (Anand, 1940; Saifullah & Nizamuddin, 1977), Lasbela coast of Balochistan (Shameel, 1987; Shameel & Afaq-Husain, 1987; Shameel *et al.*, 1989) and other parts of Pakistan (Shameel & Tanaka, 1992). This genus has already been reported from Hub River (Aisha & Hasni, 1991) with no species recorded from the freshwater environment. Similarly members of the order Charales (Charophyta) have been found to grow in the northern areas of Pakistan (Faridi, 1955, 1956; Sarim, 1991) but have not been reported from south-eastern area. During a trip to the coastal areas of Balochistan province of Pakistan, 5 taxa of freshwater *Enteromorpha* and *Chara* were collected which are being described for the first time.

Materials and Methods

The algal materials were collected from Hub River near Hub Dam and from channels of Mashki River near Gajar village, in Balochistan province of Pakistan. The area of study was subjected to no tidal influence from the nearby sea and the water was not brackish. The specimens were fixed in 4% formaline solution and some were mounted on herbarium sheets and kept in Seaweed Herbarium, MAH Qadri Biological Research Centre, University of Karachi (KUH-SW).

TAXONOMIC ENUMERATION

1. ***Enteromorpha intestinalis (L.) Nees 1820***

Fig. 1 a-d

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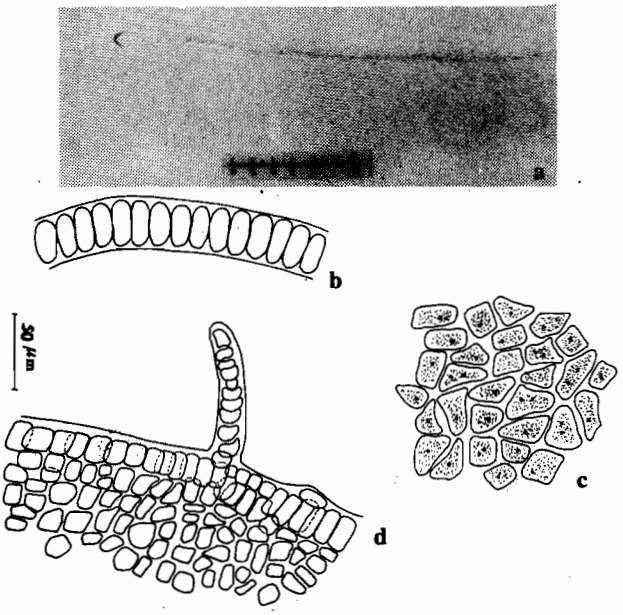

Fig. 1. *Enteromorpha intestinalis* (L.) Nees:
(a) Thallus showing general habit. (b) T.S. of thallus. (c) Thallus in surface view. (d) Part of the thallus showing a branchlet and arrangement of cells.

Basionym: *Ulva intestinalis* L. 1753: 1163.
References: Anand, 1940: 15; Chapman, 1956: 404; Durairatnam, 1961: 18; Joshi & Krishnamurthy, 1972: 124; Saifullah & Nizamuddin, 1977: 529.

Thallus light green to white, tubular, much inflated giving intestine like structure, upto 20 cm long, 3-4 mm broad; profusely branched at basal portion; rarely proliferated, proliferations 1-77 mm long, 15 µm in diameter. Cells throughout irregularly arranged, 15-18 µm x 9-12 (15) µm in transverse section, 12-18 (21) µm x (6) 9-12 µm in surface view, elongate to squarish in shape; chloroplast nearly filling the cell; 1-2 pyrenoids; thickening of wall upto 3 µm.
Ecological notes: The algae grow in the channels of Mashki River in the Gajar Village with *Chara vulgaris* f. *calveraensis*.
Type locality: Mari omni (uncertain, type probably lost).
Geographical distribution: This species is marine and widely spread in tropical as well as subtropical seas.
Local distribution: Gajar Village, Balochistan, Pakistan (*Leg.* K. Aisha 8-3-1990).
Remarks: The freshwater specimens of *E. intestinalis* are morphologically similar with marine *E. intestinalis* f. *tubulosa* Kützing (Chapman, 1956; Saifullah & Nizamuddin, 1977), but differ in transverse section. The cells of *E. intestinalis* f. *tubulosa* are rectangular in shape and either radially arranged (Saifullah & Nizamuddin, 1977) or transversely arranged (Chapman, 1956) but in our specimens of *E. intestinalis*, cells are elongated and only radially arranged. The description and diagrams of Joshi & Krishnamurthy (1972) are somewhat similar with our specimens, although the former are marine while later were collected from freshwater environment.

2. ***Enteromorpha nizamuddinii Aisha*** et ***Shameel sp. nov.***

Fig. 2 a-f

Thallus light to yellowish green, 16 cm long, 1 mm broad, tubular, branched; constrictions here and there, 0.1 mm broad; proliferations frequent, sometimes a single cell gives 2-3 proliferations, later converted into lateral branches, 0.5-4.0 mm long; cells irregularly arranged throughout the thallus, angular to squarish in shape, 15-18 μm x 9-12 (-15) μm in transverse view and 12-15 (-18) μm x 9-12 (-15) μm in surface view; chloroplast parietal; 1 rarely 2 pyrenoids; thickening of wall 3-6 μm.

Diagnosis: Thallus tubularis, ramosus, constrictus; rami et proliferationi ad parte superiore et inferiore; rami et proliferatione sustinens ad constrictione absentia; proliferationis brevis, nec late ad extremum; cellulae squarosae, sine spatio intercellularis aspectu paginae.

Ecological notes: The plants grow in the channels of Mashki River in the Gajar Village with *Chara vulgaris* f. *calveraensis* and also attached on straws.

Type locality: Gajar Village, Balochistan, Pakistan (*Leg.* K. Aisha 8-3-1990).

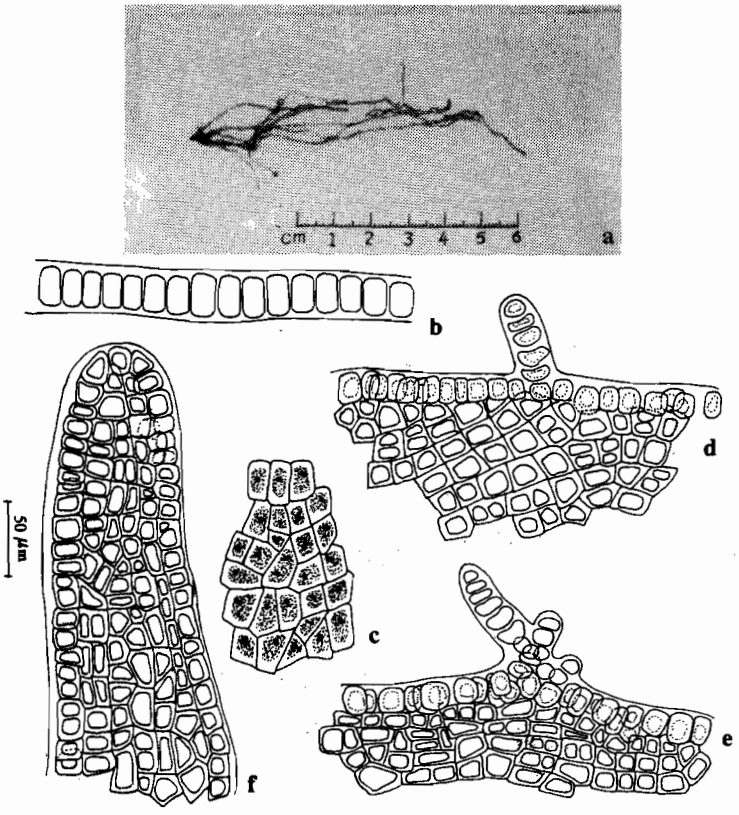

Fig.2. *Enteromorpha nizamuddinii* Aisha *et* Shameel *sp. nov.*:
(a) Thallus showing general habit. (b) T.S. of thallus. (c) Thallus in surface view. (d) Part of the thallus exhibiting a branchlet. (e) More than one branchlets arising from a single cell. (f) Arrangement of cells in the thallus.

Remarks: Enteromorpha nizamuddinii resembles *E. constricta* in having constrictions (Saifullah & Nizamuddin, 1977), but lacks supporting branches and proliferations at constrictions, branches and proliferations are at upper portion as well as lower portion, proliferations are short but without broader ends. Squarish cells are without intercellular spaces in surface view, whereas in *E. constricta* the supporting branches and proliferations are rare at the base, proliferations with broader ends are meant for attachment. The cells are oblong and have intercellular spaces. Furthermore, it occurs in freshwater while *E. constricta* is marine. The species has been named after Prof. Mohammed Nizamuddin, who has made valuable contributions on the algal flora of Pakistan.

3. ***Enteromorpha saifullahii Aisha*** et ***Shameel sp. nov.***

Fig.3 a-g

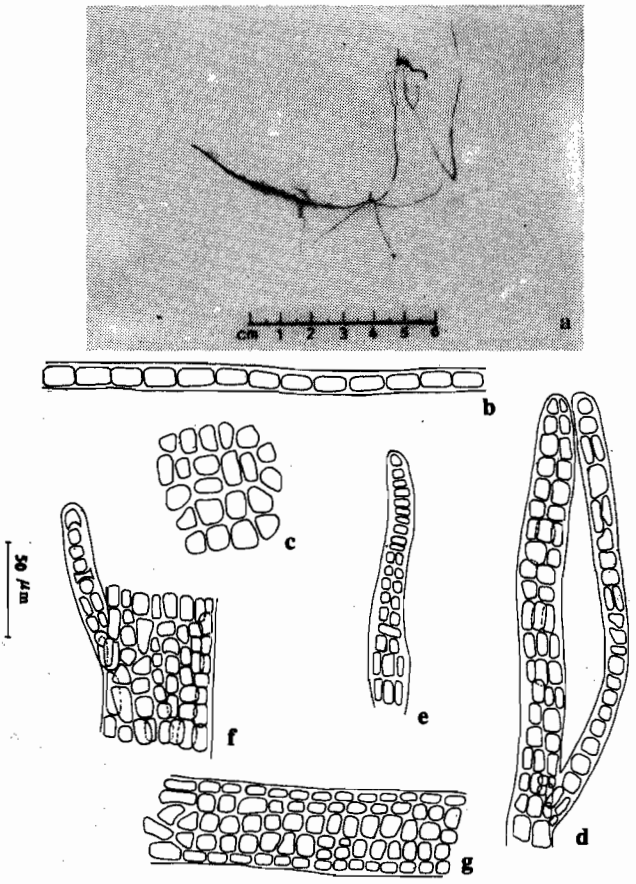

Fig.3. *Enteromorpha saifullahii* Aisha *et* Shameel *sp. nov.*:

(a) Thallus showing general habit. (b) T.S. of thallus. (c) Thallus in surface view. (d) Thallus bearing long branchlet showing partly monostromatic and partly distromatic layer. (e) Polysiphonous branch terminating into monosiphonous series of cells. (f) Thallus with a young branchlet. (g) Arrangement of cells in the thallus.

Thallus light to dark green, cylindrical, tubular, erect, upto 200 μm broad; branches opposite or irregularly arranged, 90-253 μm x 15-110 μm, attenuated at apex, not constricted at base; branchlets 92-247 μm long, frequently terminating in a single series of cells. Cells regularly arranged in longitudinal rows in greater part of the thallus but sometimes in transverse rows, squarish or rectangular in shape, flat, 10-20 μm x 6-12 μm in transverse view, 30-37 μm x 15-22 μm in surface view; chloroplast single, almost occupying the entire lumen; usually with 2-4 pyrenoids; thickening of cell wall upto 3 μm.

Diagnosis: *Thallus tubularis, ramosus; rami oppositi vel ad apicem irregulare attenuetus; cellulae in parte majore longitudinaliter dispositus, in parte minore transversoliter dispositus; cellula parieti usque ad 3 μm crassus.*

Ecological notes: Plants grow in running water and may also be found in drift or floating condition, entangled with *Cladophora* sp., as well as with higher plants. The water pH was 7.6.

Type locality: Hub River near Hub Dam (*Leg.* S. Hasni 27-2-1989).

Remarks: *Enteromorpha saifullahii* is similar with *E. procera* in arrangement of cells in transverse section as well as in surface view (Chapman, 1956) but differs in the pattern of branching and thickness of cell wall. It also differs from Pakistani specimens of *E. procera* in surface and transverse section (Saifullah & Nizamuddin, 1977). Moreover, *E. procera* is marine whereas *E. saifullahii* is a freshwater alga. This species has been named after Prof. S.M. Saifullah, who has made detailed studies on the species of *Enteromorpha* from the coast of Pakistan.

4. *Chara vulgaris L. f.* atrovirens *(Lowe) H.* et *J. Groves*

Fig. 4 a-f

Reference: Wood & Imahori, 1964: 5.

Plant monoecious, white in colour, crusted, upto 20 cm long, 1 mm broad; branchlets are at an interval of 15-37 mm, 59-branchlets arranged in whorl, length of branchlets equal or longer than internodal portion in older region; end cells 4, ecorticated, cylindrical with acuminate tips; internodal part in older axes with two types of corticating cells, obliquely arranged, 2 tiers of stipuloides in branchlets, varying in length; nodal part with 5 celled layer at one side; bractioles 4, unilateral, longer than oogonium, two short and two long in length, conical with blunt tips; oogonium oval in shape, 421 μm x 181 μm, 5 coronal cells, 11 tubular cells surrounding the oogonia; globule 273 μm in diameter with numerous chains of sperms.

Ecological notes: It grows in channels of Mashki River in Gajar Village with *Enteromorpha intestinalis* and *E. nizamuddinii*.

Geographical distribution: Germany and Pakistan.

Local distribution: Gajar Village, Balochistan, Pakistan (*Leg.* K. Aisha 8-3-1990).

Remarks: The specimens resemble those of *C. vulgaris* f. *atrovirens* described by Wood & Imahori (1964) in height, number of branchlets, number of ecorticated end cells, number and length of bractioles, and differ in the measurement of different parts and shape of the ecorticated end cells in the branchlet, which may be due to habitat differences.

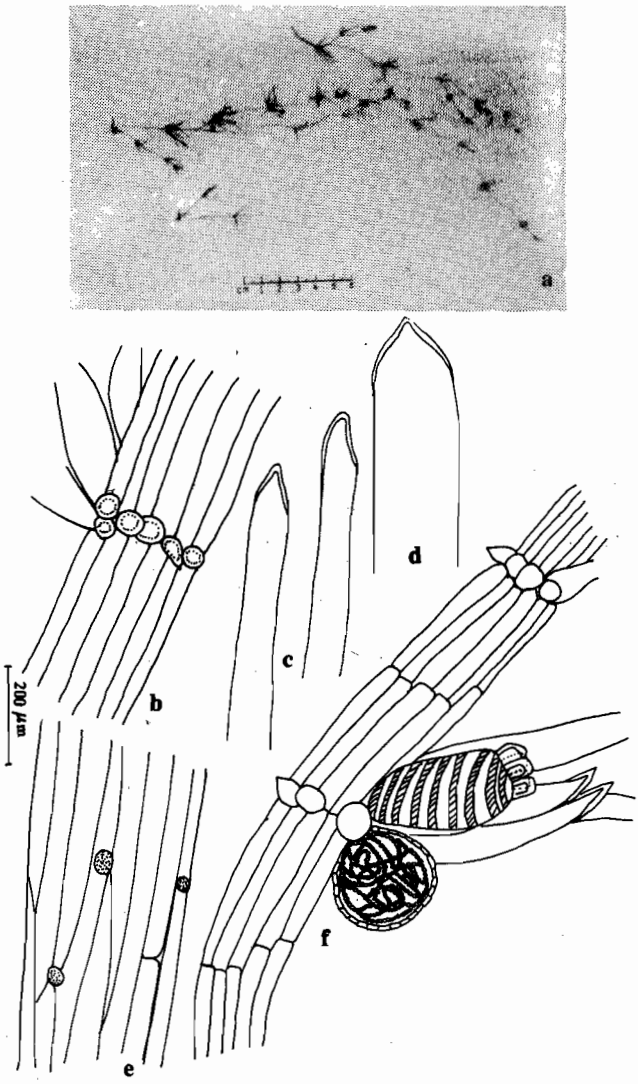

Fig.4. *Chara vulgaris* f. *atrovirens* Wood:
(a) Thallus showing general habit. (b) Nodal part of the plant. (c) Tips of two branchlets. (d) Tip of the uppermost segment of the plant. (e) Internodal part. (f) Globule and nucule at nodal part.

5. *Chara vulgaris f. calveraensis R.D. Wood*

Fig.5 a-e

References: Wood & Imahori, 1964: 12.

Plants whitish green, monoecious, crusted with lime, upto 300 mm high, 1.5 mm wide; branchlets at a distance of 10-47 mm, 6-8 mm in numbers, arranged in whorl at nodal region, length of the branchlets equal to internodal part at upper region, but in lower region the internodal portion is twice the length of branchlets; end cells 3-4,

ecorticated, conical in shape with blunt apices; internodal region 3-20 mm x 1 mm, 2 tiers of cells varying in length, obliquely arranged, in older axes regularly two types of corticating cells; single layer of cells at nodal part from which bractioles arise; bractioles 3-4, unilateral, longer than the oogonium, varying in length; oogonium oval to elongated in shape, 512 μm x 22 μm (including corona), 5 coronal cells, 10 tubular cells surrounding; globule 341 μm in diameter with numerous chains of sperms.

Ecological notes: Plants grow in water channels of Mashki River in Gajar Village, Balochistan, Pakistan.

Geographical distribution: Germany and Pakistan.

Local distribution: Gajar Village, Balochistan, Pakistan (*Leg.* K. Aisha 8-3-1990).

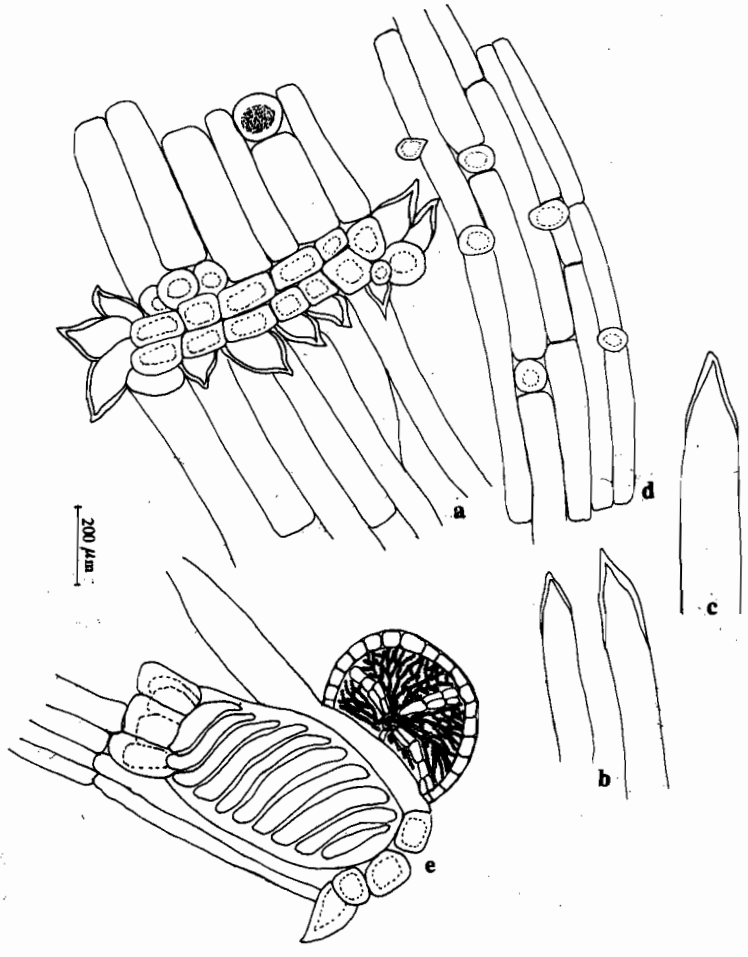

Fig.5. *Chara vulgaris* f. *claveraensis* Wood:
(a) Nodal part of the plant. (b) Tips of two branchlets. (c) Tip of the uppermost segment of the plant. (d) Internodal part. (e) Globule and nucule at nodal part.

Remarks: The specimens resemble those of *C. vulgaris* f. *calveraensis* described by Wood & Imahori (1964) in 3-4 ecorticated end cells, end cells being conical in shape, 2 tiers of stipuloides per internodal part, 2 types of corticating cells in older axis. They only differ in the measurements of different parts, internodal part is not 1-3 times as long as branchlets. Wood & Imahori (1964) have reported only sterile specimen, whereas we have observed fertile plant material.

Acknowledgements

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