

OCCURRENCE OF A NEW SPECIES OF *CHARA* (CHAROPHYTA) NEAR BALOCHISTAN COAST OF PAKISTAN

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Abstract

A new taxon, *Chara krausei* Shameel, has been described from a seawater lagoon near the coast of Gwadar, Balochistan (Pakistan) and compared with the ecorticated taxa like *Chara braunii* Gmelin, *C. corallina* f. *corallina* Wood, *C. socotrensis* f. *pashanii* Dixit and *Lamprothamnium succinctum* (A. Braun) Wood. It has been distinguished due to its small height, large number of branchlets in a whorl, small crown at branchlet apex, swelling of penultimate and shortening of lower most segments of branchlets, sturdy stipulodes and bracts, absence of gametangia at shoot nodes and bearing antheridia below oogonia.

Introduction

Members of the phylum Charophyta have long been found to grow in the northern areas of Pakistan (Groves, 1923; Faridi, 1955, 1956; Pal *et al.*, 1962; Sarim, 1991). There are a few recent reports about their growth from the province of Sindh (Leghari *et al.*, 1999, 2000, 2001; Jahangir *et al.*, 2000; Langangen & Leghari, 2001), but very little work has been done from the area of Balochistan (Aisha & Shameel, 1995; Zaidi, 2000; Langangen & Leghari, 2001). Algae belonging to the genus *Chara* Vaillant are primarily freshwater, with a few species occurring in the brackish water (Pankow, 1971), but they do not grow in the real marine environment. During surveys of the coastal areas of Balochistan province, some interesting specimens of *Chara* were found to grow, which differed from the existing taxa in several respects. It is being described here as *Chara krausei* Shameel *sp. nov.*

Materials and Methods

The algal material was collected on 27.2.1990, 16.3.1993 and 7.1.1998 from a seawater lagoon near the coast of Gwadar, Makran, Balochistan (Pakistan). The specimens were fixed in 4% formaline solution and brought to Karachi. A good amount of the liquid-preserved material from the first collection was sent to late Dr. Werner Krause for examination. Some of the material was mounted on herbarium sheets and kept in the Seaweed Herbarium, MAH Qadri Biological Research Centre, University of Karachi (KUHSW).

Results

The formaline-preserved material revealed complete plants with unripe gametangia, a few germinating oospores and several fractional parts. It was taxonomically investigated and is being described as a new species, honouring Late Dr. Werner Krause

(Amselweg 5, D-88326 Aulendorf, F.R. Germany), who has thoroughly examined the material from first collection of this alga before his sad demise and agreed to consider it as a new species.

Chara krausei Shameel *sp. nov.*

Description: Plants small, 2-5 cm high, relatively robust; shoots spread out as rosettes at the ground, encrusted, brittle (Fig. 1A). Lower internodes 1-2 cm long, 0.75-1.0 mm in diameter; upper internodes short, compact as whorls at shoot apex; ecorticated, without spines. Stipulodes in a circle, unistipulate, haplostephanous, alternating with branchlets, sturdy, cuspidate, 1.0-1.5 mm long, 0.3 mm thick, disappear in lower whorls (Figs. 1C, D). Branchlets 8-10 in each whorl, 0.5-1.0 cm long, 1.0-1.1 mm in diameter, constricted up to half of the diameter at nodes, mostly bent towards axis, 4-(5) segments (Fig. E). In young stage both the lower most segments extremely reduced, covered with bracteoles (Figs. 1B, C). Penultimate segment inflated; outermost segment mucronate, covered with its deciduous, small crown of bracts. Size and margin of branchlet segments balanced with the age (Figs. 1D, E). Bracts 100-300 μ m long, acute, invertly surrounding the branchlet, early deciduous (Fig. 1F). Bracteoles of unripe oogonia cover it to the top, up to 450 μ m long.

Plants monoecious; gametangia develop on two lower most branchlet nodes and never on shoot nodes (Fig. 1F). Antheridia without exception develop below oogonia. Often two pairs of gametangia develop side by side at the lower most node. Unripe oogonia (without corona) 450-500 μ m long, ca. 300 μ m broad; corona 200-225 μ m broad (Fig. 1G); cells stilted at the top. Germinating oospores ca. 400 μ m long, ca. 180 μ m broad; with black, 9 strong spiral ridges (Fig. 1H). Antheridia ca. 250 μ m in diameter.

Diagnosis: Monoecious small plants, 2-5 cm high, ecorticated; lower internodes 1-2 cm long, upper ones short, compact as whorls at shoot apex; stipulodes 8-10, sturdy, cuspidate, 1.0-1.5 mm long; branchlets 8-10 in each whorl, 0.5-1.0 cm long, with small crown at apex, penultimate segment inflated, two lower most segments extremely reduced, covered with sturdy bracteoles; two pairs of gametangia, side by side, at lower most segment of branchlets; antheridia below oogonia.

Planta parva, 2-5 cm alta, ecorticata; internodia inferna 1-2 cm longa, superiora breva, compacta atque verticillo ad surculus apice; stipulodia 8-10, valida, cuspidata, 1.0-1.5 mm longa; ramula 8-10 uterque verticilla, 0.5-1.0 cm longa, parvibus cornata ad apice, paenultima internodia inflata, bi internodia inferna extremum deminata, tectibus bracteolis validis; bi par gametangia, lateris per lateris, infimus at nodus ramulus; infra antheridia oogonia.

Type locality: Gwadar, Makran, Balochistan, Pakistan (Leg. M. Shameel 27-02-1990, 16-03-1993, 07-01-1998).

Habitat: Growing in the sandy bottom of a small water lagoon at Gwadar, connected with the Arabian Sea, protected with wave action and undulatory currents. Water depth 10-50 cm, salinity ca. 30 ‰ S close to that of seawater. A few specimens of *Sargassum tenerrimum* J. Agardh were also found growing in the neighbourhood. Situation is comparable with the habitat of *Lamprothamnium papulosum* (Wallr.) J. Groves in lagoons and saltworks at Mediterranean Sea (Corillion, 1953), the last outpost of Characeae against open sea, which is too reserved.

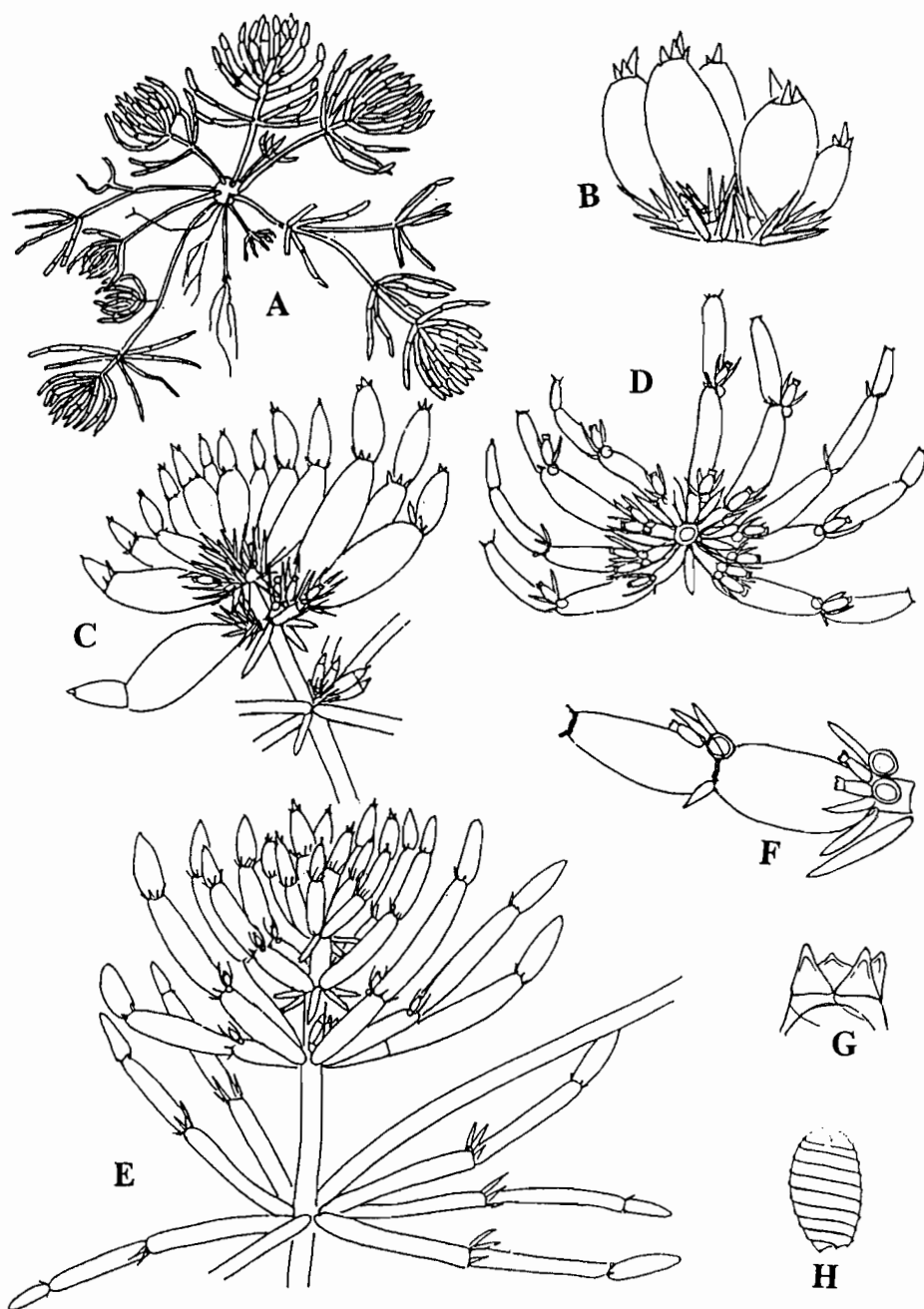


Fig. 1. *Chara krausei* Shameel sp. nov.: A. entire plant ($\times 2$), B. very young shoot-apex ($\times 25$), C. slightly grown shoot-apex ($\times 10$), D. whorl as seen from below ($\times 8$), E. much grown shoot-apex ($\times 8$), F. three lowermost segments and stipulodes of a branchlet ($\times 20$), G. corona ($\times 60$), H. oospore ($\times 30$).

Discussion

This plant belongs to the ecorticated genera of the family Characeae Richard. Among them, *Lamprothamnium* J. Groves, which is represented in the Indian Ocean by *L. succinctum* (A. Braun) Wood, may be excluded due to the absence of gametangia at the shoot nodes, position of antheridium below oogonium and shape of stipulodes (Imahori, 1964; Wood, 1965). Among subgenus *Charopsis* Kütz.: *Chara braunii* Gmelin, *C. corallina* Klein ex Willd. and *C. socotrensis* Nords in Kuhn may be considered for comparison. This plant is distinguished from *Chara corallina* f. *corallina* Wood (Fig. 2A) in large number of branchlets in a whorl, sturdy stipulodes and bracts, small crown at branchlet apex and the total structure of shoot apex. Similar differences may be found with *Chara socotrensis* f. *pashanii* Dixit (Zanefeldt, 1941; Imahori, 1964). On the contrary, the structure of shoot apex, number of branchlets in a whorl, size of stipulodes, distribution of gametangia and small crown at branchlet apex resemble with *Chara braunii* (Figs. 2B & C). Fractional differences are found in the size of plants, swelling of penultimate and shortening of lower most segments of branchlets in the young stage. Such characters have not been mentioned in the literature even by way of suggestion for *C. braunii* (Allen, 1882; Migula, 1897; Zanefeldt, 1941; Imahori, 1964; Wood, 1965; Pankow, 1971).

The question remains open, whether this plant is a habitat modification of *Chara braunii* (= *Charopsis braunii* (Gmel.) Kütz.) or an independent taxon. Before experimental work may bring clarification to this problem, the already available observations may be used as evidence. In Europe, *C. braunii* is strongly halophobic (Corillion, 1957). Its occurrence is concentrated in areas with sandy bottom and poorly electrolytic water. An example is presented by its abundance at the granite mountains of Serra de Monchique in Portugal, where it colonizes the collection basins of spring water. Its encroachment in the saline water in European sight appears to be impossible. In Indonesia *C. braunii* occurs preponderantly in poorly electrolytic mountainous lakes of higher elevation, without avoiding plains (Zanefeldt, 1941). In Pakistan it mainly grows during September and October in the cold water of Swat River in the Northwest Frontier Province and at high altitude in Kashmir (Langangen & Leghari, 2001).

Wood (1952) has reported the growth of *Chara braunii* with the halobiontic *C. canescens* Desv. et Loisel., in a salt pond of U.S.A. with 3.3 ppm NaCl and pH 9.5. This poorly described finding is the only case reported. The condition of *C. braunii* is well known in Japan (Kasaki, 1964), it belongs to the most widely distributed species of mountainous lakes up to salt lagoons. Among them are seven lakes with salinity of the order 1000-4000 mg/L NaCl. In one of them (Hachiro-gata), it grows together with *Lamprothamnium succinctum*. Likewise *C. braunii* behaves variably with water depth. In Europe it is confined to shallow water of 1 m rarely up to 2 m depth. In Japan, it develops its own vegetative zone between 2 and 8 m, which is only transversed by deep-water inhabitants like *Nitellopsis obtusa* (Desv. in Loisel.) J. Groves and *Nitella flexilis* (L.) C. Ag. Irrespective of variability in its habitat, *C. braunii* is considered as a world wide homogenous species, in which highly indistinctly delimited forms may be distinguished (Wood, 1965).

At this stage attention may be paid towards genetical inhomogeneity of the morphologically uniform taxa as recognized by Proctor (1970, 1971) and Grant & Proctor (1972). Their classification through experimental genetic research leads without

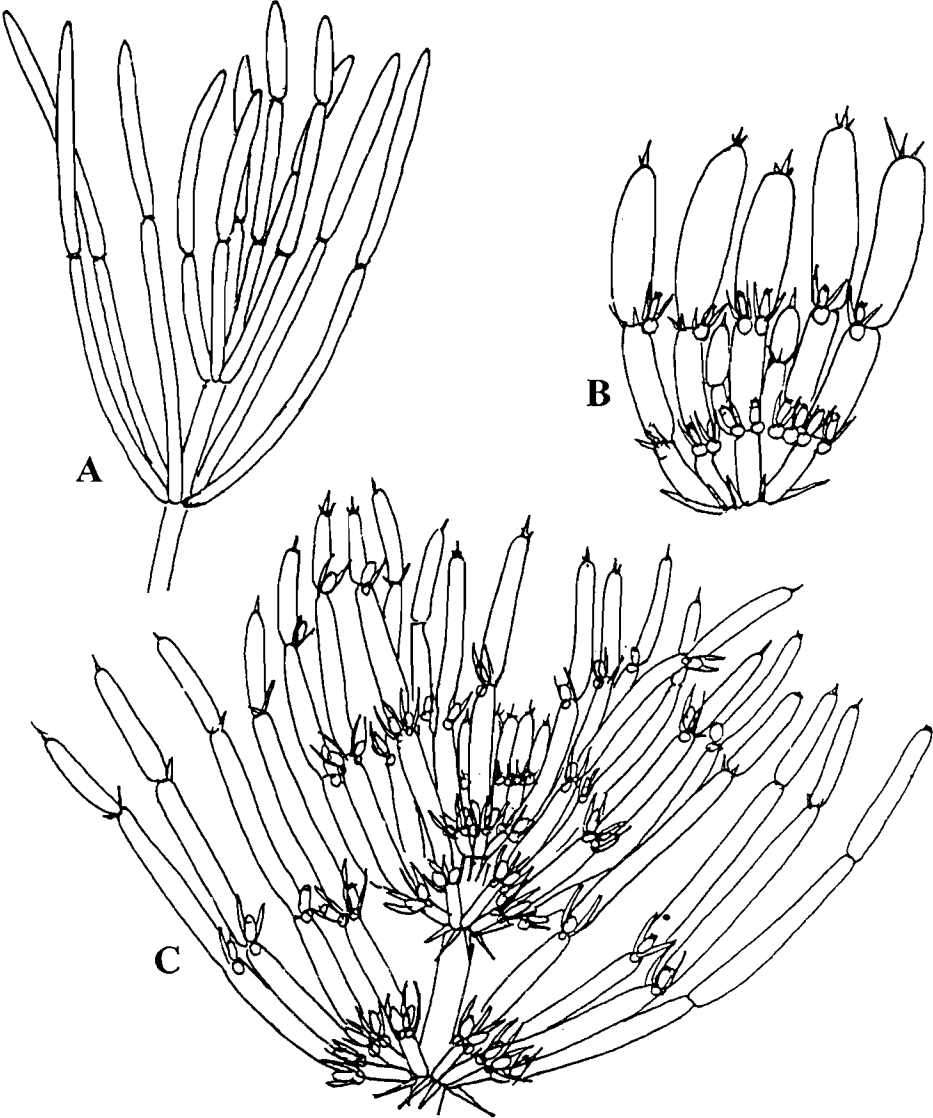


Fig. 2. *Chara* spp.: A. shoot apex of *C. corallina* ($\times 8$), B. very young shoot-apex of *C. braunii* ($\times 25$), C. well grown shoot-apex of *C. braunii* ($\times 10$).

doubt to distribute cosmopolitan species in geographically bound subunits. As the validity of such new subdivisions can not be disputed, it appears most appropriate to apply it in those cases where ecological arguments may be brought forward. It may also apply to the present plant.

Until now *Chara braunii* is distinguished in six forms according to indistinct size differences of oospores and bracts as well as measuring decisions like "slender, robust, medium size" etc., (Wood, 1965). Contrary to this "continuation with a few cut pieces", the present plant with its clear size difference, special structure of young branchlets and unusual ecological condition stays at a stage higher than "forma". To call it a "subspecies" or a "variety" also demands consideration, because a hierarchy of infraspecific taxa trimmed on the basis of generally acceptable morphological, genetical, ecological and geographically based characters is not applicable on Characeae due to insufficient information about its members (Proctor, 1980).

An example of the above mentioned dilemma was provided by Wood (1950, 1952, 1965), who gradually brought the ecorticated relatives of *Chara vulgaris* L. ex Wallr. *sensu latissimo* in one order, which is not compatible in rank sequence of subspecies, variety and form (Corillion & Guerlesquin, 1965; Krause, 1992). From this situation emerges the necessity of a neutral, unhierarchical sub-division of species, which was incidentally also recognized by Wood (1965) under the concept of "microspecies". Although, this is not an established taxonomic category, it fills a gap in the taxonomy of Characeae. However, the microspecies recognized by Wood (1965) do not coincide likewise with hierarchially arranged species of the old taxonomy of Characeae. The present plant, therefore, may be considered as a geographically limited and morphologically as well as ecologically separated microspecies within the world widely spread *Chara braunii*. Hence, it has been presented here as an independent species.

The name of *Chara krausei* is similar to that of *Chara krausii* A. Braun ex Kützinger, honouring Christian Krauss (1812-1890), a German zoologist who collected it in South Africa during 1838-1840, but both are completely different plants. The latter species has been treated as a variety of *Chara globularis* by Wood (1965). Although the two specific epithets are very close in spelling, they are based on different personal names and thus are not homonyms. Perhaps there will be no significant chance of confusion by subsequent workers.

In a recent publication on charophytes of Pakistan, Langangen & Leghari (2001) have not accepted the species reported by Sarim (1991) and Aisha & Shameel (1995). This is presumably due to non-availability of these materials to them and lack of observations. The specimens of *Chara vulgaris* f. *atrovirens* (Lowe) H. et J. Groves and *C. v. f. calveraensis* R.D. Wood, collected near the coast of Balochistan, were examined and confirmed by Dr. Werner Krause and leave no doubt about their identification, irrespective of minor differences.

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References

- Aisha, K. and M. Shameel. 1995. Some freshwater green algae near Balochistan coast of Pakistan. *Pak. J. Bot.*, 27: 41-48.
- Allen, T.F. 1882. Observations on some American forms of *Chara coronata*. *Amer. Natural.*, 16: 358-369.
- Corillion, R. 1953. *Lamprothamnium papulosum* J. Groves. *Bull. Soc. Sci. Bretagne*, 28: 33-41.
- Corillion, R. 1957. *Les Charophycées de France et d'Europe Occidentale*. Angers, 499 pp.
- Corillion, R. and M. Guerlesquin. 1965. Sur une révision récente de la systematique chez les Charophycées. *Bull. Mayenne. Sci.*, 1964: 57-87.
- Faridi, M.A.F. 1955. A contribution to the Charales of West Pakistan. *Biologia*, 1: 70-81.
- Faridi, M.A.F. 1956. A new species of *Nitella* from West Pakistan. *Biologia*, 2: 254-255.
- Grant, W.C. and V.W. Proctor. 1972. *Chara vulgaris* and *C. contraria*: Patterns of reproductive isolation for two cosmopolitan species-complexes. *Evolution*, 26: 267-281.
- Groves, J. 1923. Notes on Indian Charophyta. *J. Linn. Soc. London, Botany*, 46: 359-376.
- Imahori, K. 1964. *A Revision of the Characeae*. J. Cramer, Weinheim, 395 pp.
- Jahangir, T.M., M.Y. Khuhawar, S.M. Leghari, W.A. Baloch, A.A. Leghari and A. Leghari. 2000. Some studies on water quality and biological life at Kinjhar and Haleji lakes of district Thatta, Sindh, Pakistan. *Pak. J. Biol. Sci.*, 3: 1965-1972.
- Kasaki, H. 1964. The Charophyta from the lakes of Japan. *J. Hattori Bot. Lab.*, 27: 217-315.
- Krause, W. 1992. Die taxonomische Zuordnung von *Lamprothamnium hansenii* Sonder und *Nitella spanioclema* Groves et Bullock-Webster (Charophyta) im Lichte neuer Herbar- und Geländestudien. *Nova Hedw.*, 54: 127-136.
- Langangen, A. and S.M. Leghari. 2001. Some charophytes (Charales) from Pakistan. *Studia Bot. Hung.*, 32: 63-85.
- Leghari, S.M., S.I.H. Jafri, M.A. Mahar, K.H. Lashari, S.S. Ali, M.Y. Khuhawar and T.M. Jahangir. 1999. Biodiversity of Chotiari reservoir, district Sanghar, Sindh, Pakistan. In: *Proceedings of the Seminar on Aquatic Biodiversity of Pakistan* (Eds.) Q.B. Kazmi and M.A. Kazmi. MRCC & Zool. Dept., Kar. Univ., p. 139-157.
- Leghari, S.M., S.I.H. Jafri, M.A. Mahar, K.H. Lashari, S.S. Ali, T.M. Jahangir and M.Y. Khuhawar. 2000. Limnological study of Sonharo, Mehro Pateji and Cholari lakes of district Badin, Sindh, Pakistan. *Pak. J. Biol. Sci.*, 3: 1904-1909.
- Leghari, S.M., T.M. Jahangir, M.Y. Khuhawar and A. Leghari. 2001. Physico-chemical and biological study of Dhabeji springs, Malir, Karachi, Sindh, Pakistan. *Online J. Biol. Sci.*, 1: 623-627.
- Migula, W. 1897. Die Characeen. In: *Kryptogamen flora von Deutschland, Österreich und der Schweiz*. 5, (Eds.) Rabenhorst, L. Kummer, Leipzig, 765 pp.
- Pal, B.P., B.C. Kundu, V.S. Sundaralingam and G.C. Venkataraman. 1962. *Charophyta*. I.C.A.R., New Delhi, 130 pp.
- Pankow, H. 1971. *Algenflora der Ostsee*. I. *Benthos*. Gustav Fischer Verlag, Stuttgart, 419 pp.
- Proctor, V.W. 1970. Taxonomy of *Chara braunii*: an experimental approach. *J. Phycol.*, 6: 317-321.
- Proctor, V.W. 1971. *Chara globularis* Thuillier (= *C. fragilis* Desvaux): Breeding patterns within a cosmopolitan complex. *Limnol. Oceanogr.*, 16: 422-436.

- Proctor, V.W. 1980. Historical biogeography of *Chara* (Charophyta): an appraisal of the Braun-Wood classification plus a falsifiable alternative for future consideration. *J. Phycol.*, 16: 218-233.
- Sarim, F.M. 1991. Further notes on the Charales of Pakistan. *Pak. J. Sci. Ind. Res.*, 34: 348-351.
- Wood, R.D. 1950. Stability and zonation of Characeae. *Ecology*, 31: 642-647.
- Wood, R.D. 1952. An analysis of ecological factors in the occurrence of Characeae of the Woods Hole region, Massachussets. *Ecology*, 33: 104-109.
- Wood, R.D. 1965. Monograph of the Characeae. In: *A Revision of the Characeae*. (Eds.) R.D. Wood and K. Imahori. C. Cramer, Weinheim, 904 pp.
- Zaidi, M.I. 2000. *Fresh Water Algae From Balochistan*. United Publ., Quetta, 310 pp.
- Zanefeld, J.S. 1941. The Charophyta of Malaysia and adjacent countries. *Blumea*, 4: 1-223.

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