Typification and clarification of species concepts of *Chara fischeri* Migula and *C. gobiana* Vilhelm (*Charales, Charophyceae*)

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The original material of *Chara fischeri* Migula and *C. gobiana* Vilhelm was located in the herbarium of the Komarov Botanical Institute of the Russian Academy of Sciences (**LE**) in order to clarify its nomenclature and taxonomy. A study of the original material allowed formal designation of their lectotypes here in accordance with ICN Art. 9.3 (Turland & al., 2018) for the clarification of current species concepts (e.g., Migula, 1904; Vilhelm, 1928; Wood 1965; Hollerbach & Krassavina, 1983; Han & Li, 1994). The specimens are mostly stored in paper envelopes, but the envelope labels are usually not the original ones, and both labels are cited below in instances where they are different. Russian text in labels is reproduced with a translation in brackets. **LE** barcodes are indicated for each specimen.

Chara fischeri Migula 1904: 538.

Lectotype (here designated): [Uzbekistan, Khiva] Chiva: Chanka, in stagnis / 17 VIII 1873 / Korolkow & Krause (**LE** A0001549); Wood (1965: 189) indicated this specimen as "Isotype (or holotype?)" and is here formally designated as lectotype.

Epitype (here designated for the lectotype above): [Uzbekistan, Khiva], г. н. Ханка. Найдено в пруде (вода непроточная) [the settlement of Khanka (currently Xonqa). Found in a pond (not flowing water)] / 17 VIII 1873 / Корольков [и Краузе] [Korolkow [& Krause]] (**LE** A0001550).

≡ *C. globularis* Thuillier [var. *virgata* (Kützing) R.D.Wood] f. *fischeri* (Migula) R.D.Wood 1962: 10.

≡ *C. globularis* Thuillier [var. *virgata* (Kützing) R.D.Wood] f. *fischeri* (Migula) R.D.Wood 1965: 189. 'Isotype (or holotype?)' (Designated by Wood 1965: 189): Chiwa, Chanka [= Changsha], in stagnis / 17 VIII 1873 / Korolkow & Krause (LE).

Current name: *Chara aspera* var. *subinermis* Kützing 1849: 521. Type not designated.

Specimen in the protologue: '*Chiwa: Chanka, in stagnis* 17.III.1873 (Korollkow et Krause!)'.

Original material: 1. Envelope label: no locality / 1873 / Korolkow. Handwritten label by Migula for inner envelope: Chiva / 1873 / Korolkow. Label of the other inner envelope: *Chiva: Chanka, in stagnis* / 17 VIII 1873 / Korolkow et Krause (**LE** A0001549). Part of this specimen stored in the inner envelope was seen and annotated by Wood (**LE** A0001549), but another part of the material, perhaps a slide with fragments used for preparation of the drawings by Wood & Imahori, is kept in **NY** (**NY** 00945625), but this was not indicated in their publication. 2. Envelope label: Хива, Ханка, в стоячих водах [Khiva, Khanka, in stagnant waters] / Корольков [Korolkow] / 17 VIII 1873. Authentic label: г. н. Ханка. Найдено в пруде (вода непроточная) [the settlement of Khanka. Found in a pond (not flowing water)] / 17 VIII 1873 / Корольков [Korolkow, inscribed by other hand] (**LE** A0001550). 3. Envelope label: no locality / no collector / no date. Inner label: Chiwa / 1873 / Korolkow & Krause. A handwritten copy of authentic label: г. н. Ханка. Найдено в пруде (вода непроточная) [the settlement of Khanka. Found in a pond (not flowing water)] / 17 VIII 1873 / Корольков [Korolkow] (**LE** A0001551).

Comment: Original material stored in **LE** consists of three envelops mounted on the same sheets. It contains *C. aspera* f. *subinermis*, fragmented and entangled in intact fragments with female plants of *C. canescens* Loiseleur, *Stuckenia* sp. (*Potamogetonaceae*) together with lot of material resembling incrusted microbial mats (checked by the author). The comparison of protologue and original material clearly indicate that Migula's taxon represents the entity currently known as *C.*

aspera var. *subinermis* Kützing. The male and female plants of this taxon are tightly packed. Evidently this state of material resulted in a description of the new species, having both dioecious and monoecious plants (Migula, 1904). The latter plants were described as having oogonia only at lowest whorls and antheridia only at upper whorls in the same plant and rarely as sejoined in the same branchlet, although Migula noted the difficulty in observing this and was convinced in three cases only. This pattern was neither illustrated and described by Wood & Imahori (Wood & Imahori, 1964; Wood, 1965) after a study of small part of original material, nor illustrated by Hollerbach & Krassavina (Hollerbach & Krassavina, 1983: fig. 68) after their examination of all the original material. A similar error in interpretation of entangled monoecious and dioecious plants as a monoecious one occurred in the description of *C. arcuatifolia* Vilhelm (Romanov, 2022). Original material was collected in Uzbekistan and not in China (cf. Wood, 1965). The more abundant specimen from original material in better condition is designated here as the epitype because type material contains two dioecious species of *Chara*. For a long time *C. fischeri* was known from type locality only (Hollerbach, 1950). Later it was reported for the south of West Siberia, Central Asia (Hollerbach & Krassavina, 1983), Baikal Siberia (Zolotareva & Koryakov, 1996), Ukraine (Palamar-Mordvintseva, 1998; Borisova & al., 2016) and Mongolia (Paul, 2012). All specimens referred to this species and available for study in **LE** (checked by the author, unpublished data) are actually *C. aspera* f. *subinermis*. The resampling efforts in some known localities yielded the same results (Romanov & al., 2014; R. Romanov, unpublished data).

Chara gobiana Vilhelm 1928: 14.

Lectotype (here designated): [China, Inner Mongolia] *Mongolia. Ordos. Taj-tuhai in lac[u]* / 30 VIII 1884 / Potanin. (**LE** A0001557); Wood (1965: 103) indicated this specimen as "Isotype (or holotype?)" and is here formally designated as lectotype

Isolectotypes (here designated): 1. *Mongolia, Taj-tuhaj, in lacu* / 30 VIII 1884 / G. Potanin (**LE** A0001556). 2. Уроч[ище] Тай-Тухай. В озере [The place of Tay-Tukhay. In lake] / 30 августа 1884 [30 VIII 1884] / [G. Potanin] (**LE** A0001558).

≡ *Chara vulgaris* Linnaeus [var. *vulgaris* R.D.Wood] f. *gobiana* (Vilhelm) R.D.Wood 1962: 8.

= *C. vulgaris* Linnaeus [var. *vulgaris* R.D.Wood] f. *gobiana* (Vilhelm) R.D.Wood 1965: 178. 'Isotype (possibly holotype)' (designated by Wood 1965: 178): *Mongolia. Ordos [Desert], Taj-tuhaj, in lacu* / 30 VIII 1884 / G. Potanin (**LE**).

Current name: *Chara contraria* A.Braun ex Kützing 1845: 258. Lectotype (designated by Wood 1965: 93): Carlsruhe / 1839 / A. Braun (**L** 00546).

Specimen in the protologue: '*Mongolia. Ordos. Taj-tuhai in lacu* (30.VIII.1884, leg. G. Potanin)'.

Original material (**LE**): 1. Envelope label: *Mongolia, Taj-tuhaj, in lacu* / 30 VIII 1884 / G. Potanin (**LE** A0001556). This part was seen and annotated by Imahori & Wood as "probably juvenile variant of *C. contraria*" in their *determinavit* slip (**LE** A0001556) and monograph (Wood, 1965: 103). A part of the original material, perhaps a slide used for preparation of drawings by Wood & Imahori, is preserved at **NY** (00945631), but this was never indicated in their publications. 2. Envelope label: *Mongolia. Ordos. Taj-tuhai in lac[u]* / 30 VIII 1884 / Potanin. (**LE** A0001557). 3. Envelope label: *Mongolia. Ordos. Taj-tuchaj in lac[u]* / 30 VIII 1884 / Potanin. Authentic label: Уроч[ище] Тай-Тухай. В озере [The tract (place) of Tay-Tukhay. In lake] / 30 августа 1884 [30 VIII 1884] / [G. Potanin] (**LE** A0001558). A small part of this specimen was send as a loan to Wood and on return it was stored in separate envelope.

Comments: Original material stored in **LE** consists of three envelops mounted at the same sheets. It contains only one species. The less-fragmented specimen in better condition was selected as a lectotype. *Chara gobiana* has long ecorticate nodeless sections of the branchlet exceeding the corticated sections up to 2–2.5 times, short stipulodes in two rows, conjoined solitary and sometimes geminate gametangia at nodes between or at the top of corticated segments and

mostly tylacanthous stem cortex with solitary spine cells (own data). Therefore, it is nearly identical with a morphotype of *C. contraria* described by different authors as *C. inconnexa* Allen, *C. hypnoides* C.B. Robinson, *C. hippelliana* (Vilhelm) Vilhelm, *C. arrudensis* Mendes (Romanov, 2015; the type of *C. arrudensis* stored in **LISU** was examined by the author) and indistinctly differs with thickened cell wall at bracteole tips, long inflated basal cell in contrast with much shorter other cells of ecorticate part of branchlet, noted by Wood & Imahori (1964) and Wood (1965), which cannot be accepted as an evidence of separate taxon. *C. gobiana* is known from China and Mongolia from few localities only (Vilhelm, 1928; Han & Li, 1994; Ling & al., 2000; Paul, 2012).

I am grateful to: Thomas Gregor for improvement of this manuscript and generous sharing of his knowledge of nomenclature; to an anonymous reviewer; to Michael D. Guiry for suggestions for improvement of the manuscript; and to Ana Isabel Correia for the help and guidance in study of specimens stored in **LISU**. This work was supported by the project AAAA-A18-118022090078-2 of the Komarov Botanical Institute of the Russian Academy of Sciences.

Borisova, O.V., Palamar-Mordvintseva, G.M. & Tsarenko, P.M. (2016). *Flora vodorostej Ukraïny. Tom 12. Xarofitovi vodorosti. Vyp. 2.* [Flora algarum Ucrainicae. Charophyta, 12(2)]. pp. 1–282. Kyiv: Kholodny Institute of Botany of the National Academy of Science of Ukraine. [In Ukrainian]

Han, F.S. & Li, Y.Y. (Eds) (1994). *Flora algarum sinicarum aquae dulcis. Tomus 3. Charophyta.* pp. i–vii, 1–267. Beijing: Science Press. [In Chinese]

Hollerbach, M.M. (1950). Sistematichesky spisok kravykh vodoroslei, obnaruzhennykh v predelakh SSSR po 1935 g. vkluchitelno [The systematic list of charophytes, found on USSR territory till 1935 inclusively]. *Trudy Botanicheskogo Instituta im. V.L. Komarova AN SSSR. Ser. 2. Sporovye rasteniya* 5: 20–94. [In Russian]

Hollerbach, M.M. & Krassavina, L.K. (1983). *Opredelitel presnovodnykh vodorosley SSSR. Vyp. 14. Kharovyye vodorosli – Charophyta* [The identification manual of freshwater algae of the USSR. Iss. 14. The charophytes – Charophyta]. pp. 1–190. Leningrad: Nauka. [In Russian]

Kützing, F.T. (1845). *Phycologia germanica, d. i. Deutschlands Algen in bündigen Beschreibungen.* Nebst einer Anleitung zum Untersuchen und Bestimmen dieser Gewächse für Anfänger. pp. [i]-x, [1]–340 ['240'].

Kützing, F.T. (1849). *Species algarum*. pp. [i]-vi, [1]-922. Lipsiae [Leipzig]: F.A. Brockhaus.

Migula, W. (1904). Characeae Rossicae ex Herbarion Horti Petropolitani. *Acta Horti Petropolitani. Trudy Imperatorskago S.-Peterburgskago Botaniceskago Sada* 23: 533–539.

Paul, M. (2012). *Limnological aspects of the Uvs Nuur Basin in northwest Mongolia*. pp. 1–186, 1 pl. Diss. TU Dresden.

Romanov, R.E. (2015). *Chara inconnexa* Allen (Streptophyta: Charales) and taxonomic ambiguities associated with subgymnophyllous species close to *C. contraria* A. Braun ex Kütz. s.str. *Cryptogamie. Algologie* 36(4): 371–388.

Romanov, R.E. (2022). Typification of *Chara connivens* Salzmann ex A.Braun f. *brevifolia* Vilhelm, *C. crinita* Wallroth and *C. glomerulifera* Ruprecht and clarification of conflicting species concepts for *C. arcuatifolia* Vilhelm (Charales, Charophyceae). *Notulae algarum* 223: 1–4.

Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.-H., Li, D.-Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F., editors (2018). *International Code of Nomenclature for algae, fungi, and plants (Shenzhen Code)* adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. *Regnum Vegetabile*, Vol. 159. pp. [i]–xxxviii, 1–253. Glashütten: Koeltz Botanical Books.

Vilhelm, J. (1928). Characeae Europae orientalis et Asiae ex herbario instituti cryptogamici horti botanici reipublicae rossicae (ante Petropolitani). *Spisy vydávané Prirodovedeckov Fakultov Karlovy University (Publications de la Faculté des Sciences de l'Université Charles, Praha)* 80: 1–24, 1 pl.

Wood, R.D. (1962). New combinations and taxa in the revision of Characeae. Taxon 11(5): 7–25.

Wood, R.D. (1965). *A revision of the Characeae*. First Part. Monograph of the Characeae. pp. i–xxiv, 1–904. Weinheim: Verlag von J.Cramer.

Wood, R.D. & Imahori, K. (1964). *A revision of the Characeae*, 2. Iconograph of the Characeae. Monograph of the Characeae. pp. v–xv, 1–5, icons 1–395. Weinheim: Verlag von J.Cramer.

Zolotareva, L.N. & Koryakov, D.E. (1996). *Novye vidy kharovykh vodorosley v ozerakh Tcentralnogo Zabaykalyya* [New species of charophytes in the lakes of Central Transbaikalia]. Zabajkal'e – Sud'ba provincii [Transbaikalia – the Fate of the Province]. p. 84. Chita. [in Russian]