

**Revised treatment of Reinsch's *Selenastrum* taxa and *Messastrum* (Chlorophyta) with remarks on their original material and molecularly analysed reference strains**

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The genus *Selenastrum* Reinsch was first described by Paul Friedrich Reinsch (1836-1914). He originally included two species (Reinsch 1867), both of which were described from Franconia near the city of Erlangen in Bavaria (Germany). Although both species were illustrated, a type was not selected by Reinsch. Later researchers did not designate a type of the genus either, and the genus remained untypified (Farr & al. 1979, Farr & Zijlstra 1996 to date). This may have been because interest in the genus was low after Korshikov (1953) had included both of Reinsch's *Selenastrum* species within the genus *Ankistrodesmus* Corda, and some later authors followed him (e.g., Komárek & Fott 1983).

Krienitz & al. (2011) and Garcia & al. (2016) examined both of Reinsch's species critically and analysed them using modern clonal cultures by microscopy and molecular methods. Garcia & al. (2016) found that both species belonged to different clades at the genus level, so the authors proposed leaving *Selenastrum bibraianum* Reinsch within the genus *Selenastrum* Reinsch and erected a new genus, *Messastrum* T.Garcia on the basis of *Selenastrum gracile* Reinsch. One could argue that with this taxonomic treatment *Selenastrum* Reinsch became "monotypic", but designation of a lectotype was still necessary but was not carried out.

Messastrum T.Garcia in Garcia & al. (2016) was, however, validly published because the validly published species name *Selenastrum gracile* was explicitly included, but Garcia & al. (2016) failed to publish "*Messastrum gracile* (Reinsch) T.Garcia" validly, because a full and direct citation of the basionym was not provided (Turland & al. 2018, Art. 41.5).

Additionally, Garcia & al. (2016) named the figures in Reinsch (1867) "holotypes" without checking for further original material. Thus, their proposed epitypes have no standing. It should, however, be noted that the processes of epitypification are under discussion, and whereas some colleagues argue for an "epitypification method" to link old materials or images to ultrastructural and molecular characters via epitypification, others stigmatise epitypification as an "increasingly misused nomenclatural action" (e.g., Lendemer 2020). Nevertheless, Art. 9.9 of the current (Shenzhen) Code provides for the selection of an epitype as an interpretative type "when the holotype, lectotype, or previously designated neotype, or all original material associated with a validly published name, is demonstrably ambiguous and cannot be critically identified for purposes of the precise application of the name to a taxon."



We have attempted to establish if original material of the Reinsch *Selenastrum* species is available. According to Stafleu & Cowan (1983), algal material of Reinsch should be in the *Staatliche Naturwissenschaftliche Sammlungen Bayerns (M)*, but the *Selenastrum* or *Ankistrodesmus* species in question could not be found within the collection (D. Triebel, pers. comm.).

To overcome the shortcomings of previous publications we here give a revised treatment of *Selenastrum* and *Messastrum*.

Selenastrum Reinsch in *Abhandlungen der Naturhistorischen Gesellschaft zu Nürnberg* 3(2): 64, 1867.

Lectotypus generis (*hic designatus*): *Selenastrum bibraianum* Reinsch, *Algenfl. Franken*: 64, 1867. Registration: <http://phycobank.org/102829>

Selenastrum bibraianum Reinsch in *Abhandlungen der Naturhistorischen Gesellschaft zu Nürnberg* 3(2): 64, pl. IV: fig. II. 1867.

≡ *Ankistrodesmus bibraianus* (Reinsch) Korshikov, *Protococcineae*: 302. 1953.

Syntype localities: *Altwasser der Schwabach bei der Schleifmühle bei Erlangen* (Ox bow of the river Schwabach near the grinding mill near the city of Erlangen, Bavaria, Germany) and *Tümpel an der Regnitzbrücke bei Erlangen* (Pond near the bridge crossing river Regnitz near the city of Erlangen, Bavaria, Germany).

Lectotype (here designated): [icon] *Abhandlungen der Naturhistorischen Gesellschaft zu Nürnberg* 3(2): 65. Pl. IV: fig. IIb middle upper coenobium. (not “II. b on the right side”) 1867.

Further material: No specimens are located at **M**. The most relevant specimens are deposited at **BM**. **BM** 001045740 and **BM** 001045741 are labelled “*Prep. Micr. Algolog. P. F. Reinsch 1874*” but databased as “type”. There is, however, no indication that this material was in Reinsch’s hand when preparing the description of *Selenastrum bibraianum*. Because it is not possible to relate the Reinsch material to a concrete locality and to decide whether or not it is original material, we have chosen the image most similar to the current understanding of the species as the lectotype. The selected lectotype illustrates the typical morphology, fig. IIa illustrates a part of a syncoenobium of the species, but IIb (right side) and IIc cannot be identified unequivocally. Krienitz & al. (1985: 81) already preselected and reproduced figs IIb (middle upper coenobium) and IIa from Reinsch (1867) as “*Iconotypus*”. The term “*Iconotypus*” was discussed (Greuter & al. 2000a: 72-76) previous to the St. Louis Code (Greuter & al. 2000b), but it gained no acceptance as a name for a nomenclatural type and is not included in the Glossary of the current (Shenzhen) Code, hence Krienitz & al. (1985) do not include a formal typification.

Reference strain from Germany, Europe: CB 2009/41, 18S sequence: HM483514 (Krienitz & al. 2011), *rbcL* sequence: KT833572 (Garcia & al. 2016).

Reference specimen from Germany, Europe: **B** 40 0045144 (Pond, Botanic Garden Berlin), prepared from strain CB 2009/41.

Reference strain from Brazil, South America: CCMA–UFSCar 47, *rbcL* sequence: KT833561, ITS2: KU180820.

Reference specimen from Brazil, South America (as “epitype” in Garcia & al. (2016): **SP** 469321 (prepared from strain CCMA–UFSCar 47).

Ecological note related to Strain CB 2009/41 and specimen **B** 40 0045144: *Selenastrum bibraianum* occurs in two highly eutrophic ponds with a high diversity of chlorophytes in the Botanic Garden Berlin (Didwizsus & Kusber 1998, Geissler & Kies 2003). It was found throughout the vegetation period between 11.7 and 23.4°C water temperature, between pH 7.6 and 9.2, conductivity between 238 and 650 µS/cm. At all sampling events free phosphorous was available (Didwizsus, unpubl.).



Excluded from synonymy: *Ankistrodesmus bibraianus* sensu Krienitz & al. (2001), strain SAG 12.94, sequence Y17924, cit. err. pro *Quadrigula closterioides*.

Messastrum T.Garcia in Garcia & al. in *Fottea* 17(1): 3. 2016.

Typus generis: *Selenastrum gracile* Reinsch (designated in Garcia & al. 2016)

Messastrum gracile (Reinsch) T.Garcia, *comb. nov.*

Basionym: *Selenastrum gracile* in *Abhandlungen der Naturhistorischen Gesellschaft zu Nürnberg* 3(2): 65, pl. IV: fig. III. 1867.

≡ *Ankistrodesmus gracilis* (Reinsch) Korshikov, *Protococcineae*: 305. 1953.

Previous designation: “*Messastrum gracile*” (Reinsch) T.Garcia in Garcia & al. (2016), *nom. inval.* (Turland & al. 2018, Art. 41.5)

Registration: <http://phycobank.org/102830>

Syntype localities: *Altwässer an der Regnitz bei Erlangen* (Oxbows of river Regnitz near the city of Erlangen, Bavaria, Germany), *Gräben an der Regnitz bei Erlangen* (Ditches near river Regnitz near the city of Erlangen, Bavaria, Germany).

Lectotype (here designated): [icon] Reinsch, *Abhandlungen der Naturhistorischen Gesellschaft zu Nürnberg* 3(2): 65. Pl. IV: fig. IIIb. 1867.

Krienitz & al. (1985: 81) preselected and reproduced figs III a, b as “Ikonotypus”. As mentioned above, Krienitz & al. (1985) did not effect a formal typification.

Further material: No specimens located at **M**. The most relevant specimens are deposited at **BM**. **BM** 001045737 is labelled “*Prep. Micr. Algolog. P. F. Reinsch 1874*” and databased as “type”, but there is no indication that this material was in Reinsch’s hand when preparing the description of *Selenastrum gracile*. Because it is not possible to relate the Reinsch material to a concrete locality and to decide whether or not it is original material, we have chosen the image most similar to the current understanding of the species as the lectotype.

Reference strains from Germany, Europe: CB 2009/35 (deposited as **CCAC** 9391B), 18S sequence: KT861784; KR 1981/231, 18S sequence: HM565930 (Krienitz & al. 2011).

Reference specimen from Germany, Europe: **B** 40 0045158 (prepared from CB 2009/35).

Reference strain from England: SAG 278.2, 18S sequence: Y16937.

Reference specimen from Brazil, South America (as “epitype” in Garcia & al. (2016): **SP** 469319 (prepared from strain CCMA–UFSCar 622).

Reference strain from Brazil, South America: CCMA–UFSCar 622, 18S sequence: KT833593; *rbcL*: KT355762, ITS2: KU180825.

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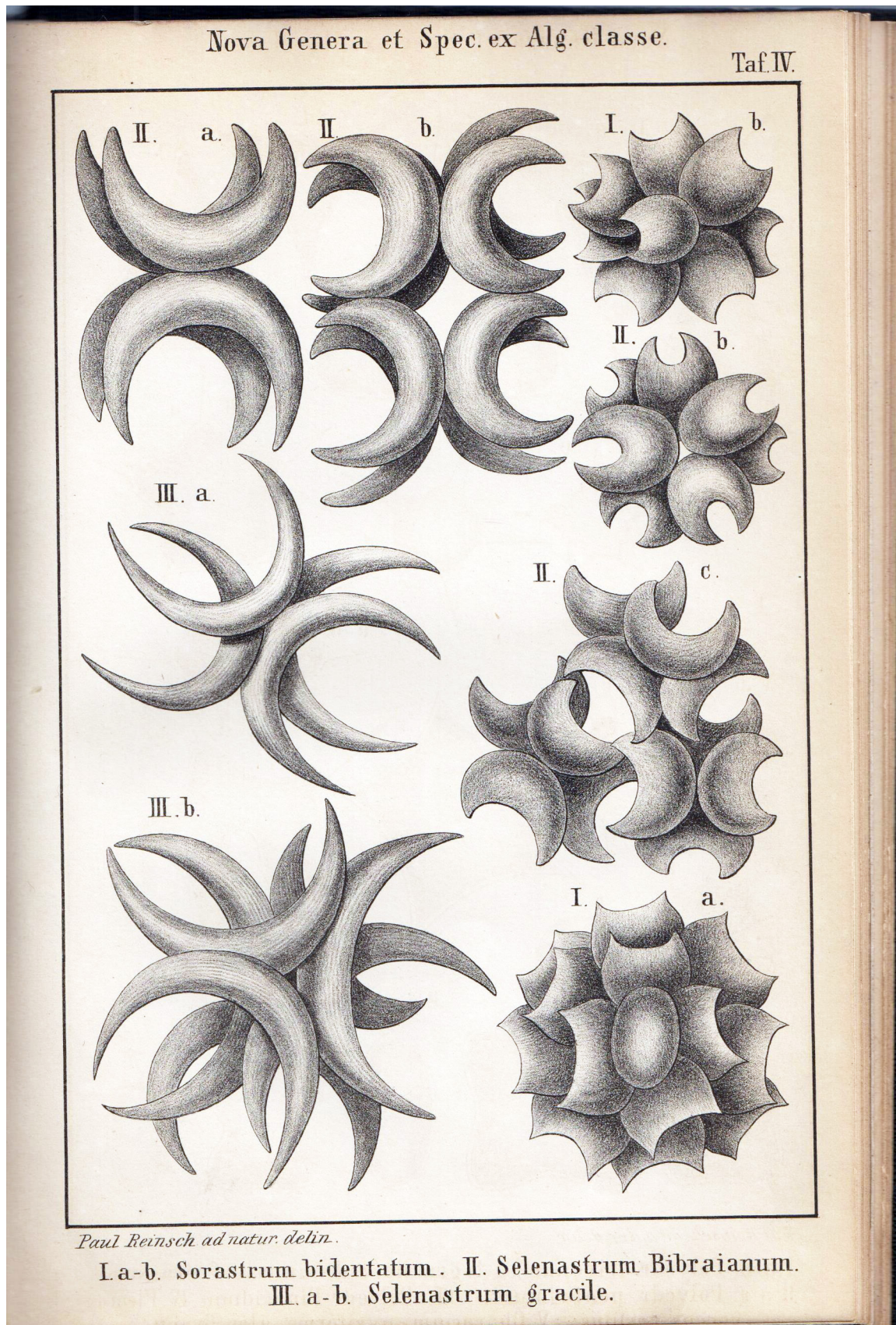


Fig. 1. Reproduction of Plate IV in Reinsch (1867): IIb (upper figure): lectotype of *Senastrum bibraianum* Reinsch. IIIb: lectotype of *Senastrum gracile* Reinsch.