



# On the morphology and distribution of a rare diatom species *Chamaepinnularia gandrupii* in Russia

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With 8 figures and 2 tables

**Abstract:** Investigation of materials from waterbodies and watercourses in the Far North of Western Siberia shows that *Chamaepinnularia gandrupii* is highly variable in terms of certain quantitative characteristics (e.g. valve length and width, number of striae and areolae in 10 µm). These observations make it possible to refine the diagnosis of this species, and indicate that *Chamaepinnularia gandrupii* var. *simplex* is a synonym of the nominate variety.

**Key words:** Western Siberia, phytoplankton, electron microscopy, Bacillariophyta, *Chamaepinnularia gandrupii*.

## Introduction

The species *Pinnularia gandrupii* Petersen was described by one valve (Petersen 1924), then transferred to the genus *Navicula* Bory (Krasske, 1938), and not long ago was assigned to a new genus – *Chamaepinnularia gandrupii* (Petersen) Lange-Bertalot & Krammer (Lange-Bertalot, Metzeltin 1996). Data on the distribution of this species is scarce – it was recorded from Finland (Lange-Bertalot & Metzeltin 1996), Russian Arctic (Lange-Bertalot & Genkal 1999; Genkal & Vekhov 2007), North America (Antoniades et al. 2008), and Mongolia (Metzeltin et al. 2009).

The aim of this manuscript, based on the study of new materials, is to investigate morphological variability of *Chamaepinnularia gandrupii* and the range of this species in Russia.

## Materials and methods

Phytoplankton samples from aquatic ecosystems in the Far North of Western Siberia served as material for this study. The samples were collected from the following locations in the Yamal Peninsula: the Mordyyakha River basin: Lake Pebtavyto – N70°18'58"E68°10'54", Unnamed Lake «Pervoye» – N70°24'25"E68°25'00", Khangolovayakha River – N70°20'07"E68°39'57", Penzetarka River – N70°20'34"E68°49'48", unnamed Lake «Poligon 8» – N70°22'58"E68°18'34"; Kharasaveiyakha River basin: unnamed stream, a right-bank tributary in the upper reaches of the Navatalovayakha River – N71°12'08"E67°03'01", the Sormiketsyatarka River – N71°09'58"E66°52'17"; the Naduiyakha River basin: the Pelkhatose channel – N70° 24'27"E68°23'06", North-West of the Yamal Peninsula: the Yakhdayakha River – N72°19'46" E70°33'10", Venyakha River – N71°32'43" E71°04'40", Sabol'yakha River – N71°53'42"E 72°18'56", and the Edyakha River – N71°43'14"E71°31'35".

Diatom frustules were released from organic matter by cold burning (Balonov 1975). Specimens were examined in a JSM-25S scanning electron microscope.

## Results and discussion

According to the original description, valves *C. grandrupii* are linear in shape, widened in the middle, with widely rounded capitate ends and three slight undulations (Petersen 1924). Several morphotypes are found in our material: type shape valves (Fig. 4), linear valves with a slight widening in the middle and capitate ends (Figs 2, 3, 6, 7), valves with capitate ends and without a widening in the middle (Fig. 8) and linear-lanceolate valves with widely rounded ends (Figs 1, 5). Similar variability in the valve shape is reported by other researchers (Antoniades et al. 2008). Valves of a similar shape (linear and linear-lanceolate with widely rounded ends) with the same quantitative characteristics as in *Navicula grandrupii* (= *Chamaepinnularia grandrupii*) (according to measurements, length 14–14.3  $\mu\text{m}$ , width 3.1  $\mu\text{m}$ , number of striae in 10  $\mu\text{m}$  23–24) were described as *Navicula grandrupii* var. *simplex* Krasske 1938 (Lange-Bertalot et al. 1996) but later this variety was also transferred to the genus *Chamaepinnularia* – *Ch. grandrupii* var. *simplex* (Krasske) Lange-Bertalot & Krammer (Lange-Bertalot & Metzeltin 1996). Similar valve shape under the name *Chamaepinnularia grandrupii* are reported by other researchers (Lange-Bertalot & Genkal 1999, Taf. 45, Figs 11, 12, Genkal & Vekhov 2007, Table 18: 6, 7, 19: 1, 2). Significant variations in valve shape also occur in other representatives of the genus, for example in *Chamaepinnularia circumborealis* Lange-Bertalot (Genkal & Yarushina 2016).

Most valves in our material are longer (Table 2) than those reported in the literature (Table 1). The width of valves from some watercourses (Table 2) also exceeds values of this parameter known from the literature (Table 1). Antoniades et al. (2008) give the range of valve width (1.5–2.5) which differs to a large extent from other published data (Table 1). Our measurements of this characteristic taken from published illustrations (Antoniades et al. 2008, Pl. 51: 11–21; 117: 7–8) give different results (2.6–3.9), close to those in the literature (Table 1). In our material, the number of striae in 10  $\mu\text{m}$  is smaller than it is reported in the literary sources so the ranges of this characteristic do not coincide (Tables 1, 2). In our opinion, these distinctions are due to some factors, including variability within different populations, which is rather significant in pennate diatoms (Krammer 2002, Genkal 2014).

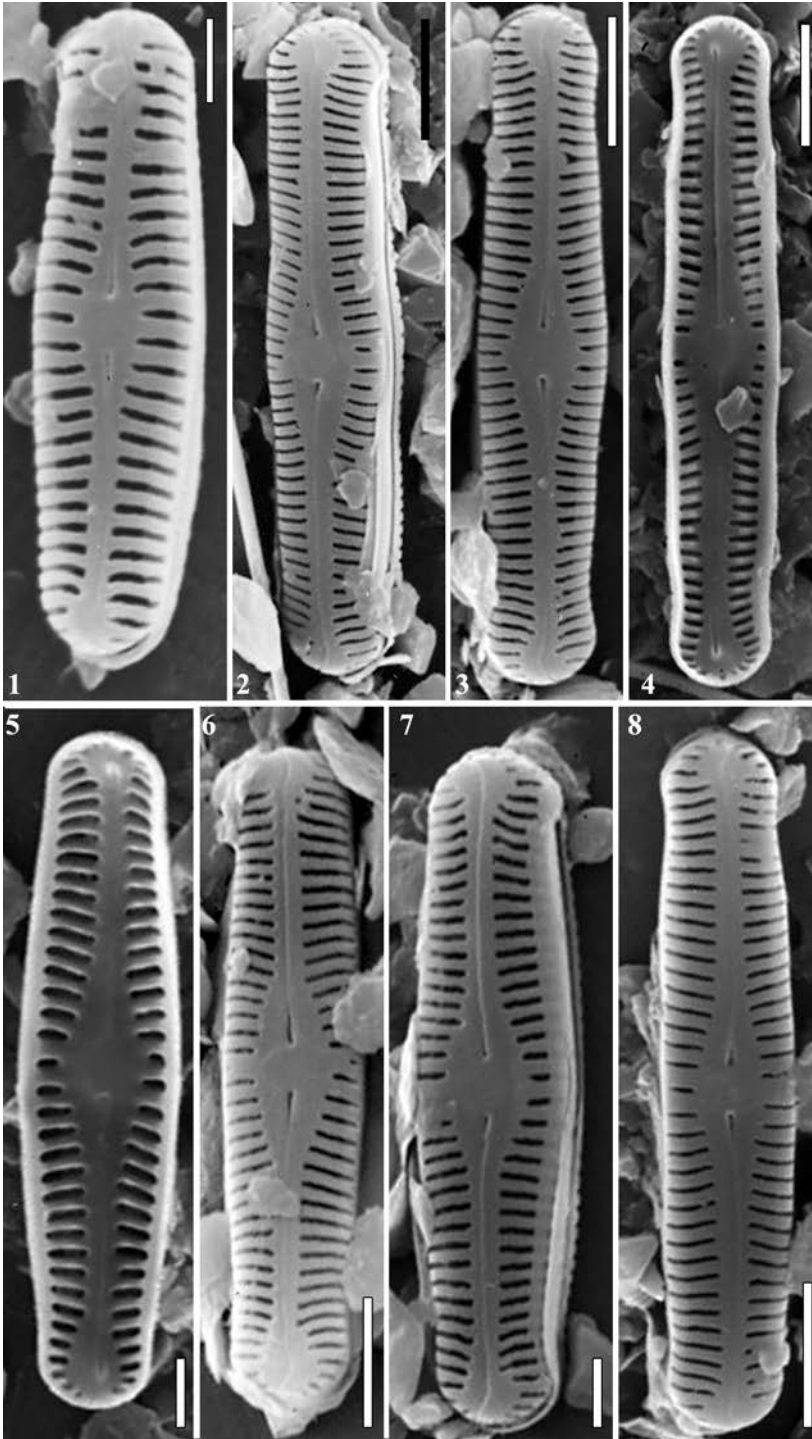
**Table 1.** Variability of morphological features in *Chamaepinnularia grandrupii* according to published data.

Length of valve, $\mu\text{m}$	Width of valve, $\mu\text{m}$	Number of striae in 10 $\mu\text{m}$	References
20	3.5	23	Petersen 1924
14.6–18.0	3.3	25	Lange-Bertalot & Metzeltin 1996*
16.0–20.6	2.7–3.3	22–23	Lange-Bertalot et al. 1996*
14.0–21.3	3.3–4.0	21–26	Lange-Bertalot & Genkal 1999*
10.4–18.5	3.2–4.0	22–24	Genkal & Vekhov 2007
9–20	1.5–2.5	22–25	Antoniades et al. 2008
12.0–19.3	4.0–4.7	21–22	Metzeltin et al. 2009*
9.0–21.3	1.5–4.7	21–26	Summarized literary data

\*measurements according to micrographs.

In Russia, *Chamaepinnularia grandrupii* was found in waterbodies of the Novaya Zemlya archipelago and Yugorsky Peninsula (Lange-Bertalot & Genkal 1999; Genkal & Vekhov 2007). Our investigations show that this species is widespread in the Yamal Peninsula but has not yet been found in waterbodies and watercourses of Gydansky Peninsula (Genkal & Yarushina 2014) and Tazovsky Peninsula (our not published data).

Our studies indicate a high morphological variability of *Chamaepinnularia grandrupii* as compared to the published data (Table 2) and widespread of this species in aquatic ecosystems



**Figs 1–8.** *Chamaepinnularia gandrupii*, SEM. Figs 1, 5. Scale bars = 2  $\mu\text{m}$ . Figs 2–4, 6–8. Scale bars = 5  $\mu\text{m}$ . 1–3, 6–8 – external view, variation of form valve; 4, 5 – internal view. 1–4 – unnamed lake «Pervoye»; 5–7 – Venyakha River; 8 – Sabol'yakha River.

**Table 2.** The variability of morphological features in *Chamaepinnularia gandrupii* in the material studied in the present report.

Length of valve, $\mu\text{m}$	Width of valve, $\mu\text{m}$	Number of striae in 10 $\mu\text{m}$	Reservoir/watercourse
22.1–24.3	4.3	15–16	Unnamed lake «Poligon 8»
19.3	4.3	16	Unnamed stream, right-bank tributary in the upper reaches of the Navatalovayakha River
21.4	4.3	16	Pelkhatose channel
20.7	5	18	Khangolovayakha River
20	4.3	18	Sormiketsyatarka River
20.7–25.0	3.9–5.0	16–18	Penzetarka River
14.5–26.4	4.0–4.6	16–18	Unnamed lake «Pervoye»
15.4–28.9	3.9–4.6	16–20	Lake Pebtavyto
18.6–23.5	4.3–5.0	16–20	Yakhydayakha River
19.3–20.7	5.0	16–18	Venyakha River
20.0–27.8	4.3–5.0	15–19	Edyakha River
21.4–24.3	4.3–5.0	16–19	Sabol'yakha River
14.5–28.9	3.9–5.0	15–20	Summarized data

in the Far North of Western Siberia that allow us to expand its diagnosis taking into account our own and literature data.

*Chamaepinnularia gandrupii* (Petersen) Lange-Bertalot et Krammer emend. Genkal et Yarushina (Figs 1–8).

Basionym: *Pinnularia gandrupii* Petersen 1924, Dansk botanisk arkiv udgivet af Dansk botanisk forening 4(5), p. 16, fig. 4.

Synonym: *Navicula gandrupii* (Petersen) Krasske 1938, Archiv für Hydrobiologie 33, p. 528; *Navicula gandrupii* var. *simplex* Krasske 1938, Archiv für Hydrobiologie 33, p. 528; *Chamaepinnularia gandrupii* var. *simplex* (Krasske) Lange-Bertalot et Krammer in Lange-Bertalot et Metzeltin 1996, Iconographia Diatomologica, vol. 2, p. 34.

Valves are small and linear, with slightly undulate margins. The apices are broadly rounded to capitate in longer forms. Length 9.0–28.9  $\mu\text{m}$ , breadth 2.7–5.0  $\mu\text{m}$ . Striae are weakly radiate in the center, becoming parallel to convergent at the apices, 15–26 in 10  $\mu\text{m}$ . The axial area is narrow, curved and opening gradually to both the apices and the central area. The central area is elliptical. Raphe is filiform, with teardrop-shaped external proximal fissures opening on the valve face; the external distal fissures from a 2-sided hook down onto the mantle at the apex. Internally, the proximal fissures form expanded pores and the distal fissures end in helictoglossae. Striae are composed of a multiseriate pore field and located internally between thickened costae. The striae continue without interruption around the apices.

A freshwater species, oligotrophic waterbodies and watercourses.

Finland, Far North of Western Siberia, Mongolia, North America.

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