The diatom flora of Berlin (Germany):
A spotlight on some documented taxa as a case study on historical biodiversity

Ursula Geissler 1, Wolf-Henning Kusber 2  & Regine Jahn * 2

1 Institut für Biologie – Systematische Botanik und Pflanzengeographie, Freie Universität Berlin, Altensteinstr. 6, 14195 Berlin, Germany
2 Botanischer Garten und Botanisches Museum Berlin–Dahlem, Freie Universität Berlin, Königin-Luise-Str. 6–8, 14191 Berlin, Germany

Abstract
This study focusses on diatoms which were described from Berlin (as Gomphonema acuminatum, Navicula diabolica, Naviculadicta geisslerae, Navicula monile, Stephanodiscus berolinensis, Stephanosira europaea, and Synedra berolinensis), or which were found in Ehrenberg samples from the mid-19th century. Four species are newly typified and one species is recombined (Orthoseira europaea). For nine diatoms the pattern of records for the last 170 years is discussed.

Introduction
Berlin (today 3.4 million inhabitants) is one of the best studied cities concerning algae since the 19th century. Its area (883 km²) contains urban and suburban parts with parks, woods and water bodies. The landscape of Berlin (Pleistocene North-German lowland) with its glacial valley is drained by the rivers Spree and Havel (catchment area of the river Elbe which meets the North Sea).

Geissler & Kies (2003) presented a literature baseline of all available recorded algae findings in Berlin (e.g. theses, experts’ reports, personal communications). This checklist spans a time of 210 years from 1787 to 1997. It reports 383 algal genera with 1638 species. Each entry consists of the scientific name, its synonymy, the references of the records and all habitats, where the taxon was found. A taxonomical and nomenclatural basis for the Bacillariophyceae, mainly the “Süsswasserflora von Mitteleuropa” (Krammer & Lange- Bertalot 1986, 1988, 1991a,b) was chosen. The checklist by Geissler & Kies (2003) of fossil and recent diatoms includes 67 genera (some of them historical names). 627 fully determined infrageneric taxa were recorded as accepted names: 493 species, 5 subspecies, 122 varieties and 7 formae. The aim of the algal checklist for Berlin (Geissler & Kies 2003) was not only the documentation of all records, but the analysis of the data set under different aspects. In Geissler & Kies (2003) records of 104 habitats in Berlin were analysed. The best documented areas by number of diatom dataset entries are the lake Tegeler See (541 records), the air of Berlin (267 records), the river Spree which is in the city mostly canal-like (248 records), a canal, connected with the river Spree “Charlottenburger Verbindungskanal” (216 records), the partially lake-like river Havel (209 records), and the shallow lake Müggelsee through which

* Corresponding author: e-mail r.jahn@bgbm.org
the river “Spree flows” (199 records). Although the data set is big enough for detailed analyses, it is also evident that our knowledge of the Berlin diatom flora is far from being complete.

In this paper we are focussing on algae findings in samples, therefore extending the literature listings of Geissler & Kies (2003) into real diatom findings. This implies looking at historical samples with modern methods/microscopes (as far as possible) and identifying them with current concepts and names. The materials of C.G. Ehrenberg (123 published records in Geissler & Kies 2003) are of special interest because they were taken before the main urbanization of Berlin took place. The drawings and preparations are extremely valuable, because they have been kept, are available, dated and well documented. Ehrenberg’s specimens and new species are being studied in detail within the AlgaTerra project by Jahn and Kusber (see also Jahn 2004, Jahn et al. 2004, Jahn & Kusber 2004, 2005), who are continuing to record the Berlin algal flora and its changes (Kusber et al. 2003).

Material & methods

From the Ehrenberg Collection at Museum für Naturkunde, Humboldt Universität zu Berlin (BHUPM) the following material was studied:

1. Ehrenberg’s drawings No. 678, 993, 1104, in BHUPM

2. Taxonomical Preparations “Trockenpräparate II Polygastrica”
   - No. 540100–1 “Gomphonema acuminatum, Berlin”;
   - No. 540117–3 “Micrasterias tetras” according to Ehrenberg (1838: 156) August 1834;
   - No. 540133–3 “Pinnularia monile, Berlin”;
   - No. 540180–2 “Stephanodiscus berolinensis α”; No. 540180–3 “Stephanodiscus berolinensis β”.

3. The following Geographical Preparations in BHUPM were studied (numbers according to the numbering schema of mica strips, consisting of mostly 5 mica slides (see Jahn & Kusber 2004) plus the label information; additional information by Ehrenberg (1848b) in square brackets. Preparations from mosses on trees:
   - 390301, 390302, 390304 “Auf Hainbuche, Moos im Thiergarten” [in mehr als Mannshöhe (8–10 Fuss) entnommen, in der Gegend von Kempershof, nach Bellevue zu, Aug. 1848] (Carpinus betulus);
   - 390305, 390306, 390307, 390308 “Auf Eichenmoos im Thiergarten, Aug. 1848” [in mehr als Mannshöhe (8–10 Fuss) entnommen, in der Gegend der Rousseau’schen Insel, im geschlossenen Walde ebenda] (Quercus);
   - 390115 “Berlin Krautsgasse, Apfelbaummoos, Aug. 1848” [in mehr als Mannshöhe (8–10 Fuss) entnommen, mitten in der sehr ausgedehnten freien Garten-Anlage des Bouchéschen Kunstgartens] (Malus);
   - 390201 “Potsdam, Brauhausberg, Baummooos, Aug. 1848” [in mehr als Mannshöhe (8–10 Fuss) entnommen, aus dem geschlossenen Walde des Brauhausberges zu Potsdam in der obersten Höhe, von einer Eiche];
   - 390202 “Potsdam, Allee, Pappelmoos, Aug. 1848” (Populus);
   - 390107, 390108 “Berlin, Baummooos d. oberen Stämme, 9 Febr. 1849”;


• 390101, 390102 “Baummoos aus der Höhe über 6’, Berlin Tiergarten, 16 Januar 1849”;
• 390103 “Berlin Tiergarten, Baummoos, Fichte, 29 Januar 1849” (Picea);
• 390507, 390508 “Berlin Baummoos, 28 Febr. 1849, Thiergarten Erle” (Alnus glutinosa);
• 390509, 390510 “Berlin Baummoos, 27 Maerz 1849, Thiergarten Erle”;

4. Modern preparations in B:
• B 2004/075 Moss (mainly Hypnum cupressiforme) on Quercus robur (oak) height 30 cm, near the isle “Rousseau-Insel”; Berlin-Tiergarten, 04. July 2004;
• B 2004/076 Moss on Acer platanoides (maple) height 2.0 m; Berlin-Tiergarten, 04 July 2004;
• B 2004/077 Moss on Alnus glutinosa (alder) 15 cm above the water level of the shallow lake “Neuer See”; Berlin-Tiergarten, 04 July 2004;
• B 2004/078 Moss (Hypnum cupressiforme) on Catalpa bignonioides, crotch at a height of 1.0 m; Berlin-Tiergarten, 04 July 2004.

Photographs at the Ehrenberg Collection were taken with an Olympus DP 50 and BX 51, Objective: Olympus SPlan 80x/N.A.0.75.

Results

We present a documentation on the first dated historical records for the river Spree (Figs 1–3, 14–18) as well as on the first studies on aero-terrestrial algae by C.G. Ehrenberg which were reinvestigated (Figs 9–13, Table 1). We provide further habitat information in an annotated species list on three scarcely known species, described in the 19th century by C.G. Ehrenberg: Orthoseira europaea (Fig. 4), Pinnularia monile (Figs 7, 8), and Stephanodiscus berolinensis (Figs 14–18), and on three species described in the 20th century, Naviculadicta geisslerae, Navicula diabolica (Fig. 6), and Staurosira berolinensis. In Figs 19, 20 we present different patterns of documented findings on eleven diatom species as a key to interpret historical biodiversity; these taxa are also included in the annotated taxon list.


Distribution in Berlin: According to Geissler & Kies (2003) this taxon (sub A. normanii (W. Greg. ex Grev.) Hust. and A. normanii morphotype subsalsus and their synonyms) was not found in Berlin before 1911; since the 1970s it was found in rivers, channels, lakes, and air (Fig. 19a). In a comparison of samples from the river Spree (September 1924, 1978 and 1979) Actinocyclus normanii f. subsalsus was not found in 1924, but in the 1970s with an abundance of 5.0%, and respectively, 0.2% of the diatom valves (Jahn & Geissler 1993); in the holotype preparation of Naviculadicta geisslerae (R. Jahn) R. Jahn, it was co-dominant, reaching 11.8% of the diatom valves (Jahn 1990, 1992). The taxon occurs in waters with an increased conductivity (627–826 µS cm⁻¹).
Figs 1–4. Historical diatom records from Berlin. **Fig. 1.** *Asterionella formosa* Hassall, first record, Spree 1845. **Fig. 2.** *Aulacoseira granulata* (Ehrenb.) Simonsen, Spree 1856. **Fig. 3.** *Stephanodiscus binderanus* (Kütz.) Willi Krieger, Spree 1845. **Fig. 4.** *Orthoseira europaea* (Ehrenb.) R. Jahn & Kusber, in moss in the Tiergarten 1848, lectotype (Figs 1–5: Ehrenberg Collection at BHUPM). Scale bars = 10 µm.

Figs 5–8. Historical diatom records from Berlin. **Fig. 5.** *Gomphonema acuminatum* Ehrenb., first available preparation by C.G. Ehrenberg. **Fig. 6.** *Navicula diabolica* Geissler & Gerloff, Teufelsbruch 1959, type. **Figs 7–8.** *Pinnularia monile* (Ehrenb.) Ehrenb. **Fig. 7.** 1840, lectotype. **Fig. 8.** Drawing by C.G. Ehrenberg. Scale bars: Figs 5, 7 = 10 µm. Fig. 6 = 1 µm.

Neotype locality: Lake Gross–Glienicker See in Berlin, Germany.
Distribution in Berlin: The first dated record is of 1845 from the river Spree (see Fig. 1). After 1910 *A. formosa* (Fig. 19b) was found in a wide range of water bodies such as rivers, channels, lakes, ponds, swamps and a sewage treatment plant (Geissler & Kies 2003).

Distribution: According to Geissler & Kies (2003) this taxon was found in rivers, channels, lakes, ponds, swamps and a sewage treatment plant. The first documented record is of 1856 from the river Spree (see Fig. 2). This taxon occurs frequently in eutrophic waters (compare Fig. 19c). In the river Spree *A. granulata* was the most abundant diatom in September 1924, 1978, and 1979 with 48.6, 56.0 respectively 77.6% of the counted cells (Jahn & Geissler 1993). In the summer plankton of the shallow lake Nikolassee in 1987 it was the most abundant diatom with nearly 100% of the counted diatom cells and a biovolume of up to 2 mm³ l⁻¹; replaced in autumn by solitary centric taxa (Kusber 1999).

Lectotype according to Jahn & Kusber (2004): [icon] specimen "b", right cell on Ehrenberg’s drawing sheet No. 678 at BHUPM, published in Ehrenberg (1838) as pl. 18, fig. 4 (part 3).
Type locality: Berlin, Germany.

Further material: Taxonomic Preparations 540100–1; 540117–3 at BHUPM (see our Fig. 5).

Habitat: Ehrenberg (1838: 217) writes “lebend bei Berlin ... im Frühjahre bei Berlin in zahlloser Menge als filzarter gelbbrauner Schleim auf den Wasserpflanzen, welche keinen Zweifel übrig lassen, dass die fossilien und jetzt lebenden Infusorien identisch sind.” The living material is referred to spring samples as a felt-like yellow-brownish mucilage on water plants. Ehrenberg (1840) later separated the fossil *G. coronata* Ehrenb. (see Jahn & Kusber 2004).

Distribution: According to Geissler & Kies (2003) this taxon was found in running waters, lake-like rivers, and swamps. Further records, not listed in Geissler & Kies (2003): Berlin, August 1834; Spree, November 1844; valve found on moss on a tree 29 January 1849; Schlachtensee, August 1856; Grunewaldsee, August 1856; records in dated samples 1998–2004 (Fig. 19d).


Distribution: According to Geissler & Kies (2003) this taxon was found in rivers, channels, lakes, swamps, a sewage treatment plant, sewage fields, and in air (Fig. 20a). The first dated documented records from Ehrenberg’s studies are shown in Figs 9–11. The microhabitats of Ehrenberg (1848b) are listed in Table 1; recently *H. amphioxys* was also found on mud and in puddles (unpubl. data).


Holotype: pl. 388, fig. 30, 31 in Geissler *et al.* (1963) (see our Fig. 6).

Type locality: Teufelsbruch in Berlin, Germany.


Habitat: Teufelsbruch in Berlin, Germany. Habitat information was not given by Geissler *et al.* (1963). According to Krüger (1962) this species was found in his sample 9a of 1 May 1959. Small water body (“Schlenke”) in a peat bog near a flooded alder woodland. The sample was taken among *Utricularia intermedia* (a species, probably now extinct in Berlin; see Prasse *et al.* 2001). The water was clear with 22°C and pH 6.2. Krüger (1962) listed 73 diatom taxa, which co-occurred. Since a detailed list of the type locality was published and the records by Krüger (1962) were checked for current taxon names (Geissler & Kies 2003), only those taxa are listed here that are included in Red List taxa for Germany (Lange-Bertalot 1996; categories, see Schnittler & Ludwig 1996): *Caloneis tenuis* (W. Greg.) Krammer (G=gefährdung anzunehmen ≈ conservation dependent/ o=oligotraphentic), *Cymbella amphioxys* (Kütz.) Cleve (2 = stark gefährdet, i.e. endangered/od=oligotraphentic predominantly in acidic waters), *Cymbella reinhardtii* Grunow (R=extrem selten, i.e. rare/o), *Cymbella turgida* Pant. (2/od), *Eunotia arcubus* Nörpel & Lange-Bert. (G/od), *Eunotia bilunaris* var. *macphila* Lange-Bert. & Nörpel (G/od), *Eunotia faba* Ehrenb. (1=vom Aussterben bedroht, i.e. critical/od), *Eunotia glacialis* F. Meister (G/od), *Navicula semen* Ehrenb. (1/od), *Pinnularia gigas* Ehrenb. (G/od), *Pinnularia gentilis* (Donkin) Cleve (G/od), *Pinnularia nobilis* (Ehrenb.) Ehrenb. (G/od).

Distribution: No further records in Berlin (Fig. 20b).
Table 1. Diatoms from mosses on trees in Berlin and Postdam.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Taxa according to Ehrenberg’s label</th>
<th>Taxa (revisited) in Ehrenberg’s samples</th>
<th>Abundance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moss on <em>Carpinus betulus</em> (hornbeam), height 2.5–3.1 m; Berlin–Tiergarten; 08.1848 (390301, 390302, 390304)</td>
<td>Eunotia amphioxys</td>
<td>Hantzschia amphioxys</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Meridion?!</td>
<td>[not found]</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Stephanosira europaea</td>
<td>Orthoseira europaea</td>
<td>+</td>
</tr>
<tr>
<td>Moss on <em>Quercus</em> (oak), height 2.5–3.1 m; Berlin–Tiergarten; 08.1848 (390305, 390306, 390307, 390308)</td>
<td>Eunotia amphioxys</td>
<td>Hantzschia amphioxys</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Cocconema?</td>
<td>[Teratology, unidentifiable]</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Gallionella?</td>
<td>[not found]</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Stephanosira europaea</td>
<td>Orthoseira europaea</td>
<td>+</td>
</tr>
<tr>
<td>Moss on <em>Malus</em> (apple tree), height 2.5–3.1 m; Berlin–Friedrichshain; 08.1848 (390115)</td>
<td>Eunotia amphioxys</td>
<td>Hantzschia amphioxys</td>
<td>+</td>
</tr>
<tr>
<td>Moss on <em>Quercus</em> (oak), 3.1 m; Potsdam; 08.1848 (390201)</td>
<td>Eunotia amphioxys</td>
<td>[not found]</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td>Moss on <em>Populus</em> (poplar), Potsdam; 08.1848 (390202)</td>
<td>Eunotia amphioxys</td>
<td>Hantzschia amphioxys</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Synedra ulna ??!</td>
<td>[unidentifiable]</td>
<td>+</td>
</tr>
<tr>
<td>Moss on a tree; Berlin; 09.02.1849 (390107, 390108)</td>
<td>Navicula semen</td>
<td>[unidentifiable]</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+++</td>
</tr>
<tr>
<td></td>
<td>Stephanosira europaea</td>
<td>Orthoseira europaea</td>
<td>+</td>
</tr>
<tr>
<td>Moss on a tree; 1.9 m; Berlin–Tiergarten; 16.01.1849 (390101, 390102)</td>
<td>Eunotia amphioxys</td>
<td>Hantzschia amphioxys</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Gallionella</td>
<td>Aulacoseira sp.</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Himantidium arcus</td>
<td>Eunotia arcus</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Navicula semen</td>
<td>[unidentifiable]</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Stephanosira semen</td>
<td>[unidentifiable]</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Stephanosira Europaea</td>
<td>[not found]</td>
<td>?</td>
</tr>
<tr>
<td>Moss on <em>Picea</em> (spruce); Berlin–Tiergarten; 29.01.1849 (390103)</td>
<td>Gomphonema acuminatum</td>
<td>Gomphonema acuminatum</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td>Moss on <em>Alnus glutinosa</em> (alder); Berlin–Tiergarten, 28.02.1849 (390507, 390508)</td>
<td>Eunotia amphioxys</td>
<td>Hantzschia amphioxys</td>
<td>+, alive*</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moss on <em>Alnus glutinosa</em> (alder); Berlin–Tiergarten, 27.03.1849 (390509, 390510)</td>
<td>Pinnularia borealis</td>
<td>Pinnularia borealis</td>
<td>+</td>
</tr>
<tr>
<td></td>
<td>Gallionella?</td>
<td>Aulacoseira sp.</td>
<td>+</td>
</tr>
</tbody>
</table>

Legend: + occurrence confirmed, +++ occurrence with many specimens, ? = identity unclear, – = not found, *alive = cell with chloroplasts, having been alive when dried onto the mica slide.
Holotype: B 400036200.

Type locality: River Spree in Berlin, Germany.

Habitat: River Spree in urban Berlin, Germany. 20 October 1982, water temperature 12°C, c. 1.2 mg l⁻¹ ortho-phosphate and 4 mg l⁻¹ ammonium-nitrate (according to Jahn 1990, 1992). The sample was taken at a shallow part of the river on slanted stones.

In October 1982 N. geisslerae had a relative abundance of 1.2%; the main taxa of this sample were: Melosira varians C. Agardh (13.3%), Actinocyclus normanii f. subsalsus (Juhl.-Dannf.) Hust. (11.8%), Achnanthidium minutissimum (Kütz.) Czarnecki (7.3%), Luticola goeppertiana (Bleisch) D.G. Mann (6.9%), Cocconeis pediculus Ehrenb. (5.0%), and Nitzschia amphibia Grunow (5.0%). In November 1982, N. geisslerae had a relative abundance of 1.0%; the main taxa of this sample were: Melosira varians (8.8%), Nitzschia amphibia (8.2%), Navicula reichardtiana Lange-Bert. (7.6%), Luticola goeppertiana (6.7%), and Fragilaria capucina var. vaucheriae (Kütz.) Lange-Bert. (5.7%).
Fig. 19. Documented records of diatoms in Berlin (according to Geissler & Kies 2003, plus additional data pre-1860 and post-1997 from this study; 0 = taxon not recorded, 1 = taxon recorded).

Fig. 19a. *Actinocyclus normanii* f. *subsalsus* (Juhl.-Dannf.) Hust.

Fig. 19b. *Asterionella formosa* Hassall.

Fig. 19c. *Aulacoseira granulata* (Ehrenb.) Simonsen.

Fig. 19d. *Gomphonema acuminatum* Ehrenb.

*Orthoseira europaea* (Ehrenb.) R. Jahn & Kusber, comb. nov.


? = *Melosira roeseana* Rabenh., Süssw.-Diat.: 13, pl. 10, suppl.: fig. 5. 1853.

Lectotype (designated here): preparation 390308–c, marked with a blue ring in BHUPM (see our Fig. 4).

Type locality: Tiergarten in Berlin, Germany.

Habitat: Tiergarten in Berlin, Germany (see Table 1).
Distribution: Because no further records of this taxon were given for Berlin (Fig. 20c, cf. Geissler & Kies 2003), we studied all available historical samples from mosses on trees in Berlin and also checked recent samples from the type locality for the occurrence of this taxon (see Table 1). In recent samples *Pinnularia borealis* Ehrenb. was found on *Acer*, *Catalpa*, and *Quercus*. On *Alnus*, a diatom flora similar to the water of lake “Neuer See”, Tiergarten was found.

Lectotype (designated here): Taxonomic Preparation No. 540133–3, documented on Fig. 7.
Type locality: Berlin, Germany.
Original material: Drawing sheet No. 993 in BHUPM “5. April 1840”.
Distribution: According to Ehrenberg (1854) this taxon also occurred in diatomite under Berlin.

Type: not indicated.
Type locality: Grunewaldsee in Berlin, Germany.
Original material: not seen; sample and unpublished illustration are mentioned in Lemmermann (1900).
Habitat: Lake Grunewaldsee is the type locality; further habitat information was not given by Lemmermann (1900).
Ecological information: Planktonic species with star-like aggregates. Lake Grunewaldsee is a glacial lake of 14.5 ha; at the turn of the century, the swamp areas surrounding the lake were degraded due to beginning urbanization. The waterbody was probably already eutrophic at that time.
Distribution: According to Geissler & Kies (2003) this taxon was scarcely found (Fig. 20d) in rivers, channels, and in other lakes.

Lectotype (designated here): preparation 540180–2 in BHUPM (see our Fig. 3).
Type locality: Spree in Berlin, November 1844, Germany. According to Ehrenberg (1845): "vivam Berolini"; the habitat, the river Spree was given first in Ehrenberg (1848a: 217); the date is according to drawing sheet No. 1104 in BHUPM.

Further original material: Taxonomical Preparations 540180–3 in BHUPM.

Habitat: No habitat information was given by Ehrenberg (1845). Indirect habitat information is available through the co-occurring algae. In the original material the following algae were identified: *Amphora copulata* Kütz. [= *Amphora libyca* Ehrenb. sensu Krammer & Lange-Bertalot (1986)], *Amphora ovalis* (Kütz.) Kütz., *Asterionella formosa* Hassall (Fig. 1), *Aulacoseira granulata* (Ehrenb.) Simonsen, *Cricula cuspidata* (Kütz.) D.G. Mann, *Cymatopleura librile* (Ehrenb.) Pant., *Encyonema minutum* (Hilse) D.G. Mann, *Fragilaria crotonensis* Kitton, *Gomphonema acuminatum* Ehrenb., *Hippodonta capitata* (Ehrenb.) Lange-Bert., Metzeltin & Witkowski, *Neidium ampliatum* (Ehrenb.) Cleve, *Nitzschia acicularis* (Kütz.) W. Sm., *Nitzschia palea* (Kütz.) W. Sm., *Placoneis placentula* (Ehrenb.) Mereschk., *Planothidium delicatum* (Kütz.) Round & L. Bukhtiyarova, *Stephanodiscus binderanus* (Kütz.) Willi Krieg. (Fig. 3).


Type (cons. prop. by Håkansson & Ross 2002, also cited in Håkansson 2002): B 6169 “Spree bei Berlin” (Krieger), not recommended by the Nomenclature Committee for Algae because of the availability of Kützing’s published pictures as part of the original material (Compère 2004).

Lectotype (designated here by R. Jahn & H. Håkansson): [icon!] pl. 2, fig. 1:1 (upper chain) in Kützing (1844).

Lectotype locality: “Moorgräben bei Hamburg”, leg. F. Binder (Germany).


Epitype locality: “Spree bei Berlin” (Germany), September 1924.

The first dated record is of 1845 (Fig. 3) from the river Spree. Later, *St. binderanus* was also found in channels and lakes (Geissler & Kies 2003). The maximum abundance (28.8% of the counted valves) was measured in a Krieger sample from the river Spree, September 1924 (Jahn & Geissler 1993). Since the 1950s, this taxon was scarcely recorded for Berlin (Fig. 20e).

Discussion

The dynamics in the occurrence of 9 single taxa, shown in Figs 19, 20 is difficult to interpret. In all graphs gaps can be found. Different reasons are responsible for this; certainly some important reasons are that many observations were never published; a lot of water bodies were not examined at all or not regularly.

Species with hardly visible characters were not detected by Ehrenberg; e.g., *Asterionella formosa* was not distinguished from *Diatoma* species although we found it in a dated historical preparation. This shows that *Asterionella formosa* has a different pattern of
Fig. 20. Documented records of diatoms in Berlin (according to Geissler & Kies 2003, plus additional data pre-1860 and post-1997 from this study; 0 = taxon not recorded, 1 = taxon recorded).

- **Fig. 20a. Hantzschia amphioxys** (Ehrenb.) Grunow.
- **Fig. 20b. Navicula diabolica** Geissler & Gerloff.
- **Fig. 20c. Orthoseira europaea** (Ehrenb.) R.Jahn & Kusber.
- **Fig. 20d. Staurosira berolinensis** (Lemmerm.) Lange-Bert.
- **Fig. 20e. Stephanodiscus binderanus** (Kütz.) Willi Krieger.

Occurrence than *Actinocyclus normani* f. *subsalsus*, a neophyte recorded for the first time in 1911 for Berlin (Geissler & Kies 2003) which we have not found yet in the Ehrenberg material. In contrast *Aulacoseira granulata* and *Gomphonema acuminatum* were identified early in Berlin diatom research, gaps in the occurrence pattern are due to uneven
Stephanodiscus binderanus the pattern of occurrence is again different, because there are only a few recent records in the last decades. As discussed in Jahn & Geissler (1993) and Geissler & Kies (2003) the taxon became rare although it is assessed as eutraphentic by Lange-Bertalot (1996). In this study, it is shown that the taxon was already part of the Berlin diatom flora at Ehrenberg’s time.

Orthoseira europaea was not found in Berlin after 1849. One reason is that the habitats (mosses on trees) were not studied in Berlin. In his broadly based study on algae in Berlin air, Baumann (1979) did not find any Orthoseira. To check whether or not this species still occurs in Berlin, we reinvestigated its type locality. Mosses on trees were found and also the diatom Hantzschia amphioxys but not Orthoseira europaea. This is possibly due to anthropogenic changes of the environment. The main changes were sinking ground water levels because of urban building, nutrient enrichment, air pollution, and changes in the species composition of the vegetation. In addition, after World War II almost all old trees in the park Tiergarten were gone. Hence, now the microclimate in the Tiergarten is much dryer than at the time of Ehrenberg and many mosses are only able to survive close to the soil and/or water.

Environmental changes are probably also the reason why Navicula diabolica was not found in Berlin again after its first description. Since no habitat information was given in Geissler et al. (1963), we have to rely on the species inventory of the original material given by Krüger (1962) with updated synonymy by Geissler & Kies (2003). It shows that this habitat was rich in threatened species of oligotraphentic waters. Further investigations of similar habitats can give evidence if the species is also an endangered oligotraphentic species, or if it was only accompanying these threatened species. A halophilous taxon, identified as N. diabolica by Karayeva (1976), with similar valve shape but different terminal raphe ends, was recorded from the Caspian Sea.

This paper shows that even the comprehensive checklist of diatoms in Geissler & Kies (2003) is far from being complete. During the times of intensive studies of the diatom flora (ca 1970–1995), when many masters and doctoral theses were done at the Freie Universität Berlin, numerous taxa from all algal groups were newly found for Berlin. For example, in the river Spree 8 out of ca. 180 diatom species were reported for the first time for Berlin (Jahn 1990). Our results underline the fact that it is worth to take detailed notice of the diatoms at your feet!

Acknowledgements

The work in the Ehrenberg Collection, curated by David Lazarus, was financed by the German Federal Ministry of Education and Research, BMBF (AlgaTerra project, grant 01 LC 0026) within the BIOLOG program. We acknowledge the contribution of H. Häkansson to the typification of Stephanodiscus binderanus.

References


JAHN, R. (1992). Navicula geisslerae sp. nov. – a small species from the river Spree (Berlin, Germany). Diatom Research, 7, 69–75.


