

## An updated list of Serbian diatom flora: new recorded taxa

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Received: June 6, 2017; Revised: September 15, 2017; Accepted: October 13, 2017; Published online: November 11, 2017

**Abstract:** Diatoms are a widespread group of organisms with well-known ecological preferences. Knowledge of their diversity is of great importance for assessing the environmental status of different aquatic ecosystems. The present study was based on 55 different localities that included rivers, streams, channels, accumulations and salt marshes throughout Serbia. The results of this study expanded the diatom checklist by 80 taxa, including two new recorded genera (*Fistulifera* and *Microfissurata*) for Serbia. The data were obtained by combining light microscopy (LM) and scanning electron microscopy (SEM) that provided reliable identification, which is very important in diatom diversity studies.

**Key words:** *Fistulifera*; *Microfissurata*; light microscopy; scanning electron microscopy; new records

## INTRODUCTION

Species diversity is one of the main factors in assessing the environmental state of various aquatic ecosystems. It also has an important role in ecosystem processes and functioning, food chains and ecosystem integrity [1]. Widespread in different environments, well-known ecological preferences and standardized identification methods point to diatoms as an important group of algae for species diversity studies that can serve to evaluate ecosystems health and environmental changes [2,3].

Diatom diversity have been relatively well studied across Europe and is presented in various books [4-9], monographs [10,14] and articles [11-13,15]. Compared to previously cited data, diatom records and literature in Serbia are scattered. The first diatom data in Serbia date from 1883 [16]. However, it was only in the second half of the 20<sup>th</sup> century that extensive research into diatoms began [17-21], and in the last twenty years the number of new recorded diatom taxa for Serbian flora has increased [20-24]. The aim of this paper was to report new records of diatom taxa from different sites throughout Serbia in order to supplement the diatom checklist.

## MATERIALS AND METHODS

### Study area

The study areas were located in different parts of Serbia (Fig. 1). Samples of diatoms were collected at different localities, in rivers, streams, channels, accumulations and salt marshes. The list of the 55 localities is presented in Table 1.

### Sample preparation

Diatoms were collected from different types of substrate (mosses, macrophytes, mud, stones) and communities (benthos, plankton) and poured into 100-mL bottles. Epiphytic and epilithic diatom samples were collected by squeezing out and scraping off the surface with a toothbrush, respectively. Epipelagic diatom samples were collected from the sediment surface using a corer (Ø 1 cm), and phytoplankton samples were collected using a plankton net (Ø 25 µm) drawn through open water. All samples were fixed with formaldehyde to a final concentration of 4%.

## Sample analysis

In the laboratory, the algological samples were treated with a standard method with concentrated acid (H<sub>2</sub>SO<sub>4</sub>) and a KMnO<sub>4</sub> solution in order to remove organic matter; the samples were then washed several times with distilled water until pH 7 [25]. Permanent slides were prepared by air-drying of the material on cover glasses and mounting in Naphrax<sup>®</sup> mounting medium. Microscopic examinations were done using a Zeiss AxioImagerM.1 light microscope (LM) with DIC optics and AxioVision 4.8 software. Scanning electron microscopy (SEM) observations were made at the Institute of Physics, University of Belgrade, using a TESCAN MIRA 3 scanning electron microscope with maximum accelerating voltage of 30 kV. Sample surfaces were sputtered with gold using Quorum Technologies Mini Sputtercoater SC7620 for enhanced conductivity.

**Table 1.** Investigated localities with UTM coordinate.

Localities	UTM coordinates
Rasina River	EN48
Raška River	DN79
Rača River	CP87
Vrla River	FN02
Mlava River	EQ40
Radovanska River	EP75
Baturski Rzav River	CP66/76
Kolubara River	DQ31
Zapadna Morava River	DP26, EP33
Karaklijski Rzav River	CP66/76
Drina River	CQ64, CQ66, CP79, CP87
Jegrička River	DR22
Toplica River	DP39
Kačer River	DQ50
Lim River	CP82, CP90
Đetinja River	CP95
Vrelo River	CP76
Zasavica River	CQ87
Belica River	EP17
Ponjavica River (Omoljica)	DQ75
Ponjavica River (Brestovac)	DQ85
Vlasina River	FN03
Krnda 2 stream	CP95
Konjski potok stream	CP95
Cvetića zaliv stream	CP95
Cvetića potok stream	CP95
Zaliv pritoke stream	CP95
Simića stream	CP95

The terminology of valve morphology is based on Krammer and Lange-Bertalot [25] and Hofmann et al. [26]. Taxa were identified according to different literature sources, indicated next to each type.

## RESULTS

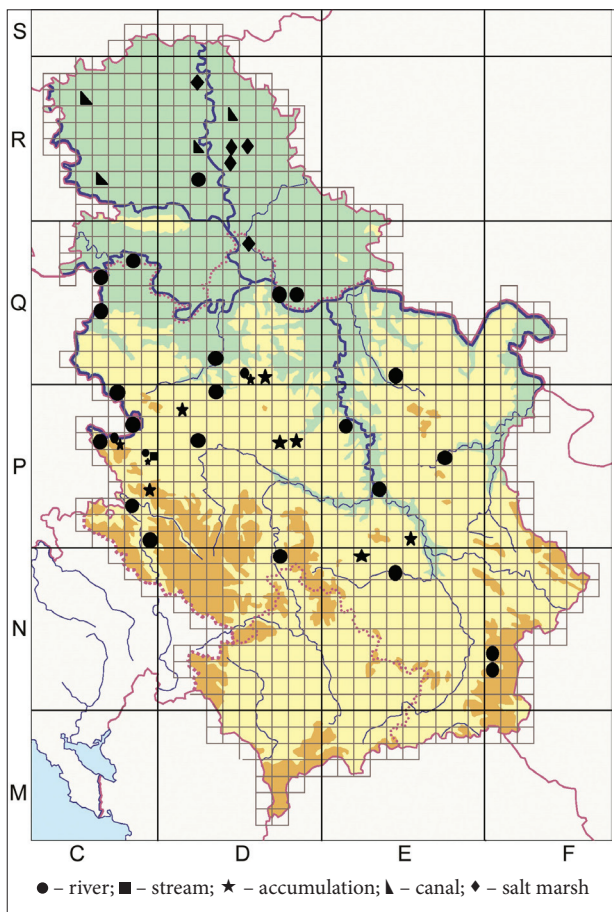
A total of 80 diatom taxa belonging to 33 genera have been noted for the first time in Serbian diatom flora. Among the 33 genera, two, *Microfissurata* and *Fistulifera*, are new to Serbian diatom flora. Species names as well as their dimensions and distribution in Serbia are given below.

***Achnantheidium caledonicum*** Lange-Bertalot (Fig. 4(30,31))

Basionym: *Achnanthes caledonica* Lange-Bertalot

Reference: Hofmann et al. [26] (p. 23, Figs. 51–55: 79)

Jasik stream	CP95
Jovac stream	CP95
Bioštanska Banja stream	CP95
Ročnjak stream	CP95
Vrutci tributary 10	CP95
Vrutci tributary 12	CP95
Vrutci tributary 13	CP95
Garaši accumulation	DQ50
Kruščica accumulation	CP76
Bresnica accumulation	EP50
Gruža accumulation	DP76/86
Zlatibor accumulation	CP93
Divčibare accumulation	DP18
Vrutci accumulation	CP95
Pridvorica accumulation	EN29
Bukulja accumulation	DQ60
Danube-Tisa-Danube Canal (Sombor)	CR57
Danube-Tisa-Danube Canal (Bač)	CR62
Danube-Tisa-Danube Canal (Novo Miloševo)	DR46
Danube-Tisa-Danube Canal (Bačko Gradište)	DR24
Jaruge salt marsh	DR44
Okanj bara salt marsh	DR43
Velika Slatina salt marsh	DQ58
Novo Ilje I salt marsh	DR54
Gergina Slatina salt marsh	DQ58
Kerekszék salt marsh	DR28
Aleksića Slatina salt marsh	DQ58



**Fig. 1.** UTM map of Serbia with new recorded diatom taxa localities.

● – river; ■ – stream; ★ – accumulation; ▲ – canal; ◆ – salt marsh

Dimensions: Valve length 15.06-20.4  $\mu\text{m}$ , breadth 2.63-3.1  $\mu\text{m}$ , striae 27-33/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Krnda 2, CP95 Cvetića zaliv and CP95 Zaliv pritoke streams, CP66 Batur-ski Rzav and CP76 Kruščica rivers (Fig. 1, Table 1).

***Achnanthidium crassum*** (Hustedt) Potapova and Ponader (Fig. 4(34, 35))

Basionym: *Achnanthes crassa* Hustedt

Reference: Potapova and Ponader [27] (Figs. 19-27, 44-49)

Dimensions: Valve length 8.37-10.25  $\mu\text{m}$ , breadth 3.04-3.86  $\mu\text{m}$ , striae of raphe valve 22-26/10  $\mu\text{m}$ , striae of rapheless valve 23-24/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina and CP86 Rača rivers (Fig. 1, Table 1).

***Achnanthidium druartii*** Rimet and Couté (Fig. 4(24, 25))

Basionym: *Achnanthidium druartii* Rimet and Couté

Reference: Rimet et al. [28] (pl. 1, Figs. 1-38, 188)

Dimensions: Valve length 20.92-4.32  $\mu\text{m}$ , breadth 3.04-3.86  $\mu\text{m}$ , striae 21/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Jovac stream and CP95 Đetinja River (Fig. 1, Table 1).

***Achnanthidium eutrophilum*** (Lange-Bertalot) Lange-Bertalot (Fig. 4(32, 33))

Basionym: *Achnanthes eutrophila* Lange-Bertalot

Reference: Hofmann et al. [26] (p. 23, Figs. 30-35: 80)

Dimensions: Valve length 9.91-13.17  $\mu\text{m}$ , breadth 3.45-4.53  $\mu\text{m}$ , striae of raphe valve 24-27/10  $\mu\text{m}$ , striae of rapheless valve 27/10  $\mu\text{m}$ .

Distribution in Serbia: CP86 Rača, CP95 Đetinja and DQ31 Kolubara rivers (Fig. 1, Table 1).

***Achnanthidium latecephalum*** Kobayasi (Fig. 4(26-29); Fig. 5(3, 4))

Basionym: *Achnanthidium latecephalum* Kobayasi

Reference: Potapova [29]

Dimensions: Valve length 10.46-18.84  $\mu\text{m}$ , breadth 3.78-5.26  $\mu\text{m}$ , striae of raphe valve 20-22/10  $\mu\text{m}$ , striae of rapheless valve 19-21/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP86 Rača, DN79 Raška and CP95 Đetinja rivers, CP95 Krnda 2 and CP95 Ročnjak streams (Fig. 1, Table 1).

***Achnanthidium straubianum*** Lange-Bertalot (Fig. 4(36, 37))

Basionym: *Achnanthes straubiana* Lange-Bertalot

Reference: Hofmann et al. [26] (p. 23, Figs 36-39: 87)

Dimensions: Valve length 6.62  $\mu\text{m}$ , breadth 3.72  $\mu\text{m}$ , striae of raphe valve 23/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška River and CP95 Vrutci tributary 10 (Fig. 1, Table 1).

***Adlafia aquaeductae*** (Krasske) Lange-Bertalot (Fig. 3(17))

Basionym: *Navicula pseudopupula* var. *aquaeductae* Krasske

Reference: Lange-Bertalot [7] (p. 105, Figs. 19-21: 142)

Dimensions: Valve length 19.57-23.82  $\mu\text{m}$ , breadth 4.05-4.99  $\mu\text{m}$ , striae 23-24/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Cvetića zaliv stream (Fig. 1, Table 1).

***Adlafia minuscula*** (Grunow) Lange-Bertalot (Fig. 3(13, 14))

Basionym: *Navicula minuscula* Grunow

Reference: Lange-Bertalot [7] (p. 106, Figs. 5-8; p. 108, Figs. 4-10: 143)

Dimensions: Valve length 10.86-15.22  $\mu\text{m}$ , breadth 3.51-4.79  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, EQ40 Mlava, FN02 Vrla, EP75 Radovanska, CP76 Vrelo rivers, CP95 Krnda 2, CP95 Cvetića zaliv, CP95 Cvetića potok, CP95 Simića potok and CP95 Jasik streams (Fig. 1, Table 1).

***Adlafia minuscula* var. *muralis*** (Grunow) Lange-Bertalot (Fig. 3(15))

Basionym: *Navicula muralis* Grunow

Reference: Lange-Bertalot [7] (p. 106, Fig. 9; p. 108, Figs. 1-3: 144)

Dimensions: Valve length 9.41-11.87  $\mu\text{m}$ , breadth 4.05-5.22  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, DN79 Raška, CQ87 Zasavica, EQ40 Mlava and EP75 Radovanska rivers (Fig. 1, Table 1).

***Adlafia suchlandtii*** (Hustedt) Lange-Bertalot (Fig. 3(16))

Basionym: *Navicula suchlandtii* Hustedt

Reference: Lange-Bertalot [7] (p. 105, Figs. 33-39; p. 106, Fig. 4: 145)

Dimensions: Valve length 10.39-15.18  $\mu\text{m}$ , breadth 2.36-3.24  $\mu\text{m}$ , striae 26-28/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, FN02 Vrla and EP75 Radovanska rivers (Fig. 1, Table 1).

***Amphora lange-bertalotii* var. *tenuis*** Levkov and Metzeltin (Fig. 4(15))

Basionym: *Amphora lange-bertalotii* var. *tenuis* Levkov and Metzeltin

Reference: Levkov [30] (p. 53, Figs. 1-12; p.163: 73, 288)

Dimensions: Valve length 37.58  $\mu\text{m}$ , valve breadth 7.22  $\mu\text{m}$ , striae 13/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Cvetići zaliv stream (Fig. 1, Table 1).

***Amphora meridionalis*** Levkov (Fig. 4(13, 14))

Basionym: *Amphora meridionalis* Levkov

Reference: Levkov [30] (p.55, Figs. 18-30; p. 166, Figs. 1-6; p.167, Figs. 1-5; p. 196, Fig. 5: 81, 289)

Dimensions: Valve length 15.72-34.27  $\mu\text{m}$ , valve breadth 4.12-6.21  $\mu\text{m}$ , frustule breadth 9.45-12.46  $\mu\text{m}$ , dorsal striae 14-17 /10  $\mu\text{m}$ , ventral striae 14-18/10  $\mu\text{m}$ .

Distribution in Serbia: CP86 Rača, CP95 Đetinja, EQ40 Mlava and EP75 Radovanska rivers, CP95 Jasik, CP95 Jovac and CP95 Ročnjak streams (Fig. 1, Table 1).

***Amphora micra*** Levkov (Fig. 4(12))

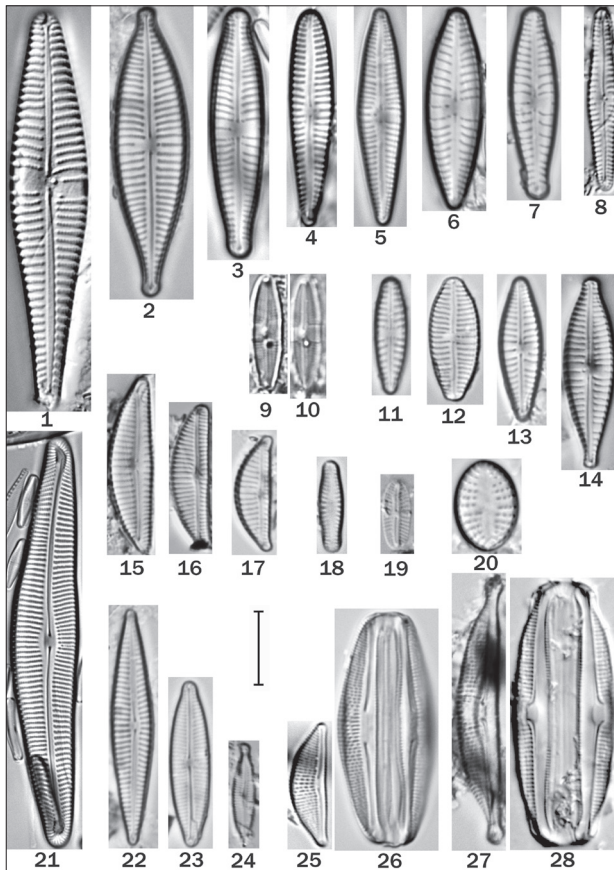
Basionym: *Amphora micra* Levkov

Reference: Levkov [30] (p. 78, Figs. 1-11; p. 189, Figs. 1-5; p. 190, Figs. 1-5; p. 195, Fig. 2: 83, 289)

Dimensions: Valve length 18.28  $\mu\text{m}$ , valve breadth 3.78  $\mu\text{m}$ , dorsal striae 18/10  $\mu\text{m}$ , ventral striae 17/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Krnda 2 and CP95 Cvetići zaliv streams (Fig. 1, Table 1).





**Fig. 2.** Light microscopy (LM) micrographs (x1600): 1 *Gomphonema zellense*; 2 *G. lippertii*; 3 *G. extantum*; 4 *G. clavatum*; 5 *G. acidoclinatum*; 6 *G. drutelingense*; 7 *G. cymbelliclinum*; 8 *G. procerum*; 9, 10 *Microfissurata australis*; 11 *G. calcifugum*; 12 *G. saprophilum*; 13 *G. sphenovortex*; 14 *G. lagenula*; 15 *Encyonema procerum*; 16 *E. subminutum*; 17 *E. brevicapitatum*; 18 *Chamaepinnularia muscicola*; 19 *Mayamaea fossalis*; 20 *Cocconeis pseudothumensis*; 21 *Cymbella lange-bertalotii*; 22 *Kurtkrammeria recta*; 23 *Encyonopsis cesatii*; 24 *E. krammeri*; 25, 26 *Halamphora veneta*; 27, 28 *H. normanii*. Scale bar=10  $\mu$ m.

***Chamaepinnularia muscicola*** (J.B.Petersen) Kulikovskiy, Lange-Bertalot and A.Witowski (Fig. 2(18))

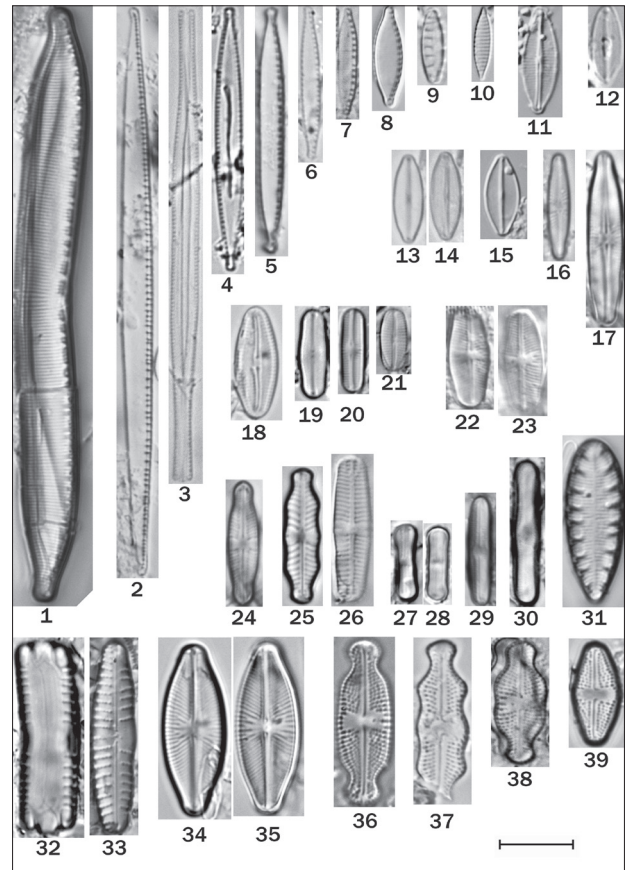
Basionym: *Pinnularia muscicola* J.B.Petersen

Reference: Hofmann et al. [26] (p. 50, Figs. 29,30: 129)

Dimensions: Valve length 12.48  $\mu$ m, breadth 3.37  $\mu$ m, striae 19/10  $\mu$ m.

Distribution in Serbia: CP95 Cvetići zaliv stream (Fig. 1, Table 1).

***Cocconeis pseudothumensis*** Reichardt (Fig. 2(20))



**Fig. 3.** Light microscopy (LM) micrographs (x1600): 1 *Hantzschia calcifuga*; 2 *Nitzschia vermicularoides*; 3 *N. draveillensis*; 4 *N. palea* var. *tenuirostris*; 5 *N. suchlandtii*; 6 *N. palea* var. *debilis*; 7 *N. acidoclinata*; 8 *N. bryophila*; 9 *N. solgensis*; 10 *Simonsenia delognei*; 11 *Craticula molestiformis*; 12 *Fistulifera pelliculosa*; 13, 14 *Adlafia minuscula*; 15 *A. minuscula* var. *muralis*; 16 *A. suchlandtii*; 17 *A. aquaeductae*; 18 *Fallacia insociabilis*; 19 *F. lenzii*; 20 *F. langebertalotii*; 21 *F. subcluidula*; 22, 23 *Naviculadicta vitabunda*; 24 *N. absoluta*; 25 *Geissleria ignota*; 26 *G. paludosa*; 27, 28 *Humidophila paracontenta*; 29 *H. irata*; 30 *H. brekkaensis*; 31 *Surirella terricola*; 32, 33 *Reimeria uniseriata*; 34, 35 *Sellaphora mutatooides*; 36 *Luticola ventriconfusa*; 37 *L. triundulata*; 38 *L. paramutica*; 39 *L. acidoclinata*. Scale bar=10  $\mu$ m.

Basionym: *Cocconeis pseudothumensis* Reichardt

Reference: Hofmann et al. [26] (p. 20, Figs. 1-4: 134)

Dimensions: Valve length 11.4-12.56  $\mu$ m, breadth 8.03-8.58  $\mu$ m, striae 10-12/10  $\mu$ m.

Distribution in Serbia: EN48 Rasina and EQ40 Mlava rivers (Fig. 1, Table 1).

***Craticula molestiformis*** (Hustedt) Mayama (Fig. 3(11))

Basionym: *Navicula molestiformis* Hustedt

Reference: Lange-Bertalot [7] (p. 93, Figs. 19-28: 116)

Dimensions: Valve length 9.5-16.5  $\mu\text{m}$ , breadth 3.5-5  $\mu\text{m}$ , striae 25-26/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava, DN79 Raška and DQ31 Kolubara rivers, DR44 Jaruge salt marsh (Fig. 1, Table 1).

***Cymbella lange-bertalotii*** Krammer (Fig. 2(21))

Basionym: *Cymbella lange-bertalotii* Krammer

Reference: Krammer [8] (p. 179, Figs. 1-6; p. 180, Figs. 1-8; p. 181, Figs. 1-6, 8; p. 182, Figs. 1-9: 152, 174)

Dimensions: Valve length 52.46-90.02  $\mu\text{m}$ , breadth 12.52-15.11  $\mu\text{m}$ , dorsal striae 8-11/10  $\mu\text{m}$ , ventral striae 10-11/10  $\mu\text{m}$ , puncta 19-23/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Đetinja, CP66/76 Karaklijski Rzav and CP66/76 Batarski Rzav rivers, DQ50 Garaši, DP76/86 Gruža, CP93 Zlatibor and DP18 Divčibare accumulations (Fig. 1, Table 1).

***Diatoma problematica*** Lange-Bertalot (Fig. 4(6))

Basionym: *Diatoma problematica* Lange-Bertalot

Reference: Hofmann et al. [26] (p. 2, Figs. 26-30: 175)

Dimensions: Valve length 15.18-26.93  $\mu\text{m}$ , breadth 4.52-5.75  $\mu\text{m}$ , striae 5-10/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP86 Rača, EQ40 Mlava and DN79 Raška rivers (Fig. 1, Table 1).

***Encyonema brevicapitatum*** Krammer (Fig. 2(17))

Basionym: *Encyonema brevicapitatum* Krammer

Reference: Krammer [31] (p. 27, Figs. 1-9, 17; p. 34, Figs. 1-7: 92)

Dimensions: Valve length 11.66-23.53  $\mu\text{m}$ , breadth 4.38-6.81  $\mu\text{m}$ , striae 14-18/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava, EP75 Radovanska and FN02 Vrla rivers (Fig. 1, Table 1).

***Encyonema procerum*** Krammer (Fig. 2(15))

Basionym: *Encyonema procerum* Krammer

Reference: Krammer [31] (p. 32, Figs. 9-19: 169)

Dimensions: Valve length 24.22-26.34  $\mu\text{m}$ , breadth 6.01-3.37  $\mu\text{m}$ , dorsal striae 13-15/10  $\mu\text{m}$ , ventral striae 13-16/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River (Fig. 1, Table 1).

***Encyonema subminutum*** Krammer and Lange-Bertalot (Fig. 2(16))

Basionym: *Encyonema subminutum* Krammer and Lange-Bertalot

Reference: Krammer [31] (p. 19, Figs. 17-24; p. 25, Figs. 28-34: 56)

Dimensions: Valve length 18.08-26.38  $\mu\text{m}$ , breadth 4.72-6.48  $\mu\text{m}$ , dorsal striae 14-17/10  $\mu\text{m}$ , ventral striae 14-16/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, EQ40 Mlava and EP75 Radovanska rivers (Fig. 1, Table 1).

***Encyonopsis cesatii*** (Rabenhorst) Krammer (Fig. 2(23))

Basionym: *Navicula cesatii* Rabenhorst

Reference: Krammer [32] (p. 182, Figs. 1-13; p. 183, Figs. 10-12; p. 184., Figs. 4-7; p. 185, Figs. 1-7, 11-13; p. 186, Figs. 10, 11; p. 187 Figs. 1-7: 152).

Dimensions: Valve length 17.07-43.96  $\mu\text{m}$ , breadth 4.59-7.88  $\mu\text{m}$ , striae 17-21/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP87 Rača, CP95 Đetinja, CP79, CP87, CQ66 Drina and CP82, CP90 Lim rivers, CP95 a 2, CP95 Cvetića zaliv, CP95 Cvetića potok, CP95 Simića potok, CP95 Jasik and CP95 Jovac streams, DP18 Divčibare, CP93 Zlatibor, EP50 Bresnica, EN29 Pridvorica and CP95 Vrutci accumulations, DR43 Okanj bara salt marsh (Fig. 1, Table 1).

***Encyonopsis krammeri*** Reichardt (Fig. 2(24))

Basionym: *Encyonopsis krammeri* Reichardt

Reference: Krammer [32] (p. 144, Figs. 12-15, 21; p. 145, Figs. 1-18; p. 147., Figs. 4-6; p. 150, Figs. 1-3, 5, 6, 11-14; p. 193, Figs. 1, 4, 6: 99)

Dimensions: Valve length 12.28-14.37  $\mu\text{m}$ , breadth 3.17-3.24  $\mu\text{m}$ , striae 28-30/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava River (Fig. 1, Table 1).

**Fallacia insociabilis** (Krasske) D.G.Mann (Fig. 3(18))

Basionym: *Navicula insociabilis* Krasske

Reference: Hofmann et al. [26] (p. 46, Figs. 21-25: 244)

Dimensions: Valve length 10.04-15.25  $\mu\text{m}$ , breadth 5.18-6.14  $\mu\text{m}$ , striae 22-23/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška, EQ40 Mlava and FN02 Vrla rivers (Fig. 1, Table 1).

**Fallacia lange-bertalotii** (Reichardt) Reichardt (Fig. 3(20))

Basionym: *Navicula lange-bertalotii* Reichardt

Reference: Hofmann et al. [26] (p. 46, Fig. 18: 242)

Dimensions: Valve length 9.78-11.47  $\mu\text{m}$ , breadth 3.24-3.31  $\mu\text{m}$ , striae 29-31.5/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Krnda 2 stream (Fig. 1, Table 1).

**Fallacia lenzii** (Hustedt) Lange-Bertalot (Fig. 3(19))

Basionym: *Navicula lenzii* Hustedt

Reference: Hofmann et al. [26] (p. 46, Figs. 3-7: 243)

Dimensions: Valve length 10.25-15.98  $\mu\text{m}$ , breadth 3.42-4.97  $\mu\text{m}$ , striae 27/10  $\mu\text{m}$

Distribution in Serbia: CP95 Ročnjak stream, CP66/76 Karaklijski Rzav, CP66/76 Batarski Rzav and DQ31 Kolubara rivers (Fig. 1, Table 1).

**Fallacia sublucidula** (Hustedt) D.G.Mann (Fig. 3(21))

Basionym: *Navicula sublucidula* Hustedt

Reference: Hofmann et al. [26] (p. 46, Figs. 1,2: 243)

Dimensions: Valve length 7.02-10.52  $\mu\text{m}$ , breadth 3.71-4.59  $\mu\text{m}$ , striae 23-28/10  $\mu\text{m}$ .

Distribution in Serbia: CP86 Rača, DN79 Raška, EQ40 Mlava and EP75 Radovanska rivers, CP95 Ročnjak stream (Fig. 1, Table 1).

**Fistulifera pelliculosa** (Kützing) Lange-Bertalot (Fig. 3(12); Fig. 5(2))

Basionym: *Synedra minutissima* var. *pelliculosa* Kützing

Reference: Lange-Bertalot [7] (p. 110, Figs. 1-11; p. 112, Fig. 1: 148)

Dimensions: Valve length 9.2-11.04  $\mu\text{m}$ , breadth 4.52-5.75  $\mu\text{m}$ .

Distribution in Serbia: CP87 Rača River, CP95 Jasik, CP95 Bioštanska Banja and CP95 Ročnjak streams, CP95 Vrutci tributary 12 and 13 (Fig. 1, Table 1).

**Fragilaria pararumpens** Lange-Bertalot, G.Hofmann and Werum (Fig. 4(5))

Basionym: *Fragilaria pararumpens* Lange-Bertalot, G.Hofmann and Werum

Reference: Hofmann et al. [26] (p. 8, Figs. 4-10: 269)

Dimensions: Valve length 23.08-46.42  $\mu\text{m}$ , breadth 2.09-4.59  $\mu\text{m}$ , striae 17-19/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, DN79 Raška, EQ40 Mlava and EP75 Radovanska rivers (Fig. 1, Table 1).

**Fragilaria radians** (Kützing) D.M.Williams and Round (Fig. 4(4))

Basionym: *Synedra radians* Kützing

Reference: Hofmann et al. [26] (p. 7, Figs. 21-25: 274)

Dimensions: Valve length 33.19-47.22  $\mu\text{m}$ , breadth 3.44-4.25  $\mu\text{m}$ , striae 10-11/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP86 Rača and DN79 Raška rivers (Fig. 1, Table 1).

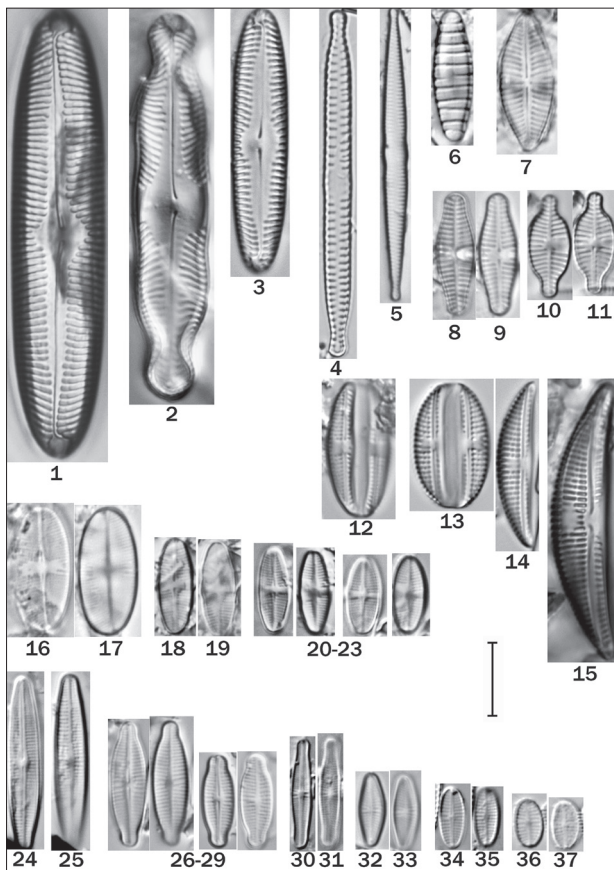
**Geissleria ignota** (Krasske) Lange-Bertalot and Metzeltin (Fig. 3(25))

Basionym: *Navicula ignota* Krasske

Reference: Lange-Bertalot [7] (p. 97, Figs. 25-30; p. 98, Figs. 1, 2: 125)

Dimensions: Valve length 18.42  $\mu\text{m}$ , breadth 5  $\mu\text{m}$ , striae 12/10  $\mu\text{m}$ .





**Fig. 4.** Light microscopy (LM) micrographs (x1600): 1 *Pinnularia peracuminata*; 2 *P. grunowii*; 3 *P. isselana*; 4 *Fragilaria radians*; 5 *F. pararumpensis*; 6 *Diatoma problematica*; 7 *Placoneis hambergii*; 8, 9 *Planothidium biporum*; 10, 11 *P. reichardtii*; 12 *Amphora micra*; 13, 14 *A. meridionalis*; 15 *A. lange-bertalotii* var. *tenuis*; 16, 17 *Psammothidium bioretii*; 18, 19 *P. grischunum*; 20-23 *P. lauenburgianum*; 24, 25 *Achnanthisdium druartii*; 26-29 *A. latecephalum*; 30, 31 *A. caledonicum*; 32, 33 *A. eutrophilum*; 34, 35 *A. crassum*; 36, 37 *A. straubianum*. Scale bar=10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Simića potok stream (Fig. 1, Table 1).

***Geissleria paludosa*** (Hustedt) Lange-Bertalot and Metzeltin (Fig. 3(26))

Basionym: *Navicula paludosa* Hustedt

Reference: Lange-Bertalot [7] (p. 97, Figs. 16-20; p. 98, Fig. 3: 126)

Dimensions: Valve length 13.09-19.83  $\mu\text{m}$ , breadth 4.45-6.69  $\mu\text{m}$ , striae 13-17/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava, EP75 Radovanska and FN02 Vrla rivers (Fig. 1, Table 1).

***Gomphonema acidoclinatum*** Lange-Bertalot and Reichardt (Fig. 2(5))

Basionym: *Gomphonema acidoclinatum* Lange-Bertalot and Reichardt

Reference: Hofmann et al. [26] (p. 98, Figs. 28-32: 294)

Dimensions: Valve length 24.61-37.13  $\mu\text{m}$ , breadth 6.26-7.45  $\mu\text{m}$ , striae 14-16/10  $\mu\text{m}$ .

Distribution in Serbia: FN02 Vrla and CQ87 Zasavica rivers, CP95 Zaliv pritoke stream (Fig. 1, Table 1).

***Gomphonema calcifugum*** Lange-Bertalot and Reichardt (Fig. 2(11))

Basionym: *Gomphonema calcifugum* Lange-Bertalot and Reichardt

Reference: Levkov et al. [9] (p. 199, Figs. 29-53: 39)

Dimensions: Valve length 16.19  $\mu\text{m}$ , breadth 4.52  $\mu\text{m}$ , striae 12/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava River (Fig. 1, Table 1).

***Gomphonema clavatum*** Reichardt (Fig. 2(4))

Basionym: *Gomphonema clavatum* Reichardt

Reference: Hofmann et al. [26] (p. 97, Figs. 7-9: 300)

Dimensions: Valve length 21-32.28  $\mu\text{m}$ , breadth 5.72-6.6  $\mu\text{m}$ , striae 11-12/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Cvetića zaliv stream, DQ58 Velika Slatina, DR43 Okanj bara and DR54 Novo Ilje I salt marshes (Fig. 1, Table 1).

***Gomphonema cymbelliclinum*** Reichardt and Lange-Bertalot (Fig. 2(7); Fig. 5(1))

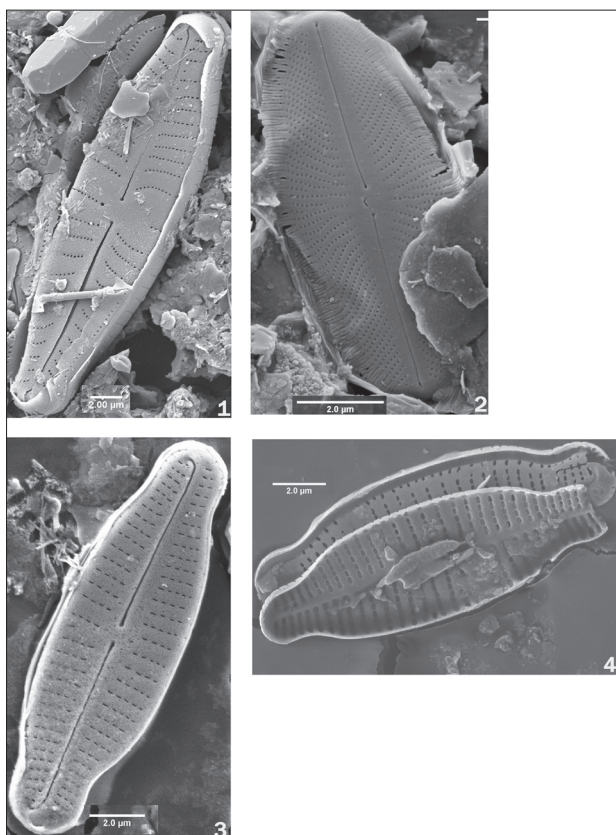
Basionym: *Gomphonema cymbelliclinum* Reichardt and Lange-Bertalot

Reference: Reichardt [33] (p. 39, Figs. 11-14, 24-26; p. 40; p. 41: Figs. 10-17: 36)

Dimensions: Valve length 19.97-36.81  $\mu\text{m}$ , breadth 5.18-6.88  $\mu\text{m}$ , striae 10-15/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP86 Rača, DN79 Raška, CP95 Đetinja, EQ40 Mlava, FN02





**Fig. 5.** Scanning electron microscopy (SEM) micrographs: 1 *Gomphonema cymbelliclinum*; 2 *Fistulifera pelliculosa*; 3, 4 *Achnanthisium latecephalum*. Scale bar=2 µm.

Vrla, EP75 Radovanska, CP66/76 Karaklijski Rzav, CP66/76 Baturski Rzav and CP79. CP87 Drina rivers, CP95 Cvetića potok, CP95 Simića potok, CP95 Jasik, CP95 Jovac, CP95 Konjski potok, and CP95 Ročnjak streams, CP95 Vrutci tributary 10, 12 and 13, DP18 Divčibare, EP50 Bresnica and DQ60 Bukulja accumulations (Fig. 1, Table 1).

***Gomphonema drutelingense*** Reichardt (Fig. 2(6))

Basionym: *Gomphonema drutelingense* Reichardt

Reference: Reichardt [33] (p. 39, Figs. 21-23; p. 42: 38)

Dimensions: Valve length 19.32-40.26 µm, breadth 6.48-8.96 µm, striae 10-14/10 µm.

Distribution in Serbia: EN48 Rasina, CP86 Rača, EQ40 Mlava, FN02 Vrla, CP76 Vrelo rivers, CP95 Jasik, CP95 Bioštanska Banja and CP95 Ročnjak streams, CP95 Vrutci tributary 13 (Fig. 1, Table 1).

***Gomphonema extentum*** Reichardt and Lange-Bertalot (Fig. 2(3))

Basionym: *Gomphonema extentum* Reichardt and Lange-Bertalot

Reference: Hofmann et al. [26] (p. 97, Figs. 21, 22: 306)

Dimensions: Valve length 21.37-40.04 µm, breadth 6.15-8.2 µm, striae 11-13/10 µm.

Distribution in Serbia: CP95 Đetinja and FN02 Vrla rivers, CP95 Zaliv pritoke stream (Fig. 1, Table 1).

***Gomphonema lagenula*** Kützing (Fig. 2(14))

Basionym: *Gomphonema lagenula* Kützing

Reference: Levkov et al. [9] (p. 102, Figs. 39-47: 71)

Dimensions: Valve length 18.89-34.37 µm, breadth 5.61-9.92 µm, striae 11-14/10 µm.

Distribution in Serbia: EN48 Rasina, FN02 Vrla, EQ40 Mlava, DP39 Toplica, DQ50 Kačer and DQ31 Kolubara rivers, CR62 Danube-Tisa-Danube Canal (Bač), DP76/86 Gruža accumulation (Fig. 1, Table 1).

***Gomphonema lippertii*** Reichardt and Lange-Bertalot (Fig. 2(2))

Basionym: *Gomphonema lippertii* Reichardt and Lange-Bertalot

Reference: Hofmann et al. [26] (p. 98, Figs. 1-5: 295)

Dimensions: Valve length 36.63-53.1 µm, breadth 9.19-10.32 µm, striae 11-13/10 µm, punctae 24/10 µm.

Distribution in Serbia: DN79 Raška River (Fig. 1, Table 1).

***Gomphonema procerum*** Reichardt and Lange-Bertalot (Fig. 2(8))

Basionym: *Gomphonema procerum* Reichardt and Lange-Bertalot

Reference: Hofmann et al. [26] (p. 96, Fig. 27: 313)

Dimensions: Valve length 37.91-40.14 µm, breadth 5-6.44 µm, striae 10-11/10 µm.

Distribution in Serbia: CP86 Rača, DN79 Raška and EQ40 Mlava rivers (Fig. 1, Table 1).

***Gomphonema saprophilum*** (Lange-Bertalot and Reichardt) Abraca, R.Jahn, J.Zimmermann and Enke (Fig. 2(12))

Basionym: *Gomphonema parvulum* f. *saprophilum* Lange-Bertalot and Reichardt

Reference: Levkov et al. [9] (p. 104, Figs. 25-33: 116)

Dimensions: Valve length 11.66-34  $\mu\text{m}$ , breadth 5.4-8  $\mu\text{m}$ , striae 9-16/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, EP75 Radovanska, FN02 Vrla, EP17 Belica, EP33 Zapadna Morava, DQ75 Ponjavica (Omoljica), DQ85 Ponjavica (Brestovac), DQ31 Kolubara and DR22 Jegrička rivers, CR57 Danube-Tisa-Danube (Sombor) and DR24 Danube-Tisa-Danube (Bačko Gradište) canals, DQ58 Velika Slatina, DQ58 Gergina Slatina, DR28 Kerekszék and DR54 Novo Ilje I salt marshes (Fig. 1, Table 1).

***Gomphonema sphenovortex*** Lange-Bertalot and Reichardt (Fig. 2(13))

Basionym: *Gomphonema sphenovortex* Lange-Bertalot and Reichardt

Reference: Hofmann et al. [26] (p. 98, Figs. 26, 27: 315)

Dimensions: Valve length 16.62-19.84  $\mu\text{m}$ , breadth 4.79-5.94  $\mu\text{m}$ , striae 13-14/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška and EQ40 Mlava rivers (Fig. 1, Table 1).

***Gomphonema zellense*** Reichardt (Fig. 2(1))

Basionym: *Gomphonema zellense* Reichardt

Reference: Reichardt [33] (p. 5: 11)

Dimensions: Valve length 41.57-61.39  $\mu\text{m}$ , breadth 9.58-11.54  $\mu\text{m}$ , striae 8-10/10  $\mu\text{m}$ , areolae 22-26/10  $\mu\text{m}$ .

Distribution in Serbia: CP86 Rača River (Fig. 1, Table 1).

***Hantzschia calcifuga*** Reichardt and Lange-Bertalot (Fig. 3(1))

Basionym: *Hantzschia calcifuga* Reichardt and Lange-Bertalot

Reference: Werum and Lange-Bertalot [34] (p. 96, Figs. 1-6; p. 97, Figs. 1-4: 63)

Dimensions: Valve length 81.4  $\mu\text{m}$ , breadth 6.44  $\mu\text{m}$ , fibulae 6/10  $\mu\text{m}$ , striae 22/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Krnda 2 stream (Fig. 1, Table 1).

***Halumphora normanii*** (Rabenhorst) Levkov (Fig. 2(27, 28))

Basionym: *Amphora normanii* Rabenhorst

Reference: Levkov [30] (p. 94, Figs. 1-8, 28-32: 208)

Dimensions: Valve length 26.73-38.21  $\mu\text{m}$ , frustule breadth 13.63-15.92  $\mu\text{m}$ , striae 18-26/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP86 Rača and DN79 Raška rivers, CP95 Jasik stream and CP95 Vrutci tributary 13 (Fig. 1, Table 1).

***Halumphora veneta*** (Kützing) Levkov (Fig. 2(25, 26))

Basionym: *Amphora veneta* Kützing

Reference: Levkov [30] (p. 94, Figs. 9-19; p. 102, Figs. 17-30; p. 217, Figs. 1-5; p. 218, Figs. 1-5: 242)

Dimensions: Valve length 21.18-31.3  $\mu\text{m}$ , valve breadth 4.75-5.29  $\mu\text{m}$ , frustule breadth 10.47-13.63  $\mu\text{m}$ , striae 20-23/10  $\mu\text{m}$ .

Distribution in Serbia: CQ87 Zasavica River, CP95 Zaliv pritoke stream (Fig. 1, Table 1).

***Humidophila brekkaensis*** (Petersen) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot and Kopalová (Fig. 3(30))

Basionym: *Navicula brekkaensis* J.B.Petersen

Reference: Werum and Lange-Bertalot [34] (p. 58, Figs. 1-13; p. 62, Figs. 30-32: 135)

Dimensions: Valve length 19.63  $\mu\text{m}$ , breadth 3.51  $\mu\text{m}$ , striae 24-25/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Simića potok stream (Fig. 1, Table 1).

***Humidophila irata*** (Krasske) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot and Kopalová (Fig. 3(29))

Basionym: *Navicula irata* Krasske

Reference: Werum and Lange-Bertalot [34] (p. 62, Figs. 39, 40: 137)

Dimensions: Valve length 14.98-23.07  $\mu\text{m}$ , breadth 3.24-3.92  $\mu\text{m}$ , striae 28-32/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River, CP95 Krnda 2 stream (Fig. 1, Table 1).

***Humidophila paracontenta*** (Lange-Bertalot and Werum) Lowe, Kociolek, Johansen, Van de Vijver, Lange-Bertalot and Kopalová (Fig. 3(27, 28))

Basionym: *Diademsis paracontenta* Lange-Bertalot and Werum

Reference: Werum and Lange-Bertalot [34] (p. 59, Figs. 1-11; p. 62, Figs. 15-17: 138)

Dimensions: Valve length 9.98-10.25  $\mu\text{m}$ , breadth 2.43-2.6  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River, CP95 Jasik and CP95 Konjski potok streams (Fig. 1, Table 1).

***Kurtkammeria recta*** (Krammer) L.Bahls (Fig. 2(22))

Basionym: *Encyonopsis recta* Krammer

Reference: Krammer [32] (p. 165, Figs. 12-14; p. 166, Figs. 4-12: 132)

Dimensions: Valve length 32.05  $\mu\text{m}$ , breadth 5.67  $\mu\text{m}$ , striae 15/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River (Fig. 1, Table 1).

***Luticola acidoclinata*** Lange-Bertalot (Fig. 3(39))

Basionym: *Luticola acidoclinata* Lange-Bertalot

Reference: Levkov et al. [35] (p. 18, Figs. 1-46; p. 19, Figs. 1-7: 52)

Dimensions: Valve length 10.12-28.6  $\mu\text{m}$ , breadth 5.61-8.74  $\mu\text{m}$ , striae 19-23/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava, FN02 Vrla and EP75 Radovanska rivers, CP95 Cvetića zaliv stream (Fig. 1, Table 1).

***Luticola paramutica*** (W.Bock) D.G.Mann (Fig. 3(38))

Basionym: *Navicula paramutica* W.Bock

Reference: Levkov et al. [35] (p. 12, Figs. 17-23; p. 32, Figs. 23-39: 182)

Dimensions: Valve length 16.54-16.73  $\mu\text{m}$ , breadth 5.83-6.68  $\mu\text{m}$ , striae 19-20/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Zaliv pritoke stream, CP93 Zlatibor accumulation (Fig. 1, Table 1).

***Luticola triundulata*** Levkov, Metzeltin and A.Pavlov (Fig. 3(37))

Basionym: *Navicula paramutica* W.Bock

Reference: Levkov et al. [35] (p. 178, Figs. 19-30; p. 180, Figs. 5-8: 240)

Dimensions: Valve length 24  $\mu\text{m}$ , breadth 7.29  $\mu\text{m}$ , striae 17/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava River (Fig. 1, Table 1).

***Luticola ventriconfusa*** Lange-Bertalot (Fig. 3(36))

Basionym: *Luticola ventriconfusa* Lange-Bertalot

Reference: Levkov et al. [35] (p. 190, Figs. 1-57; p. 191, Figs. 1-6: 250)

Dimensions: Valve length 15.87-22.94  $\mu\text{m}$ , breadth 6.48-7.69  $\mu\text{m}$ , striae 19-21/10  $\mu\text{m}$ , areolae 15/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška River, CP95 Jovac stream (Fig. 1, Table 1).

***Mayamaea fossalis*** (Krasske) Lange-Bertalot (Fig. 2(19))

Basionym: *Navicula fossalis* Krasske

Reference: Lange-Bertalot [7] (p. 104, Figs. 25-30: 138)

Dimensions: Valve length 9.78  $\mu\text{m}$ , breadth 3.64  $\mu\text{m}$ , striae 23/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Krnda 2 stream (Fig. 1, Table 1).

***Microfissurata australis*** Van de Vijver and Lange-Bertalot (Fig. 2(9, 10))

Basionym: *Microfissurata australis* Van de Vijver and Lange-Bertalot

Reference: Cantonati et al. [36] (Fig. 2: 735)

Dimensions: Valve length 15.28  $\mu\text{m}$ , breadth 3.3  $\mu\text{m}$ .

Distribution in Serbia: CP95 Ročnjak stream (Fig. 1, Table 1).

***Naviculadicta absoluta*** (Hustedt) Lange-Bertalot (Fig. 3(24))

Basionym: *Navicula absoluta* Hustedt

Reference: Hofmann et al. [26] (p. 42, Figs. 62-66: 411)

Dimensions: Valve length 17  $\mu\text{m}$ , breadth 4.59  $\mu\text{m}$ , striae 22/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River (Fig. 1, Table 1).

***Naviculadicta vitabunda*** (Hustedt) Lange-Bertalot (Fig. 3(22, 23))

Basionym: *Navicula vitabunda* Hustedt

Reference: Hofmann et al. [26] (p. 42, Figs. 67-71: 412)

Dimensions: Valve length 13.44  $\mu\text{m}$ , breadth 5.81  $\mu\text{m}$ , striae 27/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška River (Fig. 1, Table 1).

***Nitzschia acidoclinata*** Lange-Bertalot (Fig. 3(7))

Basionym: *Nitzschia acidoclinata* Lange-Bertalot

Reference: Hofmann et al. [26] (p. 112, Figs. 50-54: 431)

Dimensions: Valve length 14.25-20.96  $\mu\text{m}$ , breadth 2.56-3.02  $\mu\text{m}$ , fibulae 11-12/10  $\mu\text{m}$ , striae 11/10  $\mu\text{m}$ , fibulae 24/10  $\mu\text{m}$ .

Distribution in Serbia: CP95 Zaliv pritoke stream, FN02 Vrla River, CP93 Zlatibor accumulation (Fig. 1, Table 1).

***Nitzschia bryophila*** (Hustedt) Hustedt (Fig. 3(8))

Basionym: *Nitzschia frustulum* var. *bryophila* Hustedt

Reference: Krammer and Lange-Bertalot [37] (p. 74, Figs. 27-29; 103)

Dimensions: Valve length 12.2-21.37  $\mu\text{m}$ , breadth 3.44-4.5  $\mu\text{m}$ , fibulae 8-13/10  $\mu\text{m}$ , striae 30/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava, CP79 Drina and CP82 Lim rivers, DP18 Divčibare accumulation (Fig. 1, Table 1).

***Nitzschia draveillensis*** Coste and Ricard (Fig. 3(3))

Basionym: *Nitzschia draveillensis* Coste and Ricard

Reference: Hofmann et al. [26] (p. 106, Fig. 13: 463)

Dimensions: Valve length 34.34-64.36  $\mu\text{m}$ , breadth 2.23-2.7  $\mu\text{m}$ , fibulae 21/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina and FN03 Vlasina rivers (Fig. 1, Table 1).

***Nitzschia palea* var. *debilis*** (Kützing) Grunow (Fig. 3(6))

Basionym: *Synedra debilis* Kützing

Reference: Hofmann et al. [26] (p. 111, Figs. 10-13: 455)

Dimensions: Valve length 16.53-27.94  $\mu\text{m}$ , breadth 2.43-3.72  $\mu\text{m}$ , fibulae 12-17/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River, CP93 Zlatibor accumulation (Fig. 1, Table 1).

***Nitzschia palea* var. *tenuirostris*** Grunow (Fig. 3(4))

Basionym: *Nitzschia palea* var. *tenuirostris* Grunow

Reference: Hofmann et al. [26] (p. 111, Figs. 14-20: 455)

Dimensions: Valve length 31.41-39.5  $\mu\text{m}$ , breadth 3.24-4.64  $\mu\text{m}$ , fibulae 15-16/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, FN02 Vrla, DP26 Zapadna Morava, DQ75 Ponjavica (Omoljica) and DQ85 Ponjavica (Brestovac) rivers, DQ58 Gergina Slatina and DR44 Jaruge salt marshes (Fig. 1, Table 1).

***Nitzschia solgensis*** Cleve-Euler (Fig. 3(9))

Basionym: *Nitzschia solgensis* Cleve-Euler

Reference: Hofmann et al. [26] (p. 117, Figs. 21-25: 461)

Dimensions: Valve length 9.99-12.64  $\mu\text{m}$ , breadth 3.17-3.24  $\mu\text{m}$ , fibulae 8-10/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River (Fig. 1, Table 1).



***Nitzschia suchlandtii*** Hustedt (Fig. 3(5))Basionym: *Nitzschia suchlandtii* Hustedt

Reference: Krammer and Lange-Bertalot [37] (p. 66, Figs. 12-16; 93)

Dimensions: Valve length 22.74-33.46  $\mu\text{m}$ , breadth 3.46-3.59  $\mu\text{m}$ , fibulae 11-16/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River (Fig. 1, Table 1).

***Nitzschia vermicularoides*** Lange-Bertalot (Fig. 3(2))Basionym: *Nitzschia vermicularoides* Lange-Bertalot

Reference: Hofmann et al. [26] (p. 115, Figs. 4-6: 468)

Dimensions: Valve length 77.53-78.08  $\mu\text{m}$ , breadth 4.5  $\mu\text{m}$ , fibulae 14/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava River (Fig. 1, Table 1).

***Pinnularia grunowii*** Krammer (Fig. 4(2))Basionym: *Pinnularia grunowii* Krammer

Reference: Krammer [38] (p. 77, Figs. 7-14; p. 81, Figs. 10-17; p. 82, Fig. 7,8: 100, 222)

Dimensions: Valve length 33.46-53  $\mu\text{m}$ , breadth 8.31-10.59  $\mu\text{m}$ , striae 12-14/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava, FN02 Vrla and DQ31 Kolubara rivers (Fig. 1, Table 1).

***Pinnularia isselana*** Krammer (Fig. 4(3))Basionym: *Pinnularia isselana* Krammer

Reference: Krammer [38] (p. 103, Figs. 1-20: 132)

Dimensions: Valve length 33.6-46.3  $\mu\text{m}$ , breadth 7.15-8.63  $\mu\text{m}$ , striae 12-13/10  $\mu\text{m}$ .

Distribution in Serbia: FN02 Vrla and EP75 Radovanska rivers, CP95 Krnda 2 and CP95 Zaliv pritoke streams (Fig. 1, Table 1).

***Pinnularia peracuminata*** Krammer (Fig. 4(1))Basionym: *Pinnularia peracuminata* Krammer

Reference: Krammer [38] (p. 142, Figs. 1-10: 157)

Dimensions: Valve length 54-61.32  $\mu\text{m}$ , breadth 11-12.96  $\mu\text{m}$ , striae 10-11/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška River, DQ58 Aleksića Slatina salt marsh (Fig. 1, Table 1).

***Placoneis hambergii*** (Hustedt) K.Bruder (Fig. 4(7))Basionym: *Navicula hambergii* Hustedt

Reference: Krammer and Lange-Bertalot [25] (p. 50, Figs. 9-13: 146)

Dimensions: Valve length 14.91-19.05  $\mu\text{m}$ , breadth 6.68-7.56  $\mu\text{m}$ , striae 16-17/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina River (Fig. 1, Table 1).

***Planothidium biporum*** (Hohn and Hellerman) Lange-Bertalot (Fig. 4(8, 9))Basionym: *Achnanthes biporoma* Hohn and Hellerman

Reference: Wetzel et al. [39] (Figs. 1-18, 37-50: 45)

Dimensions: Valve length 16.42-18.24  $\mu\text{m}$ , breadth 5.2-5.83  $\mu\text{m}$ , striae 14-15/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, EQ40 Mlava and FN02 Vrla rivers (Fig. 1, Table 1).

***Planothidium reichardtii*** Lange-Bertalot and Werum (Fig. 4(10, 11))Basionym: *Planothidium reichardtii* Lange-Bertalot and Werum

Reference: Werum and Lange-Bertalot [34] (p. 15, Figs. 9-18: 172)

Dimensions: Valve length 11.94-14.03  $\mu\text{m}$ , breadth 5.06-5.8  $\mu\text{m}$ , striae 14-18/10  $\mu\text{m}$ .

Distribution in Serbia: DN79 Raška river (Fig. 1, Table 1).

***Psammothidium bioretii*** (H.Germain) Bukhtiyarova and Round (Fig. 4(16, 17))Basionym: *Achnanthes bioretii* H.Germain

Reference: Hofmann et al. [26] (p. 26, Figs. 12-16: 519)

Dimensions: Valve length 12.08-18.35  $\mu\text{m}$ , breadth 5.46-8.85  $\mu\text{m}$ , striae 23-27/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, EP75 Radovanska and FN02 Vrla rivers, CP95 Zaliv pritoke stream (Fig. 1, Table 1).

***Psammothidium grischunum*** (Wuthrich) L.Bukhtiyarova and Round (Fig. 4(18, 19))

Basionym: *Achnanthes grishuna* Wuthrich

Reference: Hofmann et al. [26] (p. 26, Figs. 33-37: 521)

Dimensions: Valve length 8.1-13.57  $\mu\text{m}$ , breadth 3.51-5.18  $\mu\text{m}$ , striae of raphe valve 21-28/10  $\mu\text{m}$ , striae of rapheless valve 24-26/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina and CP76 Vrelo rivers, CP95 Cvetića potok stream (Fig. 1, Table 1).

***Psammothidium lauenburgianum*** (Hustedt) Monnier, Lange-Bertalot (Fig. 4(20-23))

Basionym: *Achnanthes lauenburgiana* Hustedt

Reference: Hofmann et al. [26] (p. 26, Figs. 55-59: 522)

Dimensions: Valve length 7.22-17.47  $\mu\text{m}$ , breadth 3.91-6.07  $\mu\text{m}$ , striae of raphe valve 23-29/10  $\mu\text{m}$ .

Distribution in Serbia: EQ40 Mlava River, Vrutci tributary 12 (Fig. 1, Table 1).

***Reimeria uniseriata*** (W.Gregory) Kociolek and Stoermer (Fig. 3(32, 33))

Basionym: *Cymbella sinuata* W.Gregory

Reference: Sala et al. [40] (Figs. 2-10: 445)

Dimensions: Valve length 11.2-26.24  $\mu\text{m}$ , breadth 3.92-6.21  $\mu\text{m}$ , striae 7-16/10  $\mu\text{m}$ , areolae 20-24/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina, CP86 Rača, DN79 Raška, CP95 Đetinja and EP75 Radovanska rivers, CP95 Cvetića zaliv, CP95 Cvetića potok, CP95 Simića potok, CP95 Jasik, CP95 Jovac, CP95 Bioštanska Banja, CP95 Konjski potok and CP95 Ročnjak streams, Vrutci tributary 12 and 13 (Fig. 1, Table 1).

***Sellaphora mutatooides*** Lange-Bertalot and Metzeltin (Fig. 3(34, 35))

Basionym: *Sellaphora mutatooides* Lange-Bertalot and Metzeltin

Reference: Hofmann et al. [26] (p. 42, Figs. 1-4: 535)

Dimensions: Valve length 23.22-23.27  $\mu\text{m}$ , breadth 7.48-8.71  $\mu\text{m}$ , striae 19-21/10  $\mu\text{m}$ .

Distribution in Serbia: EN48 Rasina and CQ87 Zavsavica rivers (Fig. 1, Table 1).

***Simonsenia delognei*** (Grunow) Lange-Bertalot (Fig. 3(10))

Basionym: *Nitzschia delognei* Grunow

Reference: Hofmann et al. [26] (p. 117, Figs. 47-50: 540)

Dimensions: Valve length 8.98-14.23  $\mu\text{m}$ , breadth 2.16-3.11  $\mu\text{m}$ , striae 16-19/10  $\mu\text{m}$ .

Distribution in Serbia: CP86 Rača and EP75 Radovanska rivers (Fig. 1, Table 1).

***Surirella terricola*** Lange-Bertalot and E.Alles (Fig. 3(31))

Basionym: *Surirella terricola* Lange-Bertalot and E.Alles

Reference: Lange-Bertalot and Metzeltin [6] (p. 77, Figs. 15-19; p. 106, Fig. 16:107)

Dimensions: Valve length 17.61-22.34  $\mu\text{m}$ , breadth 7.17-8.16  $\mu\text{m}$ , striae 4.5-8/10  $\mu\text{m}$ .

Distribution in Serbia: CP86 Rača River and CP95 Krnda 2 stream (Fig. 1, Table 1).

## DISCUSSION

On the territory of Serbia, c. 800 diatom taxa have been recorded to date (unpublished database of Serbian diatom flora, Krizmanić). The diversity of diatoms in Serbia is relatively low as compared to other European countries, e.g. only in two lakes in Macedonia (Lakes Ohrid and Prespa) 919 taxa were recorded [14]. The number of diatom taxa in Serbia is very similar to the number of recorded taxa in Turkey (more than 800), although Turkey is much larger than Serbia [41]. The highest number of recorded taxa in Serbia is widespread and common in European, Asian, North and South American freshwaters [7,41-43]. The results of this study are based on 55 different localities (rivers, streams, channels, accumulations and salt

marshes) and have expanded the diatom checklist with 80 new recorded taxa. The reasons for the constant increase in the number of recorded diatom taxa are numerous, such as improved light microscope resolution and digital cameras with accompanying software, and the increasing use of scanning electron microscopy (SEM), which have enabled the description of a great number of new taxa as well as the separation of new taxa from *sensu lato* species.

One third of our identified taxa are diatoms with a small cell size, and belong to the genera *Achnantheidium*, *Adlafia*, *Fistulifera*, *Humidophila*, *Mayamaea* and *Psammothidium*. The recently described new taxa, *Achnantheidium crassum* and *Achnantheidium druartii* [27,28], are separated from the *A. pyrenaicum* group. *A. pyrenaicum* was described *Achnantheidium* for the first time by Obušković [44], but it is only now these taxa have provided new records. This example illustrates how a better understanding of SEM is important in diatom diversity investigations. Also, SEM has led to a marked distinction of the genus *Humidophila* from *Diadesmis* and the description of new taxa, *H. irata* and *H. brekkaensis* [45], which are new records for Serbian diatom flora.

The small-sized genus, *Microfissurata*, with its unique combination of morphological characteristics, was described using both light and SEM. It includes only two species, *M. paludosa* and *M. australis* [36]. *M. australis* was recorded at Ročnjak stream in an epilithic community, a small-discharge stream affected by seasonal desiccation. However, literature data indicate epiphytic and epipellic as the community types, but not epilithic [36]. Distinguishing between the *Fistulifera pelliculosa* form and *F. saphophila* is hardly possible without the use of SEM due to its very small dimensions (8.9-12.5 µm, breadth 4-6.2 µm) and specific morphological valve features (numerous copulae of the girdle) [7]. Our findings of *Fistulifera* correlate with literature data.

In almost all investigated Serbian freshwaters from 1984 to 2016, *Reimeria sinuata* has been recorded [22,44,46,47]. Although more than 15 years ago a related species, *R. uniseriata*, was identified [40], it has not been recorded on the territory of Serbia until now. The widespread use of high-resolution light microscopes in Serbia is probably the reason leading to an

increased insight into the main characteristics of this species, its uniseriate striae, in contrast to *R. sinuata*, which has biseriate striae.

This study has contributed a diatom checklist and provides a fuller insight of diatom diversity in Serbia. As the potential diversity of diatoms in Serbia is probably higher, this type of research is very important. Also, further detailed investigation, especially with SEM, may identify new interesting taxa for the diatom flora of Serbia.

**Acknowledgments:** Financial support was provided by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Project No. TR 037009).

**Author contributions:** All authors have contributed to the fieldwork, elaboration of the data, the writing process and the discussion of the results.

**Conflict of interest disclosure:** The authors declare no conflict of interest.

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