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COENOLOGICAL SIMILARITIES OF DIATOMS IN WELLS AND IN OTHER WATER BIOTOPES IN BOSNIA AND HERZEGOVINA

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ABSTRACT

The research and determination of diatoms (Bacillariophyta) have been carried out in the area of Semberija (Bosnia and Herzegovina) in several locations, which included 35 open shadoof wells incurred by the anthropogenic activity many decades ago, and they represent artificial fresh water ecosystems. The algological material has been collected from wells in 9 villages, the Sava River, at the site Bosanska Rača, the Drenovača pond in Velino Selo, artesian wells in Velino Selo and Donji Brodac, and ephemeral puddles in the immediate proximity of the researched wells. In all investigated habitats of those locations 149 species and infraspecific taxa of Bacillariophyta in total have been identified, of which 89 (59.73%) were identified only in the investigated wells in Semberija.

On the basis of comparative analysis results, it can be concluded that 45 (30.20%) of species and infraspecific taxa of Bacillariophyta are common for the wells and other investigated localities (Sava River, Drenovača pond, artesian wells, ephemeral puddles). 61 species and infraspecific taxa of Bacillariophyta (40.93%) were identified in Sava River, 57 species and infraspecific taxa (38.25%) in Drenovača pond, 21 species in front of the artesian wells and 16 species and infraspecific taxa in the ephemeral puddles. The density of population, i.e. the production of Bacillariophyta in the investigated wells, shows similar seasonal fluctuations. The highest average number of plants per unit of area on the moss leaves at a depth of 50 cm of well walls amounted to 453702 items/cm^2, and the lowest average number of plants was recorded at the depth of 200 cm of well walls and amounted to 68.207 items/cm^2.

In order to have the objective results of the researched and identified diatoms in the mentioned biotopes, the numerical analysis of qualitative data on the structure of diatoms in similar biotopes, i.e. on their coenological similarities, have been carried out.

Key words: *diatoms, wells, river, puddle, coenological similarities, moss.*

INTRODUCTION

The largest number of researched sites is related to shadoof wells that were created many decades ago by anthropogenic activities. The first studies on diatoms in shadoof wells in our country, as well as in the world, were published by [1,2]. The author studied siliceous algae (Bacillariophyta) in the wells around Bosanski Šamac concerning them as possible cause of endemic nephropathy. Ćurčić explored the siliceous algae around Bijeljina [3]. In the works [4,5,6] kept researching Bacillariophyta in the shadoof wells with the aim of comparison of the flora in different areas of Bosnia and Herzegovina, especially in nephropathic areas. Other research data on Bacillariophyta in shadoof wells in our country are not known. Previous studies on diatoms in wells are very rare in the world. They do not relate to shadoof wells which are subject of Jerković's and our research. Apart from some individual findings in the literature, there is no comprehensive and exact data on the study of flora of diatoms in other types of wells. Studies by other authors [7,8,9,10,11] relate to saline wells and fountains. All investigated wells are open shadoof wells with mainly wooden fences, rarely with concrete wall. The height of well fence is 100-120 cm with a well diameter of about 1 meter. The depth of wells is between 5 and 9 m. All wells were built with bricks, which are covered with mosses, particularly 1.5 m from ground level. All of them are freshwater. The settlements where the wells have been explored are located in the northeastern part of Bosnia, known as Semberija.

The names of villages are Amajlije, Dvorovi, Dazdarevo, Trnjaci, Balatun, Meterizi, Donji Brodac, Velino Selo and Jelaz. The Sava River is close to the villages (from 2 to 10 km), depending on the village, which was one of the reasons for investigating diatoms for the purpose of comparative analysis of coenological similarities with silica algae found in wells. Ćurčić explored silica algae of the Sava river as indicator of water quality [12]. Also, in the works [13,14] investigated siliceous algae in the Sava river basin as indicator of water quality. Stanković and Ćurčić [15,16] investigated siliceous algae in the Gromiželj wetlands belonging to the basin of the river Sava. Ćurčić [17] investigated threats to biodiversity of the Gromiželj wetlands. Matoničkin et al. [18] in the River Sava at the site of Bosanska Rača identified only Diatoma vulgaris. Also, the identified algae in the pond Drenovača located in the village of Velino Selo, and siliceous algae in front of the artesian wells in Velino Selo and Donji Brodac were the subject of our research conducted in 2014 and 2015. These algae in front of the artesian wells have been explored by [19].

For the purpose of marking locations, symbols in the form of initial letters of the name of the villages, wells or other localities investigated have been used in this paper, such as:

D_1- The well of Nikolić Cvijetin
D_3 – The well of Tomić Radivoje
D_4 – The well of Tomić Dimitrije
B_1 – The well of Božić Slavko
B_3 – The well of Ljubinković Branko
B_6 – The well of Lazić Mijo
B_7 – The well of Simić Ljubo
B_5 – The artesian well in Velino Selo
D - Pond Drenovača
S – The river Sava
E - Ephemeral puddles

MATERIALS AND METHODS

Concerning the nature of the habitat and character of this study, and comparative analysis of diatomaceous flora of wells with diatomaceous flora of surrounding aquatic ecosystems, sampling of materials have been done in different ways. Specific problems were present during material sampling from wells with respect to the type of construction of wells: depth, a wall forming a circle, damaged and unsafe well fences, as well as untidy environment of wells. Sampling of material from the well, especially the bottom sediments, as well as the moss from the well walls, required a specific piece of equipment. For bottom sediments extraction a small excavator for hydrobiological research was used. After removing the excavator from the wells sediments were stored in the labeled vials. Samples of the moss from the well walls were taken from an area of 100 cm^2 with special "buckets" for moss capturing [20].

After extraction from wells, the samples of moss were stored in plastic bags that were immediately labeled. The material from other studied aquatic ecosystems (the river Sava, Drenovača pond, artesian wells, ephemeral puddles) was being collected as bentos on stone, on concrete and other solid surfaces in water or in damp areas around artesian wells. The samples were stored in labeled vials and preserved with 4% formaldehyde. The nature of the habitat, or of the samples, was determining the methodology of processing the materials in the laboratory. Processing has been carried out immediately after returning from the field. The sediments of the bottom of the well, which had different impurities were separated and purified by decanting. Straight away, bottom sediment samples were viewed under a microscope "ZEISS" with middle magnification in order to determine the vitality of diatoms that come with moss from well walls or are being mostly empty shells. The remaining material had been conserved in 4% formaldehyde. The samples of moss from the walls of the wells were subjected to washing with redistilled water, firstly with hands, where after each sample hands had being disinfected. Then the material was mixed with a glass rod and underwent the friction by the walls of the glass beakers. Washing and friction leads to separation of epiphyte diatoms from moss. Rinsing was always carried out in 100 ml redistilled water. The material was processed according to the method by [7] and the resulting suspension was used for making permanent preparations. Using a micropipette from each of the studied samples it was taken 0.2 ml of suspension for each specimen. As a switch medium for permanent preparations, Canada balsam index of 1.53 was used. Determination of taxa was done by [21,22,23,24].

RESULTS AND DISCUSSION

The research of the flora of diatom Bacillariophyta in the shadoof wells in the area of Semberija [3,12,20,25], as well as the research of diatom flora in the shadoof wells in Posavina (BiH) [1] represents the first and only research of this flora in our country and in the world so far. Shadoof wells are characteristic for the climate in these areas and are traditional sources of drinking water (Figure 1 and Figure 2).

Figure 1. A shadoof well

Figure 2. The interior a shadoof well

During our research in all these localities, i.e. in all the investigated habitats, 149 species and infraspecific taxa of Bacillariophyta have been identified and determined. They are classified into 27 genera. According to a number of species and infraspecific taxa, the most dominant are genera Navicula, Nitzschia, Achnanthes and Gomphonema. There is a summary statement of Bacillariophyta flora in the wells and other studied sites. (Table 1).

Table 1. Flora of Bacillariophyta in the wells (B) and flora of Bacillariophyta of other sites studied, i.e. habitats (O)

Taxon	Localities	
	B	O
Achnanthes hauckiana Grunow	+	–
Achnanthes conspicua A. Mayer	+	–
Ach. coarctata (Brebisson) Grunow in Cleve & Grunow	+	–
Ach. clevei. var. clevei Grunow in Cleve & Grunow	+	–
Ach. lanceolata ssp. lanceolata var. lanceolata (Brebisson) Grunow	+	+
Ach. lanceolata ssp. lanceolata var. eliptica Cleve	+	–
Ach. lanceolata ssp. rostrata (Oestrup) Lange-Bertalot	+	+
Ach. hungarica (Grunow) Grunow in Cleve & Grunow	–	+

Aulacoseira granulata var. granulata (Ehrenberg) Simonsen	+	+
A. granulata var. angustissima (O. Miiller) Simonsen	+	+
Amphora aequalis Krammer	–	+
A. montana Krasske	+	+
A. perpusilla Grunow	+	+
A. normanii Rabenhorst	+	–
A. libyca Ehrenberg	–	+
A. pediculus (Kiitzing) Grunow	+	+
A. ovalis (Kiitzing) Kiitzing	–	+
A. veneta Kiitzing	–	+
Anomoeneis sphaerophora f. sphaerophora (Ehrenberg) Pfitzer	–	+
Caloneis bacillum (Grunow) Cleve	+	+
Cocconeis pediculus Ehrenberg	+	+
C. placentula var. placentula Ehrenberg	+	+
C. placentula var. lineata (Ehrenberg) Van Heurck	+	+
C. placentula var. euglypta (Ehrenberg) Grunow	+	+
Cyclotella meneghiniana Kiitzing	–	+
C. bodanica var. affinis (Grunow) Cleve-Euler	–	+
Cymatopleura solea var. solea (Brebisson) W. Smith	–	+
Cymbella silesiaca Bleisch in Rabenhorst	+	+
C. affinis Kiitzing	–	+
C. sinuata Gregory	–	+
C. lanceolata (Ehrenberg) Kirchner	–	+
Diploneis oblongella (Naegeli) Cleve-Euler	+	+
D. puella (Schumann) Cleve	+	–
D. ovalis (Hilse) Cleve	+	+
D. elliptica var. elliptica (Kiitzing) Cleve	–	+
Diatoma vulgaris Bory	–	+
D. ehrenbergi Kiitzing	–	+
D. mesodon (Ehrenberg) Kiitzing	–	+
Eunotia bilunaris var. bilunaris (Ehrenberg) Mills	+	+
E. soleirolii (Kiitzing) Rabenhorst	+	–
E. parallela var. parallela Ehrenberg	+	–
E. parallela var. angusta Grunow	+	–
E. exigua (Brebisson) Rabenhorst	+	–
E. glacialis Meister	+	–
E. lunaris (Ehrenberg) Grunow	+	–
Fragilaria capucina. var. capucina Desmazieres	–	+
F. ulna var. ulna (Nitzsch) Lange-Bertalot	–	+
F. ulna var. acus (Kiitzing) Lange-Bertalot	–	+
F. pinata var. pinata Ehrenberg	+	+
F. brevistriata Grunow in Van Heurck	–	+
F. elliptica Schumann	–	+
F. tenera (W. Smith) Lange-Bertalot	–	+
F. dilatata (Brebisson) Lange-Bertalot	–	+
F. biceps (Kiitzing) Lange-Bertalot	–	+
Frustulia vulgaris (Thw.) De Toni	+	+
Gomphonema micropus Kiitzing	+	+
G. angustum Agardh	+	+
G. clavatum Ehrenberg	–	+
G. tergestinum Fricke	+	+
G. parvulum var. parvulum f. parvulum Kiitzing	+	+
G. grovei var. lingulatum (Hustedt) Lange-Bertalot	+	+
G. truncatum Ehrenberg	–	+
G. olivaceum var. olivaceum (Hornemann) Brebisson	–	+
G. gracile Ehrenberg	+	–
G. bohemicum Reichelt & Fricke	+	–

G. intricatum Kiitzing	+	–
G. abbreviatum Kiitzing	+	–
Gyrosigma scalproides (Rabenhorst) Cleve	–	+
G. nodiferum (Grunow) Reimer	–	+
G. acuminatum (Kiitzing) Rabenhorst	–	+
G. spencerii (Quekett) Griffith & Heufrey	–	+
Hantzschia amphioxys (Ehrenberg) Grunow	+	+
Meridion circulare var. circulare (Greville) C. A. Agardh	–	+
M. circulare var. constrictum (Ralfs) Van Heurck	–	+
Navicula atomus var. atomus (Kiitzing) Grunow	+	+
N. contenta Grunow	+	+
N. capitata var. capitata Ehrenberg	–	+
N. cuspidata (Kiitzing) Kiitzing	–	+
N. cryptocephala Lange-Bertalot	+	+
N. cincta (Ehrenberg) Ralfs in Pritchard	+	+
N. trivialis Lange-Bertalot	–	+
N. mutica var. mutica Kiitzing	+	+
N. mutica var. ventricosa (Kiitzing) Cleve & Grunow	+	+
N. elginensis var. elginensis (Gregory) Ralfs in Pritchard	+	+
N. menisculus var. menisculus Schumann	–	+
N. pigmaea Kiitzing	–	+
N. goepertiana var. goepertiana (Bleisch) H. L. Smith	+	+
N. placentula (Ehrenberg) Kiitzing	–	+
N. viridula var. viridula (Kiitzing) Ehrenberg	–	+
N. nivalis Ehrenberg	+	+
N. lanceolata (Agardh) Ehrenberg	–	+
N. tripunctata (O. F. Miiller) Bory	–	+
N. bacillum Ehrenberg	+	+
N. cryptotenella Lange-Bertalot	–	+
N. recens (Lange-Bertalot) Lange-Bertalot	–	+
N. pupula var. pupula Kiitzing	+	+
N. pupula var. pseudopupula (Krasske) Hustedt	+	–
N. reinhardtii (Grunow) Grunow in Cleve & Moller	–	+
N. veneta Kiitzing	+	+
N. viridula var. rostelata (Kiitzing) Cleve	–	+
N. seminulum Grunow	+	+
N. seminulum var. radiosa Hustedt	+	–
N. gallica var. gallica (W. Smith) Lagerstedt	+	–
N. gallica var. perpusilla (Grunow) Lange-Bertalot	+	–
N. kotschyi Grunow	–	+
N. fosallis var. fosallis Krasske	+	–
N. minima Grunow in Van Heurck	+	–
N. gallica var. laevisima (Cleve) Lange-Bertalot	+	–
N. atomus var. excelsa (Krasske) Lange-Bertalot	+	–
N. paramutica Bock	+	–
N. suecorum var. dismutica (Hustedt) Lange-Bertalot	+	–
N. verecunda Hustedt	+	–
N. hustedtii Krasske	+	–
N. confervacea Kiitzing	+	–
N. hungarica var. capitata (Ehrenberg) Cleve	+	–
Nitzschia amphibia f. amphibia Grunow	+	+
N. hungarica Grunow	–	+
N. debilis Arnott	+	–
N. tryblionella Hantzsch in Rabenhorst	–	+
N. palea (Kiitzing) W. Smith	+	+
N. paleacea (Grunow) Grunow in Van Heurck	+	–
N. linearis var. linearis (Agardh) W. Smith	+	+

N. hantzschiana Rabenhorst	+	+
N. intermedia Hantzsch ex Cleve & Grunow	–	+
N. inconspicua Grunow	+	+
N. recta Hantzsch in Rabenhorst	–	+
N. disipatta var. media (Hantzsch) Grunow	–	+
N. calida Grunow in Cleve & Grunow	–	+
N. communis Rabenhorst	+	+
N. umbonata (Ehrenberg) Lange-Bertalot	–	+
N. frustulum var. frustulum (Kiitzing) Grunow in Cleve & Grunow	+	+
N. frustulum var. bulnheimiana (Rabenhorst) Grunow	+	–
N. denticula Grunow	+	–
N. sinuata var. delongei (Grunow) Lange-Bertalot	+	–
N. fonticola Grunow in Cleve	+	–
N. microcephala Grunow in Cleve & Moller	+	–
Neidium ampliatum (Ehrenberg) Krammer	–	+
Pinnularia maior (Kiitzing) Rabenhorst	–	+
P. viridis (Nitzsch) Ehrenberg	+	+
P. microstauron var. brebissonii (Kiitzing) Mayer	+	+
P. apendiculata (Agardh) Cleve	+	–
P. schroederii (Hustedt) Krammer	+	–
Orthoseira roeseana (Rabenhorst) O'Meara	+	–
Rhopalodia gibba var. gibba (Ehrenberg) O. Miiller	–	+
Roicosphaenia abbreviata (C. Agardh) Lange-Bertalot	+	+
Stauroneis anceps var. anceps Ehrenberg	+	+
S. smiithii var. smiithii Grunow	–	+
Surirella angusta Kiitzing	+	+
S. minuta Brebisson in Kiitzing	–	+

Concerning the nature of construction of shadoof wells, and the research of the flora of Bacillariophyta on the moss found on well walls and their presence in the sediments of the bottom of wells, it was found that the same floristic composition of Bacillariophyta inhabiting moss on the walls of wells and those found in sediments of wells indicates the autochthonism of this flora. A large qualitative difference between the flora of Bacillariophyta in the shadoof wells in the area of Semberija and the flora of Bacillariophyta of the river Sava, Drenovača pond, artesian wells and ephemeral puddles also indicate the autochthonism of Bacillariophyta flora in the shadoof wells. The largest number of identified silicate algae (Bacillariophyta) in the shadoof wells are aerophile algae, which, on the moss associations of well walls are determined as associations Oxyrrynchio-Platyhypnidietum rusciformis [26] demonstrated acceptable adaptive properties in such biotopes, thus making specific indigenous flora of wells. The researches of Bacillariophyta in the shadoof wells within this work have been carried out in 35 open shadoof wells located in the wider area of Semberija. We have identified 89 species and infraspecific taxa of Bacillariophyta that are found in the mosses on the well walls, in the buckets for taking water from the wells and in the wells sediments.

The presence of a large number of aerophilic Bacillariophyta indicates a very rich flora of wells ecosystems whose evolution was in the function of long-term anthropogenic activities. Therefore, these are specific wells ecosystems as anthropogenic creations that show great similarities in physical and chemical characteristics. The result of large uniformity of physical and chemical factors in the investigated wells is the presence of a large number of species of Bacillariophyta, and is common to all the investigated wells. Their natural habitat is not well water, but the mosses on the well walls that they inhabit permanently or temporarily. Findings of Bacillariophyta in well sediments are the result of long-term "falling" from well walls and from buckets for taking water, as well as from the deposition along with mosses that are their hosts, together with the forming of diatomite wells [1]. Accordingly, the chemical parameters were not taken as the factors that control the qualitative and quantitative relationships of Bacillariophyta in wells sediments because well water is not their natural habitat. It means that the habitat of aerophilic Bacillariophyta in wells are moss association of well walls and buckets for taking water from wells, that are humid throughout the year more or less, depending from a well. Humidity is the result of well water evaporation, precipitation, and spilling of water during taking it with a well bucket.

It was found out that in the investigated wells compared to the total number of identified Bacillariophyta in them, 40 (44.94%) of the same taxa of Bacillariophyta inhabit the mosses of well walls and buckets for taking water from wells. Studies have shown that in shadoof wells the majority of Bacillariophyta is common with two or more wells, but there is a small number of taxa identified only in a particular well. Along with the study of flora of Bacillariophyta in shadoof wells, we conducted the studies of flora of Bacillariophyta in other freshwater ecosystems that are in the near or distant environment of the investigated wells (the river Sava, Drenovača pond, artesian wells and ephemeral puddles). Based on the comparative review of flora of Bacillariophyta in wells and other explored sites in Semberija, it was found that out of 149 taxa of Bacillariophyta identified in all investigated localities, 89 of them (59.73%) were found only in the wells, 61 (40.93%) only in the river Sava, 57 (38.25%) in Drenovača pond, 21 (14,09%) in front of artesian wells, 16 (10.73%) in the ephemeral puddles around the wells, while 45 (30.20%) are common for wells and other investigated sites. In order to objectify the results we obtained by identification and determination of diatoms in the investigated habitats, the numerical analysis of qualitative data on the structure of Bacillariophyta in similar biotopes was carried out. The quotient of similarity (QS) shows the similarity between the two communities on the basis of the number of common and different species in both communities. In this paper, calculating the quotient of similarity based on population of Bacillariophyta was carried out by using the Sorensen method [27]:

$$QS = \frac{2c}{a+b} \cdot 100$$

QS - Quotient of Similarity

a – a number of all taxa from cenosis A
b - a number of all taxa from cenosis B
c - a number of common taxa from cenosis A and B

Based on the Sorensen's quotient of similarity, the coenological similarity between the studied sites was calculated. The data are presented in Tables 2 and 3.

Table 2. The quotient of similarity between researched wells

	B_4	B_1	B_6	B_3	D_3	D_4	D_1	B_7
B_4	–							
B_1	62.5	–						
B_6	68.5	62.8	–					
B_3	66.6	73.0	66.6	–				
D_3	66.6	60.8	72.0	70.5	–			
D_4	75.7	60.6	63.8	67.6	67.6	–		
D_1	66.6	66.6	66.6	64.5	76.4	73.8	–	
B_7	67.7	67.7	76.4	72.1	71.6	65.6	68.8	–

Table 3. The quotient of similarity between wells and other reasearched localities (the river Sava, Drenovača pond, artesian wells and ephemeral puddles)

	B_7	S	D	B_6	B_5	E	D_3
B_7	–						
S	25.80	–					
D	27.27	41.32	–				
B_6	76.40	25.74	37.50	–			
B_5	46.80	20.25	27.00	55.50	–		
E	34.78	22.78	27.00	48.10	56.25	–	
D_3	71.60	32.00	33.68	72.00	49.05	41.90	–

Using the similarity coefficient grouping has been performed by Mountford [28], resulting in the dendrograms in Figures 3 and 4.

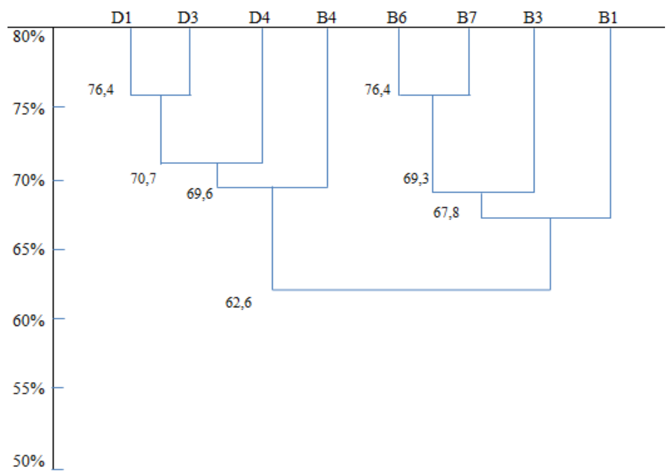

Figure 3. The dendrogram of qualitative similarities of Bacillariophyta wells

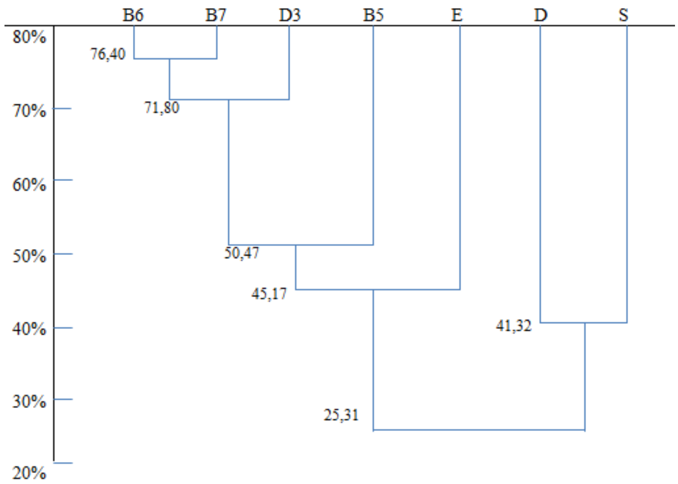

Figure 4. The dendrogram of qualitative similarities of Baillariophyta wells
and other studied sites

According to the results of coenological similarities, it was possible to determine the critical level of coenological similarities that demarcates the qualitative homogeneity and heterogeneity. Sharon [29] found that the similarity degree of 62,5 ± 2,5 % significantly demarcates areas of relative homogeneity. The results from the Table 2 indicate that the investigated wells have a relatively high degree of qualitative similarity in the structure of Bacillariophyta. The critical level of similarity applies mostly to enable comparisons. The greatest coenological similarity among investigated wells has been shown in the wells: B_6 and B_7, D_3 and D_1, B_4 and D_4 etc., and the lowest in the wells B_1 and D_4. The results in Table 3 indicate a very low level of coenological similarities between wells and other studied sites in the structure of Bacillariophyta. For example the coenological similarity between the well B_6, which is the closest to the river Sava, and the river is only 25.74%, resembles the well B_7 whose structure of Bacillariophyta is similar to the structure of Bacillariophyta from the river Sava, which is only 25.80%. If we compare the structure of Bacillariophyta in the wells B_6 and D_3 which are about 15 km away from each other, we could conclude that the coenological similarity is 72%. Also, the coenological similarities are present in the comparison of identified Bacillariophyta in the ephemeral puddles that are located right next to the researched wells and in the mere wells. The coenological similarity between the ephemeral puddle next to the well B_6 and the mere well B_6 is 48.1%, but the coenological similarity between the ephemeral pool and the river Sava is only 22.78%, and 27.0% compared to Drenovača pond. These results indicate the similarity of diatom flora in wells and diatom flora in the ephemeral puddles near the studied wells. The coenological similarity between the structure of Bacillariophyta on the moss found on the well walls and the structure of Bacillariophyta on the buckets for taking water from the well is relatively high, and amounts up to 59.54%. Therefore, the wells exhibit a homogeneity in terms of the high level of coenological similarity in the structure of Bacillariophyta, regardless of the distance of one well from the other. All these findings point out the autochthonism of Bacillariophyta flora in shadoof wells in Semberija. A very low level of qualitative similarity in the structure of Bacillariophyta in the wells and other studied sites is the consequence of large ecological differences that have been observed throughout the year.

CONCLUSION

The research of Bacillariophyta flora comprised 35 shadoof wells in the wider area of Semberija (BiH). For the purpose of comparison, i.e. the determination of the coenological similarity of Bacillariophyta flora in the wells and Bacillariophyta flora in surrounding freshwater ecosystems, the research had encompassed the river Sava (Bosanska Rača), Drenovača pond, artesian wells and ephemeral puddles which are located right next to the studied wells.

In the habitats of all the investigated sites, 149 taxa of Bacillariophyta were identified, of which 89 (59.73%) were identified only in the investigated wells in Semberija.

On the basis of the comparative results, it was concluded that 45 (30.20%) of Bacillariophyta taxa are common for the wells and other investigated localities (the river Sava, Drenovača pond, artesian wells and ephemeral puddles).

The identified siliceous algae in the wells are mainly connected to the well walls, or the moss associations that live there, then to the buckets for taking water from the wells and to the sediments of the well bottom. The algological material from other studied sites was mainly taken as a bentos from different surfaces.

Our research has shown that there is a great coenological similarity regarding the presence of a large number of diatoms, among the researched wells, and the highest similarity is in the structure of these algae identified in wells B_6 and D_3 which are 15 km from each other, having a coenological similarity of 72 %. Concerning a high coenological similarity, they are followed by the wells B_6 and B_7, D_3 and D_1, B_4 and D_4 etc.

However, the results in the Table 2 indicate a very low level of coenological similarities between the wells and other studied sites in the structure of Bacillariophyta in the wider area of Semberija. All these results clearly demonstrate the autochthonism of Bacillariophyta flora in the wells and their homogeneity in terms of a high level of coenological similarity, regardless of the distance between the wells.

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