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DIVERSITY AND STRUCTURE OF MICROALGAE IN THE MEZAM RIVER (BAMENDA, CAMEROON)

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ABSTRACT: *Human activities more and more intensify the imbalance of aquatic systems causing the reduction of biodiversity. The aim of the study was to identify the microalgae and to determine their distribution in the Mezam River (Bamenda, Cameroon). Sampling took place monthly from July 2021 to August 2022 using plankton net for phytoplankton and scrubbing for periphyton upstream, middle, and downstream of the river. Species richness of microalgae amounts to 11 classes divided into 45 genera and 75 species. The most represented class was Bacillariophyceae with 42.67% and the dominant family was the Naviculaceae in terms of abundance with 10 species. Shannon-Weaver diversity index ranges from 2.055 (downstream) to 1.313 (upstream). Spatio-temporal variation of genera revealed 3 groups; group 1 brings together the genera exclusive to phytoplankton, upstream: Pleurotaenium, Synechocystis, Microcystis, and Phormidium. Group 2 brings together the genera exclusive to epiphyte, middle: Encyonema, Trachelomonas, Gloeotrichia, Aphanizomenon, and Peridinium. Group 3 brings together the common genera in the different habitats: Fragilaria, Gomphonema, Synedra, Coscinodiscus, Navicula, Cyclotella, Cymatopleura, Cymbella, Eunotia, Tabellaria, Gyrosigma, Melosira, Pinnularia, Diatoma, Cocconeis, Thalassiosira, Achnanthidium, Nitzschia, Luticola, Rhopalodia, Euglena, Clostrium, Ulothrix, Cryptomonas, Scenedesmus, Spirogyra, Uronema, Mougeotia, Oedogonium, Calothrix, Nostoc, Rivularia, Oscillatoria and Gymnodinium. These results show that Mezam River has a highly diversified community of diatoms that can be used as bio-indicators of pollution.*

KEYWORDS: Anthropogenic activities**,** Algal distribution, Bacillariophyceae, Mezam River

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INTRODUCTION

The shallowness of the river gives it a "Wetland" characteristic and there are swamps on all sides of the river resulting from hydrological and land use changes. As a result of overflooding during the rainy season, tons of soil are loaded into the river, increasing sedimentation **(Teshale et al., 2001)**. The River flow is essentially variable over time since its evolution is generally considered to be the result of interactions with anthropisation. The growing population and industrialisation of the city can have potentially serious consequences on the rivers because domestic and industrial wastes may find their way into the rivers. The waste discharged from these urban centres and agricultural areas has contributed to the decrease in water quality and the increase in the concentrations of ions. These ions determine the physicochemical characteristics of the water known as water quality which has a relation with biodiversity **(Habiba, 2010)**.

Microalgae are a group of unicellular and multicellular photosynthetic organisms characterized by a very simple structural organisation, which uses light energy, carbon dioxide (CO_2) and ions dissolved in the water for the synthesis of complex molecules to produce biomass. They can be used to enhance the nutritional value of food and animal feed owing to their chemical composition; they play a crucial role in aquaculture (primary producers); they can produce nutraceutical (medical benefits) compounds. Since the middle of the 19th century, human impact has deeply transformed the form and function of all ecosystems on earth. Before the industrial revolution, 50% of the terrestrial biosphere was without human settlements or substantial land use and by the year 2000 only 25% remained wild or natural **(Ellis et al., 2010)**. Biodiversity changes because human activities have been a key focus of political, economic, and scientific debates in the last decades. The anthropogenic transition resulted from the widespread and growing presence of human populations, economic development, and land transformation, mainly for agriculture and infrastructure development, combined with the introduction of non-native species. The overexploitation of natural resources such as minerals, wood, water, and animals are confronting ecosystems with unprecedented levels of disturbance **(Dirzo & Raven, 2003)**. Moreover, these activities are driving other environmental changes such as habitat loss, pollution, climate change and the alteration of biogeochemical cycles **(Vitousek et al., 1997; Rockström et al., 2009)**. All the impacts mentioned above are interacting and affecting, directly and indirectly, the earth's biodiversity. Human activities involve the release of anthropogenic contaminants into surface and groundwater resources. The causes and forms of water pollution include sewage, infectious agents, organic chemicals, hazardous chemicals, mineral substances, sediments, radioactive substances, and thermal pollution resulting in the alteration of the ecological functioning of aquatic ecosystems **(Temesgen, 2009; Habiba, 2010)**.

Many developmental practices in the world have been centred on freshwater habitats and it is generally understood that freshwater and wetlands play an important role in ecology, economy, social, and cultural functions **(Ndjouondo et al., 2017)**. Aquatic ecosystems have been the heart of human civilization; thus, wetland systems have played a key role in the development and survival of human beings. Cameroon possesses a great diversity of aquatic ecosystems (shallow lakes, rivers and streams, swamps/marshes, flood plains, reservoirs and ponds, and high mountain lakes) because of the formation of diverse landscapes. Mezam River and its wetland systems have great environmental, and socio-economic services as well as sustenance of local community livelihoods which is under threats from a wide range of sources or anthropogenic activities, such as intensive agricultural irrigation, chemical spills from car

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washing sites, the expansion of human settlements including urbanization through the construction of houses, industrial pollution, agricultural pollution by pesticides and fertilizers, water diversion for drainage. Pollution of the aquatic environment involves the modification and degradation linked to an excessive intake of nutrients that increase the production of algae for example **(Aurrousseau, 2013)**. The state of biodiversity in Mezam River, Bamenda due to human activities need to be properly identified. The study aims to determine the diversity and structure of microalgae in the Mezam River (Bamenda, Cameroon).

MATERIALS AND METHODS

Description of the study area

Bamenda is the headquarter of Mezam division in the North-West region of Cameroon **(Fig. 1)**. It is made of three subdivisions (Bamenda I, Bamenda II, Bamenda III) with 391 km as total surface area. Its relief consists of interspersed plateaus with deep valleys and its vegetation is the Guinea Savannah type with moderate temperatures. There are two topographic units separated by a high scarp-oriented NE-SW **(Neba, 1999)**. Above the cliff, stands the upper plateau which is mainly Bamenda I and represents 10% of the total area of the city. Altitudes here vary between 1472 m and 1573 m. The climate is the type of humid tropical highland characterized by two seasons: rainy and dry. The temperature here is very cold especially in the morning and evening with the coldest temperature between the periods of January to March with minimum temperature from 14.10-17.80 ^{o}C and maximum temperature from 22.5-28.5 ^{o}C, humidity ranging from 39%-90% and rainfall from 0.1-14.1 inches of rain per hour (Climate-Date.org>Cameroon>Northwest Bamenda). The rainy season is generally longer and lasts for 8 months (mid-March to mid-October) with a short dry season of 4 months (mid-October to mid-March) **(Tita et al., 2012)**, and the mean annual temperature is 19.93 °C. The town has a rich hydrographical network with intense human activities and a high population along the different watercourses in the watershed **(Neba, 1999)**. Sampling points were located on maps by using Global Positioning System (GPS) coordinates. This study was conducted in three study areas, site 1 (upstream) is located between 5^{o}59’23.9’’N and 10^{o}10’42.9’’E. Site 2 (middle) is located between 05°59’14’’ N and 10°10’65.2’’ E. Site 3 (downstream) is located between 05°58’89’’ N and 10°11’14’’ E.

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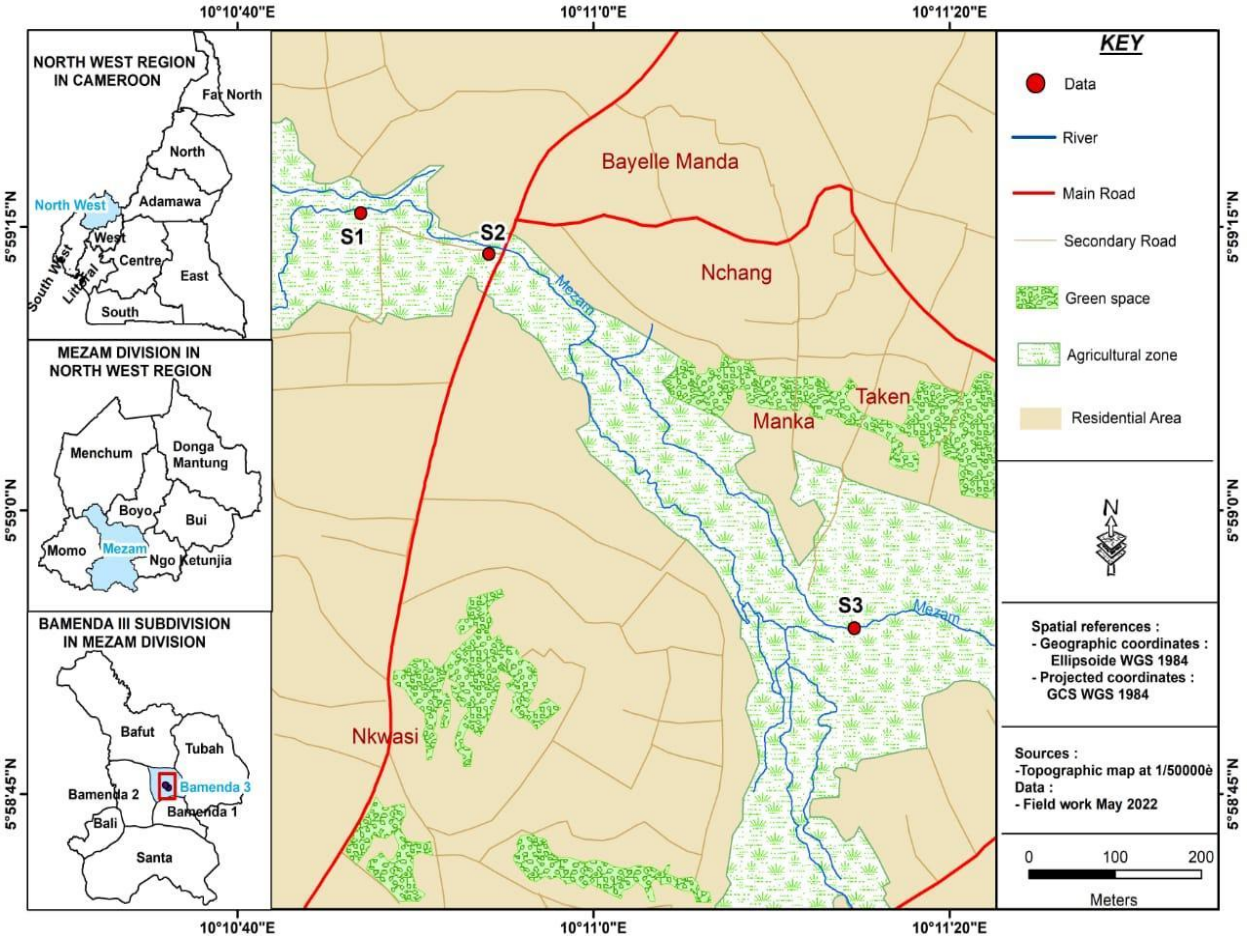

Figure 1: Localization of study sites (Fieldwork, 2022 modified).

Site selection in the study area (Mezam River)

Mezam River is located on the Bamenda highways. Sampling sites were selected and located for human-influenced sites along the River. Site 1 (upstream) is characterised by extensive agricultural activities like gardening, household activities like laundry and bathing, and sand extraction around Mendakwe quarter. Site 2 (middle) having the largest carwash facility in Bamenda III municipality is characterized by a fast-flowing stream, human settlement, fishpond, and agricultural lands settlement around Alafumble quarter. Site 3 (downstream) is characterized by agricultural activities, household construction, and an outlet for waste from the slaughterhouse Menka quarter. The distance separating site 1 and site 2 was 1200 m. While site 2 is separated from site 3 by 7300 m.

Data collection

Data was collected between July 2021 to August 2022. The water samples were taken monthly (12 campaigns) between 7:30 a.m. and 9:00 a.m., along the diagonal of each sampling station using a plankton net. A jar was used for collecting periphyton (epiphython and epilithon) which was thereafter pressed and scraped on a surface of (30×30) cm^2. After filtration, the water sub-

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samples were collected in the 60 mL pill boxes and immediately fixed with formaldehyde at 5% concentration.

Phytoplankton stand analysis

The algal cells were observed with the OAKON photomicroscope according to the technique described by **Ndjouondo et al. (2020)** and photographed. The identification of the taxa was carried out by combining key works **(Iltis, 1980; Bourrelly, 1985; Krammer & Lange-Bertalot, 2000; Lavoie et al., 2006; Guiry & Guiry, 2022)**. The cell count was carried out using an inverted microscope of the OAKON type according to the method of **Utermöhl (1958)**. To evaluate phytoplankton community and algal density, various indices such as species richness, Shannon-Weaver's diversity, Pielou's equitability, dominance, Hill's dominance and Sorensen's similarity indices were used **(Ndjouondo et al., 2017)**.

Density of microalgae

Density (D) of microalgae was computed using the following formula: $D = Ni \times a \times 1000 \times v/V$, where D is the number of cells per millilitre (cells/mL), Ni = the number of cells for a given species, a = dilution factor, 1000 = conversion factor, V = volume of the sample and v = volume of the subsample counted in mL **(Ndjouondo et al., 2017)**.

Statistical analysis

Microsoft Office Excel was used for keying and coding data collected during the study. Qualitative and quantitative variables were presented as frequency and mean ± standard deviations respectively in charts. Correlation between physicochemical, and biodiversity was conducted. Correspondence factor analysis (CFA) was applied to group sampling sites according to their microalgae similarities. These analyses were performed using XLSTAT software and PAST for the dendrograms.

RESULTS AND DISCUSSION

Species richness

The species richness shows a significant wealth in the sampling sites; this is because they can easily colonize available surfaces would justify their predominance in the composition of algae fixed on other plants (epiphytes). The species richness of the study area shows 11 classes, 38 families, 45 genera and 75 species **(Table 1)**. The results are similar to those of **Mohanapriya and Geetharamani (2014)**, who worked and obtained 49 species, on Fresh water Micro algal Diversity of Noyyal River in Tamil Nadu State, India; and **Amal and Walid (2021)**, 35 species using two media combined, on the identification of culturable microalgae diversity in the River Nile in Egypt using enrichment media. **Arsad et al. (2021)** showed that the periphyton community structure is in balance, and there are 6 divisions of 59 different genera. The six divisions found are- Bacillariophyta, Cyanophyta, Chlorophyta, Charophyta, Ochrophyta, and Rhodophyta. However, the results are higher than those obtained by **Severes et al. (2018)**, in ‘’Diversity study of freshwater microalgae of some unexplored water bodies of a rapidly developing industrial region in India’’. They obtained 22 freshwater algal genera belonging to Class Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae. **Ndjouondo et**

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al. (2020), explained that difference by the fact that nutrients (nitrates and phosphorus) coming from anthropogenic activities increase the species richness in the fresh current water, and imbalance the biodiversity. Contrary, **Motto et al. (2020)**, working on the diversity and distribution of algal settlement in Mangrove of Londji, Kribi-Southern-Cameroon, obtained 124 species including 87 genera, 50 families, 26 orders and 11 classes. The difference would be because the sampling water was the same, and also between the terrestrial zone and marine zone.

Table 1: Species richness Freshwatererent classes of microalgae

Classes	Families	Genera	Species	Proportions (%)
Chlorophyceae	4	4	4	5.33
Zygnematophyceae	2	4	6	8
Euglenoidea	1	2	4	5.33
Cryptophyceae	1	1	2	2.67
Synurophyceae	1	1	1	1.33
Bacillariophyceae	12	13	32	42.67
Coscinodiscophyceae	3	3	5	6.67
Fragilariophyceae	2	4	5	6.67
Mediophyceae	1	1	1	1.33
Cyanophyceae	9	10	12	16
Dinophyceae	2	2	3	4
Total	**38**	**45**	**75**	**100**

The most diverse class is Bacillariophyceae with 42.67% (32 species), the Naviculaceae family is the dominant family in terms of abundance. The results are similar to those of **Severes et al. (2018)** who showed that Members of Bacillariophyceae were found to be the most diverse represented by 8 genera, *Navicula, Cymbella* and *Spirogyra* being the most dominant species. Similarly, **Motto et al. (2014)**, **Arsad et al. (2021)**, **Tuley et al. (2018)**, and **Dibong and Ndjouondo (2014)**, obtained respectively 59.68% in Mangrove of Londji, Kribi-Southern-Cameroon, 47.45% in Brantas River, East Java, Indonesia, 74.32% in Melen River (Western Black Sea River Catchment) in Turkey, 40.59% in Kambo and Longmayagui rivers. In addition, Diatoms can also detach from the supports and drift in the water column, which would also explain why they have significant diversity both in underwater surfaces (benthic) and in open water (phytoplankton) **(Bowler et al., 2008)**. Bacillariophyceae is the most commonly found in various waters, with high adaptability to various environmental conditions **(Arsad et al., 2022)**. **Kumar et al. (2021)** explained the abundance of Navicula, of the diatom genera, by anthropogenic factors. The findings are not consistent with the results of **Millo (2015)** who reported Chlorophyceae was the most represented class in Batika River (Yabassi) with 36%. This could be explained by the more rapid water flow in this river from upstream to downstream compared to those abovementioned.

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Diversity indices

The Shannon-weaver's index is variable and shows 2 zones: zone 1 is characterized by high values and represents the dry season; zone 2 is characterized by low values and represents the rainy season **(Fig. 2)**. The highest value obtained is 2.89 in January by site 3. The same, lowest value obtained is 1.65 in September by site 1. These results are lower than those of **Motto et al. (2020)**, and **Fokou (2015)** respectively in Mangrove of Londji, Kribi-Southern-Cameroon, with Shannon-Weaver's index value between 2.94 and 4.43, in Tongo'o Bassa River between 4,11 and 3,59. The results are similar to those of **Armal and Walid (2021)** in the River Nile in Egypt using enrichment media. They obtained a Shannon-Weaver index between 1.92 and 1.73. The diversity index high in January shows that the population is not submitted to the influence of one species which grows but to a strong development of several different individuals. According to **Kemka et al. (2004)**, a low diversity characterizes a young population with high multiplication power with a predominance of one species or a small group of species. However, a high diversity characterizes contrary old populations showing a complex species composition. This permits us to understand the low diversity upstream of the river exposed to poor nutrients and the speed of the water.

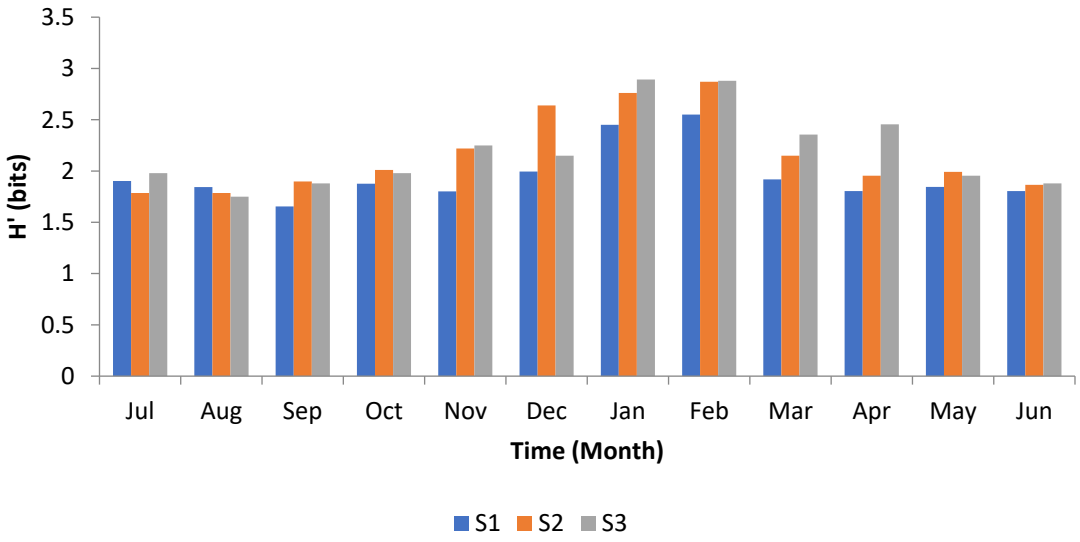

Figure 2: Variation of Shannon-Weaver's index in the study sites according to the time (Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December, Jan: January, Feb: February, Mar: March, Apr: April, Jun: June).

Pielou's equitability index is variable according to the sites and the sampling time **(Fig. 3)**. All the values are upper to 0.5 except for sites 1 and 2 in April. The highest value obtained in the dry season is 0.78 in February by sites 1 and 2. The lowest value obtained is 0.40 in April by site 1. Observing the results, there is a high similarity between regularity and diversity indices. But **Kemka et al. (2004)** having done this observation in the Yaounde municipality Lake, showed the similarity between variations of regularity and those of species diversity index. The Mezam River is more influenced by the species richness than the more or less equitable distribution of the species presents instantaneously in the environment.

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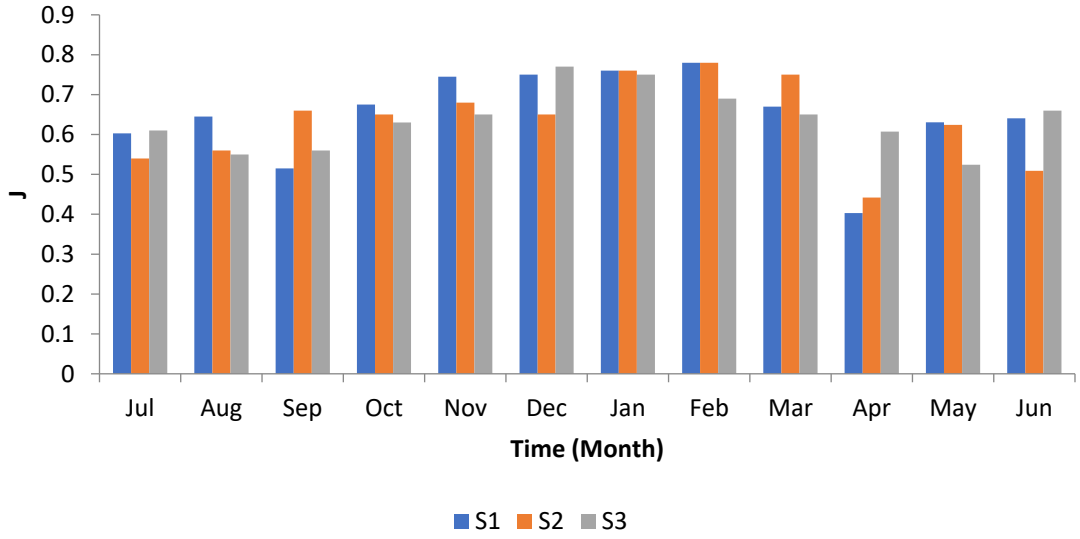

Figure 3: Variation of Pielou's regularity index in the study sites according to time (Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December, Jan: January, Feb: February, Mar: March, Apr: April, Jun: June; J = Pielou's index).

Dominance is variable in the study sites and shows 2 zones: zone 1 is observed during the dry season by high values and zone 2 is observed during the rainy season by low values **(Fig. 4)**. It is maximum in site 3 in January (0.567) and minimum in site 2 in September (0.175). The results are similar to those obtained by **Arsad et al. (2021)** in Brantas River, East Java, Indonesia with a dominance index ranging from 0.105-0.549. The results are higher than those obtained by **Armal and Walid (2021)**, with a dominance index, between 0.20 and 0.31.

Hill index shows a maximum number of species in March of 0.48 obtained in site 3 **(Fig. 5)**. The minimum number of species is 0.125 obtained in December (site 1).

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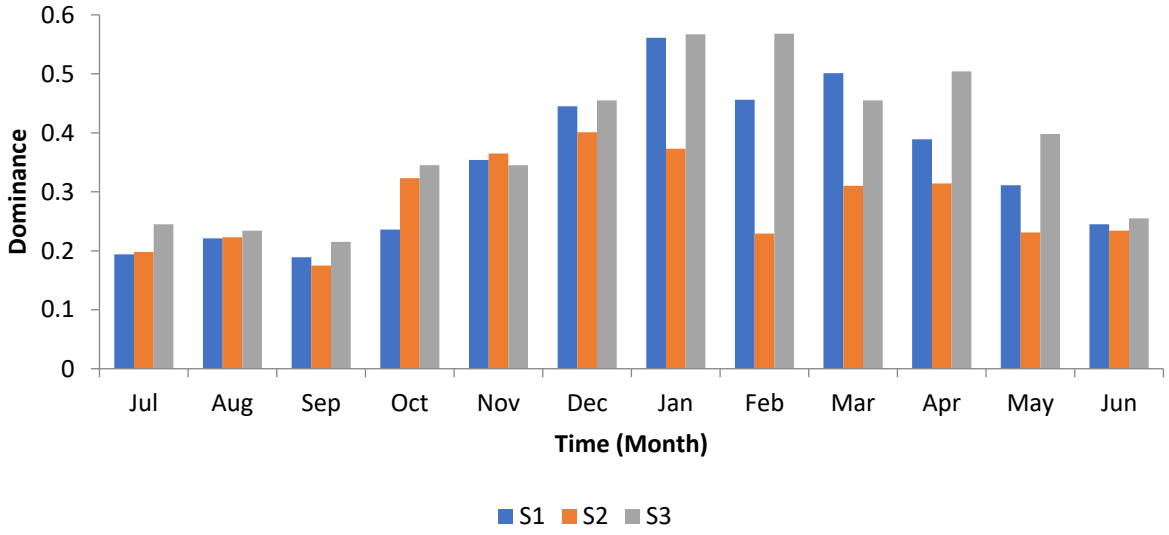

Figure 4: variation of dominance index in the study sites according to time (Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December, Jan: January, Feb: February, Mar: March, Apr: April, Jun: June).

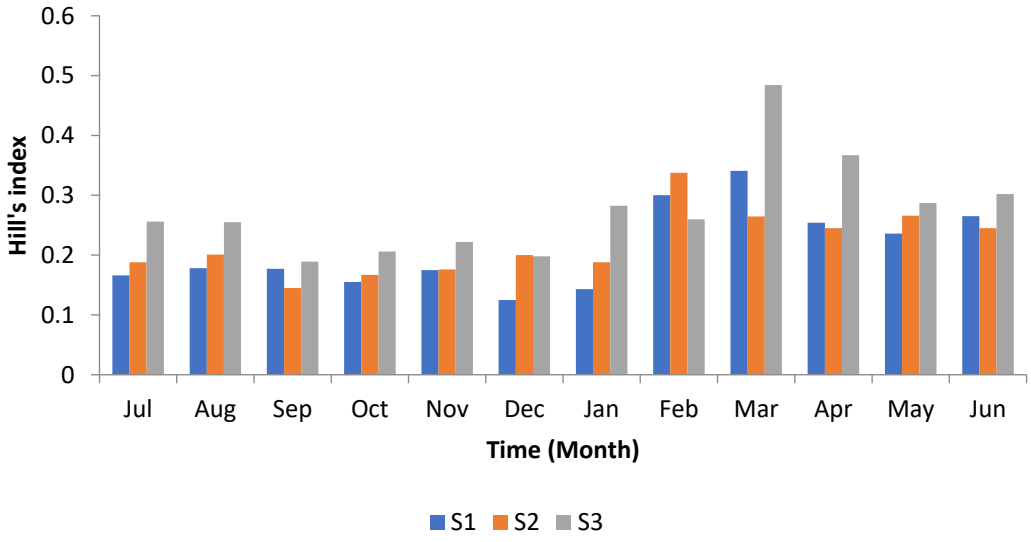

Figure 5: variation of Hill's index in the study sites according to time (Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December, Jan: January, Feb: February, Mar: March, Apr: April, Jun: June).

Similarity between different habitats according to species

The number of species is variable in the different habitats; 50 species (site 1), 41 species (site 2), and 42 species (site 3). Epiphython records the highest number with a maximum of 35

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species obtained at site 3 **(Fig. 6)**. Phytoplankton is very poor in the study sites with the lowest number of species. The minimum is 7 species obtained to site 3. The similarity is high between Epiphython and epilithon habitats. Sorensen's similarity index varies between habitats and sites **(Table 2)**. The maximum is 0.62, observed between phytoplankton site 2 and phytoplankton site 3. The minimum value is 0.15 between phytoplankton site 2 and epilite site 2. The number of species located upstream of each river is higher compared to the other stations. This finding can be explained by the fact that the upstream of the river receives fewer pollutants, which allows the periphyton to undergo less aggression and stress, favouring their development. Algae fixed on macrophytes are more diversified than algae fixed on stone. These stones located at the bottom of the current are permanently subjected to the pressure of the current and the sedimentation of particles in suspension. The epiphytes frequently encountered in these habitats are large, colonial or filamentous. These different configurations would favour their resistance to disruptive elements **(Ndjouondo et al., 2017)**.

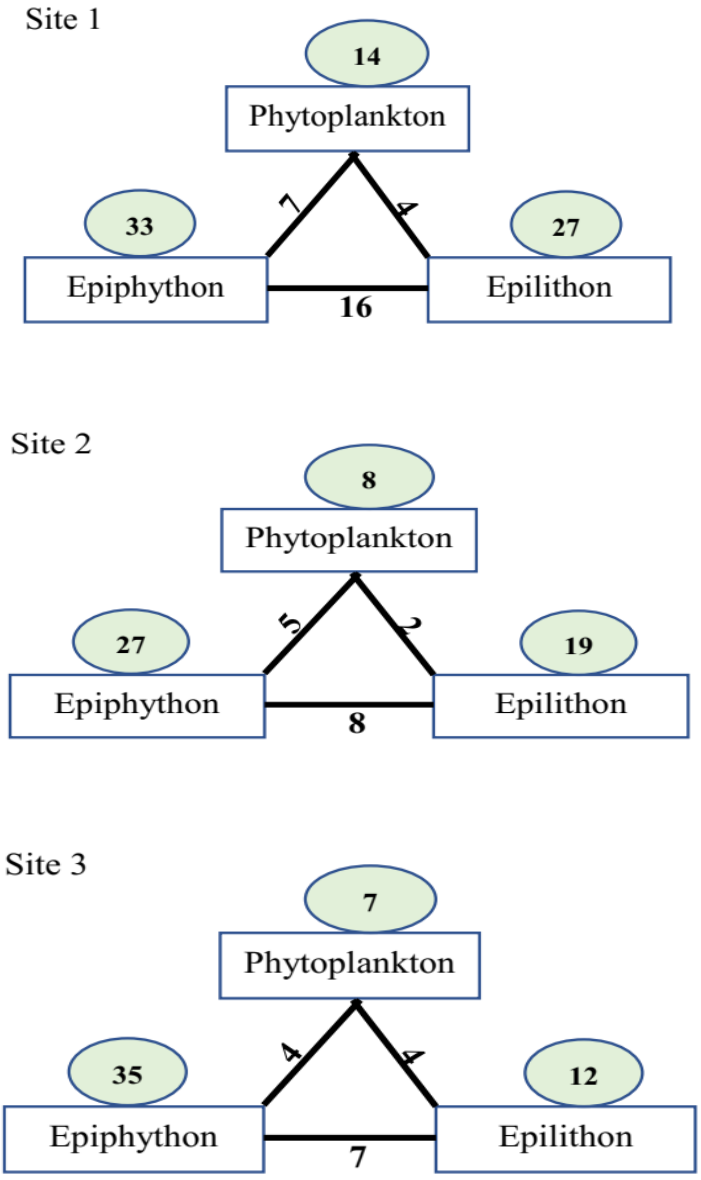

Figure 6: Distribution of the number of species according to habitats.

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Table 2: Sorensen's similarity index between the study sites and habitats

Habitat	Phy1	Epip1	Epil1	Phy2	Epip2	Epil2	Phy3	Epip3	Epil3
Phy1	1								
Epip1	30.43	1							
Epil1	0.20	0.53	1						
Phy2	0.27	0.25	0.29	1					
Epip2	0.21	0.38	0.56	0.29	1				
Epil2	0.30	0.40	0.43	0.15	0.36	1			
Phy3	0.19	0.26	0.36	0.62	0.24	0.24	1		
Epip3	0.38	0.41	0.52	0.23	0.43	0.36	0.20	1	
Epil3	0.26	0.35	0.42	0.30	0.26	0.45	0.44	0.30	1

*Phy1 = phytoplankton, Phy2 = phytoplankton site 2, Phy3 = phytoplankton site 3, Epip1 = epiphyte site 1, Epip2 = epiphyte site 2, Epip3 = epiphyte site 3, Epil1 = epilite site 1, Epil2 = epilite site 2, Epil3 = epilite site 3

Variation of density according to habitat

Density is variable in the different habitats **(Fig. 7)**. In site 1, phytoplankton shows the highest values, this by Cyanophyceae of 116200 Cells/mL. But, in site 2 the highest total density is obtained by epiphyte. Cyanophyceae dominates with 36350 Cells/mL. In site 3, the same, epiphytes show the highest values of total density dominated by Cyanophyceae with 21780 Cells/mL. Densities of microalgae showed little variation between sites as the Cyanophyceae class appears to be the densest class in each site. This is because Cyanophyceae form efflorescence (algae blooms) in streams polluted with an organic matter where the speed of the current is very slow or zero. Rivers where the speed of the current is very slow and polluted with organic matter, undergo strong eutrophication by letting appear efflorescence by the multiplication of one or a few species. These results are in line with those of **Aurrousseau (2013)** who worked on the evaluation of the impact of watercourses on eutrophication in the coastal band in France, **Groga (2012)** who focused on the structure, the functioning, and the dynamics of phytoplankton in Lake Ta'abo in Côte d'Ivoire and **Sana'a (2006)** who addressed the structure, dynamics and physicochemical and phytoplanktonic typologies of the Bou Regreg estuary in Morocco. These results are not similar to those obtained by **Dibong and Ndjouondo (2014)**, in the Kambo and Longmayagui Rivers because they counted the number of individuals, using Iltis method **(Iltis, 1980)**, considering 100 µm of filamentous like one individual, the same with a colony. Their findings revealed that Chlorophyta and Chromophyta phyla had the high densities.

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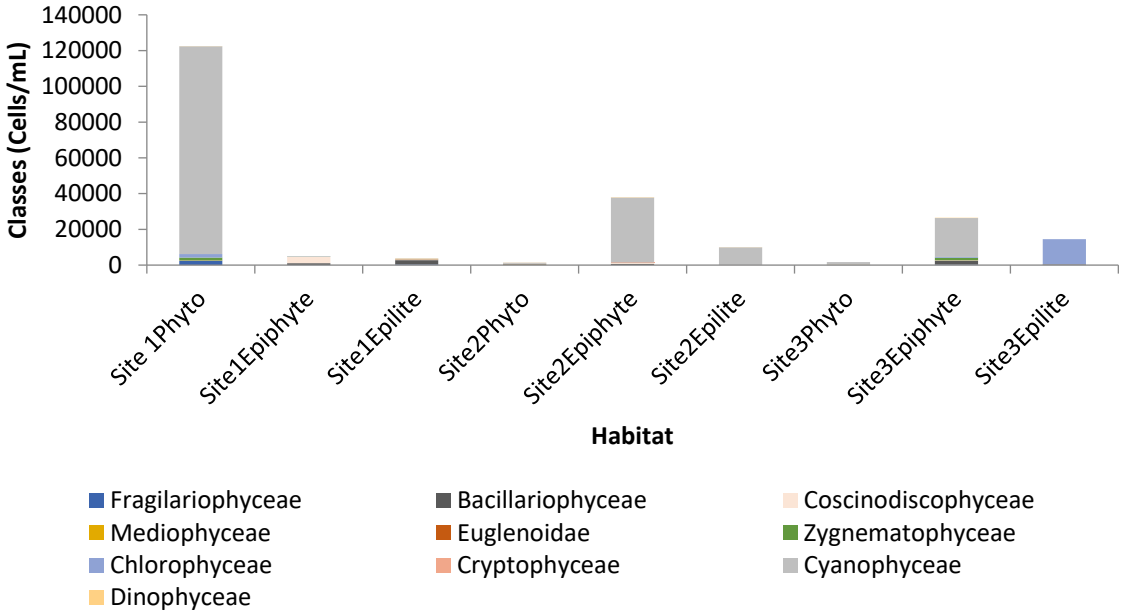

Figure 7. Variation of density in the study sites according to the habitats (Phyto: phytoplankton).

Total density of microalgae varies during the sampling time **(Fig. 8)**. From March to November, corresponding to the rainy season, density is low. But, from November to March, corresponding to dry season, density is high. The maximum value is 131390 Cells/mL obtained in January and the minimum value is 15120 Cells/mL obtained in July.

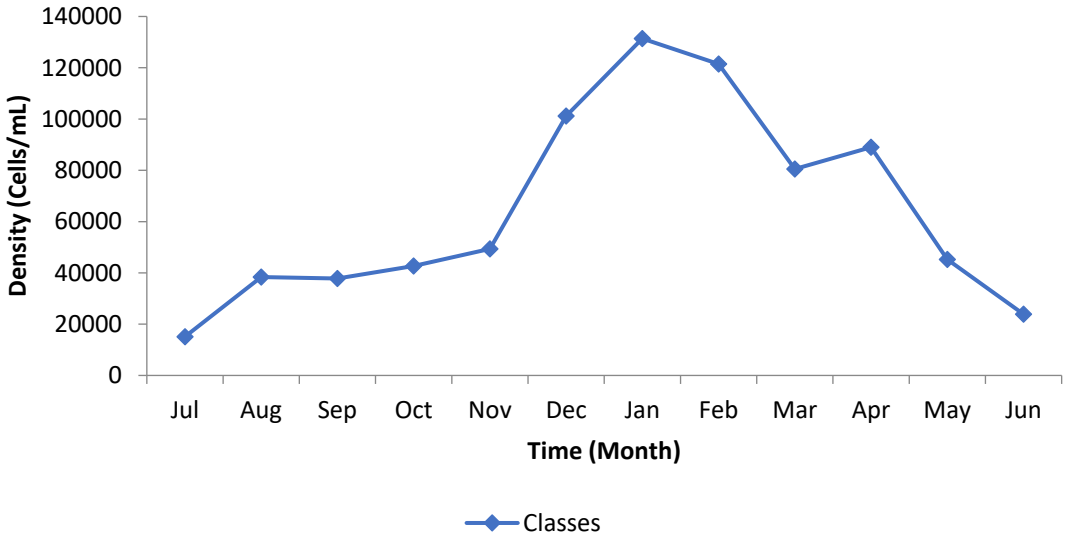

Figure 8. Variation to the total density according to the sampling time (Jul: July, Aug: August, Sep: September, Oct: October, Nov: November, Dec: December, Jan: January, Feb: February, Mar: March, Apr: April, Jun: June).

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Spatiotemporal distribution of species according to

The F1 and F2 axes (71.52% inertia) allow the sites to be divided into 3 groups according to the exclusive genera **(Fig. 9)**. Group 1 brings together the genera exclusive to phytoplankton, site 1: *Pleurotaenium, Synechocystis, Microcystis, and Phormidium*. Group 2 brings together the genera exclusive to epiphyte, site 2: *Encyonema, Trachelomonas, Gloeotrichia, Aphanizomenon, and Peridinium*. Group 3 brings together the common genera in the different habitats: *Fragilaria, Gomphonema, Synedra, Coscinodiscus, Navicula, Cyclotella, Cymatopleura, Cymbella, Eunotia, Tabellaria, Gyrosigma, Melosira, Pinnularia, Diatoma, Cocconeis, Thalassiosira, Achnanthidium, Nitzschia, Luticola, Rhopalodia, Euglena, Clostrium, Ulothrix, Cryptomonas, Scenedesmus, Spirogyra, Uronema, Mougeotia, Oedogonium, Calothrix, Nostoc, Rivularia, Oscillatoria, Gymnodinium*.

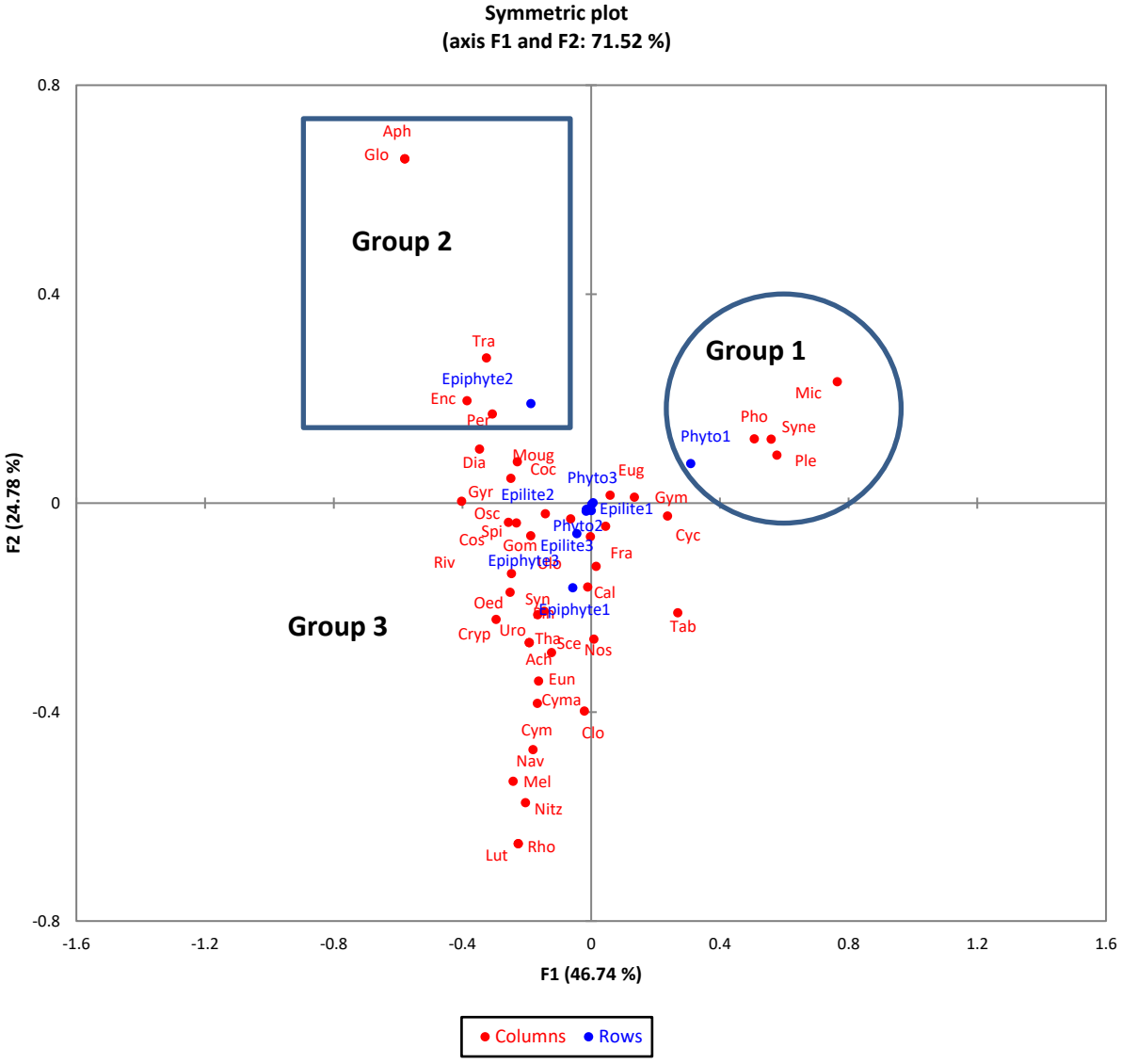

Figure 9: Correspondence factor analysis of study sites (Fra = *Fragilaria,* Gom = *Gomphonema,* Syn = *Synedra,* Cos = *Coscinodiscus,* Nav = *Navicula,* Cyc = *Cyclotella,* Cyma = *Cymatopleura,* Cym = *Cymbella,* Eun = *Eunotia,* Tab = *Tabellaria,* Gyr =

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***Gyrosigma*, Mel = *Melosira*, Pin = *Pinnularia*, Dia = *Diatoma*, Enc = *Encyonema*, Coc = *Cocconeis*, Tha = *Thalassiosira*, Ach = *Achnanthidium*, Nitz = *Nitzschia*, Lut = *Luticola*, Rho = *Rhopalodia*, Eug = *Euglena*, Tra = *Trachelomonas*, Clo = *Clostrium*, Ple = *Pleurotaenium*, Ulo = *Ulothrix*, Glo = *Gloeotrichia*, Cryp = *Cryptomonas*, Sce = *Scenedesmus*, Spi = *Spirogyra*, Uro = *Uronema*, Moug = *Mougeotia*, Oed = *Oedogonium*, Syne = *Synechocystis*, Cal = *Calothrix*, Nos = *Nostoc*, Mic = *Microcystis*, Pho = *Phormidium*, Aph = *Aphanizomenon*, Riv = *Rivularia*, Osc = *Oscillatoria*, Gym = *Gymnodinium*, Per = *Peridinium*).**

Regrouping of species according to the habitats

The ascending hierarchical classification shows 3 groups of habitats according to the species **(Fig. 10)**. Group 1 shows only the phytoplankton community in site 1; group 2 shows the epiphytic community in site 2 and group 3 shows the epiphyte and epilite in the site1, epilite, and phytoplankton in the site 2, epiphyte, epilite and phytoplankton in the site 3.

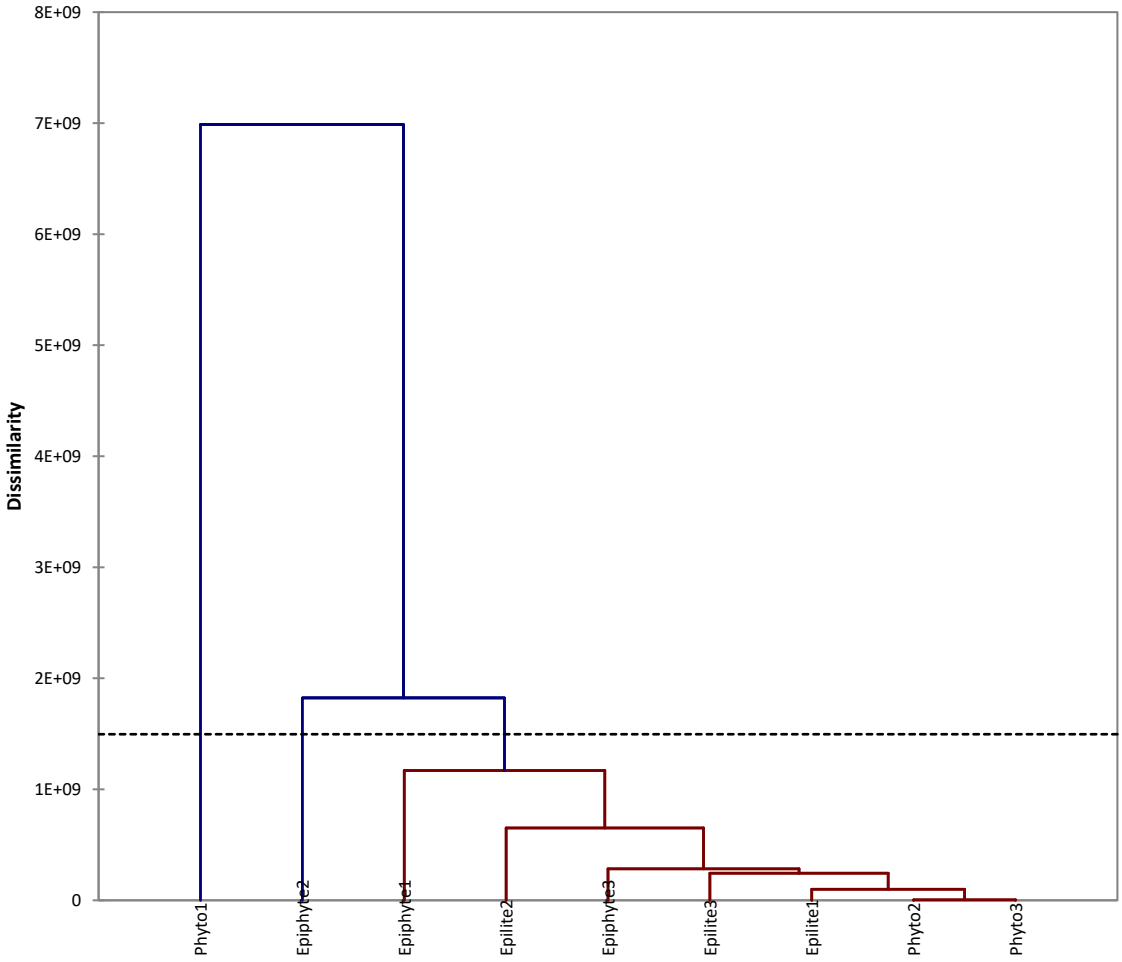

Figure 10: Dissimilarity of habitat according to the main genera in the study sites (Phyto1: phytoplankton site 1, phyto3: phytoplankton site 3).

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CONCLUSION

The general objective of the study was to determine the diversity and structure of Microalgae in Mezam River (Bamenda, Cameroon). The inventory of microalgal communities has made it possible to identify a total of 75 species divided into 45 genera and 38 families. Bacillariophyceae are the most important class with 42.67% (32 species) of the microalgal community, and the family Naviculaceae was reported as the most important in terms of abundance in the river studied. The diversity of the microalgae community is poor during the rainy season in the Mezam River. The relation with the species diversity through the correspondence factor analysis explains the probability of the generic existence of the microalgal communities and as an indicator of the ecological status. Monitoring, based on biological indices of algae, could be developed to prevent the risk of disturbance due to the mode of pollution of the Mezam River.

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