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Macrophyte diversity in polluted and non-polluted wetlands in Cameroon

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ABSTRACT

Inventory of macrophyte species in four wetlands in the Olezoa drainage basin in Yaoundé, two wetlands in the Bamenda central town, and two wetlands in the rural areas in the Menoua Division, was carried out from October 2003 to June 2004. The belt transect method was used for sampling and collecting plant specimens. In the four polluted wetlands studied in Yaoundé, 13 species belonging to 13 genera and 12 families were recorded. The families Cyperaceae and Poaceae were the most abundant, with the later being the only family represented by more than one species. A total of 43 species in 40 genera and 20 families were recorded in Bamenda wetlands, which were also polluted, as evidenced by some physicochemical analysis of wastewater. The family Poaceae appeared the most represented, having a total of 12 species in these wetlands. In the wetlands of the rural areas, a total of 67 macrophyte species in 55 genera and 27 families were identified. The family Cyperaceae was the most represented, with 16 species, followed by the Poaceae with 9 species. The macrophyte species identified were both terrestrial, aquatic and wetland species, some of which have already been tested in other countries in constructed wetlands for wastewater treatment. The number of macrophyte species recorded in the polluted wetlands was low compared with that of the wetlands in the rural areas. The species that grow well in polluted wetlands represent potential candidates for tests in artificial wetlands for phytopurification of wastewater in the studied area.

Keywords: Macrophytes, wetlands, diversity, phytopurification, wastewater, tropics.

RESUME

L'inventaire des macrophytes de quatre marécages dans le bassin versant Olezoa à Yaoundé, deux marécages dans la ville de Bamenda, et deux marécages des zones rurales dans les hautes terres de l'Ouest du Cameroun, a été conduite d'octobre 2003 à juin 2004. La méthode de transect a été utilisée pour recenser et récolter les espèces macrophytiques présentes dans chaque marécage. Dans les quatre marécages pollués de Yaoundé, 13 espèces appartenant à 13 genres distribués dans 12 familles ont été identifiées. Les familles des Cyperacées et des Poacées sont les plus abondantes, la dernière famille étant la seule représentée par plus d'une espèce. Un total de 43 espèces distribuées dans 40 genres et 20 familles a été enregistré dans les marécages de Bamenda dont le caractère pollué a été prouvé par des analyses physicochimiques. La famille des Poacées est la plus représentée avec un total de 12 espèces dans ces marécages. Dans les marécages des zones rurales, un total de 67 espèces appartenant à 55 genres et 27 familles ont été identifiées. La famille des Cyperacées était la plus représentée, avec 16 espèces, suivie par celle des Poacées avec 9 espèces. Les macrophytes identifiés dans ces milieux sont terrestres ou aquatiques et certaines ont été testées en marécages artificiels pour l'épuration des eaux usées. Le nombre d'espèces de macrophytes recensées dans les marécages recevant les eaux usées est faible comparée à celui des marécages des zones rurales. Les espèces qui prolifèrent dans les marécages pollués pourraient servir dans les essais de phytoépuration d'eaux usées par marécages artificiels dans la zone d'étude.

Mots clés: Macrophytes, marécages, diversité, phytoépuration, eaux usées, régions tropicales.

INTRODUCTION

Wetlands are transitional zones between terrestrial and aquatic environments that benefit from nutrients, energy and animal inputs from neighbouring systems [1]. The term *wetland* is therefore collective for ecosystems whose formation has been dominated by water, and whose processes and characteristics are largely controlled by water. Wetlands occur in low-lying areas where the speed of water flow is very slow. Some lie where ground water is near to the earth surface, and feed the wetland from below. Others stand next to rivers and other water bodies that regularly overflow their banks, or in coastal areas. Wetlands serve as water reservoirs during periods of drought and play a crucial role in flood control [2]. Most wetlands are open areas with photosynthetic vegetation important for wildlife use, and are therefore important sites for biodiversity conservation [3, 4]. They act as biological filters, preventing pollutants from entering lakes, rivers and groundwater.

On this basis, there has been a growing interest due to their high potential in the removal of nutrients, and constructed wetlands are nowadays used for the purification of wastewater from farms, parking lots, industries and domestic activities [5]. A lot of work has been carried out in developed countries on the use of constructed wetlands for water pollution control, with emphasis on the role of plant in the purification process [4, 6, 7, 8, 9, 10].

In developing countries, some research work has been carried out for that purpose. Dukweeds (*Lemna gibba)* and water hyacinth (*Eichhornia crassipes)*, have been tested in Morocco [11]. Similarly in Cameroon, some trials have been done using *Pistia stratiotes*, *Enydra fluctuans*, *Cyperus papyrus*, *Ipomoea aquatica*, *wolffia* *arhyza* and *Lemna equinoxialis* [12, 13]. Compared with conventional methods, wetlands are considered to be low-cost alternatives for treating municipal, industrial and agricultural effluents in many developing countries experiencing rapid population and economic growth especially in urban centres [1, 5]. Unfortunately, the approaches to sewage treatment by constructed wetlands cannot be transferred from one ecological zone to the other, because adapted plants and animals varied from one region to another due to climatic conditions [11]. There is therefore the need for studies to be carried out in each region, for the identification of the wetland plant species and their domestication in constructed ecosystems for wastewater treatment. This paper presents result of an inventory of wetland macrophytes in polluted and non-polluted wetlands in Cameroon.

MATERIAL AND METHODS

The work was carried out in four wetlands in the Olezoa drainage basin in Yaoundé, two wetlands in the Bamenda central town, and 2 wetlands in the rural areas in the Menoua Division, from October 2003 to June 2004. Yaounde is the second largest city in Cameroon with about a million inhabitants. It has an equatorial climate of Guinean type, characterized by four distinct seasons: two rainy seasons (September to mid-November and mid-march to June) and two dry seasons (mid-November to mid-march and July to August). Annual rainfall is estimated at about 1670 mm [14]. The four wetlands studied in Yaounde are Retenue, Atemengue, Melen and Obili found in the Olezoa drainage basin with surface areas of 2.1 ha, 3 ha, 1.4 ha and 2.6 ha respectively. These fishponds were created in the 1950's, by excavating and damming segments of the Olezoa stream. Because no sewage treatment facility functions in the university of Yaounde I, the fishponds were abandoned and are today covered by aquatic and semi-aquatic vegetation [13].

Bamenda is the provincial capital of the North West province of Cameroon. Situated between latitudes 5°55' and 6°30' N, and between longitudes 10°25' and 10°30' E, it falls in the equatorial climate domain exhibiting the mount Cameroon type of climate characterized by two distinct seasons, a long rainy season from April to October and a short dry season from November to March [15]. Mean annual rainfall is 2287.5 mm and mean annual temperature is 19.93 ^{0}C. This town shows an altitudinal range of 1200-1700m and is divided into two parts by an escarpment: a low lying part with altitudes varying between 1200 m and 1400 m, that gently undulates with many flat areas usually inundated for most of the year; and an elevated part at 1400-1700 m altitude that forms the crest from which arise creeks, streams, and rivers supplying the low lying part. The town has a rich hydrographical network with intense human activities and high population along the different watercourses in the watershed [15]. Two wetlands were selected for study in this town: Old Mazi park and Fish point wetlands. The old Mazi park wetland used to be an extensive wetland receiving water from a stream flowing through it. Today only a small part of it is left covering an area of about 0.06 ha. The wetland receives wastes from direct dumping of refuse from houses and restaurants around it, and domestic waters, petroleum products from a garage located besides it and even direct defecation by neighbouring population. The Fish point wetland extends behind the food market and covers about 0.05 ha. Part of this wetland was filled to construct the food market and filling is continuing in order to increase the size of the market and for other purposes.

The two other wetlands were selected in the Menoua division precisely in the villages Foto and Beleveng. Dschang, headquarter of the division is situated between latitude 5°25' and 5°30' north, and between longitude 10°00' and 10°50' east, at an average altitude of 1400 m. There are two seasons as in the Bamenda area, with an annual precipitation of 1911 mm, and a mean annual temperature of 20.1°C. The Foto wetland located at the outskirt of the town, has a total surface of about 0.3 ha, and is surrounded by hills on three of its sides. It is a natural wetland, which is supplied mainly by underground water sources in addition to precipitation. The water level is highest between July and September when rainfall is maximum, and lowest in March in the dry season. The Baleveng wetland is situated at about 12 km from Dschang, along the Dschang-Bafoussam road and has a total surface area of about 10 ha. The main water source of the wetland is the river '*Ndoumbou*' that separates Bafou and Baleveng villages.

Physicochemical analysis of water

Physicochemical characteristics of water were measured in each of the wetlands, at 12 randomly selected locations. Water samples were also collected and analyzed weekly at the entrance and the exit of each of the four wetlands in the Olezoa drainage basin, in order to ascertain their role in pollution control. The pH was determined using a Suntex pH meter; temperature, conductivity and Total Dissolved Solid (TDS) by a Hach conductivity/TDS meter. Suspended solids, Chemical Oxygen demand (COD), 5-days Biochemical Oxygen Demand (BOD_5), Nitrogen and phosphorus were measured following the general methods described in the Hach hanbook of water analysis [16].

Sampling of macrophytes

In order to identify the macrophytes species and estimate their relative abundances, two transects were laid out in each of the wetlands, using a graduated rope. The position and the direction of transects were defined considering the access into the wetlands. The transects consisted of a two meters wide strip along which macrophytes species were continuously identified and counted in quadrates materialized by a one m^2 frame placed over the vegetation. The percent area cover of each species was estimated and the relative abundance along each transects deduced using the +, 1, 2, 3, 4, 5 Braun-Blanquet index scale [17]. Table 1 present the total numbers of transects and quadrates used in the wetlands.

At least one specimen of each species found in the wetlands was collected, pressed and dried. Unknown specimens were carried to the national herbarium for identification.

Table 1 : Transect denominations and total number of quadrates investigated in the wetlands

Wetlands	Transects labels and number of quadrates		Estimated area covered (m^2)
Mazi	T_1: 26	T_2: 22	48
Fish Point	T_3: 34	T_4: 28	62
Foto	T_5: 70	T_6: 36	106
Baleveng	T_7: 66	T_8: 28	94
Retenue	T_9: 70	T_{10}: 80	150
Atemengue	T_{11} 60	T_{12}: 66	126
Melen	T_{13}: 26	T_{14}: 40	66
Obili	T_{15}: 36	T_{16}: 30	66

RESULTS

Physicochemical characteristics of water in the wetlands

Average physicochemical characteristics of the studied wetlands are presented in table 2. The values of the physicochemical characteristics in Foto and Baleveng sites, gave indication of non-polluted wetlands. In the Bamenda sites, Conductivity values ranged from 458 µS/cm to 626.0 µS/cm. The pH is slightly alkaline ranging between 7 and 8 for all the samples.

In the Foto and Baleveng wetlands, dead decaying organic matter increases the nutrient load in addition to runoffs from the surrounding agricultural farms. With the low speed of flow, there is less oxygen dissolved hence self-purification is slow followed by high accumulation of nutrients. The pH values in this wetland were below 7, a good indication that nutrient supply is mainly from precipitation and onsite decomposition of organic matter [5]. This also suggests that the contribution of the runoffs from agricultural farms was not significant.

Table 2: Some physicochemical characteristics of water in the wetlands studied

Parameters	Foto	Baleveng	Old Mazi	Fishpoint	Retenue	Melen	Atemengue	Obili
Cnd (µS/cm)	100±12	51±10	636±24	477±28	350±45	240±26	175±25	200±19
pH	6.37±0.2	6.81±0.5	7.43±0.2	7.27±0.4	6.3±0.2	6.4±0.2	6.4±0.5	6.8±0.3
SS (mg/l)	20±2	10±0.5	525±25	300±23	190±14	60±13	30±11	20±5
NO_3^- (mg/l)	1.0±0.1	0.75±0.1	15.0±2.5	10.2±2.1	14.2±2.0	3.0±0.2	1.5±0.1	2.0±0.1
PO_4^{3-} (mg/l)	0.2±0.05	0.1±0.01	0.9±0.01	1.2±0.2	0.8±0.1	0.9±0.1	0.2±0.01	0.15±0.1
COD (mg/l)	25±2.2	15±1.2	521±12	100±11	495±14	125±17	70±16	60±8
Colour (PtCo)	75±11	86±4	350±25	300±42	475±26	500±45	450±14	250±25

Macrophytes identification and analysis

Olezoa drainage basin in Yaoundé

Macrophytes found in the four wetlands of the Olezoa drainage basin and their relative abundances are presented in table 3. Thirteen species belonging to 13 genera and in 12 families were recorded, with the families Cyperaceae and Poaceae being the most represented. The Poaceae was the only family represented by more than one species (*Echinochloa pyramidalis* and *Leersia hexandra*).

Echinocloa pyramidalis and *Ipomoea aquatica* were found in all the ponds. In the Retenue fishpond, *Cyperus papyrus* and in some extend *E. pyramidalis* form a dense belt towards the edges, while *I. aquatica* and *Enydra fluctuans* occupied the deeper portions. The abundant rhizomes of *Cyperus papyrus* and the dense intertwining network of *E. pyramidalis* stems seemed to trap a lot of suspended matter, forming a particular substrate on which pockets of semi-terrestrial plants like *Pteris atroviriens, Commelina benghalensis* and the ligneous *Voacanga thouarsii* could be seen. In the Atemengue and the Obili ponds, marginal zones towards the influent were dominated by *E. pyramidalis*. Downstream, this species were successively replaced with spots of *Leersia hexandra, Jathorhiza macrantha* and *Luffa aegyptica.* Although the vegetation in the Melen pond was less diversified, *E. pyramidalis* was still the most abundant species occupying the margins. However, pockets of other species like *Pteris atroviriens, Thalia welwitschii* and *I. aquatica* could be found. The occurrence and rapid proliferation of *E. pyramidalis* in all the fishponds, suggest that this plant could be a suitable candidate for exploitation in constructed wetland systems for wastewater purification.

Bamenda central town

A total of 43 macrophyte species were identified in the two wetlands, distributed in 40 genera and 20 families (Tables 4 & 5). The species collected from all these wetlands were mainly emergent herbaceous macrophytes, with only few shrub species (*Neoboutonia glabrescens, Vernonia calvoana, Urena lobata, Triumfetta cordifolia* and *Desmodium salicifolium*). The Poaceae occurred as the most represented family with a total of 12 species, followed by the Asteraceae with five species and the Cyperaceae with four species while the rest of the families had less than four species. These were *Stemodia parviflora, Aspilia angustifolia, Rhynchelytrum repens* and *Bacopa sp.* This marsh from visual observation was dominated by *Leersia* *hexandra* growing in open water and covering large areas. Here also *Ludwigia abyssinica, Polygonum limbatum, Echinochloa crus-pavonis*, spots of *Pennisetum purpureum* and *Saccharum officinarium* could be seen here and there. In the Mazi wetland, the most abundant species were represented by *Coix lacryma-jobi, Polygonum limbatum* and *Ludwigia abyssinica. Brillantaisia lamium, Nelsonia canescens* and *Commelina benghalensis. Echinochloa crus-pavonis, Pennisetum purpureum, Spilanthes filicaulis* and *Urena lobata* showed low percentages (5-10%) while a very low percentage (<1.1 %) was recorded for *Triumfetta cordifolia.*

Table 3: Macrophyte species collected and the relative abundance in the Olezoa wetland complex

Wetland	Species	Family	RA Index
Retenue	*Cyperus papyrus*	Cyperaceae	5
	Echinochloa pyramidalis	Poaceae	4
	Enydra fluctuans	Asteraceae	3
	Ipomoea aquatica	Convolvulaceae	3
	Comelina nudiflora	Commelicaceae	2
	Pteris atroviriens	Pteridaceae	2
	Voacanga thouarsii	Apocynaceae	1
Atemengue	*Echinochloa pyramidalis*	Poaceae	5
	Leersia hexandra	Poaceae	4
	Jathorhiza macranta	Menispermaceae	3
	Luffa aegyptica	Cucurbitaceae	3
	Ipomoea aquatica	Convolvulaceae	3
	Pteris atroviriens	Pteridaceae	2
	Cyperus papyrus	Cyperaceae	2
	Nymphaea lotus	Nymphaeaceae	+
Melen	*Echinochloa pyramidalis*	Poaceae	5
	Ipomoea aquatica	Convolvulaceae	3
	Thalia welwitschii	Marantaceae	2
	Pteris atroviriens	Pteridaceae	2
	Nymphaea lotus	Nymphaeaceae	+
Obili	*Echinochloa pyramidalis*	Poaceae	5
	Jathorhiza macranta	Menispermaceae	3
	Ipomoea aquatica	Convolvulaceae	3
	Ludwigia abyssinica	Onagraceae	3
	Enydra fluctuans	Asteraceae	2
	Pteris atroviriens	Pteridaceae	2

In the Fish point wetland, the following species were prominent with relative abundance >20%: *Coix lacryma-jobi, Polygonum limbatum, Ludwigia abyssinica, Sericostachys scandens, Dicliptera laxata, Pennisetum purpureum, Nelsonia canescens, Spilanthes filicaulis, Leersia hexandra, Panicum sp, Echinochloa crus-pavonis* and *Echinochloa pyramidalis*. Among these prominent species, *Coix lacryma-jobi, Polygonum limbatum, Ludwigia abyssinica, Nelsonia canescens, Spilanthes filicaulis, Leersia hexandra, Echinochloa pyramidalis* and *Echinochloa crus-pavonis* are obligate wetland species and thus, rarely occur on dry land while *Sericostachys scandens, Dicliptera laxata, Panicum* sp and *Pennisetum purpureum* have the same likelihood of occurring in wetlands as on dry land.

Rural areas in the Menoua Division

The floristic study of both wetlands revealed plant species that were made up of terrestrial plants as well as aquatic and wetland macrophytes (Tables 6 & 7). A total of 68 species distributed in 56 genera and 27 families were identified. The family Cyperaceae is the most represented with nine genera and 16 species, followed by the Poaceae with seven genera and nine species, the Asteraceae with 5 genera and 5 species, and the Acanthaceae with four genera and four species.

In the Foto wetland, some species were present in both transects, whereas others like *Cyclosurus striatus, Crinum jagus* and *Mimosa invisa* were only present in T_5 and some others like *Cyperus haspan, Schoenoplectus articulatus* and *Phyllantus amarus* were present only in T_6. Apart from these species, all the other species were found in both transects. In the Baleveng wetland, species like *Phyllantus amarus, Cyperus difformis, Alternanthera sessilflora, Cyperus haspan, Vernonia stellulifera,* *Potamogeton* sp., *Panicum* sp2 and *Mariscus longibractiatus* were present in T_7 and absent in T_8.

Table 4: Macrophyte species collected and the relative abundance in the Mazi wetland

Species name	Family	Relative Abundance Index
Brillantaisia lamium	Acanthaceae	2
Dicliptera laxata	Acanthaceae	3
Nelsonia canescens	Acanthaceae	2
Sericostachys scandens	Amaranthaceae	1
Ageratum conyzoïdes	Asteraceae	+
Crassocephalum crepidioïdes	Asteraceae	1
Spilanthes filicaulis	Asteraceae	2
Vernonia calvoana	Asteraceae	1
Coix lacryma-jobi	Poaceae	3
Echinochloa crus-pavonis	Poaceae	2
Pennisetum purpureum	Poaceae	2
Commelina benghalensis	Commelinaceae	2
Ipomoea involucrata	Convolvulaceae	1
Zehneria scabra	Curcubitaceae	1
Desmodium uncinatum	Fabaceae	1
Urena lobata	Malvaceae	2
Ludwigia abyssinica	Onagraceae	2
Polygonum limbatum	Polygonaceae	2
Triumfetta cordifolia	Tiliaceae	1

Table 5: Macrophyte species collected and the relative abundance in the Fish point wetland

Species name	Family	RA index	Species name	Family	RA index
Brillantaisia nitens	Acanthaceae	+	*Cyperus haspan*	Cyperaceae	+
Dicliptera laxata	Acanthaceae	+	*Rhynchospora corymbosa*	Cyperaceae	+
Sericostachys scandens	Amaranthaceae	+	*Cyperus difformis*	Cyperaceae	+
Centella asiatica	Apiaceae	+	*Cyperus distans*	Cyperaceae	+
Sacciolepis africana	Asteraceae	+	*Neoboutonia glabrescens*	Euphorbiaceae	+
Crassocephalum crepidioïdes	Asteraceae	+	*Desmodium salicifolium*	Fabaceae	+
Tithonia diversifolia	Asteraceae	+	*Urena lobata*	Malvaceae	2
Vernonia calvoana	Asteraceae	+	*Tristema incompletum*	Melastomataceae	+
Coix lacryma-jobi	Poaceae	1	*Ludwigia abyssinica*	Onagraceae	+
Cynodon dactylon	Poaceae	+	*Raphia vinifera*	Palmaceae	+
Digitaria sp.	Poaceae	1	*Polygonum limbatum*	Polygonaceae	2
Echinochloa crus-pavonis	Poaceae	2	*Spermacoce latifolia*	Rubiaceae	+
Echinochloa pyramidalis	Poaceae	3	*Triumfetta cordifolia*	Tiliaceae	+
Eragrostis barteri	Poaceae	+	*Aframomum* sp.	Zingiberaceae	+
Leersia hexandra	Poaceae	2	Commelina benghalensis	Commelinaceae	1
Panicum sp.	Poaceae	3	*Ipomoea indica*	Convolvulaceae	+
Pennisetum purpureum	Poaceae	2	*Ipomoea mauritiana*	Convolvulaceae	+
Saccharum officinarum	Poaceae	+			
Sacciolepis africana	Poaceae	+			

RA= Relative Abundance

Table 6: Macrophyte species collected and the relative abundance in the Foto wetland

Species	Family	RA index	Species	Family	RA index
Brillantaisia lamium	Acantaceae	+	*Hibiscus diversifolia.*	Malvaceae	+
Eremomastax speciosa	Acantaceae	+	*Urena lobata.*	Malvaceae	+
Monechma depauperatum	Acantaceae	+	*Dissotis thollonii*	Melastomataceae	+
Nelsonia canescens	Acantaceae	1	*Mimosa invisa*	Mimosaceae	+
Crinum jagus	Amaryllidaceae	+	*Najas graminae*	Najadaceae	+
Raphia vinifera	Arecaceae	+	*Nymphaea lotus*	Nymphaeaceae	+
Ageratum conyzoïdes	Asteraceae	+	*Ludwigia hyssopifolia*	Onagraceae	1
Emilia coccinea	Asteraceae	+	*Brachiara* sp.	Poaceae	2
Crassocephalum bougheyanum	Asteraceae	1	*Coïx lacryma-jobi*	Poaceae	+
Vernonia stellulifera	Asteraceae	1	*Echinochloa crus-pavonis*	Poaceae	1
Impatiens irvingii	Basalminaceae	+	*Leersia hexandra*	Poaceae	2
Chamaecrista mimosoides	Ceasalpiniaceae	+	*Panicum* sp1	Poaceae	2
Aneilema umbrosum	Commelinaceae	+	*Panicum* sp2	Poaceae	2
Floscopa africana	Commelinaceae	2	*Pennisetum purpureum*	Poaceae	+
Cyperus difformis	Cyperaceae	2	*Sacciolepsis africana*	Poaceae	+
Cyperus distans	Cyperaceae	+	*Polygonum salicifolium*	Polygonaceae	+
Cyperus esculentus	Cyperaceae	+	*Polygonum strigasu*	Polygonaceae	+
Cyperus haspan	Cyperaceae	+	*Potamogeton* sp.	Potamogetonaceae	+
Eleocharis acutangula	Cyperaceae	+	*Oldenlandia lancifolia*	Rubiaceae	+
Fuirena umbellata	Cyperaceae	+	*Torenia thouarsii*	Scrophulariaceae	1
Licocarpha chinensis	Cyperaceae	+	*Cyclosorus striatus*	Thelipteridaceae	1
Pycreus lanceolatus	Cyperaceae	2	*Phyllanthus amarus*	Euphorbiaceae	+
Rhynchospora corymbosa	Cyperaceae	2	*Desmodium salicifolium*	Fabaceae	+
Schoenoplectus articulatus	Cyperaceae	+	*Smithia elliotii*	Fabaceae	+
Scirpus sp.	Cyperaceae	+	*Tephrosia vogelii*	Fabaceae	+
Scleria verrucosa	Cyperaceae	+	*Neohyptis paniculata*	Lamiaceae	1

RA= Relative Abundance

DISCUSSION

Pollution of the four wetlands studied in Yaoundé is mainly due to sewage from the University of Yaoundé campus. A general reduction trend was evidenced in the parameters measured, from the Retenue to the Obili wetland. An increase in the dissolved oxygen content throughout the wetland complex was also noticed (fig. 1). These wetlands are connected with stream segments and some purification processes may occur therein, due to plants and microbial symbiotic metabolism [9].

Macrophytes are generally adapted to live in different types of wetlands with some adapting to more than one wetland type. *Leersia hexandra*, *Centella asiatica* and *Ipomoea mauritiana* constitute part of peat land vegetation. This vegetation has been shown to be crucial for the purification of water. The purification involves the availability of a niche for some aerobacteria around the roots and stems of the peat land vegetation and the effective incorporation of nutrients such as phosphates, sulphates, excessive nitrogen and pollutants like heavy metals into harmless or beneficial compounds [18]. *Leersia hexandra, Sacciolepis sp, Centella asiatica, Rhynchospora corymbosa, Ludwigia abyssianica,* and *Polygonum limbatum* constitute part of semi-permanent lagoon species while *Leersia hexandra, Echinochloa pyramidalis* and *Cynodon dactylon* constitute plant species of seasonal floodplains [3].

Wetland plants play a major role in the absorption of nutrients and other dissolved substances in water, hence mitigating pollution in these systems. The drop in the values of conductivity, suspended solids, nitrates, and phosphates throughout the Olezoa wetland complex in Yaounde, can partly be attributed to the absorption of some nutrients by the vegetation of the wetlands. Many macrophytes have been tested for their phytoremediation properties of wastewater and have proved worthy of used for the process. Some of these plants have already been used on a large scale for water purification. *Coix lacryma-jobi* in a test carried out on the accumulation of heavy metals in wetland plants was considered as the most favoured plant for removal of all the studied heavy metals (Cadmium, Copper, Lead and zinc) while other plant species were more selective [19]. *Coix lacryma-jobi* has also been shown to be good at treating grey water (a form of waste water) and septic effluent; it has been used in replacement of *Phragmites australis*, which is considered as a noxious weed [20]. *Pennisetum purpureum* that grows on both dry land and wetland is very effective at wastewater treatment in constructed wetlands [21].

The plant species identified were terrestrial, aquatic and wetland species, some of which have already been tested in other countries in constructed wetlands for wastewater treatment. Although no diversity index was used in this study because the wetlands were from different regions and have completely different histories, it can be observed from the results that the number of macrophyte species adapted to polluted wetlands is generally lower than that of the wetlands that virtually receive no pollutants

Tableau 7: Macrophyte species collected and the relative abundance in the Baleveng wetland

Species	Family	RA index	Species	Family	RA Index
Monechma depauperatum	Acantaceae	+	*Neohyptis paniculata*	Lamiaceae	+
Nelsonia canescens	Acantaceae	+			
Alternanthera sessilflora	Amaranthaceae	+	*Hibiscus diversifolia.*	Malvaceae	+
Crinum jagus	Amaryllidaceae	+	*Ficus mucuso*	Moraceae	+
Raphia vinifera	Arecaceae	+	*Ficus pseudomangifera*	Moraceae	+
Aspilia angustifolia	Asteraceae	1	*Syzygium guineense*	Myrtaceae	+
Vernonia stellulifera	Asteraceae	+	*Ludwigia hyssopifolia.*	Onagraceae	+
Impatiens irvingii	Basalminaceae	+	*Echinochloa crus-pavonis*	Poaceae	2
Floscopa africana	Commelinaceae	1	*Echinochloa pyramidalis*	Poaceae	+
Cyperus difformis	Cyperaceae	+	*Leersia hexandra*	Poaceae	2
Cyperus lanceolatus	Cyperaceae	+	*Panicum* sp1	Poaceae	2
Cyperus renschii	Cyperaceae	+	*Panicum* sp2	Poaceae	1
Eleocharis acutangula	Cyperaceae	1	*Polygonum limbatum*	Polygonaceae	+
Fuirena umbellata	Cyperaceae	1	*Polygonum salicifolium*	Polygonaceae	1
Mariscus longibracteatus	Cyperaceae	+	*Polygonum strigasum*	Polygonaceae	+
Pycreus sp.	Cyperaceae	+	*Potamogeton* sp.	Potamogetonaceae	+
Rhynchospora corymbosa.	Cyperaceae	3	*Oldenlandia lancifolia*	Rubiaceae	+
Schoenoplectus articulatus	Cyperaceae	+	*Psychotria globiceps*	Rubiaceae	+
Antidesma chevaleri	Euphorbiaceae	+	*Spermacoce ocymoides*	Rubiaceae	+
Bridelia speciosa	Euphorbiaceae	+	*Allophyllus* sp.	Sapindaceae	+
Phyllanthus amarus	Euphorbiaceae	+	*Cyclosorus striatus*	Thelipteridaceae	+

RA= Relative Abundance

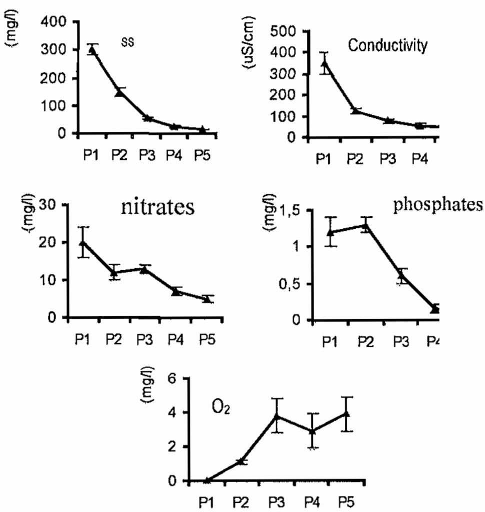

Figure 1: Evolution of selected physicochemical characteristics of water through the Olezoa wetland complex.

P1. Entrance Retenue wetland, P2. Exit Retenue and entrance Atemengue wetlands, P3. Exit Atemengue and entrance Melen wetlands, P4. Exit melen and entrance Obili wetlands, P5. Exit Obili wetland.

Most of the plants found in the wetlands can probably be good for wastewater treatment. Some of them like *Coix lacryma-jobi* and *Pennisetum purpureum* are already being used for that purpose and so are worth using in constructed wetlands.

Echinochloa pyramidalis, which is almost found in all the regions in Cameroon, could also be a good candidate. The species growing well in polluted wetlands represent potential candidates for tests in artificial wetlands for phytopurification of wastewater in the tropics.

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