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A study of planktonic Cyanobacteria taxa of the Aby lagoon system (Southern Ivory Coast, West Africa)

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Abstract

Considering the great ecological importance of the Cyanobacteria and the need for more detailed information about these organisms in Aby lagoon system, this paper provides taxonomic information about the Cyanobacteria flora in lagoon systems along the coastal plains of Ivory Coast. Investigations for the first time into the blue green algae of Aby lagoon system were carried out for 4 seasons (June 2006 - Mach 2007) using standard plankton net of mesh size 20µm. A total of 24 taxa belonging to 3 orders, 9 famillies, and 16 genera were encountered in Aby lagoon system. There was a dominance of members of the orders Chroococcales (42%) and Oscillatoriales (37%). The blue-green algae *Microcystis* formed the most predominant genus making up four species followed by *Oscillatoria*, *Anabaena* and *Aphanothece* with four species each. Thus, filamentous forms represented 53% of the populations studied and coccoid forms only 47. Four of the species described in this study belong to the potentially toxic taxa.

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Introduction

Coastal regions are complex environmental systems because they constitute transition zones between continental and oceanic environments that respond to interactions and exchanges between terrestrial, oceanic and atmospheric factors (Martins *et al.*, 2012). Those regions have also historically been prone to human habitation, and the resulting rural and urban landscapes reflect human orientations toward the use of the natural capital of lagoons. Lagoons are sensitive areas that play an important role among coastal ecosystems in providing suitable breeding areas for many bird and fish species, but many lagoons are currently deteriorating because of overuse of their natural capital. Fisheries and aquaculture, tourism, and urban, industrial and agricultural developments are typical uses that are generally not well controlled, and lagoon resources are frequently overexploited – so that their present quality and future capability to sustain productivity is being seriously compromised (Göneng and Wolflin, 2005). These lagoons usually exhibit estuarine characteristics and are regions of high primary productivity. Transfer of this productivity through the food web often yields prolific fisheries.

There are important coastal lagoons systems along the southern Atlantic coast of Ivory Coast that comprise a great biological diversity. Cyanobacteria are often significant components of the floating algal communities, contributing to the biological diversity and, in some cases, providing most of the carbon sources that sustain aquatic food webs (Seu-Anoï, 2012). In terms of morphology, physiology and metabolism, Cyanobacteria (blue-green algae) are one of the most diverse groups of gram-negative photosynthetic prokaryotes (Codd, 1995). Cyanobacteria have an important role in aquatic ecosystems and they make up part of the planktic, metaphytic, or benthic communities, representing the base of the trophic chain; they are responsible for part of primary productivity of aquatic ecosystems and are relevant in biogeochemical cycles (Wetzel 2001, Padisák *et al.*, 2003).

Due to their capacity for photosynthesis, cyanobacteria can rapidly become dominant in aquatic and terrestrial habitats by forming intensive blooms. These can have a strong negative effect on water quality, as certain species of Cyanobacteria are capable of producing toxins. The development of Cyanobacterial blooms has become a serious problem in recent decades (WHO, 2003; Berger *et al.*, 2005 and Rejmánková *et al.*, 2011), and many bloom-forming species are reported to be able to produce secondary metabolites toxic to many organisms, including humans.

In the Aby lagoon system in Ivory Coast, northern hemisphere summer blooms of Cyanobacteria have been observed (Seu-Anoï, 2012); they usually f are dominated by *Aphanizomenon flos-aquae* and *Microcystis aeruginosa*. This *Microcystis* species can become toxic (Janse *et al.* 2004). Freshwater habitats in the Aby lagoon system are relatively poorly known from a Cyanobacteria perspective, although the phytoplankton from this lagoon has been documented by Seu-Anoï (2012).

In the Southern region of Ivory Coast, studies include Seu-Anoï *et al.* (2011, 2013 & 2014) who studied phytoplankton of Aby Ebrié and Grand-Lahou lagoons respectively. Komoé *et al.* (2005 & 2009) reported on the Chlorophyta of Grand-Lahou Lagoon, Konan *et al.* (2003) studied the phytoplankton of the Fresco lagoon.

Of the entire aforementioned list, no specific report on the Cyanobacteria was included for the Aby Lagoon. The present study was a first attempt to investigate the composition of Cyanobacteria community of the Aby Lagoon for possible future biological monitoring since the lagoon is an important source of fish supply for people of South Western of Ivory Coast and beyond.

Material and methods

Study site

The Aby lagoon system consists of the main Aby Lagoon, the Tendo Lagoon and the Ehy Lagoon.

It is located in the far east of the coast of Ivory Coast, and forms a natural border between Ivory Coast and Ghana (see Fig.). The main characteristics of these lagoons and tributary rivers are listed in Table 1. The Aby lagoon system extends over 30 km of the coastline and covers an area of 424 km2, with a mean depth of 3.5 m and width of 5.5 km (Avit *et al.*, 1996). The main Aby lagoon system is the largest, covering a surface area of 305 km^2; it has a total shoreline of 24.5 km, is 15.5 km wide and has a mean depth of 4.2 m (Chantraine, 1980). Agriculture is the main human activity for the lagoon area and its river catchments. Coconut, oil palm, banana, cocoa and coffee plantations cover most of the arable land. The Aby lagoon system is surrounded by mangrove forests in the southern part and is connected to the sea via a long channel (Fig. 1). In general, tides are low (<1 m) and the residence time is probably high due to its shallow connection to the sea, with low surface salinity values (<5, except during the long dry season when surface salinities can reach 10). Because of this, Koné *et al.* (2009) suggested that this lagoon system could be classified as a choked lagoon. Salinity values in the bottom waters are high, ranging from 15 to 27. The Aby lagoon system is permanently stratified, particularly in its central part (Koné *et al.*, 2009). The climate in the study area is close to equatorial, having two rainy seasons separated by two dry seasons (Durand and Skubich, 1982). The long rainy season (LRS), from May to July, is followed by the short dry season (SDS) from August to September. The short rainy season (SRS) is from October to November, while the long dry season (LDS) is from December to April. The annual rainfall is about 2 000 (Chantraine, 1980). Thirteen stations were chosen as sampling sites (Fig. 1) in order to cover most of the system, except for the Ehy Lagoon.

Water chemistry

Temperature, salinity and pH were determined *in situ* using a WTW COND 340-i conductivity meter for temperature and salinity, and an ORION 230-A meter for pH. Two standard buffer solutions (NBS4 and NBS7) were used for pH meter calibration each day before sampling (Koné *et al.*, 2009).

Water transparency was measured using a Secchi disc. Water samples for nutrient measurements were filtered through Sartorius cellulose acetate filters, refiltered through 0.2 µm pore size polysulfone filters, and preserved with $HgCl_2$ for $NO3^-$ and soluble reactive phosphate (SRP), and with HCl for soluble reactive Si (SRSi). Concentrations of $NO3^-$ were measured on a Technicon Auto Analyser II (Tréguer and Le Corre, 1975), with an estimated accuracy of ±0.1 µmol L^{-1} and a minimum detection limit of 0.05 µmol L^{-1}. SRP and SRSi concentrations were obtained by using standard colorimetric methods (Grasshoff *et al.*, 1983), with an estimated accuracy of ±0.01 µmol L^{-1} and ±0.1 µmol L^{-1}, respectively. Minimum detection limits for SRP and SRSi were both 0.1 µmol L^{-1}.

Phytoplankton sampling and analysis of biotic variables

One sample per sector was collected in the whole lagoon system, except for Ehy Lagoon, during four seasons in 2006-2007. The phytoplankton samples were collected in the pelagic zone in June, September and November 2006 and in February 2007 using a phytoplankton net (20 µm mesh width). From a dyke or from the shore, the net was dragged horizontally for 6 m in the surface water. Samples were fixed in situ with a formalin solution (5% final concentration). The location of the 13 sampling stations is shown on the map of southern Ivory Coast in Fig. 1; the coordinates and mean depth are given in Table 2.

For species identification, phytoplankton samples were examined in the laboratory using an Olympus BX40 microscope equipped with a calibrated micrometer. The classification proposed by Hoffmann *et al.* (2005) as modified by Komárek (2006) was adopted for systematic taxonomic arrangements above the family level, and Komárek and Anagnostidis (2005) for family and lower taxonomic levels. Taxonomic descriptions and photomicrographs of each taxon observed in during the investigation are presented here. For each taxon, a short description is given together with a microphotograph taken with a Sony (N50) digital camera and its presence in the sampling stations (1 to 13 as indicated in Table 2).

Results

Water chemistry

Data of the environment parameters at the Aby Lagoon are presented in Table 3. Transparency varied slightly (0.3-1.1 m) from one sampling station to another.

However, the highest values were obtained during the SRS and the lowest during the LRS. Surface water temperatures were relatively stable with a range of between 26.0 °C and 31.2 °C. The surface water salinity at Aby Lagoon was relatively low and varied from 0 to 12.30. However, the highest values were recorded during the LDS and lowest during the LRS. The pH was alkaline (> 7) all through the sampling period.

Table 1. Some characteristics of the Aby lagoon system and of the main rivers (Tanoé and Bia) flowing into this lagoon, based on Chantraine (1980), Durand and Chantraine (1982) and Durand and Skubich (1982).

Aby Lagoon system	Area (km^2)	Volume (km^3)	Mean depth (m)	Length (km)	Width (km)	Rivers	Total length (km)	Drainage area (km^2)	Mean water discharge (m^3s^{-1})
Aby	305	1.3	4.2	24.5	15.5	Bia	290	9650	59
Tendo	74	0.2	2.6	22	3.5	Tanoé	625	16000	132
Ehy	45	0.07	1.5	16	4.5				

The dissolved oxygen (DO) values were high during LDS (13 mg/L) while values were low at SDS (2.89 mg/L). With respect to NO^{3-} and SRP concentrations, the highest values (14 µmol L^{-1} and 1.2 µmol L^{-1}, respectively) were recorded during the LRS than in LDS (NO^{3-}: 0 µmol L^{-1}) and SDS (SRP: 0.1 µmol L^{-1}) respectively. Concentrations of SRSi were significantly higher during the LDS, with values ranging from 33 to 189 µmol L^{-1}, and lower during the SDS, with values ranging from 14 to 75 µmol L^{-1}.

Table 2. Sampling stations and their geographical coordinates.

Aby lagoon system	Lagoons	Sectors	Stations Number	Mean depth (m)	GPS Localization
	Aby	Aby-North	1	1.82	5°42'73N-3°23'63W
			2	4.25	5°33'18N-3°25'W
			3	9.12	5°33'5N-3°24'91W
			4	1.00	5°29'5N-3°28'64W
			5	11.00	5°24'5N-3°27'73W
		Aby-South	6	3.55	5°19'5N-3°30'91W
			7	1.17	5°16'N-3°30'91W
			8	6.9	5°13'75N-3°31'36W
	Tendo	Tendo	9	7.4	5°17'5N-3°22'5W
			10	5.87	5°15'N-3°18'25W
			11	3.45	5°13'75N- 3°13'75W
			12	4.4	5°12'5N-3°6'25W
			13	1.92	5°12'5N- 3°00'W

Cyanobacteria-systematic account

A total of 24 taxa belonging to 3 orders, 9 families, and 16 genera were encountered in the Aby lagoon system. There was a dominance of members of the orders Chroococcales (42%) and the Oscillatoriales (37%).

The number of cyanobacterial taxa observed within the Aby system lagoon was different from one station to another.

The highest diversity was observed in the Tendo lagoon samples (at stations 11, 12 and 13 with more

70% of the total inventoried phytoplankton taxa); the lower diversity was noted in the Aby-Nord part (at station 5 with less 40% of the total inventoried taxa). Four species (*Microcystis aeruginosa*, *Nostoc caeruleum* var. *planctonicum*, *Komvophoron minutum* and O*scillatoria limosa*) were present in half of the samples regardless of the nature of the area.

In the following systematic account Cyanobacteria are given per order and the genera are arranged alphabetically within the families. Species and infra-specific taxa are put alphabetically within the genera.

Order Chroococcales

Family: Chroococcaceae Nägeli

Genus: *Chroococcus* Nägeli

Aphanothece cf. *conglomerata* F.Rich (Fig. 2).

Colonies gelatinous, without any definite shape, slimy; cells ellipsoidal to cylindrical, -5.3µm long, 3µm broad, mostly densely arranged, blue-green, sheath diffluent, colorless or yellowish.

Free-floating or forming a scum on surface of ponds and pools or drains, also epiphytic.

Table 3. The physical and chemical characteristics of surface water at Aby Lagoon system for the period of June 2006 to March 2007.

Parameters		Seasons			
		LRS	SDS	SRS	LDS
Transparancy (m)	min	0.30	0.35	1.00	0.4
	max	0.82	0.8	0.90	0.6
	Mean ±σ	0.62	0.64	0.75	0.52
Temperature (°C)	min	27.7	26.00	28.3	29.3
	max	31	28.9	31.1	31.2
	Mean ±σ	29.18	26.87	30.05	30.80
Salinity	min	0	0	0	1.5
	max	2.1	10	5.8	12.30
	Mean ±σ	1.07	1.85	1.18	6.05
pH	min	7.00	7.11	7.14	7.53
	max	8.25	8.55	9.08	9.28
	Mean ±σ	7.51	7.97	8.26	8.63
DO (mg L-1)	min	4	2.89	5.9	6.2
	max	9.9	7.23	10.4	13
	Mean ±σ	6.6	5.47	7.63	8.13
NO3- (µmol L-1)	min	0	0	0.78	0
	max	14.77	10.17	10.42	1.93
	Mean ±σ	4.81	2.00	2.83	0.47
SRP (µmol L-1)	min	0.16	0.10	0.09	0.16
	max	1.22	0.62	0.19	0.74
	Mean ±σ	0.48	0.36	0.48	0.31
SRSi (µmol L-1)	min	80.45	14.33	33.12	150.24
	max	143.53	114.43	135.72	189.0
	Mean ±σ	101.42	78.22	89.16	167.96

Localities: stations 8, 11, 12 and 13.

Aphanothece cf. *variabilis* (Schiller) Komarek (Fig. 3)

Colonies microscopic, irregular; sheath colorless, margin delimited; mucilage homogenous, colorless; cells densely agglomerated; oval to cylindrical with rounded ends, 2-3 µm diam., 5-6 µm long.

Localities: stations 12 and13.

Family: Chroococcaceae Nägeli

Genus: *Chroococcus* Nägeli

Chroococcus dispersus (Keissler) Lemmermann (Fig. 4).

Colonies free floating, microscopic, more or less spherical, cells irregularly arranged, sometimes in groups, which are distant from one other within the colonial mucilage; mucilage colorless, firm, diffluent; cells spherical or hemispherical after division, 10 µm diam.; cell contents blue-green, homogeneous.

Localities: stations 1, 11, 12 and 13,

Chroococcus minutus (Kützing) Nägeli (Fig. 5)
Colonies with few cells (2-4); cells solitary or microscopic, oval, elongated; mucilage colorless, firm, homogenous, sometimes lamellate, delimited; cells spherical or hemispherical after division, 4- 6 µm diam.; cell contents blue-green, homogenous.
Localities: stations 1, 4, 10, 11, 12 and 13.

Family: Merismopediaceae Elenkin 1933
Genus: Merismopedia Meyen 1839
Merismopedia elegans A. Braun in Kützing (Fig. 7)
Colonies many-celled (100), in outline usually rectangular, wavy, with cells more or less densely arranged in perpendicular rows. Mucilage more or less firm, with distinct margin up to 10µm beyond the cells. Cells widely oval, rarely almost spherical, after division hemispherical, with homogeneous or finely granular content, bright blue-green or greenish, 5-9 x5-7µm.

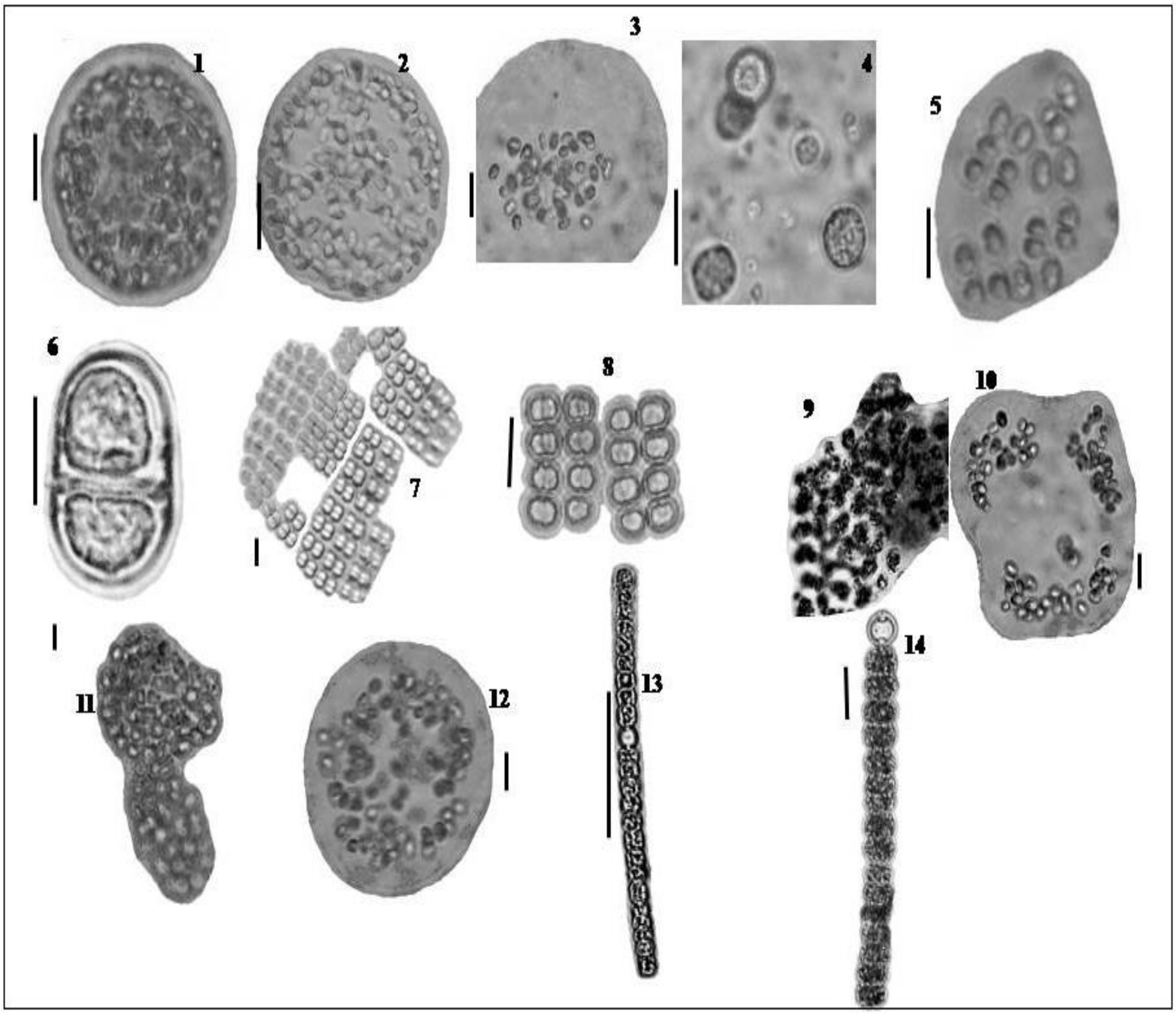

Fig. 1-14. 1-2: *Aphanothece* cf. *conglomerate* 3: *Aphanothece* cf. *variabilis* 4: *Chroococcus disperses* 5: *Chroococcus minutus* 6: *Chroococcus turgidus* 7: *Merismopedia elegans* 8: *Merismopedia glauca 9: Microcystis aeruginosa* 10-11: *Aphanocapsa* cf. *grevillei* 12: *Coelosphaerium kuetzingianum* 13: *Anabaena* cf. *flos-aquae* 14: *Nostoc caeruleum var. planctonicum*. Scalebar =10pm.

Locality: stations 1, 4, 10, 11, 12 and 13.

Merismopedia glauca (Ehrenberg) Kützing (Fig. 8).

Colonies microscopic, flat, tabular, rectangular, composed of 16 cells disposed more or less loosely in perpendicular rows within the colonial mucilage, mucilage homogeneous, fine, colorless, diffluent margin; cells spherical, widely oval, hemispherical after division, 3- 6 µm diam.; cell contents blue-green, homogenous.

Localities: stations 4, 11, 12 and 13.

Genus: *Aphanocapsa* Nägeli
Aphanocapsa cf. *grevillei* (Berkeley) Rabenhorst (Fig. 10 and 11).

Colonies many-celled, with loosely or densely distributed cells; mucilaginous, cells spherical or slightly oval, 3-4 µm in diameter.

Locality: stations 1, 2, 6, 10, 11, 12 and 13

Genus: *Coelosphaerium* Nägeli
**Coelosphaerium kuetzingianum* Nägeli (Fig. 12)
Colonies microscopic, spherical, 50.0--61.5 µm diam.; cells loosely and irregularly arranged near the colony surface; mucilage homogenous, fine, colorless, diffluent margin; cells spherical, hemispherical after division, 7 µm diam.; cell contents blue green, homogenous
or granular.

Localities: stations 12 and 13.

Family: Microcystaceae Elenkin
Genus: *Microcystis* Kützing ex Lemmermann
Microcystis aeruginosa (Kützing) Kützing (Fig. 9).

Colonies mucilaginous, microscopic, irregular, usually elongated, lobate, sometimes clathrate, (diam: up to 400 µm). Irregularly and densely arranged cells in the central part of the colonial mucilage with numerous gas vacuoles Cells spherical, sometimes slightly elongated, 5-6 µm diam.; cell contents blue-green; with aerotopes.

Localities: all stations.

Order Oscillatoriales
Family: Borziaceae Borzi
Genus: *Komvophoron* Anagnostidis & Komárek
Komvophoron minutum (Skuja) Anagnostidis & Komárek (Fig. 17 and 18).

Trichomes solitary straight, 2-4 µm wide, short, constrited at thethick, transparent, ungranulatedcross-walls, apicalcells not attenuated, rounde dorbroadly conical-rounded, without calyptraorthickened cell wall, , cells 2-3 µm wide
Localities: All stations,

Family: Oscillatoriaceae (Gray) Harvey ex Kirchner
Genus: Lyngbya Agardh ex Gomont.

Lyngbya martensiana Menegh ex Gomont (Fig. 21)
Thallus caespitose, blue-green, when dried violet, filaments long more or less flexible ; sheath colourless, thick, not coloured violet with chlor-zinc-iodide outside rough; trichome 10µm broad, not constricted at the cross-walls, cells ½-1/4 times as long as broad, 3.µm in length; end cell rotund, without calyptras.

Localities: stations 1, 2, 7, 9, 10, 12 and 13.

Genus: Oscillatoria Vaucher ex Gomont
Oscillatoria limosa Agardh ex Gomont (Fig. 23).

Thallus blackish blue-green, olive- green to brown, extended, thick, often layered, attached to the substrate, occasionally in free-floating tufts at the water level or in solitary trichomes among other cyanoprokaryotes or algae. Cells Cell content mostly finely granular (4 µm x 12 µm). Apical cells flat-rounded convex.

Localities: All stations except station 3 and 11.

Oscillatoria princeps Vaucher ex Gomont (Fig. 22)
Trichomes solitary, straight or curved, and slightly narrowed at apex, only slightly constricted 20 µm wide; -4µm long; cell content blue-green, homogenous or slightly granulated; apical cell rounded.

Localities: All stations except stations 9 and 10.

Oscillatoria cf. *leonardii* Compère (Fig. 24)
Trichomes solitary, straight or flexuous, not attenuated, only slightly constricted at the granulated cross-walls, 6 µm wide; 4 µm long; cell content blue-green, homogenous; apical cell rounded.

Localities: All stations except station 1.

Family: Phormidiaceae Anagnostidis & Komárek
Genus: Arthrospira Stizenberger ex Gomont
Arthrospira platensis (Nordstedt) Gomont (Fig. 16)
Solitary, flexuous trichomes without constriction but with visible cross walls. Shorter than wide, blue-green cells (2-4µm), slightly elongated and convex at apical.
Localities: station 11.

Genus: *Planktothrix* Anagnostidis & Komárek
Planktothrix compressa (Utermöhl) Anagnostidis & Komárek 1988 (Fig. 25).

Trichomes, immotile, note constricted at the granulated cross-walls, +-gradually attenuated at the ends. Cell (2 µm x 6 µm) content blue-green, with numerous aerotopes, apical cells widely rounded.

Localities: Station 1, 2, 3, 4, 11, 12 and 13.

Family: Pseudanabaenaceae Anagnostidis & Komárek
Genus: Pseudanabaena Lauterborn
Pseudanabaena sp. (Fig. 19).

Trichomes straight or sligtly bent, 3-4 µm wide, not constricted at the thickened and hyaline cross-walls, not attenuated at the end, cells cylindrical, 5-6 µm wide.

Localities: All stations except station 10.

Genus: Leptolyngbya Anagnostidis & Komárek
Leptolyngbya gracillima (Zopf ex Hansgirg) Anagnostidis & Komárek (Fig. 26).

Thallus thin, membranaceous, often widely expanded, pale blue-green, yellow-green or grey-green, mostly mucilaginous. Filaments pseudobranched; pseudobranches single. Sheaths thin, mostly colourless. Trichomes pale 2 µm wide and 4 µm long, not constricted and not granular at cross-walls, insignificantly gradually attenuated at the ends. Apical cells rounded.
Localities: stations 1, 2, 7, 9, 10, 12 and 13.

Order: Nostocales
Family: Aphanizomenonaceae Elenkin
Genus: Cylindrospermopsis Seenayya & Subbaraju
Cylindrospermopsis raciborskii (Wołoszyńska) Seenaya & Subbaraju (Fig. 20).

Straight trichome without constriction at the cross walls. Cylindrical, yellowishcells (6-12 µm x 2-3 µm) with aerotopes. Termminal, drop-like heterocytes (5-7µm x 3-4 µm) with pointed end.
Localities: stations 3, 6, 8, 9 and 12,
Family: Nostocaceae Agardh ex Kirchner
Genus: *Anabaena* Bory de Saint Vincent ex Bornet & Flahault.

Anabaena flos-aquae Ralfs ex Bornet & Flahault (Fig. 13).

Straight, solitary trichomes with Slight constrictions at the cross walls.Short cylindrical yellow-green cells (2.4 µm x2.6 µm) with numerous gas vacuoles. Conical, slightly elond apical cell. Solitary, intercalary, spheriical akinetes (73 µm). heterocytes not observed.
Localities: All stations except station 1.

Anabaena spiroides (Woronichin) Nygaard (Fig. 15)
Trichomes in a bundle, seldom single, bent ; cells 6 µ broad, 6µ long, with gas-vacuoles.,

Localities: all stations except station 1.

Genus : Nostoc Vaucher ex Bornet & Flahault
Nostoc caeruleum var. *planctonicum* (V.S.Poretsky & V.K.Tschernow) B.A.Whitton (Fig. 14).

Trichome straight, single, sometimes with a diffluent mucilage layer, though this tends to be most obvious adjacent to the akinete. Cells spherical, 7 µm wide, 7 µm long, sometimes with gas vacuoles. Akinete Spherical, 6 µm wide, 6 µm long, wall smooth, sometimes surrounded by conspicuous mucilage.

Localities: All stations.

Discussion

The Cyanobacteria observed during our stusy reflect the influence of hydrological conditions in the lagoon system. The dominance of *Microcystis* throughout the seasons could point that the hydrology and salinity of the studied area favour its growth.

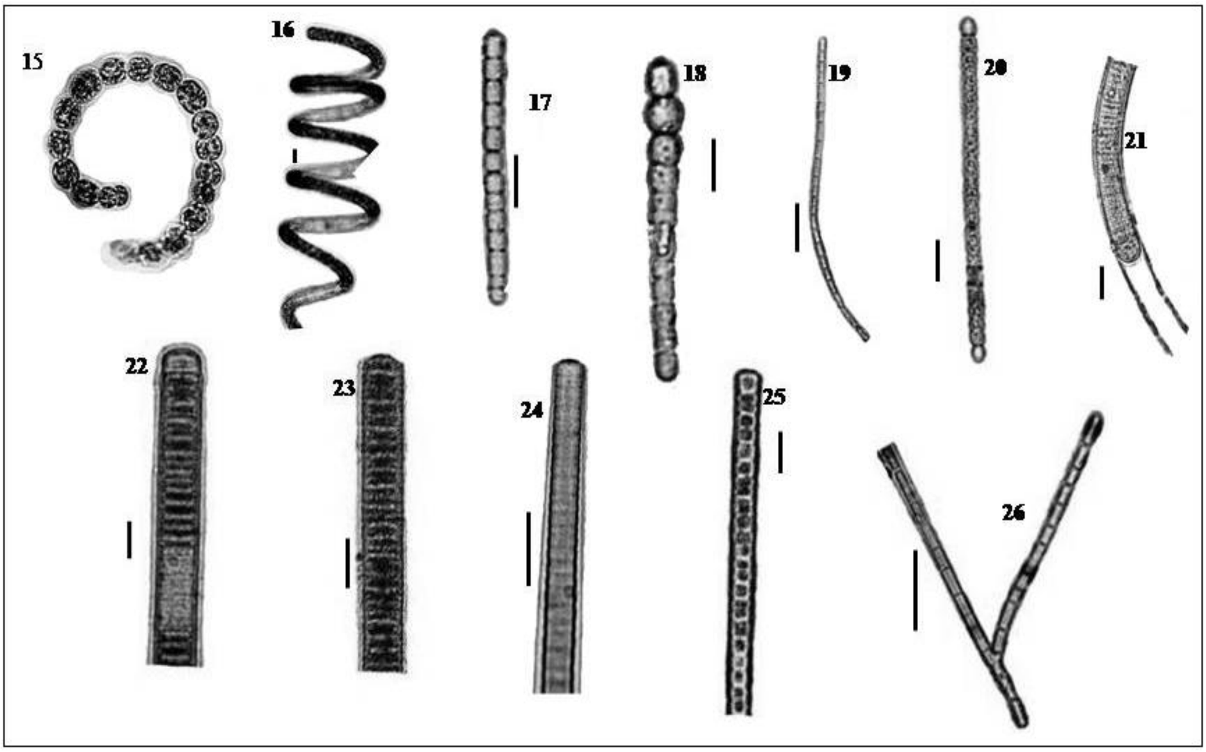

Fig. 15-26. 15: Anabaena spiroides 16: *Arthrospira platensis* 17-18: *Komvophoron minutum 19: Pseudanabaena* sp. 20: *Cylindrospermopsis raciborskii 21: Lyngbya martensiana 22: Oscillatoria princeps 23: Oscillatoria limosa 24: Oscillatoria* cf. *leonardii* 25: *Planktothrix compressa 26: Leptolyngbya gracillima*. Scalebar =10pm.

The particular high diversity of blue-greens observed in the lagoon could also indicate that the present water chemistry favours growth of Cyanobacteria. Five bloom forming Cyanobacteria identified in this study include *Microcystis aeruginos, Aphanothece* cf. *conglomerata, Anabaena spiroïdes, Nostoc coeruleum* var. *planctonicum* and *Oscillatoria limosa*. The variation in physical and chemical parameters observed during the study period may be a result of the influence of weather conditions. For instance, the rainy season characterized by low transparency and pH; increased total suspended solids, higher turbidity and increased flood water condition which might have initiated stressful environmental condition and these conform with Dart and Stretton (1980) who stated that variations in water temperature could cause alterations in the pH due to changes in ionization and increased solubility or precipitation of bottom deposits. Nwankwo and Onitiri (1992) also pointed out that it is possible that rainfall triggers off flood situations which usually increases total solids, reduces transparency and consequently light penetration and also dislodges attached algal forms. The phytoplankton community and the physcical and chemical parameters exhibited seasonal changes closely related to the pattern of rainfall. The presence or absence of any blue-green species may be due to the changing physical environment other than pollution (Nwankwo, 1994).

During the high dry season, cyanobacterial samples from Aby system lagoon were predominated mainly by the filamentous Cyanobacteria (14 species good for 63% of the total observed specimens). Among those, the filamentous non heterocystous forms showed the highest diversity with 9 genera and 10 species. Most of the cyanobacterial genera were represented by 1 to 3 species. However, the genera *Chroococcus* and *Aphanothece* followed by the genus *Oscillatoria* revealed the greatest species diversity with 4, 3 and 3 species respectively. The number of Cyanobacteria taxa observed (24 specific and subspecific taxa) was rather low due to the sampling method as taxa under 20 µm were not collected in the plankton net. More in-depth studies are needed to cover the entire Cyanobacteria diversity of the lagoon system. The present paper is a first attempt to point to the importance of the waters in the Aby Lagoon system.

Due to the shallowness of the open waters in the studied lagoon, and especially in the Tendo and Ehy with a maximum depth of 2.6 and 1.5 m respectively, it is not surprisingly that some benthic Cyanobacteria taxa occur (Seu-Anoï, 2012).

Four species (*Microcystis aeruginosa, Cylindrospermopsis raciborskii, Anabaena flos-aquae, Aphanizomenon flos-aquae)* recognized as having the potential to produce toxins were present in most samples of studied area. Therefore, the dominance of potentially toxic Cyanobacteria in the Aby lagoon system indicates the necessity to assess the potential hazards for human. This study on planktonic cyanobacteria will constitute the basis for further works on the dynamic and the possible toxicity of this community in the Aby lagoon system.

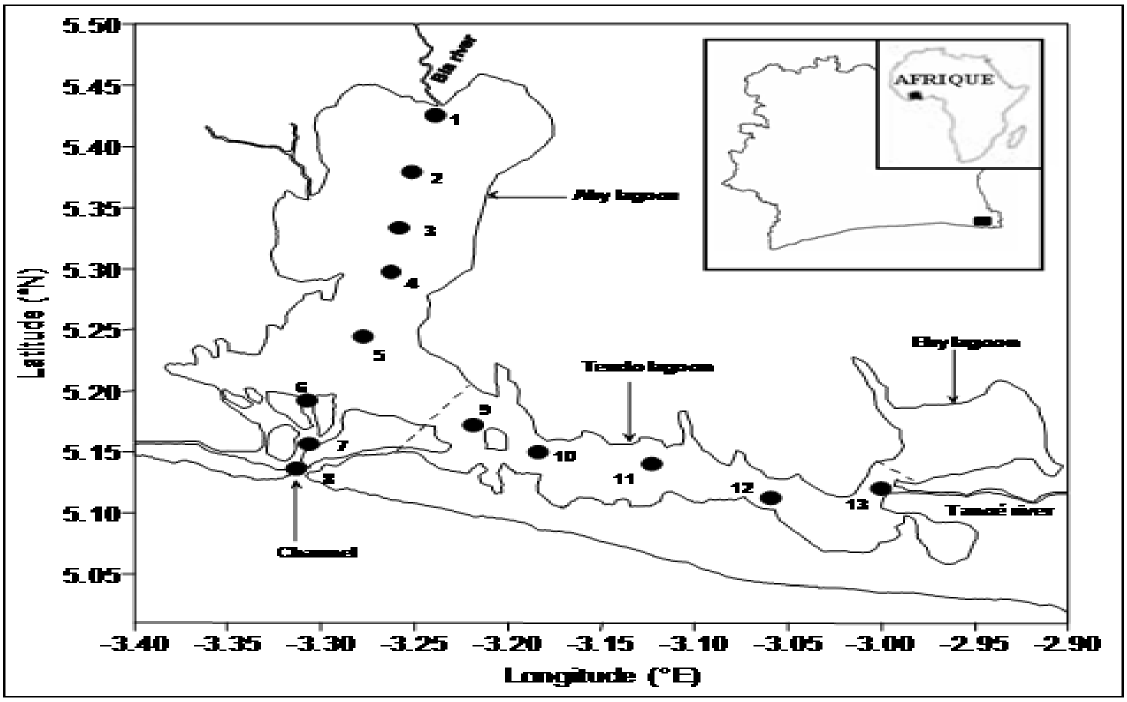

Fig. Location of the study stations in Aby lagoon system, Ivory Coast.

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