

Centric Diatoms sampled from Grand-Lahou, tropical coastal lagoon (Côte d'Ivoire).

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Abstract: A taxonomic survey of the Diatom (Bacillariophyta) was conducted with 20 µm mesh wide plankton net on ten stations in the Grand-Lahou lagoon complex. A total of 19 species have been identified and described. Each taxa is described and information about environmental characteristic of the sites where they were collected and distribution in Côte d'Ivoire. The studied taxa belong to the families Asterolampraceae (2), Coscinodiscaceae (3), Eupodiscaceae (3), Melosiraceae (5), Stellarimaceae (1), Chrysanthemodiscaceae (1) and Thalassiosiraceae (4). All taxa were recorded for the first time in Côte d'Ivoire.

[Komoé K, Touré A, Adou L M D. **Centric Diatoms sampled from Grand-Lahou, tropical coastal lagoon (Côte d'Ivoire)**. *Researcher* 2016;8(4):17-25]. ISSN 1553-9865 (print); ISSN 2163-8950 (online). <http://www.sciencepub.net/researcher>. 3. doi: [10.7537/marsrsj08041603](https://doi.org/10.7537/marsrsj08041603).

Key words: Centric diatoms, taxonomy, Grand-Lahou lagoon complex, Côte d'Ivoire.

1. Introduction

Diatoms are an extremely diverse group of unicellular algae that are uniquely characterized by a siliceous cell wall (the frustule) consisting of two valves (Round et al., 1990) and a diplontic life cycle involving gradual size reduction during vegetative divisions and rapid size restitution usually through sexual reproduction (Chepurnov et al., 2004). Diatoms are the photosynthetic micro algae found in almost every aquatic environment. These are found in both benthic and planktonic forms, classified as class Bacillariophyceae and orders centrales (which are radially symmetrical), (Hasle & Syvertsen, 1997).

In the tropical and subtropical regions, there is a large number of species which has not been yet described. The high possibility of extinction makes their inventory a priority.

The information about the centric Diatom flora of Côte d'Ivoire is incomplete and needs a careful revision on the basis of modern tools. The most recent and general analyses of this flora were held Maurer, 1978; Dufour & Durand, 1982; Couté & Iltis, 1985; Dufour, 1994; Ouattara et al., 2000; Komoé et al., 2009; Kouassi 2013; Seu-Anoi, 2012 and Konan 2014. The present paper represents centric diatom species identifications on the basis of light microscopy with new records of diatom species from Côte d'Ivoire.

2. Materials and methods

The Grand-Lahou Lagoon Complex (4°- 5°25' W, 5° 07'- 5°14' N, 190 km², mean depth of ca. 3 m) spreads about 50 km along the Gulf of Guinea coastline (Lecolle, 1971). It comprises four basins (Figure 1): Tadio lagoon (90 km², 2-3 m in maximum depth); Niouzoumou lagoon (15 km², 3 m in maximum depth); Mackey lagoon (28 km²) and Tagba Lagoon (57 km²) (Lae, 1982). The phytoplankton

samples for qualitative analyses were collected with a 20 µm mesh plankton net by vertical tows in the centre of the stream at every sampling station (Figure 1). The samples were transferred into plastic vessel (40 ml) and fixed with 40 % formalin buffered with borax to a final concentration of 5 % (Thronsen, 1978). The qualitative phytoplankton analysis was made with an Olympus microscope, type CX 31, equipped with digital camera for photographing, measuring and recording the photographs. The taxonomic classification used in this paper is based mainly on Round et al., 1990. In special cases, other authors are cited in the text. At each site, physical and chemical properties of water were recorded on monthly basis for one year from January to December 2005. Portable devices from multiparametric sounding (SET Model 351i) were used to measure the water temperature, conductivity and salinity, dissolved oxygen (YSI Model 57) and pH (Model 98158). Samples for other parameters (phosphates and nitrates) were kept in bottle and brought to laboratory for further analysis. Taxonomic determinations were mainly based on, Allen and Cupp 1935, Cupp (1943), Foged (1966, 1986), Carter & Denny (1982) and Simonsen (1987).

3. Results

The pH values varied between 6.63 and 9.23; surface temperature varied between 17.25 and 30.43°C and the conductivity between 0.5 and 41.64 mS cm⁻¹. The surface salinity varied between 0.25 and 26.95‰. Nitrates and phosphates values varied from 0.31 to 17.94 mg L⁻¹ and from 0.07 mg L⁻¹ to 2.24 mg L⁻¹ respectively. Taxonomic remarks: The different species observed are described alphabetically. Rule scale bars in illustrations represent 20 µm.

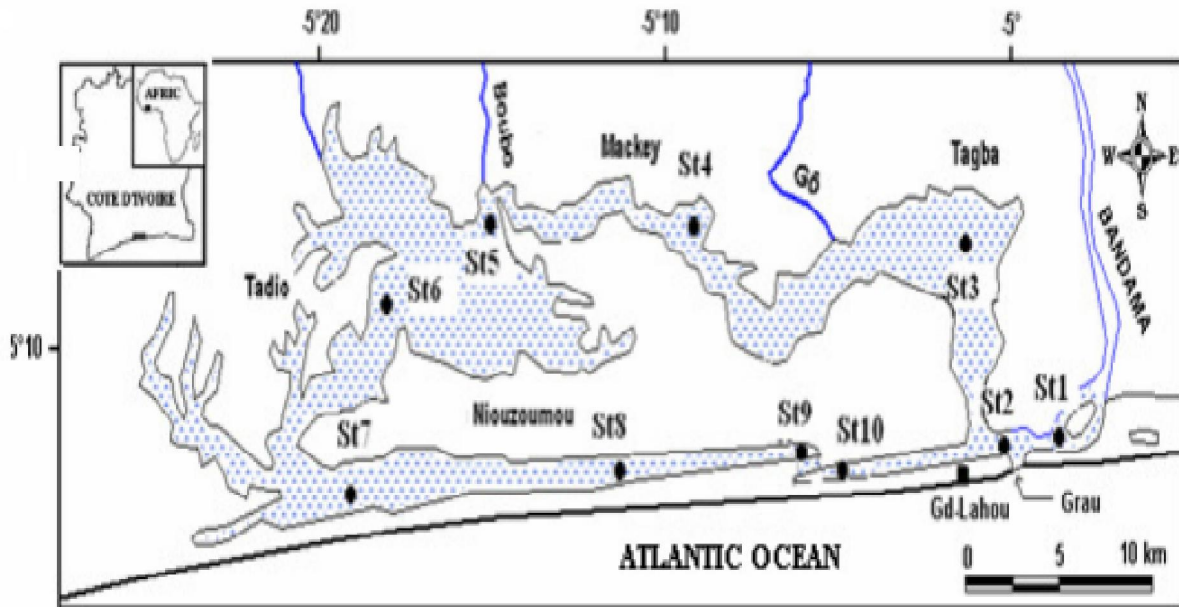


Figure 1: Map showing the sampling stations in the Grand-Lahou lagoon, Côte d'Ivoire

Family Asterolampraceae H.L. Smith emend. Gombos
Genus *Isthmia* Agardh

***Isthmia enervis* Ehrenberg**

Cells are united to form short chains, valves elongate, without costae, but well developed girdle with two distinct poles, one short and other slightly big.
 Valve surface and girdle areolate. Diameter: 30-40 µm
 Distribution: Marine, benthic. Station: 2
 Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time.



***Isthmia minima* Harvey & Bailey**

Asymmetric and dissimilar valves without costae and very large areolae are characteristic of the genus.
 Diameter: 67-80 µm, length 188-300 µm
 Distribution: Marine, benthic. Station: 2
 Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time.



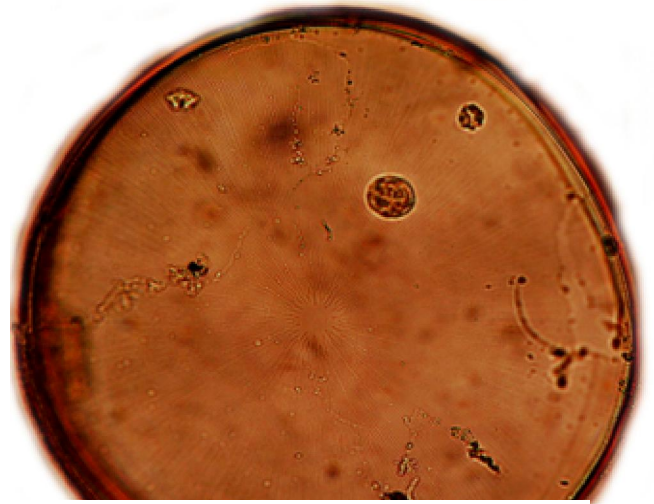
Family Coscinodiscaceae Kützing**Genus *Coscinodiscus* Kützing*****Coscinodiscus gigas* Ehrenberg**

Cells solitary. Distinct because of its size, valve diameter is between 300-500 μm . Central rosette is absent. 3-4 areolae in 10 μm . Areolae decreased their size towards valves margin.

Diameter of valves : 120-210 μm .

Distribution: Marine, oceanic, neritic, wide common, station 2

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time.

***Coscinodiscus perforatus* var. *pavillardii* (Forti) Hustedt**

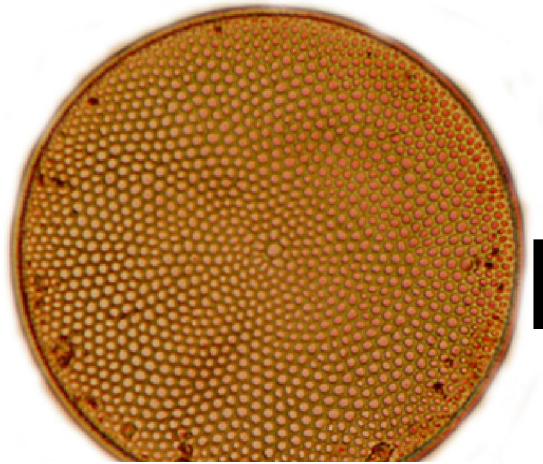
Similar to preceding variety except in the less regular distribution of the interstitial meshes which are not found before all the inserted radial rows of areolae. Central region varies in same material. A rosette formation was found

in all specimens examined. Chamber openings distinct.

Diameter of valves : 120-210 μm .

Distribution: Marine, oceanic, neritic, wide common, station 2

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time.

***Coscinodiscus radiatus* Ehrenberg**

Cells discoid, solitary, small to medium, thin, coin shaped. Valves mostly flat covered with strong polygonal areolation.

Indistinct central rosette of slightly larger areolae. Areolae in radial rows, sometimes in indistinct decussating arcs, rows long and short; areolae usually of uniform size throughout the whole valve surface, except at the margin, where they are much smaller.

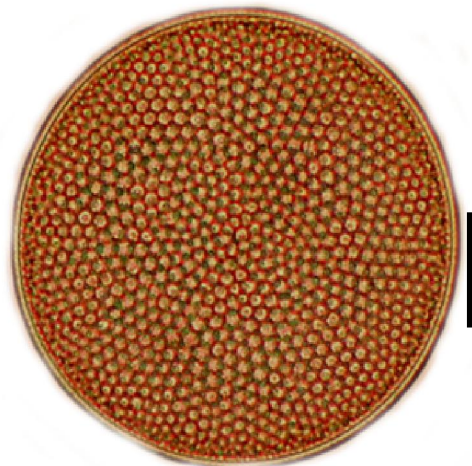
Girdle simple, narrow, striate.

Spinulae and apiculi absent.

Diameter 60-80 μm

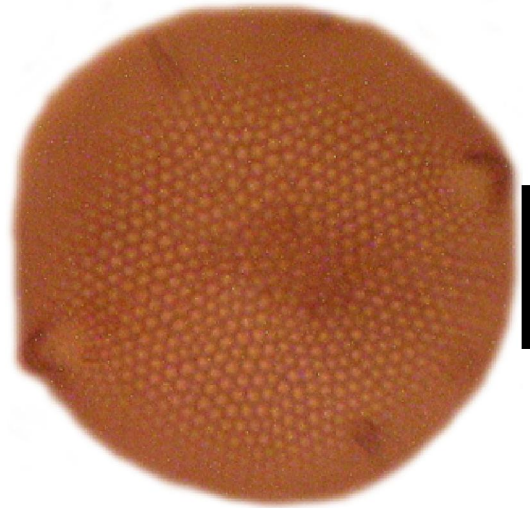
Distribution: Marine, oceanic, neritic, wide common, stations: 2 and 10

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time.



Family Eupodiscaceae Kützing**Genus *Cerataulus* (Roper) R. Ross*****Cerataulus radiatus* (Roper) R. Ross**

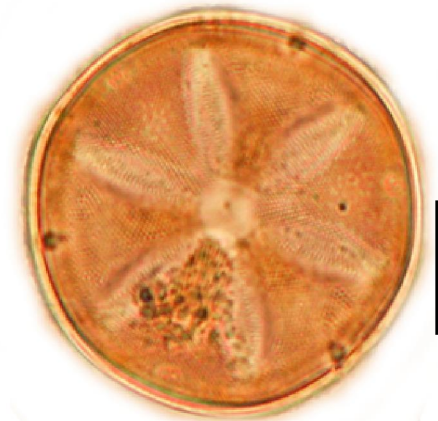
Cells solitary, elliptical or circular in valve view.
 Valvar view shows two stouts and two external tubules diametrically opposed lipped process.
 Diameter 35 -60 μ m; 10-12 areolae in 10 μ m.
 Stations: 2, 9 and 10.
 Distribution:
 Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

***Cerataulus turgidus* Ehrenberg**

Cells rectangular in girdle view with conspicuous ocelli twisted out of the perivalvar plane, surface convex. Processes very large, cylindrical, placed obliquely and inclined by the torsion of the frustule. Between the processes are two stouts pines, one on each side, frequently forked at the ends. Puncta fine, irregular at the centre and radiating toward the circumference.
 Dimensions: 48-60 μ m x 34-48 μ m, station 2
 Distribution: Marine, benthic.
 Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

**Genus *Actinoptychus* Ehrenberg*****Actinoptychus boliviensis* Janisch**

Cells discoid, solitary and circular in valve view.
 50 μ m in diameter, valves sectored (6 in the common) so that alternate sectors are elevated or depressed.
 Central area plain or granulate.
 This is a marine species, tropical, harvested at the station 10.
 Distribution: Marine, neritic and benthic.
 Distribution in Côte d'Ivoire: this tropical species is recorded for the first time in Côte d'Ivoire



Family Melosiraceae Kützing**Genus *Aulacoseira* Thwaites*****Aulacoseira italica* (Ehrenberg) Simonsen**

Mantle surface punctate, with puncta arranged in striae that wrap around the valve.

Diameter: 8-12 μm

Distribution: Littoral of freshwater streams and lakes, planktonic and benthic

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

***Aulacoseira lirata* (Ehrenberg) Ross**

Mantle height shorter than valve diameter

Diameter: 13-15 μm .

Distribution: Marine and brackish, benthic. Fresh water, planktonic, acidophilic

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

**Genus *Melosira* Agardh*****Melosira arctica* Dickie**

Cells elliptical or cylindrical with flattened ends, joined together in long chains by a marginal flange

Diameter: 12-16 μm .

Distribution: Marine, neritic.

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.



***Melosira lineata* (Dillwyn) Agardh**

Cells elliptical, seven in number, valves convex, don't possess hypospores but their surfaces are covered with areolae.

Diameter: 13- 17.1 μm

Distribution: marine species, cosmopolitan, harvested at Station 2.

Distribution: Gulf of Mexico, Caribbean Sea, U.S.A and Australian.

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire

***Melosira moniliformis* Agardh**

Cells short, cylindrical, in long chains. Diameter 23–60 μm .

Usually in process of division so are united in twos by girdle bands which have not yet separated.

Not keeled. Valves and girdle punctated, 22-24 in 10 μ on valve, 15 on girdle. In valve view puncta in partly radiating, mostly irregular short lines;

on valve mantle and girdle in more regular crossrows.

Valves circular, very convex, thick-walled, without local reinforcements on inner side.

Distribution: Marine and brackish, planktonic and benthic, wide common. Station

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire

**Genus *Stellarima* Hasle & Sims*****Stellarima stellaris* (Roper) Hasle & Sims**

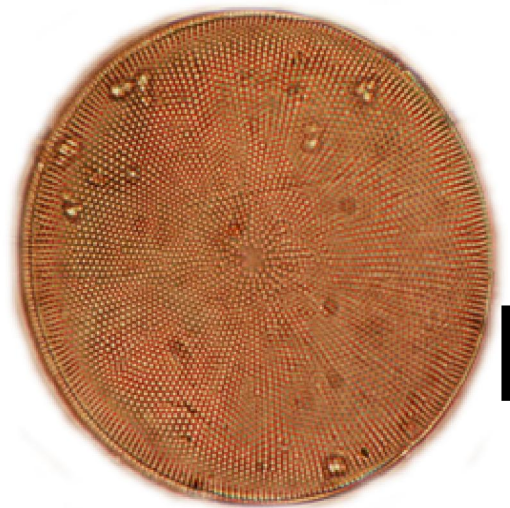
Cells with convex valves, 50–105 μm in diameter, thin-walled.

Valve surface areolated, areolae in more or less broad radial sectors within which the middle rows are nearly parallel and tangential secondary rows are concave toward the outside. Areolae 13 in 10 μm at center, 15-16 midway, and 17-20 near edge. In the center of the valve there are three irregular dark thickenings making a star like formation. No spinulae or apiculi.

No intercalary bands.

Distribution: Marine and brackish, planktonic and benthic, wide common

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.



Family Chrysanthemodiscaceae Round
Genus *Chrysanthemodiscus* Mann

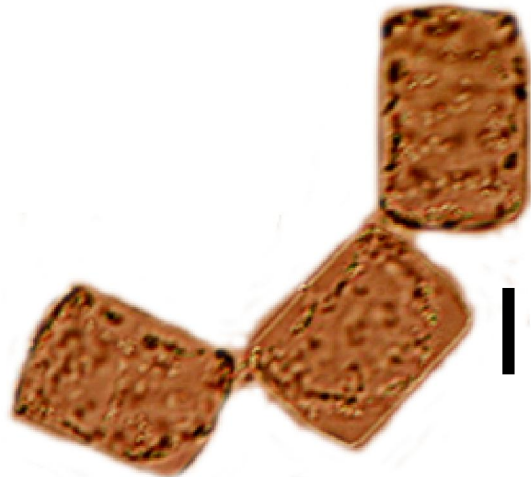
***Chrysanthemodiscus floriatus* Mann**

Cells, colonial and cylindrical in connective view, combined channel at a pseudocelle (umbilicus). Valves are strongly convex. An epiphytic, marine diatom with delicate cylindrical cells (often 4-6 times as long as wide) and convex valves, attached end-to-end by means of mucilage pads arising from the valve centres. Sometimes, however, cells are attached by pads near the valve margins and appear heterovalvate - one being domed and the other flatter and notched.

Diameter: 30-35 μm .

Distribution: Marine, wide common. Station 2

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.



Family Thalassiosiraceae Lebour emend. Hasle

Genus *Planktoniella* Schütt

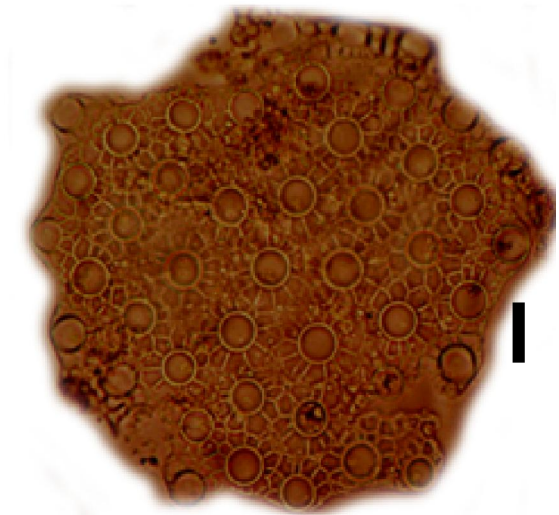
***Planktoniella muriformis* (Loeblich, Wight Darley) Round**

Cells discoid, in flat colonies. Cells in a matrix extruded from the girdle forming sheet like colonies. Colonial cells are immersed in a mucilaginous matrix. Radiating structures connect these cells to each other. The valvar view shows circular cells. Diameter: 11-14 μm .

This marine species observed in the tropics, was collected at stations 2, 3 and 10.

Distribution: marine, has only been recorded in tropical coastal regions.

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.



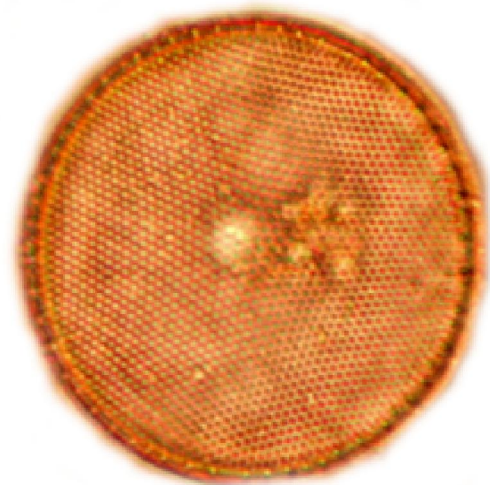
Genus *Thalassiosira* Cleve

***Thalassiosira excentrica* (Ehrenberg) Cleve,**

Cells disk-shaped. Valves almost flat, beveled edges, narrow margin. Spinulae arranged in irregular circle. Areolae hexagonal, arranged in slightly curved, nearly parallel rows, based on arrangement of seven divisions. Central areola with seven areolae grouped around it. Diameter: 30-60 μm .

Distribution: marine, wide distribution

Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

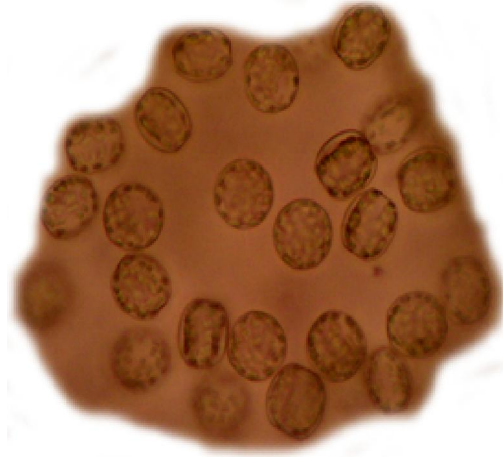


***Thalassiosira leptopus* (Grunow) Hasle & Fryxell.**

Cell of same shape as *Thalassiosira excentricus* but areolae in straight lines rather than curves. Diameter of valves 60-100 μm . Areolae slightly smaller near margins; 6 in 10 μm at center. Circular apertures of areolae or chamber openings usually distinct. Valve margin radially striated 7-12 striae in 10 μm . Marginal spinulae present and usually strong. Distribution: marine, neritic. Station 2 Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

***Thalassiosira subtilis* (Ostenfeld) Gran.**

Cells drum-shaped or boxlike, embedded in irregular gelatinous masses. Valves rounded, with a row of very small marginal spines, not visible in water, and one larger spine or apiculus. Sculpturing very delicate, even in mounted specimens difficult to see, only in the center some distinct scattered puncta. Cell diameter: 13-15 microns. Distribution: marine, wide common. Stations 2 and 9. Distribution in Côte d'Ivoire: this cosmopolitan species is recorded for the first time in Côte d'Ivoire.

**4 Discussion**

In the present study, nineteen centric diatoms, belonging to ten genera were recorded from the area. All the taxa were reported for the first time from Côte d'Ivoire. The studies of diatoms and their relationship to relative sea level in coastal and estuarine environments from the Côte d'Ivoire, however, are sparse. Taxonomic investigations on the diatom flora of Côte d'Ivoire are still very limited and most studies (Couté & Iltis, 1985; Lozo et al., 2014 and N'Guessan et al., 2014) were performed in Freshwater and oceanic area. The establishment of a diatom database would be an essential contribution to the conservation of Côte d'Ivoire's aquatic biodiversity. Most species described in the present study were inventoried during the long dry season (December to March), during which period, the marine waters invade the lagoon waters and during the short dry season (August). Indeed, August is the period of upwelling in the ocean, so we are witnessing has a nutrient recovery that cause algal blooms. The intrusion of seawater in

the lagoon complex would explain the presence of species in the samples taken.

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Reference:

1. Round F.E.; R.M. Crawford and D.G. Mann. The diatoms: biology and morphology of the genera. Cambridge University Press, Cambridge. 1990; 747p.
2. Chepurnov V.A, D.G. Mann, Sabbe K. and W. Vyverman. Experimental studies on sexual reproduction in diatoms. *Int. Rev. Cytol.* 2004; 237: 91-154
3. Hasle G.R. and E.E. Syvertsen, Marine diatoms. In *Identifying Marine Phytoplankton*, edited by

- Tomas, C.R. New York: Academic Press. 1997; pp. 5-386.
4. Maurer D. Phytoplancton et pollution : la lagune Ébrié (Abidjan), le secteur de Cortiou (Marseille). Thèse de Doctorat de 3e cycle d'Océanographie biologique. 1978, 121 p.
 5. Dufour P. and J.R. Durand. La production végétale des lagunes de Côte d'Ivoire. *Revue d'Hydrobiologie tropicale*. 1982 ; 15 (3) : 209-230.
 6. Couté A. and A. Iltis. Étude au microscope électronique à balayage de quelques Algues (Dinophycées et Diatomophycées) de la lagune Ébrié (Côte d'Ivoire).- *Nova Hedwigia*. 1985; 41 : 69-79.
 7. Dufour P. Les microphytes. In: J.R. Durand, P. Dufour, D. Guiral and S.G.F. Zabi. (Eds.), *Environnement et ressources aquatiques de Côte d'Ivoire*. Tome II. Les milieux lagunaires. 1994 ; pp. 109-136.
 8. Ouattara A, N. Podoor, G.G. Teugels ; G. Gourène. Les micro-algues de deux cours d'eau (Bia et Agnébi) de Côte d'Ivoire. *Syst. Geogr.* 2000. Pl., 70: 315-372.
 9. Komoé K., K. P. Da, A. M Kouassi, N. M. Aka, A. K. Kamanzi and A. A Ama. Seasonal distribution of phytoplankton in Grand-Lahou Lagoon (Côte d'Ivoire). *European Journal of Scientific Reseach*. 2009 ; Vol. 26 n°3, 329-341.
 10. Kouassi B.A.T. Taxonomie, composition floristique et dynamique spatio-saisonnière des algues périphytiques de la retenue d'eau d'Adzopé (Côte d'Ivoire). Thèse de Doctorat. Université Félix Houphouët Boigny (Côte d'Ivoire), 2013 ; 188 p.
 11. Seu-Anoi N.M. Structuration spatiale et saisonnière des peuplements phytoplanctoniques et variabilité des facteurs abiotiques dans trois complexes lagunaires de Côte d'Ivoire (Aby, Ebrié et Grand-Lahou). Thèse de Doctorat, Université Nangui Abrogoua, Côte d'Ivoire. 2014; 134p.
 12. Konan E. S. Distribution spatio-temporelle du peuplement phytoplanctonique en relation avec les facteurs abiotiques de la lagune de Fresco (côte d'ivoire). Thèse de Doctorat Université Félix Houphouët Boigny (Côte d'Ivoire). 2014 ; 178 p.
 13. Lecolle J. Sédimentologie des fonds lagunaires et estuariens: variations morphologiques saisonnières de l'embouchure d'un fleuve en climat intertropical (le Bandama-Côte d'Ivoire). *Cah. ORSTOM, Géol.* 1971 ; (3):189-220.
 14. Lae R. Premières observations sur la pêche en lagune de Grand-Lahou. DEA Océanographie tropicale (Université de Brest), 1982; 30 p.
 15. Thronsen J. Preservation and storage. In: *Phytoplankton manual*, ed. Sournia, UNESCO. 1978; pp. 69-74.
 16. Allen, W.E. and E.E Cup. Plankton diatoms of the Java Sea. *Annales du Jardin Botanique de Buitenzorg* 1936 ; 44(2):1-174.
 17. Cupp, E.E. Marine planktonic diatoms of the west coast of North America. *Bulletin of the Scripps Institution of Oceanography*. 1943; 5(1): 1-238.
 18. Foged N. Freshwater diatoms from Ghana. *Biologiske Skrifter udgivet af Det Kongelige Danske Videnskabernes Selskab*. 1966; 15: 1-169.
 19. Foged N. Diatoms in Gambia. *Bibliotheca Diatomologia*, 1986; 12: 1-153.
 20. Carter J.R. & P. Denny. Freshwater algae of Sierra Leone IV. Bacillariophyceae; Part (i) diatoms from the river Jong (Taia) at Njala. *Beihefte zur Nova Hedwigia*. 1982;73: 281-331.
 21. Simonsen R. Atlas and Catalogue of the Diatom Types of Friedrich Hustedt. J. Cramer, Berlin & Stuttgart. 1987; Vol. 1, 525 p., Vol. 2, 1-395 pls, Vol. 3, 396-772 pls.
 22. Lozo R. N., S. Berté, K. Komoé ; S. S. Yao and E.P Kouamélan. Bacillariophyceae (Heterokontophyta) from Bandama River in Côte d'Ivoire, West Africa, *Journal of Animal & Plant Sciences*. 2014; 2013. Vol.20, Issue 2: 3113-3121.
 23. N'Guessan K.R., C. E. Wetzel, L. Ector; M. Coste, C. Cocquyt, B. Van de Vijver, S. S. Yao, A. Ouattara, E.P Kouamélan and J. Tiso-Roseberty. *Planothidium comperei* sp. nov. (Bacillariophyta), a new diatom species from Ivory Coast. *Plant Ecology and Evolution* 2014; 147 (3): 455-462.