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Species of the Genus *Nitzschia* Hassall (Bacillariaceae Ehrenberg, Bacillariophyta) from Ngor (Dakar, Senegal): Descriptive Study and Proposal for a Determination Key

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Abstract **Original Research Article**

The objective of this work is to describe the taxa belonging to the genus *Nitzschia* encountered in the marine waters of Ngor (Senegal) and to propose a determination key. Observation of the samples collected between July 2009 and November 2011 has allowed to describe 7 taxa (*Nitzschia coarctata, N. granulata, N. lorenziana, N. panduriformis, N. scalpelliformis, N. sigma, N. spathulata*). A dichotomous determination key, based on morphological characters such as the shape of keels, frustules, valves and valves apices, has been proposed to facilitate their identification.

Keywords: *Nitzschia*; description; determination key; Ngor; Senegal.

INTRODUCTION

Diatoms are single-celled photosynthetic eukaryotes universally distributed in all types of aquatic environment. They are abundant, diverse, ubiquitous, and sensitive environmental indicators and, thus, have an enormous ecological importance [1]. Diatoms can be considered as the most sensitive algae to environmental conditions [2]. Many of them are used as indicators of organic pollution and high nutrient loads [3]. Species of the genus *Nitzschia* Hassall (Bacillariaceae Ehrenberg, Bacillariophyta) have a worldwide distribution in marine and freshwaters, and has been reported from many kinds of habitats, including both clean and highly polluted ones [4, 5]; *Nitzschia* contains many pollution-tolerant species [4] that have been used as indicators of deteriorated water quality [6, 7]. Also, the predominance of this genus is the usual feature of all diatomic populations [8]. The species belonging to the genus *Nitzschia* are distinguished by the presence of an eccentric unbroken keeled raphe on the opposite side of each valve, uniseriate striae and distinct keel puncta (fibulae) [9, 10]. But, the majority of them are identified by minute taxonomic features that are difficult to observe and document [11]. Therefore, it's important to know recognizing these species because their identification requires good taxonomic knowledge. The objective of this work is to describe *Nitzschia* taxa encountered in the marine waters of Ngor (Senegal) and to propose a determination key for facilitate their identification.

MATERIALS AND METHODS

Sampling was carried out in the marine waters of Ngor (Dakar, Senegal), between the village and the island of Ngor (14 ° 45'30"N and 17 ° 30'56"W, at 800 m to west); this, between July 2009 and November 2011 using a plankton net and by scraping surface of supports (rocks, PVC tubes, glass slides, etc.).

Sub-samples underwent a frustule cleaning treatment (calcination and chemical attack of the organic material) for the description and identification of the *Nitzschia* taxa.

From the morphological description and the identification of the various taxa belonging to the genus *Nitzschia* encountered, a dichotomous determination key, based on morphological characters, is proposed to facilitate their recognition.

RESULTS AND DISCUSSION

A total of seven *Nitzschia* taxa were observed.

Description of taxa

***Nitzschia coarctata* Grunow (Figure 1A)**

Synonyms: *Nitzschia punctata var. coarctata* (Grunow) Hustedt

Tryblionella coarctata (Grunow) Mann

Valves panduriform with broadly cuneate apices, short rostrate. Raphe strongly eccentric with keel puncta (fibulae). Transapical striae punctuate (8-10/10 µm) arranged in transverse rows, interrupted by a longitudinal fold.

Dimensions: length 50 µm, diameter 17 µm.

[12-15] described the species in the same way but [16-18] identified it as *Tryblionella coarctata* (Grunow).

Ecology and distribution: cosmopolitan marine species, brackish water.

***Nitzschia granulata* Grun. (Figure 1B)**

Synonym: *Tryblionella granulata* (Grunow) D.G.Mann 1990

Valves elliptic to elliptic-lanceolate; eccentric raph with clear keel puncta spaced equaly (6/10 µm); Transapical striae coarsely punctate (6/10 µm).

Dimensions: length 36 µm, diameter 12 µm.

The species is morphologically identical to those encountered by [13, 19, 20]. However, [17, 21, 22] named it *Tryblionella granulata* (Grunow) D.G.Mann 1990.

Ecology and distribution: marine species, along the coasts.

***Nitzschia lorenziana* Grunow (Figure 1C)**

Synonyms: *Nitzschia incurva var. lorenziana* (Grunow in Cleve & Grunow) (Ross, 1986)

Frustule sigmoid in cingulate view. Valves sigmoid, narrowly lanceolate with long, rostrated and rounded apex. Eccentric raphe, Keel puncta equally spaced; transapical striae. Two large bar-shaped chromoplasts extend on either side, of the center toward the apices.

Dimensions: length 80 µm, diameter 4-7 µm.

These same morphological characteristics were described by [15, 23-25].

Ecology and distribution: cosmopolitan species present along the marine coasts, in fresh or brackish water.

***Nitzschia panduriformis* Gregory 1857 (Figure 1D)**

Synonym.: *Psammodictyon panduriforme* (Gregory) Mann

Frustule rectangular. Linear-elliptic panduriform valves with concave sides, narrowed in the middle. Apices broadly cuneate. Marginal and strongly marked keel, 6 keel puncta / 10 µm. Valve surface with striae in transverse and oblique lines, 14-19 / 10 µm. Presence of a more or less distinct longitudinal fold in the apical axis.

Dimensions: length 78 µm, diameter 24 µm.

The species has been described under this name by [15, 19, 26] but [21, 27, 28] named it *Psammodictyon panduriforme* (Gregory) Mann.

Ecology and distribution: cosmopolitan marine, brackish, estuarine species.

***Nitzschia scalpelliformis* Grunow (Figure 1E)**

Valves linear, weakly sigmoid with slightly oblique and round apices. Keel almost central but slightly deflected in at the center of the valve. Fibulae evenly spaced (6-7 fibules/10 µm) with two central distant ones.

Dimensions: length 102-115 µm, diameter 6-7 µm.

These specimen has the same morphological characteristics as the species collected by [19, 23, 26, 29, 30].

Ecology and distribution: marine to brackish species, rarely freshwater.

***Nitzschia sigma* (Kützing) W. Smith (1853) (Figure 1F)**

Frustule linear sigmoid. Valves slightly sigmoid, linear, tapering to subacute apices. Keel eccentric and arrounded fibulae very refractive, 6 to 9/10 µm. Striae very fine, 20 to 24/10 µm.

Dimensions: length 74 µm, diameter 6-7 µm.

The same species was encountered by [1, 22, 25, 30, 27, 31].

Ecologie et distribution: cosmopolitan benthic marine and extremely euryhaline species, often found in the plankton.

***Nitzschia spathulata* Bréb. (Figure 1G)**

Frustules rectangular slightly convex at the middle, strongly spathulated at ends truncate. Two large plate-like chromoplasts extend on either side, of the center toward the apices, accompanied by longitudinal lines. Valves lanceolate, sub-acute with central keel. 4 to 5 carinal points / 10 µm; striae very fine.

Dimensions: length 52 µm, diameter 7 µm.

The same description has been made by [1, 24, 29, 32].

Ecology and distribution: cosmopolitan species, however more abundant in temperate seas.

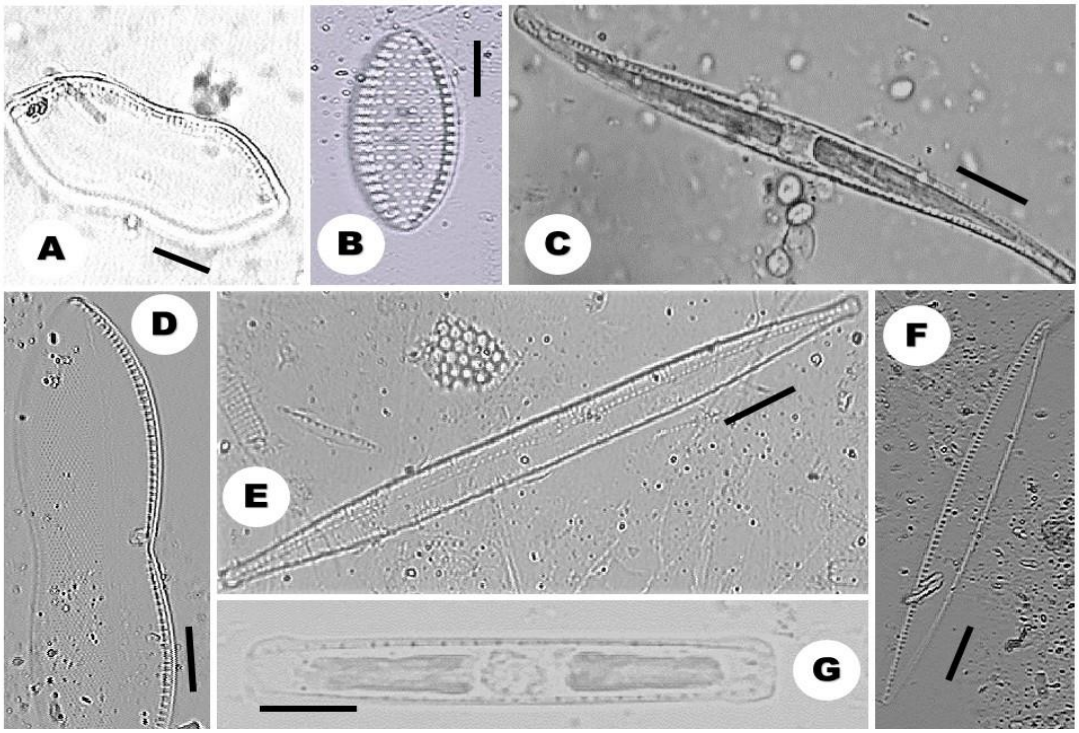

Figure 1: A: ***Nitzschia coarctata;*** **B:** ***Nitzschia granulata;*** **C:** ***Nitzschia lorenziana;*** **D:** ***Nitzschia panduriformis;*** **E:** ***Nitzschia scalpelliformis;*** **F:** ***Nitzschia sigma;*** **G:** ***Nitzschia spathulata.*** **Scales: 10 µm**

Proposal of a determination key for the species encountered

Among the species encountered in Ngor, only *Nitzschia. scalpelliformis* has an inflected keel in the middle and only *N. spathulata* has spathulate frustules at the ends. *Nitzschia coarctata* and *Nitzschia panduriformis* have panduriform valves with longitudinal row; their apices are broadly cuneate but shortly rostrate in the first and not rostrate in the second. If the valves are elliptical to elliptical-lanceolate in *Nitzschia granulata*, they are sigmoid in *Nitzschia sigma* and *Nitzschia lorenziana*. In the first, they are linear, tapering to subacute apices while in the second, they are narrowly lanceolate with long, rostrated and rounded apices.

Thus, we propose the following determination key.

Determination key of *Nitzschia* species

1. Keel inflected …….*Nitzschia scalpelliformis*

1’. Keel non inflected

2. Frustules spathulate at the ends
……..…….*Nitzschia spathulata*

2’. Frustules non spathulate at the ends

3. Valve panduriforme with longitudinal fold

4. Apices broadly cuneate, shortly rostrate
…….*Nitzschia coarctata*

4’. Apices broadly cuneate, non rostrate
……. *Nitzschia panduriformis*

3’. Valve non panduriforme without longitudinal fold

5. Valve sigmoid

6. Narrowly lanceolate with long, rostrated and rounded apices…….*Nitzschia lorenziana*

6’. Linear, tapering to subacute apices
……..…….*Nitzschia sigma*

5’. Valve elliptical to elliptical-lanceolate
……*Nitzschia granulata*

The shape of keels, frustules, valves and their apices are the main characters that have made it possible to develop the determination key of the 7 *Nitzschia* taxa encountered. Among these characters, the shape of valve and valve apices were cited by [9, 10] as important traits used to identify the species. The presence of long folds longitudinal simulating interruptions of the striae and keel curved towards the interior of the cell, in the central axis are distinctive characters used by [33] within the genus *Nitzschia*. Number of fibulae and striae, and the quotient between them are aussi important characters at species level [9, 10] but are not used here because, these are characters sometimes difficult to determine under a light microscope with frustules not or badly cleaned and provided with plasts. Also, there may be variations of some of these traits within a species. This is the case of *Nitzschia panduriformis* in which it has been noted, according to [34], a wide range of variation in striae density reported worldwide.

CONCLUSION

In this study, seven *Nitzschia* taxa were observed and described. An important determination key, based on characters such as the shape of the keels, frustules, valves and their apices, has been proposed to facilitate their recognition.

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