

Potentially Harmful Microalgae from the Southern-Central Coast of Cuba

Moreira, A.¹, Reguera, B.², Alonso, C.¹ & Comas, A.¹

¹ Cienfuegos Environmental Research Centre, PO Box 5, PC 59350, Cienfuegos, Cuba. E-mail: angel@gestion.ceac.cu, ² Spanish Institute of Oceanography, PO Box 1552, PC 36200, Vigo, Spain. E-mail: beatriz.reguera@vi.ieo.es

Abstract

Benthic and planktic toxic microalgae from the southern-central region of Cuba were surveyed intermittently between 2007 and 2009, mainly in the estuarine Cienfuegos Bay and its adjacent coast. The highest abundance of both benthic and planktic species were recorded in dry season and at the beginning of the rainy period which is directly correlated with a higher incidence of ciguatera and other episodes associated to harmful algal blooms. *Ostreopsis lenticularis* and *Gambierdiscus caribaeus* were the dominant benthic species in the eastern coast. After heavy rain, *Ostreopsis ovata* and *Prorocentrum lima* were dominant. Moderate abundance of the potentially ciguaterotoxic *Prorocentrum concavum*, *P.rathymum* and the dermatotoxic cyanophyte *Lyngbya majuscula* were registered on blooms of macroalgae. *Gymnodinium catenatum*, *Pyrodinium bahamense* and *Dinophysis ovum* were first reported in the region. Blooms of the diatom *Pseudo-nitzschia multistriata* have been observed in eutrophic zones. A small episode of dead fish was associated to blooms of *Heterocapsa circularisquama*. Other toxic or noxious species have been seen accompanying such as *Cochlodinium polykrikoides*, *Dinophysis caudata*, *Gonyaulax polygramma*, *G. spinifera* and *Prorocentrum minimum*. High abundance of the cyanobacteria *Planktothrix isoethrix*, *Pseudoanabaena* sp., *Dolichospermum solitarium* and *Microcystis aeruginosa* were registered in the bay after hurricanes.

Introduction

Coastal Cienfuegos Province in the southern-central part of Cuba (Fig. 1) is very diverse, with bays, lagoons, mangroves, coral reefs, and brackish rivers. Cienfuegos Bay is a semienclosed embayment of estuarine characteristics that represents the most important natural resource in the province, due to fishing activities, maritime transport, tourism industry, and natural parks. The northern part, with sewage input from the city of Cienfuegos (106 504 inhabitants), industrial waste and the inflow from Damují and Salado rivers, is under stronger anthropogenic impact than the southern part. Blooms of toxic and nontoxic dinoflagellates and diatoms occur near domestic waste discharged from Cienfuegos city, mainly at the end of the dry season and beginning of the rainy season, when temperatures increase and potential flushing is low. This province, like other regions in Cuba, is affected by ciguatera episodes. However, until 2005, there had only been one study of the taxonomy and ecology

of potentially benthic toxic dinoflagellates in one station of the bay. This paper describes recent occurrence of benthic and planktonic toxic microalgae at this region in Cuba.

Materials and methods

Planktonic species were sampled from 16 selected stations in Cienfuegos Bay (Fig. 1) every 3 months during 2009, as part of a monitoring program for water quality control. Plankton samples were collected by submerging a 5-L Niskin bottle below the surface and were preserved with modified Lugol solution. For the determination of densities, aliquots of concentrated samples were determined under a microscope in a Rigosha counting cell. For taxonomic purposes, samples were taken with a 20 µm mesh Nyltal net. Benthic dinoflagellates were surveyed using a mixture of the most abundant macroalgae as substrate in Cienfuegos Bay and its adjacent coast between 2007 and 2009.

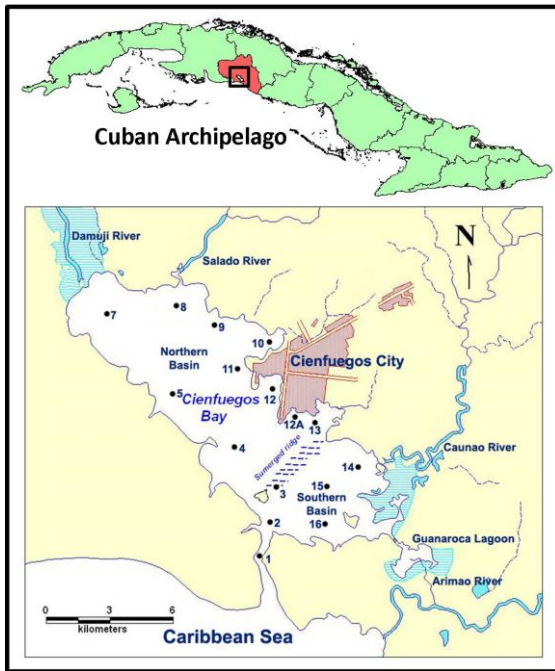


Fig. 1. Sampling stations in Cienfuegos Bay, Cuba

Results

Planktonic species

Gymnodinium catenatum, potential producer of PSP toxins, was reported for the first time in the southern part of Cuba. It was mainly found in the southern cleaner waters of the Bay. The maximum concentration was detected at station 14 (3.3×10^4 cells L^{-1}). Four-celled chains were predominant, but pairs, triplets and 6 to 8 celled chains were also observed (Fig. 2). In the Caribbean Sea, *G. catenatum* associated with PSP outbreaks was first reported in Venezuela (La Barbera 1993). The potential PSP producer *Pyrodinium bahamense* was first reported in Cuba. Cells were singular (Fig. 2) and not in chains, the latter a characteristic of the non-toxic *Pyrodinium var. bahamense*. It was observed off the Bay (concentrations up to 6.3×10^3 cells L^{-1}) in the eastern littoral in the beginning of the dry season (Nov. 2008).

Among the potential DSP-toxin producers, the most frequently observed species (concentrations up to 10^3 cells L^{-1}) were *Dinophysis caudata* and *D. ovum* (Fig. 2), which was more abundant in areas subjected to anthropogenic and riverine inputs. This is the first report for Cuban waters of *D. ovum* that

has recently been associated with a toxic outbreak in Texas (Gulf of Mexico).

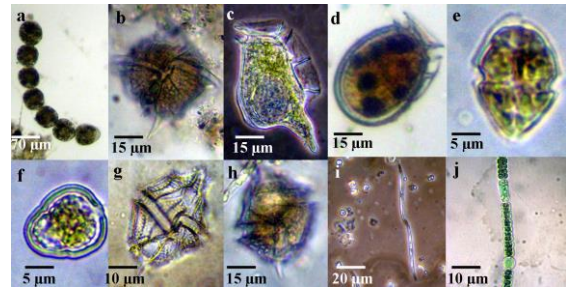


Fig. 2. Some potentially planktic toxic species: a. *Gymnodinium catenatum*, b. *Pyrodinium bahamense*, c. *Dinophysis caudata*, d. *D. ovum*, e. *Heterocapsa circularisquama*, f. *Prorocentrum minimum*, g. *Gonyaulax polygramma*, h. *G. spinifera*, i. *Pseudo-nitzschia multistriata*, j. *Dolichospermum solitarium*.

At the beginning of the rainy season, July 2009, about 50 to 100 dead fish were observed near domestic waste discharged from Cienfuegos city, near station 12, coinciding with blooms of *Heterocapsa*. Cell shape and the position of the nucleus and pyrenoid coincided with the description of *H. circularisquama* (Horiguchi 1995). Cells of this dinoflagellate were abundant in the fish's gills, but cells of the benthic *Amphidinium cf. carterae*, which produce haemolytic ichthyotoxins, were also found. Other toxic or noxious species have been seen accompanying blooms such as *Cochlodinium cf. polykrikoides*, *Dinophysis caudata*, *Prorocentrum minimum*, *Gonyaulax polygramma* and *G. spinifera* (Fig. 2).

The presence of a high concentration of the potentially amnesic toxic diatom *Pseudo-nitzschia cf. multistriata* was detected in a bloom of diatoms at station 10, with a density of $1.1 \cdot 10^6$ cells L^{-1} during the late dry period. Blooms of other *Pseudo-nitzschia* (*delicatissima* group) and the presence of *Pseudo-nitzschia cf. pungens* have been reported. Potentially toxic freshwater cyanobacteria were detected in high concentration in the bay after tropical storms and hurricanes (e.g. Dennis Hurricane in 2005), including *Planktothrix isoethrix*,

Pseudoanabaena sp., *Dolichospermum solitarium* and *Microcystis aeruginosa* (Fig. 2).

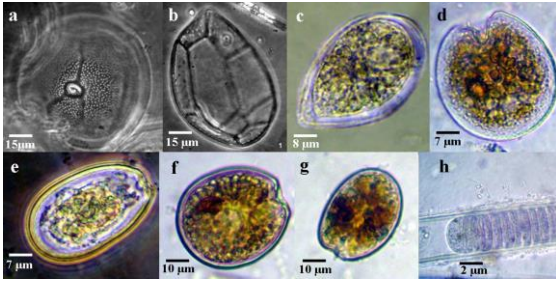


Fig. 3. Some potentially benthic toxic species: a. *Gambierdiscus caribaeus*, b. *Ostreopsis lenticularis*, c. *O. ovata*, d. *Prorocentrum emarginatum*, e. *P. lima*, f. *P. concavum*, g. *P. rathymum*, h. *Lyngbya majuscula*.

Benthic species

During the dry season of 2007 in an embayment off Cienfuegos Bay, *Ostreopsis lenticularis* (101 cells g^{-1} wet weight) and *Gambierdiscus caribaeus* (53 cells g^{-1}) were dominant. The 2007 rainy season has been one of the wettest in recent years, and seems to have affected the benthic vegetation in the embayment, as witnessed by lower diversity and abundance of the macroalgae and an increase in suspended particles. After the rainy period, the structure of the benthic dinoflagellate community changed radically, and *Ostreopsis ovata* (203 cells g^{-1}) and *Prorocentrum lima* (94 cells g^{-1}) were the dominant (Fig 3).

In July 2008 in the western part of the province, *Prorocentrum concavum* (150.5 cells

g^{-1}) was dominant, together with *P. emarginatum* (8.2 cells g^{-1}). At the same date in Cienfuegos Bay, *P. concavum* ($3.3 \cdot 10^3$ cells g^{-1}), *P. rathymum* (3.1×10^3 cells g^{-1}), *P. lima* ($2.1 \cdot 10^2$ cells g^{-1}) and *Lyngbya majuscula* ($3.0 \cdot 10^3$ cells g^{-1}) were recorded on blooms of macroalgae (Fig 3). *Gambierdiscus caribaeus* was only found in the canal which links the bay to the Caribbean Sea.

These are the first records of *Ostreopsis lenticularis*, *O. ovata* and *Prorocentrum emarginatum* in Cuba. The presence of this wide variety of potentially toxic benthic species may be linked to outbreaks of ciguatera in the region, and refute the belief that the south of Cuba is unaffected by this syndrome. Despite the need to increase these data, the results of this survey combined with epidemiological studies provide evidence of a high incidence of ciguatera in the southern central part of the island during the dry season (November– April) (Maya 2007).

Acknowledgements

To the HAB Program (COI– UNESCO) and the OIEA project on toxic algal blooms in the Caribbean region (ARCAL RLA, 7/014).

References

- La Barbera, A. (1993). FONAIAP–Centro de Investigaciones Agropecuarias del Estado Sucre, Venezuela. Serie A, 98 pp.
- Horiguchi, T. (1995). *Phycol. Res.* 43: 129–136.
- Maya, C.M. (2007). *Rev. Cubana Hig. Epidemiol.* 45: 31–40.