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Research note

New records of benthic diatoms (Bacillariophyceae) for Mexico in the Nayarit littoral found in gut contents of *Crassostrea corteziensis* (Mollusca: Bivalvia)

Nuevos registros de diatomeas bentónicas (Bacillariophyceae) para México en el litoral de Nayarit encontradas en el contenido intestinal de Crassostrea corteziensis (Mollusca: Bivalvia)

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Abstract

Research on benthic diatom floristics from Mexican littorals is scarce. For the coasts of Nayarit, within the NW region, no formal floristic studies were hitherto available. However, during identification of diatoms found in the gut contents of *Crassostrea corteziensis* from Nayarit wetlands, 9 benthic diatom taxa that constitute new species records for the Mexican littorals were observed and they are here described and depicted. © 2017 Universidad Nacional Autónoma de México, Instituto de Biología. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Keywords: *Crassostrea corteziensis*; Gut contents; Wetlands

Resumen

Los estudios florísticos de diatomeas bentónicas en los litorales mexicanos son escasos. Para la costa de Nayarit, dentro de la región noroeste, no existían estudios florísticos formales; sin embargo, durante la identificación de diatomeas encontradas en el contenido intestinal de *Crassostrea corteziensis* en un humedal de Nayarit, fueron observados y descritos 9 taxones de diatomeas bentónicas que constituyen nuevos registros para México.

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Palabras clave: *Crassostrea corteziensis*; Contenido intestinal; Humedales

Most of the benthic marine diatom species from Mexican littorals have been recorded for the northwestern region (Siqueiros-Beltrones, Argumedo-Hernández, & López-Fuerte, 2017), particularly for both coasts of the Baja California penin-

sula. According to the later authors, the scarce investigation on benthic diatom floristics in Mexican littorals favors the expectations that further surveys for most regions would yield new records of benthic diatom species. For the coasts of Nayarit, located within the NW region, no formal floristic studies on benthic diatoms were hitherto available. However, focusing on the diet of the Cortez oyster *Crassostrea corteziensis* (Hertlein, 1951), an economically important mollusk in Nayarit, the need to formally identify the diatom species found in the gut contents

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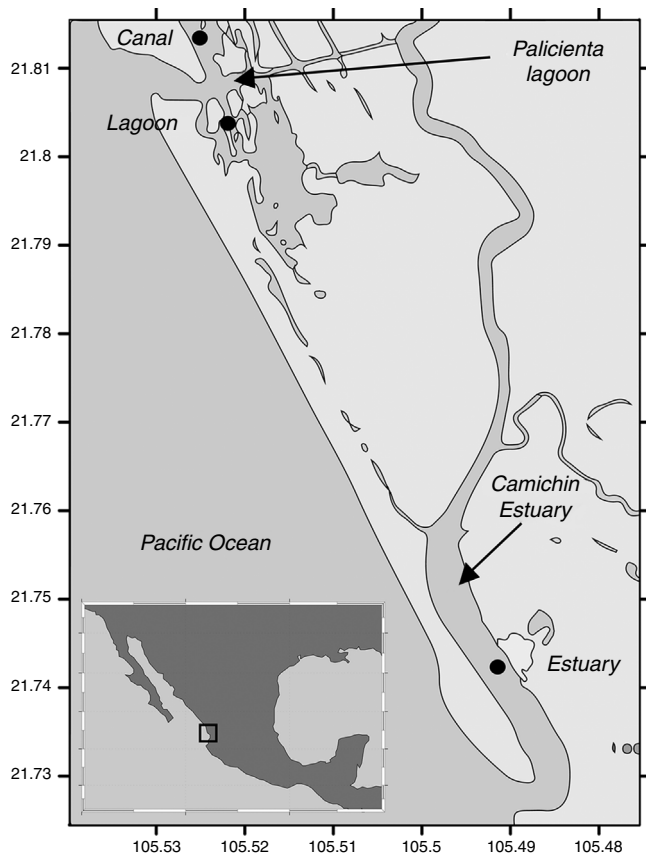


Figure 1. Location of the sampling sites in Camichin estuary and Palicmenta lagoon, Nayarit, Mexico.

of specimens of this species was evidenced. In the process, 9 benthic diatom species that constitute new records for the Mexican littorals were observed and are here described and represented iconographically.

We sampled 3 sites: estuary, canal and lagoon, located within the Biosphere Reserve Marismas Nacionales (Fig. 1), where 130 specimens of *C. cortezensis* were collected from 3 substrata: culture lines, mangrove roots, and sediments; samples were extracted in November 2013, March and June 2014. The digestive system of all the specimens were extracted and oxidized using Siqueiros-Beltrones and Voltolina (2000) technique to obtain cleaned diatoms. Diatoms were identified under a Carl Zeiss GmbH® Axiolab.A1 phase contrast microscope at 1000× (with digital camera) following Cleve-Euler (1953), Desikachary (1989), Foged (1975, 1978), Krammer and Lange-Bertalot (1997), Park et al. (2012), Ricard (1987) and Witkowski, Lange-Bertalot, and Metzeltin (2000).

Achnanthes bergii Cleve-Euler, 1953 (Fig. 9).

Dimensions: $L = 12.6 \mu\text{m}$, $W = 5.8 \mu\text{m}$; 26–28 striae/10 μm . Reference: Cleve-Euler (1953, p. 36, fig. 545a). Occurrence: rare, June. Other distribution: Finnland, Stockholm (Europe). Habitat: freshwater.

Achnanthes separata Hustedt, 1958 (Fig. 6).

Dimensions: $L = 27.6 \mu\text{m}$, W at center = 10 μm , at apices = 5 μm ; 10 striae/10 μm . Reference: Witkowski et al. (2000, pl. 43, p. 528, fig. 9). Occurrence: rare, June. Other distribution: shatt-al-Arab Delta (Asia). Habitat: freshwater.

Amphora ayensuensis Foged, 1966 (Fig. 5).

Dimensions: $L = 29.4 \mu\text{m}$, $W = 6 \mu\text{m}$; 13 striae/10 μm . Reference: Foged (1978, pl. 36, p. 218, fig. 6). Occurrence: rare, June. Other distribution: Australia, New Zealand, Africa. Habitat: freshwater.

Cymatothea minima Voigt, 1960 (Fig. 8).

Dimensions: $L = 10.2 \mu\text{m}$, $W = 10 \mu\text{m}$; 8 striae/10 μm ; 10 areolae/10 μm . Reference: Ricard (1987, p. 162, fig. 151). Occurrence: abundant, November, March, June. Other distribution: China, Taiwan (Asia). Habitat: marine.

Frustulia weinholdii Husted, 1937 (Fig. 3).

Dimensions: $L = 48 \mu\text{m}$, $W = 9.6 \mu\text{m}$; 29 striae/10 μm . Reference: Krammer and Lange-Bertalot (1997, p. 634, fig. 12–14). Occurrence: rare, June. Other distribution: Europe, Japan, South Africa, North America, South America, Australia and New Zealand. Habitat: freshwater.

Nitzschia ligowskii Lange-Bertalot, Kocielek et Brzezinska in Witkowski et al. (2004) (Fig. 4).

Dimensions: $L = 32.7 \mu\text{m}$, W at center = 7.1 μm , at apex = 4.2 μm ; 14 fibulae/10 μm , 25 striae/10 μm . Reference: Park et al. (2012, p. 120, fig. 7T). Occurrence: abundant, March. Other distribution: Europe, Canada (Arctic), Atlantic Islands, North America, South Africa, Galápagos Islands, Antarctic, subantarctic islands, Ariake Sea, Japan (Asia). Habitat: marine.

Nitzschia vexans Grunow in Van Heurck, 1881 (Fig. 10).

Dimensions: $L = 9 \mu\text{m}$, $W = 3.5 \mu\text{m}$; 16 striae/10 μm . Reference: Witkowski et al. (2000, pl. 184, p. 810, fig. 5–8). Occurrence: rare, November. Other distribution: Netherlands (Europe); Great Lakes, United States of America; Australia and New Zealand. Habitat: freshwater.

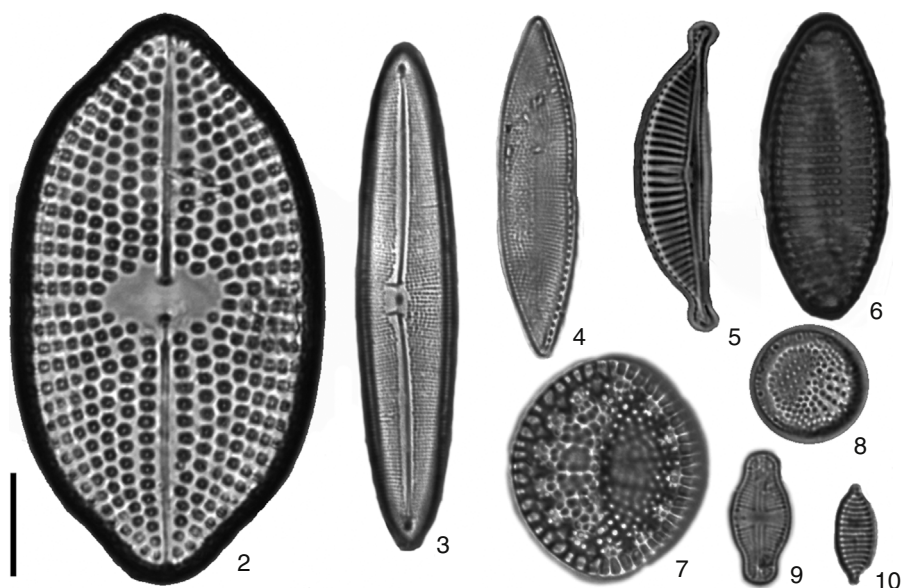
Petroneis arabica (Grunow) D. G. Mann, 1990 (Fig. 2).

Dimensions: $L = 63.5\text{--}68 \mu\text{m}$, $W = 34.4\text{--}35 \mu\text{m}$; 6 areolae/10 μm . Reference: Foged (1975, pl. 21, p. 106, fig. 6). Occurrence: rare, March, June. Other distribution: West Indies (North Atlantic Ocean); Florida; Port Jackson, Uruguay; China (Asia). Habitat: marine.

Trybliptychus cocconeiformis (Grunow) Hendey, 1958 (Fig. 7).

Dimensions: $L = 21 \mu\text{m}$, $W = 18 \mu\text{m}$; 4 striae/1 fascicle. Reference: Desikachary (1989, pl. 809, fig. 1–8). Occurrence: rare, November, March, June. Other distribution: Ariake Sea, Japan, China; South-east Asia: Singapore; Argentina, Brazil; Atlantic Islands. Habitat: marine.

In this report, we add 9 new diatoms species to the Mexican Benthic Diatom Species Checklist by López-Fuerte and Siqueiros-Beltrones (2016). Also, this confirms the Siqueiros-Beltrones et al. (2017) statement that further surveys would yield new species records for the Mexican littorals. The influence of freshwater in the area is evidenced with the presence of 5 taxa from freshwater habitats. Certainly, the convergence of marine and continental waters is expected to influence diatom species diversity. Much floristic work is needed if ecological and biogeographical models of distribution are to be constructed; the above is particularly true for countries like México, where biodiversity related studies are still required for certain taxonomic groups such as benthic diatoms either fresh-water or marine (Novelo & Tavera, 2011).



Figures 2–10. New records of benthic diatom from Nayarit littoral. 2) *Petronis arabica*, 3) *Frustulia weinholdii*, 4) *Nitzschia ligowskii*, 5) *Amphora ayensuensis*, 6) *Achnantes separata*, 7) *Tryblioptychus cocconeiformis*, 8) *Cymatotheca minima*, 9) *Achnanthes bergii*, 10) *Nitzschia vexans*. Scale bar 10 μm .

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