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RESEARCH NOTE

Unarmored dinoflagellates present during a bloom of *Ceratoperidinium falcatum* in Bahía de La Paz, Gulf of California

Dinoflagelados desnudos presentes durante un florecimiento de *Ceratoperidinium falcatum* en Bahía de La Paz, Golfo de California

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Abstract.- During a sampling on 16-17 January 2013 in the southwest part of Bahía de La Paz, a moderate bloom of the dinoflagellate *Ceratoperidinium falcatum* was detected. Its abundance varied from 11,200 to 145,400 cells L^{-1} during this period in seawater temperature at 23°C and salinity of 35.42. The specimens were solitary cells. Few two-celled chains were observed. Young cells were relatively small, 30-70 µm long; 17-36 µm wide, from ovately elongate to fusiform. Mature individuals were 40-190 µm long and 20-36 µm wide. Including *C. falcatum*, 21 species belonging to 5 orders of unarmored dinoflagellates were identified during this bloom. Four species are new records for the Gulf of California and three are new records for the Pacific coast of Mexico.

Key words: Unarmored dinoflagellates, proliferation, *Ceratoperidinium falcatum*, Gulf of California

INTRODUCTION

Microalgae proliferations are frequent and periodic throughout the year in Bahía de La Paz in the southwestern part of the Gulf of California (Gárate-Lizárraga *et al*. 2001, 2006). The majority of red tides along both coast zones of the gulf have been produced by dinoflagellate species (Cortés-Altamirano 2002, Gárate-Lizárraga *et al.* 2001, 2006) and proliferations of naked dinoflagellates are common (Cortés-Altamirano 2002, Gárate-Lizárraga *et al*. 2004a). *Noctiluca scintillans*, *Gymnodinium catenatum*, *Gyrodinium instriatum*, *Cochlodinium polykrikoides*, *C. fulvescens*, *Katodinium glaucum* and *Amphidinium carterae* are the most common blooming species recorded in Bahía de La Paz (Gárate-Lizárraga 2012, Gárate-Lizárraga *et al*. 2001, 2004a, 2006, 2009).

The unarmored dinoflagellates comprise several orders which lack cellulose plates, but have a membranous outer covering of small vesicles (Hallegraeff *et al*. 2010). Main unarmored dinoflagellates orders reported in Bahía de La Paz are: Gymnodiniales, Brachidiniales, Noctilucales and Actiniscales. Most studies of Gymnodiniales have been focused on the species responsible for harmful algal blooms, which are abundant in coastal waters of the Gulf of California (Cortés-Altamirano 2002, Gárate-Lizárraga *et al*. 2001, 2009; Gárate-Lizárraga 2012, 2014). This report describes the first proliferation of *Ceratoperidinium falcatum* (Kofoid *et* Swezy) Reñé *et* de Salas in Bahía de La Paz. Composition of naked dinoflagellate species during this proliferation is given.

MATERIALS AND METHODS

Bahía de La Paz is the largest bay on the east side of Baja California Peninsula. The bay constantly exchanges water with the Gulf of California through a wide northern and a southern opening (Gómez-Valdés *et al*. 2003). The main northern channel is wide and deep (up to 300 m), while the southern mouth is shallow and associated with a shallow basin about 10 m deep. There is a shallow lagoon, the Ensenada of La Paz, connected to the bay by a narrow inlet (1.2 km wide) with an average depth of 7 m. As part of a continuing toxic or noxious microalgae monitoring program, phytoplankton bottle samples were collected monthly at one fixed sampling station in the bay (Fig. 1; station 1, 24°21'N, 110°31'W) and another one in the mouth of the lagoon (Fig. 1; station 2, 24.23°N; 110.34°W). Phytoplankton samples were collected into plastic flasks, fixed with Lugol's solution and later preserved with 4% formalin. Identification and cell counts were made in 5 ml settling chambers and the cells were studied under an inverted Carl Zeiss phase-contrast microscope (Utermöhl 1958). Both surface and vertical tows from 15 m depth were made with a phytoplankton 20 µm mesh net. A portion of each sample was immediately fixed with acid

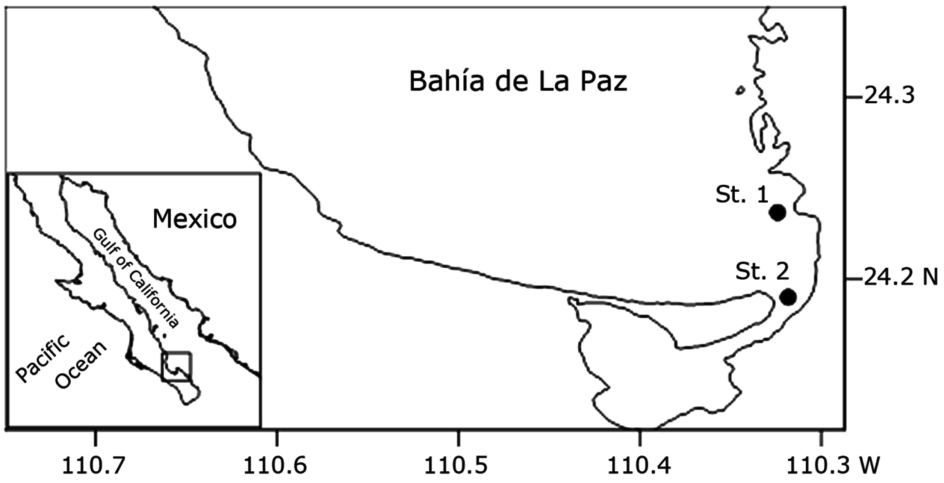

Figure 1. Map of the study area indicating sampling stations for microalgae monitoring in Bahía de La Paz / Mapa del área de estudio indicando las estaciones de monitoreo de microalgas en la Bahía de La Paz

Lugol's solution and later preserved in 4% formalin. Live phytoplankton samples were used to properly identify some uncommon species also found in the bottle samples. Sea surface temperature was measured with a bucket thermometer (Kahlsico International, El Cajon, CA, USA). Salinity was measured with a refractometer (Model STX3, Vee Gee Scientific, Kirkland, WA). An Olympus CH2 compound microscope was used to measure cells. A digital Konus camera (8.1 MP) recorded images.

Results and discussion

Ceratoperidinium falcatum was the main responsible species in the proliferation detected at the mouth of Bahía de La Paz on 16-17 January 2013. Seawater temperature was 23°C and salinity was 35.42. The specimens were solitary cells (Figs. 2A-L). Few two-celled chains were observed. Young cells were solitary, relatively small, 30-70 µm long, 17-36 µm wide, from ovately elongate to fusiform (Figs. 2A-D). Mature individuals were 40-190 µm long and 20-36 µm wide (n= 30). Some mature specimens had 'article cells' (Figs. 2J-K), which are more differentiated and the apex is thickened, matching those observed by Konovalova (2003). It is likely that these 'cells' bear generative functions of the mother sporont organism (Konovalova 2003). These 'article cells' can be observed in live specimens, (Fig. 2J) but also in fixed cells (Figs. 2K-L). Retractile appendices (both apical and antapical) are present at least during some life-cycle stages (Figs. 2G-L). According to Konovalova (2003), *C. falcatum* has about 9 developmental stages in its life cycle. Five life stages were observed during this event (Figs. 2A-L), coinciding with Konovalova (2003) and also reported by Gárate-Lizárraga *et al.* (2010) in Bahía de La Paz.

Unarmored dinoflagellates abundance varied from 29,000 to 193,000 cells L^{-1}. Abundances of *C. falcatum* during this event were moderate (11,200-145,400 cells L^{-1}). Gárate-Lizárraga *et al.* (2009) reported *C. falcatum* in Bahía de La Paz ranging from 1000-2000 cells L^{-1}. Alonso-Rodríguez *et al.* (2010) reported very low densities of *C. falcatum*: 603 cells L^{-1} from Islas Marietas and 1672 cells L^{-1} in Bahía Banderas. This species is well distributed along the Pacific coast of Mexico (Gárate-Lizárraga *et al.* 2007, 2010; Maciel-Baltazar & Hernández-Becerril 2013). Including *C. falcatum*, a total of 21 species belonging to 5 orders of naked dinoflagellates were identified during this bloom (Table 1; Figs. 2-3). The most representative order was Gymnodiniales with 14 species (Table 1). *Gymnodinium gelbum*, *Gyrodinium lachryma*, and *Takayama tasmanica* are new records for the Pacific coast of Mexico. *Achradina pulchra*, *Gyrodinium acutum*, *Karenia bicuneiformis* and *Pronoctiluca spinifera* are new records for the Gulf of California. The measurements and regional distribution data for each species are given and the species are alphabetically arranged.

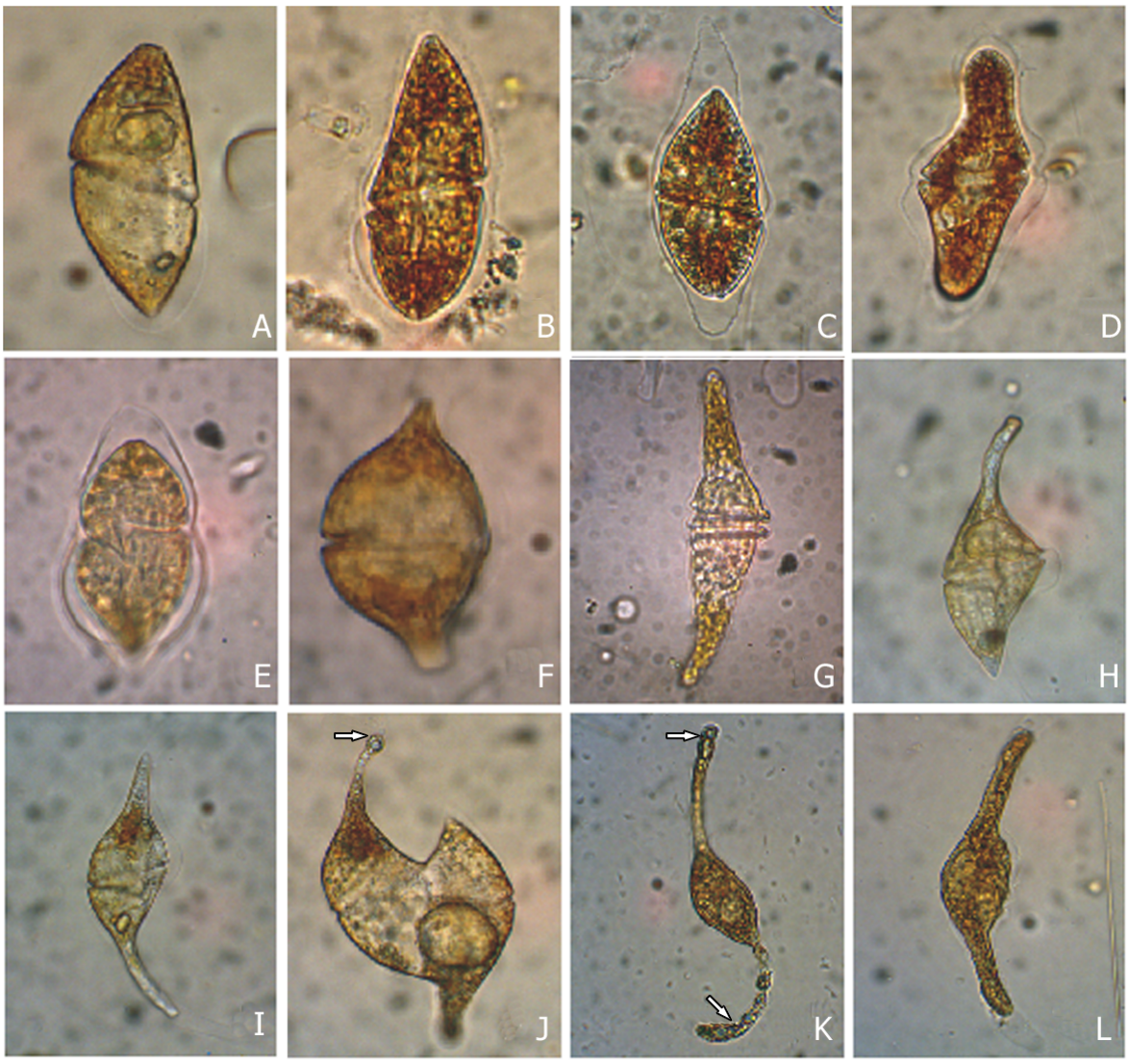

Figure 2. Micrographs of different stages in the life cycle stages of *Ceratoperidinium falcatum* in Bahía de La Paz. A-F) Immature specimens at the stage of hyaline cysts; G-L) Mature specimens; J) A dividing mature specimen of *C. falcatum*; K-L) Two specimens of *C. falcatum* fixed in Lugol's solution. Arrows indicate well-diferentiated articulate cells with generative functions of the mother sporont / Microfotografías de diferentes estadios del ciclo de vida de *Ceratoperidinium falcatum* encontrados en Bahía de La Paz. A-F) Especímenes inmaduros en estado de quistes hialinos; G-L) Especímenes maduros; J) Un espécimen maduro de *C. falcatum* dividiéndose; K-L) Dos especímenes maduros de *C. falcatum* fijados con Lugol. Las flechas indican células articuladas bien diferenciadas que tienen funciones generativas del esporonte madre

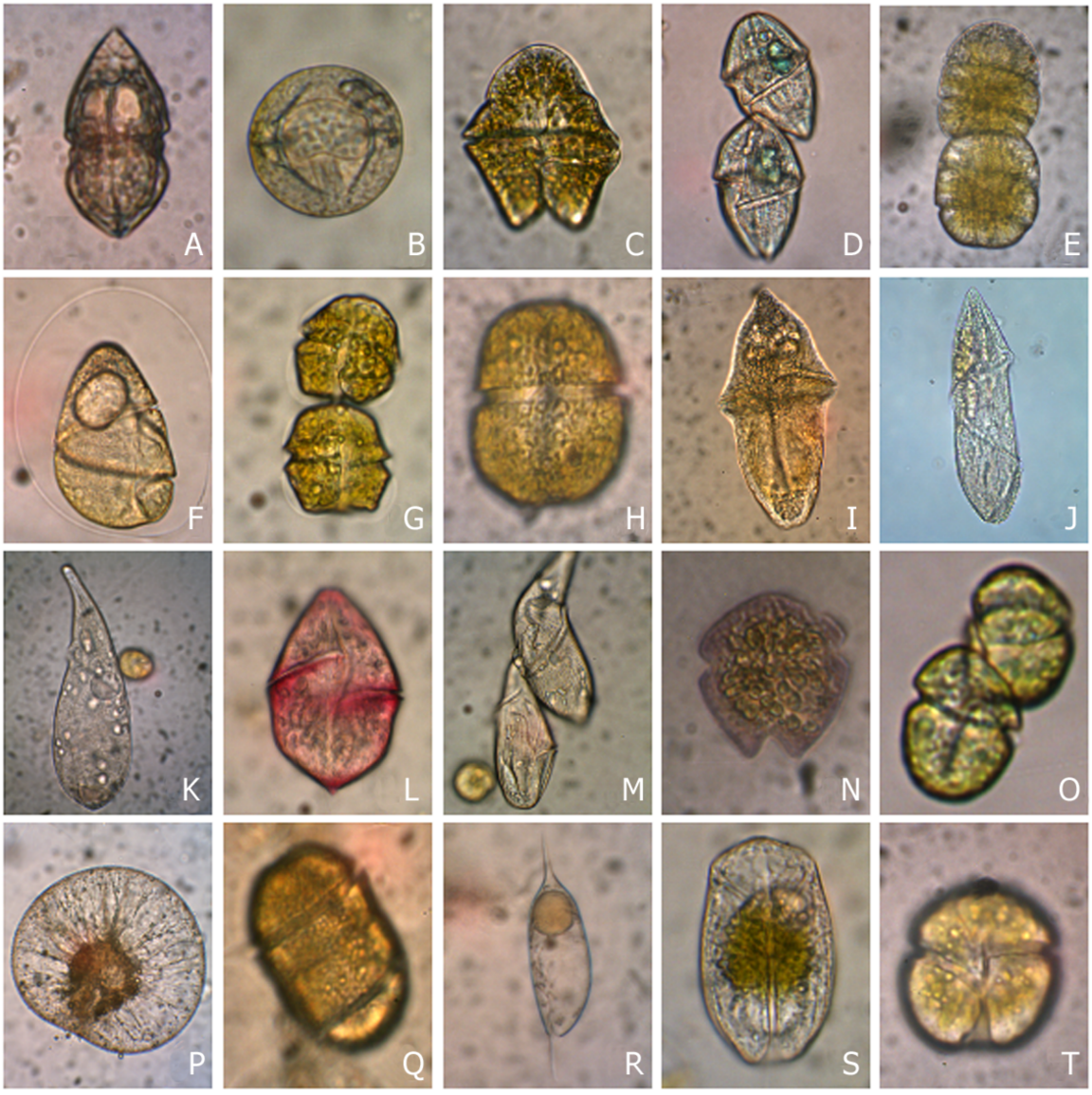

Figure 3. Light microphotographs of unarmored dinoflagellates detected during the proliferation of *Ceratoperidinium falcatum* in Bahía de La Paz. A) *Achradina pulchra*, B) *Actiniscus pentasterias*, C) *Akashiwo sanguinea*, D) Two-celled chain of *Balechina coerulea*, E) *Cochlodinium fulvescens*, F) Hyaline cyst of *Cochlodinium pirum*, G) *Gymnodinium catenatum*, H) *Gymnodinium gelbum*, I) *Gymnodinium gracile*, J) *Gyrodinium acutum*, K) *Gyrodinium lachryma*, L) *Gyrodinium rubrum*, M) *Gyrodinium spirale*, N) *Karenia bicuneiformis*, O) Two cells of *Lepidodinium chlorophorum*, P) *Noctiluca scintillans*, Q) Two-celled chain of *Polykrikos hartmannii*, R) *Pronoctiluca spinifera*, S) Immature specimen of *Spatulodinium pseudonoctiluca*, T) *Takayama tasmanica* / Microfotografías de luz de dinoflagelados desnudos detectados durante la proliferación de *Ceratoperidinium falcatum* en la Bahía de La Paz. A) *Achradina pulchra,* B) *Actiniscus pentasterias,* C) *Akashiwo sanguinea,* D) Cadena de dos células de *Balechina coerulea,* E) *Cochlodinium fulvescens,* F) Quiste hialino de *Cochlodinium pirum,* G) *Gymnodinium catenatum,* H) *Gymnodinium gelbum,* I) *Gymnodinium gracile,* J) *Gyrodinium acutum,* K) *Gyrodinium lachryma,* L) *Gyrodinium rubrum,* M) *Gyrodinium spirale,* N) *Karenia bicuneiformis,* O) Dos células de *Lepidodinium chlorophorum,* P) *Noctiluca scintillans,* Q) Cadena de dos células de *Polykrikos hartmannii,* R) *Pronoctiluca spinifera,* S) Espécimen inmaduro de *Spatulodinium pseudonoctiluca,* T) *Takayama tasmanica*

Table 1. Abundance of unarmored dinoflagellates detected during the proliferation of *Ceratoperidinium falcatum* at 16-17 January 2013 in Bahía de La Paz / Abundancia de dinoflagelados desnudos detectados durante la proliferación de *Ceratoperidinium falcatum* entre el 16-17 de enero 2013, en Bahía de La Paz

Unarmored dinoflagellates species	Order	Station 1 (cells L^{-1}) 16/01/2013	Station 1 (cells L^{-1}) 17/01/2013	Station 2 (cells L^{-1}) 16/01/2013	Station 2 (cells L^{-1}) 17/01/2013
Achradina pulchra	Amphilothales	200	0	0	200
Actiniscus pentasterias	Actiniscales	200	0	600	1200
Akashiwo sanguinea	Gymnodiniales	0	0	600	200
Ceratoperidinium falcatum	Gymnodiniales	24400	11200	145400	52800
Balechina coerulea	Gymnodiniales	400	400	200	200
Cochlodinium fulvescens	Gymnodiniales	7600	10800	4400	600
Cochlodinium pirum	Gymnodiniales	0	0	400	0
Gymnodinium catenatum	Gymnodiniales	28200	5800	7200	11400
Gymnodinium gelbum	Gymnodiniales	1200	200	400	600
Gymnodinium gracile	Gymnodiniales	0	0	600	400
Gyrodinium acutum	Gymnodiniales	200	0	200	0
Gyrodinium lachryma	Gymnodiniales	0	0	400	200
Gyrodinium rubrum	Gymnodiniales	800	0	400	0
Gyrodinium spirale	Gymnodiniales	1200	200	200	0
Karenia bicuneiformis	Brachidiniales	400	0	800	0
Lepidodinium chlorophorum	Gymnodiniales	200	0	0	400
Noctiluca scintillans	Noctilucales	4200	200	28800	2400
Polykrikos hartmannii	Gymnodiniales	0	0	800	0
Spatulodinium pseudonoctiluca	Noctilucales	200	0	800	0
Pronoctiluca spinifera	Noctilucales	200	200	200	0
Takayama tasmanica	Brachidiniales	400	0	600	0
Total unarmored dinoflagellates abundance		70000	29000	193000	70600

ACHRADINA PULCHRA LOHMANN (FIG. 3A)

References: Schiller 1937, p. 5, figs. 2 a-c; Hernández-Becerril & Bravo-Sierra 2004, p. 420, figs. 5-8; Meave del Castillo *et al*. 2012, 426, figs. 43-44; Omura *et al*. 2012, p. 134, *Achradina pulchra* (a-f).

Dimensions: cells are 34-42 μm long and 18-26 μm wide.

Regional distribution: Recorded from the west coast of Baja California Peninsula, to the Gulf of Tehuantepec (Hernández-Becerril & Bravo-Sierra 2004). Recently reported in Bahía de Acapulco (Meave del Castillo *et al*. 2012). This is the first record for the Gulf of California.

ACTINISCUS PENTASTERIAS (EHRENBERG) EHRENBERG (FIG. 3B)

Basionym: *Dictyota pentasterias* Ehrenberg

References: Hernández-Becerril & Bravo-Sierra 2004, p. 419, figs. 2-4; Hoppenrath *et al*. 2009, p. 132, fig. 55g-h; Gárate-Lizárraga 2012, p. 46, figs. 73-74; Omura *et al*. 2012, p. O 75, *Actiniscus pentasterias* (a-f).

Dimensions: cells are 32-50 μm long and 32-40 μm wide.

Regional distribution: recorded along the west coast of the Baja California Peninsula and from the Gulf of California to the Gulf of Tehuantepec (Okolodkov & Gárate-Lizárraga, 2006, Gárate-Lizárraga 2012, Gárate-Lizárraga *et al*. 2014).

Akashiwo sanguinea (K.Hirasaka) G.Hansen & Ø.Moestrup (Fig. 3C)

Basionym: *Gymnodinium sanguineum* K.Hirasaka

Synonyms: *G. splendens* M. Lebour, *G. nelsonii* G.W. Martin

References: Lebour 1925: 43, pl. 5, fig. 1; Avancini *et al.* 2006, p. 265, figs. A-C; Hoppenrath *et al.* 2009, p. 124, figs. 53k-l; Hallegraeff *et al.* 2010, p. 147, fig. 1.

Dimensions: cells are 40-86 μm long and 30-52 μm wide.

Regional distribution: bloom-forming species found along the Pacific coast of Mexico (Gárate-Lizárraga *et al.* 2001, 2007, 2014; Okolodkov & Gárate-Lizárraga 2006).

Balechina coerulea (Dogiel) F.J.R.Taylor (Fig. 3D)

Basionym: *Gymnodinium coeruleum* Dogiel

References: Taylor 1976, p. 113, pl. 37, fig. 447; pl. 40, fig. 481; Steidinger & Tangen 1997, p. 461; Gárate-Lizárraga *et al.* 2009 p. 22, fig. 20.

Dimensions: cells are 98-102 μm long and 50-53 μm wide.

Regional distribution: along the Pacific coast of Mexico (Okolodkov & Gárate-Lizárraga 2006, Meave del Castillo *et al.* 2012, Maciel-Baltazar & Hernández-Becerril 2013).

Ceratoperidinium falcatum (Kofoid *et* Swezy) Reñé *et* de Salas (Figs. 2A-L)

Basionym: *Gyrodinium falcatum* Kofoid & Swezy 1921

Synonyms: *Gymnodinium fusus* Schütt (1895) per parte, incl. only fig. 81, pl. 25. *G. caudatum*, *Pseliodinium vaubanii* Sournia (1972).

References: Okolodkov & Dodge 1997: 356, figs. 3-8, 27-28; Konovalova 2003, p. 169, figs. 1-9; Gómez 2007, p. 275, figs. 2-22; Gárate-Lizárraga *et al.* 2010, p. 54, figs. 2-21; Reñé *et al.* 2013, p. 678, figs. 3a-c.

Dimensions: mature individuals are 40-190 μm long and 20-36 μm wide.

Regional distribution: well-distributed along the Pacific coast of Mexico (Okolodkov & Gárate-Lizárraga 2006, Gárate-Lizárraga *et al.* 2010, Maciel-Baltazar & Hernández-Becerril 2013).

Cochlodinium fulvescens M. Iwataki, H. Kawami & K. Matsuoka (Fig. 3E)

References: Iwataki *et al.* 2007, p. 235, figs. 1-9; Matsuoka *et al.* 2008 p. 264, figs. 3A-G. Morquecho-Escamilla & Alonso-Rodríguez 2008, p. 5, figs. 2A-C.

Dimensions: cells are 50-64 μm long and 38-42 μm wide.

Regional distribution: has been reported in Bahía de La Paz (Gárate-Lizárraga *et al.* 2009, Gárate-Lizárraga 2014), Bahía de Mazatlán (Morquecho-Escamilla & Alonso-Rodríguez 2008) and Bahía de Acapulco (Meave del Castillo *et al.* 2012).

Cochlodinium pirum (Schütt) Lemmermann (Fig. 3F)

Basionym: *Gymnodinium pirum* Schütt

References: Schütt 1895 p. 166, pl. 23, figs. 76: 1-4; Kofoid & Swezy 1921, p. 374, pl. 9, fig. 101; text figure GG, 3.

Dimensions: cells are 68-70 μm long and 38-42 μm wide.

Regional distribution: recorded once for the Pacific coast of Mexico (Caballasi-Flores 1985). This is the first report in the Bahía de La Paz.

Gymnodinium catenatum H.W. Graham (Fig. 3G)

References: Graham 1943, p. 259, figs. 1-2; Cortés-Altamirano *et al.* 1999, p. 52, figs. 2a-c; Gárate-Lizárraga *et al.* 2004b, p. 298, figs. 2A-D.

Dimensions: cells are 28-40 μm long and 30-32 μm wide.

Regional distribution: broadly distributed along the Mexican Pacific (Okolodkov & Gárate-Lizárraga 2006, Band-Schmidt *et al.* 2010). It is the main species responsible for red tides along the Pacific coast of Mexico (Graham 1943, Mee *et al.* 1986, Cortés-Altamirano *et al.* 1999, Gárate-Lizárraga *et al.* 2004b, 2009, Díaz-Ortíz *et al.* 2010, Quijano-Scheggia *et al.* 2012).

Gymnodinium gelbum Kofoid (Fig. 3H)

References: Kofoid 1931, p. 13, pl 1. fig. 1; Wood 1968, p. 65, fig 163; Elbrächter 1979, p. 7, figs. 10-11,

Dimensions: cells are 42-51 μm long and 34-36 μm wide.

Regional distribution: first record for the Pacific coast of Mexico. Few records of *G. gelbum* have been reported worldwide (Kofoid 1931, Wood 1963, 1968, Elbrächter 1979). In the past, it is possible that specimens fixed in Lugol's solution could be confused with single cells of *Gymnodinium catenatum* because they are very similar.

Gymnodinium gracile Bergh (Fig. 3I)

References: Elbrächter 1979, p. 7, figs. 12-15, Hoppenrath *et al.* 2009, p. 124, figs. 53a-f; Gárate-Lizárraga 2012, p. 46, fig. 67.

Dimensions: cells are 85-129 μm long and 50-65 μm wide.

Regional distribution: broadly distributed along the Pacific coast of Mexico (Okolodkov & Gárate-Lizárraga 2006, Gárate-Lizárraga 2012).

Gyrodinium acutum (Schütt) Kofoid & Swezy (Fig. 3J)

Basionym: *Gyrodinium spirale* var. *acuta* Schütt

References: Schütt 1895, p. 164, pl. 21, fig. 66 Kofoid & Swezy 1921, p. 274, fig. CC, 7.

Dimensions: cells are 136-140 μm long and 40-43 μm wide.

Regional distribution: previously reported in the Bahía de Acapulco, Guerrero (Meave del Castillo *et al*. 2012). This is the first report in the Gulf of California.

Gyrodinium lachryma (Meunier) Kofoid & Swezy (Fig. 3K)

Basionym: *Spirodinium lachryma* Meunier

References: Kofoid & Swezy 1921, p. 314, fig. EE, 6; Lebour 1925, p. 43, fig. 14c; Dodge 1982, p. 98, fig. 12C; Hallegraeff *et al*. 2010, p. 155, fig. 4.6A

Dimensions: cells are 90-112 μm long and 40-52 μm wide.

Regional distribution: new record for the Pacific coast of Mexico.

Gyrodinium rubrum (Kofoid & Swezy) Takano & T.Horiguichi (Fig. 3L)

Basionym: *Gymnodinium rubrum* Koifoid & Swezy

References: Kofoid & Swezy 1921, p. 253, fig. A, Y4, pl. 8, fig. 86.

Dimensions: cells are 70-120 μm long and 30-59 μm wide.

Regional distribution: this species have been previously reported twice; Meave del Castillo & Hernández-Becerril (1998) in the Gulf of Tehuantepec, Oaxaca and in Bahía de La Paz (Okolodkov & Gárate-Lizárraga 2006). This is the second report for Bahía de La Paz.

Gyrodinium spirale (Bergh) Kofoid & Swezy (Fig. 3M)

Basionym: *Gymnodinium spirale* Bergh

References: Kofoid & Swezy 1921, p. 332, pl. 4, fig. 43, fig. DD, 14; Hulburt 1957, p. 202, pl. 3, fig. 4, Hallegraeff *et al*. 2010, p. 155, fig. 4.6B.

Dimensions: cells are 70-96 μm long and 34-38 μm wide.

Regional distribution: broadly distributed along the Pacific coast of Mexico (Okolodkov & Gárate-Lizárraga 2006). Densities of 30,000 cells L^{-1} were reported in Bahía de La Paz (Gárate-Lizárraga *et al*. 2009). Blooms of this species have occurred in shrimp farms with densities ranging from 424 to 1200 x 10^3 cells L^{-1}.

Karenia bicuneiformis Botes, Sym & Pitcher (Fig. 3N)

References: Botes *et al*. 2003, p. 566-568, figs. 10-19; Hallegraeff *et al*. 2010, p. 149, fig. 4.4A-D; Maciel-Baltazar & Hernández-Becerril 2013, p. 248, fig. 2O.

Dimensions: cells are 32-36 μm long and 30-34 μm wide.

Regional distribution: Meave del Castillo & Zamudio-Reséndiz (2012) report that *K. bicuneiformis* is restricted to Bahía de Acapulco and the Gulf of Tehuantepec; also reported by Maciel-Baltazar & Hernández-Becerril (2013). This is the first record for the Gulf of California.

Lepidodinium chlorophorum (M. Elbrächter & E. Schnepf) Gert Hansen, L. Botes & M. de Salas (Fig. 3O)

Basionym: *Gymnodinium chlorophorum* M. Elbrächter & E. Schnepf

References: Elbrächter & Schnepf 1996, p. 382, gs. 1-3; Hoppenrath *et al*. 2009, p. 124, fig. 53g; Hallegraeff *et al*. 2010, p. 147, fig. 4.2G, Omura *et al*. 2012, p. 76, *Lepidodinium chlorophorum* (a-h).

Dimensions: cells are 20-26 μm long and 14-16 μm wide.

Regional distribution: This species was previously recorded by Gárate-Lizárraga *et al*. (2014) in Bahía de La Paz. This is the second record for the Pacific coast of Mexico. Two-celled specimens of *L. chlorophorum* were observed. The formation of chains is not known in this species. Therefore they could be fusing or dividing cells.

Noctiluca scintillans (Macartney) Kofoid & Swezy (Fig. 3P)

Basionym: *Medusa scintillans* Macartney

Referencias: Steidinger & Tangen 1997, p. 466, pl. 23; Avancini *et al*. 2006, p. 361, figs. A-C; Esqueda-Lara & Hernández-Becerril 2010, p. 179, figs. 172a-b.

Dimensions: cells are 410-800 μm in diameter.

Regional distribution: Broadly distributed along the Pacific coast of Mexico (Okolodkov & Gárate-Lizárraga 2006). One of the most common species that form red tides in the Gulf of California (Gárate-Lizárraga *et al*. 2001, 2006).

Polykrikos hartmannii Zimmermann (Fig. 3Q)

Taxonomic synonym: *Pheopolykrikos hartmannii* (Zimmerman) Matsuoka & Fukuyo References: Hulburt 1957, p. 204, pl. 4, fig. 7, Gárate-Lizárraga *et al*. 2009, p. 21, figs. 30, 31; Hoppenrath *et al*. 2009, p. 31, figs. 2A-C.

Dimensions: cells are 70-74 μm long and 60-64 μm wide.

Regional distribution: Scarcely reported in the Pacific coast of Mexico (Okolodkov & Gárate-Lizárraga 2006, Gárate-Lizárraga *et al*. 2009). It was recently recorded in the Gulf of Tehuantepec (Maciel-Baltazar & Hernández-Becerril 2013).

Pronoctiluca spinifera (Lohmann) Schiller (Fig. 3R)

References: Taylor 1976, p. 188, pl. 37, fig. 429; Dodge 1982, p. 112, fig. 13G; Omura *et al*. 2012, p. 133, *Pronoctiluca spinifera* (a-d), Maciel-Baltazar & Hernández-Becerril 2013, p. 188, fig. 3G.

Dimensions: cells are 22-26 μm long and 10-14 μm wide.

Regional distribution: scarcely reported along the west coast of Baja California Sur (Gárate-Lizárraga *et al*. 2007); recently in the Gulf of Tehuantepec (Maciel-Baltazar & Hernández-Becerril 2013). This is the first report for the Gulf of California.

Spatulodinium pseudonoctiluca (Pouchet) Cachon & Cachon ex Loeblich & Loeblich (Fig. 3S)

Basionym: *Gymnodinium pseudonoctiluca* Pouchet

References: Dodge 1982, p. 136, fig. 16D; Avancini *et al*. 2006, p. 413, figs. A-C; Hoppenrath *et al*. 2009, p. 132, figs. 55g-h; Gárate-Lizárraga 2011, p. 35, figs. 11-14.

Dimensions: young cells are 82-86 μm long and 34-42 μm wide.

Regional distribution: from Bahía Magdalena to the Gulf of Tehuantepec (Okolodkov & Gárate-Lizárraga 2006, Gárate-Lizárraga 2011).

Takayama tasmanica de Salas, Bolch & Hallegraeff (Fig. 3T)

References: de Salas *et al*. 2003, p. 1235, fig. 2-12; Hallegraeff *et al*. 2010, 149, figs. 4.4E–G.; Gu *et al*. 2013, 260, figs. 21-27.

Dimensions: cells are 16-27 μm long and 14-26 μm wide.

Regional distribution: this is the first record for the Pacific coast of Mexico.

In Bahía de La Paz, monitoring of live microalgae that form red tides started in 2000 during a bloom of *C. polykrikoides* (Gárate-Lizárraga *et al*. 2004a). Since then, many microalgae bearing a soft cell membrane (dinoflagellates and raphidophytes) have been identified (Gárate-Lizárraga *et al*. 2004a; 2009). Correct identification of naked dinoflagellates in Bahía de La Paz is a good example of the importance of working with fresh samples. The morphology of naked dinoflagellates changes during observation under a light microscope. Likewise, cells tend to form an outer hyaline membrane or a temporary hyaline cyst (Figs. 2A-E and Fig. 3F); otherwise, they would explode. Specimens fixed with Lugol's solution could not always be correctly identified. Live samples are important when studying unarmored species and other naked dinoflagellates. Nevertheless, molecular analyses could be performed to combine the morphological and molecular information.

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