

# CONTRIBUTION TO THE KNOWLEDGE ON DINOFLAGELLATES (DINOPHYCEAE) OF THE ORDER DINOPHYSALES IN THE CANARY ISLANDS WATERS

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With 10 plates

*ABSTRACT.* Thirty-four species of marine dinoflagellates belonging to two families of the order Dinophysales collected using oceanographic bottles and a plankton net in the neritic zone at several depths are described: The Dinophysaceae represented by 33 taxa that belong to the genus *Dinophysis* Ehrenberg, *Heteroschisma* Kofoid & Skogsberg, *Amphisolenia* Stein, *Ornithocercus* Stein, and *Histioneis* Stein and the Citharistaceae represented by one taxa of the genus *Citharistes* Stein. Fifteen species are new records in the Canary Islands, and for seven the distribution is enlarged. Descriptions of the species are supplemented with selected references, illustrations, biometric data and information on its regional distribution.

*RESUMEN.* Aportación al conocimiento de los dinoflagelados (Dinophyceae) del orden Dinophysales en aguas de las Islas Canarias. Se estudian 34 especies de dinoflagelados marinos pertenecientes a dos familias del orden Dinophysales: Dinophysaceae representada por 33 taxones pertenecientes a los géneros *Dinophysis* Ehrenberg, *Heteroschisma* Kofoid & Skogsberg, *Amphisolenia* Stein, *Ornithocercus* Stein e *Histioneis* Stein y la familia Citharistaceae, representada por un sólo taxon perteneciente al género *Citharistes* STEIN. Se señalan 15 nuevos registros para las Islas Canarias y para 7 se amplía su distribución en la región. Cada una de las especies se acompaña de referencias bibliográficas, ilustraciones, datos biométricos e información sobre su distribución en el archipiélago Canario. Las muestras fueron recolectadas con botellas oceanográficas y pescas con red en diversas áreas de la zona nerítica.

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*RESUMO.* Contribuição para o conhecimento dos dinoflagelados (Dinophyceae) da ordem Dinophysales nas águas das Ilhas Canárias. No presente trabalho são estudadas trinta e quatro espécies de dinoflagelados marinhos pertencentes a duas famílias da ordem Dinophysales: Dinophysaceae, representada por 33 taxa pertencentes aos géneros *Dinophysis*, *Heteroschisma*, *Amphisolenia*, *Ornithocercus* e *Histioneis* e *Citharistaceae*, representada por um só taxon pertencente ao género *Citharistes*. Quinze espécies são novas para as Ilhas Canárias e sete veem ampliadas as suas áreas de distribuição na região. Para cada uma das espécies se incluem referências bibliográficas, ilustrações, dados biométricos e informação sobre a sua distribuição no arquipélago Canário.

## INTRODUCTION

In tropical and subtropical seas there is a great diversity of dinoflagellates species, which makes it possible to observe extremely ornamented and attractive organisms, many of which are from the Dinophysaceae and Citharistaceae families. The first one is represented in neritic waters in the Canary Islands by 33 taxa of which 14 belong to the *Dinophysis* genus, 1 to the *Heteroschisma* genus, 2 to the *Amphisolenia* genus, 5 to the *Ornithocercus* genus and 11 to the *Histioneis* genus, while the Citharistaceae family is represented by only one taxa from the *Citharistes* genus.

Already in 1838, CHRISTIAN GOTTFRIED EHRENBERG in his study *Die Infusionsthierchen als vollkommene Organismen* did a description of hundreds of protists among which some *Dinophysis* species can be found. Afterwards, in 1883, FRIEDRICH RITTER von STEIN, Professor of Zoology in Prague, in his work *Der Organismus der Infusionsthiere* describes 18 new genera in which *Amphisolenia*, *Citharistes*, *Histioneis*, and *Ornithocercus* are included (TAYLOR, 1987).

The analysis of the phytoplanktonic material obtained with oceanographic bottles and nets during a 10 years period, has permitted to study nannoplankton and microplankton dinoflagellates organisms, to get new records, and to enlarge the distribution of some species in the Canarian archipelago.

## MATERIALS AND METHODS

The analysed material was obtained in different cruises carried out between 1986 and 1996. A total of 332 samples were studied, of which 267 were obtained with oceanographic bottles Niskin type of 5l capacity and 65 were collected with a net of 50 µm mesh. The area studied extended from the shore to the slope of each island and from the surface to a maximum depth of 150 m. The trawl tows were done horizontally to the surface. The samples were fixed with formalin at 10% and bottle samples were preserved in Lugol solution.

The temperature data were recorded with inverted thermometers attached to the bottles or with XBT sounding. In the trawls a standard thermometer was used.

The dinoflagellates bigger than 10  $\mu\text{m}$  were studied under a Zeiss inverted microscope with phase contrast. For each taxa identified the following data are specified: the bibliographical references, the measurements taken, the sampling zone, the water temperature, and the time of the year. Additional information dealing with the distribution and ecology is provided, pointing out those species that are cited for the first time in the study area. Each description has an original scale drawing attached.

## LIST OF SPECIES

Order Dinophysales LINDEMANN, 1928

Family Dinophysaceae STEIN, 1883

Genus *Dinophysis* EHRENBERG, 1839b

Key to the species of *Dinophysis* obtained in the Canary Islands:

1. - With posterior sail or with spine.....10
  - Without posterior sail or without spine.....2
2. - With antapical prolongation.....3
  - Without antapical prolongation.....4
3. - Long drawn out body.....*D. caudata*
  - Trapezoid body in lateral view.....*D. mitra* and *D. rapa*
4. - Cuneiform body, large cell.....*D. cuneus*
  - Body of variable form.....5
5. - Almost spherical body.....6
  - Laterally flattened body.....8
6. - Large cell (> 80  $\mu\text{m}$ ) high epitheca of convex sides.....*D. argus*
  - Small cell (< 45  $\mu\text{m}$ ) epitheca of variable form.....7
7. - High and rounded epitheca, broad and deeply incised cingulum.....*D. contracta*
  - Low and rounded epitheca.....*D. rotundata*
8. - Large cell (> 70)  $\mu\text{m}$ .....*D. schoederi*

- Small cell.....9
- 9. - Generally < 35  $\mu\text{m}$ , regularly ovate.....*D. punctata*
  - Generally > 40  $\mu\text{m}$ , much longer than broad.....*D. acuminata*
- 10.- Large posterior sail, reinforced with a median rib.....*D. schuetti*
  - Small posterior sail and may be supported by a rib.....11
- 11.- Epitheca masked by anterior cingular list.....*D. hastata*
  - Epitheca not masked by anterior cingular list.....12
- 12.- Pentagonal hypotheca in lateral view.....*D. capitulata*
  - Almost triangular hypotheca in lateral view, broad posterior sail without median rib.....*D. doryphora*

***Dinophysis hastata* STEIN, 1883**

(Pl. I, fig. 1)

*Dinophysis hastata* STEIN, 1883, pl.19, fig.12.

REFERENCES: DODGE, 1982; TAYLOR, 1987; BALECH, 1988; STEIDINGER & TANGEN, 1997.

SIZE: High variability in size. One measured specimen. 102.5  $\mu\text{m}$  total length; 73.5  $\mu\text{m}$  body length; 62.5  $\mu\text{m}$  hypotheca dorso-ventral diameter; 25  $\mu\text{m}$  hypotheca posterior sail length.

HABITAT: One specimen observed in net samples in coastal shallow waters in November. Temperature 20.5° C.

DISTRIBUTION: Neritic. Warm temperate waters; world-wide distribution; rarely found in cold waters. Cited for North Scotland, NE and SW England in summer, Norwegian waters, NW Spain, south-western Atlantic as a rare species, and Mediterranean Sea as a rare species in winter.

CANARY ISLANDS: Gran Canaria (OJEDA, 1985).

***Dinophysis schoederi* PAVILLARD, 1909**

(Pl. I, fig. 2)

*Dinophysis schoederi* PAVILLARD, 1909, p. 284, fig. 5.

REFERENCES: MARGALEF, 1972; BALECH, 1988.

SIZE: 70-80  $\mu\text{m}$  body length; 45-50  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Observed in net samples in coastal shallow waters in February, April, and October always as a rare species. Temperature 19.2-21.3° C.

DISTRIBUTION: Warm waters; world-wide distribution. Cited for the

Mediterranean Sea, and south-western Atlantic.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

***Dinophysis capitulata* BALECH, 1967a**

(Pl. I, fig. 3)

*Dinophysis capitulata* BALECH, 1967a, pl.2, fig. 25-31.

REFERENCE: BALECH, 1988.

SIZE: One measured specimen. 50  $\mu\text{m}$  total length; 45  $\mu\text{m}$  body length; 38.5  $\mu\text{m}$  hypotheca dorso-ventral diameter. The sizes are slightly bigger than the ones described by BALECH (1988).

HABITAT: Two organisms were observed in the net trawls done in coastal areas in December and January. Temperature 20-20.5° C.

DISTRIBUTION: *D. capitulata* was only known in the Caribbean, where it is frequently found (BALECH, 1988). Cited as a rare species in the south-western Atlantic Ocean.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

***Dinophysis schuetti* MURRAY & WHITTING, 1899**

(Pl. I, fig. 4)

*Dinophysis schuetti* MURRAY & WHITTING, 1899, p. 331, pl. 31, fig. 10.

SYNONYM: *Dinophysis uracantha* SCHÜTT, 1895, p. 16, pl. 2, fig. 9; non *D. uracantha* STEIN.

REFERENCES: BALECH, 1988; STEIDINGER & TANGEN, 1997.

REMARKS: The dimensions recorded in specimens obtained in net trawls over a year indicate that there is a great size variation within this species. The biggest organisms were recollected in January, surpassing the dimensions obtained by BALECH (1988). However, no other morphologic characteristic has been found that justifies the separation of different taxa up to now.

SIZE: 75-120  $\mu\text{m}$  total length; 45-60  $\mu\text{m}$  body length; 45-52.5  $\mu\text{m}$  hypotheca dorso-ventral diameter; 10 mm was the height of the epitheca for one of the specimens observed.

HABITAT: In May three specimens were identified with bottle sampling at depths of 25, and 100 m in shelf and slope waters. Some were recollected during winter (January and February) with net sampling always as isolated individuals. Temperature 18.6-20.7° C.

DISTRIBUTION: Oceanic. Warm temperate to tropical waters; world-wide distribution. Considered a shade species (STEIDINGER & TANGEN, 1997). Cited in the northern Atlantic, south-western Atlantic and the Mediterranean Sea.

CANARY ISLANDS: Gran Canaria, La Palma and Hierro (OJEDA, 1996). In this paper, the distribution is enlarged for the Canarian archipelago: Gran Canaria.

***Dinophysis rapa* (STEIN) ABÉ, 1967b**

(Pl. I, fig. 5)

*Dinophysis rapa* ABÉ, 1967b, p. 66, fig. 19.SYNONYM: *Phalacroma rapa* STEIN, 1883, p. 23, pl. 19, fig. 5-8.

REFERENCES: BALECH, 1988; DELGADO &amp; FORTUÑO, 1991.

REMARKS: The antapex and the shape of the hypotheca of the two observed specimens resembles that of *D. norvegica*. However, they can be differentiated because the epitheca is not masked by an anterior cingular list.SIZE: 65-85  $\mu\text{m}$  length; 56-60  $\mu\text{m}$  epitheca dorso-ventral diameter; 60-65  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Two organisms were observed in May with bottle sampling at depths of 75, and 100 m in the shelf and the slope waters. Temperature 19.0-19.3° C.

DISTRIBUTION: Warm waters; considered a shade species (BALECH, 1988). Cited for the south-western Atlantic Ocean, Mediterranean Sea, Mauritania and Senegal coasts.

CANARY ISLANDS: Tenerife (OJEDA, 1996).

***Dinophysis mitra* (SCHÜTT) ABÉ, 1967b**

(Pl. II, fig. 1; pl IX, fig. 1)

*Dinophysis mitra* ABÉ, 1967b, p. 63, fig. 18SYNONYM: *Phalacroma mitra* SCHÜTT, 1895, p. 18, pl. 4, fig. 1-4.

REFERENCES: BALECH, 1988; DELGADO &amp; FORTUÑO, 1991.

REMARKS: The independence of this species is still being discussed. BALECH (1988) believes that it could be a small-sized variety of *D. rapa*.SIZE: 62.5  $\mu\text{m}$  total length; 54-55  $\mu\text{m}$  body length; 36 $\mu\text{m}$  epitheca dorso-ventral diameter; 42-46.2  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: One specimen observed in May with a bottle sample at 25 m of depth in shelf waters. With net samples specimens were recollected in autumn and winter (October and January). Temperature 19.6-22.2° C.

DISTRIBUTION: Warm temperate waters (COUTÉ &amp; ILLIS, 1985). Cited for the south-western Atlantic Ocean and Mediterranean Sea.

CANARY ISLANDS: Gran Canaria, and Hierro (OJEDA, 1996). In this paper, the distribution is enlarged for the Canarian archipelago: Gran Canaria.

***Dinophysis doryphora* (STEIN) ABÉ, 1967b**

(Pl. II, fig. 2; pl. IX, fig. 2)

*Dinophysis doryphora* ABÉ 1967b, p. 77, fig. 26.SYNONYM: *Phalacroma doryphorum* STEIN, 1883, p. 23, pl. 19, fig. 1-4.

REFERENCES: BALECH, 1988; DELGADO &amp; FORTUÑO, 1991.

SIZE: 75-95  $\mu\text{m}$  total length; 57.5-76  $\mu\text{m}$  body length; 50-65  $\mu\text{m}$  hypotheca dorso-ventral diameter.



**HABITAT:** One specimen observed in a bottle sampled in coastal shallow waters in October. Some were recollected during spring (March and April) and winter (December, January, and February) with net trawls, always as isolated individuals. Temperature 18.6-21.3° C.

**DISTRIBUTION:** Cited for the south-western Atlantic Ocean, Mediterranean Sea and west coast of Africa.

**CANARY ISLANDS:** Alegranza, and Gran Canaria. First record for the Canary Islands.

***Dinophysis argus* (STEIN) ABÉ, 1967b**

(Pl. II, fig. 3)

*Dinophysis argus* ABÉ, 1967b, p. 71, partim (non fig. 23a-b).

**SYNONYM:** *Phalacroma argus* STEIN, 1883, pl. 18, fig. 15-17.

**REFERENCES:** BALECH, 1988.

**SIZE:** 82.5-90 µm length; 72.5-75 µm hypotheca dorso-ventral diameter; 65-70 µm epitheca dorso-ventral diameter.

**HABITAT:** One specimen observed in a bottle sampled at a depth of 75 m in shelf waters. With net samples specimens were observed in spring and winter, agreeing with ROS & MIRACLE'S (1984) observations in the Mediterranean Sea. Temperature 17.8-20.5° C.

**DISTRIBUTION:** Warm waters. Cited for the Mediterranean Sea, west coast of Africa and the Brazil Stream.

**CANARY ISLANDS:** Fuerteventura and Gran Canaria (OJEDA, 1985). In this paper, the distribution is enlarged for the Canarian archipelago: Fuerteventura.

***Dinophysis cuneus* (SCHÜTT) ABÉ, 1967b**

(Pl. II, fig. 4)

*Dinophysis cuneus* ABÉ, 1967b, p. 68, fig. 21a-h.

**SYNONYM:** *Phalacroma cuneus* SCHÜTT, 1895, p. 148, pl. 3, fig. 14.

**REFERENCES:** BALECH, 1988; DELGADO & FORTUÑO, 1991.

**SIZE:** One measured specimen. 85 µm length; 83 µm hypotheca dorso-ventral diameter.

**HABITAT:** One organism was observed in the net trawls done in coastal areas in January. Temperature 19° C.

**DISTRIBUTION:** Warm waters. Cited for the south-western Atlantic Ocean and as a rare species in the Mediterranean Sea.

**CANARY ISLANDS:** Gran Canaria. First record for the Canary Islands.

***Dinophysis contracta* (KOFOID & SKOGSBERG) BALECH, 1967a**

(Pl. II, fig. 5)

*Dinophysis contracta* BALECH, 1967a, p. 82.

SYNONYMS: *Phalacroma contractum* KOFOID & SKOGSBERG, 1928, p. 83, fig. 3, 1; *Phalacroma ruudi* BRAARUD, 1935, p. 112, fig. 32; *Prodinophysis contracta* (KOFOID & SKOGSBERG) BALECH, 1944, p. 429; *Prodinophysis ruudi* (BRAARUD) LOEBLICH III, 1965, p. 17.

REFERENCES: DODGE, 1982; BALECH, 1988.

REMARKS: According to DODGE (1982), *D. contracta* closely resembles *D. pulchella* in shape but the characteristic differences between these species are: the presence of ribs supporting the left sulcal list in *D. pulchella*; these are absent in *D. contracta*. The sulcus extends onto the epitheca in *D. pulchella* but not in *D. contracta*.

SIZE: 27-35  $\mu\text{m}$  length; 22  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Observed in bottles sampled in shelf and slope waters from the surface down to a depth of 150 m always as isolated individuals preferably in March, and May. Temperature 17.4-21.0° C.

DISTRIBUTION: Cited for the Norwegian coastal waters, North Sea, NW Spain, Pacific Ocean, south-western Atlantic Ocean, North of Iceland and Antarctic.

CANARY ISLANDS: La Graciosa, Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, La Palma and Hierro (OJEDA, 1996). In this paper, the distribution is enlarged for the Canarian archipelago: La Graciosa, Lanzarote, Fuerteventura, and Gran Canaria.

### ***Dinophysis rotundata* CLAPARÈDE & LACHMANN, 1859**

(Pl. II, fig. 6)

*Dinophysis rotundata* CLAPARÈDE & LACHMANN, 1859, p. 6, pl. 20, fig. 16.

SYNONYMS: *Phalacroma rotundatum* (CLAPARÈDE & LACHMANN) KOFOID & MICHENER, 1911, p. 290; *Prodinophysis rotundatum* (CLAPARÈDE & LACHMANN) BALECH, 1944, p. 429; *Dinophysis whittingae* BALECH, 1971a, p. 73, pl. 10, fig. 154-167; non *Dinophysis whittingae* BALECH, 1967a, p. 85 ?.

REFERENCES: DREBES, 1974; BALECH, 1988; DELGADO & FORTUÑO, 1991.

REMARKS: BALECH (1988) in his description of this species points out that the right sulcal list reaches  $R_3$ , but the specimens observed adjust more to DODGE (1982), and DELGADO & FORTUÑO (1991) drawing with a shorter right sulcal list.

SIZE: 43  $\mu\text{m}$  length; 42.5  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Frequently cited in Galician waters as a potentially toxic species (FRAGA, 1993). Rarely found in bottle sampling. It was observed from the surface down to a depth of 150 m in shelf, and slope waters. It was observed in net sampling mainly in spring (March, April, and May) and sporadically in February. Always as isolated individuals. Toxic species. Temperature 17.4-21.3° C.

DISTRIBUTION: warm temperate waters; world-wide distribution. Cited around the British Isles specially in spring and summer. Recorded from Pacific, Atlantic and Indian Oceans. Off Norway, Greenland, Nova Scotia, from the Baltic, Mediterranean, Black Sea, Gulf of Siam, Barents Sea, Inland Sea of Japan, and Arabian Sea. DODGE (1993) cited it as



the most frequent specimen of this genus in the NE Atlantic.

CANARY ISLANDS: Lanzarote, Fuerteventura, Gran Canaria, Tenerife, Gomera, La Palma and Hierro (BORDES *et al.*, 1993; OJEDA, 1996). In this paper, the distribution is enlarged for the Canarian archipelago: Lanzarote, and Fuerteventura.

***Dinophysis caudata* SAVILLE-KENT, 1881**

(Pl. III, fig. 1; pl. IX, fig. 5)

*Dinophysis caudata* SAVILLE-KENT, 1881, p. 455-460.

SYNONYM: *Dinophysis homunculus* STEIN, 1883, pl. 21, fig. 1, 2, 5 and 7.

REFERENCES: DODGE, 1982; COUTE & ILLIS, 1985; BALECH, 1988; STEIDINGER & TANGEN, 1997.

REMARKS: It has been frequently observed as two cells together, as a result of an incomplete separation after the division, groups of 3 or 4 cells are also possible but they haven't been observed. Cited as a toxic species which causes red tides in the China Sea (TSENG *et al.*, 1993).

SIZE: 95-111 µm length; 45-50 µm hypotheca dorso-ventral diameter.

HABITAT: Observed in bottle samples in shelf and slope waters from the surface down to a depth of 50 m. Present almost all year around in the sampling obtained with the net, with a greater abundance in April. Toxic species. Temperature 18.2-22.6° C.

DISTRIBUTION: Neritic and oceanic. From warm temperate to tropical waters; world-wide distribution; rarely found in cold waters. Cited for the SW England and North Scotland in late spring and summer, south-western Atlantic and as a very frequent species in the Mediterranean Sea.

CANARY ISLANDS: Alegranza, Lanzarote, Fuerteventura and Gran Canaria (OJEDA, 1985). In this paper, the distribution is enlarged for the Canarian archipelago: Alegranza and Lanzarote.

***Dinophysis acuminata* CLAPARÈDE & LACHMANN, 1859**

(Pl. III, fig. 2)

*Dinophysis acuminata* CLAPARÈDE & LACHMANN, 1859, p. 408, pl. 20, fig. 17.

SYNONYMS: *Dinophysis borealis* PAULSEN, 1949, p. 46, fig. 14K-U and 15; *Dinophysis lachmanni* PAULSEN, 1949, p. 46, fig. 14A-H and 15; *Dinophysis boehmi* PAULSEN, 1949, p. 45; *Dinophysis skagii* PAULSEN, 1949, p. 48, fig. 14-15.

REFERENCES: DREBES, 1974; DODGE, 1982; BALECH, 1988; STEIDINGER & TANGEN, 1997.

SIZE: 37-40 µm length; 24-26 µm hypotheca dorso-ventral diameter.

HABITAT: Some specimens were recollected in coastal shallow waters from the surface down to a depth of 50 m in May, October, and November. Toxic species. Temperature 19.8-20.4° C.

DISTRIBUTION: Neritic. Typically cold and warm temperate waters; world-wide

distribution (MARGALEF, 1961; STEIDINGER & TANGEN, 1997). Cited around the British Isles except for the SE coast, mostly in spring and summer, NW Spain, coast of Holland, China Sea, south-western Atlantic Ocean and eastern coast of Russia.

CANARY ISLANDS: Fuerteventura, Gran Canaria (OJEDA, 1985) and La Palma. In this paper, the distribution is enlarged for the Canarian archipelago: Fuerteventura and La Palma.

***Dinophysis punctata* JÖRGENSEN, 1923**

(Pl. III, fig. 3)

*Dinophysis punctata* JÖRGENSEN, 1923, p. 23, fig. 28.

REFERENCES: DODGE, 1982; BALECH, 1988.

SIZE: 30-32  $\mu\text{m}$  length; 28  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Three organisms were observed in bottles samples at depths of 25 and 50 m in shelf waters. Temperature 19.7-20.2° C.

DISTRIBUTION: In warm temperate waters; world-wide distribution. Cited for the Mediterranean Sea, British Isles, the Indian Ocean, South America, Red Sea, and western coast of France.

CANARY ISLANDS: Gran Canaria and Tenerife (OJEDA, 1996). In this paper, the distribution is enlarged for the Canarian archipelago: Gran Canaria.

Genus *Heteroschisma* KOFOID & SKOGSBERG, 1928

***Heteroschisma* sp.**

(Pl. III, fig. 4)

DESCRIPTION: Medium sized. Oval elongated body from a lateral view. High and rounded epitheca, approximately 1/3 of the cell total length. Fairly elongated hypotheca, with convex sides, it narrows progressively towards the posterior end in a lateral view. Cingular list clearly visible. Long left sulcal list, apparently shorter than hypotheca. The hypothecal plates are covered with delicate reticulations clearly visible with inverted microscope.

SIZE: One measured specimen. 77  $\mu\text{m}$  total length; 48  $\mu\text{m}$  hypotheca maximum width.

HABITAT: One specimen was found with bottle sampling in the south of Gran Canaria, at a depth of 5 m in coastal waters in May. Temperature 20.4° C.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

Genus *Amphisolenia* STEIN, 1883

***Amphisolenia globifera* STEIN, 1883**

(Pl. III, fig. 5)

*Amphisolenia globifera* STEIN, 1883, pl. 21, fig. 9-10.

REFERENCES: DODGE, 1982; BALECH, 1988.

SIZE: 204.5  $\mu\text{m}$  total length for one of the observed specimens; 18  $\mu\text{m}$  maximum width. 135-243  $\mu\text{m}$  length according to BALECH (1988); 318  $\mu\text{m}$  KOFOID & SKOGSBERG (1928), and 200-300  $\mu\text{m}$  long DODGE (1982).

HABITAT: Two organisms were identified with bottles sampling in shelf and slope waters in December, and January. One specimen observed in net samples in coastal shallow waters in February. Temperature 18.6-20.4° C.

DISTRIBUTION: Warm part of the Atlantic (DODGE, 1982; MARGALEF, 1961). Found in the N. Bay of Biscay and Mediterranean Sea.

CANARY ISLANDS: Gran Canaria (OJEDA, 1985) and La Palma. In this paper, the distribution is enlarged for the Canarian archipelago: La Palma.

***Amphisolenia bidentata* SCHRÖDER, 1900**

(Pl. III, fig. 6)

*Amphisolenia bidentata* SCHRÖDER, 1900, p. 20 and 35, pl. 1, fig. 16a-c.

REFERENCES: BALECH, 1988.

SIZE: 875-895  $\mu\text{m}$  total length; 25-31  $\mu\text{m}$  hypotheca maximum width.

HABITAT: Isolated findings obtained with net sampling in February, July, and December in surface coastal areas. Temperature 19.1-22.0° C.

DISTRIBUTION: Warm temperate waters; world-wide distribution (MARGALEF, 1961). Cited for the south-western Atlantic, and Mediterranean Sea.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

Genus *Ornithocercus* STEIN, 1883

***Ornithocercus splendidus* SCHÜTT, 1893**

(Pl. IV, fig. 1; pl. IX, fig. 3)

*Ornithocercus splendidus* SCHÜTT, 1893, p. 272, fig. 82 (non vid): 1895, p. 19, pl. 5, fig. 22.

REFERENCES: BALECH, 1988; STEIDINGER & TANGEN, 1997.

SIZE: One measured specimen. 57  $\mu\text{m}$  cellular body length; 67  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: One specimen collected with bottles sampling in surface waters near the coast in December. Present almost the whole year in the net sampling done with net, always as isolated individuals. Temperature 18.6-22.6° C.

DISTRIBUTION: Oceanic. Warm, temperate and tropical waters. Cited for the Mediterranean Sea as a rare specimen, and for the south-western Atlantic.

CANARY ISLANDS: Gran Canaria (BORDES *et al.*, 1993).

***Ornithocercus thumii* (SCHMIDT) KOFOID & SKOGSBERG, 1928**

(Pl. IV, fig. 2)

*Ornithocercus thumii* KOFOID & SKOGSBERG, 1928, p. 54, fig. 81-82, pl. 18, fig. 4-6.

SYNONYM: *Parelion thumii* SCHMIDT, 1888, pl. 144, fig. 59-61.

REFERENCES: BALECH, 1988; STEIDINGER &amp; TANGEN, 1997.

SIZE: One measured specimen. 63  $\mu\text{m}$  cellular body length; 65  $\mu\text{m}$  hypotheca dorso-ventral diameter. The sizes are slightly bigger to those described by BALECH (1988).

HABITAT: In July one specimen was found with net sampling in surface coastal waters. A rare species in the study area. Temperature 22.0° C.

DISTRIBUTION: Neritic and oceanic. From warm temperate to tropical waters. Cited for the south-western Atlantic as a rare species.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

***Ornithocercus magnificus* STEIN, 1883**

(Pl. V, figs. 1a-b; pl. IX, fig. 4)

*Ornithocercus magnificus* STEIN, 1883, partim, pl. 23, fig. 1-2.

REFERENCES: COUTÉ & ILTIS, 1985; BALECH, 1988; DELGADO & FORTUÑO, 1991; STEIDINGER & TANGEN, 1997.

REMARKS: Generally it is well differentiated from *O. thumii* because of its smaller size, but occasionally some specimens are found which are doubtful. Most of the time the normal specimen has been found as it is described in the Plate V (figure 1a). Sometimes it shows a simplified structure (figure 1b) that can not be attributed to any other species. Similar shapes to this last one were described by MARGALEF (1961), BALECH (1988), and DELGADO & FORTUÑO (1991).

SIZE: 38-44  $\mu\text{m}$  cellular body length; 42-45  $\mu\text{m}$  hypotheca dorso-ventral diameter (almost as long as wide).

HABITAT: From the five species of *Ornithocercus* identified in the sampling it has been the most frequent one, which matches REYSSAC'S (1970) observation in littoral waters; COUTÉ & ILTIS (1985) and BALECH (1988) cited it as the most frequent and abundant species in the warm, tropical, and subtropical waters. Ten specimens were found with bottle sampling, from the surface down to a depth of 100 m, present all the year around in both slope and shelf waters. With the net sampling most were observed in April, when there were observed from 1 to 5 specimens per 1 ml sample. Temperature 19.4-22.2° C.

DISTRIBUTION: Oceanic. Cosmopolitan in warm temperate to tropical waters (MARGALEF, 1961; STEIDINGER & TANGEN, 1997). Very frequent in the Mediterranean Sea, mainly in November and December, Atlantic Ocean.

CANARY ISLANDS: Gran Canaria, Tenerife, and Gomera (OJEDA, 1985, 1996).

***Ornithocercus quadratus* SCHÜTT, 1900**

(Pl. V, fig. 2)

*Ornithocercus quadratus* SCHÜTT, 1900, p. 5, fig. 1, 4, 12 and 13.

REFERENCES: MARGALEF, 1961; BALECH, 1988; STEIDINGER & TANGEN, 1997.

SIZE: 48-52  $\mu\text{m}$  cellular body length; 50  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: In December one was found with bottles sampling in surface waters near the coast. Three organisms were observed in net sampling in February, July and November. Temperature 18.6-22.0° C.

DISTRIBUTION: Oceanic. Warm temperate to tropical waters; world-wide distribution. Cited for the Mediterranean Sea, Brazil Stream and Mauritania and Senegal coasts as a rare species.

CANARY ISLANDS: Gran Canaria (BORDES *et al.*, 1993; OJEDA, 1985).

***Ornithocercus heteroporus* KOFOID, 1907a**

(Pl. V, fig. 3)

*Ornithocercus heteroporus* KOFOID, 1907a, p. 206, pl. 12, fig. 70.

REFERENCES: BALECH, 1988; DELGADO & FORTUÑO, 1991; STEIDINGER & TANGEN, 1997.

SIZE: 28-30  $\mu\text{m}$  cellular body length; 28-30  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Found one with bottle sampling in superficial waters near the coast in January. Two organisms were observed with net sampling, in February and November. Found more frequently in winter. Temperature 18.9-20.5° C.

DISTRIBUTION: Oceanic. Warm temperate to tropical waters; world-wide distribution. Cited for the south-western Atlantic Ocean and Mediterranean Sea as a rare species.

CANARY ISLANDS: Gran Canaria and La Palma. First record for the Canary Islands.

Genus *Histioneis* STEIN, 1883

***Histioneis inclinata* KOFOID & MICHENER, 1911**

(Pl. VI, fig. 1)

KOFOID & MICHENER, 1911, p. 297; KOFOID & SKOGSBERG, 1928, p. 652, fig. 95, pl. 22, fig. 5.

REFERENCES: BALECH, 1988.

SIZE: 28  $\mu\text{m}$  cellular body total length; 16-19  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Two organisms collected with bottles sampling in the surface and at a depth of 100 m in waters near the coast in spring. Not found during the net sampling. Temperature 19.4-19.7° C.

DISTRIBUTION: Cited for the south-western Atlantic Ocean as a rare species.

CANARY ISLANDS: Gran Canaria and Hierro (OJEDA, 1996). In this paper, the distribution is enlarged for the Canarian archipelago: Gran Canaria.

***Histioneis milneri* MURRAY & WHITTING, 1899**

(Pl. VI, fig. 2)

*Histioneis milneri* MURRAY & WHITTING, 1899, p. 333, pl. 33, fig. 1a-b.

REFERENCES: BALECH, 1988.

REMARKS: One of the specimens observed is not clearly identified, because it is very similar to the one described by BALECH (1988) pl. 17, fig. 1, as a possible transition form. The doubt arose with the description of *Histioneis dolon* (MURRAY & WHITTING); nevertheless its dimensions are much bigger than those of the specimens observed.

SIZE: Two organisms, 80-86  $\mu\text{m}$  total length, were measured. For one of the specimens observed: 33  $\mu\text{m}$  hypotheca dorso-ventral diameter; 43  $\mu\text{m}$  anterior cingular list length.

HABITAT: Two organisms were observed with bottle sampling off La Palma on the surface and at a depth of 150 m in waters near the coast in January and May. One specimen was observed in the net trawls in September. Temperature 17.7-22.6° C.

DISTRIBUTION: Cited for the Brazil Stream as a rare species.

CANARY ISLANDS: Gran Canaria, and La Palma. First record for the Canary Islands.

***Histioneis striata* KOFOID & MICHENER, 1911**

(Pl. VI, fig. 3; pl. X, fig. 1)

*Histioneis striata* KOFOID & MICHENER, 1911, p. 30; KOFOID & SKOGSBERG, 1928, p. 684, fig. 96, pl. 20, fig. 6.

SYNONYMS: *Histioneis steinii* SCHILLER, 1928, p. 85, fig. 44a-d; non *Histioneis steinii* LEMMERMANN, 1901, *vide* SCHILLER; *Histioneis variabilis* SCHILLER, 1933, p. 231, fig. 233.

REFERENCE: BALECH, 1988.

SIZE: 38-40  $\mu\text{m}$  total length; 17-18  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Three specimens were identified with bottle sampling from the surface down to a depth of 40 m in coastal waters in January and May. One specimen observed in net samples in coastal shallow waters in April. Temperature 18.0-20.0° C.

DISTRIBUTION: Cited for the Mediterranean Sea and south-western Atlantic Ocean.

CANARY ISLANDS: Gran Canaria and La Palma. First record for the Canary Islands.

***Histioneis reticulata* KOFOID, 1907a**

(Pl. VI, fig. 4)

*Histioneis reticulata* KOFOID, 1907a, p. 205, fig. 85.

REFERENCE: BALECH, 1988.

REMARKS: Its attribution to *H. reticulata* is very doubtful (BALECH, 1971a, 1988;



NORRIS, 1969) because its description is based on a small number of specimens, which could be mistaken with *H. crateriformis* or *H. paulseni*.

SIZE: 57-59  $\mu\text{m}$  total length; 31  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Five organisms were observed with bottle sampling generally in surface coastal areas in October and December. One specimen was observed with net sampling in September. Temperature 20.4-22.6° C.

DISTRIBUTION: Cited for the south-western Atlantic Ocean.

CANARY ISLANDS: Fuerteventura and Gran Canaria. First record for the Canary Islands.

***Histioneis rotundata* KOFOID & MICHENER, 1911**

(Pl. VII, fig. 1)

*Histioneis rotundata* KOFOID & MICHENER, 1911, p. 299.

SYNONYM: *Parahistioneis rotundata* (KOFOID & MICHENER) KOFOID & SKOGSBERG, 1928, p. 593, fig. 93, pl. 19, fig. 8-9.

REFERENCE: BALECH, 1988.

SIZE: One specimen was measured. 36  $\mu\text{m}$  total length; 16  $\mu\text{m}$  cellular body length; 13.5  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: One specimen was found in May with bottle sampling at the southern part of La Palma at a depth of 100 m and at approximately 1.5 km off the coast. Temperature 19.4° C.

DISTRIBUTION: Cited for the south-western Atlantic Ocean.

CANARY ISLANDS: La Palma. First record for the Canary Islands.

***Histioneis cymbalaria* STEIN, 1883**

(Pl. VII, fig. 2)

*Histioneis cymbalaria* STEIN, 1883, pl. 22, fig. 7.

SYNONYM: *Histioneis depressa* SCHILLER, 1928, p. 84, fig. 43.

REFERENCE: BALECH, 1988.

SIZE: 50-60  $\mu\text{m}$  total length. One of the specimens measured: 25  $\mu\text{m}$  anterior cingular list length; 24.4  $\mu\text{m}$  maximum hypotheca width.

HABITAT: It was the most observed species within this genus using bottle sampling, from the surface to a depth of 100 m in both shelf and slope waters, mainly in winter. Only one was found with net sampling in surface coastal waters in January. Temperature 17.8-19.4° C.

DISTRIBUTION: Cited as the most abundant of its genus in the northeast angle of the south-western Atlantic Ocean, and isolated in the Brazil Stream.

CANARY ISLANDS: Fuerteventura, Gran Canaria, Tenerife, Gomera and La Palma (OJEDA, 1996). In this work the distribution is enlarged in the Canarian archipelago: Fuerteventura and Gran Canaria.

***Histioneis para* MURRAY & WHITTING, 1899**

(Pl. VII, fig. 3; pl. X, fig. 2)

*Histioneis para* MURRAY & WHITTING, 1899, p. 333, pl. 32, fig. 4a-b.

SYNONYM: *Parahistioneis para* (MURRAY & WHITTING) KOFOID & SKOGSBERG, 1928, p. 60. Fig. 85.

REFERENCE: BALECH, 1988.

SIZE: 81.4-84  $\mu\text{m}$  total length; 39-41  $\mu\text{m}$  length of the cellular body; 33  $\mu\text{m}$  maximum hypotheca width.

HABITAT: Five observations were made with bottle sampling in surface coastal areas in October and December. With net sampling isolated individuals were collected in spring and autumn. Temperature 19.6-22.6° C.

DISTRIBUTION: Cited for the tropical and subtropical Atlantic.

CANARY ISLANDS: Alegranza, Fuerteventura and Gran Canaria. First record for the Canary Islands.

***Histioneis oxypteris* SCHILLER, 1928**

(Pl. VII, fig. 4)

*Histioneis oxypteris* SCHILLER, 1928, p. 84, pl. 3, fig. 6, non 7.

REFERENCE: BALECH, 1988.

SIZE: Medium-sized specimen. 48  $\mu\text{m}$  total length; 23  $\mu\text{m}$  cellular body length; 22.5  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: One specimen was found with bottle sampling in May at a depth of 25 m in coastal waters. A rare species in the studied area. Temperature 19.6° C.

DISTRIBUTION: Cited for the Adriatic and south-western Atlantic as a non-frequent species.

CANARY ISLANDS: Hierro (OJEDA, 1996).

***Histioneis mitchellana* MURRAY & WHITTING, 1899**

(Pl. VIII, fig. 1; pl. X, fig. 3)

*Histioneis mitchellana* MURRAY & WHITTING, 1899, p. 333, pl. 33, fig. 3.

REFERENCE: BALECH, 1988.

SIZE: 135-140  $\mu\text{m}$  total length. One of the middle-sized specimens: 53  $\mu\text{m}$  maximum hypotheca width.

HABITAT: One specimen was found with bottle sampling in surface coastal waters in October. Three observations were made with net sampling in surface coastal waters in April, October and November. Temperature 20.0-22.2° C.

DISTRIBUTION: Cited for the south-western Atlantic as a rare species.

CANARY ISLANDS: Fuerteventura, and Gran Canaria. First record for the Canary Islands.

***Histioneis* sp.**

(Pl. VIII, fig. 2)

DESCRIPTION: Big cell. Reniform in lateral view, its width is bigger than its height. Hypotheca with concave sides at has a maximum height in its ventral face, more sharpened towards the dorsal extreme. Posterior concave edge almost at the centre. Very small epitheca tilted towards the ventral face. Funnel-shaped cingular anterior list, with a high thin tube, distal part wider at some ribs. Posterior cingular list very high, with quite visible ribs in the anterior extreme. Convex horizontal crosspiece in the ventral face and somewhat concave in the middle. The left sulcal list resembles *H. higleyi*, big, with strong and long  $R_3$  implanted in the ventral base of the body, concave towards the front.  $R_2$  shortened, slightly oblique towards the back.  $R_1$  not very notorious. This list is very narrow between  $R_1$  and  $R_2$ , with a slightly sinuous edge and very apparent. From there on  $R_2$  widens considerably, the free edge first is slightly convex and then becomes concave further on till the end; near the posterior edge the reticulations are very pronounced and homogeneous, the rest of the list continues with irregular and weaker reticulations.

SIZE: 110  $\mu\text{m}$  total length; 65  $\mu\text{m}$  length of the cellular body; 57.7  $\mu\text{m}$  hypotheca dorso-ventral diameter; 45  $\mu\text{m}$  length of the  $R_3$ .

HABITAT: One specimen was observed with net sampling in surface coastal waters in February. Temperature 19.8° C.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

***Histioneis higleyi* (o *highleii*) MURRAY & WHITTING, 1928**

(Pl. VIII, fig. 3; pl. X, fig. 4)

*Histioneis highleii* MURRAY & WHITTING, 1899, p. 334, pl. 32, fig. 5.*Histioneis higleyi* MURRAY & WHITTING, KOFOID & SKOGSBERG, 1928, p. 673.

REFERENCE: BALECH, 1988.

SIZE: Medium size specimen. 100  $\mu\text{m}$  total length; 72.8  $\mu\text{m}$  length of cellular body; 49.5  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: Seems to be more tolerant, especially possibly of more surface waters than the rest of the species of this genus. Two observations done with net sampling in November and February. Temperature 18.6-20.5° C.

DISTRIBUTION: Warm waters, and occasionally in somewhat colder waters. Cited for the south-western Atlantic.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

Family Citharistaceae KOFOID &amp; SKOGSBERG, 1928

Genus *Citharistes* STEIN, 1883***Citharistes regius* STEIN, 1883**

(Pl. VIII, fig. 4)

*Citharistes regius* STEIN, 1883, pl. 22, fig. 1-4.

REFERENCE: BALECH, 1988.

SIZE: 46.9  $\mu\text{m}$  total length; 41  $\mu\text{m}$  length of cellular body; 29.9  $\mu\text{m}$  hypotheca dorso-ventral diameter.

HABITAT: One was found with the net sampling in superficial coastal waters in January. Temperature 19.4° C.

DISTRIBUTION: Thermophilic species and eupelagic (BALECH, 1988). Cited for the south-western Atlantic, and Mediterranean Sea as a rare species.

CANARY ISLANDS: Gran Canaria. First record for the Canary Islands.

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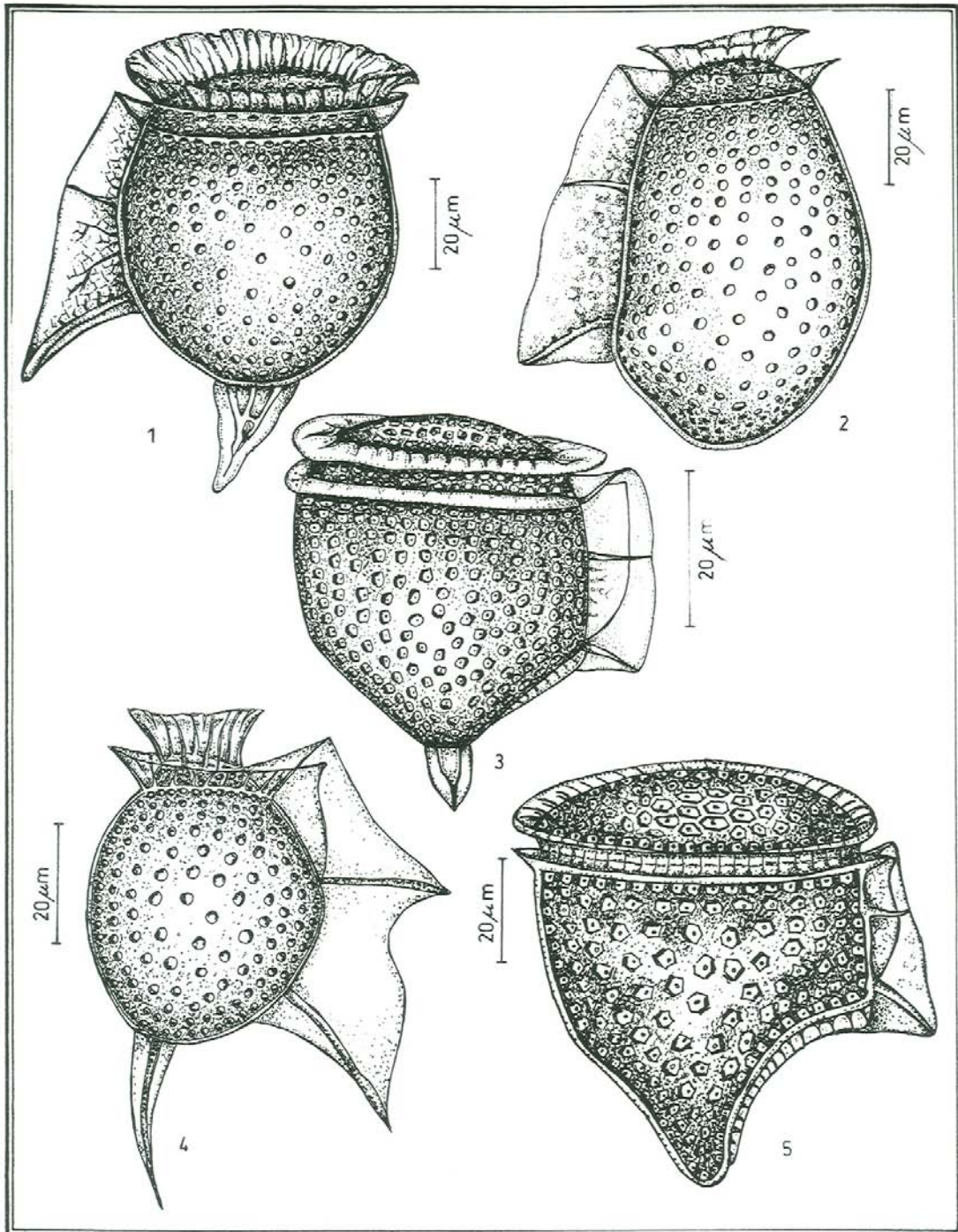


Plate I:

1 - *Dinophysis hastata*; 2 - *Dinophysis schoederi*; 3 - *Dinophysis capitulata*; 4 - *Dinophysis schuetti*; 5 - *Dinophysis rapa*.



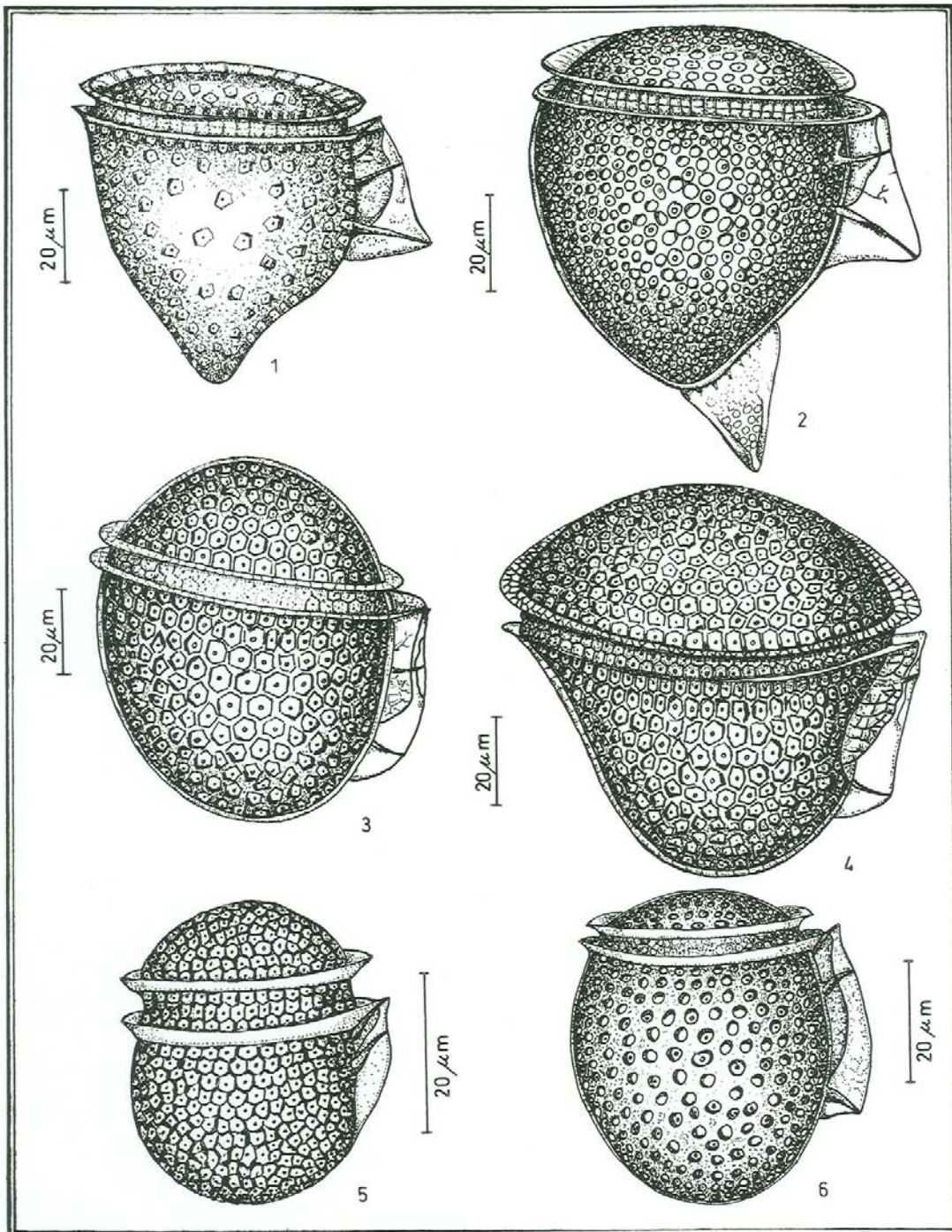


Plate II:

1 - *Dinophysis mitra*; 2 - *Dinophysis doryphora*; 3 - *Dinophysis argus*; 4 - *Dinophysis cuneus*; 5 - *Dinophysis contracta*; 6 - *Dinophysis rotundata*.

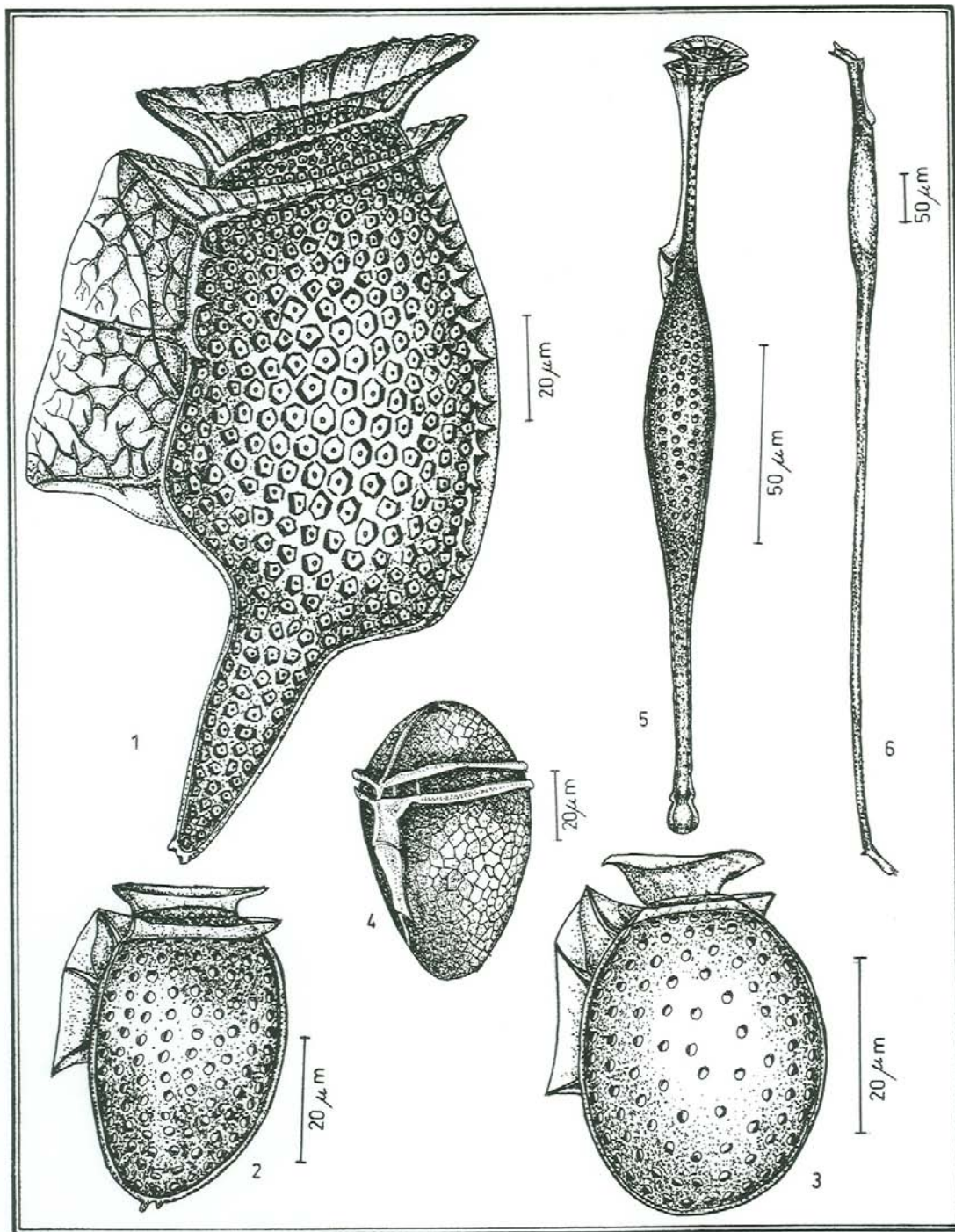


Plate III:

1 - *Dinophysis caudata*; 2 - *Dinophysis acuminata*; 3 - *Dinophysis punctata*; 4 - *Heteroschisma* sp.; 5 - *Amphisolonia globifera*; 6 - *Amphisolonia bidentata*.



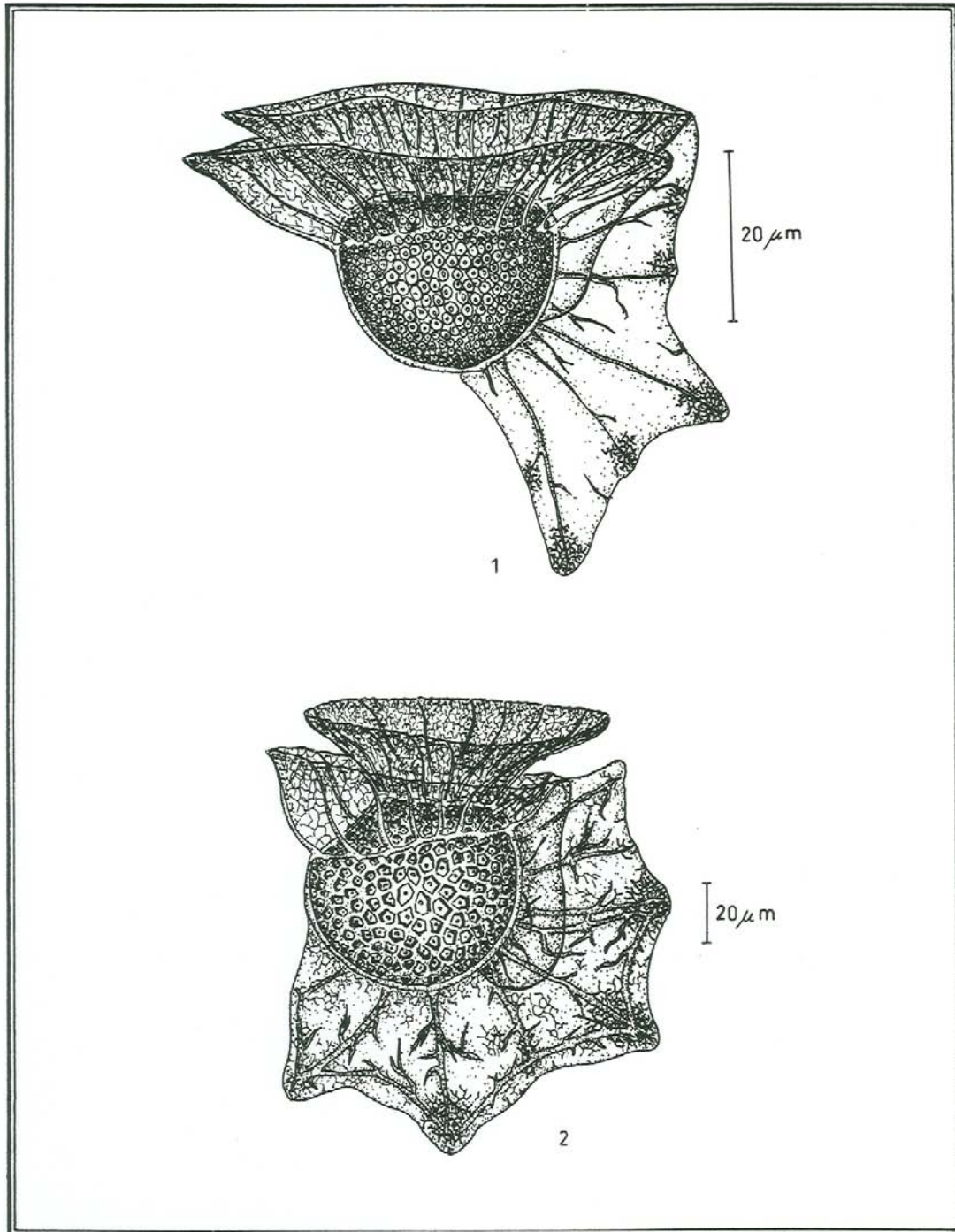


Plate IV:

1 - *Ornithocercus splendidus*; 2 - *Ornithocercus thumii*.



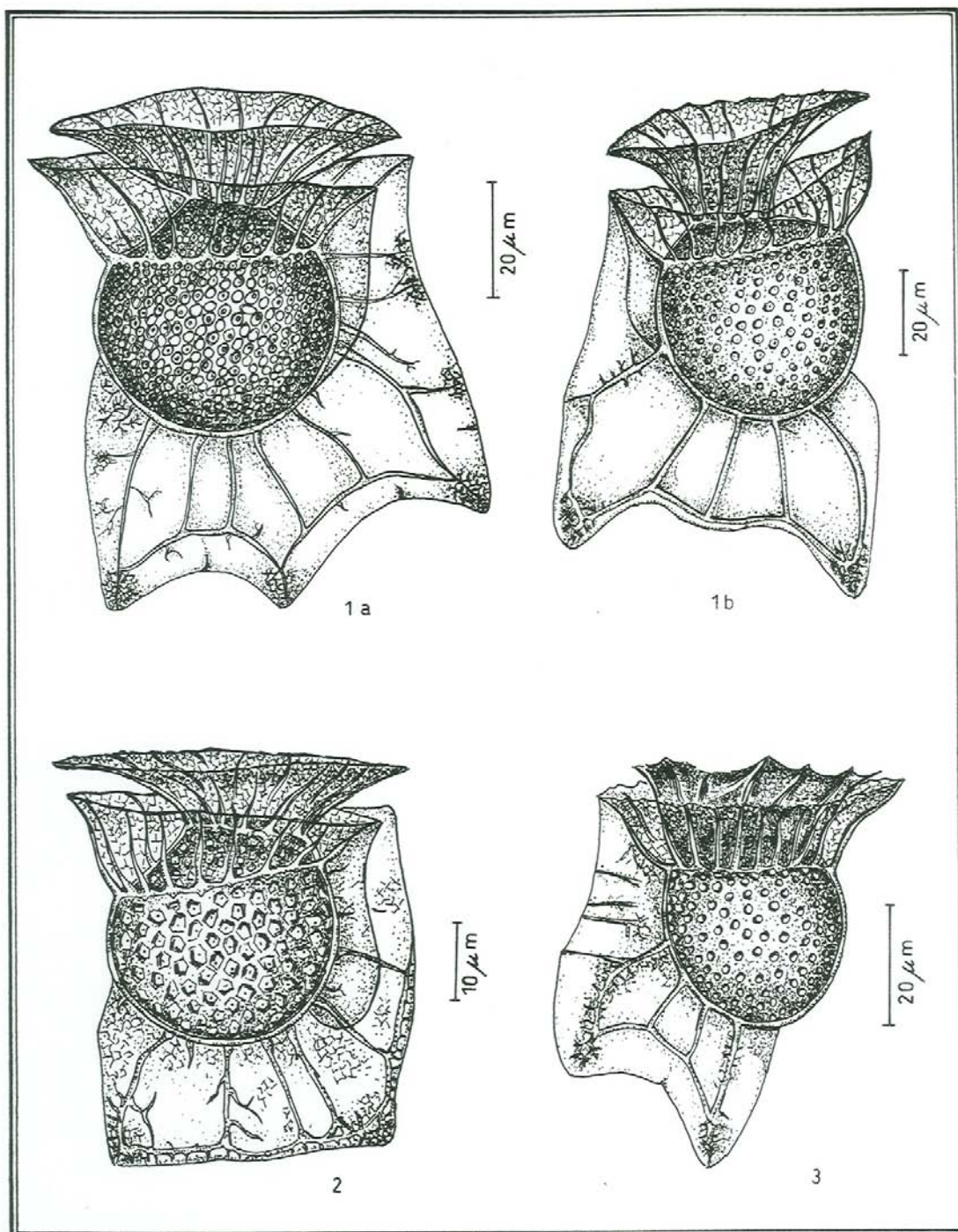


Plate V:

1a-b - *Ornithocercus magnificus*; 2 - *Ornithocercus quadratus*; 3 - *Ornithocercus heteroporus*.

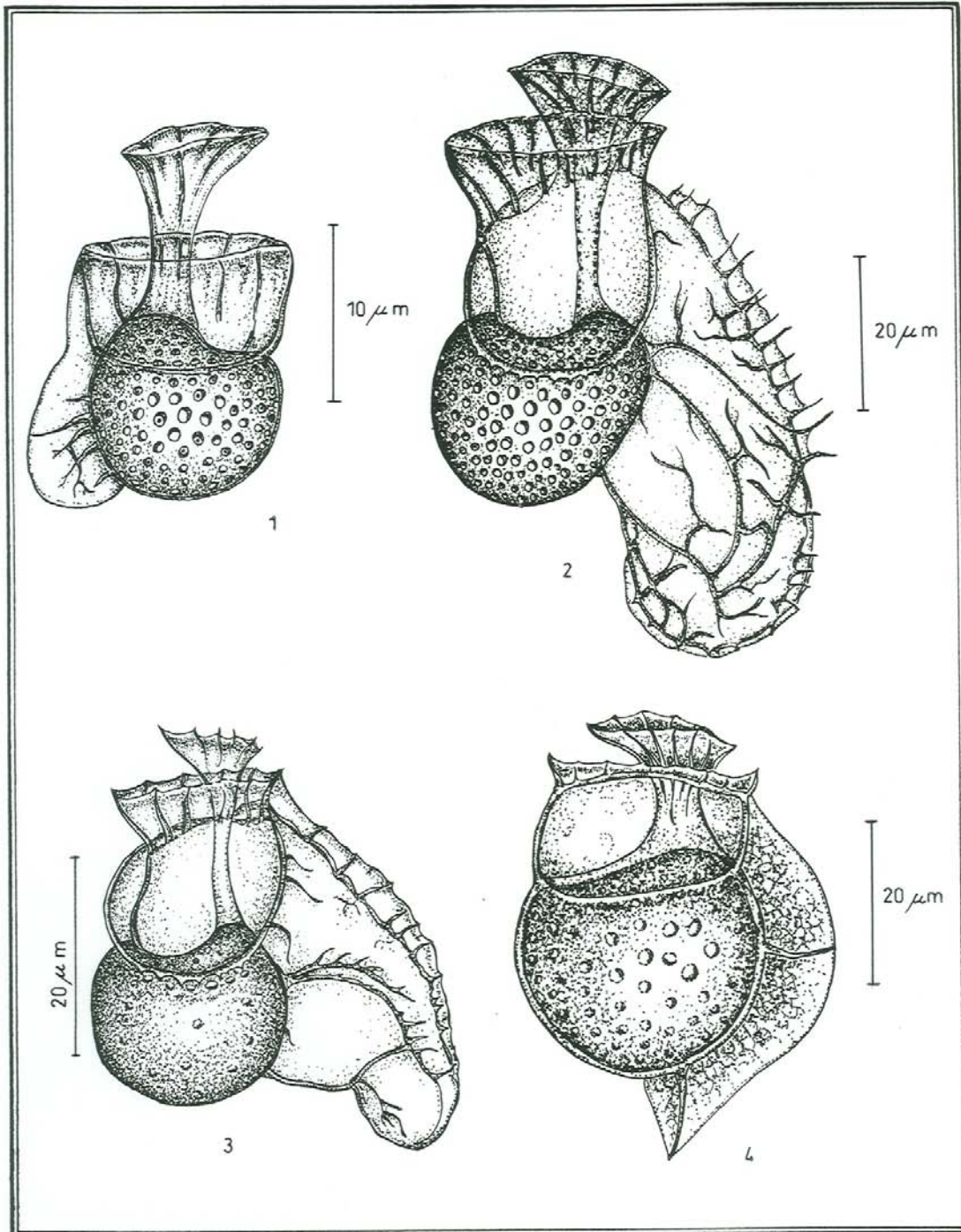


Plate VI:

1 - *Histioneis inclinata*; 2 - *Histioneis milneri*; 3 - *Histioneis striata*; 4 - *Histioneis reticulata*.



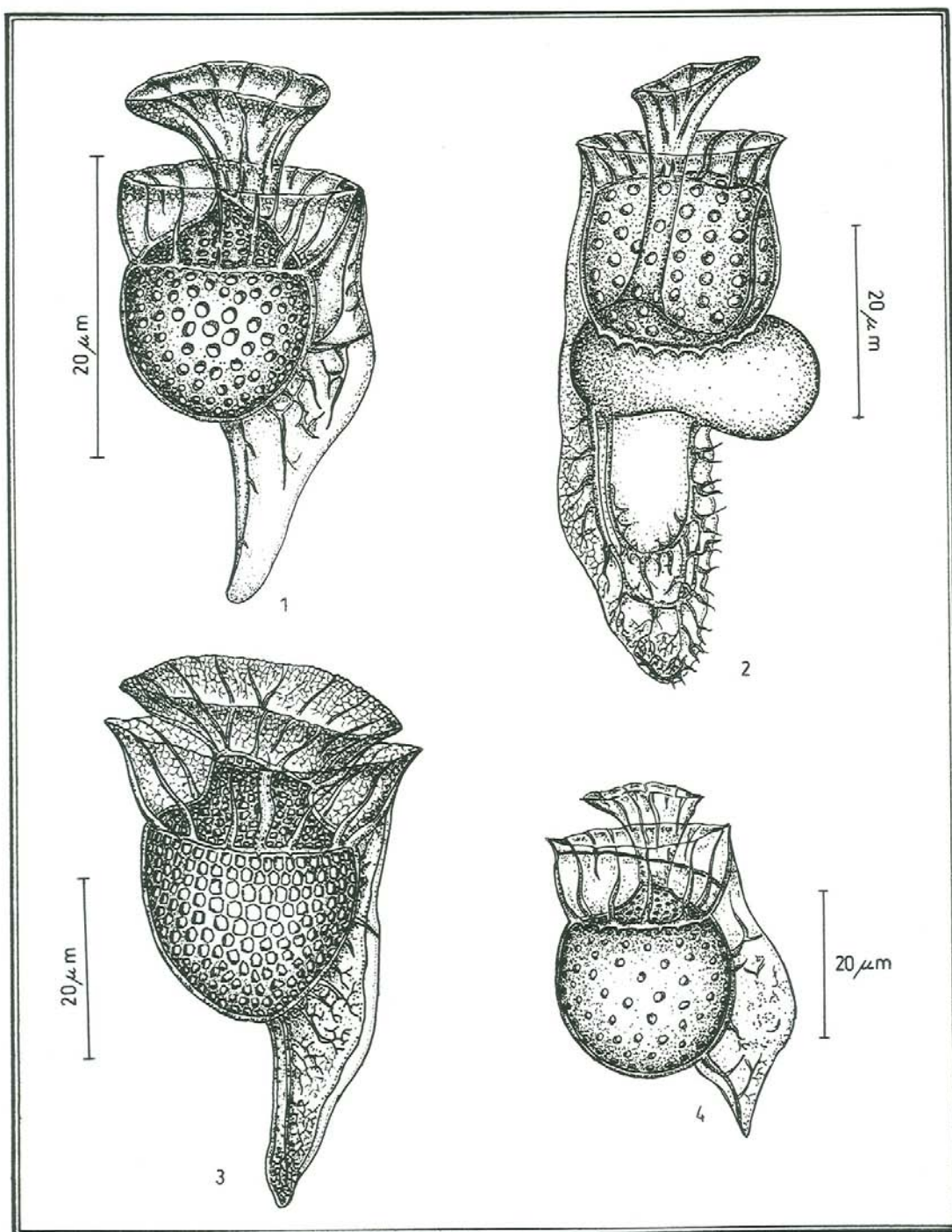


Plate VII:

1 - *Histioneis rotundata*; 2 - *Histioneis cymbalaria*; 3 - *Histioneis para*; 4 - *Histioneis oxypterus*.

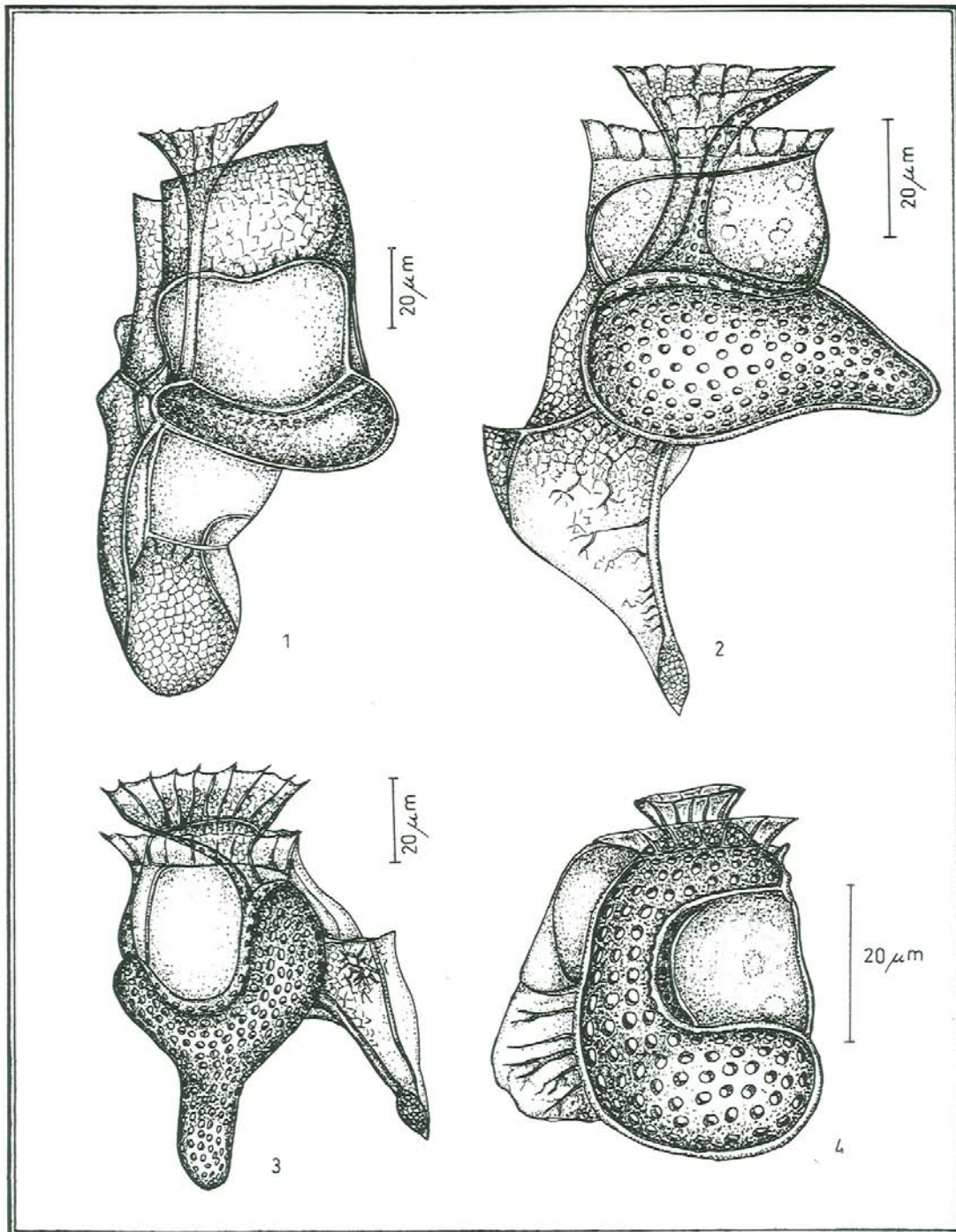
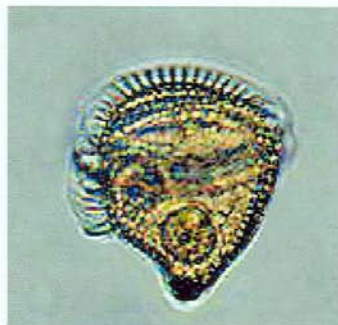
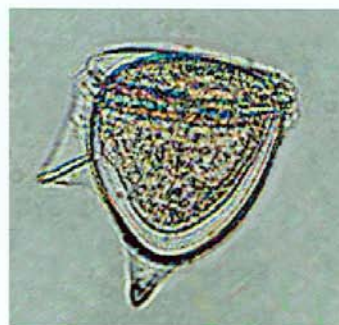
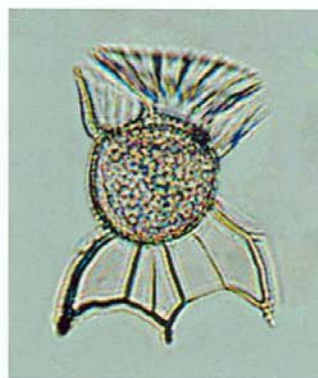
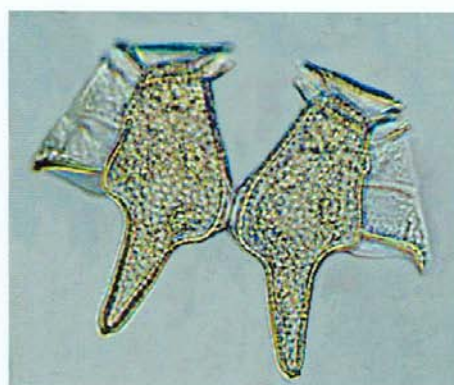


Plate VIII:

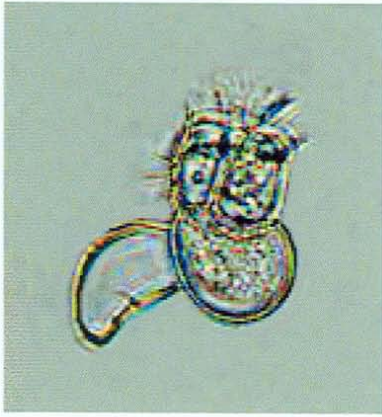
1 - *Histioneis mitchellana*; 2 - *Histioneis* sp; 3 - *Histioneis highleyi*; 4 - *Citharistes regius*.

1. *Dinophysis mitra* (X 400)2. *Dinophysis doryphora* (X 400)3. *Ornithocercus splendidus* (X 400)4. *Ornithocercus magnificus* (X 400)5. *Dinophysis caudata* (X 400)

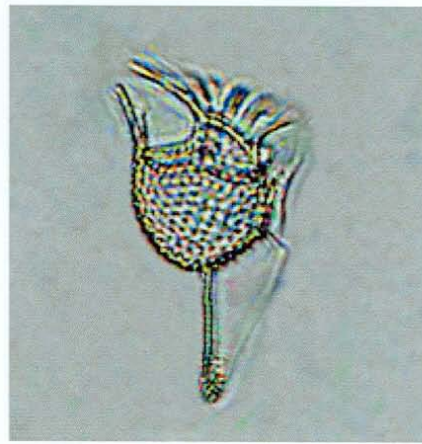
## Plate IX:

1 - *Dinophysis mitra*; 2 - *Dinophysis doryphora*; 3 - *Ornithocercus splendidus*; 4 - *Ornithocercus magnificus*; 5 - *Dinophysis caudata*.





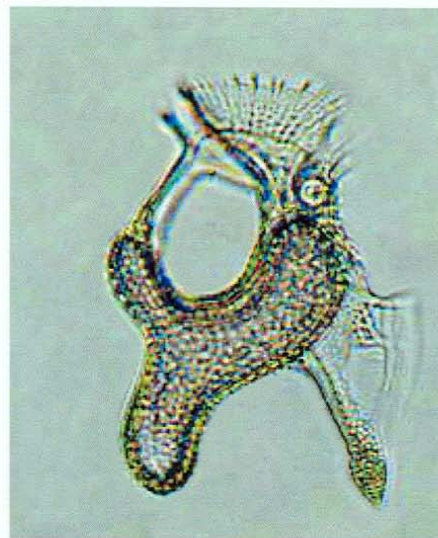
1. *Histioneis striata* (X 400)



2. *Histioneis para* (X 400)



3. *Histioneis mitchellana* (X 400)



4. *Histioneis highleyi* (X 400)

Plate X:

1 - *Histioneis striata*; 2 - *Histioneis para*; 3 - *Histioneis mitchellana*; 4 - *Histioneis highleyi*.