Canadian Pacific Fauna

1. PROTOZOA

1e. MASTIGOPHORA

BY
G. H. WAILES

WITH FIGURES

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The University of Toronto Press
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MASTIGOPHORA

SELECTED LITERATURE

The following list of selected literature includes recent monographs of certain divisions of the Protozoa and other works. Detailed references to the literature and synonomies of species are omitted from the text but will be found in the works indicated by the numbers after the name of each species.

(1) CALKINS, GARY N. Marine Protozoa from Woods Hole. Bull. U.S. Fish Comm., Vol. 21, pp. 415-468, 1901.

(2) HAMBURGER, CLARA. Flagellata und Sarcodina. Nordisches Plankton, XIII, pp. 195-208, 1913.

(3) KENT, SAVILLE. Manual of the Infusoria. 3 vols. London, 1880-1882.

(4) KOFOID, CHAS. A. Dinoflagellates of the San Diego region. Description of new species. Univ. Cal. Pub. Zool. Vol. 3, No. 13, 1907.
The genus Goniaulax, etc. Ibidem, Vol. 8, No. 4, 1911.

(5) KOFOID, CHAS. A. AND T. SKOGSBERG. The Dinoflagellata: the Dinophysoidae. Mem. Mus. Comp. Zool., Vol. 51, pp. 1-766, 31 pls., 1928.

(6) KOFOID, CHAS. A. AND OLIVE SWEZY. The free-living unarmored Dinoflagellata. Mem. Univ. Cal., Vol. 5, pp. 1-538, 12 pls., 1921.

(7) LEBOUR, MARIE V. The Dinoflagellata of northern seas. 250 pp., 35 pls., Plymouth, 1925.

(8) LEMMERMANN, E. Flagellatae, Chlorophyceae, Coccosphaerales und Silicoflagellatae. Nordisches Plankton, XXI, pp. 1-40, 1903.

(9) SCHILLER, J. Die planktischen vegetationen des adriatischen Meeres. C. Dinoflagellata. I Teil Adiniferidea, Dinophysidaceae, Systematischer Tiel. Arch. Protistenk. Vol. 61, pp. 45-99, 1928.

(10) WAILES, G. H. Dinoflagellates from British Columbia with descriptions of new species. Vancouver Museum Notes, No. 3, pp. 1-2, pls. 1-6, 1928.

(11) WAILES, G. H. Freshwater and marine Protozoa from British Columbia. Ibidem, pp. 3-4, pls. 7-9, 11, 12, 1928.

(12) WAILES, G. H. Marine ciliates of the genus Laboea from British Columbia with description of a new species. Ann. Protistol. Vol. 2, 2-3, pp. 125-126, 1929.

(13) WAILES, G. H. Description of new species of marine Protozoa from British Columbia. Contr. Canad. Biol. Fish., N.S., Vol. 7, No. 17, pp. 213-219, 1932.

MASTIGOPHORA (seu FLAGELLATA)

Animals with one or more flagella.

KEY TO SUBCLASSES

1. (4)	No transverse flagellum present.		
2. (3)	Without chlorophyll or starch grains.	ZOOMASTIGINA	(p. 2)
3. (2)	With chlorophyll or starch grains.	PHYTOMASTIGINA	(p. 6)
4. (1)	With transverse flagellum.	DINOFLAGELLINA	(p. 11)

ZOOMASTIGINA

PROTOMONADIDA

Small forms with one, two, or sometimes three flagella; holozoic, saprozoic or parasitic; reproduction by longitudinal fission.

KEY TO FAMILIES

1. (2)	Animals free-swimming with two flagella.	BODONIDAE	(p. 2)
2. (1)	Animals with one flagellum.		
3. (4)	Plastic collar present.	CRASPEDOMONADIDAE	(p. 3)
4. (3)	Plastic collar absent.		
5. (6)	Tentacle present at base of flagellum.	BICOSOECIDAE	(p. 6)
6. (5)	Tentacle absent.	OICOMONADIDAE	(p. 5)

BODONIDAE

Genus **BODO.**

Animals free-swiming, possessing two flagella of nearly equal size.

KEY TO SPECIES

1. (2)	Body over 30μ in length.	**caudatus**	(p. 3)
2. (1)	Body less than 30μ in length.		
3. (4)	Body narrow.	**rostratus**	(p. 3)
4. (3)	Body ovoid, minute.	**lens**	(p. 3)

B. caudatus (Dujardin) 1, 3 (Fig. 1).

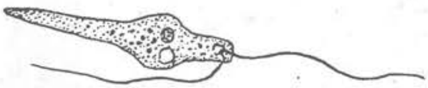


Fig. 1. *Bodo caudatus* (Duj.) X 700.

Syn. *Amphimonas caudatus* Duj.; *Diplomastix caudata* S.K.

Body varying in shape from ovoid to cylindrical.

Length 30 to 50 μ.

Departure bay, among algae.

B. rostratus (Saville Kent) 2, 3 (Fig. 2).

Syn. *Heteromita rostrata* S.K.

Body narrow, pointed anteriorly.

Length 8 to 12 μ; breadth 0.4 of length.

Departure bay, among algae and in the plankton.

Fig. 2. *B. rostratus* (S. Kent) X 1400.

B. lens (O. F. Müller) 2, 3 (Fig. 3).

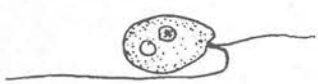


Fig. 3. *B. lens* (Müller) X 2000.

Syn. *Monas lens* O.F.M.; *Heteromita lens* S.K.

Body minute, broadly ovoid.

Length 6 μ; breadth 4 μ.

In algal infusions and decaying matter; in plankton, Departure bay.

CRASPEDOMONADIDAE

KEY TO GENERA

1.	(4)	Animals solitary.		
2.	(3)	Lorica absent.	**MONOSIGA**	(p. 3)
3.	(2)	Lorica present.	**SALPINGOECA**	(p. 3)
4.	(1)	Animals colonial.	**POLYOECA**	(p. 4)

Genus **MONOSIGA.**

Animals provided with a plasmic collar.

M. ovata Saville Kent 1, 3 (Fig. 4).

Body flask-shaped, sessile or with very short pedicel; solitary; freshwater and marine.

Length of body 5 to 6 μ.

Departure bay; Gabriola pass; on algae, diatoms, etc.

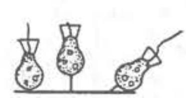


Fig. 4. *Monosiga ovata* S. K. X 900.

Genus **SALPINGOECA.**

Animals with lorica and plasmic collar.

KEY TO SPECIES

1. (2)	Plasmic collar enclosed in the lorica.	**campanula**	(p. 4)
2. (1)	Plasmic collar not enclosed.		
3. (4)	Lorica widest posteriorly.	**marina**	(p. 4)
4. (3)	Lorica ovate.	**infusionum**	(p. 4)

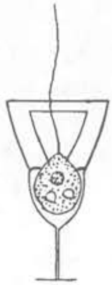


Fig. 5. *Salpingoeca campanula* S. K. X 900.

S. campanula Saville Kent 3 (Fig. 5).

Body and its collar enclosed within a goblet-shaped lorica with expanded upper part.

Length of lorica 15 to 20 μ; length of pedicel less than that of lorica.

False Narrows reef, on algae.

S. marina James Clark 3, 11 (Fig. 6).

Lorica flask-shaped widest posteriorly; attached to substratum by a pedicel.

Length of lorica, without collar, 8 to 10 μ; diameter 5 to 7 μ; length of pedicel 8 to 15 μ.

Departure bay; False Narrows reef; on shells and algae.

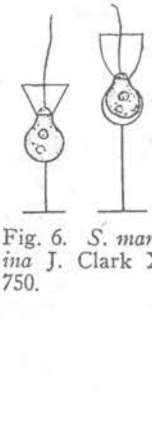


Fig. 6. *S. marina* J. Clark X 750.

Fig. 7. *S. infusionum* S. K. X 750.

S. infusionum Saville Kent 3, 11 (Fig. 7).

Lorica ovate.

Length of lorica, without collar, 7 to 8 μ; pedicel varying from once to several times length of lorica.

Departure bay on algae; Gabriola pass on *Polyzoa*.

Genus **POLYOECA.**

Animals forming colonies and with lorica and plasmic collar.

P. dichotoma Saville Kent 3, 11 (Fig. 8).

Lorica pedicellate, forming branched colonies.

Length of lorica 10 μ; diameter 3 to 5 μ; length of parent pedicel up to 50 μ.

Fig. 8. *Polyoeca dichotoma* S. K. X 500.

OICOMONADIDAE

Genus **CODONOECA.**

Animals enclosed in a stalked cup (or naked), possessing one flagellum.

KEY TO SPECIES

1. (2)	Cup amphora-shaped.	**gracilis**	(p. 5)
2. (1)	Cup enlarged to fluted cone.	**costata**	(p. 5)

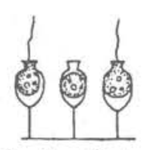


Fig. 9. *Codonoeca gracilis* Calkins X 500.

C. gracilis Calkins 1, 11 (Fig. 9).

Cup amphora-shaped.

Length of cup 12 μ; diameter 6 μ; length of pedicel 8 μ.

Gabriola pass, on algae.

C. costata James Clark 3, 11 (Fig. 10).

Aperture of cup enlarged to a fluted cone.

Length of cup 8 μ; diameter 6 μ; length of fluted cone 11 μ; largest diameter 12 μ; length of pedicel up to 30 μ.

Gabriola pass, on algae.

Fig. 10. *C. costata* J. Clark X 500.

BICOSOECIDAE

Genus **BICOSOECA.**

Animals enclosed in a stalked cup and provided with a tentacle-like process at base of the flagellum.

KEY TO SPECIES

1. (2)	Cup conical.	**gracillipes**	(p. 6)
2. (1)	Cup cylindrical.	**pocillum**	(p. 6)

Fig. 11. *Bicosoeca gracillipes* J. Clark. A, zooid extended; B, commencing to extend. X 500.

B. gracillipes James Clark 3 (Fig. 11).

Cup conical with a long pedicel.

Length of cup 12 to 14 μ; diameter 5 to 6 μ; pedicel two to three times length of cup.

Departure bay, on brown algae.

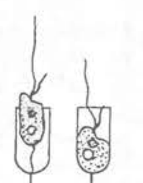


Fig. 12. *B. pocillum* S. K. A, animal extended; B, contracted. X 750.

B. pocillum Saville Kent 3, 11 (Fig. 12).

Cup cylindrical with hemispherical base; pedicel short.

Length of cup 10 to 12 μ; diameter 5 to 6 μ.

Nanaimo, False Narrows reef on diatoms.

PHYTOMASTIGINA

KEY TO ORDERS

1. (4)	Gullet present.		
2. (3)	Chlorophyll yellow or brown.	CRYPTOMONADIDA	(p. 7)
3. (2)	Chlorophyll green.	EUGLENOIDIDA	(p. 7)
4. (1)	Gullet absent.	CHRYSOMONADIDA	(p. 8)

CRYPTOMONADIDA

CRYPTOCHRYSIDAE

KEY TO GENERA

1. (2) Chromatophores present. **CRYPTOCHRYSIS** (p. 7)
2. (1) Chromatophores absent. **OXYRRHIS** (p. 7)

Genus **CRYPTOCHRYSIS.**

Chromatophores present.

C. polychrysis Pascher (Fig. 13).

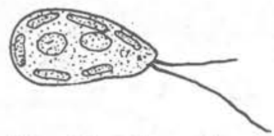


Fig. 13. *Cryptochrysis polychrysis* Pascher X 1000.

Chromatophores plate-like, numerous (up to 15), yellow-brown in colour; body somewhat labile.

Length 20 μ; breadth 10 μ.

Departure bay in plankton off wharf. Previously recorded only from freshwater.

Genus **OXYRRHIS.**

No chromatophores present; anterior recess incomplete and divided by a lobe.

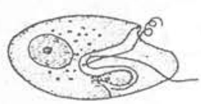


Fig. 14. *Oxyrrhis marina* Duj. From Duflein (1928) after Senn X 650.

O. marina Dujardin 1, 3, 6 (Fig. 14).

Body ovoid, recessed anteriorly whence the two flagella arise; nucleus of the dinoflagellate type situated posteriorly; when in motion one flagellum trails behind. Classified as a dinoflagellate by Kofoid and Swezy (6).

Length 15 to 40 μ; breadth 8 to 23 μ.

Nanoose bay, 10 to 15 fathoms. Departure bay.

EUGLENOIDIDA

PERANEMIDAE

Genus **ANISONEMA.**

Body striped, not plastic, with distinct mouth and pharynx; one anterior and one posterior flagellum.

KEY TO SPECIES

1. (2) Body ridged. **vitraea** (p. 8)
2. (1) Body smooth. **acinus** (p. 8)

A. vitraea (Dujardin) 1, 3 (Fig. 15).

Fig. 15. *Anisonema vitraea* (Duj.) X 450. B, outline of section of body.

Syn. *Tropidoscyphus octocostatus* Stein; *Sphenomonas octocostatus* S.K.

Body ridged; transverse section octagonal.

Length of body 40 to 50 μ.

Departure bay among algae; marine and freshwater.

A. acinus Dujardin 3 (Fig. 16)

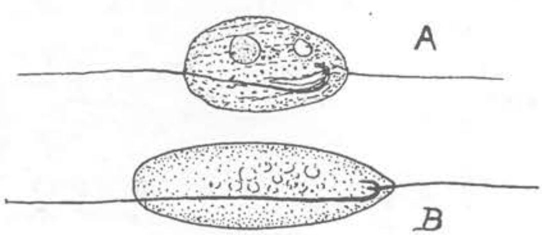


Fig. 16. *A. acinus* Duj. A, typical form; B, elongate forms, length 68 μ, breadth 20 μ, X 550.

Syn. *Bodo grandis* Ehrenb., *Anisonema concavum* J. Clark, *A.grande* Ehrenb.

Body smooth, compressed.

Length 30 to 60 μ; breadth 15 to 23 μ; trailing flagellum about two and one-half times length of body, forward flagellum equal to length of body.

Departure bay among shore algae. Marine and freshwater.

CHRYSOMONADIDA

KEY TO FAMILIES

1. (2) Animal with thin lorica. CHROMULINIDAE (p. 8)
2. (1) Animal with latticed silicious skeleton. SILICOFLAGELLIDAE (p. 9)

CHROMULINIDAE

Genus **DINOBRYON.**

Lorica delicate, partly filled by the animal which is attached by a contractile thread.

D. balticum Schütt 8, 11 (Fig. 17).

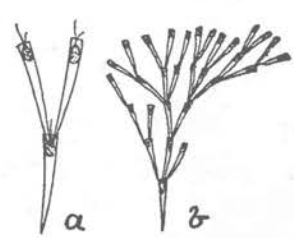


Fig. 17. *Dinobryon balticum* Schütt. A, X 125; B, X 75.

Lorica long, tapering, in branching colonies; the only species of this freshwater genus found in brackish water.

Length of lorica about 90 μ.

Kyuquot sound, in brackish water near the head.

SILICOFLAGELLIDAE

KEY TO GENERA

1. (4)	Theca angled.	
2. (3)	Theca conical, base four-angled.	**DICTYOCHA** (p. 9)
3. (2)	Theca conical, base six to ten angled.	**DISTEPHANUS** (p. 9)
4. (1)	Theca ovoid.	**EBRIA** (p. 11)

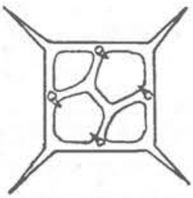


Fig. 18. *Dictyocha fibula* var. *longispina* Lemm. X 600.

Genus **DICTYOCHA**.

D. fibula var. **longispina** Lemmermann 8, 11 (Fig. 18).

Width of basal ring about 25 μ; over spines 50 to 60 μ.

Not uncommon in the neritic plankton.

Genus **DISTEPHANUS**.

KEY TO SPECIES

1. (2)	Basal ring hexagonal.	**speculum** (p. 9)
2. (1)	Basal ring not hexagonal.	
3. (4)	Basal ring octagonal.	**octangulatus** (p. 10)
4. (3)	Basal ring 10-sided.	**pentagonus** (p. 10)

D. speculum (Ehrenberg) 8, 11 (Fig. 19).

Basal ring hexagonal with two long and four shorter spines.

Diameter of ring 20 to 26 μ; the long spines up to 20 μ in length.

In the neritic plankton; not very common.

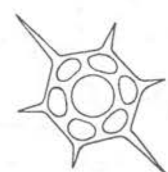


Fig. 19. *Distephanus speculum* (Ehrenb.) X 500.

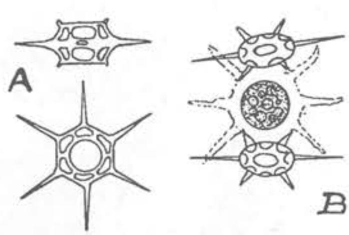


Fig. 20. *D. speculum* var. *regularis* Lemm. X 350. A, face and edge views; B, formation of spore.

D. speculum var. **regularis** Lemmermann 8, 11 (Fig. 20).

Spines of equal length.

Diameter of ring 21 to 30 μ; spore 26 to 30 μ in diameter with an hyaline investment 35 to 40 μ in diameter and radial extensions of about 16 μ in length.

Common in neritic plankton; spores rare.

D. speculum var. **septenaria** (Ehrenberg) 8 (Fig. 21).

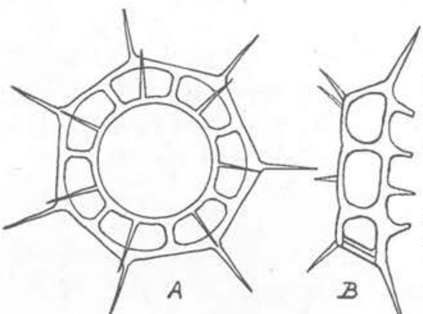


Fig. 21. *D. speculum* var. *septenaria* (Ehrenb.) X 330. A, broad view; B, edge view.

Basal ring 7 or 8-sided with a supporting bar in centre of each side, a spine at each angle and a downwardly inclined projection on each side; apical ring circular or 7 or 8-sided with a radial spine at each angle.

Apical opening 22 μ wide; basal ring diameter 34 to 39 μ; width over basal spines 55 to 72 μ; height of cone 10 μ.

Departure bay; Porlier pass.

An individual with a ten-sided basal ring and no spines on the apical ring occurred in the plankton in Departure bay, diameter 36 μ.

D. octangulatus Wailes 13 (Fig. 22).

Syn. *Distephanus speculum* var. *octonarius* Ehrenberg *forma* Wailes, 27.

Basal ring octagonal, apical ring four-sided.

Diameter of basal ring 35 μ.

Found in pilchards caught off west coast of Vancouver island.


Fig. 22. *D. octangulatus* Wailes X 450.

D. pentagonus Wailes 13 (Fig. 23).

Basal ring ten-sided; apical ring pentagonal.

Diameter basal ring 45 μ; height of cone 26 μ.

Found in pilchards caught off west coast of Vancouver island.

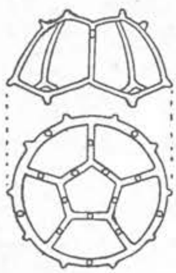


Fig. 23. *D. pentagonus* Wailes. Side and apical views X 475.

Genus **EBRIA**.

E. tripartita (Schumberger) 8, 11 (Fig. 24).

Syn. *Dictyocha tripertita* Schumberger; *D. fornix* Moebius.

Body of irregular ovoid form compressed; with a latticed silicious skeleton.

Diameter 30 to 35 μ.

Generally distributed in neritic plankton; not uncommon.

Fig. 24. *Ebria tripartita* (Schum.) A, skeleton X 450; B, and C dorsal and side view of living cell X 600.

DINOFLAGELLINA

Two flagella present, one transverse, one posterior and trailing; girdle and sulcus more or less well developed; contractile vacuole absent; body either naked or covered with a shell; planktonic.

KEY TO ORDERS

1. (2) Without girdle or sulcus. ADINIFERIDA (p. 11)
2. (1) Girdle and sulcus present. DINIFERIDA (p. 12)

ADINIFERIDA

PROROCENTRIDAE

Body enclosed in a bivalve shell that divides longitudinally.

KEY TO GENERA

1. (2) Body enclosed in a shell without conspicuous spines. **EXUVIELLA** (p. 11)
2. (1) Shell with prominent spine. **PROROCENTRUM** (p. 11)

Genus **EXUVIELLA.**

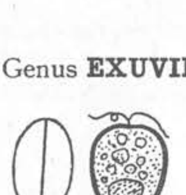


Fig. 25. *Exuviella apora* Schiller. Broad and narrow views X 600.

E. apora Schiller 7, 10 (Fig. 25).

Shell heart-shaped, compressed, composed of two valves.

Length 20 to 22 μ; breadth 18 to 20 μ; thickness 12 μ.

West coast of Vancouver island.

Genus **PROROCENTRUM.**

P. gracile Schütt (1895) 10 (Fig. 26).

Shell wedge-shaped, compressed, composed of two valves provided with spine placed anteriorly.

Length 45 to 50 μ; breadth 10 to 16 μ; length of spine 10 μ in addition.

Generally distributed in the plankton; occasionally dominant in the nannoplankton.

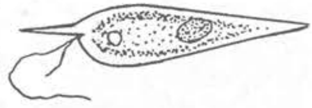


Fig. 26. *Prorocentrum gracile* Schütt X 700.

DINIFERIDA

KEY TO TRIBES

1. (2)	Body naked.	GYMNODINIOIDAE (p. 12)
2. (1)	Body enclosed in theca.	PERIDINIOIDAE (p. 22)

GYMNODINIOIDAE

KEY TO FAMILIES

1. (2)	Permanently colonial with nematocysts.	POLYKRIKIDAE (p. 12)
2. (1)	Not permanently colonial.	
3. (4)	Ocellus present.	POUCHETIIDAE (p. 13)
4. (3)	Ocellus absent.	
5. (6)	Tentacles present.	NOCTILUCIDAE (p. 15)
6. (5)	No tentacle.	GYMNODINIIDAE (p. 15)

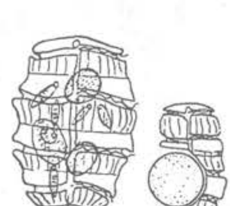
POLYKRIKIDAE

Genus **POLYKRIKOS**.

Zooids much compressed dorso-ventrally; connected together in chain formation making a compound organism with usually half as many nuclei as individuals; a limited number (usually 5 or 6) of nematocysts present; distributed centrally.

KEY TO SPECIES

1. (2)	Surface of hypocone ribbed.	**kofoidi** (p. 12)
2. (1)	Surface of hypocone smooth.	**schwartzi** (p. 13)



A B

Fig. 27. *Polykrikos kofoidi* Chatton. A, ventral view showing two nuclei, a food body and nematocysts X 200; B, individual disgorging a food particle X 100.

P. kofoidi Chatton 6, 10 (Fig. 27).

Syn. *P. schwartzi* Kofoid (1907) in part.

Surface of hypocone of each zooid ribbed, ribs most apparent in an end view; girdle displaced one-fifth length of body; body compressed dorso-ventrally; nuclei spherical usually half as many as there are zoöids in the chain; chains of four most frequently seen, but the numbers may be 2, 4, 8 (or 16).

Length of chain of 4 zooids 110 to 150 μ; breadth 70 to 90 μ; nuclei 25 to 30 μ in diameter.

Generally distributed.

P. schwartzi Bütschli 6, 7, 10 (Fig. 28).

Syn. *P. auricularia* Bergh (1881).

Body subcircular in transverse section not ribbed; girdle without displacement; number of zooids in a chain 2, 4, 8 (or 16); number of nuclei half that of zooids or fewer.

Length of chain of eight zooids 140 μ; breadth 65 μ; diameter of nuclei 20 μ.

Generally distributed.

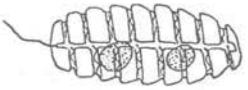


Fig. 28. *P. schwartzi* Bütschli X 200.

POUCHETIIDAE

Body with torsion; ocellus present; with or without nematocysts.

KEY TO GENERA

1. (2) With nematocysts. **NEMATODINIUM** (p. 13)
2. (1) Without nematocysts. **POUCHETIA** (p. 13)

Genus **NEMATODINIUM.**

Body with considerable torsion; ocellus and nematocysts present.

N. armatum Dogiel 6, 7, 10 (Fig. 29).

Fig. 29. *Nematodinium armatum* Dogiel X 300.

Body ellipsoidal; girdle making one and one-half turns; sulcus extending from apicone and with one coil around hypocone making one and one-quarter turns; ocellus posterior, simple, lens spheroidal, pigment mass sub-hemispherical, black; colour of body yellow to yellow-brown, sometimes colourless.

Length 45 to 70 μ; breadth 32 to 50 μ; nucleus half the breadth in diameter; nematocysts about 15 μ in length, 4 μ in diameter.

Strait of Georgia, common in summer.

Genus **POUCHETIA.**

Body usually brightly coloured and with more or less torsion; ocellus present but no nematocysts.

KEY TO SPECIES

1. (4) Length of cell 100μ or more.
2. (3) Sulcus making 0.75 of a turn. **maxima** (p. 14)
3. (2) Sulcus making 3 turns. **violescens** (p. 14)
4. (1) Length of cell less than 100μ.
5. (6) Sulcus with apical loop and 1.2 turns. **rubescens** (p. 14)
6. (5) Sulcus without special loop, making 0.5 turn. **panamensis** (p. 14)

Fig. 30. *Pouchetia maxima* K. & S. X 250. F, a food particle; N, nucleus.

P. maxima Kofoid and Swezy 6 (Fig. 30).

Girdle making one and one-half turns; sulcus making three-quarters of a turn; body of lavender colour.

Length 100 μ (145 μ K & S); breadth 65 μ; nucleus 35 μ in diameter.

Off Cortes island.

P. violescens Kofoid and Swezy 6 (Fig. 31)

Girdle making one and one-half turns; sulcus with terminal loops and making three turns; colour violet, uniformly diffused.

Length 115 μ; breadth 65 μ.

Off Cortes island.

Fig. 31. *P. violescens* K. & S. X 313. After Kofoid and Swezy 1921.

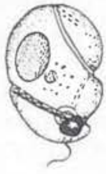


Fig. 32. *P. rubescens* K. & S. X 300. After Kofoid and Swezy 1921.

P. rubescens Kofoid and Swezy 6 (Fig. 32).

Medium sized species; girdle making one and one-fifth turns; sulcus making an apical loop and with a torsion of one and one-fifth turns; colour pink.

Length 60 to 65 μ; breadth 45 to 50 μ.

Off Cortes island.

P. panamensis Kofoid 6 (Fig. 33).

Very small species; girdle making one and one-quarter turns; sulcus about half a turn; colour pinkish.

Length 32 to 38 μ; breadth 24 to 26 μ.

Strait of Georgia.

Fig. 33. *P. panamensis* Kofoid X 500.

NOCTILUCIDAE

Genus **NOCTILUCA**

N. scintillans (Macartney) 6, 7, 10 (Fig. 34).

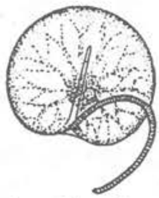


Fig. 34. *Noctiluca scintillans* (Macartney) X 75.

Body inflated kidney-shaped to spheroidal; provided with long and stout tentacle transversely striated. Girdle and sulcus only present when very young.

Diameter of body 200 to 1200 μ or more; those seen in this area usually between 300 and 500 μ in diameter.

Generally distributed; occasionally so numerous as to colour large areas a reddish or pinkish hue, their remains forming windrows on beaches. This species is well known for its luminescent qualities.

GYMNODINIIDAE

Body naked or covered with a thin pellicle.

KEY TO GENERA

1. (8)	Girdle anterior or sub-median.		
2. (3)	Girdle anterior with little or no displacement; epicone relatively minute.	**AMPHIDINIUM**	(p. 15)
3. (2)	Girdle sub-median.		
4. (5)	Girdle displaced less than one-fifth of length of body.	**GYMNODINIUM**	(p. 16)
5. (4)	Girdle displaced more than one-fifth length of body.		
6. (7)	Body with torsion less than one-half turn.	**GYRODINIUM**	(p. 19)
7. (6)	Body with torsion of more than one-half turn; girdle widely displaced making one and one-half or more turns.	**COCHLODINIUM**	(p. 21)
8. (1)	Girdle posterior and slightly displaced.	**TORODINIUM**	(p. 22)

Genus **AMPHIDINIUM**

KEY TO SPECIES

1. (2)	Epicone pointed; girdle wide.	**crassum**	(p. 15)
2. (1)	Epicone rounded; girdle narrow.	**ovoideum**	(p. 16)

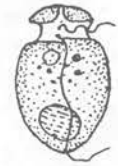


Fig. 35. *Amphidinium crassum* Lohm. X 650.

A. crassum Lohmann 6, 7, 10 (Fig. 35).

Epicone minute, girdle wide and deeply impressed.

Length about 30 μ; breadth about 20 μ.

Strait of Georgia; rare.

A. ovoideum Lemmermann 6, 7 (Fig. 36).

Cell small ovoid, not compressed; epicone about one-eighth of body in length; sulcus extending from apex to slightly beyond centre of body; nucleus spherical situated posteriorly, nuclear membrane firm, contents finely granular; nucleus may persist and be isolated after cyclosis has set in, in the living animal it is masked by the chromatophores; chromatophores spherical or ovoid, of a green colour, densely crowded; movements rapid, marine and freshwater.

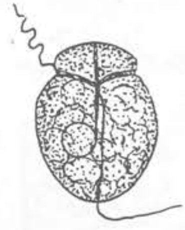


Fig. 36. *A. ovoideum Lemm.* X 900.

Length 23 to 25 μ; breadth 18 to 19 μ; nucleus 6 to 7 μ in diameter; epicone 3 μ in height.

Departure bay tide pool; numerous in March.

Genus **GYMNODINIUM.**

KEY TO SPECIES

1. (20)	Periplast thin.		
2. (7)	Periplast striated.		
3. (4)	Cell ellipsoidal; colour rose-red.	**rubrum**	(p. 16)
4. (3)	Cell not as above.		
5. (6)	Cell biconical; colour grey-green and yellow.	**multistriatum**	(p. 17)
6. (5)	Cell ovoid; colour pinkish-cinnamon.	**heterostriatum**	(p. 17)
7. (2)	Periplast not striated.		
8. (15)	Chromatophores present.		
9. (12)	Cell subspherical.		
10. (11)	Girdle constricting.	**variabile**	(p. 17)
11. (10)	Girdle not constricting.	**flavum**	(p. 17)
12. (9)	Cell not subspherical.		
13. (14)	Chromatophores dark yelllow, radiating.	**splendens**	(p. 17)
14. (13)	Chromatophores bright yellow, scattered.	**arcticum**	(p. 18)
15. (8)	Chromatophores absent.		
16. (17)	Length of cell more than 2 diameters; cyst arcuate.	**bicorne**	(p. 18)
17. (16)	Length of cell less than 2 diameters.		
18. (19)	Length 1.8 diameters; girdle displaced .3 diameter.	**scopulosum**	(p. 18)
19. (18)	Length 1.25 diameters; girdle displaced slightly; cyst lunate.	**lunula**	(p. 18)
20. (1)	Periplast thick, striated and mammillated.	**abbreviatum**	(p. 19)

G. rubrum Kofoid and Swezy 6, 7, 10 (Fig. 37).

Fig. 37. *Gymnodinium rubrum* K. & S. X 200.

Epicone of a rose-red colour with coarse striae marked by red particles; hypercone of a pale greenish colour finely striated; nucleus large with a well marked clear border situated anteriorly.

It is a very labile species but not unlikely to be confused with any other species here except *G. abbreviatum* from which it is distinguishable by the character of the nucleus.

Length 100 to 140 μ; breadth about 0.55 of length; nucleus 30 to 40 μ in breadth.

Strait of Georgia.

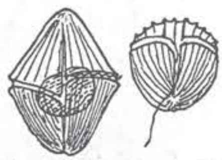


Fig. 38. *G. multistriatum* K. & S., ventral and antapical views X 300.

G. multistriatum Kofoid and Swezy 6, 10 (Fig. 38).

Cell biconical; epicone seen to be coarsely furrowed if examined in an end view; hypocone finely striated; colour grey-green and yellow.

Length 65 to 80 μ (100 μ Kofoid).

Off Cortes island, strait of Georgia. July and August.

G. heterostriatum Kofoid and Swezy 6 (Fig. 39).

Fig. 39. *G. heterostriatum* K. & S. X 300.

Cells medium size, ovoid; girdle median displaced its own width; nucleus spherical situated anteriorly; epicone coarsely, hypocone more finely striated; colour pinkish-cinnamon.

Length 60 to 75 μ; breadth 40 to 50 μ.

Off Cortes island, strait of Georgia.

G. variabile C. Herdman 7, 10 (Fig. 40).

Fig. 40. *G. variabile* C. Herdman X 350.

Epicone and hypocone both hemispherical, girdle not displaced; no striae present.

Length 30 to 40 μ; diameter 23 to 30 μ; (length 8 to 40 μ, Herdman).

Off Cortes island, rare.

Probably several species have been included under this name.

G. flavum Kofoid and Swezy 6, 10 (Fig. 41).

Fig. 41. *G. flavum* K. & S. X 1000.

Cells small subspherical, slightly compressed; girdle median, displaced twice its own width; nucleus spheroidal, situated posteriorly; cytoplasm clear with yellow chromatophores; no striae.

Length 21 to 28 μ; breadth five-sixths of length.

Departure bay, June to August.

G. splendens Lebour 7, 10 (Fig. 42).

Fig. 42. *G. splendens* Lebour X 300.

Deep yellow colour; chromatophores in radial arrangement; cell wall more resistant than in other species of *Gymnodinium*, therefore often identifiable in preserved gatherings; frequently found in process of division.

Length 50 to 80 μ; breadth 35 to 54 μ; thickness about two-thirds of breadth.

Generally distributed; common.

G. arcticum Wulff 6, 7, 10 (Fig. 43).

Epicone conical; hypercone hemispherical; girdle median; no striae present.

Length 22 to 24 μ; diameter 14 to 18 μ.

Off Cortes island, strait of Georgia; rare.

Fig. 43. *G. arcticum* Wulff X 500.

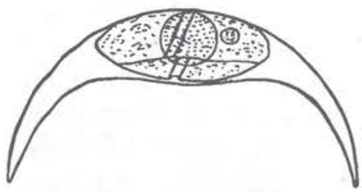


Fig. 44. *G. bicorne* K. & S. Cyst containing fully developed cell. X 400.

G. bicorne Kofoid and Swezy 6, 10 (Fig. 44).

Body elongate and biconical, not striated; cysts arcuate frequently seen in pairs; cells usually one in each cyst.

Length, in free-swimming stage, 40 to 65 μ; breadth 19 to 23 μ. Cysts about 100 μ in length.

Generally distributed, scarce.

G. scopulosum Kofoid and Swezy 6, 10 (Fig. 45).

Varies from pale yellow in colour to nearly colourless; no striae present; chromatophores absent; girdle displaced .3 diameter.

Length 35 to 45 μ; diameter 20 to 26 μ.

Strait of Georgia; not uncommon.

Fig. 45. *G. scopulosum* K. & S. X 500.

G. lunula Schütt 6, 7. 10 (Fig. 46).

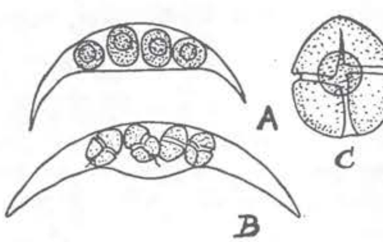


Fig. 46. *G. lunula* Schütt. A, cyst containing immature cells; B, cyst containing fully developed cells; C, free-swimming individual. A and B X 200; C X 700.

Syn. *Pyrocystis lunula* Schütt.

Body ovoid, slightly compressed; girdle displaced its own width; no striae present. Cysts lunate, sometimes occurring in spherical aggregations of 16 individuals but usually in pairs or singly; cells ovoid usually 4 or 8 in each cyst.

Length, in free-swimming stage, 20 to 26 μ; breadth 16 to 20 μ; cysts 120 to 140 μ in length.

Generally distributed, sometimes numerous.

G. abbreviatum Kofoid and Swezy 6, 7, 10 (Fig. 47).

Body striated with a more or less mammillated surface of a bright pink colour; nucleus large, conspicuous, posterior.

Length 95 to 116 μ; breadth 50 to 70 μ.

Numerous off Camp island, strait of Georgia; July and August.

Fig. 47. *G. abbreviatum* K. & S. X 200.

Genus **GYRODINIUM.**

KEY TO SPECIES

1.	(6)	Length usually more than 100 μ.	
2.	(3)	With coral red pigment.	**corallinum** (p. 19)
3.	(2)	Without red pigment.	
4.	(5)	With scattered ochraceous granules.	**ochraceum** (p. 19)
5.	(4)	Without scattered ochraceous granules.	**spirale** (p. 19)
6.	(1)	Length less than 100 μ.	
7.	(14)	Length more than 50 μ.	
8.	(11)	Epicone contracted to a point.	
9.	(10)	Striae similar on epicone and hypocone.	**pepo** (p. 20)
10.	(9)	Striae dissimilar on epicone and hypocone.	**fulvum** (p. 20)
11.	(8)	Epicone not contracted to a point.	
12.	(13)	Colour purplish-red.	**postmaculatum** (p. 20)
13.	(12)	Colour pale green..	**pingue** (p. 20)
14.	(7)	Length less than 50 μ.	**glaucum** (p. 20)

Fig. 48. *Gyrodinium corallinum* K. & S. X 200.

G. corallinum Kofoid and Swezy 6, 10 (Fig. 48).

Body with greenish tinge, surface striated with coral red spots or patches; length about twice the breadth; girdle displaced about one-third length of body, nucleus large, spherical with a clearly differentiated outer portion.

Length 84 to 160 μ; breadth 45 to 80 μ; nucleus 30 to 40 μ in diameter.

Strait of Georgia.

G. ochraceum Kofoid and Swezy 6 (Fig. 49).

Fig. 49. *G. ochraceum* K. & S. X 250.

Girdle displaced about two-fifths length of body with slight overhang; sulcus with twist ($\frac{1}{2}$ turn K. & S.); nucleus ellipsoidal; body striated with greenish lines 2 μ apart; orange or yellow granules colouring surface; pustule extending between the flagellular pores usually present.

Length 100 to 120 μ; breadth 40 to 45 μ.

Off Cortes island.

Fig. 50. *G. spirale* (Bergh) X 200.

G. spirale (Bergh) 6, 7, 10 (Fig. 50).

Apex acute; length of body from $2\frac{1}{2}$ to 3 times breadth; girdle with a displacement of about half length of body; sulcus extending full length of body; colour pale yellow; surface striated.

Length 80 to 160 μ; breadth 35 to 55 μ.

Strait of Georgia, common.

G. pepo (Schütt) 6 (Fig. 51).

Syn. *Gymnodinium spirale* var. *pepo* Schütt.

Body ovoid with pointed apex and broadly rounded antapex, coarsely striated; displacement of girdle about one-third length of body; sulcus extending length of body.

Length 80 μ; breadth 50 μ.

Strait of Georgia.

Fig. 51. *G. pepo* (Schütt) X 250.

Fig. 52. *G. fulvum* K. & S. X 400.

G. fulvum Kofoid and Swezy 6 (Fig. 52).

Body unevenly striated, with pointed apex and broadly rounded antapex; breadth equal to 0.5 to 0.6 of length; girdle with displacement equal to about half the length; nucleus subspherical; colour yellow.

Length 45 to 100 μ; breadth 23 to 60 μ.

Strait of Georgia, not uncommon July and August.

G. postmaculatum Kofoid and Swezy 6, 10 (Fig. 53).

Colour purplish red mostly concentrated at the apices and in interrupted striae; girdle displaced about one-third length of body.

Length 65 to 90 μ; breadth about half the length; nucleus about half breadth of body in diameter.

Off Cortes island, numerous in July and August; Departure bay, rare.

Fig. 53. *G. postmaculatum* K. & S. X 250.

Fig. 54. *G. pingue* (Schütt) X 300.

G. pingue (Schütt) 6, 7, 10 (Fig. 54).

Syn. *Gymnodinium spirale* var. *pinguis* Schütt.

Colour pale greenish, surface finely striated. Shape somewhat variable.

Length 45 to 80 μ; breadth 25 to 45 μ.

Strait of Georgia, not uncommon.

G. glaucum Lebour 6, 7, 10 (Fig. 55).

Girdle situated posteriorly; colour grey or greenish.

Length about 40 μ; breadth about half the length.

Strait of Georgia.

Fig. 55. *G. glaucum* Lebour X 600.

Genus **COCHLODINIUM.**

KEY TO SPECIES

1. (2) Two sides of the body symmetrical.	**vinctum**	(p. 21)
2. (1) Two sides of the body asymmetrical.		
3. (4) Girdle making 1.5 turns.	**catenatum**	(p. 21)
4. (3) Girdle making more than 1.5 turns.		
5. (6) Girdle making nearly 2 turns.	**conspiratum**	(p. 21)
6. (5) Girdle making 2.5 turns.	**archimedes**	(p. 21)

Fig. 56. *Cochlodinium vinctum* K. & S. X 300.

C. vinctum Kofoid and Swezy 6, 7, 10 (Fig. 56).

Body about one-third longer than broad; girdle making over one and one-half turns, sulcus with apical and antapical loops and a torsion of over half a turn; colour pale blue or yellowish blue.

Length 35 to 65 μ; breadth about three-quarters of length.

Strait of Georgia.

C. catenatum Okamura 6 (Fig. 57).

Body about one and one-third times as long as broad; girdle making one and one-half turns; sulcus with torsion of half a turn; colour yellowish.

Length 36 μ; breadth 26 μ.

Off Cortes island; August.

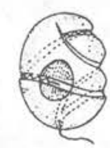


Fig. 57. *C. catenatum* Okamura X 425.

Fig. 58. *C. conspiratum* K. & S. X 400.

C. conspiratum Kofoid and Swezy 6, 10 (Fig. 58).

Body a little longer than wide; girdle making nearly two turns; sulcus with apical and antapical loops and a torsion of less than one turn; colour yellow.

Length 35 to 50 μ; breadth 30 to 45 μ.

Strait of Georgia.

C. archimedes (Pouchet) 6, 7, 10 (Fig. 59).

Body about twice as long as broad; girdle making two and one-half turns; sulcus with torsion of at least one and one-half turns; colour red.

Length 60 μ; breadth 32 μ.

Off Cortes island, strait of Georgia, June.

Fig. 59. *C. archimedes* (Pouchet) X 300.

Fig. 60. *Torodinium robustum* K. & S. X 350.

Genus **TORODINIUM.**

T. robustum Kofoid and Swezy 6, 7, 10 (Fig. 60).

Syn. *Gymnodinium teredo* Schütt (1895) in part.

Body elongate, subcircular in section; sulcus extending whole length of body with an apical loop; girdle placed posteriorly, slightly displaced; nucleus elongate from one-third to one-half length of body.

Length 80 to 103 μ; breadth 23 to 39 μ; nucleus about 5 μ in width.

Off Cortes island; July and August, scarce.

PERIDINIOIDAE

KEY TO FAMILIES

1. (2) Theca divided into discrete plates. PERIDINIIDAE (p. 26)
2. (1) Theca not so divided.
3. (4) Body laterally compressed; dividing laterally. DINOPHYSIDAE (p. 22)
4. (3) Body not compressed; dividing equatorially. GLENODINIIDAE (p. 25)

DINOPHYSIDAE

Theca divided by a seam into two lateral halves; body flattened laterally.

KEY TO GENERA

1. (4) Epitheca conspicuous above the lists.
2. (3) Sulcus prolonged onto epitheca with dilated end. **PSEUDOPHALACROMA** (p. 22)
3. (2) Sulcus not prolonged onto epitheca. **PHALACROMA** (p. 23)
4. (1) Epitheca not conspicuous above the lists which are sometimes much developed. **DINOPHYSIS** (p. 23)

Genus **PSEUDOPHALACROMA.**

P. nasutum (Stein) 5, 7, 10 (Fig. 61).

Body nearly as broad as long, compressed; fundus broadly rounded; epitheca broad extending beyond the girdle lists. Very similar in appearance to *Phalacroma rotundatum*, the extension of the sulcus onto the epitheca being inconspicuous unless seen in apical view.

Length 45 to 50 μ; thickness about three-quarters of the breadth.

Generally distributed, scarce.

Fig. 61. *Pseudophalacroma nasutum* (Stein). A, broad view; B, ventral view. X 430.

Genus **PHALACROMA.**

P. rotundatum Claparède and Lachman 5, 7, 10 (Fig. 62).

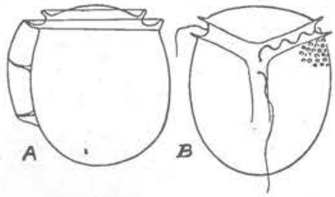


Fig. 62. *Phalacroma rotundatum* C. & L. A, broad view; B, ventral view. X 400.

Body nearly as broad as long, dark colour; epitheca broad; girdle and ventral lists narrow; sulcus inconspicuous.

Length 49 to 61 μ; breadth 45 to 55 μ; thickness about three-quarters of the breadth.

Generally distributed, common.

Genus **DINOPHYSIS.**

KEY TO SPECIES

1. (4)	Cell with fundus smooth or with papillae only.		
2. (3)	Cell with fundus forked.	**tripos**	(p. 23)
3. (2)	Cell with fundus provided with stout spine.	**hastata**	(p. 24)
4. (1)	Cell with fundus not as above.		
5. (14)	Body in side view elliptical.		
6. (11)	Fundus rounded.		
7. (10)	Body symmetrical.		
8. (9)	Papillae present on fundus.	**acuminata**	(p. 24)
9. (8)	Papillae absent on fundus.	**lenticulata**	(p. 24)
10. (7)	Body asymmetrical.	**ellipsoides**	(p. 24)
11. (6)	Fundus bluntly pointed.		
12. (13)	Apex of fundus situated on median axis.	**norvegica**	(p. 24)
13. (12)	Apex of fundus asymmetrical.	**acuta**	(p. 25)
14. (5)	Body in side view broadly oval or subspherical.		
15. (16)	Body symmetrical.	**rotundata**	(p. 25)
16. (15)	Body asymmetrical.	**parva**	(p. 25)

D. tripos Gouret 5, 7, 11 (Fig. 63).

Readily distinguished by the forked fundus; occurs occasionally in twin form.

Length 100 to 110 μ; breadth 55 to 58 μ not including lists; lists about 25 μ in breadth.

Off west coast of Vancouver island, scarce; strait of Georgia, rare.

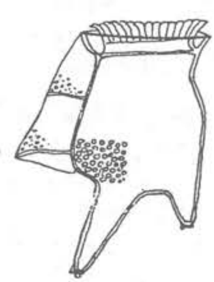


Fig. 63. *Dinophysis tripos* Gouret X 300.

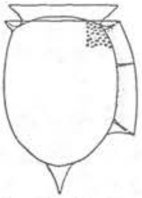


Fig. 64. *D. hastata* Stein. Usual form in B.C. waters.

D. hastata Stein 5, 10 (Fig. 64).

The form usually found here is more symmetrical, the spine is smaller and posterior portion of wing is narrower than in type.

Length 45 to 78 μ not including spine; spine 10 to 15 μ in length; breadth 40 to 64 μ, wing 10 μ in width in addition.

Off east and west coasts of Vancouver island, scarce.

D. acuminata Claparède and Lachman 5, 7, 10 (Fig. 65).

Small papillae usually present on base of theca.

Length 40 to 55 μ; breadth 30 to 40 μ; thickness about half the breadth.

Generally distributed, often numerous.

Fig. 65. *D. acuminata* C. & L. X 400.

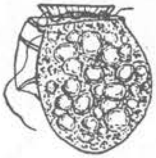


Fig. 66. *D. lenticulata* Pavillard X 400.

D. lenticulata Pavillard 5, 7, 10 (Fig. 66).

Somewhat similar to *D. acuminata* but less symmetrical and usually smaller; papillae never present.

Length 40 to 50 μ; breadth 30 to 42 μ.

Generally distributed.

D. ellipsoides Kofoid 4, 5, 10 (Fig. 67).

Body ellipsoidal with straight ventral margin; list extending about two-thirds length of body. Larger here than found by Kofoid off California where length was 43 μ excluding collar. Colourless and usually transparent.

Length 45 to 70 μ; breadth 32 to 45 μ.

Generally distributed, often abundant off west coast of Vancouver island.

Fig. 67. *D. ellipsoides* Kofoid X 400.

D. norvegica Claparède and Lachmann 5, 7, 10 (Fig. 68).

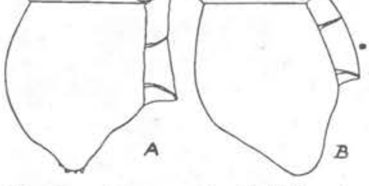


Fig. 68. *D. norvegica* C. & L. A, X 370; B, X 350.

Syn. *D. sphaerica* pars Schütt 1895, pl. 1, fig. 7.

Base of theca more or less bluntly pointed, apex situated on or near longitudinal axis; papillae often present.

Length 68 to 71 μ.

Generally distributed but not numerous.

D. acuta Ehrenberg 5, 7, 10 (Fig. 69).

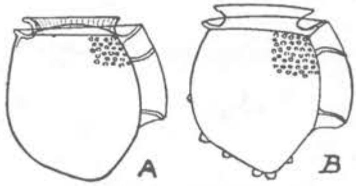


Fig. 69. *D. acuta* Ehrenb. A, form with blunt apex; B, with more pointed apex and nodular excrescences. X 400.

Theca terminating in a blunt point on ventral side of median line; papillae occasionally present on fundus; colour rose-red or yellow.

Length 49 to 71 μ; breadth 40 to 55 μ.

Generally distributed, occasionally numerous.

Fig. 70. *D. rotundata* var. *intermedia* Lindemann. X 400.

D. rotundata var. **intermedia** Lindemann (Fig. 70).

Body broadly oval with large collar.

Length 53 to 55 μ; breadth .9 of the length; collar 30 μ in diameter at bottom of groove.

Departure bay, rare.

D. rotundata Claparède and Lachmann belongs to the genus *Phalacroma* (vide supra); the specific name *D. intermedia* cannot be applied to this species as it is preoccupied.

D. parva Schiller 9 (Fig. 71).

Fig. 71. *D. parva* Schiller X 500.

Body in broad view subcircular, distinguished by its asymmetrical form from other species of the genus.

Length 40 to 50 μ; breadth without lists 35 to 38 μ.

In the neritic plankton; generally distributed, sometimes numerous.

The form found by Schiller in the Adriatic measured only 22 to 23 μ in length; a similar form ascribed by Schütt to *D. sphaerica* measures 70 μ in length.

GLENODINIIDAE

Genus **GLENODINIUM**

Theca not formed of separate plates; dividing equatorially.

G. danicum Paulsen 7, 12 (Fig. 72).

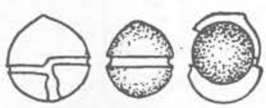


Fig. 72. *Glenodinium danicum* Paulsen. A, ventral; B, dorsal view; C, liberation of spore. X 350.

Theca subspherical, homogenous, colourless; girdle groove equatorial, shallow, recessed, without lists; frequently found containing spherical spores or discharging them by the theca dividing along the girdle groove.

Diameter 25 to 35 μ.

Generally distributed, plentiful.

PERIDINIIDAE

Theca divided into plates; apical pore usually present.

KEY TO GENERA

Apicals.	Anterior intercalaries.	Precingulars.	Postcingulars.	Posterior intercalaries.	Antapicals.		
2′	0	6″	6‴	1 p.	1⁗	**PROTOCERATIUM**	(p. 26)
3′ to 5′	0 to 2a	6″	6‴	1 p.	1⁗	**GONYAULAX**	(p. 26)
3′	1a to 2a	6″	5‴	0	2⁗	**PERIDINIOPSIS**	(p. 28)
3′	1a to 2a	7″	5‴	0	1⁗	**DIPLOPELTOPSIS**	(p. 29)
4′	2a to 3a	7″	5‴	0	2⁗	**PERIDINIUM**	(p. 30)
4′	3a	6″	5‴	0	2⁗	**MINUSCULA**	(p. 41)
5′ to 9′	0	9″ to 12″	9‴ to 12‴	0	3⁗ to 4⁗	**PYROPHACUS**	(p. 41)
5′	0	5″	5‴	0	1⁗	**OXYTOXUM**	(p. 41)
4′	0	5″	5‴	0	2⁗	**CERATIUM**	(p. 42)
2′	1a	6″	3‴	0	4⁗	**PODOLAMPAS**	(p. 45)

Fig. 86 illustrates the names and abbreviations here used for the thecal plates of the Peridiniidae (after Kofoid).

Genus **PROTOCERATIUM.**

P. reticulatum Claparède and Lachmann 7, 10 (Fig. 73).

Cell spheroidal, strongly reticulated sometimes spinous; colour dark; girdle equatorial.

Length 39 to 54 μ; breadth 33 to 50 μ.

Generally distributed, occasionally numerous.

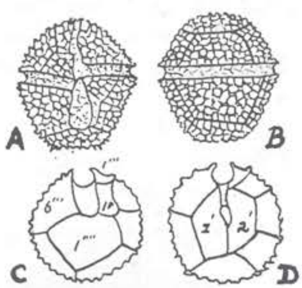


Fig. 73. *Protoceratium reticulatum* C. & L. A, ventral; B, dorsal; C, antapical; D, apical views. X 400.

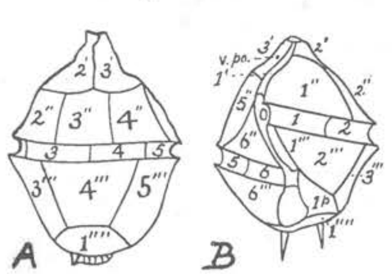


Fig. 74. Arrangement and numbering of the plates in the genus *Gonyaulax*; A, *G. polygramma* dorsal view; B, *G. spinifera* ventral view. After Kofoid.

Genus **GONYAULAX.**

Girdle left-handed, displaced from once to several times its width, usually with an overhang; first apical plate (1′) narrow and extending from apex to sulcus; only one antapical plate (1⁗).

KEY TO SPECIES

1. (2)	Plate formula 4′ 2a 6″ 6‴ 1p 1⁗.	**longispina**	(p. 27)
2. (1)	Plate formula not as above.		
3. (4)	Plate formula 3′ 2a 6″ 6‴ 1p 1⁗.	**triacantha**	(p. 27)
4. (3)	Plate formula 3′ 0a 6″ 6‴ 1p 1⁗.		
5. (8)	Cell spheroidal.		
6. (7)	Cell large, spines present.	**alaskensis**	(p. 27)
7. (6)	Cell small spines absent.	**scrippsae**	(p. 28)
8. (5)	Cell ellipsoidal.		
9. (10)	Girdle with large overhang.	**spinifera**	(p. 28)
10. (9)	Girdle with little overhang.		
11. (12)	Antapical spines stout, two in number.	**digitale**	(p. 28)
12. (11)	Antapical spines small (or absent).	**polygramma**	(p. 28)

G. longispina Lebour 7 (Fig. 75).

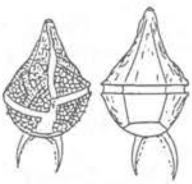


Fig. 75. *Gonyaulax longispina* Lebour. Ventral and dorsal views. X 325.

Apical plates four (4′), anterior intercalaries two (2a).

Length without spines 55 to 58 μ; length of spines 12 to 16 μ; breadth 32 to 36 μ; thickness two-thirds the breadth.

West coast of Vancouver island, rare.

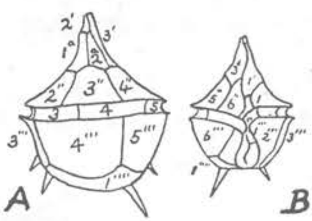


Fig. 76. *G. triacantha* Joerg. A, dorsal view X 500. (After Kofoid). B, ventral view. X 350.

G. triacantha Joergensen 7, 10 (Fig. 76).

Apical plates three (3′), anterior intercalaries two (2a). Epicone with concave sides; hypercone with from five to seven spines of various lengths.

Length 42 to 60 μ, usually about 50 μ, not including spines; spines up to 15 μ in length; breadth three-quarters of length; thickness half of length.

Generally distributed, scarce.

G. alaskensis Kofoid 10 (Fig. 77).

Fig. 77. *G. alaskensis* Kofoid X 325.

Apical plates three in number (3′); no anterior intercalaries (0a); cell spheroidal with two short antapical spines.

Length 61 to 74 μ; breadth equal to or slightly less than length; antapical spines 4 μ in length.

Generally distributed, scarce.

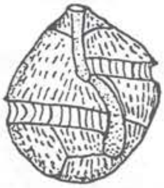


Fig. 78. *G. scrippsae* Kofoid X 600.

G. scrippsae Kofoid 7, 10 (Fig. 78).

Small subspherical species; girdle without lists; apical plates three (3″); no anterior intercalaries (0a). Surface has a characteristic striated appearance.

Diameter 30 to 40 μ.

Strait of Georgia; west coast of Vancouver island; rare.

G. spinifera (Claparède and Lachmann) 7, 10 (Fig. 79).

Apical plates three (3′); no anterior intercalaries (0a) girdle with an overhang of from one to two girdle widths. Antapical spines short and slender, may be more than two in number.

Length 39 to 42 μ; breadth 32 to 40 μ; spines up to 6 μ in length.

Generally distributed, occasionally numerous.

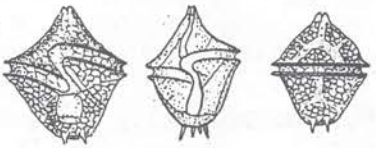


Fig. 79. *G. spinifera* (C. & L.). Three individuals. X 425.

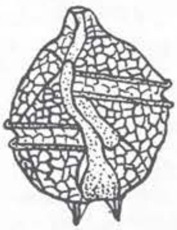


Fig. 80. *G. digitale* (Pouchet) X 500.

G. digitale (Pouchet) 7, 10 (Fig. 80).

Apical plates three (3′); no anterior intercalaries (0a). Distinguished by presence of two stout antapical winged spines.

Larger than *G. spinifera* and with less overhang of the girdle; recorded as that species by various authors, among others Schütt (1895) and Paulsen (1908).

Length 50 to 70 μ; breadth about seven-eighths of length.

Generally distributed; not uncommon off the west coast of Vancouver island.

G. polygramma Stein 7, 10 (Figs. 74 & 81).

Apical plates three (3′); no anterior intercalary plates (0a). Antapical spines short and winged. Distinguished from *G. spinifera* by the less displacement and overhang of the girdle.

Length 42 to 64 μ; breadth 38 to 55 μ; spines 3 μ in length; spines may be absent.

West coast Vancouver island; scarce.

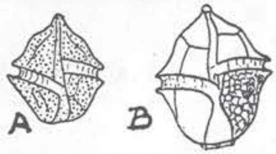


Fig. 81. *G. polygramma* Stein. A, small individual without antapical spines; B, usual form with spines. X 350.

Genus **PERIDINIOPSIS.**

KEY TO SPECIES

1. (2) Cell subspherical, less than 30 μ in diameter. **rotunda** (p. 29)
2. (1) Cell ovoid, more than 30 μ in diameter. **asymmetrica** (p. 29)

P. rotunda Lebour 7, 10 (Fig. 82).

Fig. 82. *Peridiniopsis rotunda* Lebour. A, ventral; B, dorsal; C, side view. X 324. After Lebour 1925.

Cell small, subspherical; with one anterior intercalary (1a) of unusual shape; plates difficult to elucidate.

It is liable to be confused with *Peridinium faeroense* but is distinguishable by the presence of a prominent wing-like list on the left side of the sulcus.

Height and diameter subequal 23 to 25 μ.

Generally distributed, scarce.

P. asymmetrica Mangin 7, 10 (Fig. 83).

Ovoid in side view; two anterior intercalaries (2a) and two antapicals (2'''') present; the first precingular plate (1a) is wide; in the living state when the plates are difficult to elucidate, may be confused with *Diplopeltopsis minor*.

Height 38 to 48 μ; diameter 50 to 65 μ.

Generally distributed, common.

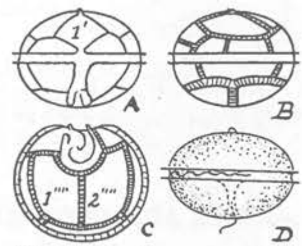


Fig. 83. *P. asymmetrica* Mangin. A, ventral; B, dorsal; C, antapical view; D, dorsal view of living specimen. X 300.

Genus **DIPLOPELTOPSIS.**

D. minor Lebour 7, 10 (Figs. 84 & 85).

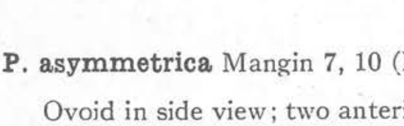


Fig. 84. *Diplopeltopis minor* Lebour. A, ventral; B, dorsal; C, antapical view. X 300.

Ovoid in side view, with two anterior intercalaries (2a) the first of which is very small and situated near the girdle; the plates difficult to elucidate in living animal; distinguishable from *Peridiniopsis asymmetrica* by its narrow first apical (1'') and its single antapcial (1'''').

Height 32 to 35 μ; diameter 40 to 50 μ.

Generally distributed, common.

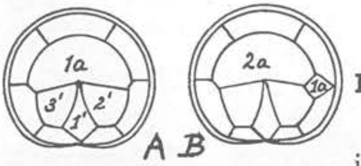


Fig. 85. *D. minor* var. *occidentalis* Wailes X 400. A, apical view; B, apical view of *D. minor* showing small plate, la, that is wanting in var. *occidentalis.*

D. minor var. **occidentalis** Wailes (Fig. 85).

Similar to type but lacking the small first anterior intercalary plate (1a).

West coast of Vancouver island; scarce.

Genus **PERIDINIUM.**

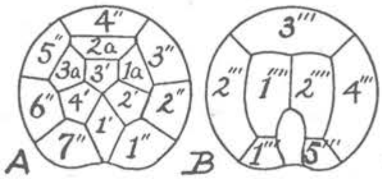


Fig. 86. Arrangement and numbering of the plates in the genus *Peridinium*. A, apical; B, antapical view.

KEY TO MARINE SUB-GENERA

1. (2) Plate formula 4′ 2a 7″ 5‴ 2⁗.	**ARCHAEPERIDINIUM**	(p. 30)
2. (1) Plate formula 4′ 3a 7″ 5‴ 2⁗.	**PERIDINIUM**	(p. 32)

Subgenus **ARCHAEPERIDINIUM.**

The two anterior intercalary plates 1a and 2a, touch each other on the median dorsal axis, in the marine species.

KEY TO SPECIES

1. (2) Apical axis situated eccentrically.	**excentricum**	(p. 30)
2. (1) Apical axis not eccentric.		
3. (6) Cell dish-shaped.		
4. (5) Cell more than 70 μ in diameter.	**decipiens**	(p. 31)
5. (4) Cell less than 70 μ in diameter.	**discoides**	(p. 31)
6. (3) Cell not dish-shaped.		
7. (8) Cell elongate less than 25 μ in diameter.	**triqueta**	(p. 31)
8. (7) Cell rhombic, ovoid, spherical or sphaeroidal.		
9. (10) Cell rhombic, over 60 μ in diameter.	**thorianum**	(p. 31)
10. (9) Cell not as above.		
11. (12) Cell ovoid with irregular outline.	**avellana**	(p. 32)
12. (11) Cell spheroidal or spherical.		
13. (14) Cell spheroidal, apex more or less prominent, height 42 to 55 μ.	**monospinum**	(p. 32)
14. (13) Cell spherical, height 30 to 42 μ.	**minutum**	(p. 32)

P. excentricum Paulsen 7, 10 (Fig. 87).

Easily recognized by the eccentrically placed apex when seen in edge view; in broad view liable to be overlooked.

Diameter 45 to 60 μ; height about half diameter.

Generally distributed, often abundant off the west coast of Vancouver island.

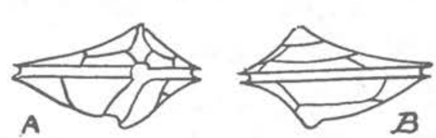


Fig. 87. *Peridinium excentricum* Paulsen. A, ventral; B, side view. X 500.

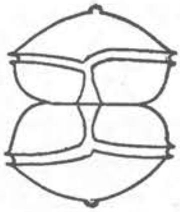


Fig. 88. *P. decipiens* Joerg. X 300.

P. decipiens Joergensen 7, 10 (Fig. 88).

The plates have never been completely elucidated, but so far as could be partially seen they are arranged similarly to those of *P. discoides*, which it resembles in form and habit. Usually seen in pairs placed base to base.

Height 44 to 56 μ; diameter 75 to 90 μ.

Off the west coast of Vancouver island; rare.

P. discoides Wailes 10 (Fig. 89).

Occurs in chain formation up to 12 individuals but usually seen in pairs, placed apex to base; it is dark brown in colour; plates difficult to elucidate.

Height 23 to 32 μ; diameter 32 to 42 μ.

Generally distributed, sometimes abundant.

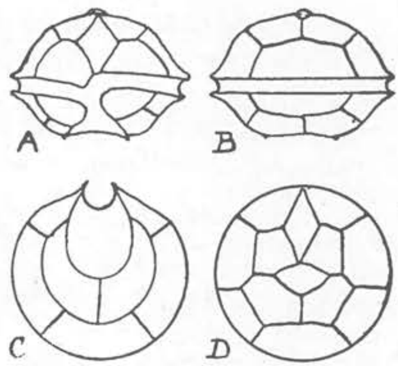


Fig. 89. *P. discoides* Wailes. A, B, C, D, ventral, dorsal, antapical and apical views. X 600.

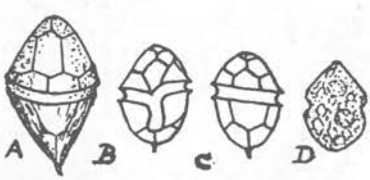


Fig. 90. *P. triqueta* (Stein). A, X 600; B and C, X 500; D, spore X 500.

P. triqueta (Stein) 7, 10 (Fig. 90).

Cell elongated, often more or less irregular with apex prolonged.

Length 25 to 30 μ; breadth from half to three-quarters length.

Generally distributed. Spores sometimes occur in large numbers.

P. thorianum Paulsen 7, 10 (Fig. 91).

Body large, somewhat rhombic in shape with concave base; rounded projections on surface of plates giving a distinctive scalloped pattern; colour red. European form narrower and of a yellow colour.

Length 68 to 74 μ; breadth 61 to 83 μ.

Generally distributed; common.

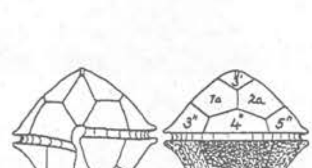


Fig. 91. *P. thorianum* Paulsen. Ventral and dorsal views. X 250.

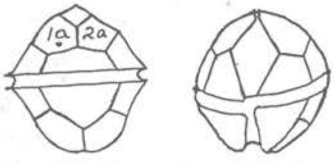


Fig. 92. *P. avellana* Meunier X 400.

P. avellana Meunier 7, 10 (Fig. 92).

Recognizable by its ovoid shape and irregular outline.

Length 50 to 55 μ; breadth 45 to 49 μ.

Off the west coast of Vancouver island, scarce except occasionally.

P. monospinum Paulsen 7, 10 (Fig. 93).

Body spheroidal somewhat produced towards the apex; amount of prominence of epicone variable.

Height 42 to 55 μ; diameter 39 to 52 μ.

Generally distributed.

Fig. 93. *P. monospinum* Paulsen. Three individuals showing variations in form of the spines. X 300.

P. minutum Kofoid 4, 7, 10 (Fig. 94).

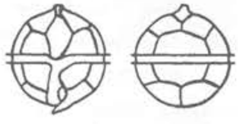


Fig. 94. *P. minutum* Kofoid X 350.

Distinguished from *P. monospinum* by its spherical shape and usually smaller size.

Height and diameter 30 to 42 μ not inciuding the girdle lists which project 2 to 3 μ.

Generally distributed.

Subgenus **PERIDINIUM**.

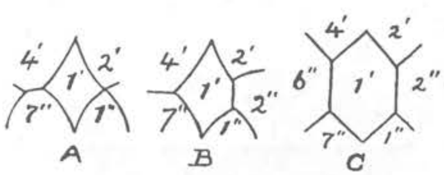


Fig. 95. Diagrams of the first apical plates, 1', in the subgenus *Peridinium*.

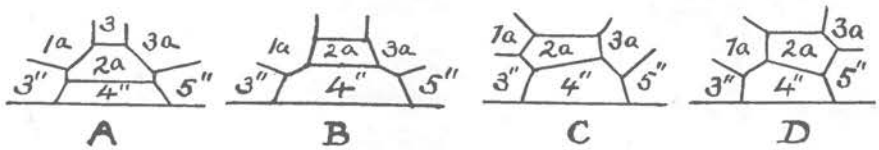


Fig. 96. Diagrams of the positions of the second intercalary plate, 2a, with respect to the precingular plates 3'', 4'' and 5'' in the subgenus *peridinium*.

KEY TO DIVISIONS

1. (2) First apical plate (1') four-sided. **ORTHOPERIDINIUM** (p. 33)
2. (1) First apical plate five or six-sided. **METAPERIDINIUM** (p. 37)

Division **ORTHOPERIDINIUM.**

KEY TO SECTIONS

1. (2) Plate 2a touching the three plates 3″, 4″ and 5″, figure 96A.	**Conica**	(p. 33)
2. (1) Plate 2a not as above.		
3. (4) Plate 2a touching 4″ only, figure 96B.	**Oceanica**	(p. 34)
4. (3) Plate 2a touching 3″ and 4″ or 4″ and 5″, figure 96C and D.	**Tabulata**	(p. 36)

Section **CONICA.**

KEY TO SPECIES

1. (10) Cells more than 40 μ in length.		
2. (7) Plates 1″ and 7″ four-sided.		
3. (4) Theca smooth.	**conicoides**	(p. 33)
4. (3) Theca reticulated and spiny.		
5. (6) Antapex notched.	**leonis**	(p. 33)
6. (5) Antapex retuse.	**subinerme**	(p. 33)
7. (2) Plates 1″ and 7″ three-sided.		
8. (9) Antapex notched.	**conicum**	(p. 34)
9. (8) Antapex not notched.	**pentagonum**	(p. 34)
10. (1) Cells less than 40 μ in length.		
11. (12) Cell elongate with conspicuous apex.	**trochoideum**	(p. 34)
12. (11) Cell spheroidal.		
13. (14) Antapex notched.	**achromaticum**	(p. 34)
14. (13) Antapex not notched.	**faeroense**	(p. 34)

P. conicoides Paulsen 7, 10 (Fig. 97).

Theca smooth; antapex retuse with two short hollow horns.

Length 49 to 58 μ; breadth 44 to 55 μ.

Generally distributed, numerous.

Fig. 97. *P. conicoides* Paulsen X 300.

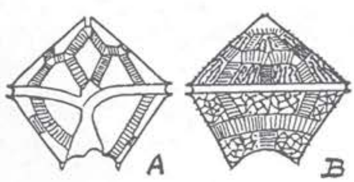


Fig. 98. *P. leonis* Pav. X 250. The reticulations are omitted in A.

P. leonis Pavillard 7, 10 (Fig. 98).

Theca more or less reticulated and spiny or sometimes ridged; antapex notched; precingular plates 1″ and 7″ four-sided. Intercalary bands sometimes very broad.

Length 68 to 100 μ; breadth 65 to 95 μ.

Generally distributed, numerous.

P. subinerme Paulsen 7, 10 (Fig. 99).

Theca reticulated and spiny; broad intercalary striae frequently present; antapex retuse, without prolonged horns.

Length and breadth sub-equal, 50 to 55 μ.

Generally distributed.

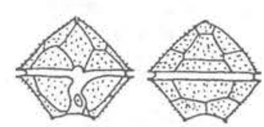


Fig. 99. *P. subinerme* Paulsen X 260.

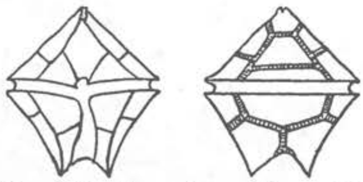


Fig. 100. *P. conicum* (Gran) X 300.

P. conicum (Gran) 7, 10 (Fig. 100).

Theca smooth; distinguishable from *P. leonis* by the precingular plates 1″ and 7″ being triangular; antapex deeply notched.

Length 50 to 84 μ; breadth 55 to 80 μ.

Generally distributed, numerous.

P. pentagonum Gran 7, 10 (Fig. 101).

Cell pentagonal, large; breadth nearly equal to or greater than length; antapical spines hollow.

Length 74 to 92 μ; breadth 65 to 90 μ.

Generally distributed, sometimes numerous.

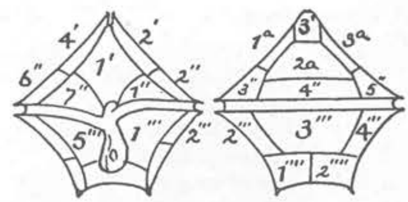


Fig. 101. *P. pentagonum* Gran X 300.

P. trochoideum (Stein) 7, 10 (Fig. 102).

Cell elongate with conspicuous apex; shape somewhat variable and may occasionally more or less resemble *P. faeroense* but the first apical plate (1′) is broader than in that species.

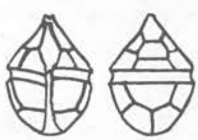


Fig. 102. *P. trochoideum* (Stein) X 550.

Length 27 to 32 μ; breadth 20 to 24 μ.

Generally distributed; occasionally large areas of water are coloured reddish by the presence of vast numbers of this species.

P. achromaticum Levander 7, 10 (Fig. 103).

Hypotheca with convex sides, the sulcus with sharp edges that resemble spines in broad view; colourless and transparent.

Length and width subequal 31 to 36 μ.

Generally distributed, seldom numerous.

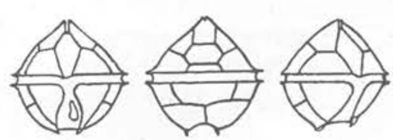


Fig. 103. *P. achromaticum* Levander X 400.

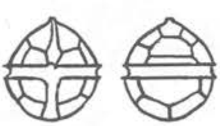


Fig. 104. *P. faeroense* Paulsen X 550.

P. faeroense Paulsen 7, 10 (Fig. 104).

Cell small, subspherical; first apical plate (1″) narrow.

Length 23 to 25 μ; breadth 20 to 23 μ.

Generally distributed, rare.

Section **OCEANICA.**

Plate 2a touching plate 4″ only.

KEY TO SPECIES

1. (6) Cell with prolonged apex.
2. (5) Cell more than 125 μ in length.
3. (4) Antapical horns not spreading. **depressum** (p. 35)
4. (3) Antapical horns spreading. **saltans** (p. 35)
5. (2) Cell less than 125 μ in length. **oblongum** (p. 36)
6. (1) Cell without prolonged apex. **obtusum** (p. 36)

P. depressum Bailey 7, 10 (Fig. 105).

Syn. *P. divergens* of many authors.

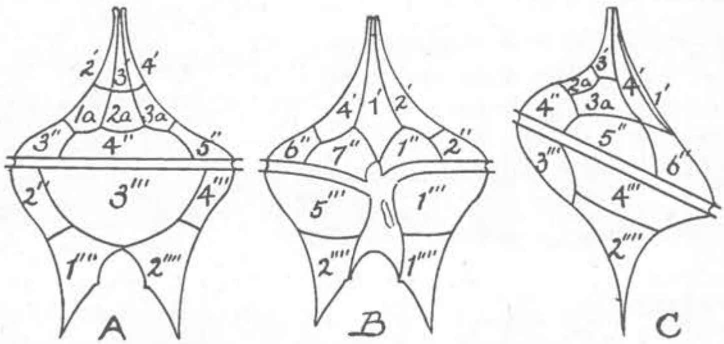


Fig. 105. *P. depressum* Bailey. A, dorsal; B, ventral; C, right hand side view; X 300.

The largest species of the genus in this area; epicone prolonged, tapering with concave sides; in narrow side view longitudinal axis seen to make an acute angle with the girdle which has only a slight displacement.

Length 125 to 170 μ; breadth three-quarters of length.

Generally distributed, a dominant species in this area, persistent throughout the year.

P. saltans Meunier 10 (Fig. 106).

Similar to *P. depressum* but with spreading antapical horns and usually smaller in size; shape and size of horns variable.

Length 125 to 170 μ.

Generally distributed, scarce.

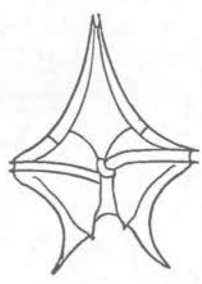


Fig. 106. *P. saltans* Meunier X 250.

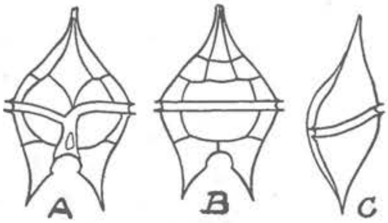


Fig. 107. *P. oblongum* (Auriv.) A, ventral; B, dorsal; C, left hand side view; X 300.

P. oblongum (Aurivillius) 7, 10 (Fig. 107).

Similar to *P. depressum* but smaller and narrower in proportion to length; shape of antapical horns somewhat variable.

Length 80 to 118 μ; breadth about two-thirds length.

Generally distributed, abundant; usually in association with *P. depressum*.

P. obtusum Karsten 7, 10 (Fig. 108).

Medium-sized species with surface more or less spinous; intercalary bands often present; epicone frequently less spinous than hypocone.

Length 52 to 60 μ; breadth 42 to 52 μ; thickness two-thirds of the breadth; antapical spines 4 to 6 μ in length.

Generally distributed, common.

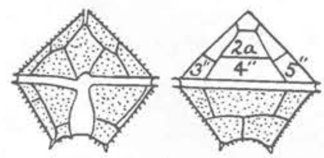


Fig. 108. *P. obtusum* Karsten; X 350.

Section **TABULATA.**

Plate 2a touching plates 3″ and 4″.

KEY TO SPECIES

1. (2) Cell with antapical horns. **claudicans** (p. 36)
2. (1) Cell without antapical horns.
3. (4) Antapex retuse. **punctulatum** (p. 37)
4. (3) Antapex convex. **subpunctulatum** (p. 37)

P. claudicans Paulsen 7, 10 (Fig. 109).

Fig. 109. *P. claudicans* Paulsen. A, ventral; B, dorsal; C, right side view X 350.

Cell large, broad and rotund; right antapical horn larger than left; plate 2a touching 3″ and 4″.

Length 100 to 120 μ; breadth 68 to 85 μ. Larger than found in European waters where the length is 50 to 96 μ.

Generally distributed, sometimes numerous.

Fig. 110. *P. punctulatum* Paulsen X 400.

P. punctulatum Paulsen 7, 10 (Fig. 110).

Cell subspherical; antapex retuse; plate 2a touching 3″ and 4″.

Length and breadth equal, 34 to 48 μ.

Generally distributed, not common.

P. subpunctulatum Wailes 10 (Fig. 111).

Cell nearly spherical; distinguished from *P. punctulatum* by its larger size and convex antapex.

Length and breadth equal, 48 to 58 μ.

Generally distributed, not common; not recorded from elsewhere.

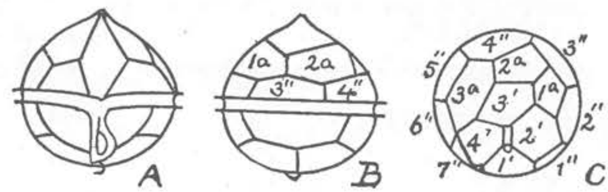


Fig. 111. *P. subpunctulatum* Wailes. A, ventral; B, dorsal; C, apical view. X 400.

Division **METAPERIDINIUM.**

First apical plate (1′) five or six-sided.

KEY TO SECTIONS

1.	(2) Plate 2a touching 3″ and 4″ or 4″ and 5″, figure 96C and D.	**Pyriformia**	(p. 37)
2.	(1) Plate 2a not as above.		
3.	(6) Plate 2a touching 4″ only, figure 96B.		
4.	(5) Antapical horns hollow.	**Divergens**	(p. 38)
5.	(4) Antapical horns solid.	**Humilia**	(p. 39)
6.	(3) Plate 2a touching plates 3″, 4″ and 5″, figure 96A.	**Paraperidinium**	(p. 40)

Section **PYRIFORMIA.**

Plate 2a touching plates 3″ and 4″.

KEY TO SPECIES

1.	(2) Cell with spreading antapical horns.	**grani**	(p. 38)
2.	(1) Cell with short antapical spines.	**ovatum**	(p. 38)

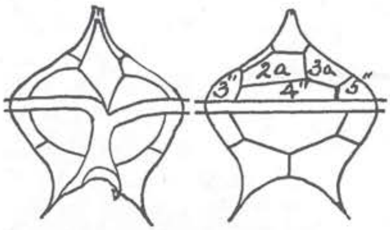


Fig. 112. *P. grani* Ostenfeld X 500.

P. grani Ostenfeld 7, 10 (Fig. 112).

Cell broad with prominent apex; antapex furnished with two spreading hollow horns; plate 1′ hexagonal, plate 2a touching 3″ and 4″.

Length 50 to 61 μ; breadth 41 to 50 μ.

Generally distributed, sometimes numerous.

P. ovatum var. **minor** Cleve 7 (Fig. 113).

A neritic form similar to type but smaller; plate 1′ pentagonal, plate 2a touching 3″ and 4″; cell ovoidal; antapex with two short, solid spines.

Length without spines 42 to 48 μ; breadth 49 to 52 μ.

Generally distributed; not numerous.

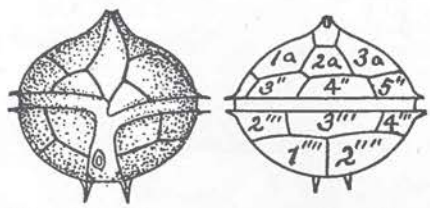


Fig. 113. *P. ovatum* var. *minor* Cleve X 500.

Section **DIVERGENS.**

Plate 2a touching plate 4″ only; first apical plate five-sided; antapical horns hollow.

KEY TO SPECIES

1. (2) Antapex with prominent horns. **divergens** (p. 38)
2. (1) Antapex without horns. **crassipes** (p. 38)

P. divergens Ehrenberg 7, 10 (Fig. 114).

Distinguished by the form of the antapical horns as shown in the illustration.

Length 80 to 84 μ; breadth 65 to 70 μ.

Off the west coast of Vancouver island; not uncommon; strait of Georgia, scarce.

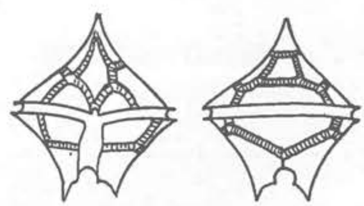


Fig. 114. *P. divergens* Ehrenb. X 300.

P. crassipes Kofoid 4, 7, 10 (Fig. 115).

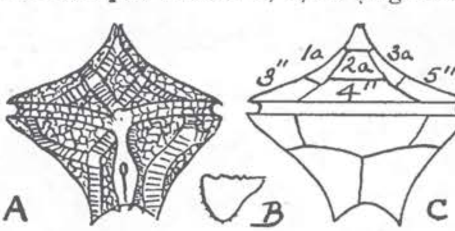


Fig. 115. *P. crassipes* Kofoid. A, ventral; B, side view of antapical spine; C, dorsal view. X 350.

Cell broad with concave sides; ends of antapical plates forming spine-like projections as seen in front and back views, broadly rounded in side view, figure B.

Length 71 to 86 μ; breadth 70 to 96 μ.

Generally distributed, often numerous off west coast of Vancouver island.

Section **HUMILIA.**

Plate 2a touching plate 4″ only; first apical plate five-sided; antapical horns solid.

KEY TO SPECIES

1. (4) Diameter greater than the height.
2. (3) Apex with concave sides. **monocanthus** (p. 39)
3. (2) Apex with concavo-convex sides. **subcurvipes** (p. 39)
4. (1) Diameter of cell not greater than its height.
5. (6) Apex prolonged. **micrapium** (p. 39)
6. (5) Apex not prolonged.
7. (8) Cell spherical. **cerasus** (p. 40)
8. (7) Cell rhomboidal. **brevipes** (p. 40)

P. monocanthus Broch 7, 10 (Fig. 116).

Epicone flattened with concave sides; antapical plate 1'''' prolonged into a short curved spine.

Height 46 to 48 μ; breadth 68 to 70 μ.

Strait of Georgia; Barkley sound; scarce.

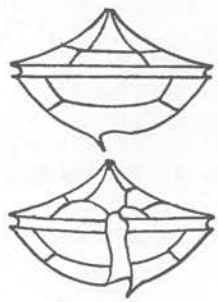


Fig. 116. *P. monocanthus* Broch X 400.

P. subcurvipes Lebour 7, 10 (Fig. 117).

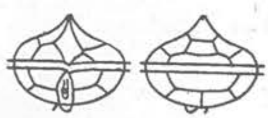


Fig. 117. *P. subcurvipes* Lebour X 350.

Cell small, broader than high; epicone with concave sides; antapex flattened with one short spine; edges of sulcus prominent.

Height about one-fifth less than the diameter; diameter about 44 μ.

Strait of Georgia, rare.

P. micrapium Meunier 7, 10 (Fig. 118).

Cell with elongate apex and two stout-winged antapical spines.

Length 39 to 48 μ; breadth 32 to 42 μ; spines 10 to 13 μ in length.

Generally distributed, abundant.

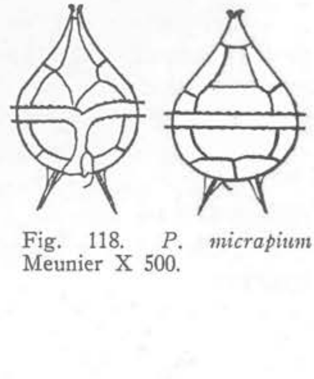


Fig. 118. *P. micrapium* Meunier X 500.

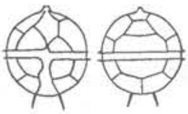


Fig. 119. *P. cerasus* Paulsen X 300.

P. cerasus Paulsen 7, 10 (Fig. 119).

Cell spherical with two slender divergent antapical spines.
Length and breadth equal, 35 to 45 μ.
Generally distributed, not numerous.

P. brevipes Paulsen 7, 10 (Fig. 120).

Cell rhomboidal with two very short antapical spines.

Length and breadth equal, 32 to 38 μ.

Generally distributed, scarce.

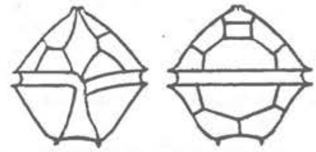


Fig. 120. *P. brevipes* Paulsen X 500.

Section **PARAPERIDINIUM.**

Plate 2a touching plates 3″, 4″ and 5″; first apical plate five or six-sided.

KEY TO SPECIES

1.	(2) First apical plate five-sided.	**asperum**	(p. 40)
2.	(1) First apical plate six-sided.		
3.	(4) Cell over 53 μ in length; antapical spines large.	**pallidum**	(p. 40)
4.	(3) Cell less than 53 μ in length; antapical spines small.	**pellucidum**	(p. 41)

P. asperum Wailes 10 (Fig. 121).

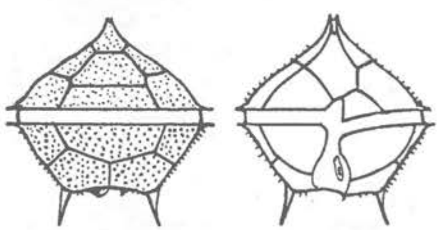


Fig. 121. *P. asperum* Wailes X 400.

Cell rhomboidal, spinous; first apical plate five-sided; antapical spines large, placed far apart; epicone usually less spinous than the hypercone.

Length without spines 55 to 65 μ; spines 10 to 12 μ in length; breadth 58 to 61 μ.

Off the west coast of Vancouver island, sometimes abundant; not recorded from elsewhere.

P. pallidum Ostenfeld 7, 10 (Fig. 122).

Cell compressed dorsoventrally; first apical plate six-sided; surface finely dotted or reticulate; colour dark; antapex with two winged spines.

Length 53 to 84 μ not including spines; breadth 52 to 67 μ; thickness about two-thirds breadth.

Generally distributed, common.

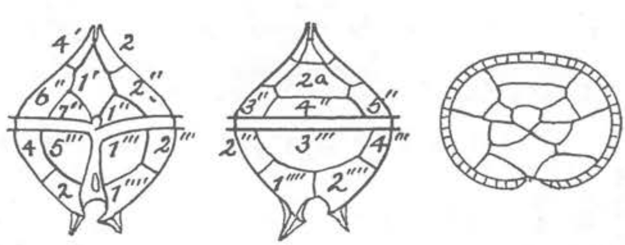


Fig. 122. *P. pallidum* Ostenfeld. Ventral, dorsal and apical views. X 350.

P. pellucidum (Bergh) 7, 10 (Fig. 123).

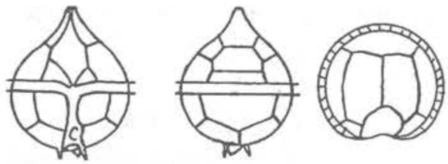


Fig. 123. *P. pellucidum* (Bergh). Ventral, dorsal and antapical views. X 400.

Cell rotund, not compressed; first apical plate (1′) six-sided; antapex with two short, divergent, winged spines; colourless and pellucid.

Length 40 to 52 μ; breadth 36 to 44 μ. In the Atlantic it attains 68 μ in length.

Generally distributed, common.

Genus **MINUSCULA.**

M. bipes (Paulsen) 7, 10 (Fig. 124).

Cell with prolonged apex and two prominent divergent spines on antapex.

Length without spines 30 to 40 μ; spines 10 μ in length; breadth 24 to 26 μ.

Generally distributed, scarce.

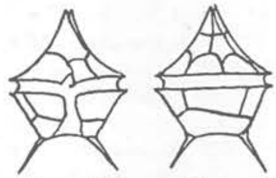


Fig. 124. *Minuscula bipes* (Paulsen) X 600. After Lebour 1925.

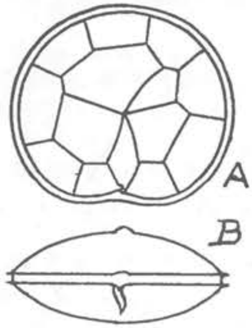


Fig. 125. *Pyrophacus horologicum* Stein. A, apical; B, ventral view. X 265.

Genus **PYROPHACUS.**

P. horologicum Stein 7, 10 (Fig. 125).

Cell lenticular in section, circular in apical view. Frequently found containing cysts and the cells split along the girdle line.

Those seen in this area had plate formula 5′, 9″, 9‴, 3⁗.

Height 40 to 45 μ; diameter 100 to 106 μ.

Generally distributed, sometimes numerous.

Genus **OXYTOXUM** Stein.

O. diploconus var. **fusiformis** Okamura 10 (Fig. 126).

Cell elongate, epicone much reduced in size; surface with numerous large poroids.

Length 60 to 68 μ; breadth 16 to 24 μ; thickness 12 to 16 μ.

Generally distributed, scarce.

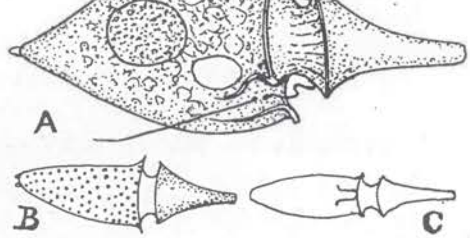


Fig. 126. *Oxytoxum diploconus* var. *fusiformis* Okamura. A, living cell X 1000; B and C, side and ventral views of a narrow form X 500.

Genus **CERATIUM.**

Cells with one apical and one to three antapical horns; girdle left-handed with lists.

KEY TO SPECIES

1. (2)	Cell with one antapical horn.	**fusus**	(p. 42)
2. (1)	Cell with more than one antapical horn.		
3. (4)	Cell with three antapical horns.	**hirundinella**	(p. 42)
4. (3)	Cell with two antapical horns.		
5. (10)	Antapical horns parallel to axis of cell.		
6. (7)	Cell over 50 μ in diameter.	**pentagonum**	(p. 43)
7. (6)	Cell less than 50 μ in diameter.		
8. (9)	Horns slender and cell fragile.	**lineatum**	(p. 43)
9. (8)	Horns stout and cell robust.	**furca**	(p. 44)
10. (5)	Antapical horns not parallel to axis of cell.		
11. (16)	Extremities of antapical horns closed.		
12. (15)	Cell anchor-shaped.		
13. (14)	Horns short and stout.	**azoricum**	(p. 44)
14. (13)	Horns slender and curved.	**tripos**	(p. 44)
15. (12)	Cell not anchor-shaped.	**divaricatum**	(p. 44)
16. (11)	Extremities of antapical horns not closed.		
17. (18)	Horns curved, spreading.	**longipes**	(p. 45)
18. (17)	Horns not curved, spreading.		
19. (20)	Cell spinous.	**horridum**	(p. 45)
20. (19)	Cell not spinous.	**macroceros**	(p. 45)

C. fusus (Ehrenberg) 7, 10, 11 (Fig. 127).

Fig. 127. *Ceratium fusus* (Ehrenb.) X 170.

Cell extremely slender; curved, with one antapical horn.

Length variable, 300 to 600 μ; breadth 15 to 30 μ.

Generally distributed, abundant.

C. hirundinella (O. F. Müller) 10 (Fig. 128A).

Cell reticulated, with three antapical horns only moderately divergent.

Length variable, 95 to 400 μ; but usually 200 to 250 μ.

A polymorphic freshwater species found near the mouths of rivers, scarce in a marine habitat. In some varieties the left side horn may be only rudimentary.

C. hirundinella var. **piburgense** Zederbauer 10 (Fig. 128B).

Antapical horns long and divergent.

Length 200 to 260 μ.

This form is the one usually found here in brackish water. It is generally distributed and abundant in the lakes of British Columbia. The cysts are four-sided with angles produced into spines.

C. hirundinella var. **robustum** Amberg 10 (Fig. 128C).

Body of cell larger than in type; antapical horns moderately divergent, left side horn small or rudimentary, cysts triangular with three spines.

Length 250 to 300 μ.

In or near brackish water; scarce.

C. hirundinella var. **carinthaceum** Zederbauer 7 (Fig. 128D).

Cell with two slightly divergent, prominent antapical horns, the third horn rudimentary.

Length 150 μ.

Forward inlet; Quatsino sound; scarce.

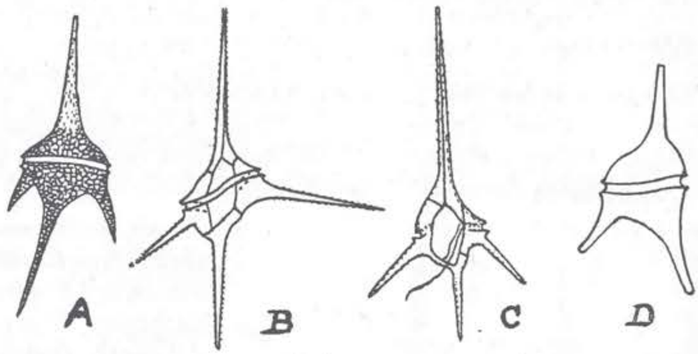


Fig. 128. *C. hirundinella* (O. F. Müller). A, dorsal view of type; B, of var. *piburgense*; C, ventral view of var. *robustum*; D, dorsal view of var. *carinthaceum*; all X 200.

C. pentagonum Gourret 11 (Fig. 129).

Cell robust; antapical horns slender.

Length 200 to 300 μ; breadth 58 to 65 μ.

Off the west coast of Vancouver island; not uncommon.

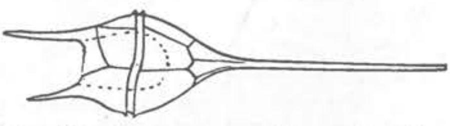


Fig. 129. *C. pentagonum* Gourret X 225.

C. lineatum (Ehrenberg) 7, 10, 11 (Fig. 130).

Cell fragile and colourless; antapical horns slender, unequal in length.

Length 3 to 5 times the breadth; breadth 30 to 45 μ.

Generally distributed, sometimes numerous.

Fig. 130. *C. lineatum* (Ehrenb.) X 300. Dorsal view.

C. furca (Ehrenberg) 7, 10 (Fig. 131).

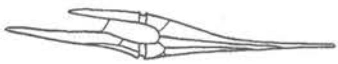


Fig. 131. *C. furca* (Ehrenb.) X 165.

Two antapical horns stout, unequal in length and parallel; proportions variable.

Length usually 160 to 200 μ; breadth 30 to 50 μ.

Generally distributed; plentiful.

On occasions is the dominant species in the neritic plankton.

C. azoricum Cleve 7, 10 (Fig. 132).

Cells short, stout, with prominently rounded fundus; antapical horns with closed pointed extremities.

Length 100 to 135 μ.

Off the west coast of Vancouver island, not common.

Fig. 132. *C. azcricum* Cleve X 200.

C. tripos var. **atlantica** Ostenfeld 7, 10 (Fig. 133).

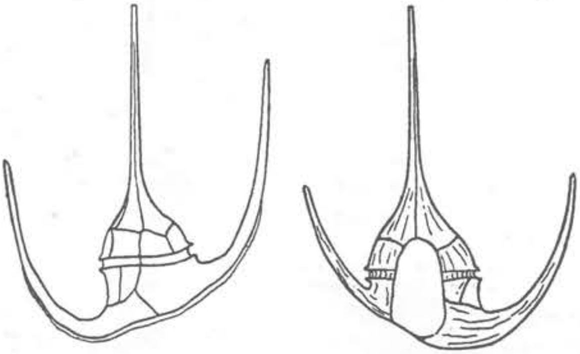


Fig. 133. *C. tripos* var. *atlantica* Ostenfeld. Dorsal and ventral views X 200.

Cell anchor-shaped; antapical horns of similar length with closed pointed extremities, their curvature variable.

Length variable, usually 200 to 300 μ; breadth of body 70 to 90 μ.

Generally distributed, often plentiful but was never found dominant in the plankton.

C. divaricatum Lemmermann 10 (Fig. 134).

Antapical horns short, stout, pointed, sometimes rudimentary.

Length up to about 225 μ.

Off the west coast of Vancouver island, common; strait of Georgia, rare.

Fig. 134. *C. divaricatum* Lemm. X 110.

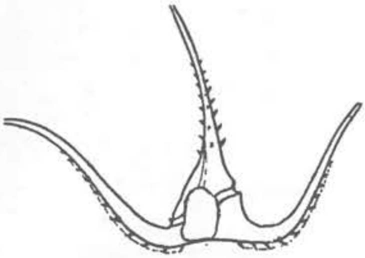


Fig. 135. *C. longipes* (Bailey) X 150.

C. longipes (Bailey) 7, 10 (Fig. 135).

Antapical horns projecting beyond fundus and both spreading, with open extremities; all horns more or less spinous.

Length up to about 250 μ; breadth of body 50 to 55 μ.

Generally distributed but not common.

C. horridum Gran 7, 10 (Fig. 136).

Antapical horns projecting beyond fundus, right-side horn parallel with apical horn, left-side horn divergent; horns with open extremities and serrated lists.

Length up to about 200 μ; breadth of body about 45 μ.

Generally distributed but not abundant.

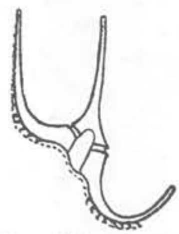


Fig. 136. *C. horridum* Gran X 150.

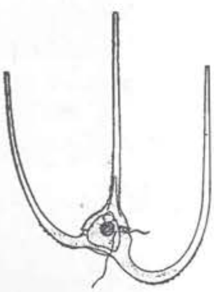


Fig. 137. *C. macroceros* (Ehrenb.) X 125.

C. macroceros (Ehrenberg) 7, 11 (Fig. 137).

Antapical horns more or less parallel to apical horn and projecting beyond fundus, extremities of horns open.

Length up to about 400 μ; breadth of body 45 to 55 μ.

Generally distributed, often abundant.

Genus **PODOLAMPAS.**

P. palmipes Stein 7, 10 (Fig. 138).

Cells elongate with two winged spines posteriorly.

Length 100 to 120 μ.

Strait of Georgia; rare.

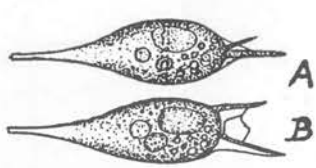


Fig. 138. *Podolampas palmipes* Stein. A, left-hand side view; B, ventral view. X 350.