

CANADIAN PACIFIC FAUNA

1. PROTOZOA

- 1a. LOBOSA
- 1b. RETICULOSA
- 1c. HELIOZOA
- 1d. RADIOLARIA

BY
G. H. WAILES

WITH FIGURES

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LOBOSA, RETICULOSA, HELIOZOA ET RADIOLARIA

INTRODUCTION

The present paper is the first of a series dealing with the marine Protozoa of the Canadian Pacific coast.

The figures of the species here described are drawn and measurements made from British Columbia specimens (with a few exceptions which are noted). Thanks are due to the Vancouver Art and Historical Association for permission to reproduce figures from "Museum Notes".

All measurements, except when quoted from other authorities, are expressed in micromillimetres (μ). $1 \mu = 0.001 \text{ mm. or } 0.00003937 \frac{1}{(25400)}$ of an inch.

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 synonymies of species are omitted from the text but will be found in the works indicated by the numbers after the name of each species.

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- (5) DONS, CARL. Heliozoen *Microsol borealis*. Ibidem 41, pp. 1-41, 1918, 1919.
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- (11) RHUMBLER, L. Systematische Zusammenstellung der recenten Reticulosen. *Archiv. für Protist.* 3, 2, pp. 181-294, 1904.
- (12) SCHAEFFER, A. A. Taxonomy of the Amebas with descriptions of thirty nine new marine and freshwater species. *Dept. Marine Biol. Carnegie Instit. Washington.* 116 pp. 11 pls. 1926.
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- (16) WAILLES, G. H. Description of new species of marine Protozoa from British Columbia. *Contr. Canad. Biol. Fish.* Vol. 7, No. 17, 1932.
- (17) WAILLES, G. H. AND J. HOPKINSON. British freshwater Rhizopoda and Heliozoa. *Ray Soc. London.* Vols. 3-5. 1915-1921.

KEY TO CLASSES OF PROTOZOA

- | | |
|---------------------------------------|------------------|
| 1. (2) (3) With pseudopodia. | SARCODINA (p. 2) |
| 2. (1) (3) With one or more flagella. | MASTIGOPHORA |
| 3. (1) (2) With cilia or tentacles. | INFUSORIA |

SARCODINA

Protozoa naked or testaceous having digitate, lobose, reticulate or radiate pseudopodia.

KEY TO ORDERS

- | | |
|--|-------------------|
| 1. (4) Lobose, digitate, acicular or reticulate pseudopodia. | |
| 2. (3) Body naked or testaceous; pseudopodia not reticulate. | LOBOSA (p. 2) |
| 3. (2) Body naked or testaceous; pseudopodia forming a reticulum. | RETICULOSA (p. 6) |
| 4. (1) Radiating pseudopodia; mostly floating forms. | |
| 5. (6) Tests simple, no central capsule present; body spherical with numerous radiating straight, simple pseudopodia with firm axes. | HELIOZOA (p. 6) |
| 6. (5) Tests furnished with a central capsule; body divided by a porous membrane into internal and external parts. | RADIOLARIA (p. 9) |

LOBOSA

KEY TO SUBORDERS

- | | |
|---|-------------------|
| 1. (2) Body naked; pseudopodia lobose, digitate or acicular. | AMOEBAEA (p. 3) |
| 2. (1) Body covered by a shell or test; pseudopodia lobose, digitate or acicular. | CONCHULINA (p. 4) |

AMOEBAEA

KEY TO GENERA

1. (4) Amoebas which form indeterminate pseudopodia or eruptive waves during locomotion.
2. (3) Body clavate; no branching pseudopodia formed; posterior extremity during locomotion with uroid consisting of numerous hair-like projections.
TRICHAMOEBA (p. 3)
3. (2) Body not clavate; a few blunt pseudopodia; locomotion achieved by a general streaming of the endoplasm into a main blunt pseudopodium.
METACHAOS (p. 3)
4. (1) Amoebas which form determinate conical or tapering pseudopodia which do not direct locomotion; the advancing pseudopodia free from granules.
5. (6) Body with eight or more blunt pseudopodia; in locomotive stage body sub-cylindrical without an uroid and usually without pseudopodia.
STRIOLATUS (p. 4)
6. (5) Body with long, slender pseudopodia capable of making movements after the manner of tentacles; during locomotion pseudopodia are withdrawn.
VESELLIFERA (p. 4)

CHAIDAE

Genus **TRICHAMOEBA**

T. gumia Schaeffer 12 (Fig. 1).

Endoplasm yellowish containing numerous granules up to 2μ in diameter; length when extended 40 to 150μ usually 60 to 100μ ; nucleus difficult to distinguish, single spherical; nuclear membrane 12μ in diameter; vacuoles usually present.

Departure bay; on *Zostera* and algae.

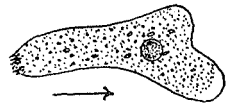


Fig. 1
Trichamoeba gumia
Schaeffer x 300.

Genus **METACHAOS**

M. fulvum Schaeffer 12 (Fig. 2)

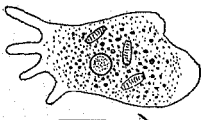


Fig. 2
Metachaos fulvum
Schaeffer x 375.

Endoplasm colourless, containing numerous small grains about 1μ in diameter together with larger granules up to 5 or 6μ in diameter, yellowish to brown in colour; nucleus conspicuous, single, spherical, 9μ in diameter containing a chromatin mass 7μ in diameter; length 50 to 65μ , width about 40μ . When suspended in the water a rayed form is assumed having 5 or 6 blunt pseudopodia.

Departure bay; False narrows; among algae.

MAYORELLIDAE

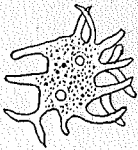
Genus **STRIOLATUS****S. tardus** Schaeffer 12 (Fig. 3).

Fig. 3

Striolatus tardus
Schaeffer. Shape
assumed when
stationary x 375.

Endoplasm clear, pale bluish-green in colour, filled with refracting grains 1μ in diameter; nucleus single or double, spherical, 10μ in diameter with central chromatin mass 5μ in diameter; body 30μ in diameter, length when in motion 50μ . Body when at rest or suspended in the water having numerous bluntly pointed pseudopodia.

Cortes island; Departure bay; among algae on the beaches.

Genus **VEXILLIFERA****V. vacillans** Wailes 16 (Fig. 4).

Endoplasm colourless containing few minute grains; nucleus single 6μ in diameter; pseudopodia up to 90μ in length, radiating, tenuous, pointed, capable of independent motion, often waved or assuming helical or twisted forms. Body 12 to 25μ in diameter.

Nanaimo district in cultures of algae.

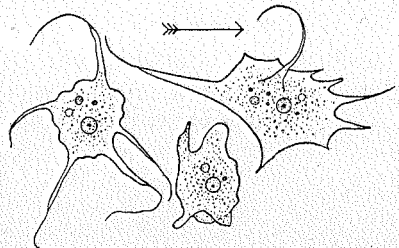


Fig. 4

Vexillifera vacillans Wailes x 400.

CONCHULINA

KEY TO GENERA

1. (2) Test ovoid formed of overlapping hyaline plates.
2. (1) Test retort-shaped formed of small discs.

EUGLYPHA (p. 4)**CYPHODERIA** (p. 5)

EUGLYPHINAE

With filose pseudopodia

Genus **EUGLYPHA****E. ciliata** (Ehrenb.) 17 (Fig. 5).

Test oviform, compressed, formed of elliptical imbricated scales, usually more or less provided with short cils; aperture elliptical bordered by 8 to 14 pointed scales with 3 denticulations in each; plasma colourless with granular inclusions; nucleus single, spherical 10 to 20μ in diameter, situated posteriorly; pseudopodia filose.

Length 40 to 90μ ; breadth 24 to 60μ .

Strait of Georgia, near the shore and in brackish water.

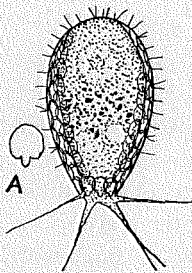


Fig. 5

Euglypha ciliata
(Ehrenb.) x 400. A,
aperture scale enlarged

E. laevis (Ehrenb.) 17 (Fig. 6).

Test oviform, glabrous, formed of elliptical scales, transverse section and aperture elliptical to subcircular, aperture bordered by a row of pointed scales; plasma colourless granular; nucleus single, spherical; pseudopodia filose.

Length 22 to 55 μ ; breadth 12 to 30 μ ; thickness 8 to 26 μ .

Strait of Georgia, near the shore.

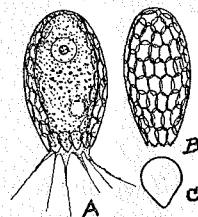


Fig. 6

E. laevis (Ehrenb.)

A, active individual; B, narrow side view of test; C, aperture scale enlarged. A and B x 400.

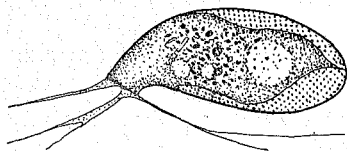
Genus **CYPHODERIA****C. ampulla** (Ehrenb.) 17 (Fig. 7).

Fig. 7

Cyphoderia ampulla (Ehrenb.)
x 300.

Test retort shaped, not compressed, formed of non-imbricated discs 1.5 to 2.5 μ in diameter arranged in diagonal rows on a thin chitinous pellicle; plasma greyish in colour containing numerous granules and food particles; nucleus large, granular, containing numerous nucleoles, situated posteriorly; pseudopodia few, filiform, long, straight or curved.

Length 100 to 140 μ usually (60 to 190 μ).

Strait of Georgia on or near the shore.

C. ampulla var. **vitrea** Wailes 17.

Similar to the type but with transparent test having no visible structure. When the test is dissolved in acid it is found to be composed of pellets similar to those in tests of the type.

Length usually 100 to 110 μ (67 to 120 μ).

Camp island, strait of Georgia; among algae on the beach, rare.

C. ampulla f. **laevis** forma nov. (Fig. 8).

Test transparent and smaller than type, with truncated neck to orifice; plasma and pseudopodia similar to type.

Length 48 to 49 μ ; breadth 25 to 26 μ ; aperture 10 to 11 μ in diameter.

Off Cortes island, strait of Georgia, rare.

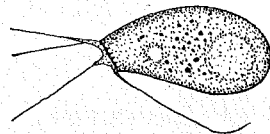


Fig. 8

C. ampulla var. *laevis*
Penard x 450.

RETICULOSA
FORAMINIFERA
RHABDAMMINIDAE

Test monothalamous, variously shaped, but never spiral, with one or more apertures but without true pores.

Genus **ALLOGROMIA**

Test spherical or ovoid, membranous without continuous covering of foreign particles, aperture single, terminal; pseudopodia arising from a peduncle or raphe. Freshwater and marine.

A. ovoidea Rhumbler 11, 17 (Fig. 9).

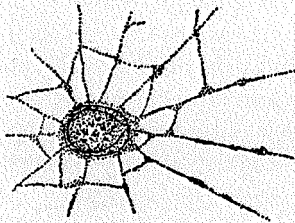


Fig. 9

Allogromia ovoidea Rhumbler x 150. Only part of the pseudopodial reticulum is shown.

Syn. *Gromia oviformis* M. Schultze (1854); non Dujardin (1835).

Test ovoid; yellowish or dark in colour; pseudopodia arising from a short stalk or peduncle; when active the plasma enveloping whole of test and giving rise to an extensive reticulum.

Length of test 60μ .

Departure bay; among algae, etc., on float.

This species attains a larger size than those observed, being said by Rhumbler (1903) to attain 500μ in length.

HELIOZOA

KEY TO SUBORDERS

1. (2) No external skeleton; body enclosed in thin membrane only. APHROTHORACIDEA (p. 6)
2. (1) External skeleton present formed of discontinuous solid elements cemented together by protoplasmic material. CHALAROTHORACIDEA (p. 8)

APHROTHORACIDEA

KEY TO GENERA

1. (2) Freeswimming. **ACTINOPHRYS** (p. 7)
2. (1) Fixed by means of a stalk.
3. (4) Body spherical. **MICROSOL** (p. 7)
4. (3) Body pear-shaped. **ACTINOLOPHUS** (p. 7)

Genus **ACTINOPHRYS****A. sol** Ehrenb. 8, 17 (Fig. 10).

Body spherical with numerous large vacuoles at the periphery; nucleus large, placed centrally; contractile vacuole large protruding beyond periphery; pseudopodia long. Usually less vacuolised in the sea than in freshwater.

Small individuals, 12 to 16 μ diameter, possibly the result of binary or multiple division, are frequently found both in the sea and in freshwater in association with the mature *A. sol*. (They may be identical with *A. sol* var. *simplex* (Schaudinn) Playfair (1914), non *Acanthocystis simplex* Schaudinn 8).

Diameter up to about 50 μ .

Departure bay and strait of Georgia; also in algal infusions.

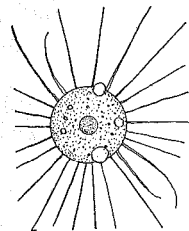


Fig. 10
Actinophrys sol
Ehrenb. x 200.

Genus **MICROSOL****M. borealis** (Meresch.) Dons. 3, 5 (Fig. 11).

Syn. *Haeckelina borealis* Meresch. 1879. *Podophrya gracilis* Calkins 1901.

Body spherical, usually with a mucous investment marked by adherence of adventitious foreign particles; nucleus single; stipe long, slender; pseudopodia capitate when retracted.

Body diameter 25 μ , investment diameter 35 μ ; stipe up to 200 μ in length, 2 μ in diameter.

Departure bay float; attached to algae, shells, etc.

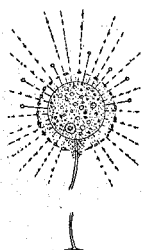


Fig. 11
Microsol borealis
(Meresch.) x 300.

Genus **ACTINOLOPHUS****A. pedunculatus** F. E. Schulze 2, 15 (Fig. 12)

Body pedicellate pear-shaped with a mucilaginous envelope to which foreign particles may be adherent; pseudopodia long, granuliferous, radial. Cysts thecate, stalked or sessile.

Body 26 to 40 μ in diameter; investment 45 to 60 μ in breadth; pedicel 50 to 95 μ in length. Cysts 45 to 58 μ in diameter.

Nanosee harbour and Gabriola pass, strait of Georgia; in shallow water attached to diatoms (*Melosira*).

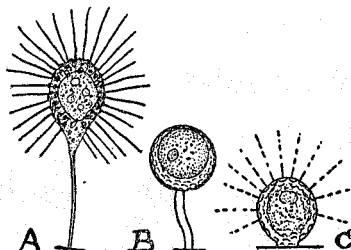


Fig. 12

Actinolphus pedunculatus F. E. Schulze. A, active individual; B, another with its pseudopodia withdrawn; C, sessile form. All x 200.

CHALAROTHORACIDEA

KEY TO GENERA

1. (2) Sessile with long hollow stipe; body with investment of spicules. **WAGNERELLA** (p. 8)
2. (1) Free floating.
3. (4) Body with mucilaginous investment containing fine, indistinct, chitinous spicules. **HETEROPHRYS** (p. 8)
4. (3) Body with envelope formed of two kinds of silicious elements; the one, oval scales arranged tangentially, the other, flat-headed radial spines. **ACANTHOCYSTIS** (p. 9)

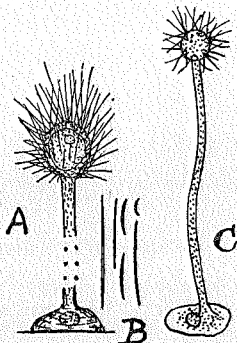


Fig. 13

Wagnerella borealis Meresch.
A, x 100; B, spines composing the investment x 150; C x 50.

Genus **WAGNERELLA**

W. borealis Mereschkowsky 4, 15 (Fig. 13).

Body spherical or ellipsoid with investment of spicules, attached to long hollow stipe; nucleus single, situated in base of stipe in mature individuals.

Diameter of body about 80μ but may attain 200μ . Stipe 18 to 30μ diameter, 400 to 600μ (or more) in length.

Strait of Georgia; Barkley sound; dredged from 10 to 20 fathoms; often numerous locally.

Genus **HETEROPHRYS**

H. marina Hertwig and Lesser 7, 8, 15 (Fig. 14).

Body spherical, encased in a thick mucilaginous envelope; radial spines more or less divergent and irregularly arranged; pseudopodia long, tenuous; nucleus single, situated eccentrically; plasma containing numerous inclusions; vacuoles absent.

Diameter over envelope 30 to 33μ (H. and L. 25 to 30μ); spines about half the diameter of the body in length.

Barkley sound; strait of Georgia; scarce.

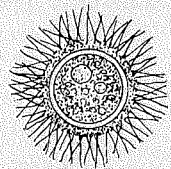


Fig. 14

Heterophrys marina
H. & L. x 350.

Genus **ACANTHOCYSTIS****A. brevicirrhis** (Perty) 8, 15, 17 (Fig. 15).

Body spherical encased in a double investment, the inner portion consisting of small silicious scales, the outer portion of the bases of short spines; plasma clear containing small granules; nucleus single situated eccentrically.

Diameter of body 34μ ; length of spines about 6μ .

Deep bay, Burrard inlet, near the outfall from lake Buntzen.

This freshwater species was seen only once in a marine habitat and its presence may be adventitious.



Fig. 15

Acanthocystis brevicirrhis Perty x 300.

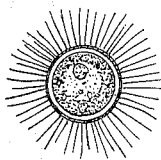
A. spinifera Greeff 8, 15, 17 (Fig. 16).

Fig. 16

A. spinifera Greeff
x 300.

Body spherical with an outer investment formed of the bases of numerous long, straight, pointed, radial spines; plasma clear containing few inclusions; nucleus situated eccentrically.

Diameter $22-30\mu$; length of spines equal to half diameter of body.

Barkley sound; strait of Georgia; often numerous during August and September.

In freshwater this species measures 40 to 60μ in diameter; it might be advisable to separate the marine from the freshwater species.

RADIOLARIA

KEY TO SUBORDERS

1. (2) Central capsule spherical perforated by uniformly distributed pores; extra-capsular region well developed; skeleton either wanting or consisting of scattered silicious spicules or of a lattice-work shell.
SPUMELLARIA (seu PERIPYLARIA) (p. 10)
2. (1) Central capsule not uniformly perforated.
3. (4) Skeleton of spines radiating from centre of body and composed of strontium sulphate; central capsule may or may not be present.
ACANTHARIA (seu ACTIPYLARIA) (p. 11)
4. (3) Skeleton not as above in form and composed of silica.
5. (6) Central capsule monaxial or bilateral with a simple membrane, bearing on one pole of main axis a porous area forming base of intracapsular cone.
NASSELLARIA (seu MONOPYLARIA) (p. 12)
6. (5) Central capsule with a principal and usually two accessory apertures; pigment bodies present.
PHAEODARIA (seu TRIPYLARIA) (p. 13)

SPUMELLARIA

KEY TO GENERA

1. (2) No radial spines present. **CENOSPHAERA** (p. 10)
2. (1) Radial spines present.
3. (4) Six radial spines from central capsule and symmetrically spaced. **HEXASTYLUS** (p. 11)
4. (3) Numerous radial spines on surface of a spherical shell. **RHIZOPLEGMA** (p. 11)

LIOSPHAERIDAE

Genus **CENOSPHAERA**

Capsule a single latticed sphere; pores in capsule without collars or projections.

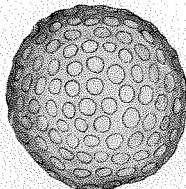


Fig. 17
Cenosphaera proserpinae Haeckel x 200.

C. proserpinae Haeckel 6 (Fig. 17).

Shell thin walled, smooth, spherical; bars narrow; perforations more or less circular and equal in size.

Capsule diameter 110 to 130 μ ; pores 8 to 12 μ .
Departure bay, February and March.

C. polygonalis Haeckel 6 (Fig. 18).

Shell thin walled, smooth, spherical; bars narrow; perforations polygonal and unequal.

Capsule diameter 106 μ ; pores up to 17 μ in breadth.
Departure bay, February.

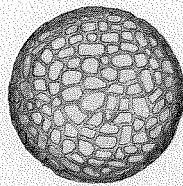


Fig. 18
C. polygonalis
Haeckel x 200.

CUBOSPHAERIDAE

Genus **HEXASTYLUS**

Shell one simple latticed sphere; all spines simple and similar.

H. triaxonius Haeckel 6 (Fig. 19).

Shell thin-walled, smooth, spherical, provided with 6 radial spines spaced symmetrically; pores irregular, polygonal; bars narrow; spines tapering, triangular in section, nearly as long as diameter of shell.

Diameter 50μ ; pores 4 to 8μ in width; length of spines 40μ , breadth at base 6μ .

Strait of Georgia; March.

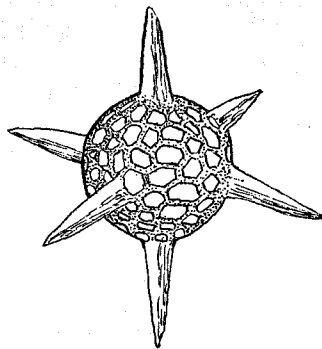


Fig. 19
Hexastylus triaxonius Haeckel
x 500.

ASTROSPHAERIDAE

Genus **RHIZOPLEGMA**

Shell spongy, spherical or polyhedral, with one single spherical latticed medullary capsule without auxilliary spines.

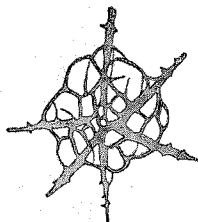


Fig. 20
Rhizoplegma boreale
(Cleve) x 200. The
central capsule is omitted
for the sake of distinctness.

R. boreale (Cleve) Joergensen 13 (Fig. 20).

Latticed shell irregularly spherical having central medullary sphere attached to it by 6 primary spines provided with thorn-like lateral processes, but without secondary spines; openings in shell from oval to circular in shape.

Diameter of shell 80μ ; over spines up to 200μ .

Strait of Georgia, February and March.

ACANTHARIA

Genus **ACANTHOMETRON**

Central capsule absent; radial spines twenty in number arranged in five zones of four spines each (Icosacantha); of nearly equal size and similar form; simple without apophyses or lateral processes; cylindrical, transverse section circular.

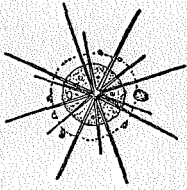


Fig. 21
Acanthometron pellucidum J. Müller x 200.

A. pellucidum J. Müller 9, 6. (Fig. 21.)

Central plasma spherical with ill-defined margin, colourless, containing numerous fine granules; radial spines 20 in number, long, slender, smooth, pointed, circular in section without enlarged bases, meeting at centre of body.

Body diameter 25 to 100 μ ; width over spines 50 to 300 μ .

Generally distributed, not uncommon.

NASELLARIA

KEY TO GENERA

- | | |
|--|-----------------------------|
| 1. (4) Without complete lattice shell. | |
| 2. (3) Ventral sagittal spine present. | PHORMACANTHA (p. 12) |
| 3. (2) Ventral sagittal spine absent. | PLECTACANTHA (p. 12) |
| 4. (1) With a complete latticed shell. | |
| 5. (6) Base with three ribs prolonged into spines. | DICTYOPHIMUS (p. 13) |
| 6. (5) Base with simple spines. | LITHOMELISSA (p. 13) |

PLECTANIDAE

Skeleton with basal tripod without ring, formed by interlacing branches of the radial spines.

Genus **PHORMACANTHA**

P. hystrix (Joergensen) 13 (Fig. 22).

Primary spines connected by strong primary arches with a secondary network of arches and spines forming an irregular structure imperfectly closed below.

Width of network 40 to 70 μ ; width over spines 100 to 150 μ .

Strait of Georgia; December and March.

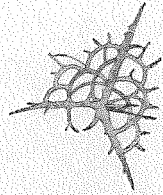


Fig. 22
Phormacantha hystrix (Joerg.) x 200.

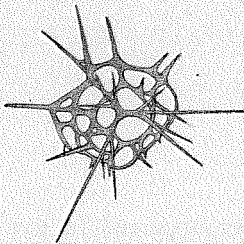


Fig. 23
Plectacantha oikiskos Joerg. x 300. After Joergensen 14.

Genus **PLECTACANTHA**

P. oikiskos Joergensen 13 (Fig. 23).

Primary spines connected by wide primary arches with secondary arches bearing long auxiliary spines forming a more compact structure than in *P. hystrix*.

Width over spines up to about 100 μ .

Strait of Georgia; March.

TRIPOCYRTIDAE

Shell with simple or reduced cephalis without sagittal constriction, and divided into apical and basal part; few (3) radial apophyses present.

Genus **DICTYOPHIMUS**

D. histicosus Joergensen 13 (Fig. 24).

Shell conical with open base; apex sub-hemispherical; upper portion of shell armed with spines of varying length, base with 3 ribs prolonged into long spines; pores in shell uneven in size and shape.

Height of shell 55 to 70 μ ; diameter at base exceeding height.

Off the west coast of Vancouver island throughout the year, scarce; strait of Georgia in the winter months, rare.

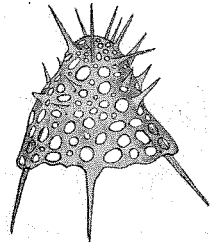


Fig. 24

Dictyophimus histicosus
Joerg. x 250. After Joergensen 14.

Genus **LITHOMELISSA**

L. setosa Joergensen 13 (Fig. 25).

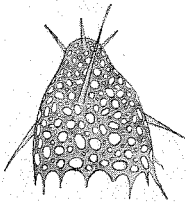


Fig. 25

Lithomelissa setosa
Joerg. x 200.

Shell conical, provided with subcircular pores of varying size; junction of cephalis and basal portion marked by a shoulder in which region are four primary divergent spines connected together within the shell and a ventral sagittal spine projecting downwards; few small auxillary spines may be present on the outer surface of shell.

The base in young individuals is reported to have slender spines which may disappear with age.

Height of shell 80 to 100 μ ; diameter of base less than height.

Generally distributed, common.

PHAEODARIA

KEY TO GENERA

1. (2) Shell with adoral teeth and marginal spines. **CHALLENGERON** (p. 14)
2. (1) Shell with adoral teeth, but without marginal spines. **PROTOCYSTIS (Challengeria)** (p. 14)

CHALLENGERIDAE

Shell simple, monaxial, usually ovate or lenticular; mouth with peristome on oral pole of main axis; structure hexagonal, provided more or less abundantly with adoral teeth and marginal spines; central capsule always situated eccentrically.

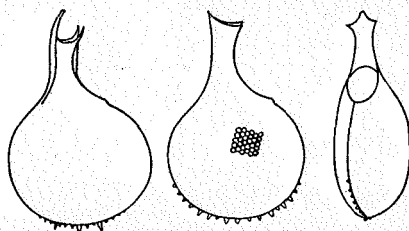


Fig. 26

Challengeron depauperatum Wailes x 225.

Genus **CHALLENGERON**

C. depauperatum Wailes 16 (Fig. 26).

Shell broadly ovate in side view, lenticular in section, of an hexagonal structure, margin furnished with a variable number of short, radial, thorn-like spines which are largest towards the aboral pole; peristome helmet-shaped with two pairs of conical, curved, divergent teeth.

Length 104 to 133 μ ; breadth 65 to 90 μ ; marginal spines up to 4 μ in length.

Off the coast of Vancouver island throughout the year; common on the west coast, rare on the east coast.

Genus **PROTOCYSTIS** (Challengeria)

P. tridens (Haeckel) 1, 6 (Fig. 27).

Shell smooth, subcircular in side view, slightly compressed; peristome long with one dorsal and two paired lateral teeth.

Length 90 to 110 μ ; including the peristome; breadth 40 to 70 μ .

East and west coasts of Vancouver island throughout the year.



Fig. 27

Protocystis tridens
Borgert x 250.

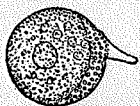


Fig. 28

P. aurita Wallich
x 200.

P. aurita Wallich 1, 2 (Fig. 28).

Syn. *P. harstoni* Murray 6.

Shell smooth subcircular in side view, slightly compressed; peristome short, bifid.

Length 80 to 100 μ including the peristome.

West coast of Vancouver island; rare.