

REPORT OF THE BIOLOGICAL SURVEY OF MUTSU BAY.
24. THE PELAGIC CILIATA, SUBORDER TINTINNOINEA¹⁾.

By

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(With 26 text-figures)

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INTRODUCTION

The present work is based upon the materials obtained by myself in surface collections and vertical hauls during August, 1929–September, 1930 at numerous stations scattered throughout Mutsu Bay, and upon the plankton collected with a surface tow net twice a month during 1927–1931 and preserved in the Asamushi Marine Biological Station of the Tôhoku Imperial University.

In this paper I have recorded 34 species belonging to 12 genera and 8 families according to KOFOID and CAMPBELL's systematic arrangement of the Tintinnoinea (1929). Of these, 7 seem to be new to science.

It is my pleasure and duty to offer my sincere acknowledgment to Professor Dr. C. A. KOFOID and Dr. A. S. CAMPBELL, of the Zoological Department of the University of California, for their kind advice and help in identification of the species and in the accomplishment of this investigation. In collection and examination of the materials I am indebted to Dr. S. KOKUBO and Mr. T. TAMURA, of the Asamushi Marine Biological Station.

SYSTEMATIC PART

Class CILIATA.

Order HETEROTRICHIDA.

Suborder **Tintinnoinea.**

Key to genera.

1. Lorica consisting of a bowl with or without an aboral horn; wall

¹⁾Contributions from the Marine Biological Station, Asamushi, Aomori-Ken. No. 93.

- composed of a fine primary structure and an agglomerated material.
Genus *Tintinnopsis*.
2. Lorica with a very low, hyaline collar and a coarsely constituted bowl.
Genus *Stenosemella*.
 3. Lorica consisting of a higher, hyaline, subcylindrical collar with spiral turns and a coarser bowl with an alveolar pattern or agglomerated particles.
Genus *Codonellopsis*.
 4. Lorica usually bell-shaped, with a flaring callar divided by a nuchal constriction from a bowl; wall bilamellate, with an irregularly polygonal reticulation.
Genus *Cyttarocyliis*.
 5. Lorica chalice-shaped; wall composed of separated lamellae with fine, subuniform, hexagons.
Genus *Parafavella*.
 6. Lorica bell-shaped, having two elevated bands; wall weakly bilaminated; surface with minute irregular polygons or fine plications.
Genus *Ptychocyliis*.
 7. Lorica with double collars, inner one a little higher than the outer denticulated with short triangular teeth; wall bilamellate, usually hyaline, but not structureless.
Genus *Acanthostomella*.
 8. Lorica elongated chalice-shaped; aboral end drawn out into a simple caudal lance; wall generally hyaline, composed of almost separated laminae fused partially in the aboral end.
Genus *Parundella*.
 9. Lorica vase- or cup-shaped, with a fairly developed inner collar by the reason of the thickened wall in the suboral region; wall trilamellate, translucent.
Genus *Proplectella*.
 10. Lorica consisting of a low funnel-shaped collar and an elongated bowl with a few ridges or lines; oral rim entire and circular; wall translucent.
Genus *Amphorella*.
 11. Lorica subcylindrical, open at the both ends; wall typically hyaline.
Genus *Tintinnus*.
 12. Lorica elongate, tubular; collar an inverted, truncate, conical cone; shaft subcylindrical, with some fins at the aboral region; aboral end usually open; wall almost hyaline.
Genus *Salpingella*.

Family Codonellidae.

Genus TINTINNOPHIS STEIN, 1867.

1. *Tintinnopsis beroidea* STEIN.

Tintinnopsis beroidea STEIN, *1867; KOFOID and CAMPBELL, 1929, p. 28, fig. 26; HADA,

*Indicates literature which I have not examined.

1932 b, p. 41, fig. 2.

Length, 61(50-74) μ ; oral diameter, 35(31-40) μ .
Occurs in February-April and September; common.

2. *Tintinnopsis urnula* MEUNIER.

Tintinnopsis urnula MEUNIER, 1910, p. 145, pl. 13, figs. 21-25; KOFOID and CAMPBELL, 1929, p. 50, fig. 20; HADA, 1932 b, p. 42, fig. 3.

Length, 60 μ ; oral diameter, 40 μ .
Occurs in March and April; very rare.

3. *Tintinnopsis tubulosoides* MEUNIER.

Tintinnopsis tubulosoides MEUNIER, 1910, p. 139, pl. 12, figs. 10, 11; KOFOID and CAMPBELL, 1929, p. 49, fig. 74; HADA, 1932 b, p. 43, fig. 5.

Length, 94(83-104) μ ; oral diameter, 36(34-40) μ .
Occurs in April; rare.

4. *Tintinnopsis tenuis*, n. sp.

Text-figure 1.

Lorica elongated capsular, 2.0-2.5 oral diameters in length; oral rim usually entire; bowl cylindrical; aboral end generally hemispherical; wall thin, subuniform, 0.03 of the oral diameter in thickness, showing a slight spiral structure in the suboral part, with fine and sparse agglomerations.

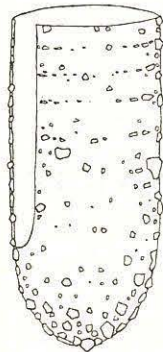
Length, 60(54-64) μ ; oral diameter, 27(25-29) μ .
Occurs in May-October; rare.

Differs from *Tintinnopsis acuminata* DADAY and *Tps. beroidea* STEIN in the rounded aboral end and in the presence of the faint spiral structure, from *Tps. karajacensis* BRANDT and *Tps. rotundata* JÖRGENSEN in dimensions and in a sparse agglomerated material, and from *Tps. minuta* WAILES in being larger and in more slender proportions.

5. *Tintinnopsis conglobata*, n. sp.

Text-figure 2.

Lorica ovoidal, 2.3 oral diameters in length, consisting of a short subcylindrical collar and an ovate bowl, widest near the middle, its greatest transdiameter 1.8 of the oral diameter; oral rim ragged; shoulder gradually sloping; aboral end rounded; wall rather coarse and thick, without a spiral structure.

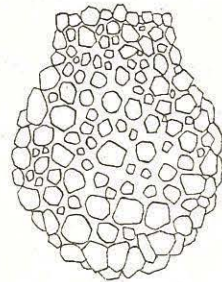


Text-fig. 1. *Tintinnopsis tenuis*, n. sp. × 750.

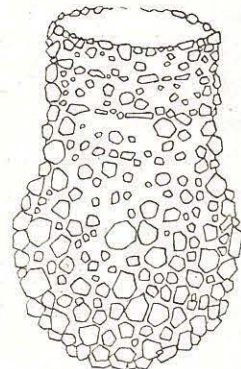
Length, 46(44–48) μ ; oral diameter, 20 μ .

Occurs in February–April; rare.

Differs from *Tintinnopsis compressa* DADAY in the presence of the marked subcylindrical nuchal part and from *Tps. nucula* (FOL) in the widened bowl, in the hemispherical aboral end and in the less shouldered collar.



Text-fig. 2. *Tintinnopsis conglobata*, n. sp. × 750.



Text-fig. 3. *Tintinnopsis lohmanni* LAACKMANN. × 750.

6. *Tintinnopsis lohmanni* LAACKMANN.

Text-figure 3.

Tintinnopsis lohmanni LAACKMANN, 1906, p. 20, pl. 1, figs. 10, 11, pl. 2, fig. 23.

Tintinnopsis sp. BRANDT, 1906, pl. 17, figs. 1, 3; 1907, p. 180.

Tintinnopsis tubulosa, var. *lohmanni*, JÖRGENSEN, 1927, p. 7.

Tintinnopsis subacuta (part), KOFOID and CAMPBELL, 1929, p. 47.

Lorica stout flask-shaped, 2 oral diameters in length, cylindrical anteriorly, enlarged aborally; oral rim more or less irregular, no oral flare; tubular part 0.40–0.43 of the total length in length, provided with 2 or 3 spiral turns; aboral region subspherical or broadly conical, 1.14–1.23 oral diameters in transdiameter at the posterior 0.3 of the total length; wall agglomerated rather coarsely, 0.08 oral diameters in thickness.

Length, 60 μ ; oral diameter, 30 μ .

Occurs in August; rare.

Differs from *Tintinnopsis compressa* DADAY in contour being composed of the oral cylindrical part and the expanding aboral region, from *Tps. subacuta* JÖRGENSEN in the shortened anterior tubular part and in the shape of the aboral end, and from *Tps. turgida* KOFOID and CAMPBELL in the short suboral region and in the presence of the spiral structure in the same portion.

7. *Tintinnopsis directa*, n. sp.

Text-figure 4.

Tintinnopsis sp. (*T. campanula* var.?) OKAMURA, 1907, p. 139, pl. 6, fig. 64.

Tintinnopsis patula (part), KOFOID and CAMPBELL, 1929, p. 43.

Lorica tall campanulate, 1.6–2.2 oral diameters in length; oral rim irregular, flaring (60°–92°); suboral region somewhat tapering, conical (5°–10°), laid up with about 6 spiral turns, narrowest at the basal portion of the subcylindrical part, its smallest transdiameter 0.68–0.82 of the oral diameter; posterior region subspherical, with a rounded aboral end, 0.80–0.95 oral diameters in transdiameter; wall rather coarse in the posterior part, about 0.035 diameters in thickness at the thickest portion of the aboral region.

Length, 88(72–100) μ ; oral diameter, 42(40–45) μ ; greatest transdiameter, 38(34–40) μ .

Type locality, off Tosa, Japan.

Occurs in July–October; common.

Differs from *Tintinnopsis dadayi* KOFOID in the elongated lorica and in the coarse surface, from *Tps. everta* KOFOID and CAMPBELL in having a distinct aboral enlargement, from *Tps. pallida* BRANDT in the presence of the more differentiated aboral part, and from *Tps. turgida* KOFOID and CAMPBELL in possession of a flare of the oral rim.

8. *Tintinnopsis bütschlii* DADAY.

Text-figure 5.

Tintinnopsis Bütschlii DADAY, 1887, p. 556, pl. 20, figs. 4, 5; KOFOID and CAMPBELL, 1929, p. 29, fig. 85.

Tintinnopsis campanula var. *bütschlii* (part), BRANDT, 1907, p. 151.

Lorica campanulate, consisting of a broadly expanding and everated oral region and a convex conical bowl, its length 0.94–1.05 oral diameter; oral rim roughened, conical (about 130°); bowl narrowest at the upper third of the lorica, its least transdiameter 0.41–0.45 of the oral diameter, dilated posteriorly a little (7°–9°), 0.43–0.48 of the oral diameter in greatest transdiameter at the posterior 0.25 of the total length; aboral end hemispherical; wall 0.023–0.027 oral diameters in thickness, with a trace of a spiral structure in the suboral nuchal region.

Length, 88(84–92) μ ; oral diameter, 88(80–92) μ ; greatest transdiameter of the bowl, 40(38–43) μ .

Occurs in August–October; common.

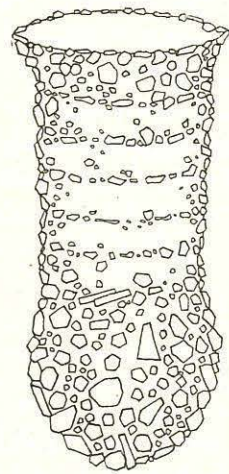
Differs from *Tintinnopsis cyathus* DADAY and *Tps. everta* KOFOID and CAMPBELL in the more spreading oral flare and from *Tps. mortensenii* SCHMIDT in the shape of the oral flare which is not so much everted in this species as in the last.

9. *Tintinnopsis karajacensis* BRANDT.

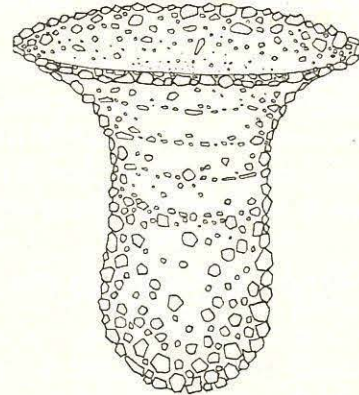
Text-figure 6.

Tintinnopsis karajacensis BRANDT, 1896, p. 57, pl. 3, fig. 5; 1906 (part), 19, figs. 5, 10, 12, pl. 26, fig. 3; 1907, p. 162; LAACKMANN, 1906, p. 21, pl. 1, figs. 12-14; JÖRGENSEN, 1927, pp. 5, 7; KOFOID and CAMPBELL, 1929, p. 37, fig. 38.

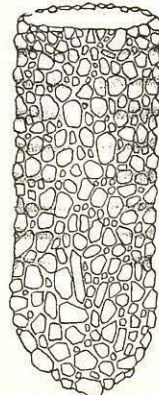
Lorica cylindrical, 2.0-2.7 oral diameters in length, oral rim ragged; aboral end rounded or disfigured as the result of irregularly agglomerated particles; wall coarse, having several slight spiral turns in the anterior half.



Text-fig. 4. *Tintinnopsis directa*, n. sp. $\times 650$.



Text-fig. 5 *Tintinnopsis bütschlii* DADAY $\times 550$.



Text-fig. 6. *Tintinnopsis karajacensis* BRANDT $\times 300$.

Length, 111-172 μ ; oral diameter, 55-64 μ .

Occurs in June and July; rare.

Differs from *Tintinnopsis cochleata* (BRANDT) in less extensive spiral organization and in roughened agglomeration, from *Tps. lobiancoi* DADAY in the shorter lorica, and from *Tps. rotundata* JÖRGENSEN in more slender proportions and in the shape of the aboral end.

10. *Tintinnopsis lobiancoi* DADAY.

Text-figure 7.

Tintinnopsis Lobiancoi DADAY, 1887, pp. 545, 553, pl. 19, fig. 27; CLEVE, 1900 a, p. 17,

fig. 4; 1900 b, p. 18; BRANDT, 1906, pl. 19, fig. 3, pl. 24, fig. 16, pl. 26, figs. 7, 8; 1907, p. 160; OKAMURA, 1907, p. 137, pl. 6, fig. 56; ENTZ, Jr. (part), 1909, pl. 9, fig. 2, pl. 12, fig. 4, pl. 21, fig. 6; MERKLE, 1909, p. 153, pl. 2, figs. 13, 24; MEUNIER, 1910, p. 138, pl. 12, figs. 5-9; JÖRGENSEN, 1927, pp. 5, 7; KOFOID and CAMPBELL, 1929, p. 38, fig. 95.

Tintinnopsis radix forma *subrotundata* LAACKMANN, 1913, p. 23, pl. 2, fig. 32.

Tintinnopsis radix forma *curta-subrotundata* LAACKMANN, 1913, p. 23, pl. 2, fig. 34.

Lorica elongate, tubular, usually straight, 4.5 oral diameters in length; oral rim ragged; aboral end rounded or shaped somewhat irregularly; wall agglomerated roughly, but comparatively thin, 0.04 of the oral diameter in thickness, without a spiral structure.

Length, 151 μ ; oral diameter, 34 μ .

Occurs in September; very rare.

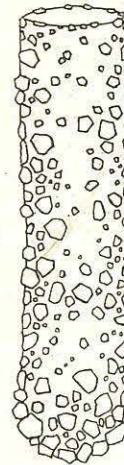
Differs from *Tintinnopsis karajacensis* BRANDT in the longer lorica and in slender proportions and from *Tps. cochleata* (BRANDT) in lack of the spiral structure.

11. *Tintinnopsis tocaninensis* KOFOID and CAMPBELL.

Text-figure 8.

Tintinnopsis aperta var. a BRANDT, 1906, pl. 25, figs. 2, 7; 1907 pp. 129, 177.

Tintinnopsis tocaninensis KOFOID and CAMPBELL, 1929, p. 48, fig. 46.



Text-fig. 7. *Tintinnopsis lobiancoi* DADAY $\times 400$.



Text-fig. 8. *Tintinnopsis tocaninensis* KOFOID and CAMPBELL $\times 600$.



Text-fig. 9. *Tintinnopsis kofoidi* HADA $\times 350$.

Lorica elongated, 4.7 oral diameters in length, cylindrical anteriorly, expanding posteriorly, tapering distally into a stout aboral horn; dilated part not spiraled, 1.2 of the oral diameter in transdiameter; aboral horn conical (35°), obliquely or irregularly open at the tip; wall thick and coarse.

Length, $103\ \mu$; oral diameter, $22\ \mu$.

Occurs in September; very rare.

Differs from *Tintinnopsis aperta* BRANDT in the absence of the spiral structure at the enlarged region and in having the stout aboral horn.

12. *Tintinnopsis kofoidi* HADA.

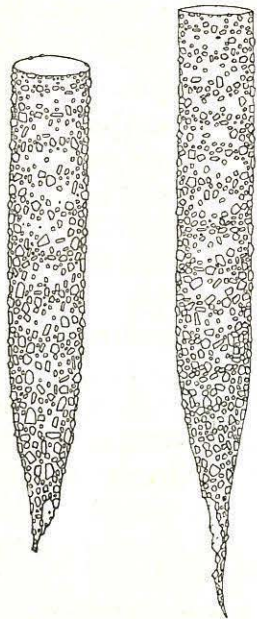
Text-figure 9.

Tintinnopsis kofoidi HADA, 1932 a, p. 210, figs. 2, 3; 1932 b, p. 44, fig. 6.

Occurs in July; rare.

13. *Tintinnopsis radix* (IMHOF) BRANDT.

Text-figure 10.



Text-fig. 10. *Tintinnopsis radix* (IMHOF) $\times 250$.

Codonella radix IMHOF, 1886, p. 103.

Tintinnopsis Davidoffii DADAY, 1887, p. 552, pl. 19, fig. 23.

Tintinnopsis Davidoffii var. *cylindrica* (part), DADAY, 1887, p. 553, pl. 19, fig. 25.

Tintinnopsis Davidoffii var. *longicauda*, DADAY, 1887, pp. 545, 553, pl. 19, fig. 26.

Tintinnopsis curvicauda DADAY, 1887, p. 554, pl. 19, fig. 33.

Tintinnopsis fracta BRANDT, 1906, pl. 23, figs. 1, 3-5, 9-13, pl. 31, fig. 8; 1907, p. 174; OKAMURA, 1907, p. 137, pl. 6, fig. 57.

Tintinnopsis radix, BRANDT, 1907, p. 20; LAACKMANN, 1913, p. 17, pl. 2, figs. 17-20, 27-28; KOFOID and CAMPBELL, 1929, p. 45, fig. 93.

Tintinnopsis radix forma *typica* LAACKMANN, 1913, p. 22.

Tintinnopsis radix forma *curta* LAACKMANN, 1913, p. 23, pl. 2, figs. 21-24, 26.

Tintinnopsis radix forma *cylindrica*, LAACKMANN, 1913, p. 23, pl. 2, figs. 25, 29-31.

Lorica elongate, slender, tubular, 6.0-9.5 oral diameters in length; oral rim generally

entire, sometimes irregular; bowl long, cylindrical; aboral region tapering gradually into an aboral horn, inverted conical (41° - 21°); aboral horn usually more or less curved, with an irregularly formed aboral opening typically set laterally as gouged, leaving its tip or cutting off it; wall thin and fragile, 0.03 of the oral diameter in thickness, with a slight spiral structure.

Length, $337(260-416)\ \mu$; oral diameter, $43(40-45)\ \mu$.

Occurs in August-October; common.

Differs from *Tintinnopsis kofoidi* HADA in the fragile construction of the lorica, in less contraction at the aboral region, and in the shape of the lateral opening in the aboral horn.

Family Codonellopsidae.

Genus STENOSEMELLA JÖRGENSEN, 1924.

14. *Stenosemella nivalis* (MEUNIER) KOFOID and CAMPBELL.

Text-figure 11.

Codonella ventricosa, ENTZ, Sr., 1884, p. 413, pl. 24, fig. 24.

Tintinnopsis ventricosa, DADAY, 1887, pp. 546, 559, pl. 20, figs. 19, 20.

Tintinnopsis nucula (part), LAACKMANN, 1906, p. 19, pl. 1, fig. 4, pl. 3, figs. 48-50; CAMPBELL, 1926, pp. 173-236, pl. 12-15, text-figs. A-G.

Tintinnopsis nivalis MEUNIER, 1910, p. 143, pl. 13, figs. 26, 27.

Stenosemella nucula, JÖRGENSEN, 1927, p. 8, fig. 7.

Stenosemella nivalis, KOFOID and CAMPBELL, 1929, p. 69, fig. 136.

Lorica ovoidal, 1.8-2.2 oral diameters in length; collar somewhat concave conical, 0.08-0.10 of the total length in height; bowl widest a little upper the middle of the lorica, 1.9 oral diameters in transdiameter; aboral region subacute; wall of the collar thin and hyaline, about 0.05 of the oral diameter in thickness, sometimes with a few foreign particles, wall of the bowl with a rather coarse agglomerated material.

Length, $43(40-44)\ \mu$; oral diameter, $21(20-22)\ \mu$; transdiameter of the bowl, $39(36-41)\ \mu$.

Occurs throughout the year; rare.

Differs from *Stenosemella pacifica* KOFOID and CAMPBELL in lack of fenestrae at the base of the collar and from *S. ventricosa* (CLAPARÈDE LACHMANN) in dimensions.

Genus CODONELLOPSIS JÖRGENSEN, 1924.

15. *Codonellopsis pusilla* (CLEVE) KOFOID and CAMPBELL.

Text-figure 12.

Codonella pusilla CLEVE, *1900; BRANDT, 1907, p. 120.

Codonellopsis pusilla, KOFOID and CAMPBELL, 1929, p. 87, fig. 146.

Lorica stout fusiform, 2.6 oral diameters in length; collar subcylindrical in the anterior 0.6 of its length and posteriorly conical (55°), then gradually changing into an ovoidal bowl, with about 13 spiral turns extending towards the bowl; bowl ovate, 1.8 of the oral diameter in transdiameter; aboral region an inverted cone of 125°, with a blunt aboral end; wall nearly uniform in thickness throughout the lorica, composed of an alveolar structure and very few agglomerated particles.

Length, 56 μ ; oral diameter, 21 μ ; transdiameter, 37 μ .

Occurs in July; very rare.

Differs from *Codonellopsis contracta* KOFOID and CAMPBELL in lack of fenestration of the basal portion of the collar and in the subacute aboral end.

16. *Codonellopsis contracta* KOFOID and CAMPBELL.

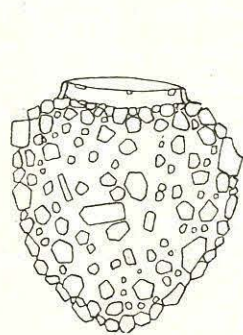
Text-figure 13.

Codonellopsis contracta KOFOID and CAMPBELL, 1929, p. 78, fig. 147.

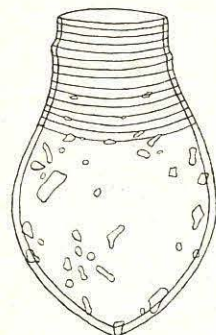
Lorica ovate, 2.1 oral diameters in length; collar 0.31–0.35 of the total length in length, usually with 6 spiral turns, concave conical (30°–40°), provided with a few, transversely elliptical fenestrae in its basal part; bowl globose, 1.7 of the oral diameter in thickness, with primary and secondary structures and few agglomerated particles.

Length, 43(40–45) μ ; oral diameter, 22(20–23) μ , transdiameter, 36(35–37) μ .

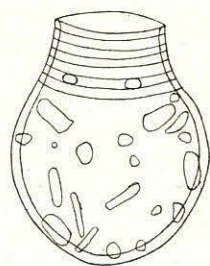
Occurs in July; rare.



Text-fig. 11. *Stenosemella nivalis* (MEUNIER) $\times 750$.



Text-fig. 12. *Codonellopsis pusilla* (CLEVE) $\times 750$.



Text-fig. 13. *Codonellopsis contracta* KOFOID and CAMPBELL $\times 750$.

Differs from *Codonellopsis frigida* HADA in having fenestrae and in the smoothly sloping shoulder and from *C. pusilla* (CLEVE) in the presence

of fenestration at the lower part of the collar, in the comparatively small number of spiral turns, and in its hemispherical aboral end.

17. *Codonellopsis limosa*, n. sp.

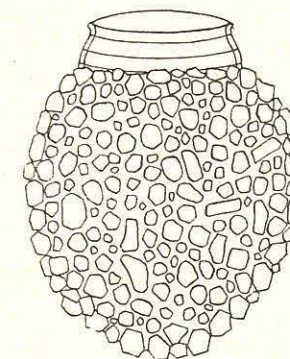
Text-figure 14.

Lorica ovoidal, 2.4 oral diameters in length; collar short with a little oral eversion, 0.13 of the total length in length, convex conical (30°), figured with a few spiral turns; bowl ovate, widest near the middle of the lorica, 1.8 oral diameters in transdiameter; aboral region hemispherical; wall agglomerated neatly with small particles.

Length, 82 μ ; oral diameter, 33 μ ; greatest transdiameter, 63 μ .

Occurs in January; very rare.

Differs from all other allied species of *Codonellopsis morchella* (CLEVE) in the short collar and in fewer spiral turns.

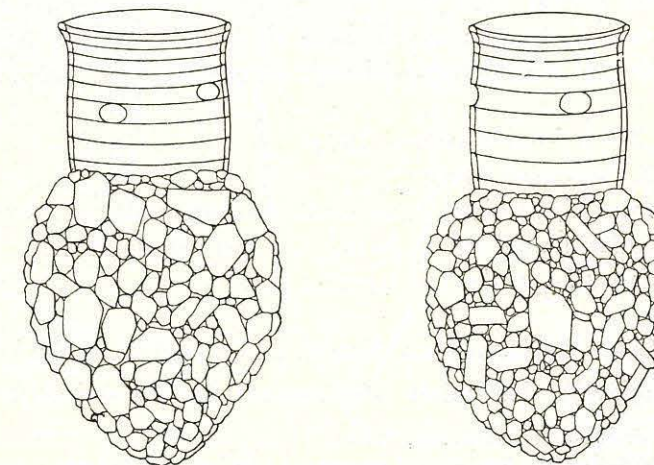


Text-fig. 14. *Codonellopsis limosa*, n. sp. $\times 550$.

18. *Codonellopsis orientalis*, n. sp.

Text-figure 15.

Lorica consisting of a subcylindrical collar and an ovate bowl, 2.5–2.7 oral diameters in length; oral rim flaring; collar 0.30–0.42 of the total



Text-fig. 15. *Codonellopsis orientalis*, n. sp. $\times 650$.

length in length, constricted slightly in the suboral part and bulging out in the middle, with 8-11 spiral turns increasing in width towards the bowl, a few fenestrae appearing in the dilated region; bowl widest a little above the middle, contracting aborally; aboral region broadly convex conical (85° - 105°); aboral end blunt; wall coarsely agglomerated.

Length, $90(84-92)\mu$; oral diameter, $34(32-34)\mu$; greatest transdiameter, 50μ .

Occurs in September-January; common.

Differs from *Codonellopsis americana* KOFOID and CAMPBELL, *C. erythraensis* (BRANDT), and *C. indica* KOFOID and CAMPBELL in the conical aboral region and from *C. morchella* (CLEVE) in an everted oral margin and in the shape of the collar.

Family Cyttarocylidae.

Genus CYTTAROCYLIS FOL, 1881.

19. *Cyttarocylis magna* BRANDT.

Text-figure 16.

Cyttarocylis cassis var. *c magna* BRANDT, 1906, pl. 34, fig. 3, pl. 35, fig. 3; 1907, pp. 189, 196; LAACKMANN, 1909, p. 447.

Cyttarocylis magna, KOFOID and CAMPBELL, 1929, p. 114, fig. 222; KOFOID, 1930, fig. 29 (No. 222).

Lorica consisting of a low funnel-shaped collar and a tall inverted conical bowl of angles changing from 15° in the anterior half to 45° in the aboral region, its length 1.8-2.2 oral diameters; oral rim irregularly dentate; collar convex conical (42°), 0.9 oral diameters in transdiameter, 0.06 of the total length in length; aboral horn short, 0.05 of the total length in length, shaped irregularly; wall with a comparatively larger polygonal reticulation.

Length, 300μ ; oral diameter, 150μ .

Occurs in November; rare.

Differs from *Cyttarocylis acutiformis* KOFOID and CAMPBELL in the coarsely reticulated wall and in having the marked aboral horn and from *C. cassis* (HAECKEL) in the tall tapering bowl.

Genus PARAFAVELLA KOFOID and CAMPBELL, 1929.

20. *Parafavella denticulata* (EHRENBERG) KOFOID and CAMPBELL.

Tintinnus denticulatus EHRENBERG, *1840.

Parafavella denticulata, KOFOID and CAMPBELL, 1929, p. 163, fig. 310; HADA, 1932 b, p. 50, fig. 15.

Length, $225(200-235)\mu$; oral diameter, $63(62-64)\mu$.

Occurs in January-March; common.

21. *Parafavella gigantea* (BRANDT) KOFOID and CAMPBELL.

Cyttarocylis gigantea (part) BRANDT, 1896, p. 63, pl. 3, figs. 21, 24.

Parafavella gigantea, KOFOID and CAMPBELL, 1929, p. 165, fig. 311; HADA, 1932 b, p. 51, fig. 16.

Length, $380(337-486)\mu$; oral diameter, $65(63-69)\mu$.

Occurs in January-May; common.

22. *Parafavella pacifica* HADA.

Parafavella pacifica HADA, 1932 b, p. 49, fig. 13.

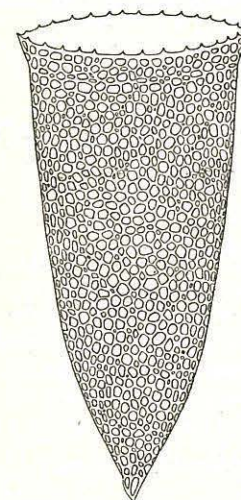
Length, $135(120-154)\mu$; oral diameter, $47(45-52)\mu$.

Occurs in June-September; common.

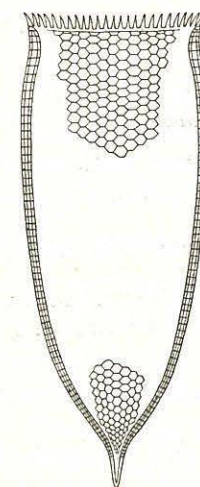
23. *Parafavella faceta*, n. sp.

Text-figure 17

Lorica tall bell-shaped, 2.0-3.1 oral diameters in length; oral rim denticulate with about 48 triangular teeth; bowl dilated slightly at the



Text-fig. 16. *Cyttarocylis magna* BRANDT $\times 200$.



Text-fig. 17. *Parafavella faceta*, n. sp. $\times 400$.



Text-fig. 18. *Parafavella ventricosa* (JÖRGENSEN) $\times 250$.

anterior 0.2 of the total length; its widest transdiameter 1.07 oral diameters, below the suboral expansion contracting gradually, changing from 10°–15° at the middle to 70°–90° in the aboral region; aboral horn stout, shortened, conical (20°–32°), 0.07–0.09 of the total length in length, tip usually acute.

Length, 147(123–171) μ ; oral diameter, 56(51–61) μ ; greatest transdiameter, 60(54–65) μ .

Occurs in January; common.

Differs from *Parafavella obtusangula* (OSTENFELD) and *P. parumdentata* (BRANDT) in more abrupt contraction of the aboral region and in having a more distinct aboral horn and from *P. pacifica* HADA in having many teeth of the oral rim and in the slowly contracting aboral part.

24. *Parafavella ventricosa* (JÖRGENSEN) KOFOID and CAMPBELL.

Text-figure 18.

Cyttarocylis denticulata var. β *cylindrica* forma *ventricosa* JÖRGENSEN, 1899, p. 34, pl. 3, fig. 30.

Parafavella ventricosa, KOFOID and CAMPBELL, 1929, p. 171, fig. 314; KOFOID, 1930, fig. 30 (No. 314).

Lorica finger-shaped, 5 oral diameters in length; oral margin denticulated with comparatively fewer teeth; bowl subcylindrical, with a slight suboral bulge, enlarged gradually towards the aboral end and widest at the posterior 0.37 of the total length, its greatest transdiameter 1.25 oral diameters; aboral region an inverted convex cone of 78°; aboral horn 0.1 of the total length in length, conical (8°), tip more or less acute.

Length, 316 μ ; oral diameter, 64 μ ; greatest transdiameter, 80 μ .

Occurs in August; very rare.

Differs from *Parafavella gigantea* (BRANDT) in the bulbous aboral region, in the shorter horn, and in fewer teeth on the oral margin.

25. *Parafavella subrotundata* (JÖRGENSEN) KOFOID and CAMPBELL.

Cyttarocylis denticulata var. γ *subrotundata* JÖRGENSEN, 1899, p. 34, pl. 2, figs. 20, 21.

Parafavella subrotundata, KOFOID and CAMPBELL, 1929, p. 170, fig. 316; HADA, 1932 b, p. 54, fig. 1.

Length, 220(211–228) μ ; oral diameter, 62(58–63) μ .

Occurs in February and March; rare.

Family **Ptychocylidae**.

Genus **PTYCHOCYLIS** BRANDT, 1896.

26. *Ptychocylis obtusa* BRANDT.

Ptychocylis obtusa BRANDT, 1896, p. 59, pl. 3, fig. 15; KOFOID and CAMPBELL, 1929, p. 188, fig. 349; HADA, 1932 b, p. 55, fig. 21.

Length, 98(97–112) μ ; oral diameter, 63(60–71) μ .

Occurs in January–July; common.

27. *Ptychocylis drygalskii* BRANDT.

Text-figure 19.

Ptychocylis Drygalskii BRANDT, 1896, p. 59, pl. 3, fig. 14; KOFOID and CAMPBELL, 1929, p. 188, fig. 350.

Ptychocylis urnula var. *digitalis* JÖRGENSEN, 1901, p. 17, pl. 2, figs. 29, 30.

Ptychocylis urnula var. *digitalis* forma *subintegerrima* JÖRGENSEN, 1901, p. 26, pl. 3, fig. 31.

Ptychocylis obtusa var. *drygalskyi* (part), BRANDT, 1906, pl. 55, figs. 1–3, pl. 56, figs. 3, 3 a, pl. 57, fig. 10; 1907, p. 312.

Ptychocylis ventricosa MEUNIER, 1910, p. 127, pl. 10, fig. 3.

Lorica wide goblet-shaped, 1.4 oral diameters in length; oral rim regularly denticulated; bowl generally a low, inverted, convex cone with two distinct expansions: each respectively 1.15 and 1.20 oral diameters in transdiameter; aboral region concave conical 90°; aboral end broadly rounded, more or less thicker than the other parts, with a rugose surface.

Length, 77 μ ; oral diameter, 55 μ .

Occurs in July; very rare.

Differs from *Ptychocylis obtusa* BRANDT in stouter proportions and in the shape of the aboral cone.

Family **Petalotrichidae**.

Genus **ACANTHOSTOMELLA** JÖRGENSEN, 1927.

28. *Acanthostomella norvegica* (DADAY) JÖRGENSEN.

Text-figure 20.

Amphorella norvegica DADAY, 1887, p. 543.

Acanthostomella norvegica, KOFOID and CAMPBELL, 1929, p. 193, fig. 363; HADA, 1932 b, p. 56, fig. 22.

Length, 43–47 μ ; oral diameter, 29–30 μ ; greatest transdiameter, 31–32 μ .

Occurs in February and March; rare.

Family **Xystonellidae**.Genus **PARUNDELLA** JÖRGENSEN, 1924.29. **Parundella pellucida** (JÖRGENSEN) KOFOID and CAMPBELL.

Text-figure 21.

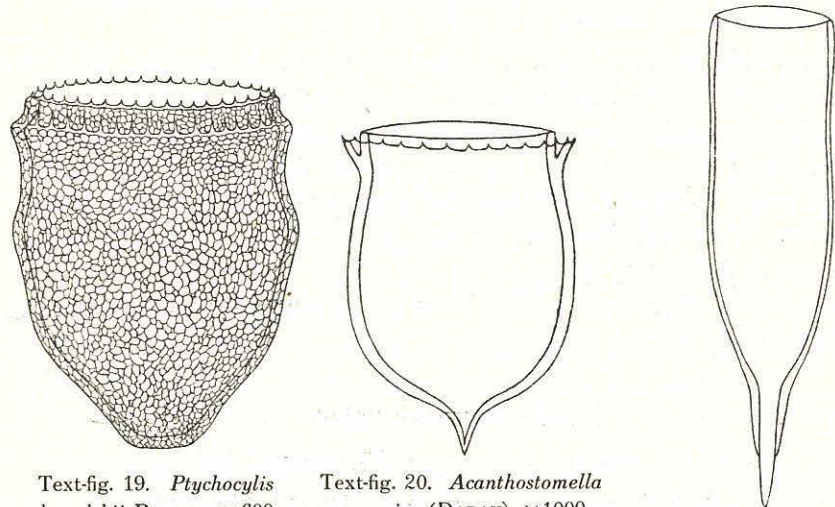
Undella pellucida (part) JÖRGENSEN, 1899, p. 41, pl. 1, fig. 7.*Parundella pellucida*, KOFOID and CAMPBELL, 1929, p. 233, fig. 438.

Lorica elongate chalice-shaped, 4 oral diameters in length; oral rim entire; bowl subcylindrical, slightly contracting in the anterior 0.25 of the total length; aboral region tapering (45°) to a caudal spine; lance conical (18°), 0.25 of the total length in length, single-lamellate in the posterior 0.42 of its length, with three somewhat spiral costae on the upper thick-walled part, tip pointed.

Length, 102μ ; oral diameter, 27μ .

Occurs in November; very rare.

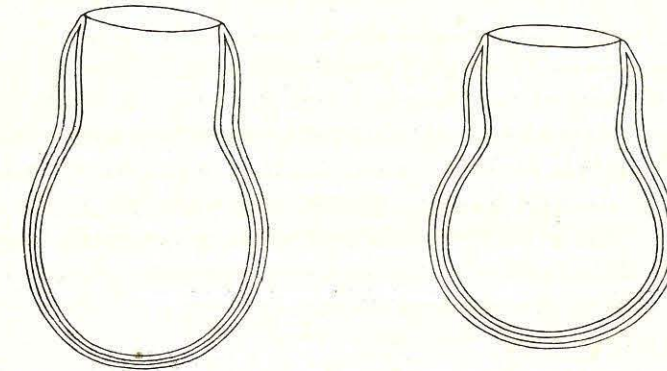
Differs from *Parundella caudata* (OSTENFELD) in the absence of predominant fins at the junction of the aboral region and the lance.

Text-fig. 19. *Ptychocylis drygalskii* BRANDT $\times 600$.Text-fig. 20. *Acanthostomella norvegica* (DADAY) $\times 1000$.Text-fig. 21. *Parundella pellucida* (JÖRGENSEN) $\times 600$.Family **Undellidae**.Genus **PROPECTELLA** KOFOID and CAMPBELL, 1929.30. **Propectella expolita**, n. sp.

Text-figure 22.

Lorica stout flask-shaped, with a well-developed outer collar, 2.00–2.58

oral diameters in length; suboral region subcylindrical, thinning outwardly to a sharp oral rim, its length 0.30–0.33 of the total length; bowl generally subspherical, sometimes broadly ovate, 1.5–2.0 oral diameters

Text-fig. 22. *Propectella expolita*, n. sp. $\times 750$.

in transdiameter; aboral end usually hemispherical or widely rounded, occasionally showing weakly a trace of bluntly pointing; wall thickened at the basal part of the collar, thinning gradually towards the aboral end, about 0.15 of the oral diameter in thickness in the thickest wall of the collar.

Length, $66(56-76) \mu$; oral diameter, $27(24-30) \mu$; transdiameter of the bowl, $49(44-52) \mu$.

Occurs in June-August; common.

Differs from all other species of *Propectella* in having the conspicuous collar and from *Undella californiensis* KOFOID and CAMPBELL in the structure of the wall which is uniform in thickness in that species, but in this species is thickest at the lower part of the collar and thinnest at the aboral end.

Family **Tintinnidae**.Genus **AMPHORELLA** DADAY, 1887.31. **Amphorella brandti** JÖRGENSEN.

Text-figure 23.

Tintinnus amphora, BRANDT, 1906, pl. 69, fig. 6; 1907 (part), p. 433.*Amphorella quadrilineata* var. *brandti* JÖRGENSEN, *1924.*Amphorella brandti*, KOFOID and CAMPBELL, 1929, p. 309, fig. 588.

Lorica 2.2–2.6 oral diameters in length, consisting of a collar of the circular cross-section and a triangular bowl, narrowest at the base of the

collar, its smallest transdiameter 0.71-1.79 of the oral diameter; collar an inverted, truncated, concave cone of 65°-75°; bowl cylindrical in the little upper part, triangular in the lower region with three prismatic longitudinal ridges; aboral end transversely concave; wall having separated lamellae in the anterior region of the lorica, fused posteriorly into a single lamina and thinning.

Length, 119(100-128) μ ; oral diameter, 44(42-46) μ .

Occurs in March-October; common.

Differs from *Amphorella quadrilineata* (CLAPARÈDE and LACHMANN) in having three instead of four fins.

Genus TINTINNUS SCHRANK, 1803.

32. *Tintinnus exigua*, n. sp.

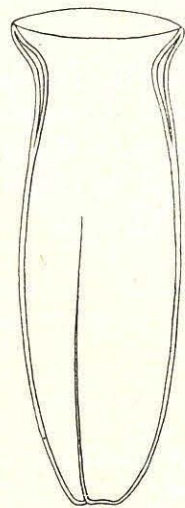
Text-figure 24.

Lorica an elongate truncated cone of 3°-5°, 3.5-4.2 oral diameters in length; oral end abruptly flaring to form a marked brim; sides nearly straight; aboral end 0.64-0.75 of the oral diameter in aboral diameter, without a brim and a flare.

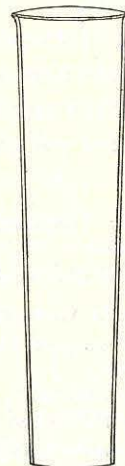
Length, 148(130-160) μ ; oral diameter, 38(36-40) μ .

Occurs in May-October; common.

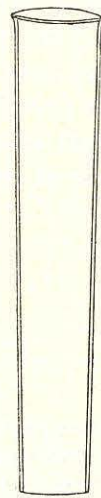
Differs from *Tintinnus tenuis* KOFOID and CAMPBELL in being smaller and more widely conical.



Text-fig. 23. *Amphorella brandti* JÖRGENSEN $\times 500$.



Text-fig. 24. *Tintinnus exigua*, n. sp. $\times 400$.



Text-fig. 25. *Tintinnus tenuis* KOFOID and CAMPBELL $\times 250$.

33. *Tintinnus tenuis* KOFOID and CAMPBELL.

Text-figure 25.

Tintinnus lusus-undae (part), ZACHARIAS, 1906, p. 518, fig. 6; BRANDT, 1907, p. 420.

Tintinnus lusus-undae var. c (part), BRANDT, 1906, pl. 65, fig. 19; 1907, p. 422.

Tintinnus tenuis KOFOID and CAMPBELL, 1929, p. 339, fig. 655.

Lorica a long, inverted, truncated cone of 2°-3°, with very slightly expansion in the middle part, its length 4.4-5.9 oral diameters; both ends entire, oral one flaring with a brim, the other without a flare, 0.64-0.77 of the oral diameter in aboral diameter.

Length, 261(236-312) μ ; oral diameter, 51(49-56) μ .

Occurs in June-September; common.

Differs from *Tintinnus fraknóii* DADAY in the absence of the aboral flare and from *T. lusus-undae* ENTZ in more slender proportions.

Genus SALPINGELLA JÖRGENSEN, 1924.

34. *Salpingella attenuata* JÖRGENSEN.

Text-figure 26.

Tintinnus acuminatus, ENTZ, Sr., 1885, p. 201, pl. 14, fig. 13.

Tintinnus acuminatus var. c *glockentögeri* (part) BRANDT, 1906, pl. 68, fig. 2-4; 1907, p. 390.

Salpingella acuminata subsp. *glockentögeri* var. *attenuata* JÖRGENSEN, *1924.

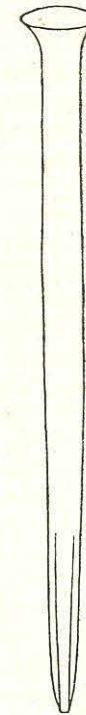
Salpingella attenuata, KOFOID and CAMPBELL, 1929, p. 351, fig. 687.

Lorica much elongated, slender, 9 oral diameters in length; consisting of a funnel-shaped collar and a long tubular bowl; collar a wide inverted concave cone of 60°; bowl cylindrical in the posterior half, 0.5 of the oral diameter in length, sharply conical (5°) in the posterior half, distally convex conical (30°); aboral end open, truncate; aboral region with 6 somewhat dextro-tropic fins on the posterior 0.29 of the total length.

Length, 288 μ ; oral diameter, 32 μ ; trans-diameter of the bowl, 16 μ .

Occurs in November; very rare.

Differs from *Salpingella gracilis* KOFOID and CAMPBELL in size and in having fewer fins and



Text-fig. 26. *Salpingella attenuata* JÖRGENSEN $\times 300$.

from *S. ricta* KOFOID and CAMPBELL in more slender proportions and in lack of the surface rugose.

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