

## Tintinnidae from the Strait of Georgia, B.C.

By G. H. WAILES

Plankton gatherings were taken by the writer at Departure Bay, Nanaimo, and at various localities to the south as far as Friday Harbour on San Juan Island where Juan de Fuca Strait begins; the period covered was from May, 1923, to October, 1924.

The object in view was to obtain as complete a record as possible of the protozoan fauna and of the flora found in the plankton, together with the coastal protozoa, and to prepare annotated and illustrated lists of the species in each group.

The present paper on the *Tintinnidae* is the first of the series to be completed. Early in its preparation it became evident that many undescribed forms occurred in these waters, and many species found in other parts of the North Pacific ocean did not occur here; thus of six new species described by Kofoid from San Diego, Cal. (1905) only one was observed; of nineteen species recorded by Okamura from Japan (1907) only three were found.

Brandt (1906) has been followed for the synonymy and largely for identification; the works of Cleve, von Daday and Jörgensen were also of assistance.

In this paper 23 species, 8 varieties and 3 forms are recorded and figured, of which the following are described for the first time:

*Dictyocysta apiculata*.

*Cyttarocylis repanda*.

*C. serrata* var. *conica*.

*Tintinnopsis davidoffi* var. *cylindrica* f. *lata*.

*Tintinnopsis davidoffi* var. *cylindrica* f. *annulata*.

*Tintinnopsis davidoffi* var. *laevis*.

*Tintinnopsis expansa*.

*Tintinnopsis karajacensis* var. *minutus*.

*Tintinnus lususundae* var. *rectus*.

*Tintinnus translucens*.

*Tintinnus translucens* var. *major*.

*Tintinnus translucens* var. *minor*.

*Undella columbiana*.

No gatherings were taken during the months of December, January, or February as the plankton is so meagre in those months; about March it begins to increase.

With reference to the designations here used of "numerous", "common", etc., these terms are merely relative; no gathering taken was crowded with any particular organism except diatoms; if, say, a dozen individuals of a species were present under the cover glass they are termed "numerous", if two or three they are called "common".

Three or four tows a week were taken on an average, but occasionally one or two were taken each day.

The sizes here given are of those measured by me and consist usually of only a small proportion of the individuals observed; after ascertaining the average size of a species, only noticeably large or small individuals were measured.

The dimensions are given in microns ( $\mu$ ).

### I. Genus DICTYOCYSTA Ehrenb.

*D. apiculata* sp. nov. (Pl. I, Fig. 1).

Test circular in transverse section, conical with rounded fundus, wall thick with 8 large elliptical perforations near the aperture, the interior rounded at the fundus leaving a solid terminal apex; aperture margin with a serrated edge; surface of test coarsely reticulated; animal not observed.

Dimensions—Length  $115\mu$ ; diameter  $85\mu$ .

Habitat—In the surface plankton of the Strait of Georgia off Nanaimo, B.C. Only one empty test was found in November.

### II. Genus CYTTAROCYLIS Fol.

*C. arcuata* Brandt. (Pl. I, Figs. 2, 3).

The test of this species is cylindrical and parallel-sided for the major portion of its length and then tapers more or less steeply to the terminal spine which is solid; the margin of the aperture is irregular but not serrated. The test is transparent and nearly colourless, with faint reticulated markings over its surface, which in some cases can be distinguished only with difficulty.

The animal swims rapidly with a considerable portion of its body projecting from the aperture.

Dimensions—Length  $200-265\mu$ ; diameter  $81-100\mu$ . Plentiful in Departure Bay and vicinity during spring and summer.

*C. repanda* sp. nov. (Pl. I, Fig. 14).

Test circular in end view, tapering from the oral end to a long terminal spine and having two or three annulations; the aperture circular, slightly contracted, with irregular margin; the terminal spine with a longitudinal perforation; the animal with the characteristics of the genus.

Dimensions—Length  $100-110\mu$ ; diameter  $71-80\mu$ ; aperture about  $10\mu$  less than the diameter.

Departure Bay and vicinity; a few seen in November only.

The individuals of the other species of this genus found near Nanaimo all have solid terminal spines. The undulating outline of the test distinguishes this species from its allies.

*C. serrata* Möbius (Pl. I, Fig. 4).

Less common than *C. arcuata* from which it is distinguished by its gradually tapering test and long terminal spine which is often bent or irregular in shape, also by its larger size.

Dimensions—Length over all about  $290\mu$ ; diameter about  $90\mu$ ; length of spine  $50-70\mu$ .

In the figure it will be noticed that the animal contains an ingested diatom (*Navicula* sp.) and a Peridinium (*Dinophysis acuta*).

Var. *conica* var. nov. (Pl. I, Figs. 5, 6).

Distinguished from the type by its conical shape and usually larger diameter.

Dimensions—Length about  $290\mu$ ; diameter  $100-123\mu$

This is Var. A of Brandt (T. 40, Figs. 8, 8a-8d).

At Nanaimo it is not common.

### III. Genus *PTYCHOCYLIS* Brandt.

*P. obtusa* Brandt. (Pl. I, Figs. 8, 13).

Not so common as *P. urnula* and of rather smaller size.

Dimensions—Length  $85-95\mu$ ; diameter  $65-80\mu$ .

*P. urnula* C. & L. (Pl. I, Figs. 7 and 9).

Found numerously except in the winter months; the animals are active and swim rapidly.

Dimensions—Length  $80-115\mu$ ; diameter  $70-85\mu$ .

Var. *pelagica* Brandt. (Pl. I, Figs. 11, 12).

The tests are as broad or broader than long; the shape is very constant. This variety is not as common as the type and few were seen alive.

Dimensions—Length  $80-96\mu$ ; diameter  $90-96\mu$ .

### IV. Genus *TINTINNOPSIS* Stein.

*T. beroidea* Stein. (Pl. I, Figs. 17-21).

Under this name are here included forms that agree with Stein's designation of "thimble-shaped", that is, having the aperture slightly everted, the body of equal or nearly equal diameter throughout and the fundus hemispherical or bluntly pointed.

Dimensions—Length  $55-100\mu$ ; diameter  $30-50\mu$ , usually equal to about half the length.

Occurs numerously in the Gulf of Georgia throughout the year except in winter.

*T. ehrenbergii* Cl. & L. (Pl. I, Fig. 32).

A few were seen similar to the one depicted.

Dimensions—Length  $75\mu$ ; diameter  $25\mu$ .

*T. expansa* sp. nov. (Pl. I, Fig. 33).

Test membranous, covered more or less thickly with silicious particles or plates; bluntly cone shaped; the circular aperture provided with a nearly flat collar; animal not observed.

Dimensions—Length  $68-76\mu$ ; diameter  $60-68\mu$ ; diameter of collar  $77-86\mu$ .

The flat collar is characteristic of this species; the plates forming it are large, thin and transparent, it has a very irregular periphery; the aperture is contracted and furnished with a short collar.

*T. davidoffi* v. Daday.

This species was not observed.

Var. *cylindrica* v. Daday (Pl. II, Fig. 1).

This is perhaps the most plentiful species of the *Tintinnidae* around Nanaimo.

Its diameter is very constant but it varies considerably in length; the terminal spine bears a very constant ratio to the total length of the test and is always hollow and truncate. Living specimens were not numerous.

Dimensions—Length 120-240 $\mu$ ; diameter 38-40 $\mu$ ; length of spine one-fifth to one-quarter the total length.

*f. lata* f. nov. (Pl. II, Fig. 2).

Similar to type but larger in diameter and of less variable length.

Dimensions—Length 130-160 $\mu$ ; diameter 45-60 $\mu$ ; spine one-quarter of the total length.

*f. annulata* f. nov. (Pl. II, Fig. 3).

Similar to type but with a thickened rim around the aperture.

Dimensions—Length 150-240 $\mu$ ; diameter 40 $\mu$ .

Very few were observed.

Var. *laevis* var. nov. (Pl. II, Fig. 4).

Similar to type but smaller.

Dimensions—Length 50-70 $\mu$ ; diameter 20-30 $\mu$ , but usually 20 $\mu$ .

*T. karajacensis* Brandt. (Pl. II, Figs. 5, 6).

Syn. (?) *T. lobiancoi* v. Daday.

This species as found off Nanaimo has a moderately smooth, parallel-sided test with a rounded or bluntly pointed fundus. The diameter is nearly always 50 $\mu$ .

Dimensions—Length 85-150 $\mu$ ; diameter 45-50 $\mu$ .

Not numerous but found throughout the year except in winter. No living specimens were noted.

Var. *minutus* var. nov. (Pl. II, Figs. 7, 8).

Similar to type but much smaller.

Dimensions—Length 25-30 $\mu$ ; diameter 14 $\mu$ .

*T. nucula* Fol. (Pl. I, Figs. 15, 16).

A few small tests were observed which seem to belong to this species.

Dimensions—Length about 40 $\mu$ ; diameter about 30 $\mu$ ; aperture 20-26 $\mu$ .

*T. nitida* Brandt. (Pl. I, Fig. 31; Pl. II, Fig. 31).

Only a few individuals which appear referable to this species were observed and those of small size.

Dimensions—Length 65-75 $\mu$ ; diameter 43-50 $\mu$ .

*T. punctata* sp. nov. (Pl. I, Figs. 23-26).

Test membranous covered with scattered flat or angular silicious particles, circular in transverse section, nearly as broad as long; fundus hemispherical or bluntly conical; oral end truncate with a constricted circular aperture, furnished with a smooth membranous everted border, the base of the border pierced with twelve small elliptical openings symmetrically arranged; the body of the animal nearly filling the test and when active projecting considerably from the aperture. Nuclei ellipsoidal, two in number.

Dimensions—Length 60-75 $\mu$ ; diameter 55-61 $\mu$ ; aperture 29-32 $\mu$ .

Often occurred numerous and observed during most of the year.

This species is easily distinguished from *T. ventricosa* by the twelve small pores surrounding the aperture. To observe these clearly the test should be tilted at an angle of 45°.

It does not resemble any other species.

*f. minor* f. nov. (Pl. I, Figs. 27-28).

Dimensions—Length 35-40 $\mu$ ; diameter 30 $\mu$ .

*T. sacculus* Brandt. (Pl. II, Fig. 9).

Similar to *T. karajacensis* but the test is shorter and broader in proportion to its length.

Dimensions—Length 50-80 $\mu$ ; diameter 32-60 $\mu$ .

*T. tubulosa* Levander. (Pl. II, Fig. 10).

Only one individual observed.

Dimensions—Length 160 $\mu$ ; diameter of aperture 21 $\mu$ ; diameter of fundus 30 $\mu$ .

*T. ventricosa* Brandt. (Pl. I, Figs. 22, 29, 30),

Syn. *Tintinnus ventricosa* H. & L.

This species was not uncommon.

Dimensions—Length 61-70 $\mu$ ; diameter 55-67 $\mu$ .

Fig. 30 shows a somewhat abnormal test which measured 74 $\mu$  in length and 77 $\mu$  in greatest diameter.

#### V. Genus TINTINNUS Schrank.

*T. acuminatus* C. & L. (Pl. II, Figs. 27, 28),

The diameter of the rim of the aperture measured 40 $\mu$ , except in one case when it was 45 $\mu$ .

Dimensions—Length 210-252 $\mu$ ; diameter 16-18 $\mu$ , diameter of rim of aperture 40 $\mu$ .

*T. lususundae* Entz. (Pl. II, Fig. 23).

Not uncommon; rather larger than type.

Dimensions—Length 190-300 $\mu$ ; oral diameter 61-75 $\mu$ ; aboral diameter 50-58 $\mu$ .

Var. *rectus* var. nov. (Pl. II, Fig. 22).

Test straight and parallel-sided throughout.

Dimensions—Length 176-255 $\mu$ ; diameter 36-42 $\mu$ . Not common; found in July and August.

*T. serratus* Kofoid. (Pl. II, Figs. 25, 26).

This species was rare.

Dimensions—Length 135-142 $\mu$ ; diameter oral end 25-27 $\mu$ ; diameter aboral end 16 $\mu$ .

As suggested by Kofoid the animals that were observed active did not project beyond the oral aperture, and the spaces between the teeth (about 20) would therefore provide egress for the cilia which are stated by v. Daday to be 18-20 in number. The animal is attached to the side of the test about one-third

of its length from the aboral end, a small disc serving as a point of attachment; this disc was not observed in other species.

*T. subulatus* Ehrenb. (Pl. II, figs. 18-21).

This species occurs numerously throughout the year except in winter. Fig. 18 shows what appears to be a case of sporulation, the test being closely packed with 16 ovoid spores.

Dimensions—Length 145-240 $\mu$ ; diameter 23-24 $\mu$ .

One abnormally large test measured 315 $\mu$  in length and 26 $\mu$  in diameter. The long, slender, pointed cone forming the aboral end of the test is characteristic of the species.

The serrations around the aperture are very fine and not deep; the visible spiral growth rings may number a dozen or more.

*Tintinnus translucens* sp. nov. (Pl. II, Figs. 11-14).

Test thin, transparent, colourless; cylindrical for more than half its length, thence tapering gradually to a fine point; the aperture with a smooth border; animal when active not protruding far from test, attached by an epode to a point near the spine.

Dimensions—Length 84-106 $\mu$ ; diameter 18-23 $\mu$ .

Occurs numerously.

Fig. 11 shows two individuals in conjugation.

This species, especially its variety *major*, approaches *Undella lachmanni* var. *caudata* (Ost.) Brandt, but the test conforms to the characters of the Genus *Tintinnus* and not to those of the Genus *Undella*.

Var. *major* var. nov. (Pl. II, Fig. 15).

Similar to type but larger.

Dimensions—Length 132-155 $\mu$ ; diameter 36-40 $\mu$ .

Var. *minor* var. nov. (Pl. II, Figs. 16-17).

Similar to type but smaller.

Dimensions—Length 45 $\mu$ ; diameter 17 $\mu$ .

#### VI. Genus UNDELLA v. Daday

*U. columbiana* sp. nov. (Pl. II, Figs. 29, 30).

Test small, transparent, slightly yellowish in colour, cauldron-shaped; fundus hemispherical with a small button or triangular spine at the apex; sides slightly retuse; aperture circular with everted lip; animal attached to centre of fundus, not emerging from aperture when active; two ellipsoidal nuclei present.

Dimensions—Length 38-40 $\mu$ ; diameter 32 $\mu$ .

One individual measured only 33 $\mu$  in length.

Not uncommon.

*U. lachmanni* v. Daday. (Pl. II, Fig. 24).

One test that may be referred doubtfully to this species was seen.

Dimensions—Length 110 $\mu$ ; diameter 22 $\mu$  at neck and 24 $\mu$  near the fundus.

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PLATE I

- Figs.
1. *Dictyocysta apiculata* Wailes.  $\times 300$ .
  - 2, 3. *Cyttarocylis arcuata* Brandt.  $\times 200$ .
  4. *C. serrata* Möbius. View of living animal.  $\times 150$ .
  - 5, 6. *C. serrata* var. *conica* Wailes. Fig. 5—Section of an empty test.  $\times 200$ .  
Fig. 6—View of active individual.  $\times 150$ .
  7. *Ptychocylis urnula* Cl. & L. View of active individual.  $\times 300$ .
  8. *P. obtusa* Brandt.  $\times 200$ .
  - 9, 10. *P. urnula* Cl. & L.  $\times 200$ .
  - 11, 12. *P. urnula* var. *pelagica* Brandt.  $\times 200$ .
  13. *P. obtusa* Brandt.  $\times 300$ . In the test is a Silicoflagellate (*Distephanus speculum*).
  14. *Cyttarocylis repanda* Wailes.  $\times 200$ .
  - 15, 16. *Tintinnopsis nucula* Fol. Fig. 15—Active individual.  $\times 300$ . Fig. 16—Empty test.  $\times 400$ .
  - 17–21. *T. beroidea* Stein. Various shaped tests.  $\times 300$ .
  22. *T. ventricosa* H. & L. Active individual.  $\times 300$ .
  - 23–26. *T. punctata* Wailes. Fig. 23—Empty test.  $\times 200$ . Fig. 24—Active individual.  $\times 200$ . Figs. 25 and 26—Side and oral views of empty test, showing the pores around the aperture.  $\times 300$ .
  - 27, 28. *T. punctata* f. *minor* Wailes. Active individuals.  $\times 300$ .
  - 29, 30. *T. ventricosa* H. & L. Side and oral views of two empty tests. Fig. 29— $\times 200$ . Fig. 30— $\times 300$ .
  31. *T. nitida* Brandt.  $\times 300$ .
  32. *T. ehxenbergii* Cl. & L.  $\times 300$ .
  33. *T. expansa* Wailes.  $\times 200$ .



PLATE I

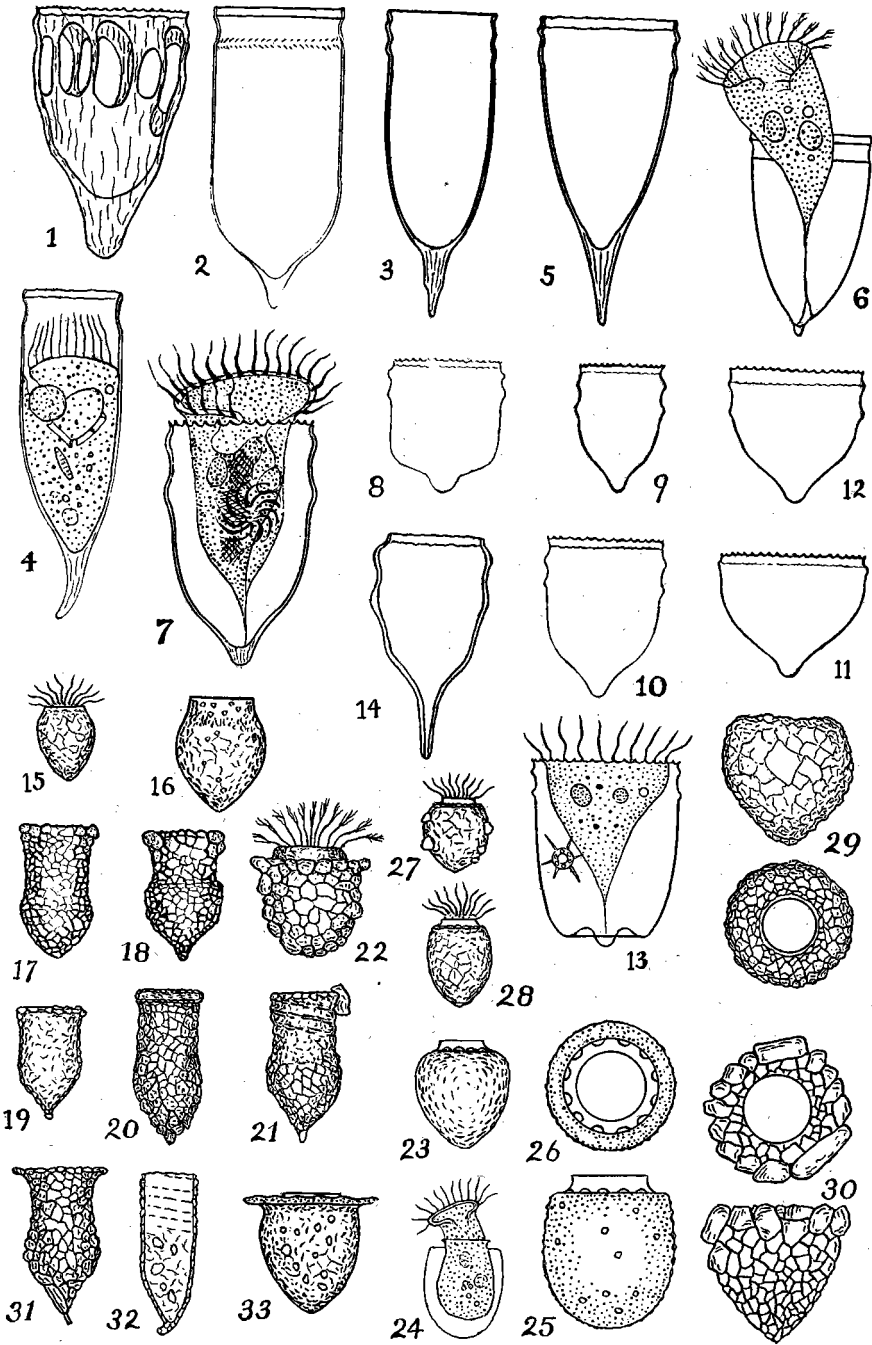


PLATE II

- Figs
1. *Tintinnopsis davidoffi* var. *cylindrica* Daday. Empty test.  $\times 200$ .
  2. *T. davidoffi* var. *cylindrica* f. *lata* Wailes.  $\times 200$ .
  3. *T. davidoffi* var. *cylindrica* f. *annulata* Wailes.  $\times 200$ .
  4. *T. davidoffi* var. *laevis* Wailes.  $\times 200$ .
  - 5, 6. *T. karajacensis* Brandt. Fig. 5— $\times 200$ . Fig. 6—Short variety.  $\times 200$ .
  - 7, 8. *T. karajacensis* var. *minutus* Wailes. Fig. 7— $\times 400$ . Fig. 8— $\times 200$ .
  9. *T. sacculus* Brandt.  $\times 200$ .
  10. *T. tubulosa* Levander.  $\times 200$ .
  - 11–14. *Tintinnus translucens* Wailes. Fig. 11—Two individuals in conjunction.  
Fig. 12—Active individual. Fig. 13—Empty test. Fig. 14—  
Animal retracted. All  $\times 200$ .
  15. *T. translucens* var. *major* Wailes. Section of test showing thickness of  
the wall.  $\times 300$ .
  - 16–17. *T. translucens* var. *minor* Wailes.  $\times 300$ .
  - 18–21. *T. subulatus* Ehrenb. Fig. 18—Test containing spores.  $\times 300$ . Figs.  
19 and 21. Empty tests.  $\times 200$ . Fig. 20—Active individual.  
 $\times 200$ .
  22. *T. lususundae* var. *rectus* Wailes.  $\times 200$ .
  23. *T. lususundae* Entz.  $\times 200$ .
  24. *Undella lachmanni* Daday.  $\times 300$ .
  - 25–26. *Tintinnus setratus* Kofoid.  $\times 300$ .
  - 27, 28. *T. acuminatus* C. & L.  $\times 200$ .
  - 29–30. *Undella columbiana* Wailes.  $\times 300$ .
  31. *Tintinnopsis nitida* Brandt.  $\times 300$ .

PLATE II

