Tintinnina (Ciliophora: Oligotrichida) in the Marian Cove, King George Island

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킹조지섬 마리안 소만의 유종류 (Ciliophora: Oligotrichida)

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Abstract: A taxonomical study on antarctic tintinnids was conducted based on the plankton samples collected from King George Island in South Shetland Islands during March 1988 through January 1989. As a result, 8 species of tintinnids comprising 3 genera and 2 families were identified and described in the present study: Codonelopsis balechi, C. gaussi, Laackmanniella naviculaefera, Cymatoclysis brevicaudata, C. calciformis, C. convallaria, C. drygalskii, and C. vanhoeffeni. All of them are known to be endemic species of antarctic waters.

Key words: Tintinnina, Plankton, Systematics, King George Island, Antarctica


주요어: 유종류, 적유생물, 계통분류, 킹조지섬, 남극

Introduction

More than 800 species of tintinnids have been reported from all around the world oceans. They have a very wide geographical distribution, and most are known to be largely related to water temperature.

For the antarctic tintinnids, Laackmann (1907, 1909) initiated the taxonomical study in the early 1900’s. His studies were based on the materials from Indian Ocean of antarctic waters. After Laackmann’s initiation, some studies of tintinnids taxonomy in antarctic waters were continued by Hada (1960, 1970), Balech (1973), Sassi and Melo (1986) and Barria de Cao (1987). Among them, Sassi and Melo (1986) described and reported 13 species of tintinnids in the waters around South Shetland Islands.

In the present study authors describe some taxonomical notes for 8 species of tintinnids gathered from Marian Cove, King George Island during the period of the first overwintering year of Korea Antarctic Research Programme.
Materials and Methods

All the materials used in this study were collected in Marian Cove at the end of pier of King Sejong Station (62°13′S, 58°45′W), King George Island. A total of 25 samples was taken during March 1988 through January 1989. The samplings were usually conducted at high tide using Kitahara net (100μm) and water bottles. The samples from water bottles were filtered with 20μm mesh. Temperature and salinity were also measured at the same time using Neil Brown S-CTD system.

The tintinnids were fixed and preserved in 1.5 % formaldehyde seawater solution buffered with sodium tetraborate. For identification and measurement, fixed materials were rinsed in distilled water several times and mounted in glycerin jelly. Examination and photographs were taken under the microscope using the illuminating method of DIC.

Systematic Account

As a result of this study, 8 species in 2 families of tintinnidids were identified. The systems of nomenclature and classification we adopted are from of Laackmann (1907, 1909), Kofoid and Campbell (1929), Hada (1970), Balech (1973), Sassi and Melo (1986) and Barria de Cao (1987).

Phylum Ciliophora Doflein, 1901
Subclass Spirotrichia Butschli, 1889
Order Oligotrichida Butschli, 1887
Suborder Tintinnina Kofoid and Campbell, 1929
Family Codonellopsidae Kofoid and Campbell, 1929
Genus Codonellopsis Jorgensen, 1924
1. Codonellopsis balechi (Hada, 1932)
2. C. glacialis (Laackmann, 1907)
Genus Laackmanniella Kofoid and Campbell, 1929
3. Laackmanniella naviculaefera (Laackmann, 1907)
Family Ptychocyclidae Kofoid and Campbell, 1929
Genus Cymatoecylis Laackmann, 1909
4. Cymatoecylis breviceudata(Laackmann, 1909)
5. C. calyciformis (Laackmann, 1907)
6. C. convallaria Laackmann, 1909
7. C. drygalskii (Laackmann, 1907)
8. C. vanhoeffeni (Laackmann, 1907)

1. Codonellopsis balechi Hada, 1970
(pl. 1, fig. 1)

Codonellopsis antarctica Balech, 1971, p. 168,
pl. 37, figs. 714, 715.
Codonellopsis balechi Hada, 1970, p. 31;
Sassi and Melo, 1986, p. 65, pl. 1, figs. 9~11;
Barria de Cao, 1987, p. 276, fig. 3c.
Description : Lorica consisting of an annular collar and a spherical bowl; collar short and hyaline, with 3 or 4 spiral turns, without fenestrae on the collar; bowl expanded ovate shaped, strongly covered with foreign particles; aboral and round or bluntly pointed; lorica length, 78~81μm; oral diameter, 35μm.
Remarks : This species is rather stable in the form, structure and dimensions of the lorica except that spiral turns on the collar are hardly visible in some specimens. Sassi and Melo (1986) suggested that Codonellopsis antarctica described by Balech (1971), having a well mounted shoulder and a high collar, is reduced to a synonym of Codonellopsis balechi. In our observations this is predominantly occurred on April and May, 1988.

2. Codonellopsis gaussii (Laackmann, 1907) (pl. 1, figs. 2, 3)

Codonella gaussii Laackmann, 1907, p. 239, fig. 12.
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PLATE I
Explanation of Plates

Plate I

1. *Codonellopsis balechi*
2. *Codonellopsis gaussi*
3. *C. gaussi*, showing a collar of spiral turns and aboral wall structure with fragments of pennate diatom frustules
4. *Cymatocylis brevicaudata*
5. *C. brevicaudata*, showing denticulate crest
6. *Cymatocylis calyciformis*
7. *C. calyciformis*, showing a reflexed and recurved oral rim
8. *C. calyciformis*, showing a minutely denticulate oral rim
9. *Cymatocylis convallaria*
10. *C. convallaria*, showing a oral rim with a slight striaion
11. *C. convallaria*, showing a minutely denticulate oral rim

Scale bar = 50 μm
Explanation of Plates

Plate II
1. *Cymatocyliis drygalskii*
2. *C. drygalskii*, showing a denticulate crest
3. *C. drygalskii*, showing a reflexed oral rim
4. *Cymatocyliis vanhoeffeni*
5. *C. vanhoeffeni*, showing a wall with longitudinal striae in the anterior region
6. *C. vanhoeffeni*, showing a minutely denticulate oral rim
7. *Laackmanniella naviculaefera*
8. *L. naviculaefera*, showing a tubular, spirally wound collar

Scale bar = 50μm
Codonella glacialis Laackmann, 1907, p. 239, fig. 13.


Leprotintinnus glacialis: Laackmann, 1909, p. 408—409, pl. 47, figs. 5—8.

Codonellopsis glacialis: Kofoid and Campbell, 1929, p. 79, fig. 162; Hada, 1970, p. 32, fig. 49.

Codonellopsis gaussi: Kofoid and Campbell, 1929, p. 79, fig. 164; Hada, 1970, p. 32, fig. 50; Balech, 1973, p. 28, fig. 145—163; Sassi and Melo, 1986, p. 67, pl. 1, figs. 7, 8.

Description: Lorica with a short cylindrical collar and a conical bowl; collar hyaline, with 6 spiral turns; wall of the bowl covered with foreign particles, including sparsely attached fragments of diatom frustules; lorica length, 66—72μm; oral diameter, 36μm.

Remarks: The morphological characteristics of this species are very similar to that of genus Laackmanniella. The variations of lorica shape in this species were reported by Balech (1973). He considered that the stouter form, called C. glacialis, was the same species with C. gaussi showing the elongate lorica. In our work the stouter lorica is occurred in the plankton samples taken on March and April, 1988.

3. **Laackmanniella naviculacea**
   (Laackmann, 1907)
   (pl. II, figs. 7, 8)

Codonella naviculacea Laackmann, 1907, p. 239, fig. 10.

Codonella prolongata Laackmann, 1907, p. 239, fig. 11.

Leprotintinnus naviculacea: Laackmann, 1909, p. 402, pl. 46, figs. 1—9, pl. 47, figs. 9—11.

Leprotintinnus prolongatus: Laackmann, 1909, p. 403, pl. 46, figs. 10—12, pl. 47, fig. 12, pl. 48, figs. 5—7.

Leprotintinnus prolongatus f. ventricosa Laackmann, 1909, p. 404, pl. 46, figs. 13—15.

Laackmanniella naviculacea: Kofoid and Campbell, 1929, p. 91, fig. 182; Hada, 1970, p. 33, fig. 51; Sassi and Melo, 1986, p. 69, pl. 2, figs. 13—15; Barria de Cao, 1987, p. 277, fig. 2A.

Laackmanniella prolongata: Kofoid and Campbell, 1929, p. 91, fig. 183.

Description: Lorica long tubular shaped; consisting of two distinct regions, a collar and a bowl; hyaline long tubular collar with 15—20 spiral turns; oral margin slightly flared; bowl also long tubular shaped, more or less expanded than collar part; foreign particles including diatoms, especially pennate frustules coarsely attached to the bowl; aboral region gradually tapering to a truncated and open aboral end; lorica length, 150—200μm; oral diameter, 30—40μm.

Remarks: This species seems to be widely distributed in the Antarctic and appears as a dominant species on March and April in our study. The lorica shows allied shape with Codonellopsis gaussi except for having a distinct aboral opening at the distal end. For the great variation of lorica size, the shorter species was identified as Laackmanniella naviculacea and the longer, L. prolongatus, respectively. But it was difficult to identify between them only by the length. So, the two forms were placed in a single species following the Balech's opinion (cited from Hada, 1970). Our specimens observed in the present study are mainly the stouter form.

4. **Cymatoclysis brevicaudata** (Laackmann, 1909) (pl. I, figs. 4, 5)

Cymatoclysis calyciformis f. brevicaudata Laackmann, 1909, p. 391, pl. 42, figs. 7—10.

Cymatoclysis brevicaudata: Kofoid and Campbell, 1929, p. 125, fig. 272; Hada, 1970, p. 37, fig. 56.

Description: Lorica stout bell-shaped; erect inner oral margin surrounded with trigonal minute
teeth, outer margin with a inverted flare, like a band developed in suboral region; bowl short cup-shaped rotund, contracting in convex conical aboral region; aboral horn slender, pointed, surface furrowed; wall usually smooth on the surface of bowl; loric length, 160~200\(\mu\)m; oral diameter, 90~100\(\mu\)m.

Remarks: It was reported a rather rare species among those of *Cymatoclysis* occurring in the antarctic waters. This species differs from *Cymatoclysis calyciformis* in the much shorter aboral horn. The lorical morphological characteristics of this species show the intermediated form between *C. convallaria* and *C. calyciformis*. In our present study, this species was observed only one time, June, 1988.

5. *Cymatoclysis calyciformis* (Laackmann, 1907) (pl. I, figs. 6, 7, 8)

*Cyttaroclysis calyciformis* Laackmann, 1907, p. 236, fig. 3.

*Cymatoclysis calyciformis*: Laackmann, 1909, p. 391, pl. 42, figs. 7~10; Kofoid and Campbell, 1929, p. 127, fig. 265; Hada, 1970, p. 37, fig. 57.

Description: Lorica bell-shaped with a long slender aboral horn; inner oral margin denticulated with trigonal teeth, outer oral margin with a inverted flare about 60° and provided with an expanding suboral band; bowl abruptly contracting in convex conical aboral horn; aboral horn long and thin; surface of the bowl smooth without any ornamentation; loric length, 300~390\(\mu\)m; oral diameter, 120~140\(\mu\)m; length of aboral horn, 150~250\(\mu\)m.

Remarks: In our present study, this species is detected only one time, 8 June, 1988, together *C. brevicaudata*.

6. *Cymatoclysis convallaria* Laackmann, 1909 (pl. I, figs.9, 10, 11)

*Cymatoclysis convallaria* Laackmann, 1909, p. 382, pl. 43, figs. 1~4; Kofoid and Campbell, 1929, p. 132, fig. 273; Sassi and Melo, 1986, p. 76, pl. 3, figs. 21~23; Barria de Cao, 1987, p. 279, fig. 3A.

*Cymatoclysis convallaria* f. *typica* Laackmann, 1909, p. 490, pl. 33, fig. 5.

Description: Lorica typical bell-shaped; inner oral margin with minute trigonal teeth, outer margin with a inverted flare; suboral region surrounded with a band, striae developed on the band; aboral region convex towards the aboral end; aboral horn conical, short, sometimes with striae; loric length, 90~120\(\mu\)m; oral diameter, 70~100\(\mu\)m.

Remarks: This species is considered as being extremely variable. Especially it is very difficult to distinguish *C. convallaria* from *C. affinis*. Through the analysis of the morphometry of loricae to the described species *C. affinis* and *C. convallaria*, Boltovskoy et al (1990) strongly suggested that both of them were a single species. Such a study of the intraspecific variability on this species would be necessary on other tintinnid species.

7. *Cymatoclysis drygalskii* (Laackmann, 1907) (pl. II, figs. 1, 2, 3)

*Cyttaroclysis drygalskii* Laackmann, 1907, p. 236, fig. 2.

*Cymatoclysis drygalskii* Laackmann, 1909, p. 376, pl. 34, figs. 1~3, pl. 35, figs. 2, 4, pl. 40, fig. 8, pl. 41, fig. 6; Kofoid and Campbell, 1929, p. 137, fig. 262; Sassi and Melo, 1986, p. 76, pl. 3, figs. 24~27, pl. 4, figs. 32~34; Barria de Cao, 1987, p. 278, fig. 2D.

*Cymatoclysis drygalskii* f. *typica* Laackmann, 1909, p. 379, pl. 33, figs. 2, 3, pl. 35, fig. 1, pl. 36, fig. 3, pl. 40, fig. 13, pl. 41, figs. 1, 4, 5, 7, 8.

*Cymatoclysis drygalskii* f. *ovata* Laackmann, 1909, p. 41, fig. 3.

*Cymatoclysis ecaudata* Kofoid and Campbell, 1929, p. 137, fig. 263.
**Cymatoclysis ovata** Kofoid and Campbell, 1929, p. 141, fig. 257.

**Description:** Lorica chalice-shaped; inner oral margin with minute trigonal teeth, outer margin with averted flare, surrounding with a band on the suboral region; delicate striae stretched on the suboral band; bowl almost cylindrical, its middle region slightly contracting; aboral region gradually tapering to a conical aboral end, with or without aboral horn; wall with fine alveolar structure; lorica length, 190–280μm; oral diameter, 80–95μm.

**Remarks:** The length of lorica and that of the apical horn are highly variable characters. So, we agree with Sassi and Melo (1986)’s opinion, including *C. ecaudata* and *C. ovata* of Kofoid and Campbell (1929) in the synonym of the *C. drygalskii*.

8. **Cymatoclysis vanhoeffeni** (Laackmann, 1907) (pl. II, figs. 4, 5, 6)

*Ptychoclysis vanhoeffeni* Laackmann, 1907, p. 238, fig. 9.

*Cymatoclysis vanhoeffeni* Laackmann, 1909, p. 350, pl. 37, fig. 29, pl. 38, figs. 9–15: Kofoid and Campbell, 1929, p. 146, fig. 241; Balech, 1973, p. 61, fig. 164; Sassi and Melo, 1986, p. 77, pl. 4, figs. 28–31; Barria de Cao, 1987, p. 279, fig. 3D.

*Cymatoclysis vanhoeffeni* f. *ventricosa* Laackmann, 1909, p. 350, pl. 37, fig. 6.


*Cymatoclysis vanhoeffeni* f. *robusta* Laackmann, 1909, p. 350, pl. 37, fig. 1.

*Cymatoclysis robusta* Kofoid and Campbell, 1929, p. 142, fig. 242.

**Description:** Lorica chalice-shaped, with extremely long and slender aboral horn; oral margin surrounded trigonal teeth and slightly flared; suboral region slightly expanded, without a band; aboral region gradually tapering into long aboral horn and contracted at the middle; wall developed coarse striae on the suboral region and fine alveolar structure in the rest of lorica; surface with brown color especially on the oral region; lorica length, 400–560μm; oral diameter, 80–90μm.

**Remarks:** Sassi and Melo (1986) did not accept the raising of *C. vanhoeffeni* f. *robusta* Laackmann to specific rank by Kofoid and Campbell (1929) since the highly polymorphic nature of *C. vanhoeffeni*. We follow the Sassi and Melo’ suggestion and adjust *C. vanhoeffeni* f. *robusta* as synonym with *C. vanhoeffeni*. And, we think that a detailed analysis on the morphological variability of this species have to be followed in further study.

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