

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

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## 킹조지섬 마리안 소만의 유충류 (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 : *Codonellopsis balechi*, *C. gaussi*, *Laackmanniella naviculaefera*, *Cymatocylis brevicaudata*, *C. calyciformis*, *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

**요약** : 1988년 2월부터 1989년 1월에 걸쳐 남극 킹조지섬의 마리안 소만에서 채집한 유충류를 동정하고 기재하였다. 총 2과 3속 8종이 동정되었으며 이들은 모두 남극 고유종으로 밝혀진 종들이다. 출현종은 *Codonellopsis balechi*, *C. gaussi*, *Laackmanniella naviculaefera*, *Cymatocylis brevicaudata*, *C. calyciformis*, *C. convallaria*, *C. drygalskii*, *C. vanhoeffeni* 등 이었다.

**주요어** : 유충류, 부유생물, 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 1990'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 (100 $\mu$ m) and water bottles. The samples from water bottles were filtered with 20 $\mu$ m 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 tintinnides 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 Ptychocylididae Kofoid and Campbell, 1929

Genus *Cymatocylis* Laackmann, 1909

4. *Cymatocylis brevicaudata* (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. I, 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.

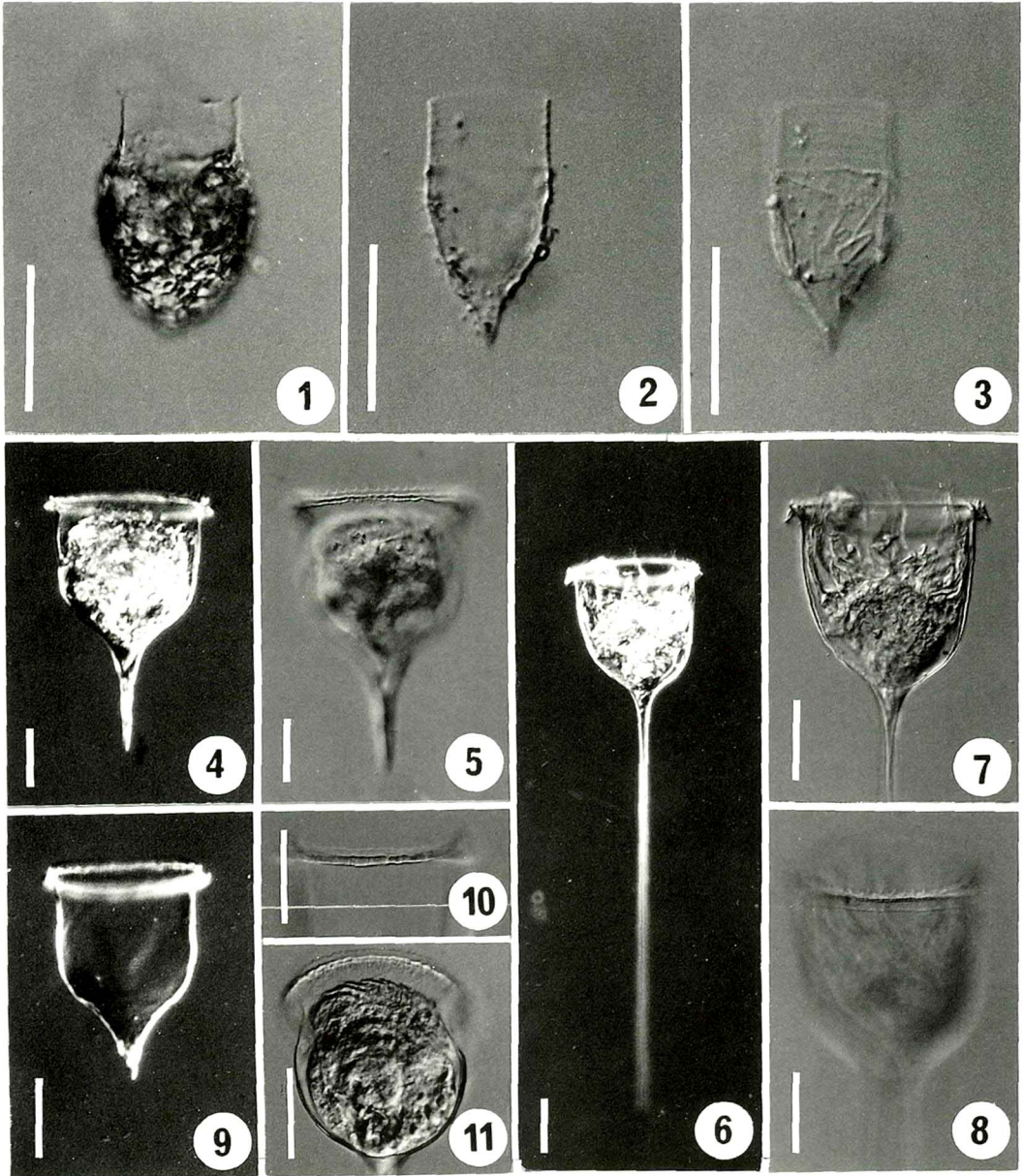
**Description** : Lorica consisting of an annular collar and a spherical bowl; collar short and hyaline, with 3 or 4 spiral turns, without fenestrae on the collar; bowl expanded ovate shaped, strongly covered with foreign particles; aboral and round or bluntly pointed; lorica length, 78~81 $\mu$ m; oral diameter, 35 $\mu$ m.

**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 gaussi* (Laackmann, 1907) (pl. I, figs. 2, 3)

*Codonella gaussi* Laackmann, 1907, p. 239, fig. 12.

# PLATE I

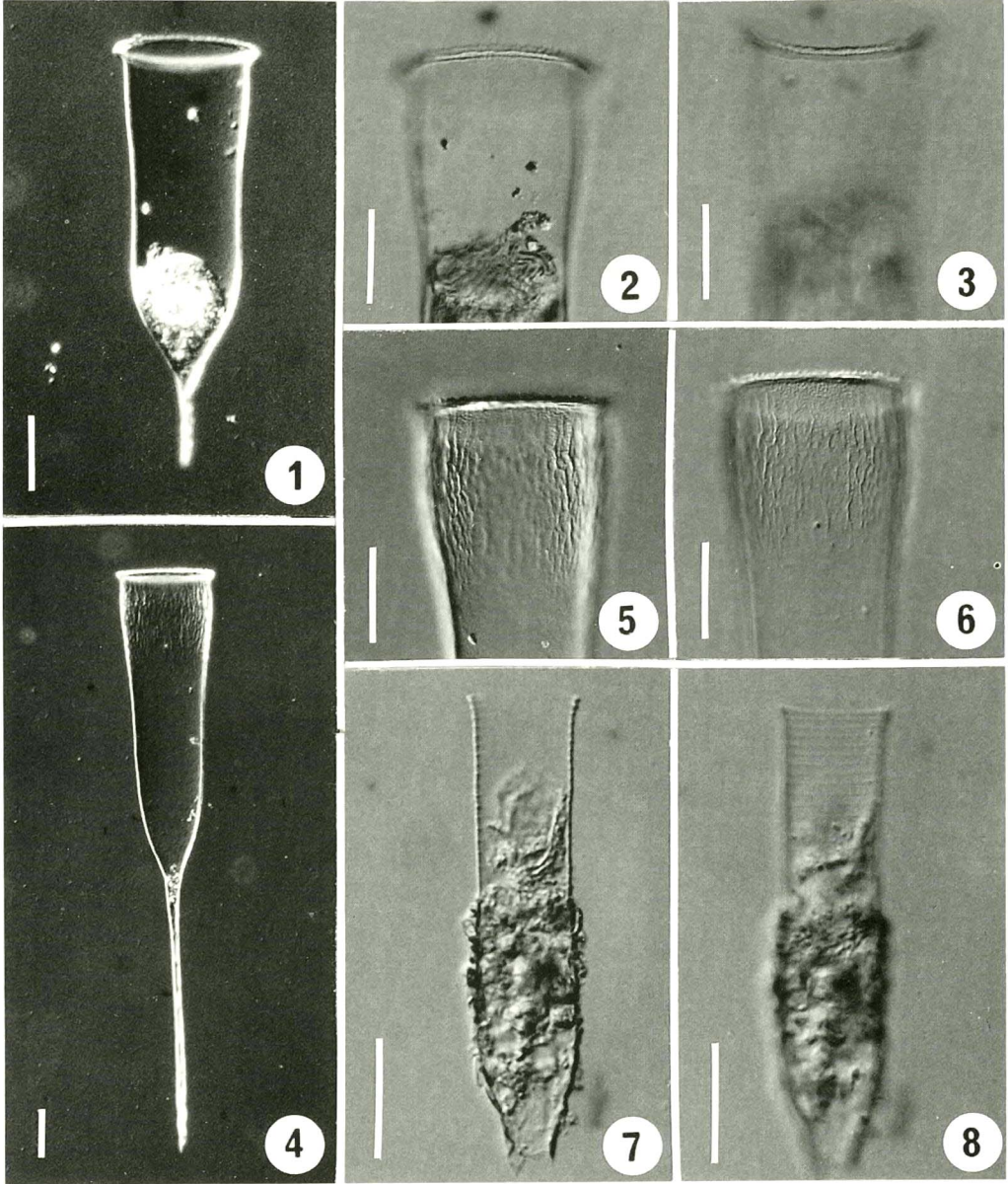


Explanation of Plates

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 . *Cymatocylys brevicaudata*
  - 5 . *C. brevicaudata*, showing denticulate crest
  - 6 . *Cymatocylys calyciformis*
  - 7 . *C. calyciformis*, showing a reflexed and re-curved oral rim
  - 8 . *C. calyciformis*, showing a minutely denticulate oral rim
  - 9 . *Cymatocylys convallaria*
  - 10 . *C. convallaria*, showing a oral rim with a slight striation
  - 11 . *C. convallaria*, showing a minutely denticulate oral rim
- Scale bar = 50 $\mu$ m

# PLATE II



Explanation of Plates

Plate II

1. *Cymatocylys drygalskii*
  2. *C. drygalskii*, showing a denticulate crest
  3. *C. drygalskii*, showing a reflexed oral rim
  4. *Cymatocylys 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 = 50  $\mu$ m

*Codonella glacialis* Laackmann, 1907, p. 239, fig. 13.

*Leprotintinnus gaussi*: Laackmann, 1909, p. 407, pl. 47, figs. 1~4.

*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, 66~72 $\mu$ m; oral diameter, 36 $\mu$ m.

**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 naviculaefera* (Laackmann, 1907) (pl. II, figs. 7, 8)

*Codonella naviculaefera* Laackmann, 1907, p. 239, fig. 10.

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

*Leprotintinnus naviculaeferus*: 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* Laack-

mann, 1909, p. 404, pl. 46, figs. 13~15.

*Laackmanniella naviculaefera*: 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, 150~200 $\mu$ m; oral diameter, 30~40 $\mu$ m.

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

*Cymatocylis calyciformis* f. *brevicaudata* Laackmann, 1909, p. 391, pl. 42, figs. 7~10.

*Cymatocylis 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; lorica length, 160~200 $\mu$ m; oral diameter, 90~100 $\mu$ m.

**Remarks:** It was reported a rather rare species among those of *Cymatocylys* occurring in the antarctic waters. This species differs from *Cymatocylys 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. *Cymatocylys calyciformis* (Laackmann, 1907) (pl. I, figs. 6, 7, 8)

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

*Cymatocylys 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; lorica, 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. *Cymatocylys convallaria* Laackmann, 1909 (pl. I, figs. 9, 10, 11)

*Cymatocylys 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.

*Cymatocylys 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; lorica 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. *Cymatocylys drygalskii* (Laackmann, 1907) (pl. II, figs. 1, 2, 3)

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

*Cymatocylys 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.

*Cymatocylys 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.

*Cymatocylys drygalskii* f. *ovata* Laackmann, 1909, pl. 41, fig. 3.

*Cymatocylys ecaudata* Kofoid and Campbell, 1929, p. 137, fig. 263.



*Cymatocylis ovata* Kofoid and Campbell, 1929, p. 141, fig. 257.

**Description:** Lorica chalice-shaped; inner oral margin with minute trigonal teeth, outer margin with a inverted flare, surrounding with a band on the suboral region; delicated 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, 190~280 $\mu$ m; oral diameter, 80~95 $\mu$ m.

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

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

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

*Cymatocylis 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.

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

*Cymatocylis vanhoeffeni* f. *minor* Laackmann, 1909, p. 350, pl. 37, figs. 7~9.

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

*Cymatocylis 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, 400~560 $\mu$ m; oral diameter, 80~90 $\mu$ m.

**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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