印度アラビヤ海沿岸のコチン港の原生動物プランクトン（英文）

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（受付　昭和49年９月19日）

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抄　録

1971年１月18日にインドの南西岸にあるインド最古の貿易港であるコチン港内の２地点でプランクトンの採集を行い、一部は固定しないで生の材料を持ち帰ったが、この熱帯地方の海洋のプランクトンを生かして持ち帰ることには失敗した。従がって、今回報告する原生動物プランクトンは、すべて固定材料を検鏡して種の固定を行ったものだけである。

Cochin 港は大潟湖の Vembanad Lake の入口にある天然の良港で、1498に Vasco da Gama が希望峰を廻ってインドに到達して、香料などのインドの特産物をヨーロッパに持ち帰ったヨーロッパとの最初の貿易港であり、その後キリスト教やヨーロッパ文化がこの港を通じてインドにはいってきたため、現在この地方の一般住民の教育程度がインドでは最も進んでいるようにみうけられた。高等教育も進んでおり、コチン市内だけでも College, University を合せると４校が古くからキリスト教財団によって設立されている。現在のコチン市は Ernakulam, Willingdon Is. Mattanchori の３地区からなり、政治・経済の中心地は Ernakulam で、Willingdon Is. には国の施設が集中しており、Mattanchori 地区には古い遺跡が多く観光の中心地である。

プランクトンの採集は第１図に示した２地点で行った。第１表で示したように気温

と水温は両地点で大差はないが、塩分はかなりの差がみられた。原因は St. I では満潮時に採水したが、St. II では引潮になって採水したため起ったものと考えている。採集材料から検出した原生動物は有色鞭毛虫類18種、海産太陽虫1種、繊毛虫類23種の合計42種で、新種は見出されなかった。すべての種が沿岸水域に生息している普通種で、汚染海域のプランクトンとして検出されている種ばかりである。従って、42種の原生動物プランクトン中の35種が広島湾から見付かっている。すなわち、83%の種が共通種であることは、海産プランクトンにとっては所在地や気象条件の相違よりも、海の汚染の影響が著しいことをもの語っているよい実例ではないだろうかと考えている。

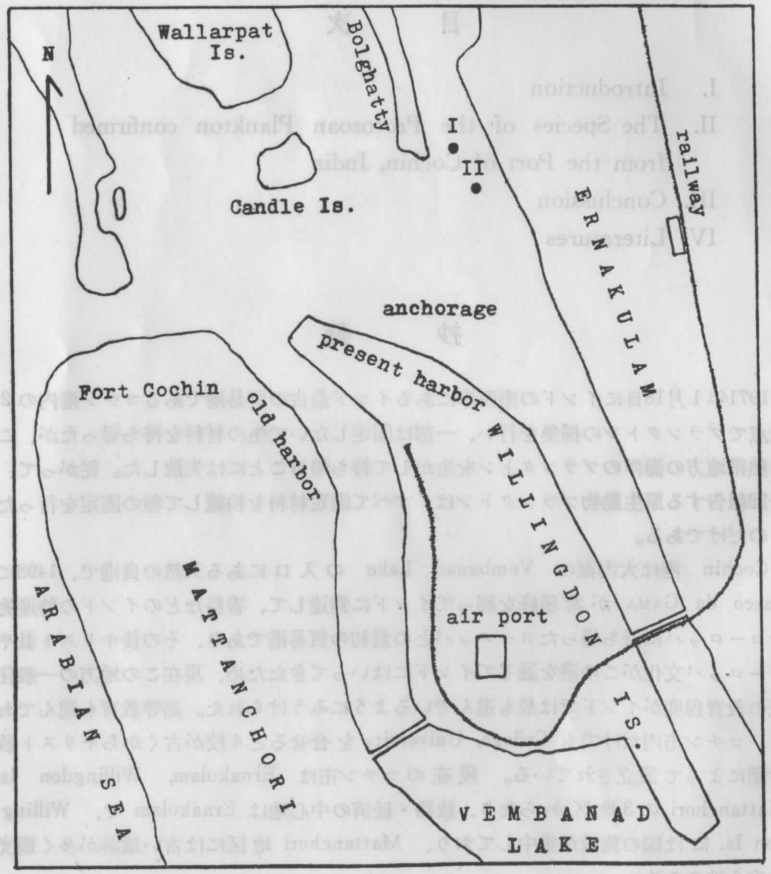

Fig. 1. Showing two stations of the collection of the Protozoan plankton in the port of Cochin.

The Protozoan Plankton collected from the port of Cochin on the Arabian Sea Coast of India

by

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I. Introduction

The symposium on "Indian Ocean and Adjacent Seas" was held during January 12–18, 1971 at Cochin on the southern coast of the Arabian Sea, India. The author was present at the symposium and collected the plankton at the two stations of the port of Cochin shown in Figure 1 on the last day of the symposium. As shown in Table 1, air and water temperatures were fairly higher at St. 2 than at St. 1, but salinities were contrarily lower. The cause of these different results of the observations is probably due to that the collection made at St. 1 was carried at high water, but one of the other station at low tide.

Table 1. Observations made on January 18, 1971 in the port of Cochin, India.

Station	Time	Air Temp. °C	Wat. Temp. °C	pH	Salinity ‰
I	10.35	29.5	29.1	7.8	33.26
II	11.10	30.0	29.5	8.0	28.38

1) old name—Hiroshima Shoka Daigaku. new adress—731-31, Numata-Cho, Hiroshima City.

In spite of the success of carring back the fresh materials of the Protozoa obtained from fresh water in India, the living samples of the Protozoan plankton were not brought back to Japan. Therefore, the most species of the Protozoa in the paper have been examined from the fixed materials collected from the port of Cochin.

II. The Species of the Protozoan Plankton confirmed from the Port of Cochin, India

A. Subphylum Sarcomastigophora

The subphylum compries two superclasses: one is the Mastigophora moving with flagella and the other is the Sarcodina having pseudopodia. The Superclass Mastigophora is divided the Class Chromonadea and Leucomonadea. The most forms of the latter class have not any hard parts in the body, therefore, these micro-organisms were unable to detect from fixed materials obtained from the port of Cochin. The Superclass Sarcodina consists of the two classes, Rhizopodea carrying changeable pseudopodia and Actinopodea moving with axopodia. A single Heliozoan species belonging to the latter class has been found in the present work.

Class Chromonadea

Order Chrysomonadida

Suborder Euchrysomonadina

Family Chromulinidae

1. ***Kephyrion mosquense*** Gusewai Figure 2

Kephyrion mosquense: Hada, 1974, p. 116, fig. 1–5.

The minute flagellate carries a chitinous lorica which is specific to each species of the Genus *Kephyrion*. The lorica of this form consists of a cylindrical neck with a spiral growth line and a heart-

shaped bowl. The flagellate has a single flagellum and a golden yellow chromatophore. The specimens examined from the plankton samples taken from the port of Cochin are very small, being as long as 3.5–4.5 μ in length of a lorica. It is difficult to collect the minute flagellate with a plankton-net. *Kephyrion* species are usually so common in polluted water, that it is necessary to take up polluted water and detect directly minute specimens from drawn water.

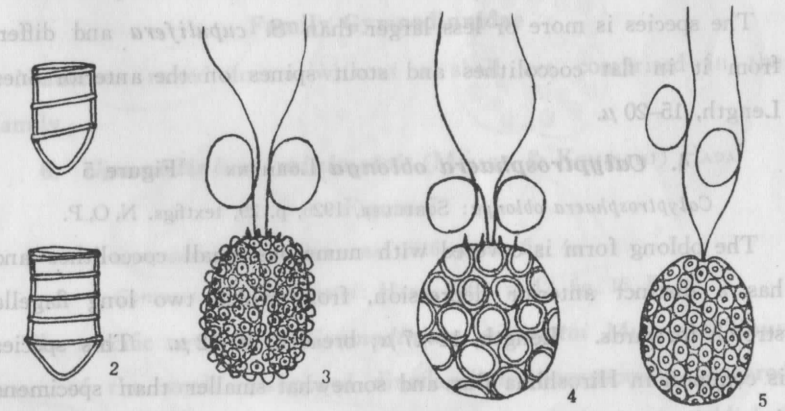

Fig. 2. *Kephyrion mosquense* Gusewai, 4,000 ×.
Fig. 3. *Syracosphaera cupulifera* Schiller, 1,500 ×.
Fig. 4. *Syracosphaera mediterranea* Lohmann, 1,500 ×.
Fig. 5. *Calyptrosphaera oblonga* Lohmann, 1,300 ×.

Order Coccolithophorida

The forms of the order have two long flagella of equal length, two large chromatophores and many various scaled coccolithes on the surface of the body. Three species have been examined from the samples of the plankton of the port of Cochin.

Family Syracosphaeridae

2. *Syracosphaera cupulifera* Schiller Figure 3

Syracosphaera cupulifera: Schiller, 1926, p. 19, textfig. J.

The small species is oblong in form and covered with many thick discal coccolithes the most surface of the body excepting the anterior region provided with coccolithes having a short spine. Length, 12 μ; breadth, 10 μ.

3. *Syracosphaera mediterranea* Lohmann Figure 4

Syracosphaera mediteranea: Schiller, 1926, p. 17, textfig. G.

The species is more or less larger than *S. cupulifera* and differs from it in flat coccolithes and stout spines on the anterior ones. Length, 15–20 μ.

4. *Calyptrosphaera oblonga* Lohmann Figure 5

Calyptrosphaera oblonga: Schiller, 1926, p. 29, textfigs. N, O, P.

The oblong form is covered with numerous small coccolithes and has a distinct anterior depression, from which two long flagella stretch forwards. Length, 12–17 μ; breadth, 10–12 μ. This species is common in Hiroshima Bay and somewhat smaller than specimens found from the port of Cochin, being 10–15 μ in length and 7–10 μ in breadth.

Order Dinoflagellida

The remarkable characteristic of the order is the presence of the large nucleus, in which are generally observed many chains of chromatic grains in the living condition. The order is divided into the following two suborders: the Adinidina without any groove on the surface of the body and the Diniferina having two different ones called as the sulcus and girdle. A single form of the Adinidina and ten species of the Diniferina have been examined in the

samples of the plankton collected from the port of Cochin.

Family Protocentridae

5. *Prorocentrum micans* Ehrenberg Figure 6

Prorocentrum micans: Hada, 1967, p. 8, fig. 9, A.

The form is composed of double fusiform shells with an apical lobe. It has two flagella different in length and structure and also two large chromatophores in the body. It is one of the common species in costal waters of the world. Length, 50–55 μ; breadth, 21–25 μ; thickness, 12 μ.

Family Gymnodinnidae

Numerous naked forms without a shell are comprised in the family.

6. *Gymnodinium mikimotoi* (Miyake & Kominami) Hada Figure 7

Gymnodinium sp. Okamura, 1916, p. 32, fig. 4.

Gymnodinium mikimotoi: Hada, 1967, p. 12, fig. 16, B.

The specific new name, *Gymnodinium mikimotoi* Miyake & Kominami, of the small unarmored dinoflagellate unexpectedly appeared without any description on the form in the Oda's report published in 1935. Afterwards, Miyake & Kominami described in Japanese on the form as a new species in the private notes of the company. Though the specific name had been widely used in Japan scince 1935, it was incomplete as a specific name of the Protozoa on account of its description written only with Japanese letters on the unofficial papers. Therefore, the present author (1967) has described in English on the form to be a sufficient specific name.

The species having many minute chromatophores is one of the commonest dinoflagellates, and sometimes makes blooming water in

coastal water in Japan. The specimens examined from the plankton samples taken from Cochin, are 20–23 μ in length, 13–15 μ in breadth and 10 μ in thickness.

7. *Gyrodinium lachrymum* (Meunier) Figure 8

Gyrodinium lachrymum: Hada, 1970, p. 15, fig. 12.

The large fusiform species having the tapering anterior part

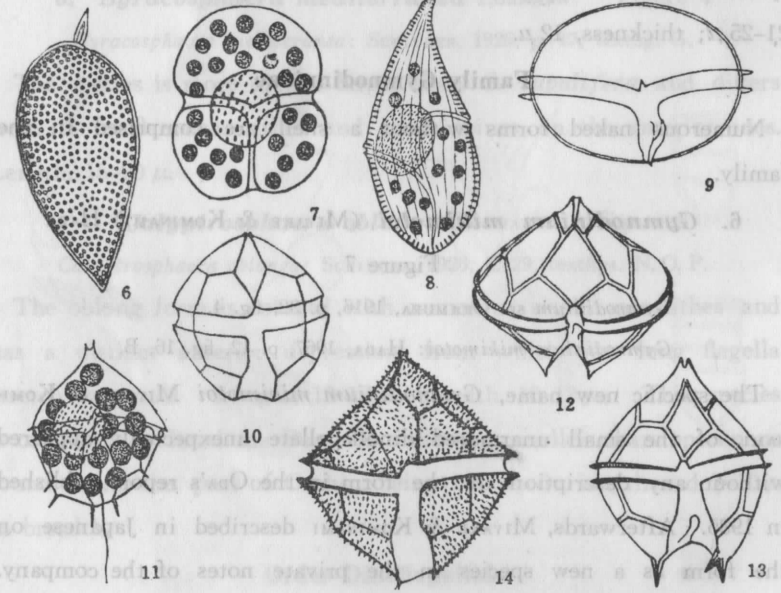

Fig. 6. *Prorocentrum micans* Ehrenberg, 650 ×.
Fig. 7. *Gymnodinium mikimotoi* (Miyake & Kominami), 1,200 ×.
Fig. 8. *Gymnodinium lachrymum* (Meunier), 450 ×.
Fig. 9. *Diplosalis lenticula* Bergh, 550 ×.
Fig. 10. *Peridinium nanum* Balech, 750 ×.
Fig. 11. *Peridinium quinquecorne* Abe, 1,000 ×.
Fig. 12. *Peridinium adriaticum* Broch, 700 ×.
Fig. 13. *Peridinium pentagonium* (Gran), 600 ×.
Fig. 14. *Peridinium crassipes* Kofoid 730 ×.

carries few spherical chromatophores and numerous trichocysts in the surface layer of the body, on which many longitudinal striae are running along the entire length. Length, 63–95 μ; breadth, 42–65 μ.

The author (1970) frequently examined the large dinoflagellate in the collections obtained from the antarctic and subantarctic regions of the Indian Ocean, but he has not found from Japanese waters.

Family Peridinidae

8. *Diplosalis lenticula* Bergh Figure 9

Diplopsalis lenticula: Hada, 1967, p. 15, fig. 26.

The compressed form has been rarely found in the samples of the plankton taken from the port of Cochin. Length, 30 μ; diameter, 45–50 μ.

9. *Peridinium nanum* Balech Figure 10

Peridinium nanum: Hada, 1970, p. 19, fig. 20.

The small round form having characteristic globular chromatophores, is one of the common dinoflagellates of the Indian Ocean on account of frequent examinations in materials collected from the southern region of the Ocean. Length, 20–30 μ; diameter, 20–23 μ.

10. *Perinium quinquecorne* Abe Figure 11

Peridinium quinquecorne: Abe, 1927, p. 40, figs. 30, A-C; Hada, 1967, p. 19, fig. 30, B.

The small form with several antapical spines is so common in the materials of the port of Cochin as in those of the Inland Sea, Setonaikai in Japan. Length, 22–27 μ; breadth, 18–23 μ.

11. *Peridinium adriaticum* Broch Figure 12

Peridinium adriaticum: Hada, 1967, p. 17, fig. 28, C.

The world-wide species was rarely examined in the plankton samples taken from the port of Cochin. Length, 37 μ; breadth, 35 μ.

12. *Peridinium pentagonium* (Gran) Figure 13

Peridinium pentagonium: Hada, 1967, p. 17, fig. 28, A.

The common species in the seas all over the world has been clear that it is also common in the sea of Cochin from the present investigation. Length, 52–55 μ; breadth, 47–50 μ.

13. *Peridinium crassipes* Kofoid Figure 14

Peridinium crassipes: Paulsen, 1930, p. 65, fig. 39; Abe, 1927, p. 407, figs. 26, 27.

The low rhombic form was rare in the collections from Cochin and the examined specimens was more or less smaller than those from the other seas, being 45 μ in length and 50 μ in breadth.

14. *Ceratium furcum* (Ehrenberg) Figure 15

Ceratium furcum subsp. *eugrammum*: Jörgensen, 1911, p. 17, pl. 2, figs. 24, 25.

Ceratium furcum: Hada, 1967, p. 20, fig. 31, B.

The examined form has been identified as a variety *eugrammum* Jörgensen which has the short apical horn and antapical spines as compered with those of the typical form. Length, 90 μ; breadth, 32 μ.

15. *Ceratium tripos* (Müller) Figure 16

Ceratium tripos: Jörgensen, 1911, p. 35, pl. 1, figs. 1, 2; Hada, 1967, p. 20.

The world-wide species has been rarely secured in the materials collected brom the port of Cochin.

Order Euglenoida

The species of the order having paramylon granules as a reserved substance usually appear in polluted fresh and sea water. The author (1973) has collected 33 forms of the order from fresh water

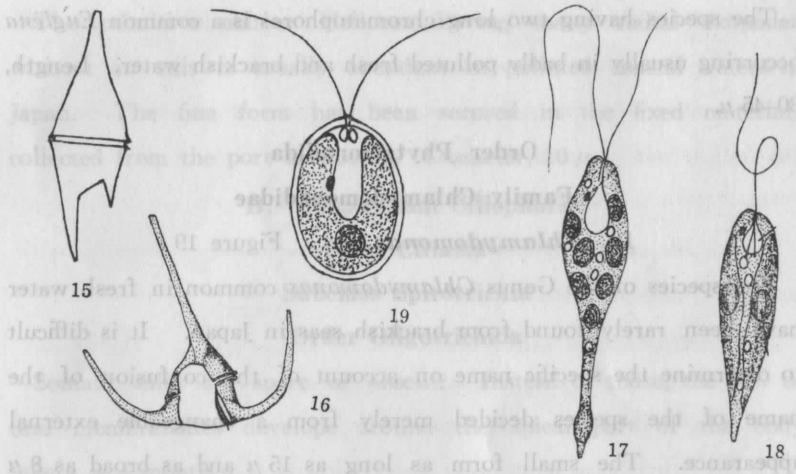

Fig. 15. *Ceratium furcum* (Ehrenberg), 380 ×.
Fig. 16. *Ceratium tripos* Müller, 200 ×.
Fig. 17. *Eutreptiella marina* da Cunha, 500 ×.
Fig. 18. *Euglena pisciformis* Klebs, 750 ×.
Fig. 19. *Chlamydomonas* sp., 1,400 ×.

in India, Nepal and Surilanka, but only two have been examined from the port of Cochin.

Family Eutreptidae

The species of the family have two flagella.

16. *Eutreptiella marina* da Cunha Figure 17

Eutreptiella marina: Hada, 1972, p. 21, fig. 73.

The species carrying two flagella different in length is the typical marine form and one of the common flagellates in the Protozoan plankton of the port of Cochin. Length, 35–80 μ.

Family Eugleniidae

The species of the family carry a single flagellum.

17. *Euglena pisciformis* Klebs Figure 18

Euglena pisciformis: Hada, 1972, p. 23, fig. 75.

The species having two long chromatophores is a common *Euglena* occurring usually in badly polluted fresh and brackish water. Length, 30–45 μ.

Order Phytomonadida

Family Chlamydomonadidae

18. ***Chlamydomonas*** sp. Figure 19

The species of the Genus *Chlamydomonas* common in fresh water have been rarely found from brackish seas in Japan. It is difficult to determine the specific name on account of the confusion of the name of the species decided merely from a changeable external appearance. The small form as long as 15 μ and as broad as 8 μ has been observed from the collection obtained from St. II in the port of Cochin as well as from the Inland Sea in Japan.

Superclass Sarcodina

Class Actinopodea

Subclass Heliozoia

Order Actinophryida

Family Ciliophryidae

1. ***Ciliophrys marina*** GAULLERY Figure 20

Ciliophrys marina: HADA, 1968, p. 23, fig. 38.

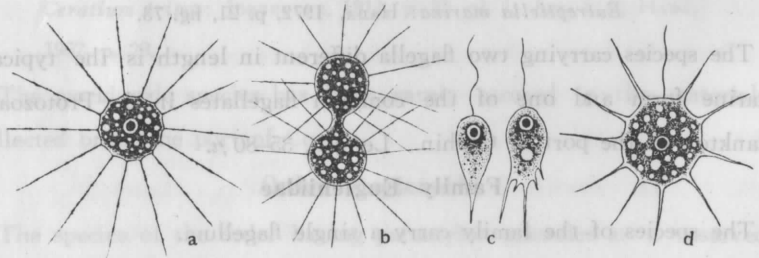

Fig. 20. *Ciliophrya marina* GAULLERY, 900 ×;
a. adult; b. dividing; c, d. flagellate larvae.

The primitive marine Heliozoa having many radial axopodea without an axis is usually abundant in polluted coastal waters in Japan. The fine form has been secured in the fixed materials collected from the port of Cochin. Diameter, 10 μ.

B. Subphyllum Ciliophora

Class Ciliatea

Subclass Spirotrichia

Order Oligotrichida

Somatic cilia are spare or absent. Instead of those, the row of oral membranelles develope around the apical part of the body where is a mouth.

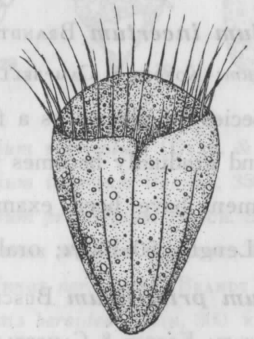

Fig. 21. *Strobilidium striatum* (BUSCH), 750 ×.

1. ***Strobilidium striatum*** (BUSCH) Figure 21

Strobilidium striatum: HADA, 1970, p. 27, fig. 37.

The species is composed of a round anterior portion with an oral row of membranelles and a conical posterior part provided with several striae on the surface. Length, 45 μ.

Order Tintinnida

The species of the order carry a lorica and have many tentaculoids

peculiar to the forms of the order between membranelles of the oral part. In the present investigation have been secured 22 forms occurring usually in coastal water and the most of those have been also found from the seas of Japan.

Family Tintinnididae

The loricae of the species of the family are loosely composed with foreign minute particles.

2. ***Tintinnidium mucicolum*** (Clap. & Laackm.) Figure 22

Tintinnidium mucicola: Kofoid & Campbell, 1929, p. 15, fig. 1; Hada, 1937, p. 151, fig. 6; 1938, p. 89, fig. 1.

The species having a irregular shaped lorica is one of the common forms in the port of Cochin. Length, 35–150 μ.

3. ***Tintinnidium incertum*** Brandt Figure 23

Tintinnidium incertum: Kofoid & Campbell, 1929, p. 7, fig. 7.

The lorica of the species is shaped as a finger sack. The wall thickened in the oral end gradually becomes thinner to the rounded aboral end. Many specimens have been examined in the materials of the port of Cochin. Length, 50–140 μ; oral diameter, 20–25 μ.

4. ***Tintinnidium primitivum*** Busch Figure 24

Tintinnidium primitivum: Kofoid & Campbell, 1929, p. 15, fig. 3.

The lorica of the species is similar in external form to one of the former, *T. incertum*, but it is easily distinguished from the former in having an aboral openning. This was as many as the former species in samples of the plankton of the port of Cochin. The author has examined stout specimens of this species (length, 87–162 μ; oral diameter, 27–35 μ) from the sea of the Indian Ocean off Cape Town. Length, 65–180 μ; oral diameter, 22–25 μ.

Family Tintinnopsidae

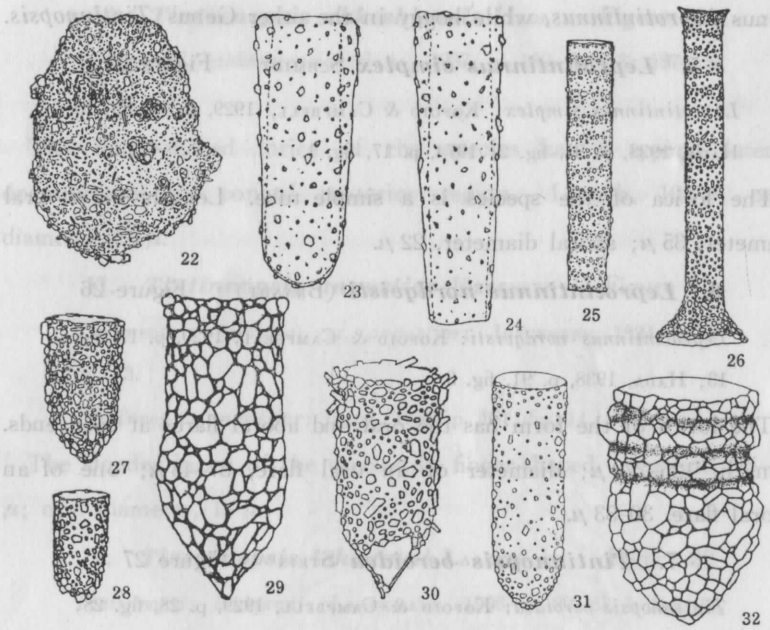

Fig. 22. *Tintinnidium mucicolum* (Clap. & Laachm.), 350 ×.
Fig. 23. *Tintinnidium incertum* Brandt, 350 ×.
Fig. 24. *Tintinnidium primitivum* Busch, 350 ×.
Fig. 25. *Leprotintinnus simplex* Schmidt, 200×.
Fig. 26. *Leprotintinnus nordqvisti* (Brandt), 200 ×.
Fig. 27. *Tintinnopsis beroidea* Stein, 300 ×.
Fig. 28. *Tintinnopsis nana* Lohmann, 500 ×.
Fig. 29. *Tintinnopsis elongata* Daday, 400 ×.
Fig. 30. *Tintinnopsis akkeshiensis* Hada, 300 ×.
Fig. 31. *Tintinnopsis angustior* Jörgensen, 250 ×.
Fig. 32. *Tintinnopsis lohmanni* Laachmann, 300 ×.

The family comprises two genera, *Leprotintinnus* and *Tintinnopsis*. The loricae of the species of the both genera are similar in composition which is composed with cuticular cement and foreign particles, but differ each other in shape which is tubular in the

Genus *Leprotintinnus*, while boggy in the other Genus *Tintinnopsis*.

5. ***Leprotintinnus simplex*** Schmidt Figure 25

Leprotintinnus simplex: Kofoid & Campbell, 1929, p. 18, fig. 10; Hada, 1938, p. 91, fig. 2; 1974, p. 17, fig. 1.

The lorica of the species is a simple tube. Length, 140 μ; oral diameter, 35 μ; aboral diameter, 22 μ.

6. ***Leprotintinnus nordqvisti*** (Brandt) Figure 26

Leprotintinnus nordqvisti: Kofoid & Campbell, 1929, p. 17, fig. 13; Hada, 1938, p. 91, fig. 3.

The lorica of the form has the oral and aboral flares at each ends. Length, 125–270 μ; diameter of an oral flare, 37–43 μ; one of an aboral flare, 30–33 μ.

7. ***Tintinnopsis beroidea*** Stein Figure 27

Tintinnopsis beroidea: Kofoid & Campbell, 1929, p. 28, fig. 28; Hada, 1932a, p. 42, fig. 2; 1932b, p. 554; 1937, p. 156, fig. 9; 1938, p. 93, fig. 4.

The lorica of the species is simple bullet-shaped. Length, 25–35 μ; oral diameter, 11–13 μ.

8. ***Tintinnopsis nana*** Lohmann Figure 28

Tintinnopsis nana: Kofoid & Campbell, 1929, p. 41, fig. 15; Hada, 1938, p. 94, fig. 5.

The finger-shaped lorica of the species is smallest among those of the genus. Length, 25–35 μ; oral diameter, 11–13 μ.

9. ***Tintinnopsis elongata*** Daday Figure 29

Tintinnopsis elongata: Kofoid & Campbell, 1929, p. 34, fig. 80; Hada, 1937, p. 158, fig. 11.

The large elongate lorica of the form is gradually tapering to the posterior end. Length, 92–120 μ; oral diameter, 32–45 μ.

10. ***Tintinnopsis akkeshiensis*** Hada Figure 30

Tintinnopsis akkeshiensis: Hada, 1937, p. 160, fig. 13; 1974, p. 17, fig. 6.

The bullet-shaped lorica of the species has a typical lateral openning in the conical posterior region. Length, 102 μ; oral diameter, 20 μ.

11. ***Tintinnopsis angustior*** Jörgensen Figure 31

Tintinnopsis beroidea var. *angustior*: Jörgensen, 1924, p. 68, fig. 73.

Tintinnopsis angustior: Hada, 1937, p. 161, fig. 14.

The slender lorica of the species is finger-shaped. Length, 35–40 μ; oral diameter, 15 μ.

12. ***Tintinnopsis lohmanni*** Laackmann Figure 32

Tintinnopsis lohmanni: Laackmann, 1906, p. 20, pl. 1, figs. 10, 11; pl. 2, fig. 23; Hada, 1932b, p. 556, fig. 3; 1937, p. 168, fig. 20; 1974, p. 17, fig. 7.

The lorica of the common species consists of a cylindrical anterior part and a conical or ovate posterior bowl. Length, 65–125 μ; oral diameter, 37–40 μ.

13. ***Tintinnopsis bermudensis*** Brandt Figure 33

Tintinnopsis bermudensis: Kofoid & Campbell, 1929, p. 27, fig. 48.

The lorica of the species is similar to one of *T. lohmanni* in outline, but it is distingushable from the latter in composition of the wall, of which in the collar of this species is composed with fine sand grains, while in the latter with coarse particules as well as in the bowls of both species. The author has first examined this species from the collection of the port of Cochin. Length, 87–88 μ; oral diameter, 30 μ.

14. *Tintinnopsis urnula* Meunier Figure 34

Tintinnopsis urnula: Kofoid & Campbell, 1929, p. 50, fig. 20; Hada, 1932a, p. 42, fig. 3; 1932b, p. 558.

The small lorica of the species common in the Cochin Port is shaped like an urun with an oral flare. Length, 30–35 μ; oral diameter, 22–25 μ.

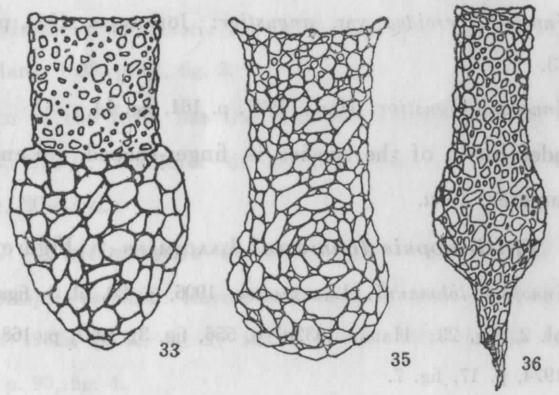

Fig. 33. *Tintinnopsis bermudensis* Brandt, 500 ×.
Fig. 35. *Tintinnopsis directa* Hada, 500 ×.
Fig. 36. *Tintinnopsis tocantinensis* Kofoid & Campbell, 500 ×.

15. *Tintinnopsis directa* Hada Figure 35

Tintinnopsis directa: Hada, 1932b, p. 557, fig. 4; 1938, p. 99, fig. 12; 1974, p. 17, fig. 4.

The elongate lorica of the species is campanulate in the anterior region and rounded in the posterior end. Length, 75–100 μ; oral diameter, 40–55 μ.

16. *Tintinnopsis tocantinensis* Kofoid & Campbell Figure 36

Tintinnopsis tocantinensis: Kofoid & Campbell, 1929, p. 48,

fig. 46; Hada, 1932b, p. 559, fig. 8; 1974, p. 17, fig. 3.

Tintinnopsis aperta var. *tocantinensis*: Hada, 1938, p.101, fig.15.

The lorica of the species consists of an anterior tube and a posterior bowl with a stout horn openning laterally. Length, 62–130 μ; oral diameter, 20–25 μ; diameter of the bowl, 25–36 μ.

17. *Tintinnopsis radix* (Imhof) Figure 37

Tintinnopsis radix: Kofoid & Campbell, 1929, p. 45, fig. 33; Hada, 1932b, p. 560, fig. 10; 1937, p. 166, fig. 18; 1938, p. 100, fig. 14; 1974, p. 17, fig. 2.

The elongate lorica of the world-wide species is shaped like a pencil and always has a lateral openning in the posterior tapering horn. Length, 205–260 μ; oral diameter, 35–47 μ.

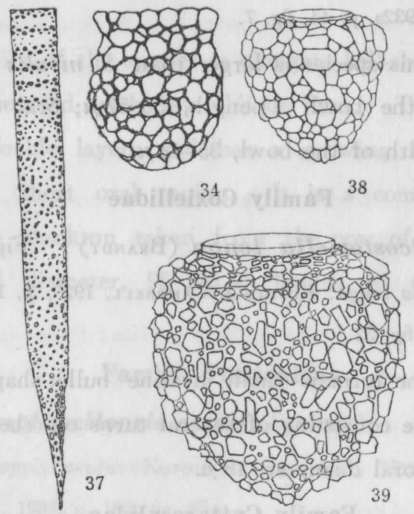

Fig. 34. *Tintinnopsis urnula* Meunier, 700 ×.
Fig. 37. *Tintinnopsis radix* (Imhof), 250 ×.
Fig. 38. *Stenosemella nivalis* (Imhof), 250 ×.
Fig. 39. *Stenosemella ventricosa* (Clap. & Lachm.), 600 ×.

Family Codonellopsidae

18. *Stenosemella nivalis* (Meunier) Figure 38

Stenosemella nivalis: Kofoid & Campbell, 1929, p. 69, fig. 136; Hada, 1932b, p. 561, fig. 11; 1937, p. 178, fig. 26; 1938, p. 105, fig. 20; 1974, p. 17, fig. 9.

The cosmoplitan species having a small lorica consisting of a remarkable short hyaline collar and an ovate bowl composed with fine sand grains, has been rarely examined in materials taken from the port of Cochin. Length, 28–35 μ; oral diameter, 15 μ; breadth of the bowl, 22–23 μ.

19. *Stenosemella ventricosa* (Clap. & Laachm.) Figure 39

Stenosemela ventricosa: Kofoid & Campbell, 1929, p. 71, fig. 142; Hada, 1932a, p. 44, fig. 7.

The lorica of this species is larger than *S. nivalis* and coarser in agglomeration of the bowl. Length, 50–57 μ; oral diameter of the collar, 30 μ; breadth of the bowl, 35–42 μ.

Family Coxiellidae

20. *Helicostomella longa* (Brandt) Figure 40

Helicostomella longa: Kofoid & Campbell, 1929, p. 106; Hada, 1938, p. 115, fig. 32.

The lorica of the form is small hyaline bullet-shaped and has a spiral growing line consisting of several turns on the anterior part. Length, 50–55 μ; oral diameter, 18 μ.

Family Cyttarocylidae

21. *Favella ehrenbergi* (Clap. & Lachm.) Figure 41

Favella ehrenbergi: Kofoid & Campbell, 1929, p. 152, fig. 280; Hada, 1937, p. 186, fig. 32; 1974, p. 17, fig. 11.

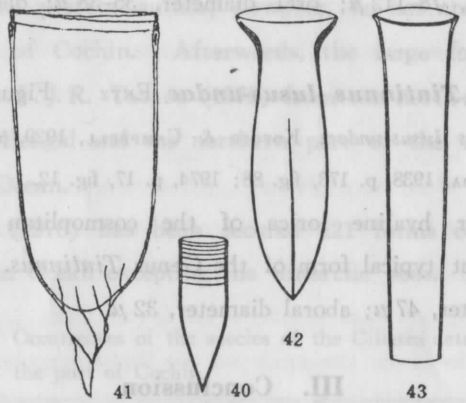

Fig. 40. *Helicostomella longa* (Brandt), 280 ×.
Fig. 41. *Favella ehrenbergi* (Clap. & Lachm.), 200 ×.
Fig. 42. *Amphorellopsis acuta* (Schmidt), 350 ×.
Fig. 43. *Tintinnus lusus-undae* Entz, 250 ×.

The large lorica of the species is elongate bell-shaped with a stout aboral horn provided with few oblique fines. The wall is usually composed of double layers and has a growing spiral line on the surface of the short oral region. It is a common form in the samples of the plankton taken from the port of Cochin. Length, 225–320 μ; oral diameter, 95–120 μ; length of the aboral horn, 40–80 μ.

Family Tintinnidae

22. *Amphorellopsis acuta* (Schmidt) Figure 42

Amphorellopsis acuta: Kofoid & Campbell, 1929, p. 315, fig. 598; Hada, 1938, p. 168, fig. 85.

The hyaline lorica of the species distributed in the tropical seas consists of a low funnel-shaped collar and an elongate bowl tapering towards an acute triangular end of the posterior region with three

fins. Length, 78–112 μ; oral diameter, 35–38 μ; diameter of the neck 20–22 μ.

23. ***Tintinnus lusus-undae*** Entz Figure 43

Tintinnus lusus-undae: Kofoid & Campbell, 1929, p. 335, fig. 656; Hada, 1938, p. 173, fig. 88; 1974, p. 17, fig. 12.

The tubular hyaline lorica of the cosmoplitan species is a somewhat stout typical form of the Genus *Tintinnus*. Length, 190 μ; oral diameter, 47 μ; aboral diameter, 32 μ.

III. Conclussion

The Protozoan plankton secured in the materials collected from the port of Cochin on the coast of the Arabian Sea in India, consists of 18 species of the Flagellata (Class Chromonadea), one of the Heliozoa (Class Actinopodea) and 23 forms of the Ciliata (Class Ciliatea). All of unicellular organisms are coastal water inhabitants excepting a few of the Chromonadea and several of the Ciliatea occurring frequently even in open seas.

In the 102 oceanic forms of the Order Dinoflagellida which have been reported from the Mozambique Channel by Dr. E. S. Silva (1956), are included only 3 cosmoplitan species common to the port of Cochin as followed; *Prorocentrum micans* Ehrenberg, *Peridinium crassipes* Kofoid and *Ceratium tripos* (Müller). This is showing that the most of the flagellates of the port of Cochin are planktonic elements of polluted seas. In fact, *Gymnodinium mikimotoi* Miyake & Kominami and *Peridinium quinquecorne* Abe have sometimes made remarkable colored waters by blooming in Japan. The collection of the notable peculiar formed dinoflagellate, *Noctiluca scintillans* (Macartoney) common in Japanese waters, had been

expected by the present author, however, he has unable to find it from the port of Cochin. Afterwards, the large form has been reported by Dr. F. J. R. Taylor (1973) from the north-eastern region of the Bay of Bengal and the northern part of the Andaman Sea in the Indian Ocean.

The author (1970) has been secured 121 forms of the Ciliatea from the Indian Ocean excepting the antarctic seas. The other 11

Table 2. Occurrences of the species of the Ciliatea detected from the port of Cochin.

Species	Indian Ocean	Japanese seas	Coastal water	Open seas
1. *Strobilidium striatum*	+	+	+	+
2. *Tintinnidium mucicola*	+	+	+	−
3. *T. incertum*	−	+	+	−
4. *T. primitivum*	+	+	+	−
5. *Leprotintinnus simplex*	−	+	+	−
6. *L. nordqvist*	−	+	+	−
7. *Tintinnopsis beroidea*	+	+	+	−
8. *T. nana*	−	+	+	−
9. *T. elongata*	−	+	+	−
10. *T. akkeshiensis*	−	+	+	−
11. *T. angustior*	+	+	+	−
12. *T. lohmanni*	−	+	+	−
13. *T. bermudensis*	−	−	+	−
14. *T. urnula*	−	+	+	−
15. *T. directa*	+	+	+	−
16. *T. tocantinensis*	−	+	+	−
17. *T. radix*	+	+	+	−
18. *Stenosemella nivalis*	+	+	+	−
19. *S. ventricosa*	−	+	+	−
20. *Helicostomella longa*	−	+	+	+
21. *Favella ehrenbergi*	−	+	+	−
22. *Amphorellopsis acuta*	+	+	+	+
23. *Tintinnus lusus-undae*	+	+	+	+
total	10	22	23	4

species examined in the present study are further added to them. As shown in the table 2, 23 species of the Ciliatea detected in the materials taken from the port of Cochin are pelagic organisms without exception in coastal water, however, the following four, *Strobilidium striatum* (Busch), *Helicostomella longa* (Brandt), *Amphorellopsis acuta* (Schmidt) and *Tintinnus lusus-undae* Entz, are also distributed in open seas. One of them, *Tintinnopsis bermudensis* Brandt, has not been yet found from Japanese waters.

It is concluded from the study on the Protozoan plankton collected from the port of Cochin, India that all of the examined organisms are the members of the plankton in polluted coastal water.

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