

CONTRIBUTIONS TO THE KNOWLEDGE
OF THE RED SEA

No. 14

THE TINTINNINA OF THE GULF OF EYLATH (AQABA)

by

B. KOMAROVSKY

Sea Fisheries Research Station, Haifa

INTRODUCTION

The Tintinnina form an important part of the plankton of all the seas. They are undoubtedly the most common and widespread group of ciliate protozoans populating the neritic and oceanic regions of the seas, feeding chiefly on microscopic algae in the photic zone. It is for this reason that the loricae of these protozoans are found, usually empty, among the components of the microplankton taken either by horizontal or vertical haulings in the light penetrated regions of any marine environment.

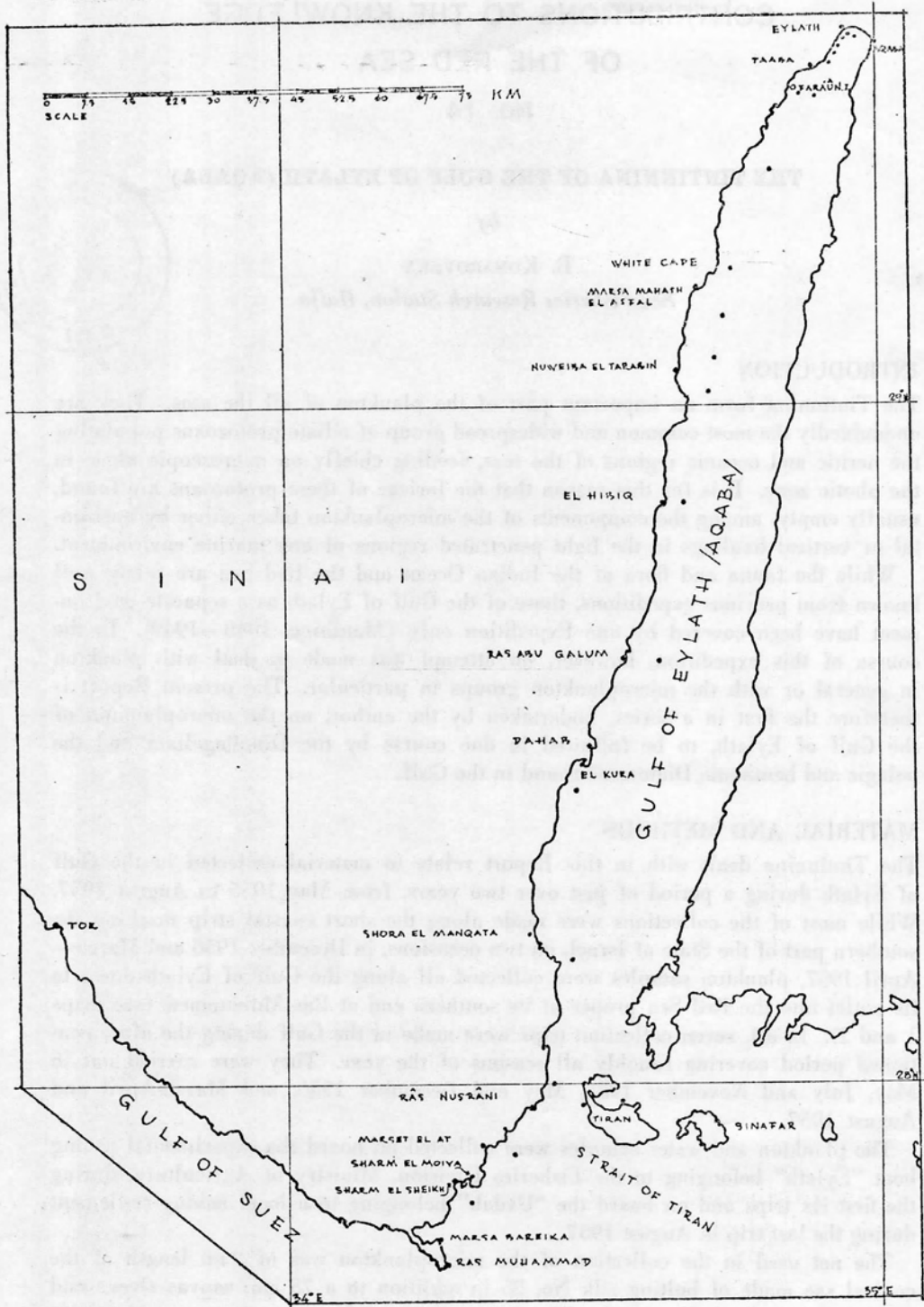
While the fauna and flora of the Indian Ocean and the Red Sea are fairly well known from previous expeditions, those of the Gulf of Eylath as a separate environment have been covered by one Expedition only (Manihine, 1948—1949). In the course of this expedition, however, no attempt was made to deal with plankton in general or with the microplankton groups in particular. The present Report is therefore the first in a series, undertaken by the author, on the microplankton of the Gulf of Eylath, to be followed in due course by the Dinoflagellata and the pelagic and benthonic Diatomeae found in the Gulf.

MATERIAL AND METHODS

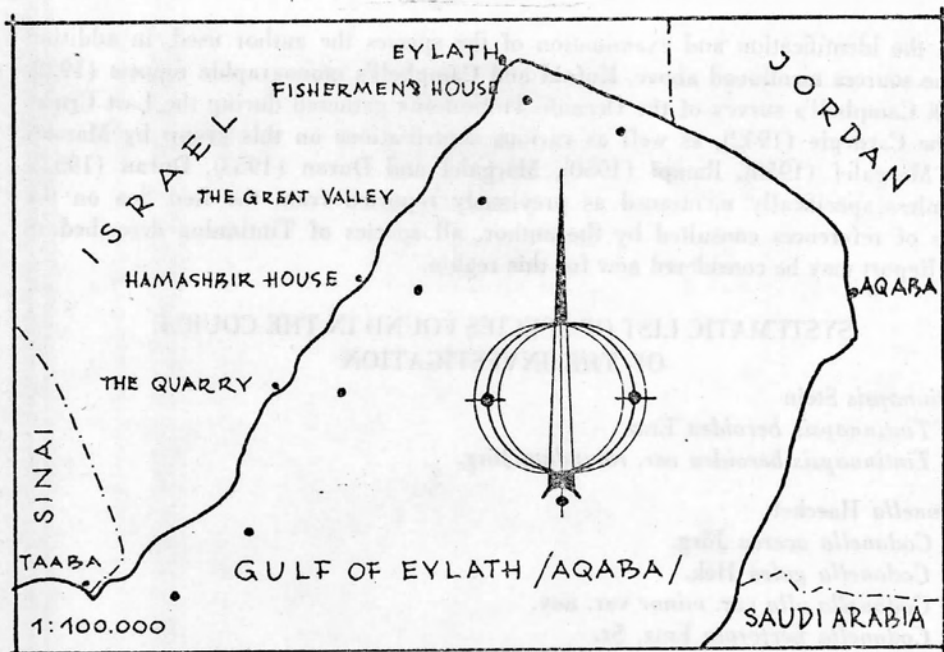
The Tintinnina dealt with in this Report relate to material collected in the Gulf of Eylath during a period of just over two years, from May 1955 to August 1957. While most of the collections were made along the short coastal strip marking the southern part of the State of Israel, on two occasions, in December 1956 and March—April 1957, plankton samples were collected all along the Gulf of Eylath down to its outlet into the Red Sea proper at its southern end at Ras Muhammed (see maps 1 and 2). In all, seven collection trips were made in the Gulf during the aforementioned period covering roughly all seasons of the year. They were carried out in May, July and November 1955, May and December 1956, and March-April and August 1957.

The plankton and water samples were collected on board the experimental fishing boat "Eylath" belonging to the Fisheries Division, Ministry of Agriculture, during the first six trips and on board the "Uvdah" belonging to a local fishing settlement during the last trip in August 1957.

The net used in the collection of the microplankton was of 2 m. length of the conical sac made of bolting silk No. 25 in addition to a 75 cm. canvas sleeve and 50 cm. diameter of the mouth. The material thus collected was preserved in 4% formalin. The examination of the plankton samples after determination of their



Map. 1 — Sinai Peninsula showing location of stations where samples were taken.



Map 2 — Northern tip of the Gulf of Eylath on a large scale.

volumes in standard sedimentation tubes was carried out in the Plankton Laboratory of the Sea Fisheries Research Station, Haifa.

Several slides were made of each sample, the whole field being thoroughly examined for the presence of Tintinnina using a mechanical stage. A Sartorius camera lucida was permanently at hand to make accurate drawings at standard magnifications of all the species and varieties belonging to this group. In addition, standard measurements were taken of the loricae of each individual species and variety. These data, together with the morphological descriptions, were used in the taxonomic work. Very rarely, in the course of this work was the animalcule still found to be present in the lorica, and such cases are, as a rule, mentioned in this Report.

While no attempt was made to make actual counts of individual species occurring in a given plankton sample, a relative appraisal of their abundance was made, using the symbols : (x) rare, (xx) common, and (xxx) abundant. This was found to be sufficient, at least at this stage, to give a general idea of the relative abundance and even seasonal fluctuations of individual species throughout the year.

NOMENCLATURE AND CLASSIFICATION

The system of nomenclature and classification is chiefly that used by Campbell (1954) who included all the known recent and fossil Tintinnids in one suborder, Tintinnina, as distinct from earlier investigators (Jorgensen, 1924 and others) who included all the known genera in one family, the Tintinnidae.

Campbell's classification is chiefly based on a close study of the loricae, in the same way as the shells of Foraminifera and Radiolaria serve for the identification of the latter groups, rather than on the characteristics of the animalcule which usually gets lost in preserved material.

In the identification and examination of the species the author used, in addition to the sources mentioned above, Kofoid and Campbell's monographic reports (1929, 1939), Campbell's survey of the Oceanic Tintinnina gathered during the Last Cruise of the Carnegie (1942), as well as various contributions on this group by Massuti and Margalef (1950), Rampi (1950), Margalef and Duran (1953), Duran (1957).

Unless specifically mentioned as previously reported from the Red Sea on the basis of references consulted by the author, all species of Tintinnina described in this Report may be considered new for this region.

SYSTEMATIC LIST OF SPECIES FOUND IN THE COURSE OF THE INVESTIGATION

Tintinnopsis Stein

1. *Tintinnopsis beroidea* Entz
2. *Tintinnopsis beroidea* var. *rotundata* Jörg.

Codonella Haeckel

3. *Codonella acerca* Jörg.
4. *Codonella galea* Hck.
5. *Codonella olla* var. *minor* var. nov.
6. *Codonella perforata* Entz, Sr.

Codonellopsis Jörg.

7. *Codonellopsis eylathensis* sp. nov.
8. *Codonellopsis longa* Kof. and Campb.
9. *Codonellopsis morchella* Cleve.
10. *Codonellopsis orthoceras* Hck.

Dictyocysta Kof. and Campb.

11. *Dictyocysta pacifica* Kof. and Campb.

Coxliella Brandt

12. *Coxliella decipiens* Jörg.
13. *Coxliella fasciata* (Kof.) Brandt
14. *Coxliella laciniosa* (Bdt.) Laack.
15. *Coxliella meunieri* var. *minor* var. nov.

Cyttarocylis Fol

16. *Cyttarocylis eucecryphalus* (Hck.) Kof.

Epirocylis Jörg.

17. *Epirocylis atlantica* Kof. and Campb.
18. *Epirocylis blanda* Jörg.
19. *Epirocylis exquisita* Kof. and Campb.
20. *Epirocylis undella* (Ostf. and Schm.) Jörg.

Epiorella Kof. and Campb.

21. *Epiorella curta* Kof. and Campb.

Epicancellula Kof. and Campb.

22. *Epicancellula nervosa* (Cleve) Kof. and Campb.

Craterella Kof. and Campb.

23. *Craterella obscura* (Brandt)
24. *Craterella urceolata* (Ostenf.) Kof. and Campb.

Petalotricha Kent

25. *Petalotricha ampulla* (Fol) Kent
26. *Petalotricha major* Jörg.
27. *Petalotricha pacifica* Kof. and Campb.

Protorhabdonella Jörg.

28. *Protorhabdonella simplex* (Cleve) Jörg.

Rhabdonella (Bdt.) Laack.

29. *Rhabdonella brandti* Kof. and Campb.
30. *Rhabdonella indica* Laack.
31. *Rhabdonella poculum* (Ostf. and Schm.) Brandt
32. *Rhabdonella valdestriata* Brandt

Parundella Jörg.

33. *Parundella aculeata* Jörg.
34. *Parundella inflata* Kof. and Campb.

Xystonella Jörg.

35. *Xystonella clavata* Jörg.
36. *Xystonella treforti* (Dad.) Laack.

Proplectella Kof. and Campb.

37. *Proplectella angustior* Kof. and Campb.
38. *Proplectella claparèdei* Kof. and Campb.
39. *Proplectella fastigata* (Jörg.) Kof. and Campb.
40. *Proplectella ostensfeldi* Kof. and Campb.
41. *Proplectella perpusilla* Kof. and Campb.
42. *Proplectella praelonga* Kof. and Campb.
43. *Proplectella subangulata* Kof. and Campb.
44. *Proplectella tenuis* Kof. and Campb.

Climacocylis Jörg.

45. *Climacocylis scalaria* (Brandt) Jörg.

Poroecus Cleve

46. *Poroecus curtus* Kof. and Campb.

Favella Jörg.

47. *Favella azorica* (Cleve) Jörg.

Eutintinnus Kof. and Campb.

48. *Eutintinnus apertus* Kof. and Campb.
49. *Eutintinnus apertus* var. *curta* var. nov.
50. *Eutintinnus brandti* Kof. and Campb.
51. *Eutintinnus elegans* Jörg.
52. *Eutintinnus fraknóii* (Dad.) Kof. and Campb.
53. *Eutintinnus latus* (Jörg.) Kof. and Campb.
54. *Eutintinnus lusus-undae* Entz, Sr.
55. *Eutintinnus macilentus* (Jörg.) Kof. and Campb.
56. *Eutintinnus medius* Kof. and Campb.

Salpingella Jörg.

57. *Salpingella acuminata* (Clap. and Laack.) Jörg.
58. *Salpingella attenuata* Jörg.
59. *Salpingella decurtata* Jörg.

Amphorella Daday

60. *Amphorella minor* Jörg.

61. *Amphorella quadrilineata* (Clap. and Laack.) Daday

Dadayiella Kof. and Campb.

62. *Dadayiella bulbosa* (Brandt) Kof. and Campb.

63. *Dadayiella ganymedes* (Entz, Sr.) Kof. and Campb.

Steenstrupiella Kof. and Campb.

64. *Steenstrupiella gracilis* (Jörg.) Kof. and Campb.

65. *Steenstrupiella intumescens* Jörg.

66. *Steenstrupiella steenstrupii* (Clap. and Laack.) Kof. and Campb.

DESCRIPTION OF GENERA AND SPECIES WITH NOTES ON THEIR DISTRIBUTION

CODONELLIDAE Kent

The family is represented in our material by two genera, *Tintinnopsis* and *Codonella*, both of which are known to occur in coastal waters.

Tintinnopsis Stein

This genus is known to be neritic and quite rare in the oceanic plankton (Campbell, 1942). Wall of lorica single and covered with agglutinated foreign bodies.

Tintinnopsis beroidea Entz

(Figs. 1, 2.)

The species was recorded in our material under two forms. The first and slightly more common, has a lorica almost cylindrical, slightly dilated towards the mouth and with evenly round posterior end (fig. 1). It thus answers Daday's description of the main species which, according to Jörgensen (1924), was subsequently designated by the former as *T. beroidea* var. *rotundata*.

Length 55μ , diameter of mouth 30μ .

The second form (fig. 2) differs from the former in having a rather conical posterior end and the upper part of the lorica slightly constricted. This form is, according to Margalef and Duran (1953, p. 53, fig. 15—g), a transition form close to *T. beroidea*.

Length 50μ , diameter of mouth 33μ , minimum diameter (in the upper part of the lorica) 30μ .

Tintinnopsis beroidea var. *rotundata* was found in our material during the May 1956 trip in vertical and horizontal samples collected off the coast of Israel (Fishermen's House, The Quarry 40m.—Om., The Quarry—northwards) while the second form was found in one instance only at Eylath in July 1955.

Geographical distribution — Mediterranean, European Coast from the Bay of Biscay to the North Sea, Baltic. It is therefore a neritic species common in the temperate and northern coastal waters and its presence in the plankton of the Gulf of Eylath signifies probably its most southern limit of distribution. It is not recorded in Campbell's Report of the Carnegie Expedition (1942).

Codonella Haeckel

Lorica urn-shaped with two well defined lamellae and a conspicuously large collar.

40-0m

May

July

Vertical

Horizontal

The species of this genus are confined to warmer seas, occurring rarely in cooler waters (Campbell, 1942).

Codonella perforata Entz, Sr.

Fig. 3.

This species is easily recognised by the broadly oval lorica whose maximum diameter is situated about its middle. The lower part of the lorica shows an obtuse point. The collar is low and symmetrically convex. The meshes are polygonal or oval in shape.

68
45
50μ
Total length 68μ, lorica proper 53μ, diameter of mouth 45μ, maximum diameter 50μ.

AVRIL According to the dimensions, the present form is closer to *Codonella acerca* Jörg. but the shape of the lorica with its maximum diameter along its middle line and the symmetrically convex collar suggest that this is perhaps a slightly smaller than average form of *Codonella perforata*.

This species was quite frequent in the samples taken in April 1957 off Faraun Island (100m.—Om.) and off White Cape (Ras el Burqa) some 23 miles South of Eylath. Otherwise rare.

Geographical distribution — Mediterranean, Atlantic (West of South Africa to Azores), Florida Current, Indian Ocean, South Western Australia, Tasmania and Pacific.

Codonella acerca Jörg.

Fig. 4.

63
38
50
This species is very similar to the former except that it is smaller and the maximum diameter of the lorica is somewhat below the middle region of the latter while the collar is generally more conically expanded towards the oral end although the upper edge is slightly incurved. Posterior end somewhat pointed.

AVRIL
Yace
vertic
Total length 63μ—68μ, lorica proper 50μ—60μ, diameter of mouth 38μ—50μ, maximum diameter 50μ—53μ.

Rare. Found in the vertical samples collected during April 1956 off Faraun Island (100m.—Om.) and White Cape (100m.—Om.) as well as in a horizontal sample collected off Hamashbir House further north.

Geographical distribution — Recorded from the Mediterranean, Atlantic (Sargasso Sea).

Codonella galea Haeckel

Figs. 5, 6.

73-100
60-75
60-70
This species has an ovoid lorica with the aboral end rounded or obtusely acute and conically expanded collar towards the oral end.

Total length 73μ—100μ, lorica proper 63μ—75μ, diameter of mouth 60μ—75μ, maximum diameter 60μ—70μ.

Geographical distribution — Mediterranean, Atlantic, Arabian Gulf, Indian Ocean, Red Sea, Pacific.

Codonella olla Kof. and Campb. var. *minor* var. *nov.*

Fig. 7.

The lorica of this species is distinctly pot-like with the bowl somewhat expanded towards the aboral end, the maximum diameter situated about $\frac{2}{3}$ from the upper rim.

The collar whose length is just under $\frac{1}{4}$ of the total length has convex sides, the diameter at the neck constriction almost equalling that of the oral opening.

Total length 65μ , lorica proper 40μ , diameter of mouth 40μ , maximum diameter 50μ .

These diameters are lower than the ones given by Campbell (1942) for the typical species which he puts between 75μ — 90μ . It is for this reason that we propose calling the form here described var. *minor*, similar to the main species in all respects except its size.

It was found only once in our material in April 1957 at Faraun Island.

Geographical distribution — Recorded from the Atlantic in the Sargasso Sea and the equatorial region.

CODONELLOPSIDAE Kofoid and Campbell

Of the three genera belonging to this family only *Codonellopsis* was found in our material in a wide range of forms and variations.

Codonellopsis Jörg.

Codonellopsis is easily recognized by the oval or roundish lorica with or without a caudal prolongation, coarse structure and agglutinated foreign bodies forming a dense cover over it. The hyaline collar of varying length is adorned with spiral or annular markings.

Codonellopsis orthoceras Haeckel

Fig. 8.

This is by far the most common species of *Codonellopsis* recorded in this collection. It is easily recognized by the elongated collar bearing some 20—24 spiral markings, the egg-shaped lorica covered with agglutinated foreign bodies and a caudal prolongation of varying length. These bodies often project conspicuously from the surface of the lorica giving the latter an irregular appearance.

Variations occur both in the length of the collar which probably depends on the age of the organism and in its general shape which, although cylindrical in most cases, is also occasionally of a slightly smaller diameter at its oral end than at its base or vice-versa.

Total length 188μ — 230μ , length of collar 88μ — 100μ , diameter of collar 50μ — 65μ , collar at base 45μ — 52μ , maximum diameter of lorica proper 73μ — 78μ , caudal prolongation 12μ — 43μ .

Codonellopsis orthoceras was very common in our material during the late spring and summer both in the horizontal and vertical plankton samples, although it rarely became numerous (White Cape, 100m.—Om., April 1957). It was absent from the plankton during November and December.

Geographical distribution — Common in all warm water seas. Recorded from the Mediterranean, Atlantic Ocean, Indian Ocean, Red Sea, Pacific.

Codonellopsis longa Kof. and Campb.

Figs. 9, 11.

This species is closely similar to the preceding one except in the longer size of the caudal prolongation and in the presence of a thin diaphragm separating it from the lorica proper.

Total length 215μ — 240μ .

Common in the plankton of the Gulf of Eylath during the same seasons as *C. orthoceras*.

Geographical distribution — Recorded from Mediterranean, the Atlantic (Equatorial region, Sargasso Sea, Gulf Stream), the Pacific (California region) and the Indian Oceans.

Codonellopsis morchella Cleve

Fig. 10.

Lorica broader and shorter than in both preceding species with a posterior obtuse point and without a caudal prolongation. Collar also shorter with distinct markings.

Total length 80μ — 93μ , length of lorica 47.5μ — 55μ , diameter of mouth 35μ — 47μ , maximum diameter 45μ — 53μ .

The dimensions of this species as well as the general shape of the lorica and of the collar with its rim slightly expanding in its upper part correspond well with *C. orientalis*, this similarity being observed also by Campbell (1942).

This species is known for its great variability. Duran (1957) considers *Codonellopsis morchella* synonymous with *C. orientalis* while Hada (1932) considers *C. indica* and *C. erythraensis* as additional synonyms of the main type.

The species is widely distributed in our material being found at most stations during July 1955, at all stations during November 1955 and May 1956 and during April 1957. It rarely becomes numerous.

Geographical distribution — Recorded from the Mediterranean, Red Sea, Indian Ocean, Malay Archipelago and the Pacific.

Codonellopsis eylathensis sp. nov.

Figs. 12 and 13.

This species with globose bowl and elongated collar differs both from *C. americana* Kof. and Campb. and from *C. ostensfeldi* (Schmidt) by its wider and shorter lorica and from *C. globosa* Kof. and Campb. by its more elongated collar.

Aboral end round or slightly acute, foreign bodies present on the surface of the bowl. The collar with slightly erected oral rim bears 16—17 annular markings.

Length of lorica 50μ — 60μ , maximum diameter 50μ — 60μ , length of collar 90μ , diameter of mouth 40μ — 50μ , diameter of lower collar 35μ — 38μ .

Rare, found on two occasions in vertical samples (40—Om.) off the Great Waadi south of Eylath (2.11.1955) and the Quarry further south (14.5.1956) and in a horizontal sample taken between the White Cape and Faraun Island on 2.4.1957.

DICTYOCYSTIDAE

The family is represented in our material only by the genus *Dictyocysta* which is found abundantly in the tropics (Campbell, 1942).

Dictyocysta Kof. and Campb.

Dictyocysta pacifica Kof. and Campb.

Fig. 14.

Two specimens of this species were found in May 1956 in a vertical haul taken off the Fishermen's House at Eylath.

Collar with 6—7 large rectangular windows arranged in a regular row. Below it there is another row of windows parallel to the former and of a somewhat less regular shape. This second row actually is situated on the bowl. The aboral part of

the lorica which is obtusely pointed is made up of small and irregular perforations of a reticulate pattern. Oral rim undulating and bearing fine denticles.

Total length 50μ , lorica proper 33μ — 40μ , collar 12μ , diameter of mouth 41μ — 43μ .
Dictyocysta pacifica differs from *D. mitra* in having oral denticles.

Geographical distribution — Recorded from the Pacific in the equatorial, the Galapagos and California regions. It is a typical Pacific species hitherto unknown in this part of the world.

COXIELLIDAE Kof. and Campb.

Coxiella Brandt

Lorica annulated all over, without a collar and open only above

Coxiella laciniosa (Bdt.) Laack.

Figs. 18, 19, 20.

Lorica roughly conical with aboral end pointed at the tip of a short caudal prolongation. Annuli of varying number (8—11) occasionally closer to each other near the oral end. Lorica wall with two well separated lamellae.

Total length 88μ , caudal prolongation 13μ , diameter of mouth 63μ .

Very scarce. Found sporadically south of Eylath (the Great Waadi) in November 1955 and between Faraun Island and White Cape (100m.—Om.) in April 1957.

Geographical distribution — Recorded from Mediterranean, the warmer regions of the Atlantic, Indian Ocean, South-East Coast of Arabia and the Pacific.

Coxiella fasciata (Kof.) Brandt

Fig. 17.

A conically elongated form, narrow with a gradually constricted caudal prolongation, spiral turns present on the lorica along its whole length.

Fig. 17 shows a specimen with the animalcule still inside the lorica.

Rare, found sporadically in July 1955 at Eylath and in November 1955 south of Eylath.

Total length 303μ — 350μ , diameter of mouth 70μ — 75μ , thickness of wall 2μ — 3.5μ , helicoidal band with approximately 15 turns.

Geographical distribution — Mediterranean, Atlantic, Pacific.

Coxiella meunieri var. *minor* var. nov.

Fig. 21.

Lorica thimble-shaped, tall and slightly expanding towards the oral end; aboral end hemispherical; wall with 9 spiral turns. The species differs from *C. ampla* in its taller and narrower shape. Due to its considerably smaller size than the main species described by Kofoid and Campbell (1929, p. 101), the name *C. meunieri* var. *minor* is proposed for our form.

Extremely rare, found only once at Eylath, in May 1955 in shallow water (18m.—Om.).

Total length 58μ , diameter of mouth 33μ .

Geographical distribution — Type locality for the species — the Kara Sea.

Coxiella decipiens Jörg.

Figs. 15, 16.

Lorica conically shaped with 20—25 spiral turns along its whole length. Aboral end projects into a considerably narrower caudal prolongation, sometimes slightly

220/60
curved. It differs from *C. fasciata* in the larger number of spiral turns on the lorica. Fig. 16 which is shorter and without the distinct caudal prolongation is probably a younger specimen of the same species.

Total length 220 μ —320 μ , diameter of the mouth 60 μ —70 μ .

Geographical distribution — The species is reported from Naples in the Mediterranean.

CYTTAROCYLIDAE Kof. and Campb.

This family is represented by one genus only, *Cyttarocyclus*, characteristic of warm seas.

Cyttarocyclus eucecryphalus (Hck.) Kof.

Fig. 22.

has been frequent
Lorica wide and almost cylindrical gradually tapering towards the aboral end to an obtuse point. Collar expanded and quite distinct from lorica. Wall of lorica coarsely reticulated.

This is a fairly common species in our material and probably perennial. It was recorded in the plankton samples along the whole length of the Gulf from Eylath to Ras Muhammed, but never in high numbers.

NOV
DECE
AVRIL
100
93
HORIZON
Detected off Eylath and the Great Waadi (November 1955), south of Eylath (in a horizontal sample, May 1956), Nuweiba, Dahab, Ras Muhammed (December 1956) and Taaba, Faraun Island and White Cape (April 1957).

Total length 100 μ —113 μ , diameter of mouth 115 μ —137 μ , maximum diameter 93 μ —115 μ , oral breadth 10 μ —18 μ .

Geographical distribution — Mediterranean, Red Sea, Indian Ocean, Southern Asia, Pacific, Atlantic (Sargasso Sea).

EPIPOCYLIDAE Kof. and Campb.

Representatives of all three genera: *Epiplocyclus*, *Epiorella* and *Epicanella*, were found in our material, All are chiefly tropical in their distribution.

Epiplocyclus Jörg.

The genus includes species with double-walled, cup-like loricae with distinct caudal prolongation. Outer lamella of the lorica with coarse reticulation on its lower part. Very common in warm water seas.

Epiplocyclus blanda Jörg.

Fig. 23.

125
62,5M
NOV
MAY
AVR
vertical
Lorica elongated with coarse reticulation on its lower part and longitudinal ridges protruding in the caudal prolongation. Upper part of lorica almost cylindrical, below the middle gradually tapering towards the aboral horn.

Total length 125 μ —150 μ , caudal prolongation 25 μ —37.5 μ , diameter of mouth 62.5 μ —75 μ .

It was found in our material at all stations along the Israel Coast of the Gulf in November 1955 (chiefly in vertical samples (50m—0m.) as well as in May 1956 and April 1957.

Geographical distribution — Mediterranean (mentioned by Jörgensen as *E. undella* var. *blanda*) Sargasso Sea, California, Mexican, Peruvian and South Equatorial Currents (Kof. and Campb., 1939).

Epiplocylix exquisita Kof. and Campb.

Fig. 24.

Cup-shaped lorica considerably wider at the oral end than the previous species. Sides convex gradually narrowing below the middle of the lorica and passing rather abruptly into the conical aboral horn which forms between 0.25 to slightly less than 0.3 of the total length. Reticulation covers the lower half of the bowl leaving the aboral horn more or less clear.

Total length 110μ — 112.5μ , diameter of mouth 72.5μ — 87.5μ caudal prolongation 25μ — 30μ .

Rare in our material. Found in horizontal samples off Eylath and the Great Waadi (November 1955) and the Quarry (May 1956).

Geographical distribution — The type locality is off the Somali Coast of the Indian Ocean (Kof. and Campb., 1939), North and South of the Equator in the Atlantic and the Pacific Oceans.

Epiplocylix undella (Ostf. and Schm.) Jörg.

Fig. 25.

This species is one of the most common Tindinnids recorded in our material. It is easily distinguished by the shape of the lorica, which is slightly dilated below the oral opening, the coarse reticulation in its lower portion with roundish or polygonal meshes and acute caudal prolongation.

Total length 105μ — 125μ , caudal prolongation 18μ — 30μ , diameter of mouth 62.5μ — 65μ , maximum diameter 70μ .

Geographical distribution — A very common warm water species, recorded from the Mediterranean, Indian Ocean, Red Sea, Arabian Gulf, Pacific.

Epiplocylix atlantica Kof. and Campb.

Fig. 26.

Lorica similar in shape to *E. undella* but slightly shorter and with a shorter and blunt caudal prolongation. Lorica expands from the lower rim reaching the maximum diameter about its middle or slightly below. The reticulated lower portion of the lorica covers about one third of the total length.

Total length 92.5μ — 102.5μ , caudal prolongation 12.5μ — 15μ , diameter of mouth 62.5μ — 72.5μ , maximum diameter 70μ .

Rare. Found in our material only once in November 1955 off the Great Waadi, south of Eylath.

Geographical distribution — Recorded from the Atlantic in the Sargasso Sea and the equatorial region (Carnegie Expedition, 1942).

Epiorella Kof. and Campb.

The genus *Epiorella* was separated from the genus *Epiplocylix* by Kofoid and Campbell (1939) on account of the collar which is present in the former and absent in the latter. According to Campbell (1942), *Epiorella* inhabits cooler water than *Epiplocylix* and this also applies to the species found in our material which was recorded chiefly from vertical haulings.

Epiorella curta Kof. and Campb.

Fig. 28.

Upper margin of lorica separated from the cuff by a shallow trough. Lower portion of lorica reticulated with distinct convex walls tapers gradually into an acute and

short caudal prolongation. In the upper half there are free longitudinal lines reaching almost to the upper edge.

Length 75μ , diameter of mouth 45μ , diameter of surrounding cuff 50μ .

Found at all stations along the Israel Coast in longitudinal haulings: The Quarry 40m.—Om., Fishermen's House 40m.—Om., the Great Waadi 40m.—Om., Hamashbir House 100m.—Om. in May 1956 and Taaba in April 1957. This confirms Campbell's view, as mentioned above, as at this time of the year the temperature of the deeper water layers is lower than the surface temperature of the water.

Geographical distribution — The species is recorded from the Atlantic and the Pacific Oceans.

Epicancella Kof. and Campb.

This genus is related to *Epiplocylys* and to *Rhabdonella* on account of the structure of the lorica with horizontal and vertical ribs and bars.

Epicancella nervosa (Cleve) Kof. and Campb.

Fig. 27.

This is the single species, so far known, belonging to the genus *Epicancella*. It is easily recognized by the characteristic vertical ridges and crossbars covering the lorica over its whole surface. Similar in shape to *Epiorella* except for the different reticulation of the lorica and the shape of its lower portion which in *Epicancella nervosa* is more conically pointed without a prolongation.

Total length 70μ — 75μ , diameter of mouth 60μ , diameter of surrounding cuff 60μ — 62μ .

Rare, found at Taaba in April 1957.

Geographical distribution — Recorded from the Atlantic and Pacific.

PETALOTRICHIDAE Kof. and Campb.

Subf. CRATERELLINAE Kof. and Campb.

Craterella obscura (Brandt)

Fig. 29.

This species closely resembling *Epiplocylys curta* but for the different markings on the lorica which are in the form of longitudinal unbranching lines, was included in the subfamily CRATERELLINAE as *C. obscura* Brandt. No double collar, however, was visible at the oral opening of our specimen justifying the inclusion of this species in the PETALOTRICHIDAE. Similar doubts about the systematic position of this species were expressed by Duran (1957) whose drawing of *C. obscura* reproduced on p. 116 closely resembles ours.

Total length 72.5μ , diameter of cuff 55μ , oral rim 50μ .

The species was found at the same stations and at the same time of the year as the preceding one.

Craterella urceolata (Ostf.) Kof. and Campb.

Fig. 81.

Lorica short and wide having $\frac{1}{3}$ of the distance from its upper end, a prominent annular rib. Above the rib there is a marked constriction to an erect mouth. Below the annular rib the lorica narrows rapidly into a wide conical bowl pointed at its posterior end.

43
30
22 r
441
July

Total length 43μ — 45μ , length of lorica proper 30μ — 34μ , diameter of mouth 28.4μ — 30μ , maximum diameter 43.2μ .

Present and at times abundant (The Quarry — northwards) in our material during May 1956, at all stations off the Israel Coast. Also found in July 1955, off Eylath. Geographical distribution — Reported from the Mediterranean, Atlantic, the Eastern Tropical Pacific.

Subf. PETALOTRICHINAE.

Petalotricha ampulla (Fol) Kent

Fig. 30.

Lorica bowl-shaped with aboral end rounded or with an obtuse point but without caudal prolongation. Wall double. At the oral end a double collar, the lower one slightly dilated and the upper one spreading in the form of an oral rim.

100
125

Length 100μ — 110μ , diameter of mouth 125μ , maximum diameter 100μ — 107μ , lower edge of collar 100μ — 112μ , diameter at constriction 87μ — 102μ .

Petalotricha ampulla is perennial in the Gulf of Eylath. It was found in most of the samples both in the vertical and in the horizontal ones.

Geographical distribution — Recorded from the Mediterranean, the Atlantic, Indian Ocean, Red Sea and Arabian Gulf, Pacific.

Petalotricha major Jörg.

Figs. 31, 32.

This species has also a globose lorica which, according to Campbell (1942), has in some cases a minute point at the aboral end. The lorica proper is shorter than it is wide and the upper collar also expands as a flat oral rim. Both the aborally rounded and the slightly pointed forms were found in our material during summer and fall 1955 off the Israel Coast of the Gulf.

140
etc.

Length of lorica 110μ .

Geographical distribution — Recorded from the warm-water regions of the Atlantic and Pacific Oceans. Also from the Mediterranean.

Petalotricha pacifica Kof. and Campb.

Fig. 33.

110
NOV
rare

Lorica widest at its oral end with oral margin irregularly sinuous. Bowl rounded with aboral end showing a minute point. In the upper part of the lorica three rows of circular fenestrae.

Length 105μ — 112μ , diameter of mouth 120μ — 152μ , first collar 10μ , second collar 7.5μ .

Rare. Several specimens found off Eylath in November 1955.

Geographical distribution — Recorded from Western Tropical Pacific, California and South Equatorial currents.

RHABDONELLIDAE Kof. and Compb.

Family represented by two genera: *Protorhabdonella* and *Rhabdonella*. Both genera are tropical to subtropical.

Protorhabdonella Jörg.

Lorica short and wide, more or less acute below, with longitudinal ribs; no caudal prolongation.

Protorhabdonella simplex (Cleve) Jörg.

syn. *Rhabdonella amor* var. *simplex* Brandt.

Fig. 37.

Lorica short, conical, with maximum diameter somewhat below the oral opening; aboral end pointed. Longitudinal ribs, unbranched, extend along whole length of lorica.

Total length 50μ — 57.5μ , diameter of mouth 32.5μ — 35μ .

This species was found to be quite common in our material being recorded both in the vertical and horizontal plankton samples collected at the permanent stations along the Israel Coast of the Gulf during July and November 1955 and May 1956.

Geographical distribution — An Indopacific and circum tropical species known from the Red Sea, Arabian Gulf, warmer regions of the Atlantic and the Pacific Oceans and the Mediterranean Sea.

Rhabdonella (Bdt.) Laack.

Genus resembling *Protorhabdonella* except in the presence of a larger number of longitudinal ribs which are often branching and anastomizing distally and of a more or less well developed caudal prolongation. Wall of lorica double and mouth channelled.

Rhabdonella brandti Kof. and Campb.

Fig. 34.

The lorica of this species is conically widened near the oral rim with a tapering caudal prolongation. Numerous longitudinal ribs converge towards the aboral end. Outer edge of the oral rim surrounds the inner margin of the wall bearing the ribs. Scattered circular fenestrae present in intercostal spaces.

Total length 195μ — 213μ , caudal prolongation 58μ — 75μ , outer diameter of mouth 65μ — 68μ , inner diameter of mouth 52μ — 60μ .

Rare in our material. Recorded from all the permanent stations along the Israel Coast in vertical samples in November 1955.

Geographical distribution — Recorded from the Atlantic (Sargasso Sea, and the Indian Ocean (off Borneo).

Rhabdonella indica Laack.

(Formerly *Rhabdonella amor* var. *indica* Laack.)

Fig. 35.

Lorica conical with acuminate posterior end but without caudal prolongation. Numerous longitudinal ribs.

Length 74μ — 95μ , outer diameter of mouth 50μ , inner diameter of the mouth 43μ — 47.5μ . Maximum diameter 47.5μ — 50μ .

Found at all stations off the Israel Coast during May 1956 and especially abundant during the same month off Hamasbir House (40m.—0m.).

This form is closely similar in shape to *Rhabdonella amor* (Cl.) Laack. from which it differs only in its smaller size, more numerous striae and lack of fenestrae. The loricae of the Gulf of Eylath material are, however, larger than those reported by Kofoid and Campbell (1929, 1939) and Campbell (1942) for this species.

Geographical distribution — Recorded from the Southern Indian Ocean, the eastern Mediterranean (probably due to infiltration through the Suez Canal), and the tropical regions of the Pacific Ocean.

50
32.5μ

July
NOV
MAY

common
vert. &
HORIZON

NOV

rare

195

58

65

NOV

vertical

75
47.5μ

extreme

MAY

abundant

40-0m

Rhabdonella poculum (Ostf. and Schm.) Brandt

Fig. 26.

NOV
MAY
This species differs from *R. amor* in its shorter and wider lorica and the distinctly conical horn which is absent in the former. The oral rim is entire and is at the same level as the outer margin of the suboral trough which surrounds it. Slightly reflected ribs with few fenestrae in the intercoastal spaces present along whole length of lorica. Colour of lorica brown.

Total length 85μ , diameter of oral rim 55.5μ , outer lip diameter 60μ , basal diameter of aboral horn 19μ .

The distribution of this species in the present material is limited but it was found in large numbers in May 1956 off the Quarry, South of Eylath.

Geographical distribution — Known from various parts of the Pacific. Apparently new for the Red Sea and the Indian Ocean.

Rhabdonella valdestriata Brandt

Fig. 38.

NOV
NOV
Lorica chalice-shaped with little suboral flare. Transition between lower part of bowl and horn proper gradual. Wall thickest in the upper part of lorica then gradually thinning towards aboral end. Horn tapers to a sharp point.

Total length 193μ , oral diameter 61μ . Ribs continuous, vertical and not branched.

Rhabdonella valdestriata was found in large numbers in November 1955 at most stations along the Israel Coast of the Gulf of Eylath.

Geographical distribution — Widely distributed in the Tropical Pacific, Indian Ocean, Red Sea and the Atlantic.

XYSTONELLIDAE Kof. and Campb.

Of the four genera included in this family, *Parasjavella*, *Xystonellopsis*, *Parundella* and *Xystonella*, only representatives of the latter two were found in the material from the Gulf of Eylath.

Parundella Jörg.

Xystonellidae with cylindrical upper bowl and thin, erect oral rim and a well developed caudal prolongation. Raised to status of genus by Kofoid and Campbell (1929).

Parundella inflata Kof. and Campb.

Fig. 39.

NOV
MAY
Lorica cylindrical and slightly inflated below its middle and again in the lower part of the cone. Wall double, hyaline, the two lamellae nearing each other towards the end of the caudal prolongation.

Length 118μ , outer diameter of mouth 35μ , inner diameter 28μ .

Scarce. Found in May 1956 both in horizontal and vertical samples collected off the Coast of Israel.

Geographical distribution — Recorded from the Pacific and equatorial regions of the Atlantic.

Parundella aculeata Jörg.

Fig. 43.

Lorica almost cylindrical in its upper half and conically protracted in a downward

direction. Lamellae distinct along whole length of lorica. Horn terminates in a sharp point.

Length 135 μ , outer diameter of mouth 30 μ , inner diameter 25 μ .

Rare. Found only once, in May 1956.

Geographical distribution — Reported from the Pacific, Atlantic, Mediterranean and the Indian Ocean.

Xystonella Brandt.

XYSTONELLIDAE with elongated lorica and long caudal prolongation showing close to the aboral end either a knob-like thickening or a dilatation separating upper portion and lower acicular one.

A circular groove at the oral end separates the outer and inner edges of the mouth.

Xystonella clavata Jörg.

Fig. 40.

Lorica elongated and caudal prolongation showing a lancet-shaped expansion at its end. This latter characteristic serves to distinguish this species from other species belonging to the genus *Xystonella*.

Total length 308 μ —325 μ , outer diameter of the mouth 70 μ , inner diameter 53.5 μ , aboral horn 100 μ .

Extremely rare. Found only once off the Great Waadi in November 1955.

Geographical distribution — Recorded from the Mediterranean and the Eastern Tropical Pacific, Atlantic.

Xystonella treforti (Dad.) Laack.

Figs. 41, 42.

Lorica similar to that of the previous species except for the dilatation present close to the end of the caudal prolongation which gives it a characteristic appearance.

Oral rim is sometimes denticulate due to the structure of the cell wall which is made up of hexagonal meshes.

Total length 330 μ , outer diameter of the mouth 70 μ , inner diameter 53.5 μ .

Very common and at times found in large numbers at all stations of the Gulf of Eylath. Perennial.

Geographical distribution — Known from the Mediterranean, Indian Ocean, Red Sea and Arabian Gulf and from the Atlantic and Pacific Oceans.

UNDELLIDAE Kof. and Campb.

The family is represented by one genus only, *Proplectella*. characteristic of warm water seas with some penetration, however, into cooler regions.

Proplectella Kof. and Campb.

The genus is characterized by urn-shaped loricae with rounded, pointed or flattened aboral end, with an inner collar and absence of suboral ledge. No rings present on surface of lorica.

The species included in this genus are highly variable in shape and it is, therefore, particularly hard to distinguish between well-defined species and transition forms. Thus, many of the forms described as varieties by Jörgensen (1924) have later been raised to the status of species by Kofoid and Campbell (1929, 1939). For this reason the seasonal distribution of the various species reported below in the Gulf of Eylath will apply to the genus as a whole except in individual cases when

the data collected on well-defined individual species warrant separate observations under these headings.

Proplectella praelonga Kof. and Campb.

Fig. 44.

Lorica elongated, ovoidal, with total length about 3 oral diameters. Oral diameter relatively narrow and maximum diameter of bowl at its mid-length. Lorica wall uniformly thick except at oral opening.

Total length 78μ , oral opening 23μ , maximum diameter 47.7μ .

Rare. Found sporadically in November 1955 and May 1956 in vertical and horizontal samples.

Geographical distribution — Known from the Eastern Tropical Pacific.

Proplectella claparèdei (Entz, Sr.) Kof. and Campb.

Figs. 45, 52, 53.

Lorica oval with maximum diameter generally below its middle. Cavity of lorica urn-shaped. Aboral end either round or slightly obtuse.

Very variable in shape and size.

Total length 82μ , oral diameter 45.5μ — 47.7μ .

Rare. The species was occasionally found in the summer and fall samples collected off the Israel shores of the Gulf of Eylath (July 1955, November 1955, May 1956).

Geographical distribution — Recorded from the Mediterranean, the Indian Ocean, the Atlantic and the Pacific.

Proplectella ostensfeldi Kof. and Campb.

Fig. 48.

This is one of the better defined species on account of the lorica which at the posterior end is distinctly pointed after reaching its maximum diameter a little below its middle. It is smaller than *P. claparèdei* and slightly wider than *P. angustior*, to which it is very similar.

Length 54.5μ , oral diameter 34.1μ , maximum diameter 42μ .

Geographical distribution — Recorded from the Eastern Tropical Pacific.

Proplectella perpusilla Kof. and Campb.

Figs. 49, 51.

Lorica thimble-shaped, somewhat narrower than in the preceding species and with the aboral end rounded. Maximum diameter a little below the middle of the bowl.

Total length 55μ , oral diameter 30μ , maximum diameter 40μ .

Very common. It was found at all stations in the Gulf except in December 1956 and March 1957, indicating a preference for higher temperatures of the water.

Geographical distribution — Recorded from the Eastern Tropical Pacific.

Proplectella angustior Kof. and Campb.

Fig. 50.

Lorica similar to that of *P. ostensfeldi* except in the more pronounced pointing of the lower bowl which starts at a little below the middle. Cell wall thinning gradually towards the aboral end.

Length 52μ , oral diameter 27.2μ , maximum diameter 35.2μ .

Fairly common in the Gulf during the summer (July 1955, May 1956) and fall (November 1955).

NON
rare
NOV
MAY
VERTIC
of HORIZON

82
47
rare
etc
July
NOV
MAY

NON

NON
MAY
DECEM

52
35
very common
July
MAY
NOV

Geographical distribution — Recorded from the Mediterranean, South Atlantic, Eastern Tropical Pacific.

Proplectella tenuis Kof. and Campb.

Fig. 46.

Lorica with maximum diameter close to posterior end. Aboral end pointed. Wall thinnest at aboral end where the two lamellae generally meet.

Length 72.5μ , oral diameter 40μ , maximum diameter 50μ .

Rare. Found sporadically in horizontal and vertical samples off Eylath in November 1955 and May 1956.

Geographical distribution — Recorded from the Atlantic Equatorial region and the Pacific.

Proplectella subangulata Kof. and Campb.

Fig. 47.

This species is easily recognized by its angularity which divides the lorica into 3 distinct sections: an anterior one formed by an inner collar 0.33 total length in length; a middle one appearing like an inverted truncated cone 0.50 total length in length, and a posterior one 0.15 total length in length, pointed and with convex sides.

Maximum diameter at lower end of inner collar where the lorica wall is the thickest.

Total length 68μ , oral diameter 40μ , maximum diameter 55μ .

Rare. Found sporadically off Eylath in November 1955 and May 1956, chiefly in vertical samples.

Geographical distribution — Reported from the Eastern Tropical Pacific.

Proplectella fastigata (Jörg.) Kof. and Campb.

Figs. 54, 55.

Lorica globose and thick-walled, with aboral end broadly rounded, convex sides, and short inner collar.

Length 68μ , oral end 32μ .

Rare. Occasionally found off the Israel Coast of the Gulf in November 1955 and May 1956, chiefly in horizontal samples.

Geographical distribution — Recorded from the Atlantic (Sargasso Sea, Gulf Stream) and the South Pacific.

Climacocyclus scalaria (Brandt) Jörg.

Fig. 57.

Lorica has general characteristics of the genus. A protruding rib runs in the middle of the helicoidal band parallel to the lorica wall. A thin, flaring membrane covers the protuberances on the outside, giving the organism a characteristic appearance.

Total length 236μ . Tube length 200μ . Oral diameter 40μ .

Found in small numbers at all plankton stations — except off the Quarry where it proved common in vertical samples — along the Coast of the Gulf, in November 1955.

Geographical distribution — Recorded from the Mediterranean, the Atlantic, Madagascar, south-west Australia and the Pacific.

NON
horiz &
vertical
NOV
MAY

NON
horiz
NON
MAY
vertical

NON

horiz
NOV.
MAY
HORIZO

236

40 μ

Common in
vertical.
NOV

FAVELLIDAE Kof. and Campb.

The family is represented in the material from the Gulf of Eylath by two genera: *Poroecus* and *Favella*.

Poroecus Cleve.

Poroecus curtus Kof. and Campb.

Fig. 56.

Lorica thimble-shaped, with abrupt constriction in the lower region, continued by conical aboral horn. Wall covered with polygonal meshes.

Total length 67.5μ — 57μ , oral diameter 26.4μ — 30μ , aboral horn 10μ — 15μ .

Geographical distribution — Reported from the Equatorial region of the Eastern Pacific.

Favella Jörg.

Favella azorica (Cleve) Jörg.

Fig. 58.

Lorica double-walled, almost cylindrical in the upper two thirds, then abruptly contracting aborally with a slightly protacted aboral end.

Length 63.6μ , oral diameter 45.4μ .

Rare. Found in several samples in July 1955 and May 1956 off the Israel Coast of the Gulf of Eylath.

Geographical distribution — Reported from the Mediterranean, Persian Gulf.

TINTINNIDAE Clap. and Laack.

The genera represented in the Gulf of Eylath material are included in the two sub-families SALPINGELLINAE and TINTINNINAE. They are *Eutintinnus* and *Salpingella* of the SALPINGELLINAE and *Amphorella*, *Dadayiella* and *Steenstrupiella* of the TINTINNINAE. The family itself is one of the best represented in the tropical marine fauna due to the great variety of forms in many of the genera.

Subf. TINTINNINAE Kof. and Campb.

Eutintinnus Kof. and Campb.

Lorica always open at both ends, oral region generally flared. Wall hyaline.

Eutintinnus franköii (Daday) Kof. and Campb.

Figs. 59, 62, 63.

Lorica tall, elongated, conically dilated towards the mouth and slightly dilated close to the aboral opening. There is no median bulge of the lorica.

Length 310μ — 340μ , oral diameter 45.5μ — 50μ , aboral diameter 22.7μ — 27.2μ .

Common. Frequently found in small numbers in July and November, 1955.

Geographical distribution — Frequently reported from the Eastern Tropical Pacific, the Indian Ocean and the Mediterranean.

Eutintinnus latus (Jörg.) Kof. and Campb.

Fig. 60.

Lorica stouter than in the preceding species. Slight median bulge present. Gradual suboral flaring and dilated aboral end.

Length 340μ , oral diameter 50μ , aboral diameter 34μ .

Rare. Found in May 1956 off the Quarry and in April 1957 at stations situated in the northern part of the Gulf down to White Cape.

NOV

63
45
Rare
July
MAY

310 μ
455
Common
July
NOV

340
50
rare
MAY
AVR

NOV
300
54
715
NOV

NOV
COM
MAY
AVR

19
45
NOV
NOV

163
35

RA
JUL
NOV
MAY

Geographical distribution — Reported from the Mediterranean, the Atlantic equatorial region.

Eutintinnus brandti Kof. and Campb.

Fig. 61.

Lorica with pronounced pre-median bulge and oral and aboral dilatations. The species is well-defined and easily distinguished from other forms.

Length 300μ , oral diameter 54.4μ , aboral diameter 38.6μ .

Very rare. Found only once in a vertical sample off the Great Wadi in November 1955.

Geographical distribution — Recorded from the Atlantic (Sargasso Sea), California, off Ceylon, New Zealand.

Eutintinnus medius Kof. and Campb.

Fig. 64.

This is a shorter and stouter species than the preceding ones. Lorica flares very gradually towards the oral rim and very slightly at the aboral end. Slight median bulge present.

Length 259μ , oral diameter 60μ , aboral diameter 34μ .

One of the most common species of *Eutintinnus* found in this material. It was recorded at all stations in the Gulf of Eylath especially during May 1956 and April 1957.

Geographical distribution — Recorded from the Atlantic, the Eastern and Western Pacific, Bay of Bengal.

Eutintinnus lusus-undae Entz, Sr.

Fig. 65.

This species, as mentioned also by Jørgensen (1924), is similar in many respects to *E. frankóü* and connected to it by intermediate forms.

Lorica almost cylindrical with pronounced dilatation at the aboral end which is bordered by a rim.

Length 193μ , oral diameter 45.5μ , aboral diameter 22.7μ .

Fairly common. It was found in both vertical and horizontal samples off the Israel Coast of Eylath, especially in November 1955.

Geographical distribution — Recorded from the Mediterranean, the Indian Ocean and the Pacific.

Eutintinnus elegans Jörg.

Fig. 66.

This species is conspicuous by the median bulge of the lorica and flaring oral and aboral ends. Oral rim present. Similar in shape to *E. brandti* but shorter and more slender.

Length 163.6μ — 180μ , oral diameter 23.5μ — 37.5μ , median bulge 35μ , aboral diameter 20μ .

Rare in the Eylath material. Found sporadically in July 1955 in a horizontal sample at the northern tip of the Gulf and in May 1956 off the Fishermen's House in Eylath.

Geographical distribution — Recorded from the Mediterranean and the Eastern and Southern Pacific.

non

300

54

very rare

found in

vertical

NOV

non

Common

MAY

AVR

193

45

very common

vertical

horizontal

especially

in NOV

163

35

RARE

July

HORIZONTAL

MAY

Eutintinnus macilentus (Jörg) Kof. and Campb.

Fig. 67.

Lorica shorter than in the preceding species and generally without a median bulge. Slightly dilated at the oral end. Oral margin with brim. Aboral end truncate and considerably narrower than the oral opening.

Length 130μ — 175μ , oral diameter 32.7μ — 47.5μ , aboral diameter 20 — 37.5μ .

Rare. Found sporadically in November 1955 and May 1956, near Eylath.

Geographical distribution — Recorded from the Mediterranean, Atlantic, New Zealand, Eastern Tropical Pacific and South Pacific Islands.

Eutintinnus apertus Kof. and Campb.

Figs. 68, 69.

Lorica chalice-shaped at the aboral end, narrowing abruptly to a short tubular section. Oral brim present. The Gulf of Eylath loricae are more similar to those described by Jörgensen (1924, p. 12, Fig. 640), who renamed this species *Tintinnus apertus* and later on (1939) *Eutintinnus apertus*.

Length 87μ — 100μ , oral diameter 34μ — 37.5μ , aboral diameter 17.5μ — 20.5μ .

The species was found at several stations in November 1955 and May 1956.

Geographical distribution — Recorded from the Mediterranean Sea and the Atlantic (Sargasso Sea and Equatorial region) and the Pacific Oceans.

Eutintinnus apertus var. *curta* var. nov.

Fig. 70.

Lorica similar in shape to that of the main species except for its being considerably shorter.

Length 55μ , oral diameter 27.5μ , aboral diameter 12.5μ .

Very rare. It was found only once off the Quarry in November 1955.

Salpingella Jörg.

The genus includes species with trumpet-shaped loricae and fins limited to the aboral region of the latter. It is mainly tropical in distribution with few representatives in cooler seas.

Salpingella acuminata (Clap. and Laack.) Jörg.

Fig. 71.

Lorica with widely spreading oral funnel and acuminate aboral end. It is considered a very variable species in length, oral dilatation and length of plicate region, according to its distribution in warmer or cooler waters (Jörg. 1924).

Length 277μ — 312μ , oral diameter 31.8μ — 37.5μ , diameter of lorica in the middle 16μ , plicate region 86μ .

Very rare. Found in May 1956 off the Great Wadi and in April 1957 off Taaba.

Geographical distribution — It is a widely distributed species recorded from the Mediterranean, Atlantic, Indian Ocean, various parts of the Pacific.

Salpingella attenuata Jörg.

Figs. 72, 73.

Lorica elongated, tapering gradually towards the aboral end. Fins in the lower region of the lorica vertical. Differs from *S. acuminata* in the smaller diameter of the lorica and in the more attenuated shape of its lower region.

Length 272μ , oral diameter 30μ , diameter of lorica in the middle 13.6μ , plicate region 63.6μ .

272
63M

The loricae recorded by Jörgensen (1924) from the Mediterranean are larger due to the lower temperature of the water.

rare

Rare. Found sporadically in May 1956, off the Israel Coast of the Gulf.

MAI

Geographical distribution — Recorded from the Mediterranean, Atlantic, Western and Eastern Tropical Pacific.

Salpingella decurtata Jörg.

Figs. 74, 75.

Lorica somewhat similar in shape to that of *S. acuminata* but considerably shorter.

101

Length 181 μ —186 μ , diameter of the mouth 20 μ , diameter of lorica in the middle 11.3 μ ; plicate portion $\frac{1}{4}$ — $\frac{1}{3}$ of total length of lorica. The dimensions of the Eylath loricae are somewhat larger than the ones recorded for this species by Jörgensen (1924) and Campbell (1942). The possibility therefore remains open that they might be intermediate forms between *Salpingella decurtata* and *S. acuminata* as suggested also by Jörgensen in the case of a similar lorica from the Mediterranean.

20

rare
vertical

Rare. Found in vertical samples off the Great Waadi in May 1956 and off Eylath and Taaba in April 1957.

MAI

Geographical distribution — Recorded from the Mediterranean and the Atlantic.

HVR1

Subf. AMPHORELLINAE Kof. and Campb.

Amphorella Daday

The genus includes species with single-walled vase-like lorica without aboral horn and closed at the posterior end. It has a wide distribution both in tropical and temperate seas.

Amphorella quadrilineata (Clap. and Laack.) Daday

Figs. 76, 77.

Lorica elongated with flaring collar and truncate posterior end, middle section of the doric tubular, generally of the same diameter as the oral opening, then gradually narrowing towards the aboral end. Four vertical fins present on the lower half to two thirds of the lorica. Wall thickest at the collar region.

Common

July

Length 100 μ —128 μ , diameter of mouth 46.6 μ —53 μ , diameter of lorica in the middle 30 μ —45 μ .

NOV

MAI

Common. Found at the northern end of the Gulf in July and November 1955, at all stations off the Israel Coast in May 1956, and at several stations including Eylath, Taaba and White Cape in April 1957.

100
46M

Geographical distribution — Cosmopolitan. Widely distributed in northern temperate waters and in warm waters. Reported from the Mediterranean, the Atlantic, Indian and Pacific Oceans.

Amphorella minor Jörg.

Fig. 78.

This species is considered by Jörgensen (1924) as a smaller variety of *A. quadrilineata* common mostly in tropical seas. It is indeed very similar to the preceding species but for the rather more inflated middle section of the lorica and smaller size. The collar is also lower in *A. minor* than in *A. quadrilineata*. The fins on the lower and middle section of the bowl similar to those of *A. quadrilineata*.

48M

Length 82 μ , oral diameter 48 μ , diameter of lorica in the middle 48 μ .

72
48M

The distribution of *A. minor* in the Gulf of Eylath material is similar to that of *A. quadrilineata*.

Geographical distribution — Recorded from the Mediterranean (*A. quadrilineata* var. *minor*), the Atlantic, Indian and Pacific Oceans.

Dadayiella Kof. and Campb.

A tropical genus including species with goblet-shaped lorica, collar with oblong facets and aboral horn terminated with or without an aboral knob or a pointed aboral tip.

Dadayiella ganymedes (Entz, Sr.) Kof. and Campb.

Fig. 79.

Lorica-chalice-shaped and pointed aboral horn has several ribs extending longitudinally from the oral margin to about 0.20% of the total length. Upper third of the lorica almost tubular, then gradually narrowing till the base of the aboral horn which is about $\frac{1}{4}$ of the total length.

Length 98μ — 112.5μ , oral diameter 23μ — 30μ , aboral horn 18μ — 25μ .

Found at all stations off the Israel Coast of the Gulf in May 1956, sometimes in higher numbers (the Quarry). Also recorded once in July 1955 at the northern end of the Gulf.

Geographical distribution — Recorded from the Atlantic and Pacific Oceans. Also from the Gulf of Aden, Arabian Gulf and the Bay of Bengal.

Dadayiella bulbosa (Brandt) Kof. and Campb.

Fig. 80.

Lorica tubular to slightly concave in its upper two thirds, then narrowing abruptly and continuing into a short caudal prolongation with a characteristically knob-like swelling at its tip. A number of short longitudinal ridges at upper end alternate with slightly larger ones extending from oral lip downwards for about 0.2% of the total length.

Length 72.7 — 87.5μ , oral diameter 27.2μ — 32.5μ , maximum diameter 30μ , aboral horn 13.5μ — 15μ .

Rare. Found occasionally off Eylath in November, 1955, off the Great Waadi in May 1956, and off Hamashbir House in April 1957.

Geographical distribution — Reported from the Mediterranean, the equatorial region of the Atlantic, and the Pacific.

Steenstrupiella Kof. and Campb.

AMPHORELLINAE with elongated loricae and rounded antapex. Closely related to *Amphorella*.

Steenstrupiella gracilis (Jörg.) Kof. and Campb.

Fig. 82.

This species mentioned by Jörgensen (1924) under the name of *Amphorella gracilis* is considered by this author as an unfinished lorica of a closely related species now known as *Steenstrupiella intumescens* Jörg. Kofoid and Campbell (1929, 1939), however, refer to it as a separate species. The lorica has a tubular bowl with a rather smaller diameter towards the middle then slightly increasing below. Collar with little flaring. No ridges or fins were observed on the lower bowl. The lorica of our single specimen belonging to this species is slightly longer than that reported by other authors.

Length 95μ , Oral diameter 32.5μ .

Rare.

Geographical distribution — Reported from the Mediterranean, Atlantic and the eastern and southern Pacific.

Steenstrupiella streenstrupii (Clap. and Laack.) Kof. and Campb.

Fig. 83.

Lorica elongated, with flaring collar and lower part of the bowl slightly expanded with rounded aboral end. The expanded part of the lower bowl covered with pronounced vertical ridges.

Length 140μ , diameter of mouth 32μ , diameter of bowl (middle region) 16.2μ , diameter of bowl (lower region) 32.2μ .

Common. Frequently found in small numbers along the Israel Coast of the Gulf of Eylath during spring, summer and fall.

Geographical distribution — Recorded from the Mediterranean, Indian, Atlantic and Pacific Oceans.

Steenstrupiella intumescens Jörg.

Fig. 84.

This species is closely related, as mentioned above, to *Steenstrupiella gracilis* except for the more elongated lorica gradually narrowing below its middle region towards the aboral end which is either truncate or rounded. A slight swelling noticeable in the middle part of the lorica.

Length 186μ , diameter of mouth 37.2μ .

Very rare. Found only once off Faraun Island in April 1957 in a vertical sample

Geographical distribution — Reported from the Mediterranean.

DISCUSSION AND CONCLUSIONS

The present report deals with 66 species and varieties of Tintinnina chiefly from the northern part of the Gulf of Eylath. These species belong to 24 recognised genera of which all but two, *Epiorella* and *Epicanella*, are represented in the adjoining Mediterranean Sea, though not always by the same species (Jørgensen, 1924, Rampi, 1950).

The number of species common both to the Mediterranean and this branch of the Red Sea is quite significant. 42 species out of a total of 90 listed in Jørgensen's Report on the Mediterranean Tintinnidae (1942) have also been recorded from our collections in the Gulf of Eylath. On the other hand, Rampi's Report on this group based on collections carried out off Monaco in 1950 includes only 23 species common also to the Gulf of Eylath out of a total of 66 species. This could be explained by the far more limited scope of Rampi's investigations off Monaco as compared with Jørgensen's work which was based on material collected by "Thor" over most of the Mediterranean, including parts of its eastern basin which might come within the influence of the Red Sea through the Suez Canal.

Even more striking is the similarity of the Tintinnid fauna between the Gulf of Eylath and the Tropical and Subtropical Pacific. Some 50 species found by us in the Gulf of Eylath have also been recorded from the Pacific and 35 from similar latitudes in the Atlantic. It is to be assumed that these are tropical species populating in varying degrees all the warm water seas.

Most of the species of Tintinnina listed in our Report are apparently new for the Red Sea as a specific marine environment. This is probably due to the very limited plankton research carried out in this region as evidenced by some of the most

140
32 μ
Common
from temp
etc

186
37.2 μ
found 1957
sub
in AVR

reliable references on this group which were available to the author (see list of references).

A continuation of this survey is therefore necessary in the whole of the Red Sea with a view both to acquiring additional data on the distribution and abundance of individual species in this region and to determining whether the Gulf of Eylath forms a separate sub-entity as regards its microfauna due to its geographical position as a closed sea branch.

Of the proven circumtropical species to which even the Red Sea is no exception on the basis of previous investigations, the following should be mentioned: *Codonella galea*, *Codonellopsis morchella*, *C. orthoceras*, *Cyttarocypris eucecryphalus*, *Petalotricha ampulla*, *Protorhabdonella simplex* and *Xystonella treforti*.

None of these and the other species included in the Report ever becomes really abundant in the plankton of the Gulf of Eylath, although a few of them are truly perennial. Of the latter mention should be made of *Codonellopsis morchella* and *Xystonella treforti* which are also far more common than most other species at any time of the year.

The occurrence of some temperate species like *Tintinnopsis beroidea* in the plankton of the Gulf of Eylath is surprising. In any case it can be assumed that this environment forms the most southern limit of its distribution as it is not reported either from the Indian Ocean or the Pacific, although known from the Mediterranean and the Atlantic.

A full evaluation of the Tintinnid fauna of the Red Sea in relation to that of neighboring seas and more remote ones will be possible, for reasons mentioned above, only after the examination of additional material from this marine environment as a whole.

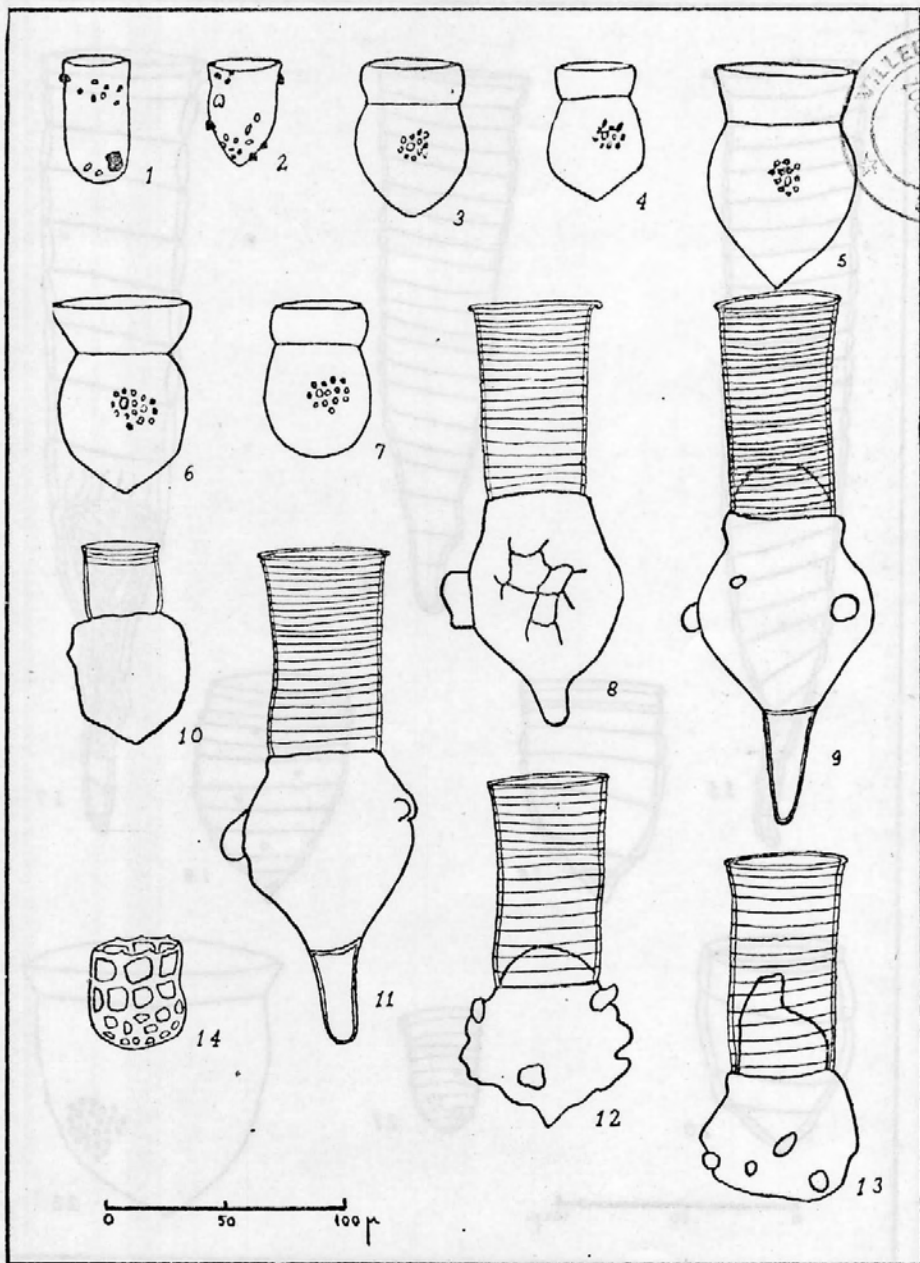
ACKNOWLEDGMENTS

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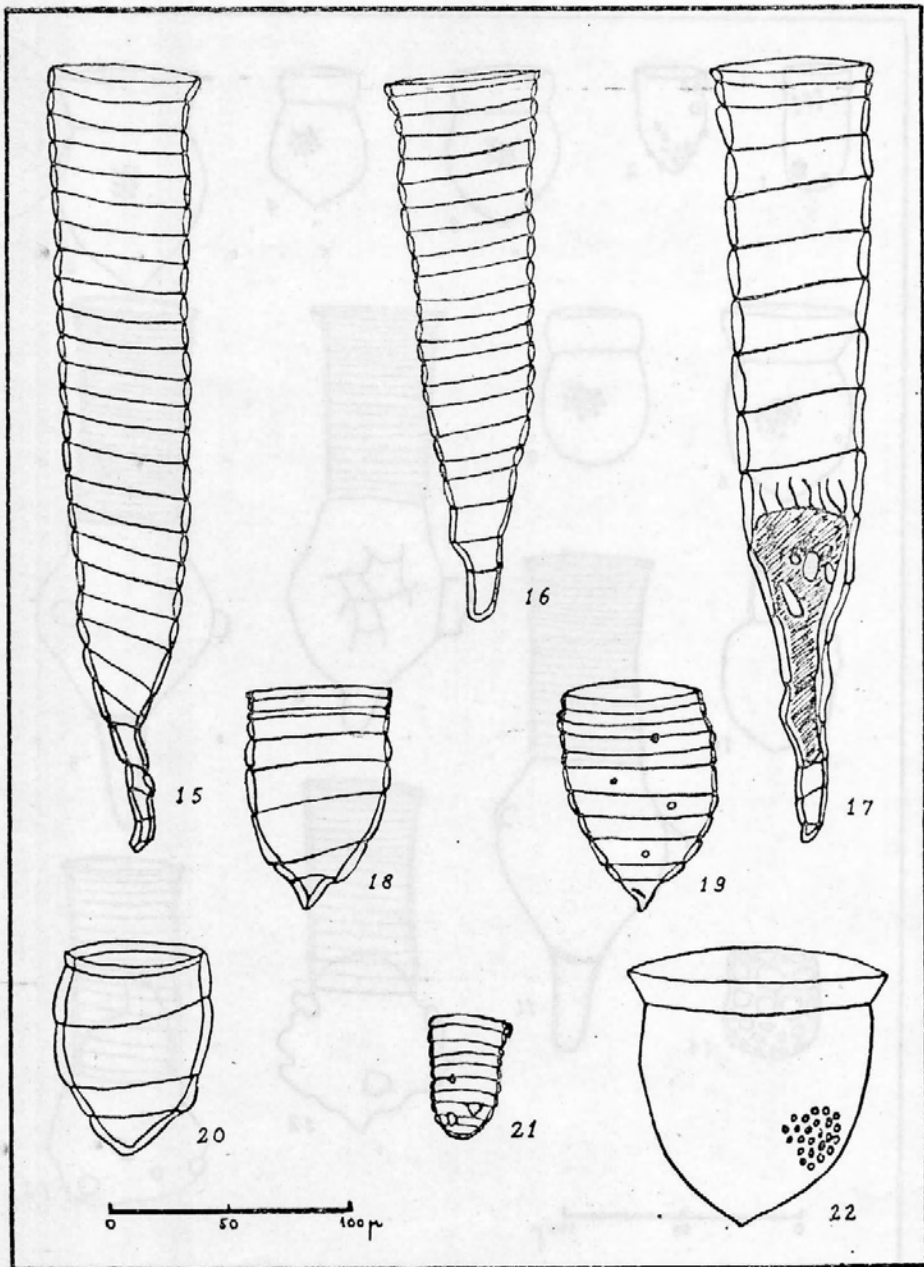
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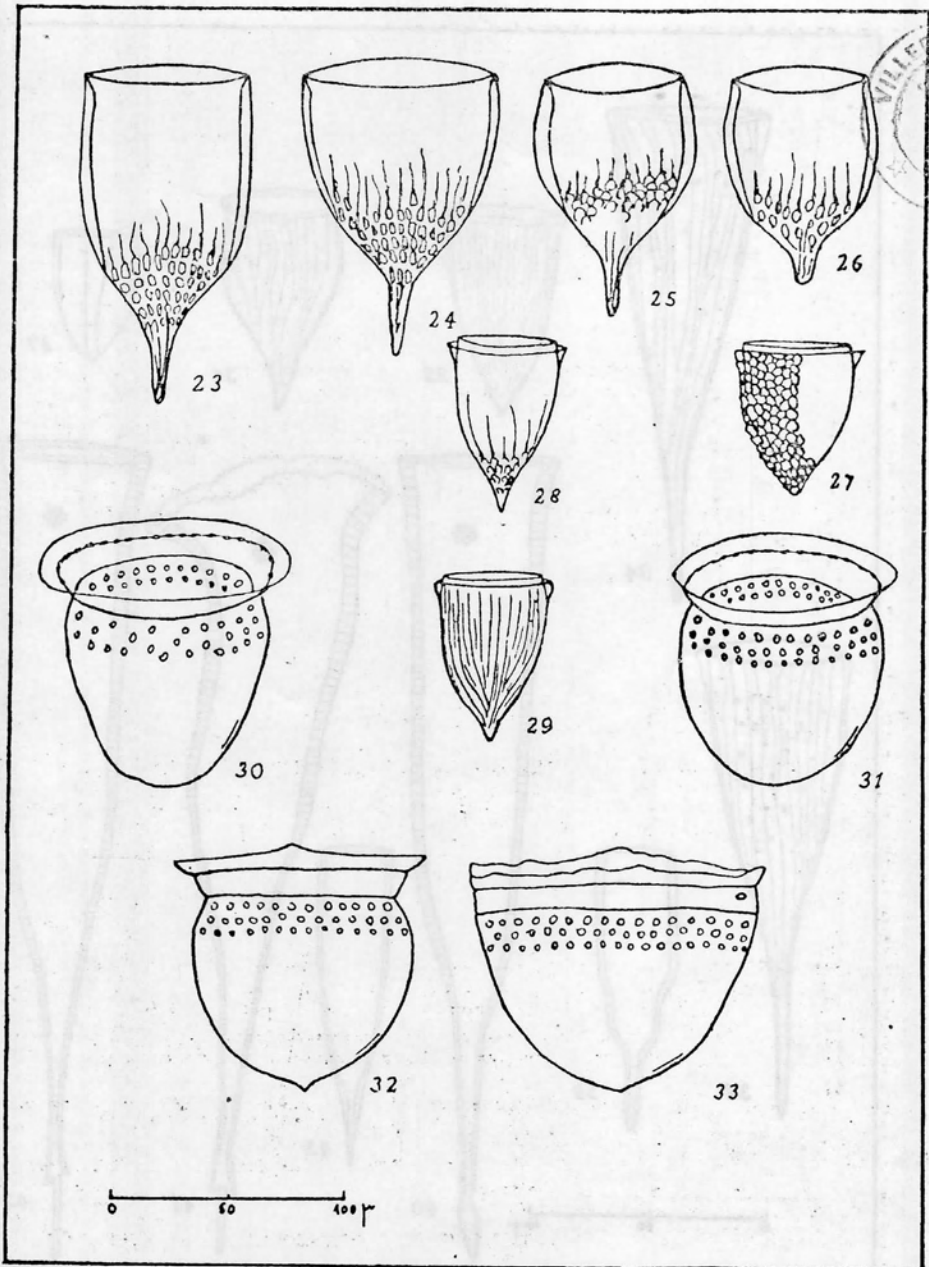
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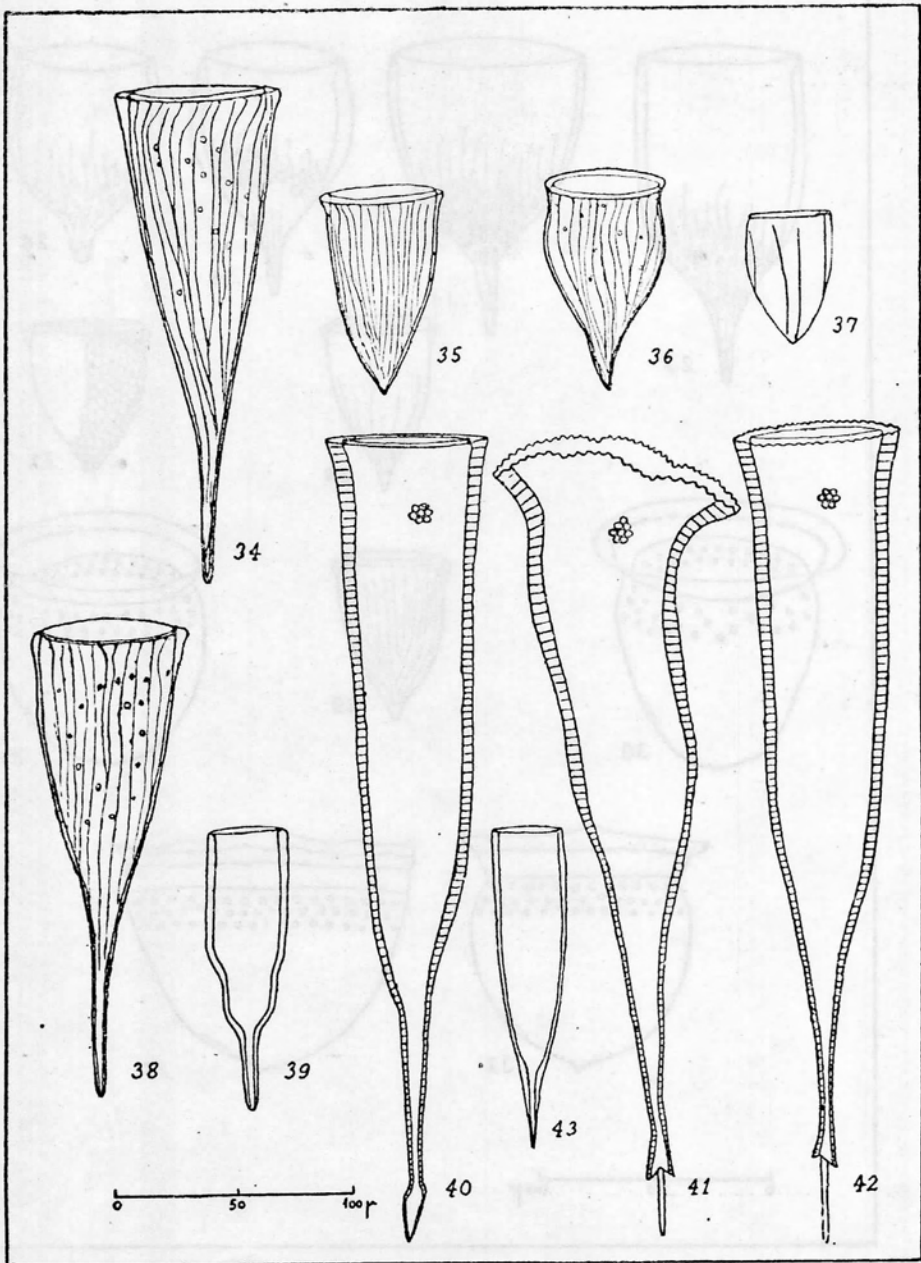
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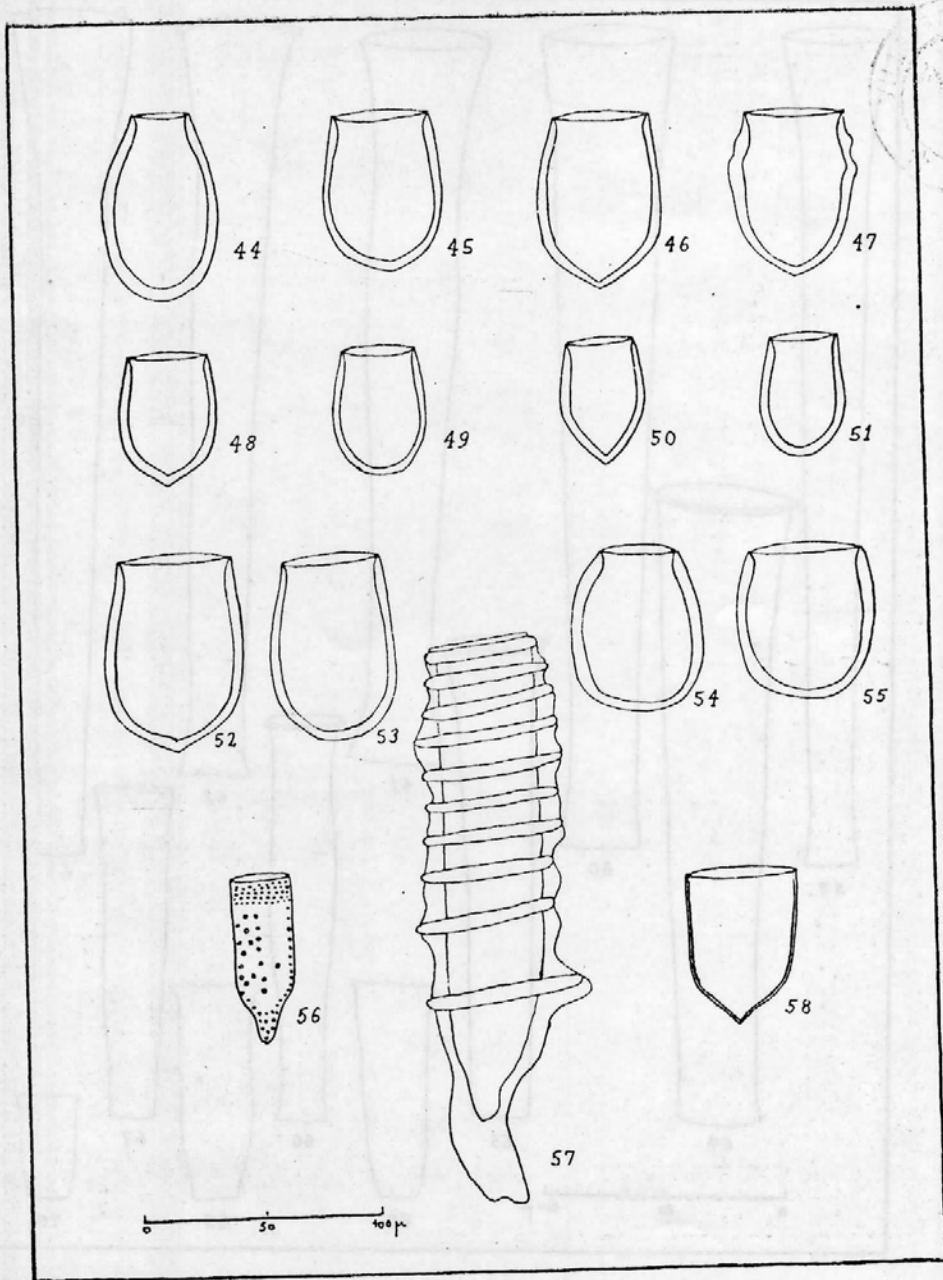
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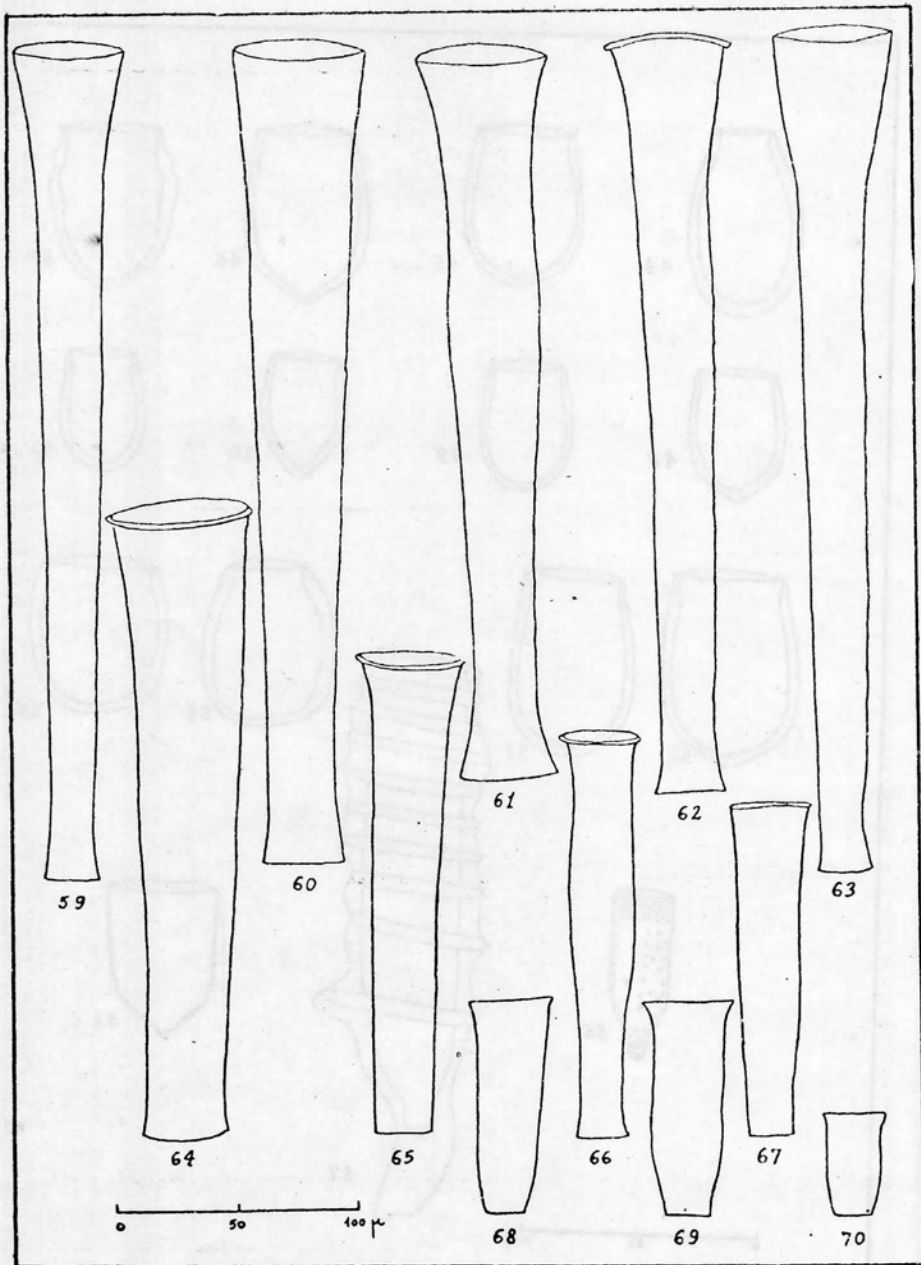
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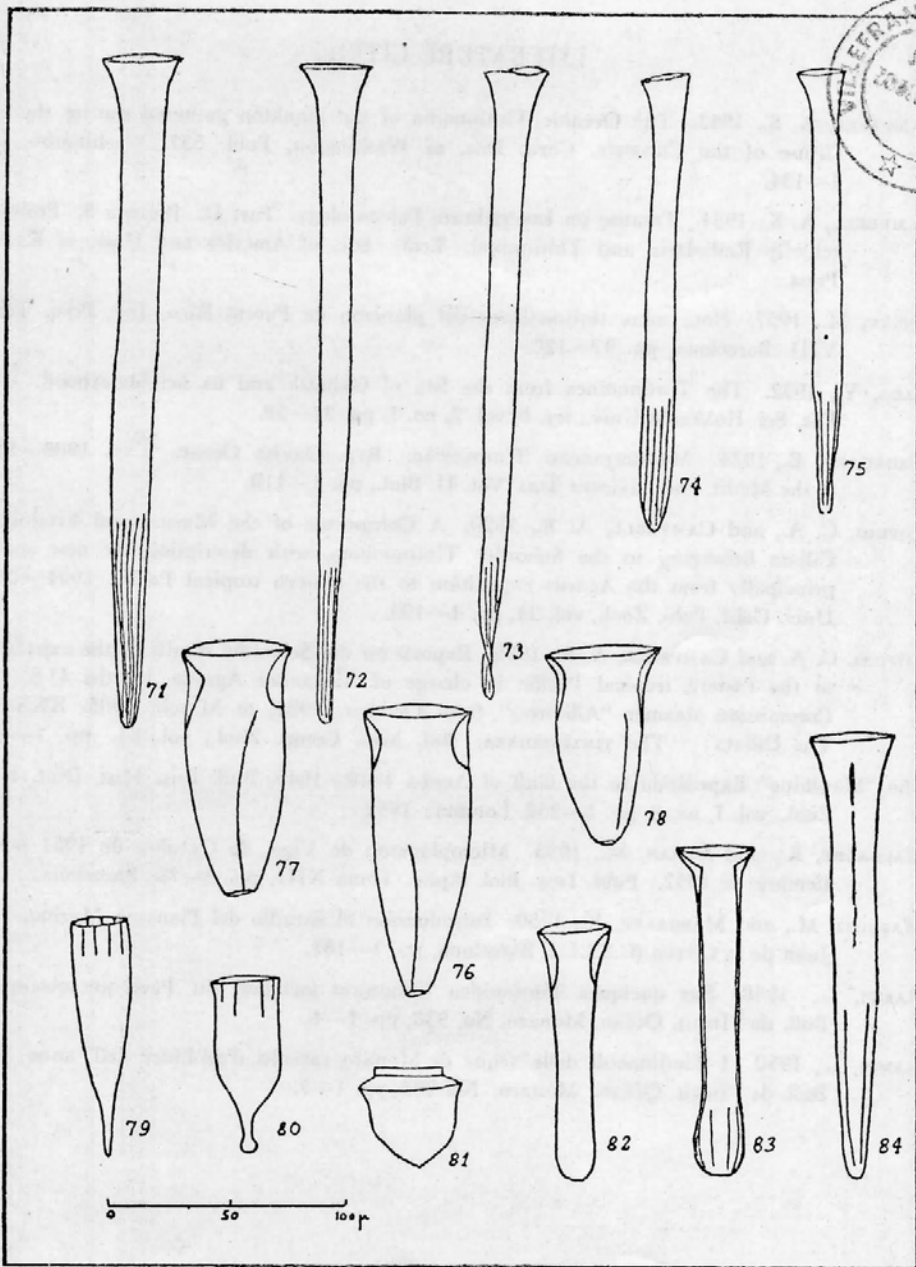
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