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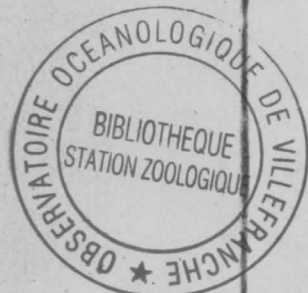
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Michèle LAVAL

1933

Tintinnids from Laguna Beach

Arthur S. Campbell



The tintinnid fauna of the Laguna Beach region, based upon a study of eight plankton samples, collected in June-August of 1932-1933, is made up of sixteen species comprising six genera of as many families of these loricate ciliates. Of the sixteen species only three have been previously reported in Southern California waters, and one other, *Coxiella subcaliforniensis*, is new. The remaining twelve are all known from Pacific waters, ten of them from the North Pacific, one from the Asiatic shoreline, and one from Panama. Nearly all of the sixteen species, except *Tintinnus tenuis*, are neritic; *Tintinnus tenuis* and *Tintinnopsis mortensenii* are pelagic as well as neritic. Two of the three species previously reported from this region are apparently confined to it; these two are *Tps.dadayi* and *Tps.reflexa* and both are known only from the kelp beds off San Diego.

The assemblage described below, while probably very far from a complete list, doubtlessly contains the common species of the Laguna Beach region and will be repeatedly found on further examinations. It would be interesting to see a series collected at daily intervals during the season, or at night in the luminescent plankton.

Some species are constant in the plankton and others are rare. *Stenosemella* and *Favella* are apt to appear and disappear from time to time; the former is most abundant in late Spring while *Favella* occurs most frequently in the Fall. *Tintinnus* is possibly a vagrant in neritic plankton while *Tintinnopsis* is almost certainly alloseasonal. *Tintinnidium* and *Coxiella* are usually rare.

The species are treated below in the systematic order adopted by Kofoid and Campbell (1929); this arrangement is generally utilized at present by others. All of the species described are figured by these authors, except *Coxiella subcaliforniensis* sp.nov.

The dinoflagellates will be reported at another time. Those noted belong to the Dinophysidae, Peridinidae and Ceratiidae.

Foraminiferans are doubtlessly common at Laguna. They should be sought in tide-pools, in sandy materials, along the bottom of the offshore region, and among hydroids. Those present in these places will be found to belong to the Miliolidae, Peneroplidae, Valvulinidae, Calcarinidae, Homotremidae, Nonionidae, and Rotalidae.

SYSTEMATIC LIST OF THE TINTINNOINEA AT LAGUNA

Family Tintinnididae Kofoid and Campbell.

This family differs from all others mainly in having finely alveolar walls and in lacking, in general, well-developed laminae.

Tintinnidium incertum Brandt.

The very long, slender, delicate lorica has a length of 13 oral diame-

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ters. The oral margin is thin, erect and entire. There is a very low suboral cylinder of less than 0.1 of the total length in length, below which the bowl expands to a diameter of nearly 1.5 oral diameters at a level established near 0.1 of the total length below the suboral cylinder. This diameter is maintained to within 0.1 of the aboral end. The aboral end is rounded and otherwise unmodified in form.

The wall is smooth and free from surface irregularities except for minute flecks which may be the remains of coccoliths. The wall is subuniformly thick for the greater part of the length of the lorica, thinning down only in the more or less differentiated suboral region.

The lorica had a length of 270 u.

The proportions of *Tdm. incertum* are such that the species may be at once told from *Tdm. neapolitanum*, and the regular wall is in marked contrast to the irregular one of *Tdm. mucicola*. All of the other species of the genus occur only in fresh water lakes.

Tdm. incertum was recorded at Laguna Beach only in July, 1933. It is otherwise known only from the Gulf of Tocantins off Brazil.

Family Codonellidae Kent, emended Kofoid and Campbell

This family has a coarsely alveolar lorica, which is generally saccular in shape.

Tintinnopsis acuminata Daday.

Tps. acuminata is a small, pointed test-tube like form with an irregularly flecked surface.

It has been reported from the Atlantic and Mediterranean, and at Laguna during August, 1933, it was rare.

Tintinnopsis bütschlii Daday.

This species resembles *Tps. dadayi* but is larger and lacks aboral inflation. It lacks an aboral horn which distinguishes *Tps. campanula*. The single specimen from Laguna had distinct suboral rings around the bowl and these are unquestioned evidences of the manner of formation of the lorica through the coöperation of substance-secretion and behavior. This species is almost certainly not a "tailless" form of *Tps. campanula* as has been suggested. It is not always associated with that species as Hofker (1931) states, and also, it may be added, it is rarely associated with *Tps. dadayi*. The fission of this species should be carefully studied under controlled conditions.

Tps. bütschlii is new to the west coast. It occurred at Laguna Beach in July, 1933.

Tintinnopsis dadayi Kofoid.

The fairly large lorica of this species is always abundant in the plankton of Southern California. It is about half as long as *Tps. bütschlii*, and has a bulb-like aboral inflation which the other species lacks.

Tps. dadayi was found at Laguna Beach in June-August 1932, and 1933. It probably occurs as far northward as Santa Barbara but not much beyond.

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Tintinnopsis levigata Kofoid and Campbell.

This is a tiny goblet-like species with rough, Favella-like walls, and is likely to be overlooked in carelessly examined plankton.

It has been seen only off British Columbia and at Laguna Beach occurred in August, 1933.

Tintinnopsis mortensenii Schmidt.

Figure 1.

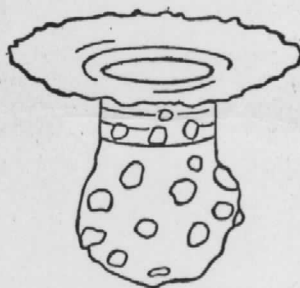


Fig. 1. *Tintinnopsis mortensenii*
Schmidt X550.

This beautiful little species has a lorica with an extraordinary, widely-flaring flat collar, and a short, thimble-like bowl; its length is only 0.86 of the oral diameter and the flat collar surrounds the aperture which is less than half of the diameter of the collar in diameter. The bowl arises at once below the aperture and is cylindrical for over 0.5 of the total length. The aboral region is broadly rounded, somewhat swollen, but otherwise lacks special modification.

The lorica from Laguna Beach was 65 μ in length and the oral diameter was 76 μ .

The wall is very regular save for surface flecks of alveolar material. Annular rings were present in the collar and around the upper part of the bowl.

Tintinnopsis mortensenii is so unlike the remainder of the genus that it can be told at once from them. The wide collar and short bowl are its outstanding characters. There is a series of aberrant species among which *Tps. chyzeri*, *Tps. incurvata* and *Tps. multirella* may be mentioned, that should be sought more attentively and these are not distantly related to *Tps. mortensenii*.

The lorica found at Laguna Beach differs from the type specimen in size, being 65 μ as against only 41 μ and the oral diameter was 76 μ as against 53 μ . It was also more inflated aborally than the type. Doubtless, these differences in size are due to the differences that obtain in the temperature of the water in different regions.

Tps. mortensenii was found only during June, 1932 at Laguna Beach. This is the first record of the species beyond Asia; it is also known off the Tocantins in the Atlantic and in Hong Kong where I have seen it in company with my *Codonellopsis kofoidi*, a new, and as yet, undescribed species. It is probable that it obtained entrance into California waters via the South-flowing California Current from off Japan, or else directly across the Equatorial Current.

Tintinnopsis reflexa Kofoid.

This tiny species has a reflexed collar unlike that of any other species of *Tintinnopsis*. The bowl is tube-like and the aboral end is rounded. The surface is reticulated.

Tps. reflexa appears to be strictly endemic in the neritic subsurface plankton of Southern California.

Specimens of *Tps. reflexa* from Laguna Beach differ from the type figure in that the collars are not as deeply reflexed, the bowls are aborally swollen, the lateral walls of the upper bowl are mildly concave, and the walls are reticulated with large surface areas. The process of division has been studied by Campbell (1929).

Tps. reflexa was found at Laguna Beach in June, 1932, and again in August, 1933.

Tintinnopsis sacculus Brandt.

The sack-like lorica is easily distinguished from other species of *Tintinnopsis*, and the aboral end is unpointed unlike *Tps. lata*.

Tps. sacculus occurs off Greenland, and at Laguna Beach it was found during August, 1933.

Tintinnopsis tubulosoides Meunier.

This moderately large species has characteristic rings on the bowl, a suboral flare, and a bluntly pointed aboral end.

One specimen was found off Laguna Beach in July, 1933.

Tintinnopsis undella Meunier.

The lorica is moderately large and with some lateral concavity, changing to a mildly swollen, round aboral end.

Tps. undella is recorded from the Kara Sea, U.S.S.R., and was found off Laguna Beach only in August, 1933.

Tintinnopsis wailesi Kofoid and Campbell.

The lorica resembles that of *Tps. acuminata* but is aborally pointed with a curved horn and the upper bowl has a spiral lamina.

Tps. wailesi was found only in August, 1933 from off Laguna Beach; otherwise it is known from British Columbia.

Family Codonellopsidae Kofoid and Campbell.

This family has a spiral collar and a well-developed bowl with dense structure.

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Stenosemella nivalis (Meunier) Kofoid and Campbell

The loricae of this species are common members in neritic plankton in many parts of the world but are also equally confused with the loricae of other species. The collar should always be examined for the presence or absence of low, demilunar windows.

S. nivalis differs from *S. ventricosa* in its smaller size, being about 40-60 μ as against 90 μ , and from *S. expansa* in smaller size and the lack of a wide, suboral shelf.

S. nivalis was found in June, 1932 off Laguna Beach.

Family Coxliellidae Kofoid and Campbell.

This family includes forms in which there is a well-marked spiral lamina forming the lorica in whole or in part, but in the latter instance never with a well-developed bowl.

Coxliella subcaliforniensis sp. nov.

Figure 2.



Fig. 2. *Coxliella Subcaliforniensis* sp. nov. X228.

The lorica is moderately tall, fairly narrow, and more or less thimble-like. It has a length of 2.12 oral diameters. The oral rim is minutely ragged and erect and is formed from the thin, upwardly projecting inner, or lining lamina. The suboral region is the unmodified continuation of the cylindrical portion of the bowl below. The cylindrical part of the bowl occupies 0.67 of the total length and retains virtually the same diameter for its whole length. The aboral third of the bowl contracts subregularly as an inverted dome with a length of 0.68 of the upper diameter. The aboral end is not modified in any way.

The wall is exceedingly regular and free from even slight irregularities in the cylindrical portion, but in the dome-like region it is wrinkled and quite irregular. The spiral lamina which forms the lorica makes ten turns. These turns are deflected from left to right and they are more or

less subequal in width; the widest ones are found in the region of transition between the cylinder and dome in which place some of them are as much as 0.33 of the oral diameter in width. The other turns are all less in width. The wall has a thickness of less than 0.1 of the oral diameter and is uniformly thin at all levels. Inner and outer laminae are only imperfectly formed; the inner one is best developed. Prismatic structure was not detected at all and the sutures between the spiral turns are evident only as dark lines.

The body contained two oval macronuclei, each of which was 20 by 10 u.

The single lorica had a length of 170 u and the oral diameter was 80 u.

Coxiella subcaliforniensis is a distinct species related to *C. annulata*. It is not as tall, being 2.12 as against 2.70 oral diameters, and is only about half as long in actual dimensions. It lacks the suboral flare, the lateral irregularity, and the pointed aboral end of *C. annulata*. It is differently proportioned to *C. ampla* which I have examined from material coming from Sydney, Australia. *C. ampla* is only 1.3 as against 2.12 oral diameters, and is only half as long, being 100 u as against 170 u in length. The aboral irregularity recalls that of *C. cymatiocoides* but the surface wrinkles, and the proportions serve to distinguish the two species. The aboral end is not as irregular as that of *C. frigida* or *C. minor*, and *C. subcaliforniensis* has little else in common with them.

Coxiella subcaliforniensis is clearly a member of the subgenus *Protocoxiella* for it has imperfectly formed laminae and poorly developed prismatic structure. It belongs then, with *C. ampla* and *C. annulata* and is the third member of the subgenus.

Coxiella subcaliforniensis was found only once, off Laguna Beach in July, 1933; this locality is, therefore, the type-locality.

Family Cyttarocylidae Kofoid and Campbell.

This family, or at least the section including *Favella*, has a roughened outer surface on the lorica, an aboral horn, and often one or two suboral rings.

Favella franciscana Kofoid and Campbell.

This is the common form which occurs along the coast of California from San Diego to British Columbia. It resembles *F. serrata* but is less regularly denticulate, more rounded aborally, and with a more regularly cylindrical bowl; the upper bowl often has a suboral bulge and contraction. It lacks the aboral fullness of *F. panamensis* and is 200-265 u in length.

Favella franciscana was found off Laguna in July, 1932-1933, and in August, 1933.

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Favella panamensis Kofoid and Campbell.

This very regular and handsome species has the characteristically variable pedicel, the suboral rings and the upwardly projecting inner lamina of the type figure. The prismatic structure was quite evident. The lorica had a length of 300 u while those described by Kofoid and Campbell (1929) were 136-232 u in length. Possibly, the larger sizes of the species at Laguna Beach is a reflection of cooler waters there than in some other places for the loricae of the Tintinnoinea are influenced by water temperature and size is usually inverse to temperature in these ciliates.

Favella panamensis occurred only in June, 1932 off Laguna Beach. It was moderately abundant at that time. Otherwise it is known only from the coast of Central America, and off Holland.

Family Tintinnidae Claparède and Lachmann, emended
Kofoid and Campbell

This family generally lacks fine prismatic structure and the loricae are thin-walled and of a wide variety of forms such as trumpets, tubes, cups or sacks. Usually there are well-formed laminae.

Tintinnus tenuis Kofoid and Campbell.

This species, which was named by Kofoid and Campbell (1929), is widely spread in the Pacific and Atlantic. It is related to *T. lusus-undae* from which it differs in its more slender shaft, and in the gradual anterior flare.

It was taken off Laguna Beach in July, 1933 and again in August, 1933. At the later date there were a number of the Chaetoceros with attached choanoflagellates. *T. tenuis* is common off San Francisco, and *T. pectinis*, a serrate species may be expected at Laguna Beach for it has been found at San Diego, and at San Francisco together with *T. tenuis*.

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