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PARASITIC INFUSORIA FROM MACQUARIE ISLAND

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WITH TWENTY-SIX TEXT FIGURES.

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PARASITIC INFUSORIA FROM MACQUARIE ISLAND.

By T. Harvey Johnston, Professor of Zoology, University of Adelaide.

(Twenty-six text-figures.)

Residues from dredging and shore collections of the Australasian Antarctic Expedition, remaining after material had been forwarded to specialists for report, was sent to me by the Director of the Australian Museum, Sydney, for further examination. Amongst some debris which formed part of a collection made by Mr. H. Hamilton in the vicinity of low tide mark near the northern end of Macquarie Island, were found (1) some lamellibranchs, *Gaimardia coccinea* Hedley, containing numerous peritrichous ciliates; and (2) an Asellid crustacean parasitised by a suctorian. These two parasites appear to be new and are described as *Urceolaria gaimardiae* (Urceolariidae) and *Ophryodendron macquariae* (Ophryodendridae), respectively.

The type material has been mounted on slides and is deposited in the Australian Museum, Sydney.

Ophryodendron macquariae *n.sp.* (figs. 1–14).

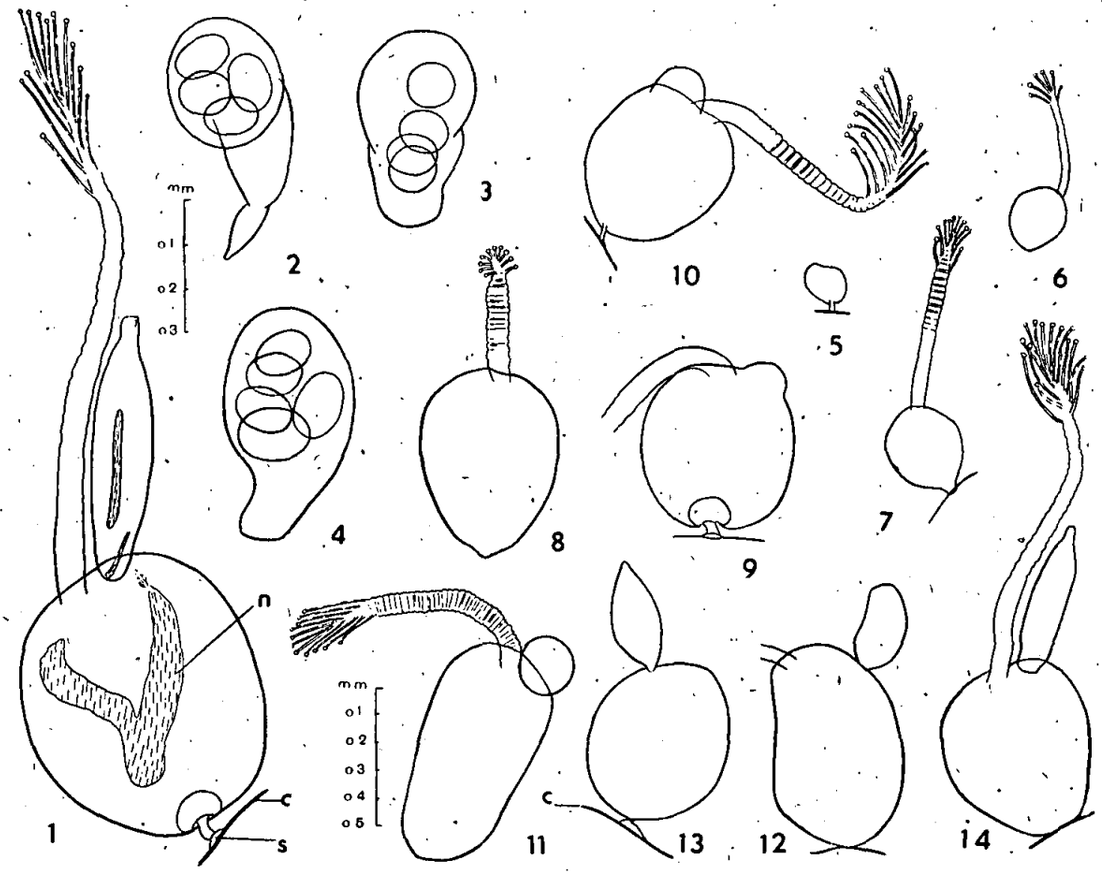
While searching through some material collected by Mr. H. Hamilton by scraping the under surface of stones just below low tide mark, at the northern end of Macquarie Island, there was found a specimen of a small Asellid crustacean with a number of parasitic suctorians attached to one leg. The host was identified by Mr. H. M. Hale, Director of the South Australian Museum, as *Munna novazelandica* Chilton.

The material is poorly preserved and as a result, cytological detail is not satisfactorily discernible. The species belongs obviously to *Ophryodendron* (Ophryodendridae). The proboscidiphore (proboscidiform individual of various authors) and vermiform stages, as well as ciliate embryos, are represented.

The proboscidiphore.

The smallest specimens are almost circular in face view, 17 μ diameter; 15 by 16 μ; and do not exhibit a proboscis, though a minute stalk was detected in one. Arranged in order of increasing dimensions, animals were found with the following respective lengths and breadths, 30 by 22 μ (proboscis not seen); 24 by 20, with a proboscis 50 μ long; 35 by 30, with a proboscis 74 μ long by 5 μ wide. Larger specimens were 60 by 50 μ; 82 by 65; 73 by 60; 60 by 45; 57 by 50; 65 by 60; 68 by 62; 83 by 42; and 75 by 47 μ; all of these exhibiting some degree of budding, the length of the developing

vermiform individual not being included in the length of the parent. The full-grown proboscidiphore individuals are thus more or less rounded in most cases.



Figs. 1 to 14.

Fig. 1. Adult proboscidiphore with vermiform bud about to be set free. 2–4. Individuals with ciliate embryos. 5. Smallest individual seen. 6–8. Stages in growth of the proboscidiphore. 9–14. Stages in the development of the vermiform individual.

Figs. 1–4 drawn to scale indicated between figs. 1 and 2; remainder to scale to left of fig. 11.
c, cuticle of crustacean; n, meganucleus; s, stalk.

The stalk is extremely short and narrow and commonly not visible. It measures 2 to 5 μ long, its region of attachment to the crustacean being flattened into a raised disc of about 10 μ in diameter. Its distal portion merges into a rounded vacuole-like structure within the body of the suctorian, this region perhaps being a thickening of the cuticle rather than a vacuole.

The meganucleus was seldom recognisable. In a specimen with a well-developed vermiform bud, it appears as a large Y-shaped structure, one limb having, no doubt, supplied the bud with its nucleus. The micronucleus was not seen. "Tinctinkörper" were detected in some cases and, as Martin (1909) has pointed out, represent the remnants of nuclear material derived from the prey.

The proboscis varies considerably in its dimensions according to the degree of contraction. The longest seen is 140 μ with a breadth of 6 μ. The widest measures 10 μ in breadth and 120 μ in length. In a specimen 24 μ long by 20 μ the proboscis is 50 μ

long. In all cases the length has been taken from the free end of the tentacles to the free end of the animal, that part of the proboscis which is surrounded by the body not being taken into account. The surface is markedly annulate in most specimens—due to contraction, and the delicate myonemes from the stalk to the tentacles can be detected. The tentacles seem to be variable in number, about 16 being the maximum. They are restricted to the distal quarter of the proboscis. The terminal suckers are very minute.

The vermiform individual.

All of those seen were still attached to the parent suctorian. The oldest, which was probably about to become liberated, measures 60 μ in length, with a maximum breadth of 13 μ, narrowing to 4 μ at its area of junction with the parent, while the free end narrows more rapidly to terminate in a squarish portion 4 μ wide. The form is thus somewhat cigar-shaped. The nucleus is long and cylindrical. A minute stalk was seen, still lying within the tissue near the region of attachment. The bud, which apparently develops singly on the proboscidiphore, appears first as a low broad swelling with a rounded free margin. As the process lengthens its base becomes constricted very considerably and the more or less fusiform or columnar shape assumed. Young individuals measured 33 by 18 μ; 4 by 18 μ; 57 by 23 μ; while the buds measured 6 μ long by 20 μ wide at the base; 10 by 20; 15 by 20; and 20 by 20 μ.

Ciliate embryo.

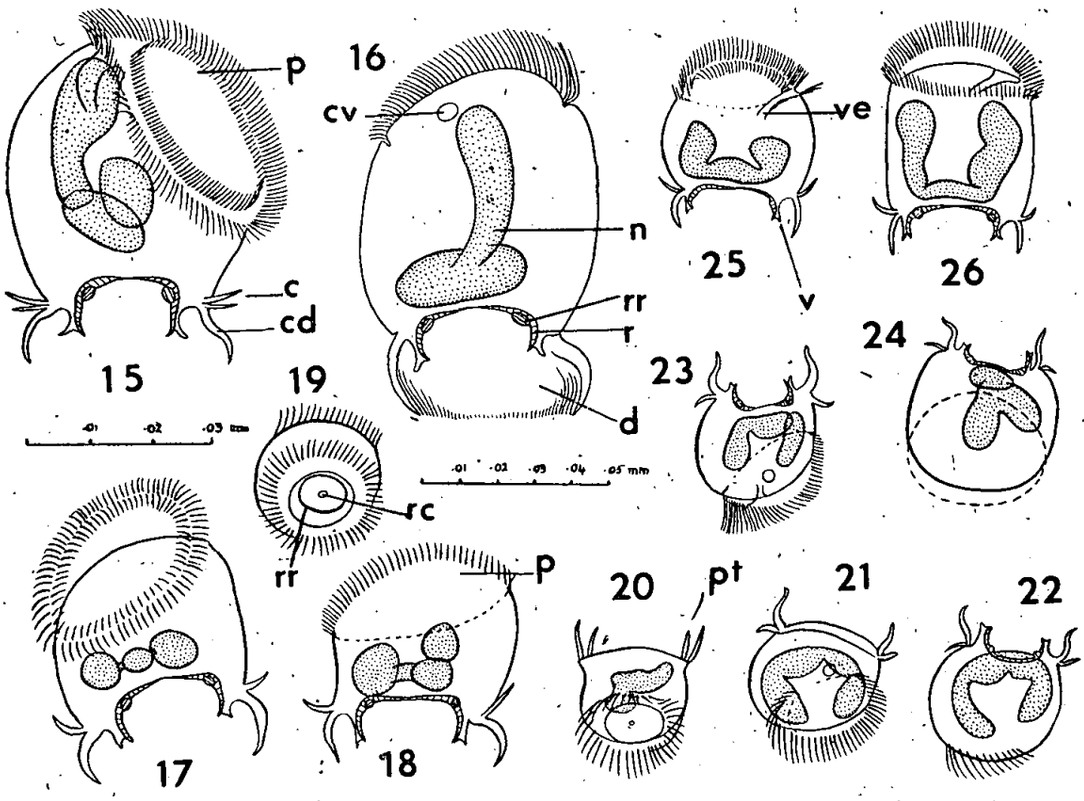
A few individuals which are probably proboscidiphores, since they resemble those figured by Martin (1909, pl. 15, fig. 7), were seen to contain ciliate embryos. These adults are devoid of apparent proboscis and are more or less club-shaped, with a narrowed stalk-like basal portion, and with non-staining cytoplasm. The largest number of embryos seen in any one individual was five. The measurements varied from 13 by 8 μ to 17 by 12 μ, most of them being about 13 by 10 μ. In one case a single embryo is present, measuring 28 by 20 μ, this perhaps being really an embryonic mass which has not undergone fission to produce embryos as described by Martin.

This species differs from *O. trinacria*, *O. multicapitatum*, and some others by its possession of a single proboscis. It is distinguished from other forms, including *O. abietinum*, by its general shape and its very short stalk. *O. pedicellatum*, as figured by Delagé and Herouard, and by Bütschli (1889), resembles its proboscidiphore in some features, but differs in the features just mentioned. *O. conicum* Schröder (1907, 359), found on the legs of a copepod collected by the " Gauss " in October, 1902, while drifting in the Antarctic pack ice near Posadowsky Bay, north of Gaussberg, has a conical body, four to six proboscides and a long stalk.

URCEOLARIA GAIMARDIAE *n.sp.* (figs. 15–26).

This small *Trichodina*-like peritrichous infusorian was obtained from the mantle cavity of several specimens of the small, delicately-coloured bivalve, *Gaimardia coccinea* (or *G. trapezia* var. *coccinea*) Hedley, found amongst green algae in the littoral zone of Buckle's Bay, Macquarie Island. The molluscs had been preserved merely by being placed in alcohol along with the algae.

The body form is rather variable, but usually appears rounded or somewhat helmet shaped, the appearance depending on the position of the animal. The dimensions of a number taken at random, measuring as length the distance from the bottom of the aboral disc to the middle of the peristome, and as breadth, the maximum width (approximately mid-width) of the body, were as follows :—40 (50) μ by 40 μ; 35 (42) by 40; 33 (48) by 38; 27 (33) by 35; 24 (35) by 30; 25 (40) by 32; 20 (30) by 30 μ. The figure in brackets after the length indicates the total length, *i. e.*, from the peristome to the outer end of the post-oral ciliate ring, the difference between the two figures thus indicating the distance (6 to 15 μ) from the base of the sucker-discs to the free edge of its cilia.



Figs. 15–26.

Figs. 15–18 drawn to scale below fig. 15; 19–26 drawn to scale between figs. 19 and 23. Fig. 26 probably represents the natural uncontracted condition. All figures except 21 to 24 are drawn with the disc directed toward the bottom of the page.

c, cirrus; cd, ciliate ring of disc; cv, contractile vacuole; d, disc; n, meganucleus; p, peristome; pt, peristomial tentacles; r, rosette; rc, uncuticularised midregion of the base of the rosette; rr, rosette ring; v, velum; ve, vestibule.

Zick (1928, 361, fig. 4) in his excellent account of another marine form, *Urceolaria korschelti* from the gill cavity of *Chiton* from Heligoland, referred to the normal form of that species, while alive, as a regular cylinder with its height about the same as its radius, the postoral disc not being taken into account in assessing the height. He went on to state that dead and preserved specimens were bell-like, helmet-like or turban-shaped, such forms (shown in his figures on plate 7, figs. 4, 5) being artefacts produced by the strong contraction of the peristomial myonemes during the death of the animals.

Extremely few of our specimens exhibit the cylindrical form, the measurements in such a case being 40 μ (60 μ total length) by 37 μ, so that the species is relatively longer and narrower than *U. korschelti* whose dimensions are, height 20–25μ and diameter 30–35 μ.

The peristome and the postoral disc in our material is lying nearly always in quite different planes, indicating perhaps a much more marked contraction of one side of the parasite. They make an angle of about 60° in forms lying in such a position as to allow the inclination to be measured.

The form of the peristome depends on the degree of contraction of its sphincter myonemes. It varies from being a practically flat disc—the normal state—to a strongly arched dome which is a common condition in the specimens examined. The peristomial cilia are arranged as in *U. korschelti* as a sinistral spiral when viewed from the front and following the curve outwardly from its inner end. The cilia have a length of about 15 to 20 μ. The two parts of the spiral are rather close together and the amount of overlap is small. The vestibule, at first shallow, eventually dips down into the cytoplasm for a short distance in the vicinity of the rounded contractile vacuole. The undulating membrane in the cytopharynx was not recognised.

The aboral disc, or sucker, retains its form because of its well-marked cuticularisation. It has a well-developed hollow, with a nearly flat base. The walls are supported at their base by an especially thickened internal ring, elliptical in section, connected with a thinner portion forming the cuticular part of the base of the cavity, the central part of which remains as a thin, rounded, non-cuticularised region. The upright part of the wall forms a prominent projecting circular rim ending in an in-turned free margin. The height of this cuticularised portion of the adhesive apparatus is about 10 μ, and the maximum diameter 17 to 20 μ, the diameter at its opening being about 13 to 16 μ. Its surface is marked by extremely delicate radial ridges (" Haftrosette " of Zick, figs. 4, 6) extending across the free margin and the base. No trace of definite teeth was detected, nor could the architecture of the supporting ring (" Haftring " of Zick, figs. 7–8) be determined. The velum lying immediately outside the ring is very delicate, and just outwardly from it is the prominent circlet of very numerous fine cilia resembling an undulating membrane and so arranged as to form a deep cup at whose base lies the cuticularised adhesive structures already mentioned. Outwardly from the aboral cilia, and projecting more or less at right angles from the body and bending forwards, is the series of stronger cilia or cirri (" Tastcilien " of Zick), 10 μ long.

Though the tiny rounded micronucleus was seldom seen, the large branched meganucleus was obvious. It consists of a large disc-like central mass close to the adhesive ring and from this there extend forwards two prominent masses terminating a short distance from the peristome, so that a characteristic shape is produced. The marked bifid condition of the ends of these arms figured by Zick as occurring in *U. korschelti* was not seen, though a thickening of the free extremities is present.

The organism belongs to the Urceolariidae Stein as defined by Doflein (1929, 108), and to the genus *Urceolaria* as diagnosed by Doflein and by Zick. The latter has given a summary of the various species assigned to the different genera in the family. Our form seems to approach more nearly to *U. korschelti*, but differs in its dimensions, form, and nuclear structure.

Remarks on Urceolaria and Leiotrocha.

Since the foregoing report was submitted for publication, it has been ascertained that *Urceolaria* Stein 1854 is preoccupied by *Urceolaria* Lamarck 1801.* The latter author in 1816 gave a diagnosis, placed his genus between *Furcularia* and *Vorticella*, mentioning the differences between it and the latter. He gave a list of twenty-six species, many of them having been referred to previously by Müller in his Animalcula Infusoria. Lamarck (1816, 22, 40) classed these genera as belonging to the rotifers. Sherborn, in his Index Animalium, referred to *Urceolaria* Lam. 1801 as ? Infusoria.

Harring† in his Synopsis of the Rotifers, stated that Lamarck had established in 1801 a monotypic genus, *Urceolaria*, for *Rotifer redivivus* Cuvier, though *Rotifer* of Cuvier 1798 was also monotypic, being based on *Vorticella rotatoria* Müller 1773, which Cuvier renamed. He designated *U. rediviva* (Cuv.) Lam. as type of *Furcularia* Lam. 1816, but assigned *F. rediviva* as a synonym of *Rotaria rotatoria* (Pallas 1776), *Urceolaria* Lam. 1801 being placed along with *Rotifer* Cuv. 1798, *Furcularia* Lam. 1816, and other genera as synonyms of *Rotaria* Scopoli 1777, a monotypic genus with *Brachionus rotatorius* Pallas as type.

Stein's genus is now placed by authors along with *Vorticella* amongst the Peritricha, though they are assigned to different families or subfamilies. As will be indicated later, Bütschli (1889) considered Lamarck's genus to be, at least in part, the same as that of Stein. From the foregoing it becomes obvious that the two are quite distinct, and, consequently, Stein's name is no longer valid, as also is the family name Urceolariidae which Stein (1867) based on it. The type *U. mitra* (Siebold 1850) Stein 1854,‡ from a freshwater planarian, *Planaria torva*, was referred to by Saville Kent (1882, 649, pl. 31, fig. 44; pl. 33, fig. 22) who gave an account of it and republished the figures of Stein and of Claparède and Lachmann.§

In 1888 Fabre-Domergue‖ described a new genus and species, *Leiotrocha serpularum*, from Serpulids. Bütschli (1889, 1758) retained Urceolariidae Stein, but suppressed *Urceolaria* as a synonym of *Trichodina*. He also listed Lamarck's genus as

* Lamarck, Hist. Nat. Animaux sans Vertébrés, 1801, 389 (not available); and *Idem.*, 2, 1816, 40.

† Harring, H. K., Synopsis of the Rotatoria, U.S. Nat. Mus. Bull. 81, 1913, 226 pp. (pp. 50, 91, 92).

‡ Stein, Die Infusionsthiere, etc., 1854.

§ Claparède, E., and Lachmann, J., Études sur les infusoires et les rhizopodes. Mem. Inst. Genevois, 5, 1857 (1858), 160 pp.

‖ Fabre-Domergue, P., Récherches anatomiques et physiologiques sur les Infusoires ciliés. Ann. sci. nat. zool., 5, 1888, 129; Études sur l'organisation des Urceolaires, etc. Jour. Anat. Physiol., 23, 1888, 214–260; Note sur la famille des Urceolaires. C. R. Soc. Biol., 5, 1888, 238–241.

a partial synonym of *Vorticella* (p. 1763), *Ophrydium* (p. 1768) and *Stentor* (p. 1728), and regarded *Leiotrocha* as synonymous with *Cyclochaeta* Jackson, which is now generally considered as belonging to *Trichodina*.

Perrier* quoted the family Urceolariidae as containing *Cyclochaeta*, *Trichodina* and *Urceolaria* Lamarck, the last-named with one species, *U. torva*, from fresh water planarians, the specific name being apparently a lapsus for *U. mitra* whose host is *Planaria torva*. In the Zoological Record for 1888 and in the Index Zoologicus (I, 1902, 194) the name is quoted incorrectly as *Leiotricha*. Wallengren† who reviewed the family Urceolariidae, placed *Leiotrocha* under *Urceolaria*. Zick (1928) gave a summary (pp. 392–398) of all the species of *Trichodina* and other genera belonging to the Urceolariidae, and followed Wallengren in regarding *Leiotrocha* as a synonym of *Urceolaria* (pp. 395, 397). He regarded as valid species of the latter only *U. mitra*, *U. serpularum* and *U. korschelti*.

From the foregoing remarks it is obvious that *Leiotrocha* is available to replace *Urceolaria* Stein. The three species mentioned by Zick, together with the new one described in this paper, should then be transferred to *Leiotrocha* as *L. mitra* (Siebold), *L. serpularum* Fabre-Dom., *L. korschelti* (Zick), and *L. gaimardiae*, while the family name should become Leiotrochidae.

Calkins‡ (1926) referred to some of the genera and placed the group provisionally as a sub-family, Urceolarinae (sic), *i.e.*, Leiotrochinae, of the Vorticellidae.

Another genus which should be considered in connection with the suppression of *Urceolaria* Stein, is *Trichodinopsis*. The latter was erected by Claparède and Lachmann (1858) for a new species, *Tr. paradoxa*, from the respiratory region of a land mollusc, *Cyclostoma*, from Switzerland. Kent (1882, 614, 615, pl. 31, figs. 39–43) gave a diagnosis of the genus and species, republished the original figures, and created the family Trichodinopsidae (Heterotricha) to receive it. He mentioned that, apart from the general surface being finely ciliate, the characters of the genus resembled those of *Trichodina*, *Trichodinopsis* forming a connecting link through the latter with the Peritricha.

Bütschli (1889, 1760; pl. 72, fig. 13) gave an account of the species, placing the genus in the sub-family Urceolarina (*i.e.*, Urceolariinae). Perrier (1893, 518) recognised Kent's family name, but placed the group in the Oligotricha. The papers of Issel (1906)§ and of Cépède and Willem (1911)‖ relating to *Tr. paradoxa* are not available. Calkins (1926) regarded *Trichodinopsis* as a distinct genus, as also did Doflein (1927, 1209). Zick (1928, 396–7) gave a summary of the characters of the species, and

* Perrier, E. Traité de Zoologie. Fasc., 2, Protozoaires, 1893, 519.

† Wallengren, H. Studier ofver Ciliata Infusorier. Bidrag till kannedomen om famil Urceolarina Stein. Acta Reg. Soc. Physiogr. Lund, 33, 1897.

‡ Calkins, G. Biology of the Protozoa, 1926, 396, 411.

§ Issel, R. Intorno alla struttura ed alla biologia dell' infusorio Trichodinopsis paradoxa. Ann. Mus. Civ. Genova (3), 2, 1905–6 (1906), 334–357.

‖ Cépède, C. and Willem, V. Observations sur Trichodinopsis paradoxa. Bull. scient. France et Belgique, 45, ser.7 3, 1911, 239–248.

mentioned that the accounts given by Issel and by Cépède and Willem differed considerably. He doubted whether the genus was distinct, though he listed it as a fourth genus of the family (p. 399), and thought that it was probably an *Urceolaria* modified in accordance with the special habits of its terrestrial host (p. 397).

If *Trichodinopsis* be synonymous with *Urceolaria*, then it has priority over *Leiotrocha* and the species belonging to it would be *Tr. paradoxa* and the four herein attributed to *Leiotrocha*, viz.: *Tr. gaimardiae, mitra, korschelti* and *serpularum*, and the family should be known as Trichodinopsidae Kent.

Muel'er (1932, 140) in his account of *Trichodina renicola* from a fish, *Esox niger*, retained *Urceolaria* as a valid genus distinct from *Cyclochaeta* and included both under Urceolariidae. Fulton's paper (1923) reviewing this family is not available.

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