A taxonomic study of sessile peritrichs (Ciliophora: Peritricha) associated with crustacean fish ectoparasites in South Africa

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Three new and four known species of sessile peritrichs were identified from the crustacean ectoparasites, *Lernaea barnimiana* (Hartman, 1870), *L. cyprinacea* Linnaeus, 1758 and *Dolops ranarum* (Stuhlmann, 1891) from various fish hosts in South Africa. The new species described are: *Epistylis cyprinaceae* sp. n., *E. epibarnimiana* sp. n. and *Epistylis magna* sp. n. Comparative descriptions of the four known species are given, i.e. *Vorticella convallaria* (Linnaeus, 1758), *V. microstoma* Ehrenberg, 1830, *Epistylis branchiophila* Perty, 1852 and *E. nympharum* (Engelmann, 1862).

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Drie nuwe en vier bekende sessiele Peritricha-spesies, afkomstig van die Crustacea-ektoparasiete *Lernaea barnimiana* (Hartman, 1870), *L. cyprinacea* Linnaeus, 1758 en *Dolops ranarum* (Stuhlmann, 1891) van verskillende varswatervisse in Suid-Afrika is geïdentifiseer. Die nuwe spesies wat beskryf word is *Epistylis cyprinaceae* sp. n., *E. epibarnimiana* sp. n., en *Epistylis magna* sp. n. Vergelykende beskrywings van die vier bekende spesies word gegee, nl. *Vorticella convallaria* (Linnaeus, 1758), *V. microstoma* Ehrenberg, 1830, *Epistylis branchiophila* Perty, 1852, en *E. nympharum* (Engelmann, 1862).

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Introduction

In the course of fish parasite surveys in the Transvaal, sessile peritrichians (Ciliophora: Peritricha) were often observed on the crustacean ectoparasites *Lernaea barnimiana* (Hartman, 1870), *L. cyprinacea* Linnaeus, 1758 and *Dolops ranarum* (Stuhlmann, 1891). In some cases the peritrich growth was of such an extent as to be visible to the naked eye. Sessile peritrichs have previously been reported from different *Lernaea* species but were not specifically identified: *Vorticella* from *L. haplocephala* Cunnington, 1914 (Cunnington 1914), stalked protozoans from *L. carassi* Tidd, 1933 (Tidd 1933), Vorticellidae from *L. tortua coquae* Dolley, 1940 (Dolley 1940), *Carchesium* sp. from *L. chackoensis* Gnanamuthu, 1951 (Gnanamuthu 1951a) and *L. bengalensis* Gnanamuthu, 1951 (Gnanamuthu 1951b), clusters of colonial peritrichs from *L. barnimiana* (Hartmann, 1870) (Thurston 1969), encrustations of peritrichs (vorticellids, *Epistylis* sp.) from *L. hessaragattensis* Srinivasachar & Sundarabai, 1971 (Srinivasachar & Sundarabai 1971) and in a recent study by Viljoen (1983) in South Africa, *Epistylis* sp. from *L. barnimiana*.

It is well established that a large number of sessile peritrich species inhabit fresh water, attached to a variety of substrates. Representatives of at least four genera, *Ambiphrya, Apiosoma, Epistylis* and *Scyphidia* are known to be associated with fish (Lom 1966). Although it has not yet been determined beyond any doubt whether the association of the peritrichs and the fish is of an ectocommensal or parasitic nature, some species are known to have caused severe damage and even mortalities amongst fish (Fischthal 1949; Rogers 1971). In a recent investigation of the substrate preference of the sessile peritrichs, it was established that those occurring on fish are specific to piscean substrates. Peritrichs in the same habitat occurring on other substrates were not found on fish (Viljoen & Van As 1983). It is therefore of particular interest to establish whether the peritrichs occurring on the fish ectoparasites, can also settle on the piscean hosts. However, this will only be possible when the comprehensive taxonomic study of fish-associated peritrichs, presently under way, has been completed.

In this paper, specific identifications and taxonomic descriptions are presented of the sessile peritrichs occurring on the crustacean ectoparasites, collected from a variety of host fish and localities in South Africa. Other crustacean ectoparasites occurring on the skin and fins of fish, such as *Argulus japonicus* Thiele, 1900 and *Chonopeltis australis* Boxshall, 1976 were also collected and examined but did not host any sessile peritrichs.

Material and Methods

Sessile peritrichs were removed from the carapace and appendages of crustaceans ectoparasitic on fish, mounted in a drop of pond water on a microscope slide and studied live under a compound microscope. The slides were then air dried, stained with Harris' hematoxylin and used for further microscopic investigations.

Systematic descriptions are based on live as well as hematoxylin-stained specimens. All measurements are in micrometres and were obtained from stained specimens. Minimum and maximum values are given, followed in parenthesis by the arithmetic mean, standard deviation and number of specimens measured. Body length is measured from the junction of zooid and stalk to the peristomial disc, and body diameter at the widest part of zooid.

Type specimens of new species described are deposited in the fish parasite collection of the Department of Zoology of the Rand Afrikaans University, Johannesburg. Specimen reference numbers are indicated at the relevant descriptions. In the case of comparative descriptions of known species, specimen reference numbers of microscope slides deposited in this collection are provided.

Taxonomy

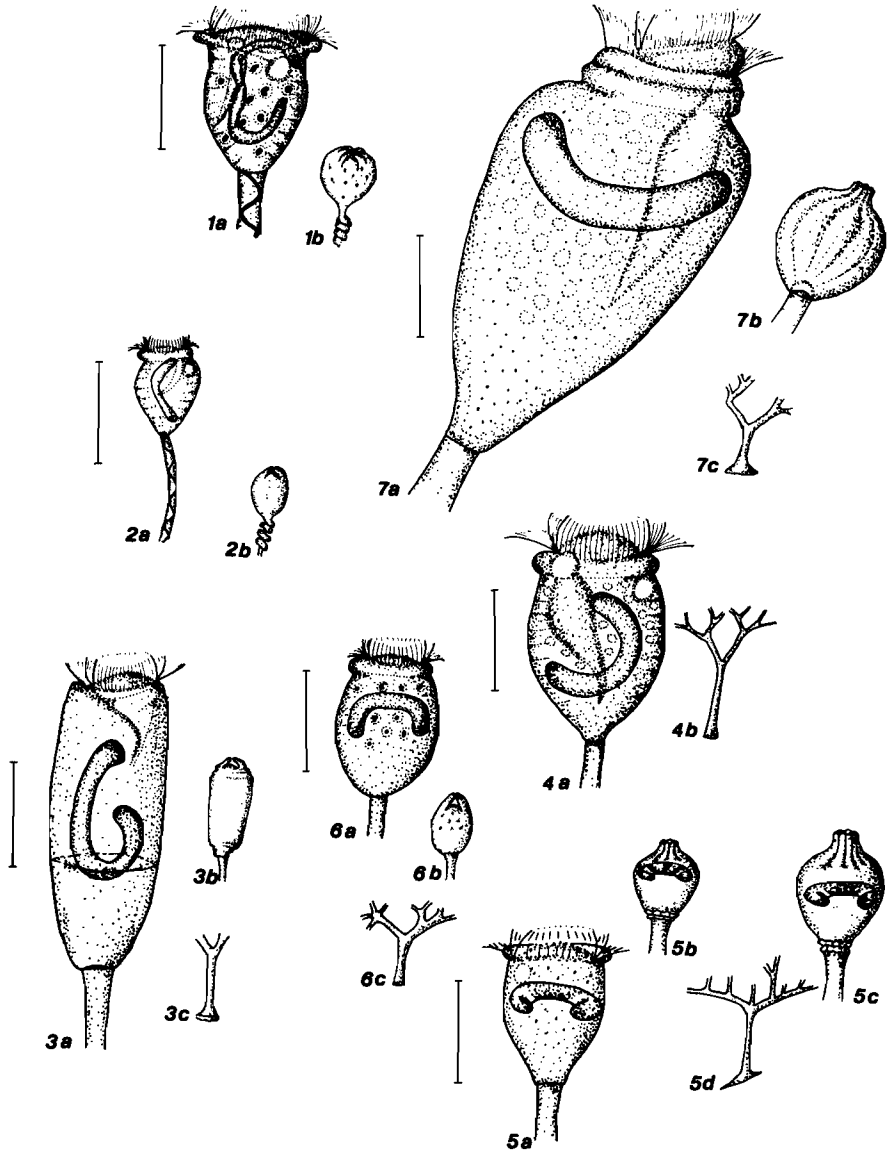
Vorticella Linnaeus, 1767

***Vorticella convallaria* (Linnaeus, 1758)** (Figures 1a, 1b and 8A)

Specimen reference number: Slide 82/4/10 – 3
Host: Lernaea cyprinacea Linnaeus, 1758 from *Oreochromis mossambicus* (Peters, 1852).
Locality: Hartbeespoort Dam (25°45'S/27°50'E), Transvaal.
Dimensions: Length of body 27 – 72 (49,1 ± 7,0; 24), diameter of body 25 – 65 (47,8 ± 11,5; 22), diameter of stalk 2 – 6 (4,4 ± 1,0; 19), diameter of macronucleus 3 – 6 (4,8 ± 0,8; 13).
Remarks: Conforms to the description of *V. convallaria* by Noland & Finley (1931) and Viljoen & Van As (1983). The latter authors found representatives of this species attached to a variety of plant, animal and inanimate substrates in an impoundment in the Transvaal.

***Vorticella microstoma* Ehrenberg, 1830** (Figures 2a, 2b and 8B)

Specimen reference number: Slide 83/4/20 – 14
Host: L. cyprinacea from *O. mossambicus*.



Figures 1 – 7 (1) *Vorticella convallaria:* (a) expanded, (b) contracted. (2) *Vorticella microstoma:* (a) expanded, (b) contracted. (3) *Epistylis nympharum:* (a) expanded, (b) contracted, (c) stalk. (4) *Epistylis branciophila:* (a) expanded, (b) stalk. (5) *Epistylis cyprinaceae:* (a) expanded, (b) contracted microzooid, (c) contracted macrozooid, (d) stalk. (6) *Epistylis epibarnimiana:* (a) expanded, (b) contracted, (c) stalk. (7) *Epistylis magna:* (a) expanded, (b) contracted, (c) stalk. Scales in all cases indicate 8 µm for Figures (a), Figures (b), (c) and (d) not drawn to scale.

Locality: Lowveld Fisheries Research Station, Marble Hall (24°55'S/29°20'E), Transvaal.

Comparative description: Solitary. Body oval-shaped, length 29 – 46 (36,3 ± 6,1; 14), diameter 20 – 38 (30,5 ± 5,8; 14). Pellicular striations present but inconspicuous. Stalk contractile, diameter 3 – 4 (3,5 ± 0,5; 10). Peristomial disc roundly convex. Peristomial lip does not open as wide as body. Infundibulum curved, extending to middle of body. Contractile vacuole situated near peristomial lip. Food vacuoles distributed throughout body. Macronucleus ribbon-like, diameter 2 – 5 (3,5 ± 0,9; 9).

Remarks: Not previously recorded from South Africa. Con-

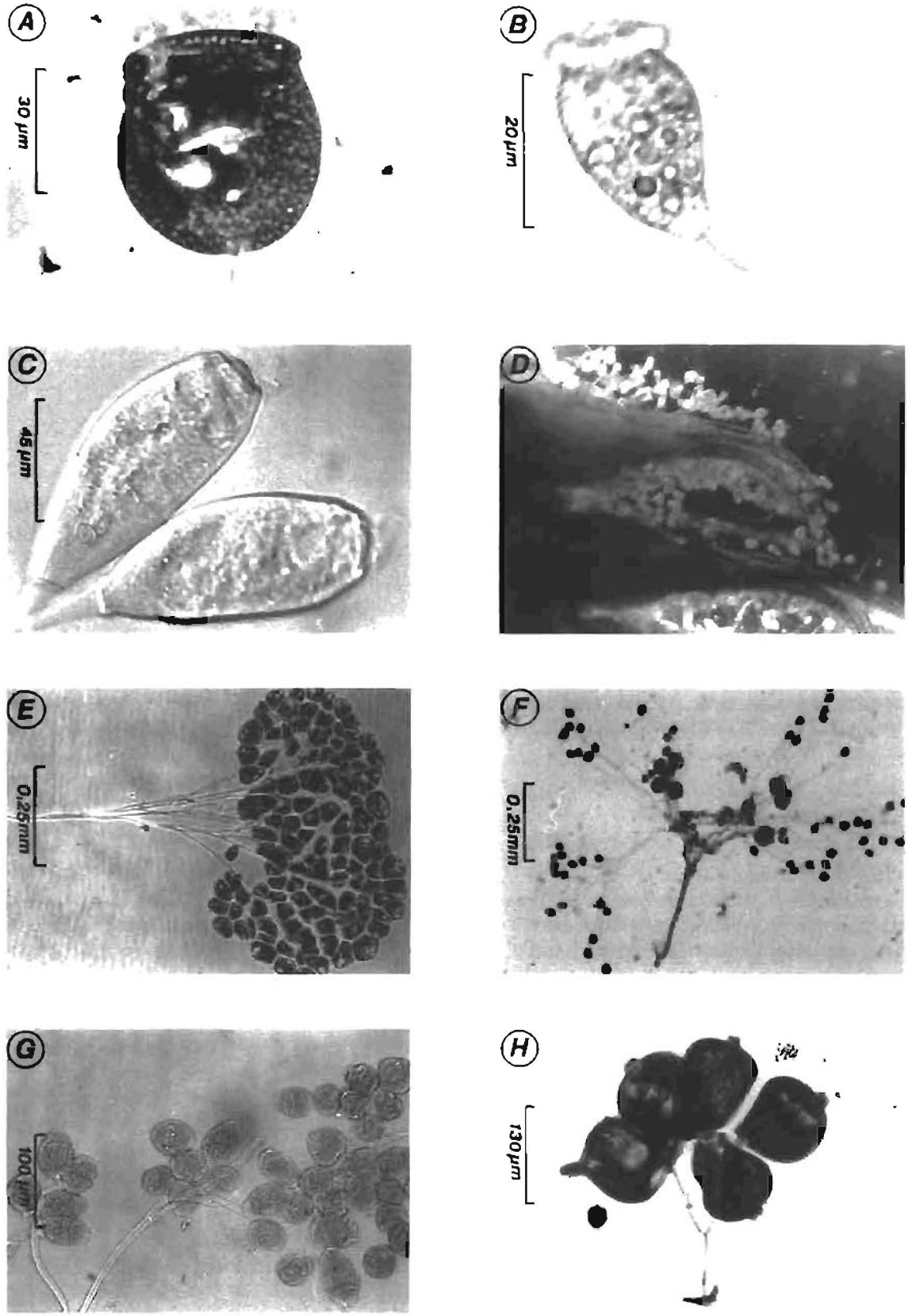


Figure 8 Photomicrographs of hematoxylin-stained (A, E, F, H) and live (B, C, D, G) sessile peritrichians from crustacean fish ectoparasites. (A) *Vorticella convallaria.* (B) *Vorticella microstoma.* (C) *Epistylis nympharum.* (D) *Epistylis nympharum* on appendages of *Dolops ranarum.* (E) *Epistylis branchiophila.* (F) *Epistylis cyprinaceae.* (G) *Epistylis epibarnimiana.* (H) *Epistylis magna.*

forms to the descriptions by Noland & Finley (1931) and Green (1974). This species is considerably smaller than, and differs significantly in the shape of the zooid from *V. convallaria*. The macronucleus, although ribbon-like, is relatively short. *Vorticella microstoma* corresponds in overal dimensions to *V. lymnaearum* Viljoen & Van As 1983, but differs significantly in the shape of the zooid, diameter of the peristomial lip when expanded, and shapes of both macronucleus and contracted zooid.

Epistylis Ehrenberg, 1838

***Epistylis nympharum* (Engelmann, 1862)** (Figures 3a, 3b, 3c, 8c and 8D)

Specimen reference number: Slide 83/4/30 – 2
Host: Dolops ranarum (Stuhlmann, 1891) from *Oreochromis mossambicus*.
Locality: Roodeplaat Dam (25°5′S/28°30′E), Transvaal.
Comparative description: Frequently solitary, sometimes paired on bifurcated stalk or colonial. Zooid cylindrical and elongated, length 61 – 157 (112,9 ± 23,3; 31), diameter 24 – 98 (55,9 ± 20,9; 31). Divided into two regions by circular groove. Upper region about twice the length of lower region. No pellicular striations observed. Stalk bifurcated in colonial forms, short, less than one third of zooid length, diameter 5 – 18 (8,3 ± 3,6; 24). Peristomial lip opens as wide as body. No vacuoles observed. Macronucleus sausage-shaped, centrally placed, diameter 5 – 12 (7,7 ± 1,8; 36).
Remarks: First record of this species in South Africa. Conforms to the descriptions of *E. nympharum* by Nenninger (1948) and Green (1974). It has a relatively large zooid and has a characteristic groove which is more distinct than in other species of this genus. It has previously been found on Chironomidae by Nenninger (1948), on cladocerans and insect larvae by Green (1974) and *Cyclops* spp. by Foissner & Schiffmann (1974). During contraction, the zooid maintains its cylindrical shape, the base of the zooid has a wrinkled appearance and the peristomial lip is drawn together rather than inward as in the case of *Vorticella* species.

***Epistylis branchiophila* Perty, 1852 (Syn: *E. formosa* Nenninger, 1948)** (Figures 4a, 4b, and 8E)

Specimen reference number: 82/5/3 – 1
Host: L. cyprinacea from *O. mossambicus*.
Locality: Hartbeespoort Dam (25°45′S/27°50′E), Transvaal.
Comparative description: Colonial. Large colonies with many zooids per colony. Zooid cylindrical to inverted bell-shaped, length 48 – 94 (69,6 ± 11,2; 22), diameter 51 – 84 (64,0 ± 8,0; 22). Pellicle striated. Stalk, dichotomously branched, diameter 5 – 14 (8,9 ± 2,6; 19). Peristomial disc convex. Peristomial lip opens as wide as body. Infundibulum curved, extending past middle of body. Contractile vacuole and food vacuoles situated in upper body region. Macronucleus sausage-shaped, short and thick, diameter 5 – 9 (7,2 ± 1,0; 21).
Remarks: First record of *E. branchiophila* in South Africa. The shape and dimensions of zooids as well as branching of stalk conforms to the description by Nenninger (1948) and Biegel (1954) who however makes no mention of the colony size. This species differs significantly from the other known *Epistylis* species as well as those described in the present study, with reference to the large colony size and relative long main stalk.

***Epistylis cyprinaceae* sp.n.** (Figures 5a, 5b, 5c, 5d and 8F)

Type specimens: Holotype slide 83/4/20 – 5, paratype slide 82/5/3 – 3
Type host: L. cyprinacea from *O. mossambicus*.
Type locality: Hartbeespoort Dam (25°45′S/27°20′E), Transvaal.
Description: Colonial. Many zooids per colony. Zooids of two distinct sizes. Zooids roundish-oval. Microzooid, length 19 – 33 (27,9 ± 3,9; 18), diameter 21 – 26 (22,3 ± 1,3; 18), macrozooid, length 45 – 48 (46,4 ± 1,5; 6), diameter 51 – 54 (52,1 ± 1,4; 6). Pellicle not striated. Stalk branched extensively, diameter 3 – 4 (3,5 ± 0,5; 16). Macronucleus horseshoe-shaped, mostly situated in adoral region of zooid, in microzooid, diameter 3 – 5 (3,7 ± 0,7; 11), and in macrozooid, diameter 3 – 5 (3).
Remarks: A second population of this species was found on *L. cyprinacea* from *Labeo rubropunctatus* Gilchrist & Thompson, 1913 from Glen Alpine Dam (23°20′S/28°40′E), Transvaal. The two populations correspond in morphological characteristics, differing only slightly in overall dimensions. The mean dimensions of the Glen Alpine Dam population are given below. Microzooids, length 22,4; diameter 19,3. Macrozooids, length 39,2; diameter 37,8. Stalk diameter 3,4. Macronucleus in microzooid 1,8 and in macrozooid 3,0.

Viljoen & Van As (1983) found an unidentified *Epistylis* sp. on the thoracical appendages of a freshwater crab in an impoundment in the Transvaal, of which the morphological characteristics of the zooids conform to the present species. It differs however in overall dimensions, as well as the absence of micro- and macrozooids. Mention of micro- and macrozooids in a single *Epistylis* colony was made by Matthes & Scheubel (1970) in which case the size differences of zooids were ascribed to different stages of the reproductive cycle. In the present study the presence of micro- and macrozooids was a constant feature of all observed colonies and it is clearly a distinct species from those observed by the above-mentioned authors.

***Epistylis epibarnimiana* sp. n.** (Figures 6a, 6b, 6c and 8G)

Type specimens: Holotype slide 83/4/20 – 3, paratype slide 83/4/20 – 2
Type host: Lernaea barnimiana from *Labeo capensis* (Smith, 1841).
Type locality: Wuras Dam (19°0′S/26°15′E), Orange Free State.
Description: Colonial. Up to 20 zooids per colony. Zooids oval, length 41 – 98 (57,3 ± 11,5; 21), diameter 44 – 69 (53,8 ± 5,3; 20). No pellicular striations observed. Stalk irrigularly branched, diameter 4 – 11 (7,4 ± 2,1; 17). Peristomial disc flat. Peristomial lip opens as wide as body. Food vacuoles situated centrally. Macronucleus sausage-shaped, centrally placed, diameter 4 – 6 (5,2 ± 1,0; 19).
Remarks: This species is the only sessile peritrich thus far found on *Lernaea barnimiana*, an indigenous crustacean copepod ectoparasite of fish in Africa. A distinctive characteristic of this peritrich is the orientation of the macronucleus in relation to the body axis, the shape of the zooid and the irregularly branched stalk. Although individual colonies do not consist of many zooids, large clusters were found on the cephalothorax of *L. barnimiana*, visible to the naked eye.

***Epistylis magna* sp.n.** (Figures 7a, 7b, 7c and 8H)

Type specimens: Holotype slide 82/5/3 – 1, paratype 82/5/3 – 2
Type host: L. cyprinacea from *O. mossambicus*.
Type locality: Hartbeespoort Dam (25°45′S/27°20′E), Transvaal.

Description: Colonial. Four to eight zooids per colony. Zooids inverted bell-shaped when expanded, round when contracted, length 83 – 166 (130,6 ± 22,8; 15), diameter 82 – 145 (117,7 ± 18,3; 15). No pellicular striations observed. Stalked, main stalk short, bifurcated, sometimes with three branches, diameter 7 – 21 (13,2 ± 4,1; 10). Peristomial disc protruding distinctly when expanded. Peristomial lip does not open as wide as body. Infundibulum not spiralled, extending to middle of body. Food vacuoles situated in upper body region. Macronucleus sausage-shaped and curved, situated adorally, diameter 11 – 20 (13,8 ± 3,1; 9).

Remarks: This species is the largest sessile peritrich occurring on crustacean fish ectoparasites found in the present study. It is also relatively large in comparison to other species of the genus.

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