



***Characithecium* (Monogeneoidea: Dactylogyridae) parasitic on the Neotropical fish *Oligosarcus jenynsii* (Teleostei: Characidae) from the Pampasic region, Argentina, with the emendation of the genus**

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Abstract

Presently, only 2 species of dactylogyrid monogeneans have been reported Characidae inhabiting lakes and streams from the Pampasic region (central Argentina). During a parasitological survey on the characid *Oligosarcus jenynsii*, from Nahuel Rucá Lake (Buenos Aires province, Argentina), dactylogyrids were found on the gills. Specimens were identified as members of *Characithecium*: *C. chascomusensis* n. comb., *C. longianchoratum* n. sp., *C. robustum* n. sp., *C. quadratum* n. sp. and *C. chelatum* n. sp. These species can be distinguished from each other mainly by differences in the shape of the accessory piece of the male copulatory organ, morphology of anchors and ventral bars as well as position of vaginal aperture. The observation of some additional features present in all species studied, such as the vaginal aperture position (as midventral, lateroventral or lateromarginal) and the variability in the morphology of ventral bar (posteromedial projection present or absent) justified an emended diagnosis of *Characithecium*.

Key words: South America parasites, Neotropical monogenean, dactylogyrids, *Characithecium chascomusensis* n. comb., *Characithecium longianchoratum* n. sp., *Characithecium robustum* n. sp., *Characithecium quadratum* n. sp., *Characithecium chelatum* n. sp., characid fish, *Oligosarcus jenynsii*

Introduction

Characidae is the fourth most diverse family of fishes and the most diverse among Neotropical fishes, with more than 1,000 species distributed from the southern USA to northern Patagonia (Argentina) in South America (Ornelas-García *et al.* 2008; Mirande 2010). The dactylogyrid fauna of characids has been extensively studied in northern South America, especially in Brazil (Thatcher 2006; Cohen & Kohn 2009; Cohen *et al.* 2013) and, in lesser extent, in Central America (Mendoza-Franco *et al.* 2009). At present, the knowledge of monogenean parasitizing characids in the southern boundaries of the family distribution, represented by the Pampasic region in central Argentina, is scarce and fragmentary, in comparison with their northern counterparts. This fauna comprises, to date, the records of only 2 species of *Palombitrema* Price & Bussing, 1968 that have been reported from Chascomus Lake (Buenos Aires province). These species include *P. heteroancistrum* (Price & Bussing, 1968) Suriano, 1997 a parasite of *Astyanax fasciatus fasciatus* Cuvier, and *P. chascomusense* (Suriano, 1981) Suriano, 1997, a parasite of the curimatid *Cyphocharax voga* (Hensel) as well as of *Oligosarcus jenynsii* (Günther) (Suriano 1981; 1997).

During a parasitological examination of *O. jenynsii* captured in Nahuel Rucá, a shallow lake located in Buenos Aires province, Argentina, dactylogyrid monogeneans were found in the gills. *Oligosarcus jenynsii* is one of the most widely distributed and dominant species in the ecosystems at regional scale (Rosso 2006). However, little is known about its parasite fauna. Herein, 5 species were identified as members of *Characithecium* Mendoza-Franco, Reina & Torchin, 2009 a monospecific genus containing *C. costaricensis* (Price & Bussing, 1967) Mendoza-Franco, Reina & Torchin, 2009, reported from 3 species of *Astyanax* across Central America (Mendoza-Franco *et al.* 2009). Four of the species found are described for first time, whereas the fifth species was identified as *P.*

chascomusense. However, supplemental observations justified transference of this species to *Characithecium* based on newly collected specimens found on *O. jenynsii*, from the type locality (Chascomús lake). The addition of new species to this genus required emendation of the generic diagnosis of *Characithecium*.

Materials and methods

During 2013, a total of 54 specimens of *O. jenynsii* caught by trawl were examined for gill monogeneans, including 4 fish from Chascomús Lake (35°35'S, 58°01'W) and 50 from Nahuel Rucá Lake (38°08'S, 57°32'W) Buenos Aires province, Argentina. Thirteen specimens of *C. voga* were also caught at Chascomús Lake in the same date. Gills were removed and shaken individually in Petri dishes containing hot water (70°C), and then water was removed and replaced by formalin 4% for fixation. Monogeneans were removed from fixed gills and sediments with the aid of dissecting needles and droppers under stereoscopic microscopy. Some specimens were stained with Gomori's trichrome and mounted in Canada balsam for study of their soft anatomy; other specimens were cleared and mounted Hoyer's mounting media (Thatcher 2006) or in wet mounts using SDS (Wong *et al.* 2006) for the study of sclerotized structures. Drawings were made with the aid of a drawing tube attached to a light microscope equipped with differential interference contrast. Measurements were made following Mizelle & Klucka (1953) and Kritsky & Boeger (2002) and are given in micrometers. Distribution and numbering of hook pairs follows Mizelle (1936, see Mizelle & Price 1963) and the procedure to determining the direction of the coil of male copulatory organ (MCO) follows the suggestions of Kritsky *et al.* (1985). Prevalence and mean abundance were calculated according Bush *et al.* (1997) for a subsample of 10 *O. jenynsii* from Nahuel Rucá Lake. Type specimens are deposited in the Helminthological Collection of the Museo de La Plata (HCMLP), La Plata, Argentina.

Results

No specimens of *C. chascomusensis* **n. comb.** were found in specimens of its type host, *C. voga*, caught at Chascomús Lake. On the other hand, 2 out of the 4 *O. jenynsii* obtained from the type locality harbored specimens identifiable as *P. chascomusense* as described by Suriano (1997). Samples of *O. jenynsii* obtained in the Nahuel Rucá Lake were parasitized by the same species, as well as by other 4 additional species. All species share a number of morphological particularities in agreement with *Characithecium*. The observation of some additional features present in all species studied, justifies the following amendment of the genus.

Dactylogyridae Bychowsky, 1933

Ancyrocephalinae Bychowsky, 1937

Characithecium Mendoza-Franco, Reina & Torchin, 2009

Type species. *Characithecium costaricensis* (Price & Bussing, 1967) Mendoza-Franco, Reina & Torchin, 2009

Type host. *Astyanax aeneus* (Günther) (Characidae).

Type locality. Central America, from southeastern Mexico to Panama.

Other species. *Characithecium chascomusensis* **n. comb.** Instead of *Characithecium* **comb. n.** *C. longianchoratum* **n. sp.**, *C. robustum* **n. sp.**, *C. quadratum* **n. sp.**, *C. chelatum* **n. sp.**

Other localities. The Pampasic region, Argentina.

Emended diagnosis. Body comprising cephalic region, trunk, peduncle and haptor. Tegument thin and smooth. Cephalic lobes developed, head organs and cephalic glands present. Eyespots present. Mouth midventral; pharynx muscular; esophagus short, 2 intestinal ceca confluent posterior to gonads, lacking diverticula. Gonads intercecal, overlapping; testis dorsal to germarium. Seminal vesicle as dilation of vas deferens with distal loop before reaching base of male copulatory organ (MCO); single prostatic reservoir present. Copulatory complex comprising an articulated MCO and accessory piece. MCO coiled tube with counterclockwise rings, with dilated

and reel shaped base; articulation process present, lying within rings of MCO. Accessory piece, clamp shaped, comprising 2 subunits. Genital pore midventral near level of cecal bifurcation. Seminal receptacle pregerminal; vagina single, sclerotized or slightly sclerotized; opening sinistral, midventral, lateroventral, or in marginal position. Vitellaria follicular, restricted to trunk and coextensive with intestine. Haptor with 7 pairs of hooks with ancyrocephaline distribution, being pairs 1 and 5 reduced in size, 2 pairs of anchors with developed roots and U shaped bars. Hooks similar, each with depressed thumb, delicate point, and shank comprising 2 subunits (proximal subunit expanded). Ventral anchor larger than dorsal anchor. Ventral bar with dilated extremities and posteromedial projection present or absent.

Remarks. *Characithecium* was erected by Mendoza-Franco *et al.* (2009) to accommodate *Urocleidoides costaricensis* Price & Bussing, 1967, a species considered *incertae sedis* by Kristy *et al.* (1986) in their emendation of *Urocleidoides*. *Characithecium costaricensis* (Mendoza-Franco *et al.* 2009) has been extensively reported from southern and central Mexico and Nicaragua from different species of *Astyanax*. The characteristics shared by the 5 species found in *O. jenynsii* that allowed their inclusion in *Characithecium* are: (1) eyes present; (2) overlapping gonads (testis dorsal to germarium); (3) a seminal vesicle formed by a simple dilation of the vas deferens; (4) an articulated MCO and accessory piece; (5) MCO with a coiled shaft in counterclockwise direction; (6) ventral anchor larger than dorsal anchor; and (7) hook shanks, each composed of 2 subunits (proximal subunit expanded) (Mendoza-Franco *et al.* 2009). Additional characters observed in the 5 new species required to extend the generic diagnostic features to include the vaginal aperture position (as midventral, lateroventral or lateromarginal) and the variability in the morphology of ventral bar (posteromedial projection present or absent).

***Characithecium chascomusensis* (Suriano, 1981) n. comb.**

(Figs. 1–8; 43–44)

Type host. *Cyphocharax voga* (Hensel)

Type locality. Chascomús Lake, 35° 37'S, 58° 04' W, Chascomús, Buenos Aires province, Argentina.

Other host. *Oligosarcus jenynsii* (Günther).

Other localities. Nahuel Ruca Lake, 38°08'S, 57°32'W, Mar Chiquita, Buenos Aires Province, Argentina.

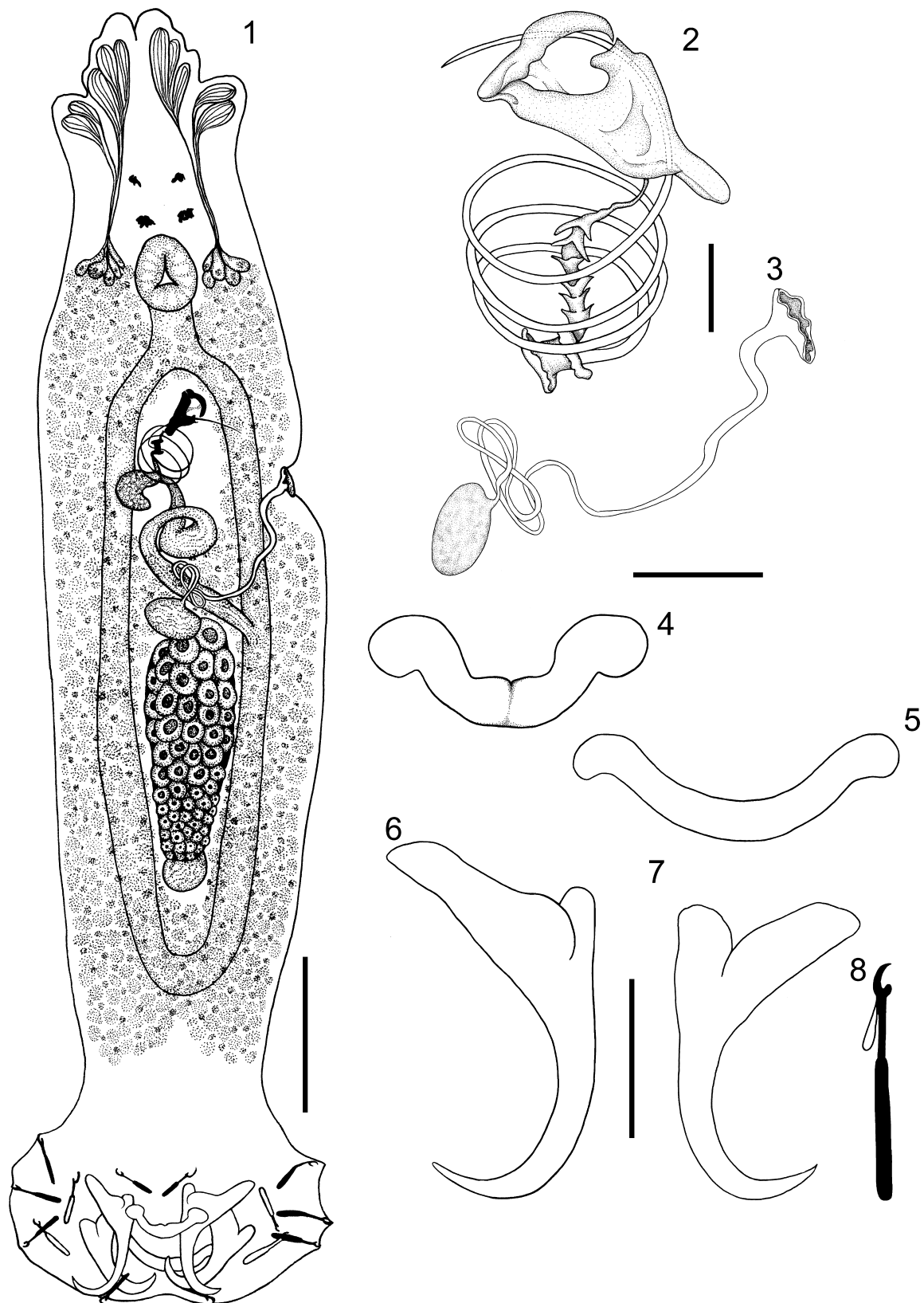
Synonyms: *Androspira chascomusensis* Suriano, 1981; *Palombitrema chascomusense* (Suriano, 1981) Suriano, 1997

Prevalence. 100%.

Mean abundance (intensity range). 36 (2–163).

Type material. Voucher specimens (MLP-He-6803) were deposited in the Helminthological Collection of the Museo de La Plata (HCMLP), La Plata, Argentina.

Redescription. Based on 20 specimens. Body robust, 611 (480–754; n = 20) long; greatest width 196 (137–277) usually at middle of body. Two pairs of cephalic lobes, 1 lateral and 1 anterior pair divided into 3 lobules. Five pairs of head organs and cephalic glands present. Four eyespots, frequently dissociated, accessory granules often present in cephalic region and anterior to pharynx. Pharynx ovate, muscular 43 (33–48) in greatest width; esophagus short to moderately long. Haptor sub-hexagonal, 85 (71–89) long, 113 (100–132) wide. Ventral anchor 40 (31–44) long, base 26 (20–28) wide; with elongate superficial root, short deep root, straight shaft and curved distal point. Dorsal anchor 36 (27–42) long; base 22 (16–23) wide; with well-developed roots, straight shaft and curved distal point. Ventral bar 36 (30–46) long, with medial suture with expanded ends. Dorsal bar widely U-shaped, 40 (37–49) long, with slightly enlarged ends. Hooks similar in shape; pairs 1 and 5 reduced in size 16 (13–19) long, hooks (excluding pairs 1 and 5) 23 (16–28) long, with protruding thumb and delicate point; shank comprised of 2 subunits; proximal subunit expanded, filamentous hooklet (FH) loop extending anterior to union of shank subunits. MCO a coiled tube with 3–4 counterclockwise coils, 237 (216–254) long; base of MCO reel-shaped, connected to articulation process of accessory piece. Accessory piece 33 (29–40) long, clamp-shaped, comprising 2 subunits connected by a muscular ligament, distal subunit claw-like, proximal subunit larger, subtriangular, with short and slightly concave free distal extreme serving as guide for MCO. Articulation process of accessory piece twisted. Gonads overlapping; testis dorsal to germarium; seminal vesicle a distal dilation of vas deferens, looping before entering base of MCO; single, prostatic reservoir present. Vitellaria moderately dense throughout trunk, except in regions of reproductive organs; oviduct, ootype and uterus not observed. Vaginal



FIGURES 1–8. *Characithecium chascomusensis* n. comb. (Suriano 1981). 1. whole mount, ventral view. 2. copulatory complex, ventral view. 3. vagina, ventral view. 4. ventral bar. 5. dorsal bar. 6. ventral anchor. 7. dorsal anchor. 8. hook. Scale bars: 1 = 50 μ m; 2 = 10 μ m; 3–8 = 20 μ m.

aperture strongly sclerotized and sinistral; vagina a long and tortuous sclerotized tube, directed posteriorly and convoluted before connecting with seminal receptacle. Seminal receptacle, medial and anterior to germarium. Eggs not observed.

Remarks. A detailed morphological examination of the specimens newly collected from *O. jenynsii* from both, the type locality and Nahuel Rucá Lake, and their comparison with the descriptions provided by Suriano (1981; 1997) showed that all are members of the same taxon by having identical morphology of MCO, accessory piece, hooks and internal organs. It is noteworthy that no type material is available for this species, which was originally described as *Androspira chascomusensis* by Suriano (1981) and later transferred to *Palombitrema chascomusense* by the same author (Suriano 1997). However, the morphology of the MCO and hooks does not agree with the diagnosis of *Palombitrema* Price & Bussing, 1968 to which the species was assigned by Suriano (1997). *Palombitrema* is characterized by having the MCO directly articulated to the accessory piece, pairs 6 and 7 of hooks different in shape than hooks 1–5, being the pair 7 also considerably larger, and dorsal anchors with little developed roots and larger than ventral anchors. (Price & Bussing 1968; Kritsky & Leiby 1972; Kritsky & Thatcher 1974; Mendoza Franco *et al.* 1999; 2003; 2009). In contrast, in our specimens, the MCO is articulated by a ligament to accessory piece, hooks are of similar shape and length and anchors have developed roots. These characteristics that clearly differentiate *Palombitrema* from *Characithecium*, were not considered in the resurrection of *Palombitrema* by Suriano (1997), indicating that the inclusion of specimens from *C. voga* and *O. jenynsii* in this genus was erroneous. Consequently, this species is transferred to *Characithecium* as *C. chascomusensis* n. comb.

Characithecium chascomusensis n. comb. can be readily differentiated from *C. costaricensis*, the only member of the genus, by the morphology of the accessory piece, the number of coils in the MCO (3–4 in *C. chascomusensis* n. comb. vs $\frac{1}{2}$ –1 in *C. costaricensis*), the position of vaginal aperture (lateral in *C. chascomusensis* vs midventral in *C. costaricensis*) and the absence of a posterior ventral projection in the ventral bar as present in *C. costaricensis*. Furthermore, *C. chascomusensis* n. comb. can be distinguished from its other congeners herein described by possessing a higher number of coils in the MCO; by having the vaginal aperture located anteriorly, at level of the prostatic reservoir; and by the shape of the accessory piece, with a pointed claw-like distal subunit and a subtriangular proximal subunit, latter with short and slightly concave free distal extreme.

***Characithecium longianchoratum* n. sp.**

(Figs. 9–17; 45–46)

Type host. *Oligosarcus jenynsii* (Günther)

Type locality. Nahuel Rucá Lake, 38°08'S, 57°32'W, Mar Chiquita, Buenos Aires Province, Argentina.

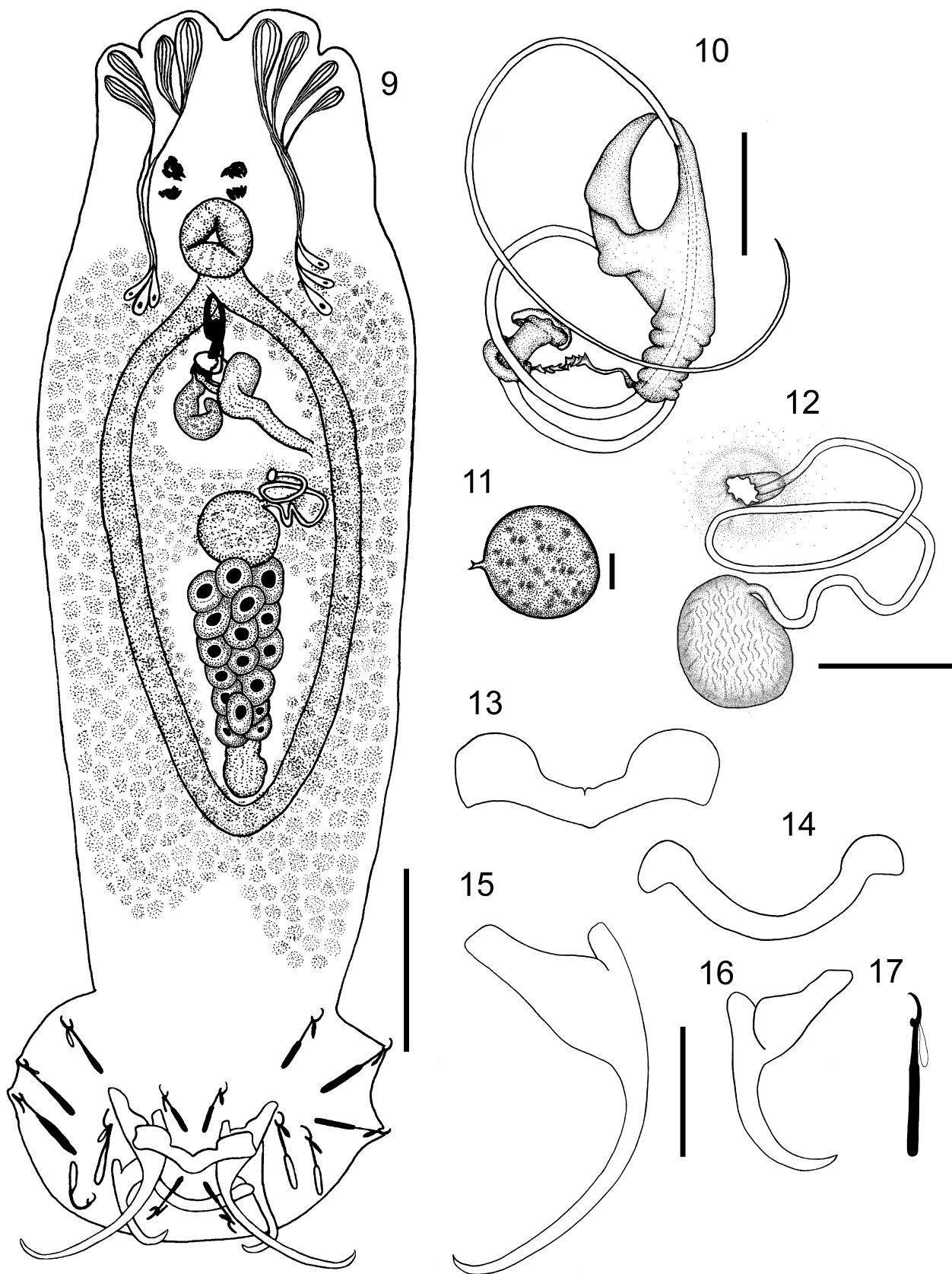
Prevalence. 100%.

Mean abundance (intensity range). 20.8 (2–98).

Type material. Holotype (MLP-He-6795) and paratypes (MLP-He-6796) are deposited in the Helminthological Collection of the Museo de La Plata (HCMLP), La Plata, Argentina.

Etymology. The specific name refers to the large size of ventral anchors.

Description. Based on 20 specimens. Body small and delicate, 450 (351–540; n=20) long; greatest width 144 (104–181) usually at middle of body. Two pairs of cephalic lobes, 1 lateral and 1 anterior. Four pairs of head organs observed. Cephalic glands present. Four eyespots, frequently dissociated, accessory granules often present in cephalic region and anterior to pharynx. Pharynx spherical, muscular 32 (25–38) in diameter; esophagus short. Haptor 110 (93–134) wide, 60 (50–70) long. Ventral anchor 56 (51–61) long, base 24 (20–26) wide; with well-developed roots, superficial root elongate, deep root shorter, shaft long and curved, curvature more pronounced at distal tip; anchor filament conspicuous. Dorsal anchor 34 (30–38) long, base 22 (19–25) wide, with well-developed roots, straight shaft and curved distal point. Ventral bar 43 (39–56) long, with slight antero-medial projection, medial suture and expanded ends. Dorsal bar curved, 33 (28–43) long, with expanded ends. Hooks similar in shape; pairs 1 and 5 reduced in size 18 (16–19) long, hooks (excluding pairs 1 and 5) 26 (18–37) long, with protruding thumb and delicate point; shank comprised of 2 subunits; proximal subunit expanded, FH loop extending anterior to union of shank subunits. MCO a coiled tube with 2 counterclockwise coils, 144 (123–176) long, base of MCO reel shaped, connected to articulation process of accessory piece. Accessory piece 26 (24–28) long, clamp-shaped,



FIGURES 9–17. *Characithecium longianchoratum* n. sp. 9. whole mount, ventral view. 10. male genital complex, ventral view. 11. Egg. 12. vagina, ventral view. 13. ventral bar. 14. dorsal bar. 15. ventral anchor. 16. dorsal anchor. 17. hook. Scale bars: 9= 50 μ m; 10 = 10 μ m; 11–17 = 20 μ m.

comprising 2 subunits with sharp distal ends, proximal subunit larger and serving as guide for MCO. Gonads overlapping; testis dorsal to germarium; seminal vesicle as a distal dilation of vas deferens, looping before entering base of MCO. Prostatic reservoir present. Vitellaria moderately dense throughout trunk, except in regions of reproductive organs. Oviduct, ootype and uterus not observed. Vaginal aperture poorly sclerotized, sinistroventral; vagina as a sclerotized tube connecting with large and globose seminal receptacle. Seminal receptacle, medial and anterior to germarium. Egg 55 long, 45 wide, spherical yellow brown bearing a short polar filament with bifurcate end.

Remarks. *Characithecium longianchoratum* **n. sp.** can be differentiated from *C. costaricensis* by the morphology of accessory piece, the number of coils of the MCO (2 in *C. longianchoratum* **n. sp.** vs $\frac{1}{2}$ –1 in *C. costaricensis*), the position of the vaginal aperture (latero ventral vs midventral), the sclerotization of the vaginal canal and the absence of a posterior ventral projection in ventral bar. Furthermore, *C. longianchoratum* differs from its congeners herein described by having a poorly sclerotized and sinistroventral vaginal pore; by the shape of the accessory piece with both distal and proximal subunits with pointed tips; by having a ventral bar with sub-quadrate elongated ends; and by having a long and curved shaft in the ventral anchor.

The distally pincer-shaped accessory piece and the shape of anchors of the new species show some resemblance to *Urocleidoides strombicirrus* (Price & Bussing, 1967) Kritsky & Thatcher, 1974. This species was considered as *incertae sedis* by Kritsky *et al.* (1986) in their revision of *Urocleidoides*. Since then, no generic reassignment has been made for *U. strombicirrus*, despite it has been reported later parasitizing *Astyanax* spp. from Colombia, Nicaragua and Panama (Mendoza-Franco *et al.* 2003, 2009). Mendoza-Franco *et al.* (2003) suggest that it species may constitute a new genus. The extended diagnosis of *Characithecium* could now include *U. strombicirrus*, however more studies are necessary for confirm their generic status, especially because the MCO is apparently directly articulated to the accessory piece (see Price & Bussing 1967; Kritsky & Thatcher 1974; Mendoza-Franco *et al.* 2003; 2009). Nevertheless, although *U. strombicirrus* could in the future be transferred to *Characithecium*, being readily distinguished from *C. longianchoratum* by its smaller size and by having a lateral and heavily sclerotized vaginal aperture (Price & Bussing 1967; Kritsky & Thatcher 1974; Mendoza-Franco *et al.* 2003; 2009).

***Characithecium robustum* n. sp.**

(Figs. 18–26; 47–48)

Type host. *Oligosarcus jenynsii* (Günther).

Type locality. Nahuel Rucá 38°08'S, 57°32'W, Mar Chiquita, Buenos Aires Province, Argentina.

Prevalence. 70%.

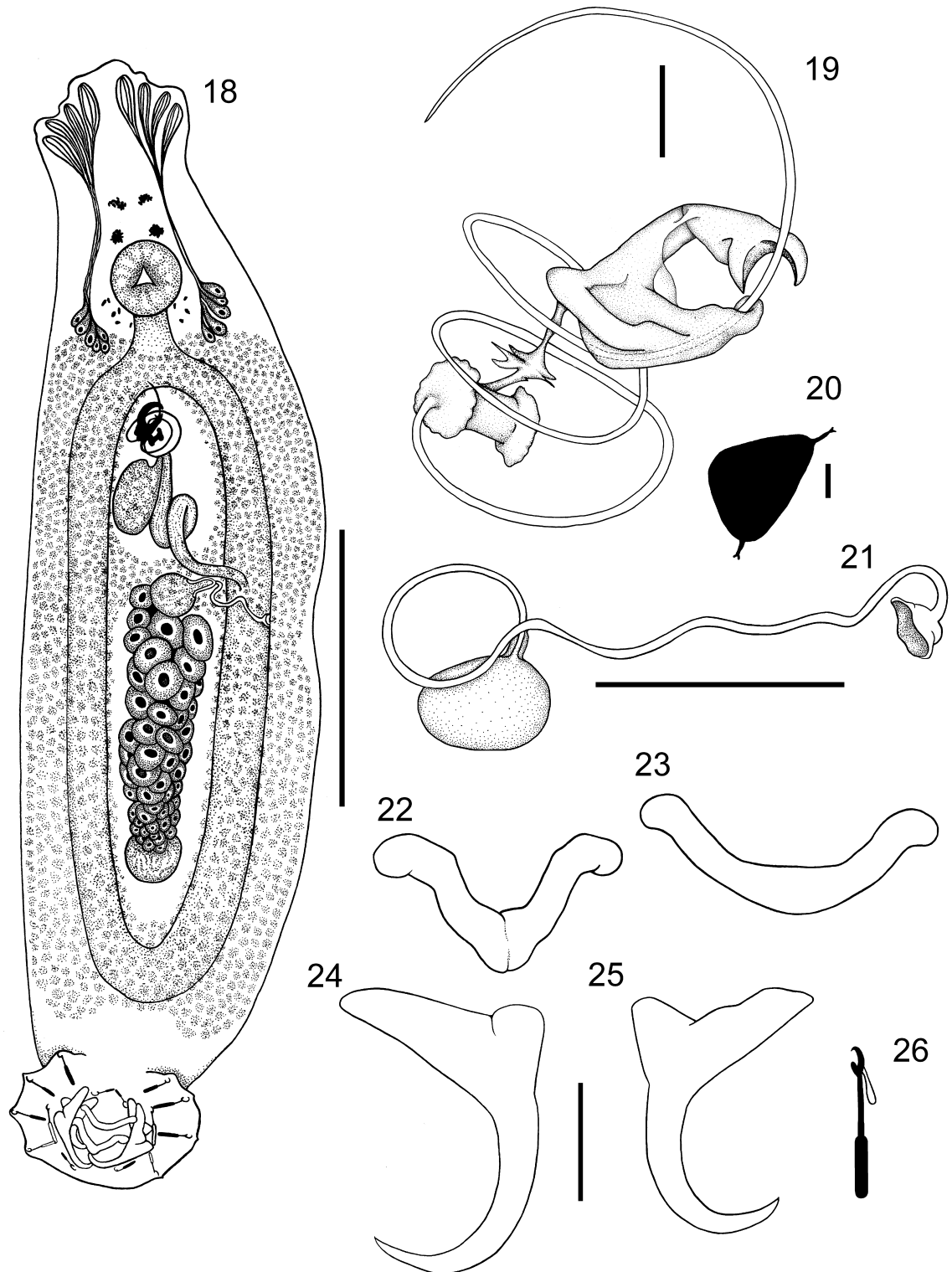
Mean abundance (intensity range). 1.8 (1–7).

Type material. Holotype (MLP-He-6797) and paratypes (MLP-He-6798) are deposited in the Helminthological Collection of the Museo de La Plata (HCMLP), La Plata, Argentina.

Etymology. The specific name is derived from Latin *robustus* (=robust) and refers to the larger size of this species in relation to the other species in the genus.

Description. Based on 11 specimens. Body robust 842 (606–1000; n=10) long; greatest width 236 (186–282) usually at middle of body. Cephalic lobes developed. Five pairs of head organs and cephalic glands present. Four eyespots in cephalic region and anterior to pharynx, accessory granules present in cephalic regions posterior to pharynx. Pharynx spherical, 47 (40–59) in diameter; esophagus moderately long. Haptor hexagonal, 81 (67–92) long, 114 (100–128) wide. Ventral anchor 43 (39–48) long, base 29 (26–32) wide, with superficial root well developed and elongated, short deep root, straight shaft and curved distal point; anchor filaments conspicuous. Dorsal anchor 35 (32–37) long, base 25 (21–27) wide, with developed roots, similar in shape to ventral anchor. Ventral bar 30 (27–34) long, V-shaped, with medial suture and slightly dilated extremes. Dorsal bar 35 (31–38) long, U-shaped, with curved convex margin, straight concave margin and expanded ends. Hooks similar in shape, pairs 1 and 5 reduced in size 17 (11–20) long, hooks (excluding pairs 1 and 5) 22 (17–24) long, with protruding thumb and delicate point; shank comprised of 2 subunits; proximal subunit expanded, FH loop short. MCO a coiled tube with 2 $\frac{1}{2}$ counterclockwise coils, 231 (216–240) long; base of MCO reel-shaped, connected to articulation process of accessory piece. Accessory piece 28 (22–30) long, pincer-shaped, comprising 2 subunits connected by a muscular ligament, distal subunit with bifurcate end; proximal subunit larger, with concave free distal extreme

serving as guide of MCO. Gonads overlapping; testis dorsal to germarium; seminal vesicle as a distal dilation of vas deferens, looping before entering base of MCO. Prostatic reservoir present. Vitellaria dense throughout trunk, except in regions of reproductive organs. Oviduct, ootype and uterus not observed. Vaginal aperture ventro-sinistral sclerotized and funnel-shaped. Vagina a sinuous sclerotized tube connecting with a sclerotized vaginal vestibule leading to a seminal receptacle anterior to germarium. Egg 78 long x 50 wide, brownish, triangular, bearing short bipolar filament.



FIGURES 18–26. *Characithecium robustum* n. sp. **18.** whole mount, ventral view. **19.** male genital complex, ventral view. **20.** Egg. **21.** vagina, ventral view. **22.** ventral bar. **23.** dorsal bar. **24.** ventral anchor. **25.** dorsal anchor. **26.** hook. Scale bars: **18** = 125 μ m; **19** = 10 μ m; **20–26** = 20 μ m.

Remarks. *Characithecium robustum* **n. sp.** is the largest member of the genus and can be distinguished from *C. costaricensis*, by the morphology of accessory piece, the number of coils of MCO ($2\frac{1}{2}$ in *C. robustum* **n. sp.** vs $\frac{1}{2}$ –1 in *C. costaricensis*), the position of the vaginal aperture (latero ventral vs midventral), the sclerotization of the vaginal canal and the absence of a posterior ventral projection in ventral bar. Furthermore, *C. robustum* differs from the new species here described by having a sclerotized vaginal vestibule, as well as a V-shaped ventral bar, and by the shape of the accessory piece, with distal subunit with bifurcate end.

Characithecium quadratum* **n. sp.*

(Figs. 27–34; 49–50)

Type host. *Oligosarcus jenynsii* (Günther).

Type locality. Nahuel Rucá 38°08'S, 57°32'W, Mar Chiquita, Buenos Aires Province, Argentina.

Prevalence. 60%.

Mean abundance (intensity range). 1 (1–4).

Type material. Holotype (MLP-He-6799) and paratypes (MLP-He-6800) are deposited in the Helminthological Collection of the Museo de La Plata (HCMLP), La Plata, Argentina.

Etymology. The specific name is derived from Latin *quadratum* (=square) and refers to the shape of the accessory piece of the copulatory complex.

Description. Based on 10 specimens. Body robust 631 (498–752; n=10) long; greatest width 174 (144–223) usually at middle of body. Cephalic lobes developed. Five pairs of head organs and cephalic glands present. Two pair of eyespots in cephalic region and anterior to pharynx, accessory granules present in cephalic regions at level of pharynx. Pharynx spherical, 36 (32–40) in diameter; esophagus short. Haptor hexagonal, 78 (71–90) long, 100 (87–114) wide. Ventral anchor 43 (40–46) long, base 28 (23–31) wide, with well-developed elongate superficial root, shorter deep root, straight shaft and curved distal point, anchor filaments conspicuous. Dorsal anchor 34 (32–36) long, base 20 (18–23) wide, with developed roots, superficial root fusiform, straight shaft with curved distal point. Ventral bar 34 (29–37) long, with medial suture flanked by 2 blunt small protrusions at posterior margin and dilated extremes. Dorsal bar curved 39 (36–41) long with ends slightly expanded. Hooks similar in shape pairs 1 and 5 reduced in size 16 (12–19) long, hooks (excluding pairs 1 and 5) 22 (19–27) long, with protruding thumb and delicate point; shank comprised of 2 subunits; proximal subunit expanded, FH loop short. MCO a coiled tube with 2 counterclockwise coils, 163 (156–171) long; base of MCO reel-shaped, connected to articulation process of accessory piece. Accessory piece large, 40 (37–45) long, comprising 2 subunits connected by a muscular ligament, distal subunit a hook-shaped; proximal subunit elongate, with expanded and cup-shaped distal end serving as guide for male copulatory organ. Gonads overlapping; testis dorsal to germarium; seminal vesicle as a distal dilation of vas deferens. Prostatic reservoir present. Vitellaria dense throughout trunk, except in regions of reproductive organs. Oviduct, ootype and uterus not observed. Vaginal aperture marginal sinistral and slightly sclerotized, opening at level of anterior border of testicle. Vagina as a sinuous sclerotized tube connecting with a seminal receptacle anterior to germarium.

Remarks. *Characithecium quadratum* **n. sp.** differs from its congeners mainly by having the largest accessory piece, which is also different in shape, being rectangular with hook-shaped distal subunit and elongate proximal subunit ending in a cup-shaped anterior extreme. The position of vaginal aperture (at level of anterior margin of testicle) is also unique among congeners.

Characithecium chelatum* **n. sp.*

(Figs. 35–42; 51–52)

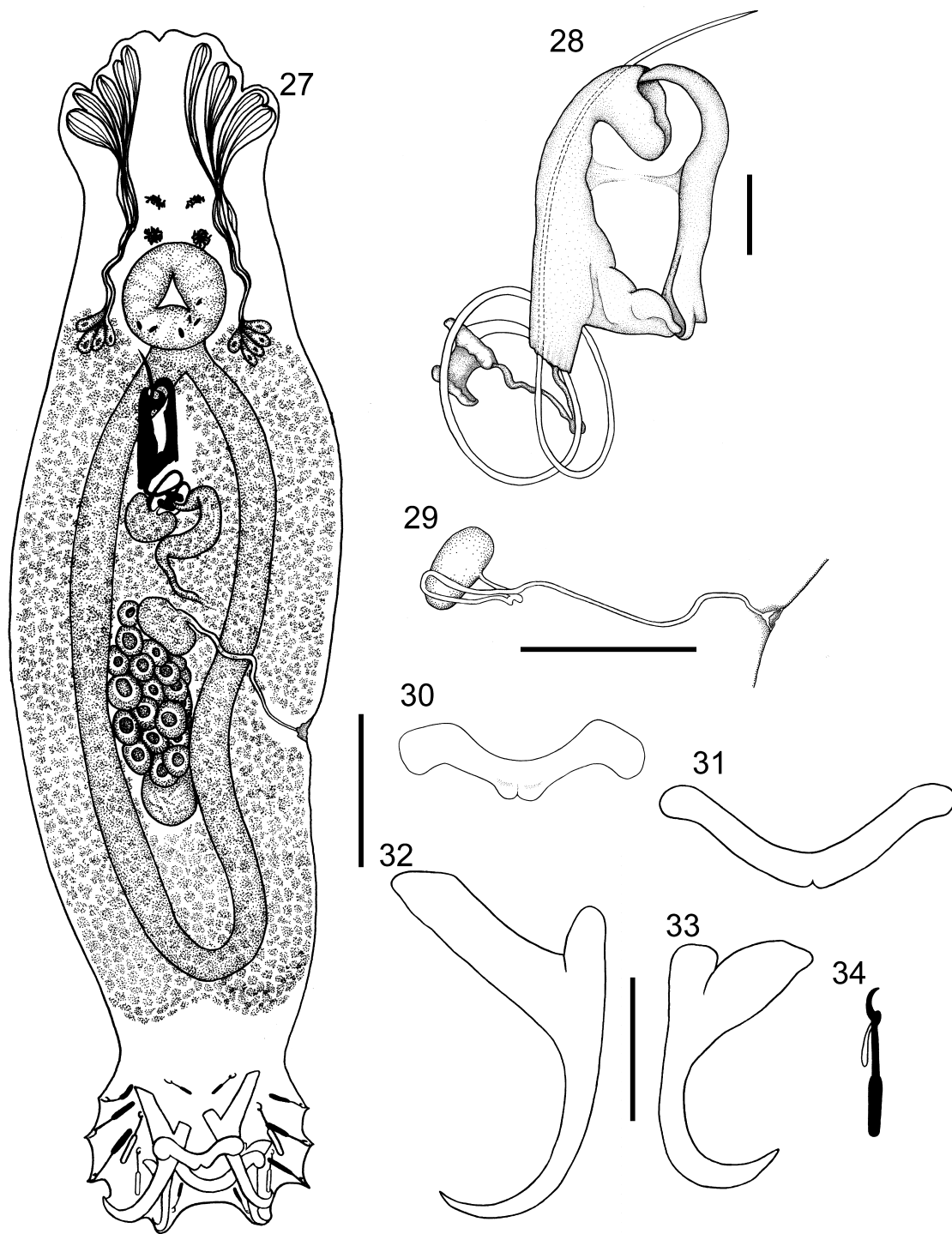
Type host. *Oligosarcus jenynsii* (Günther)

Type locality. Nahuel Rucá 38°08'S, 57°32'W, Mar Chiquita, Buenos Aires Province, Argentina.

Prevalence. 50%

Mean abundance (intensity range). 8.5 (2–65).

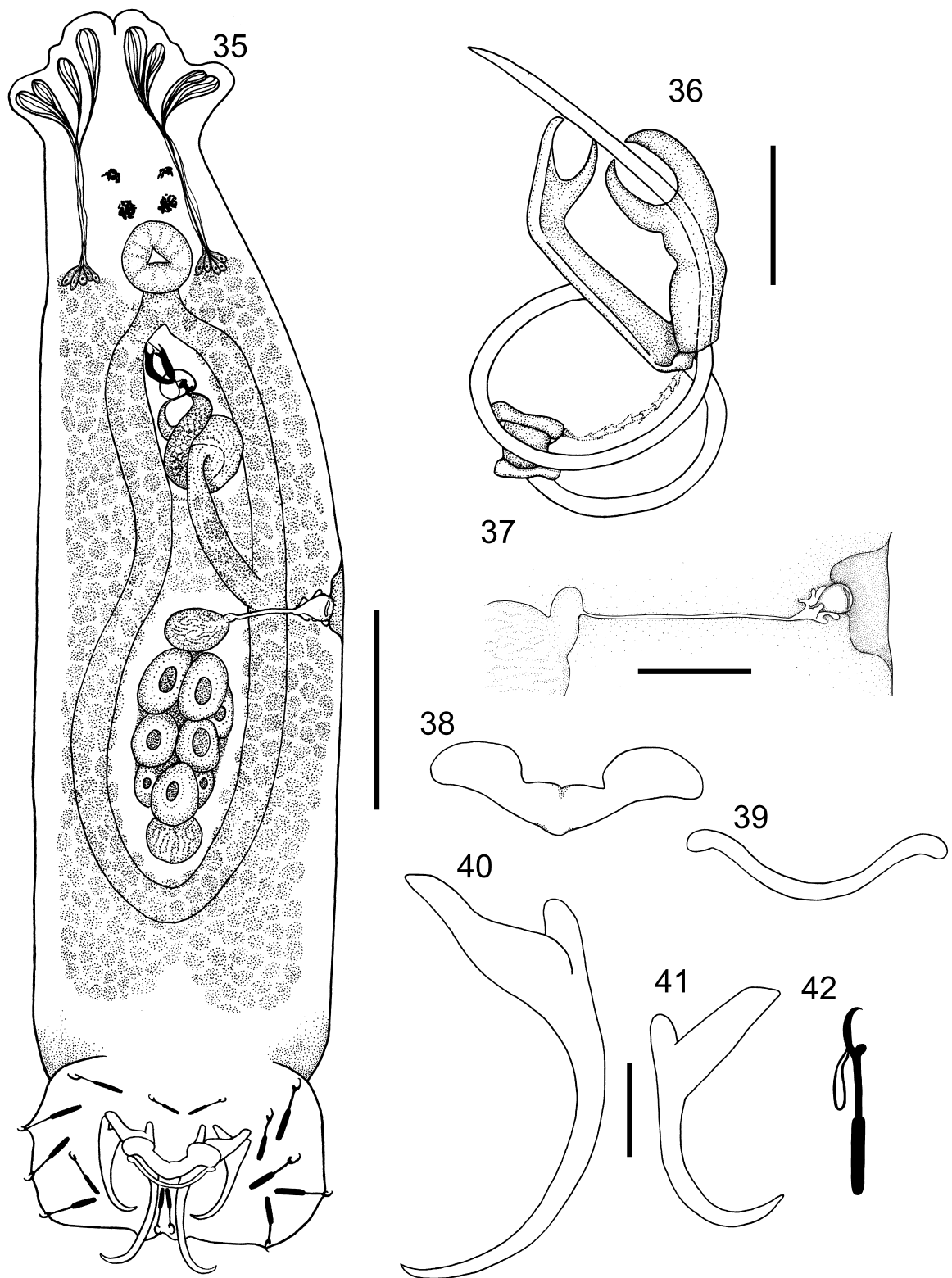
Type material. Holotype (MLP-He-6801) and paratypes (MLP-He-6802) are deposited in the Helminthological Collection of the Museo de La Plata (HCMLP), La Plata, Argentina.



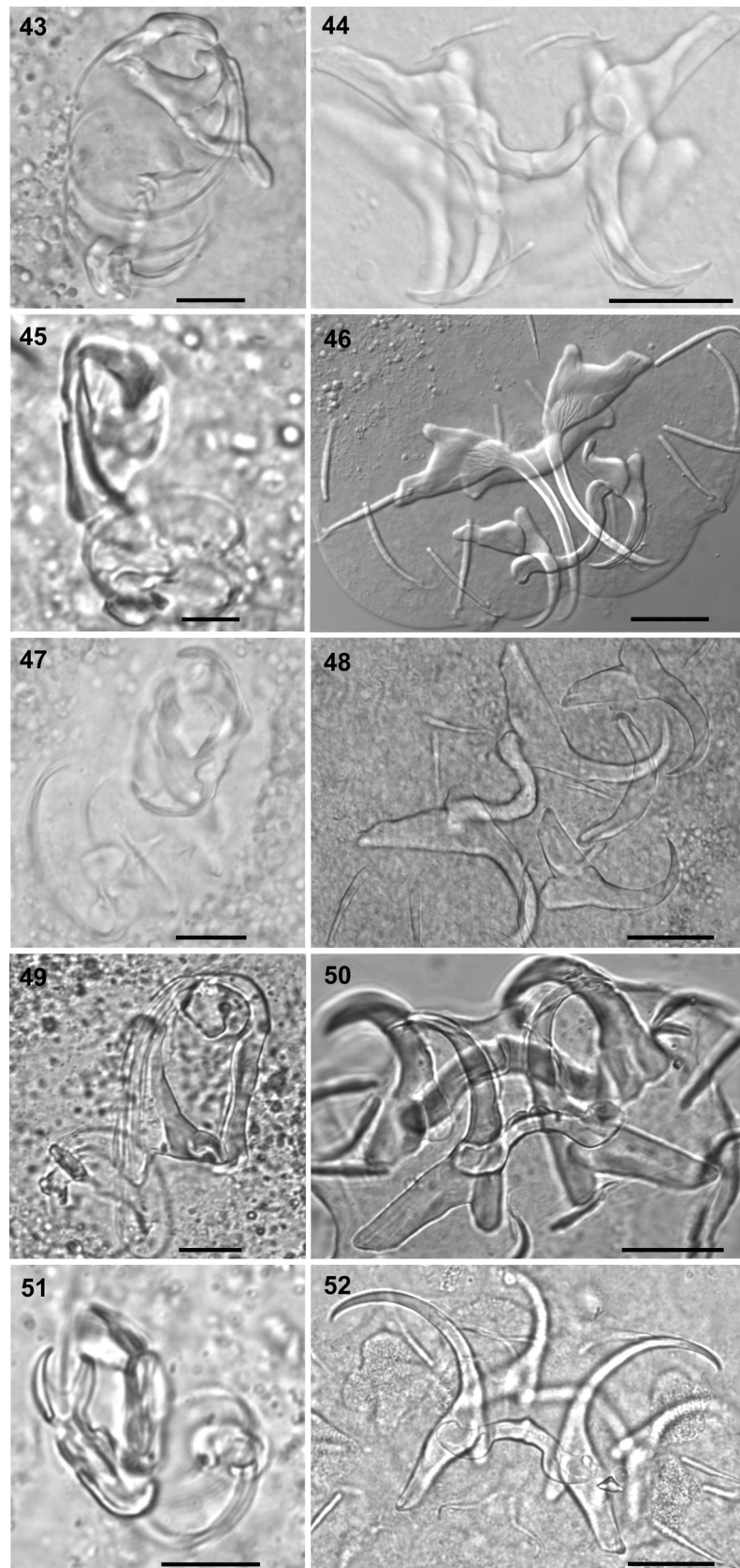
FIGURES 27–34. *Characithecium quadratum* n. sp. 27. whole mount, ventral view. 28. male genital complex, ventral view. 29. vagina, ventral view. 30. ventral bar. 31. dorsal bar. 32. ventral anchor. 33. dorsal anchor. 34. hook. Scale bars: 27= 125 μ m; 28= 10 μ m; 29–34= 20 μ m.

Etymology. The specific name is derived from Latin *chela* (=claw) and refers to the pincer shape of the accessory piece of the copulatory complex.

Description. Based on 10 specimens. Body small and delicate, 337 (270–426; n = 10) long; greatest width 99 (61–131) usually at middle of body. Two pair of cephalic lobes well developed 1 anterior and 1 lateral. Four pairs of head organs observed. Cephalic glands present. Two pair of eyespots in cephalic region, frequently dissociated, accessory granules often present in cephalic region. Pharynx spherical, 22 (17–28) in diameter; esophagus short.



FIGURES 35–42. *Characithecium chelatum* n. sp. 35. whole mount, ventral view. 36. male genital complex, ventral view. 37. vagina, ventral view. 38. ventral bar. 39. dorsal bar. 40. ventral anchor. 41. dorsal anchor. 42. hook. Scale bars: 35 = 50 μ m; 36 = 10 μ m; 37–42 = 20 μ m.



FIGURES 43–52. Male genital complex (MGC) and haptor armature of 5 species of *Characithecium*. **43–44.** *C. chascomusensis* n. comb. **43.** MGC, ventral view. **44.** haptor, ventral view. **45–46.** *C. longianchoratum* n. sp. **45.** MGC, dorsal view. **46.** haptor, ventral view. **47–48.** *C. robustum* n. sp. **47.** MGC, dorsal view. **48.** haptor, ventral view. **49–50.** *C. quadratum* n. sp. **49.** MGO, dorsal view. **50.** haptor, ventral view. **51–52.** *C. chelatum* n. sp. **51.** MGC, dorsal view. **52.** haptor, ventral view. Scale bars: **43, 45, 47, 49, 51** = 10 μ m; **44, 46, 48, 50, 52** = 20 μ m.

Haptor 75 (54–96) wide, 58 (49–70) long. Ventral anchor 44 (41–46) long, base 20 (18–23) wide; with well-developed and elongate superficial root, shorter deep root, curved shaft and curved distal point, anchor filaments conspicuous. Dorsal anchor 29 (26–31) long, base 16 (13–17) wide, with developed roots, superficial root elongated, straight shaft with curved distal point. Ventral bar 30 (20–33) long, V-shaped, with medial suture and dilated extremes. Dorsal bar curved 32 (28–36) long, posterior ends slightly expanded. Hooks similar in shape, hooks excluding pairs 1 and 5 and length with protruding thumb, delicate point; hooks pairs 1 and 5 reduced in size 15(14–18) long, longer hooks 20 (18–21); shank comprised of 2 subunits; proximal subunit expanded, filamentous booklet (FH) loop short. MCO a coiled tube with 1 ½ counterclockwise coils, 93 (85–108) long; base of MCO reel shaped, connected to articulation process of accessory piece. Accessory piece 17 (15–23) long, pincer shaped, comprising 2 subunits articulated at proximal ends, both with bifurcate extremes, the shorter serving as guide for MCO. Gonads overlapping; testis dorsal to germarium; seminal vesicle as a distal dilation of a vas deferens, looping before junction to MCO. Prostatic reservoir present. Vitellaria extended throughout trunk, except in regions of reproductive organs. Oviduct, ootype and uterus not observed. Vaginal aperture heavily sclerotized, coup-shaped plate at midbody, lateral and sinistral. Vagina almost straight connecting with a seminal receptacle. Seminal receptacle medial and anterior to germarium. Eggs not observed.

Remarks. *Characithecium chelatum* n. sp. is one of the smallest member of the genus; It resembles *C. longianchoratum* n. sp. in the general morphology and relative size of anchors as well as by having ventral anchors protruding from haptor. However, *C. chelatum* n. sp. can be distinguished from its congeners by the shape of the accessory piece, with 2 subunits articulated at base and with bifurcate extremes, by having 1½ coils in the MCO, by the shape and sclerotization of the vaginal aperture and by the absence of a posterior medial projection in ventral bar.

Discussion

Agarwal & Kritsky (1998) stated that the number of known Dactylogyridae genera parasitizing neotropical characiforms undoubtedly represents a limited proportion of the actual diversity. The present findings support this idea by adding 4 new species from a single host species caught in a single locality. These results also show that, even in the southern boundaries of the distribution of the Characiformes, the diversity of Dactylogyridae is fairly unknown. The finding of *C. chascomusensis* n. comb. in *C. voga*, reported by Suriano (1981) when the species was erected, is doubtful. Indeed, no specimens of this species were found in the present work on its type hosts from the type locality, but they were common in *O. jenynsii* in the same lake. It is probable that juvenile *O. jenynsii* may have been identified as *C. voga* by Suriano (1981). Consequently, the presence of *C. chascomusensis* n. comb. Presently has been confirmed parasitizing only *O. jenynsii* in the Pampasic region. *Oligosarcus* comprises 18 species (Menezes & Cunha Ribeiro 2010; Mirande *et al.* 2011), distributed throughout most of South American river basins below 14° latitude (Menezes 1987), and it would be expected that *Characithecium* is present in congeneric hosts from other regions of South America as it has been observed in different species of *Astyanax* from Central America.

A high degree of specificity is common for some dactylogyrids genera at the level of host genus (Poulin 1992; Sasal *et al.* 1998). However the possibility of their endemism in the Pampasic region cannot be discarded. Although its presence in other host species should be confirmed, together with the clarification of the generic identity of the *incertae sedis* species *Urocleidoides strombicirrus* and *U. trinidadensis* from northern latitudes. The speculative nature of these suppositions highlights the need of further studies on the monogenean fauna of Characid fishes in the Neotropics, and of their representatives in the Pampasic region in particular.

Species of *Oligosarcus* have a distribution pattern consisting mostly of allopatric species, except for *O. jenynsii*, that occurs in sympatry with *O. robustus* (Menezes), *O. oligolepis* (Steindachner) and *O. jacuiensis* (Menezes & Cunha Ribeiro) along the coastal plains of Rio Grande do Sul in Brazil and Uruguay (Menezes & Ribeiro 2010). In case the specificity of *Characithecium* spp. by *Oligosarcus* is confirmed, an interesting system will be available for research on evolutionary biology, including coespeciation, host switching, cophylogeography etc., of these groups of parasites and hosts.

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