

## New species of *Cichlidogyrus* Paperna, 1960 (Monogenea, Ancyrocephalidae) from the gills of *Sarotherodon occidentalis* (Daget) (Osteichthyes, Cichlidae) in Guinea and Sierra Leone (West Africa)

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### Abstract

The examination of gill parasites from *Sarotherodon occidentalis* (Daget) (Pisces, Cichlidae) in Guinea and Sierra Leone (West Africa) revealed the presence of seven species of Monogenea. Two of them have previously been described: *Cichlidogyrus halli* (Price & Kirk, 1967) and *Scutogyrus ecoutini* Pariselle & Euzet, 1995. Five are considered as new species, all belonging to *Cichlidogyrus* Paperna, 1960. They are *C. bouvii* n. sp., *C. fontanai* n. sp., *C. guirali* n. sp., *C. paganoi* n. sp. and *C. sanjeani* n. sp.

### Résumé

L'examen des parasites branchiaux de *Sarotherodon occidentalis* (Daget) (Pisces, Cichlidae) en Guinée et en Sierra Leone (Afrique de l'Ouest) a révélé la présence de sept espèces de Monogènes. Deux ont déjà été décrites: *Cichlidogyrus halli* (Price & Kirk, 1967) et *Scutogyrus ecoutini* Pariselle & Euzet, 1995. Cinq, appartenant toutes au genre *Cichlidogyrus* Paperna, 1960, sont considérées comme nouvelles, *C. bouvii* n. sp., *C. fontanai* n. sp., *C. guirali* n. sp., *C. paganoi* n. sp. et *C. sanjeani* n. sp.

### Introduction

*Sarotherodon occidentalis* (Daget) (Osteichthyes, Cichlidae), which has not previously been examined for parasites, was sampled in Guinea and Sierra Leone (West Africa) for a survey of their gill parasitic monogeneans.

### Materials and methods

Fish were captured in short coastal rivers of Guinea and Sierra Leone using gill or cast nets, or with Rotenone (Predatox<sup>®</sup>) which is a natural ichthyotoxic compound. The fish were dissected on site immediately after capture; the left branchial arches were frozen in liquid nitrogen until examination. To verify the spe-

cific identity of the host fishes, the carcasses were numbered and preserved in formalin. In the laboratory, the parasites, after thawing, were detached from the gill using a strong water current and transferred individually to a drop of ammonium picrate-glycerine (Malmberg, 1957). The preparation was then covered with a cover-slip and sealed with Glyceel (Gurr-BDH Chemicals Ltd). Sclerotised pieces of the haptor and of the copulatory complex were drawn using a camera lucida. Measurements, made with a digitiser in micrometres as the mean  $\pm$  the standard deviation followed by the range in parentheses, are those proposed by Gussev (1962) (Figure 1). The method of numbering of the haptoral pieces is that adopted at ICOPA IV (Euzet & Prost, 1981); the terminology is that proposed by Pariselle & Euzet (1995a): *uncinulus* for the marginal hooklets; *gripus* for the large median hooks.

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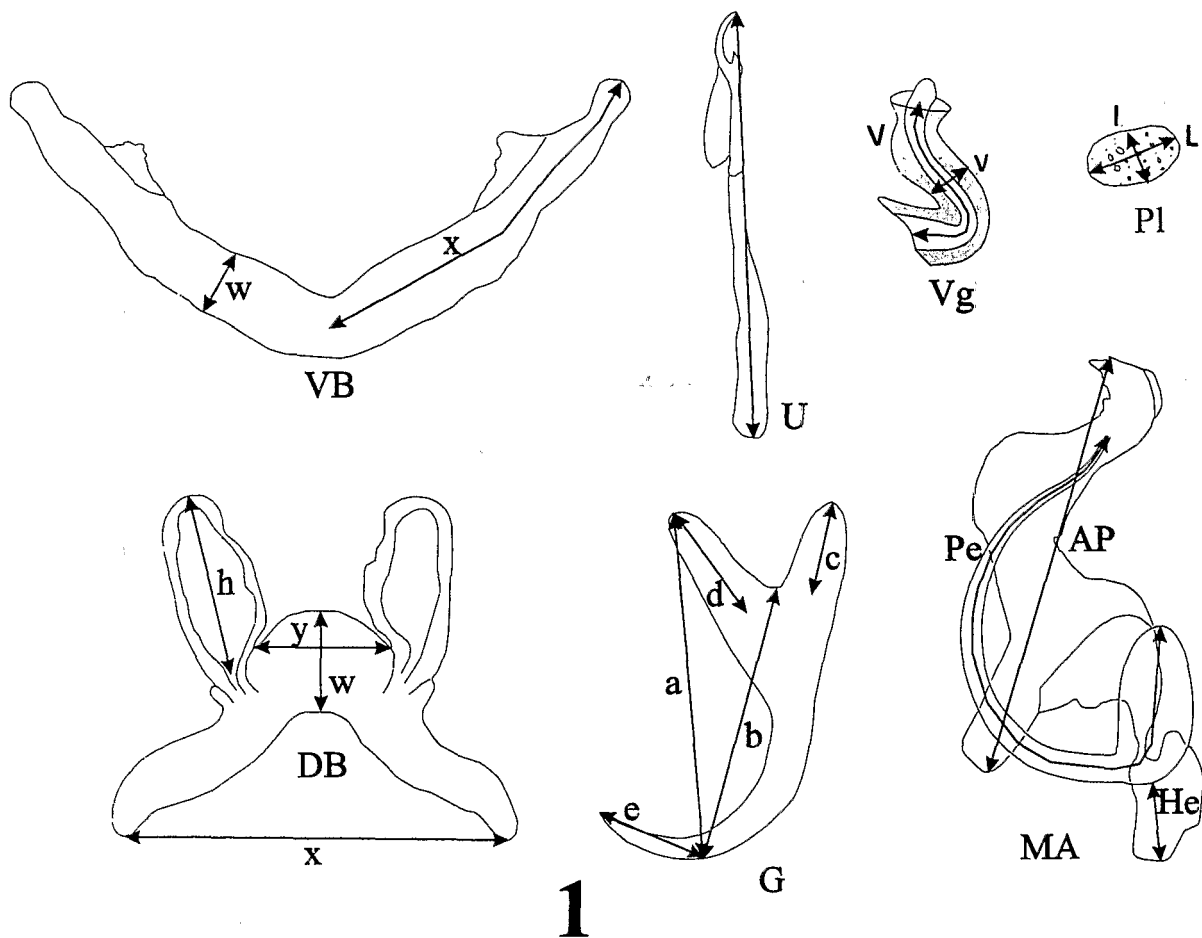


Figure 1. Measurements used in this study. Abbreviations: AP, accessory piece; DB, dorsal transverse bar; G, gripus; He, heel; MA, male apparatus; Pe, penis; Pl, auxiliary plate; U, uncinulus; VB, ventral transverse bar; Vg, vagina.

Although the work of Kritsky & Boeger (1989) has shown that ancyrocephalids formed "an unnatural taxon", we have opted in this contribution to keep this family as defined by Bychowsky and Nagibina (1978). However, we are absolutely conscious that a new taxonomic revision is clearly needed for Dactylogyridea. Readers should refer to Boeger & Kritsky (1993) for the phylogenetic position of the ancyrocephalid group.

## Results

Seven species of the Ancyrocephalidae (Monogenea) were recorded. Two, *Cichlidogyrus halli*\* (Price &

\* According to Dossou (1982) and Douëllou (1993), this species should be re-examined because of differences noticed between measurements of specimens from wide ranges of hosts.

Kirk, 1967) and *Scutogyrus ecoutini* Pariselle & Euzet, 1995, have already been described. Five are considered new species belonging to the genus *Cichlidogyrus*, as redefined by Dossou & Birgi (1984).

### *Cichlidogyrus* Paperna, 1960.

Ancyrocephalidae. Three pairs of cephalic glands. Two posterior eye-spots with crystalline lenses. Two small inconsistent anterior eye-spots. Simple intestinal caeca united posteriorly. Two pairs of gripi, one dorsal, one ventral. Two transverse bars, dorsal with two auricles, ventral V-shaped. Fourteen uncinuli. Median posterior testis. Vas deferens on right side, not encircling intestinal caecum. Seminal vesicle present. One prostatic reservoir. Male copulatory complex with penis and accessory piece. Auxiliary plate sometimes present. Median pre-testicular ovary. Submedian vaginal open-

ing. Sclerotised vagina. Seminal receptacle present. Parasites of African Cichlidae (rarely on Cyprinodontidae and Nandidae).

*Type-species: Cichlidogyrus arthracanthus* Paperna, 1960.

***Cichlidogyrus bouvii* n. sp.**

*Type-host: Sarotherodon occidentalis* (Daget).

*Site:* Gills.

*Type-locality:* River Bourouma, 10 km south-west of La Ramié (Guinea).

*Other records:* This species was also found on the same host in the River Batapon (tributary of the Rio Nunuez River) at Kamouri (Guinea) and in the Little Scarcies River at Katonga (Sierra Leone).

*Material studied:* 29 individuals stained and mounted in Malmberg solution.

*Type-material:* Holotype deposited at the Muséum National d'Histoire Naturelle (Paris): 530 HF, Tk 48. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): 530 HF, Tk 49 et Tk 50; The Natural History Museum (London): BM(NH) 1997.1.28.2; the Musée Royal d'Afrique Centrale (Tervuren): MRAC. M.T. 37.395.

*Description* (Figure 2)

*Adults:* 478 ± 45 (401–573) long, 96 ± 19.1 (62–139) wide at level of vagina. Dorsal gripus with blade regularly arched: a = 29 ± 1 (27–31), b = 23 ± 1 (21–25), c = 8 ± 0.9 (6–11), d = 11 ± 1.1 (8–13), e = 8 ± 0.7 (6–9). Arched dorsal transverse bar: x = 36 ± 2.9 (30–42), y = 11 ± 1 (9–13), w = 5 ± 0.9 (3–8), h = 12 ± 1 (10–15). Ventral gripus: a = 32 ± 1.2 (30–37), b = 29 ± 1.1 (26–31), c = 9 ± 0.9 (7–11), d = 11 ± 1.2 (8–13), e = 10 ± 0.7 (8–11). V-shaped ventral transverse bar: x = 31 ± 1.8 (27–35), w = 5 ± 0.7 (4–7). Uncinulus I small = 17 ± 1.3 (14–20), uncinulus II = 12 ± 0.5 (10–12), uncinuli III to VII long: III = 34 ± 1.6 (31–39), IV = 38 ± 1.3 (36–41), V = 40 ± 1.5 (37–43), VI = 36 ± 1.4 (34–40), VII = 35 ± 1.4 (32–39). Arched tubular penis with ovoid basal bulb and heel: Pe = 54 ± 2.9 (48–61), He = 6 ± 0.5 (5–8). Arched accessory piece, linked to the basal bulb of the penis, with a hook-shaped distal end: Ap = 35 ± 1.5 (31–39). Short conical vagina, curved in middle: V = 9 ± 1.4 (7–12), v = 3 ± 0.4 (2–4).

*Comments*

This *Cichlidogyrus* species is characterised by a small uncinulus I, long uncinuli III to VII, a short, conical vagina and no auxiliary plate associated with the male copulatory complex. These features are shared with *C. dossoui* Douëllou, 1993 and *C. vexus* Pariselle & Euzet, 1995, but the new species mainly differs by the shape and the dimensions of the accessory piece (smaller). The name *C. bouvii* n. sp. is proposed for Dr Marc Bouvy from ORSTOM.

***Cichlidogyrus fontanai* n. sp.**

*Type-host: Sarotherodon occidentalis* (Daget).

*Site:* Gills.

*Type-locality:* River Bourouma, 10 km south-west of La Ramié (Guinea).

*Other records:* This species was also found on the same host in the River Batapon (tributary of the Rio Nunuez River) at Kamouri (Guinea).

*Material studied:* 23 individuals stained and mounted in Malmberg solution.

*Type-material:* Holotype deposited at the Muséum National d'Histoire Naturelle (Paris): 532 HF, Tk 53. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): 532 HF, Tk 53; The Natural History Museum (London): BM(NH) 1997.1.28.3; the Musée Royal d'Afrique Centrale (Tervuren): MRAC. M.T. 37.396.

*Description* (Figure 3)

*Adults:* 524 ± 80.6 (364–701) long, 98 ± 14.7 (70–120) wide at level of penis. Dorsal gripus with guard 3 times longer than shaft, blade curved in distal third: a = 41 ± 2.5 (36–45), b = 35 ± 2.2 (31–38), c = 2 ± 0.4 (1–3), d = 11 ± 1.1 (9–13), e = 11 ± 0.7 (10–13). Dorsal transverse bar with large auricles: x = 34 ± 3.6 (22–38), y = 12 ± 1.2 (10–15), w = 8 ± 1.6 (5–10), h = 15 ± 1.8 (12–18). Ventral gripus same as dorsal: a = 42 ± 2.7 (36–46), b = 38 ± 2.2 (33–41), c = 2 ± 0.4 (1–3), d = 10 ± 1.1 (7–12), e = 14 ± 1.2 (12–17). V-shaped ventral transverse bar: x = 32 ± 2.1 (27–36), w = 6 ± 0.8 (5–8). Uncinuli short: I = 12 ± 0.4 (11–14), II = 11 ± 0.8 (8–12), III = 14 ± 0.8 (13–17), IV = 18 ± 1.1 (16–20), V = 20 ± 1.3 (16–22), VI = 17 ± 1 (15–20), VII = 14 ± 0.7 (12–15). Short, slightly arched penis, with small basal bulb; thin narrow heel: Pe = 29 ± 2.4 (24–36). Accessory piece linked to basal bulb, with

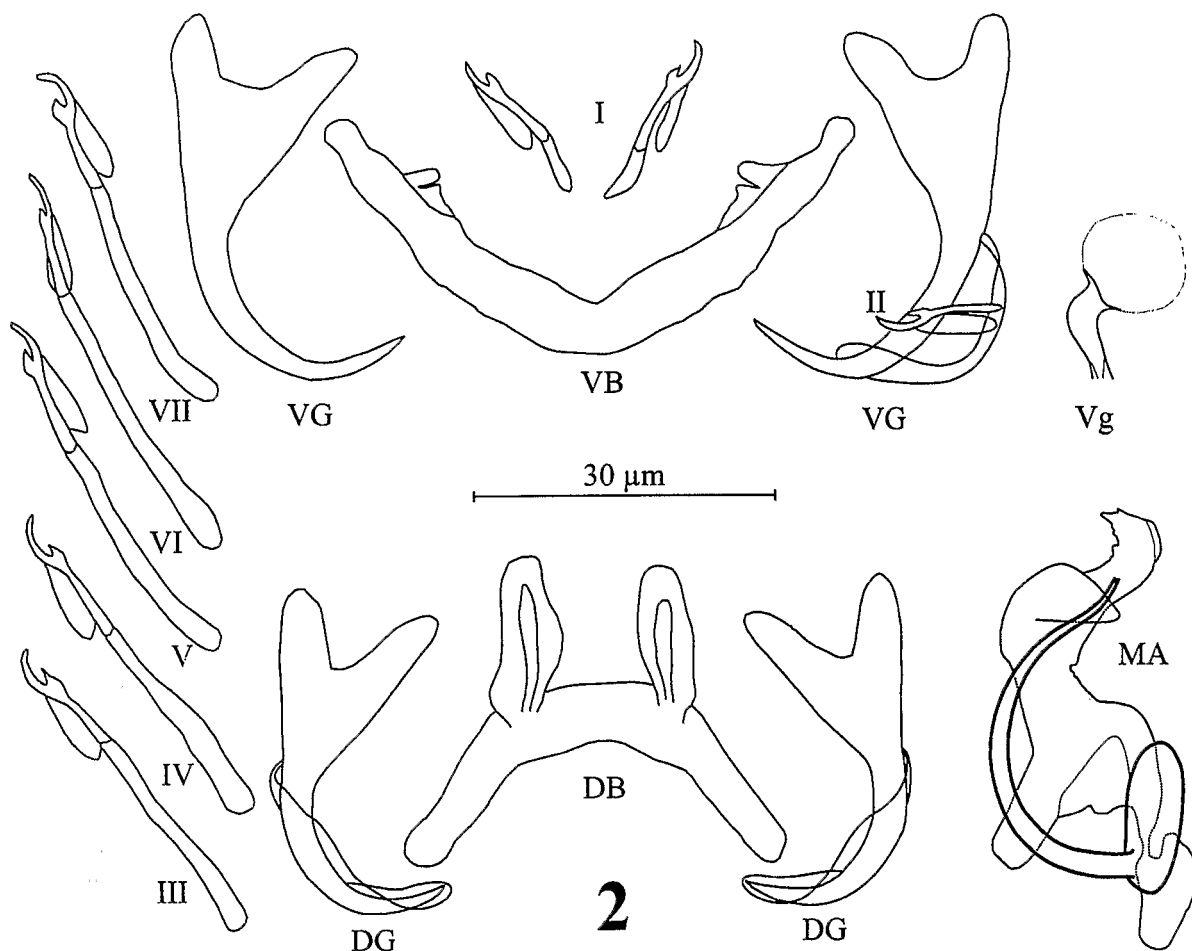


Figure 2. *Cichlidogyrus bouvii* n. sp. Abbreviations: DB, dorsal transverse bar; DG, dorsal gripus; MA, male apparatus; VB, ventral transverse bar; Vg, vagina, VG, ventral gripus; I to VII, uncinuli.

small diverticulum proximally and distal bifurcation formed by at least, 2 large pointed projections:  $Ap = 24 \pm 1.9$  (20–28). No visible vagina.

#### Comments

This species is characterised by small uncinuli I to VII, a short and slightly arched penis without a swollen portion and no visible vagina. These features are shared with: *C. haplochromii* Paperna & Thurston, 1969 and *C. tilapiae* Paperna, 1960. The new species is easily distinguished from all these species which have a single hook-shaped distal end of the accessory piece (vs two large distal points). The name *C. fontanai* n. sp. is proposed for Dr André Fontana, ORSTOM's representative in Guinea, who helped us in collecting material.

#### *Cichlidogyrus guirali* n. sp.

*Type-host*: *Sarotherodon occidentalis* (Daget).

*Site*: Gills.

*Type-locality*: River Bourouma, 10 km south-west of La Ramié (Guinea).

*Other records*: This species was also found on the same host in the River Batapon (tributary of the Rio Nunueze River) at Kamouri (Guinea) and in the Little Scarcies River at Katonga (Sierra Leone).

*Material studied*: 12 individuals stained and mounted in Malmberg solution.

*Type-material*: Holotype deposited at the Muséum National d'Histoire Naturelle (Paris): 533 HF, Tk 54. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): 533 HF, Tk 55; The Natural History

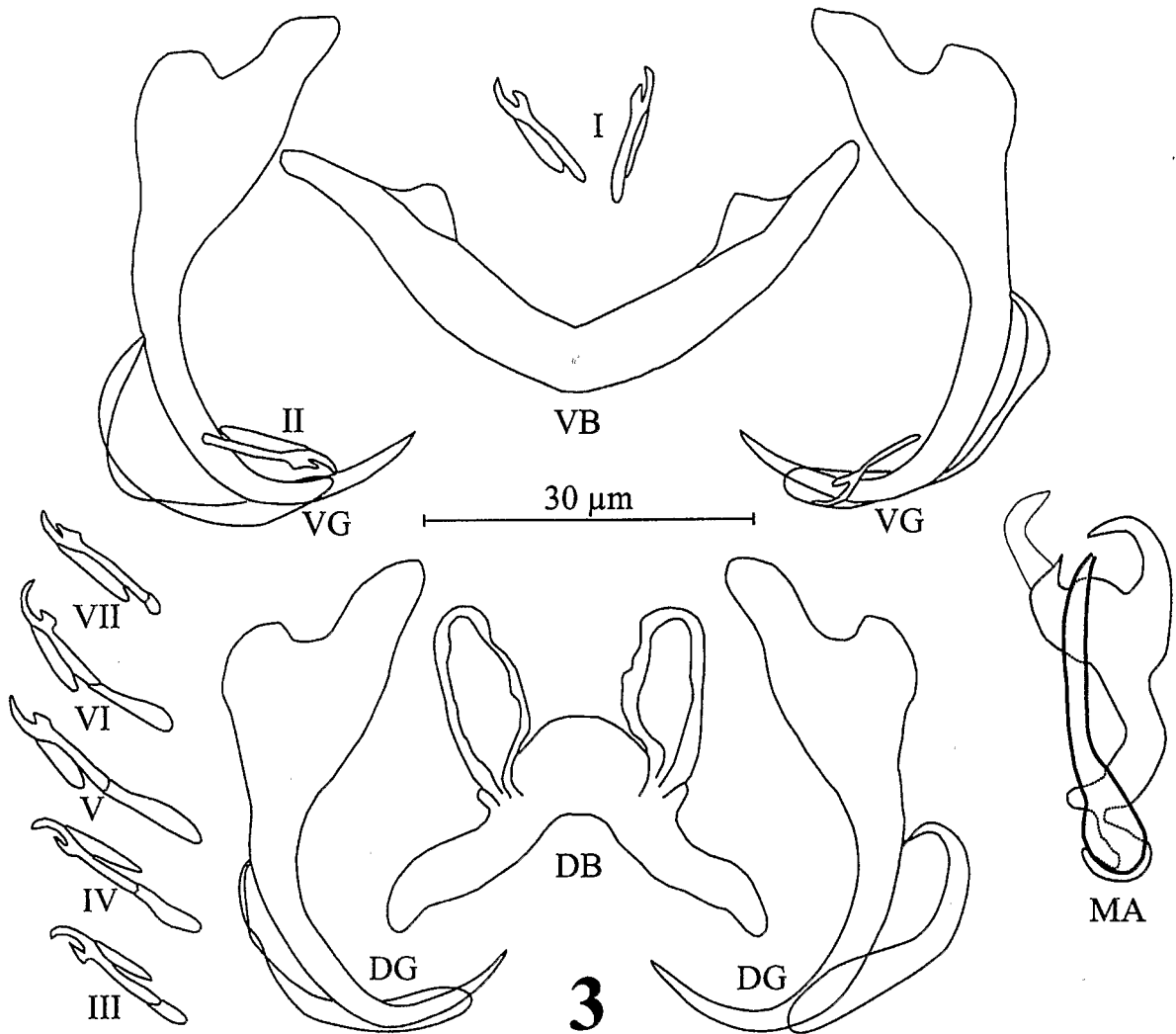


Figure 3. *Cichlidogyrus fontanai* n. sp. Abbreviations: DB, dorsal transverse bar; DG, dorsal gripus; MA, male apparatus; VB, ventral transverse bar; VG, ventral gripus; I to VII, uncinuli.

Museum (London): BM (NH) 1997.1.28.4; the Musée Royal d'Afrique Centrale (Tervuren): MRAC. M.T. 37.397.

#### Description (Figure 4)

*Adults*: 523 ± 104.2 (338–722) long, 109 ± 25.8 (70–151) wide at level of vagina. Dorsal gripus with guard twice as long as shaft: a = 27 ± 1.3 (24–29), b = 23 ± 1 (21–24), c = 5 ± 0.7 (4–7), d = 10 ± 1 (8–12), e = 10 ± 0.7 (9–11). Dorsal transverse bar: x = 37 ± 3.3 (31–44), y = 14 ± 1.4 (11–16), w = 6 ± 1.5 (4–8), h = 13 ± 1.5 (11–17). Ventral gripus: a = 33 ± 1.6

(30–35), b = 28 ± 1 (26–29), c = 6 ± 0.7 (4–6), d = 13 ± 1.3 (11–15), e = 12 ± 0.7 (10–14). V-shaped ventral transverse bar: x = 36 ± 2.9 (30–41), w = 5 ± 0.8 (4–6). Uncinulus I small = 16 ± 0.9 (14–18), uncinulus II = 13 ± 0.6 (11–14), III = 34 ± 2.8 (30–40), IV = 37 ± 2.6 (32–41), V = 38 ± 2.7 (33–42), VI = 37 ± 2.8 (32–41), VII = 34 ± 2.7 (29–39). Short penis with small ovoid bulb and poorly-developed heel: Pe = 54 ± 3.9 (46–61), He = 3 ± 0.4 (3–4). Accessory piece straight, with 2 small, very thin auxiliary plates, linked to basal bulb, enlarged in middle, ends in point: Pl<sub>1</sub> = 7 ± 1.5 (5–10) by 4 ± 0.7 (3–6), Pl<sub>2</sub> = 10 ± 1.5 (7–12) by 4

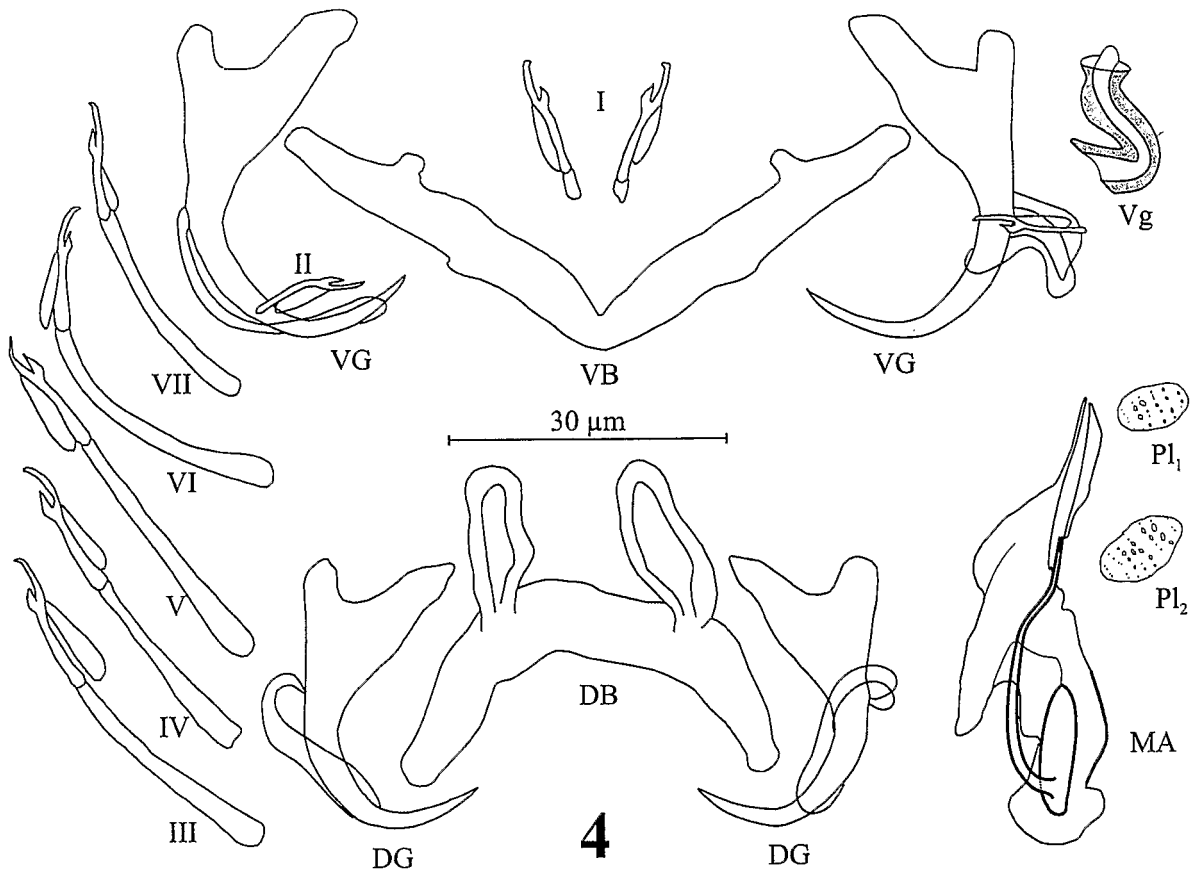


Figure 4. *Cichlidogyrus guirali* n.sp. Abbreviations: DB, dorsal transverse bar; DG, dorsal gripus; MA, male apparatus; Pl1 and Pl2, auxiliary plates; VB, ventral transverse bar; Vg, vagina; VG, ventral gripus; I to VII, uncinuli.

$\pm 0.7$  (3–5),  $Ap = 42 \pm 3.8$  (34–48). Short, C-shaped vagina:  $V = 17 \pm 2.1$  (14–21),  $v = 4 \pm 0.4$  (4–5).

#### Comments

This *Cichlidogyrus* species is characterised by two thin auxiliary plates associated with the male copulatory complex; it is the only representative of the genus possessing this character. *C. guirali* n. sp. is named for Dr Daniel Guiral of ORSTOM.

#### *Cichlidogyrus paganoi* n. sp.

*Type-host*: *Sarotherodon occidentalis* (Daget).

*Site*: Gills.

*Type-locality*: River Bourouma, 10 km south-west of La Ramié (Guinea).

*Other records*: This species was also found on the same host in the River Batapon (tributary of the Rio Nunuez River) at Kamouri (Guinea) and in the Little Scarcies River at Katonga (Sierra Leone).

*Material studied*: 25 individuals stained and mounted in Malmberg solution.

*Type-material*: Holotype deposited at the Muséum National d'Histoire Naturelle (Paris): 531 HF, Tk 51. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): 531 HF, Tk 52; The Natural History Museum (London): BM (NH) 1997.1.28.5; the Musée Royal d'Afrique Centrale (Tervuren): MRAC. M.T. 37.398.

#### Description (Figure 5)

*Adults*:  $530 \pm 77.2$  (404–697) long,  $124 \pm 24.6$  (83–168) wide at level of vagina. Dorsal gripus with guard longer than shaft; blade regularly arched:  $a = 30 \pm 1.2$

(27–32),  $b = 23 \pm 0.9$  (22–26),  $c = 10 \pm 0.9$  (7–12),  $d = 14 \pm 1.1$  (12–17),  $e = 9 \pm 0.7$  (7–11). Dorsal transverse bar:  $x = 33 \pm 3.6$  (28–44),  $y = 12 \pm 1.7$  (9–17),  $w = 8 \pm 1.1$  (6–10),  $h = 21 \pm 1.6$  (18–24). Ventral gripus similar to dorsal:  $a = 32 \pm 1.1$  (29–35),  $b = 26 \pm 1.1$  (22–28),  $c = 10 \pm 1$  (7–12),  $d = 14 \pm 1.1$  (12–17),  $e = 10 \pm 0.8$  (8–12). Strong V-shaped ventral transverse bar:  $x = 41 \pm 2.9$  (35–48),  $w = 8 \pm 1.3$  (5–11). Uncinulus I short =  $14 \pm 0.9$  (11–16), uncinulus II =  $13 \pm 0.7$  (11–15), uncinuli III–VII long: III =  $39 \pm 1.9$  (35–43), IV =  $41 \pm 2.1$  (37–44), V =  $42 \pm 2.1$  (38–46), VI =  $41 \pm 1.8$  (37–44), VII =  $39 \pm 2$  (34–42). Penis, beginning as ovoid bulb, is C-shaped with round heel:  $Pe = 60 \pm 5.5$  (50–74),  $He = 6 \pm 0.8$  (5–8). Right-angled (L-shaped) accessory piece with thin, wide auxiliary plate:  $Ap = 41 \pm 2.8$  (34–46),  $Pl = 26 \pm 1.9$  (22–29) by  $17 \pm 1.7$  (14–20). Vagina, large, straight:  $V = 21 \pm 2.7$  (17–28),  $v = 5 \pm 0.9$  (4–8) in diameter.

#### Comments

This species is characterised by a small uncinulus I, long uncinuli III to VII and one auxiliary plate associated with the male copulatory complex. These features are shared with *C. aegypticus* Ergens, 1981, *C. agnesi* Pariselle & Euzet, 1995, *C. bilongi* Pariselle & Euzet, 1995, *C. gallus* Pariselle & Euzet, 1995, *C. microscutus* Pariselle & Euzet, 1996 and *C. thurstonae*\* Ergens, 1981. The new species is readily distinguished from these as follows:

– *C. aegypticus*, *C. agnesi*, *C. bilongi* and *C. gallus* have the same shape of accessory piece but a very different vagina (in shape and length);

– *C. microscutus* has a small accessory plate (*vs* wide);

– *C. thurstonae* has the same shape of vagina but a very different accessory piece (S-shaped *vs* L-shaped, with a long diverticulum at the base *vs* short).

The species is named *C. paganoi* n. sp. for Dr Marc Pagano of ORSTOM.

#### *Cichlidogyrus sanjeani* n. sp.

*Type-host*: *Sarotherodon occidentalis* (Daget).

*Site*: Gills.

*Type-locality*: River Bourouma, 10 km south-west of La Ramié (Guinea).

\* Although Ergens (1981) did not mention this character in his original description.

*Other records*: This species was also found on the same host in the River Batapon (tributary of the Rio Nunuez River) at Kamouri (Guinea) and in the Little Scarcies River at Katonga (Sierra Leone).

*Material studied*: 14 individuals stained and mounted in Malmberg solution.

*Type-material*: Holotype deposited at the Muséum National d'Histoire Naturelle (Paris): 534 HF, Tk 56. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): 534 HF, Tk 57; The Natural History Museum (London): BM (NH) 1997.1.28.6; the Musée Royal d'Afrique Centrale (Tervuren): MRAC. M.T. 37.399.

#### Description (Figure 6)

*Adults*:  $379 \pm 41.8$  (323–436) long,  $85 \pm 19.2$  (59–112) wide at level of penis. Dorsal gripus with very short shaft and blade strongly bent in distal third:  $a = 30 \pm 1.5$  (27–33),  $b = 25 \pm 1.3$  (22–27),  $c = 1 \pm 0.2$  (1–2),  $d = 10 \pm 1$  (8–11),  $e = 12 \pm 0.5$  (11–13). Dorsal transverse bar with small auricles:  $x = 31 \pm 2.3$  (28–36),  $y = 16 \pm 1.4$  (13–18),  $w = 7 \pm 1.1$  (5–8),  $h = 10 \pm 1.5$  (8–14). Ventral gripus similar to dorsal:  $a = 33 \pm 1.9$  (27–36),  $b = 27 \pm 1.6$  (23–30),  $c = 1 \pm 0.4$  (0.5–2),  $d = 9 \pm 0.8$  (8–11),  $e = 14 \pm 0.5$  (13–15). Short, thick, V-shaped ventral transverse bar:  $x = 27 \pm 1.6$  (25–31),  $w = 5 \pm 0.8$  (3–6). Uncinuli I–VII short: I =  $12 \pm 0.5$  (11–14), II =  $11 \pm 0.5$  (10–12), III =  $14 \pm 0.8$  (13–16), IV =  $16 \pm 0.7$  (14–17), V =  $16 \pm 0.6$  (15–18), VI =  $15 \pm 0.6$  (13–16), VII =  $13 \pm 0.8$  (11–14). Penis with small ovoid bulb and well-developed swollen portion:  $Pe = 39 \pm 1.4$  (37–42),  $He = 3 \pm 0.6$  (2–4). Simple C-shaped accessory piece with bifurcate distal end:  $Ap = 29 \pm 3$  (24–35). No visible vagina.

#### Comments

This *Cichlidogyrus* species is characterised by a well-developed swollen portion of the penis, which it shares with *C. amphoratus* Pariselle & Euzet, 1996, *C. gibbus* Dossou, 1982,\* *C. karibae* Douëllou, 1993, *C. ornatus* Pariselle & Euzet, 1996, *C. papernastrema* Price et al., 1969, *C. philander* Douëllou, 1993 and *C. zambezensis* Douëllou, 1993. The new species can be readily distinguished from these by the following features:

– *C. papernastrema* and *C. philander* have large uncinulus I (*vs* small);

\* Although Dossou (1982) did not mention this character in his original description.

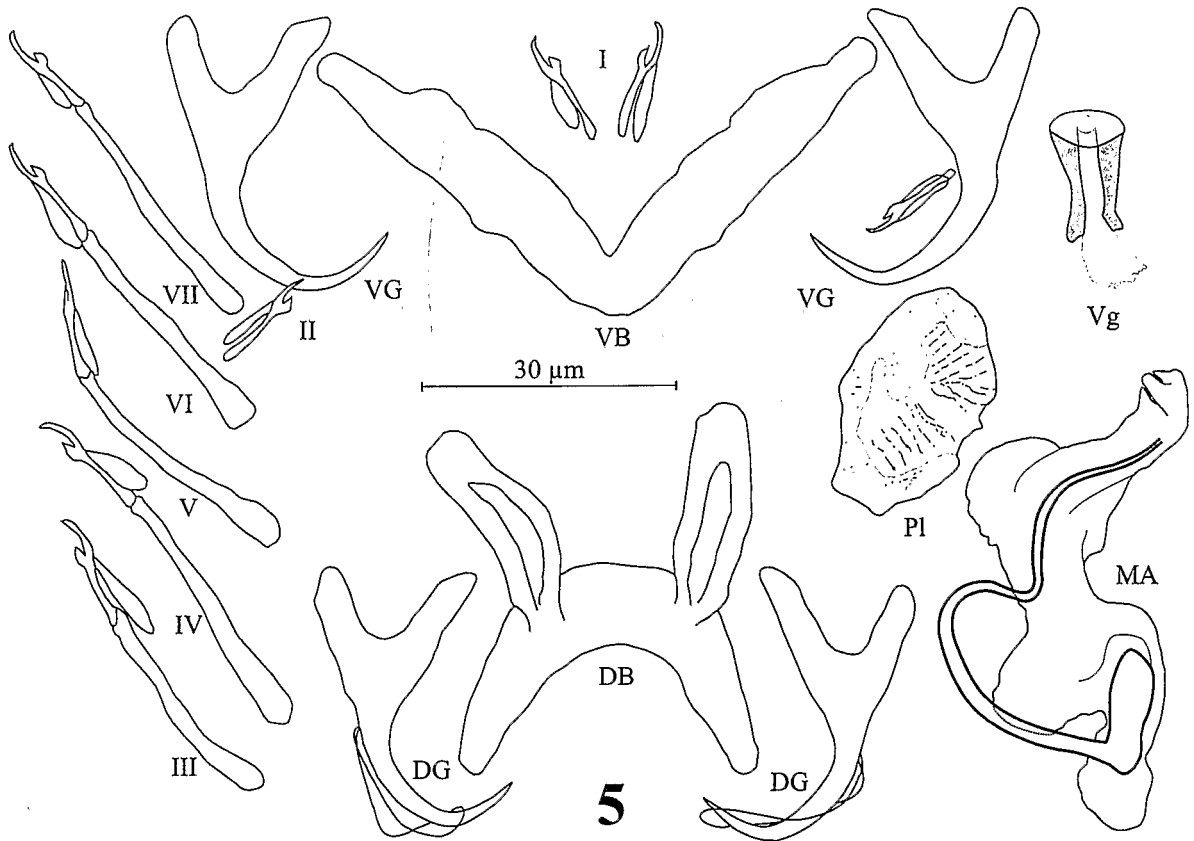


Figure 5. *Cichlidogyrus paganoi* n. sp. Abbreviations: DB, dorsal transverse bar; DG, dorsal gripus; MA, male apparatus; PI, auxiliary plate; VB, ventral transverse bar; Vg, vagina; VG, ventral gripus; I to VII, uncinuli.

– *C. amphoratus*, *C. karibae*, *C. ornatus* and *C. zambezensis* have single hook-shaped ends to the accessory pieces of the male apparatus (*vs* bifurcate) and a vagina (*vs* no observed vagina);

– *C. gibbus* has an indistinct swollen portion of the penis (*vs* well-developed).

*C. sanjeani* n. sp. is named for Dr Lucien Saint-Jean from ORSTOM.

## Discussion

The species richness of parasites is probably influenced by the phylogeny and the ecology of the hosts (Combes, 1995). In the case of *Sarotherodon occidentalis*, this hypothesis cannot be assumed. In fact, among the cichlid fishes that have been examined for monogeneans (see Pariselle & Euzet, 1994, 1995a,b,c, 1996), *S. occidentalis* is notable for its great number (seven) of parasite species on the gills, in spite of its restricted bioge-

ographical range (from Guinea Bissau to Liberia) and its small size (less than 283 mm in length) (Teugels & Thys van den Audenaerde, 1992). Furthermore, there are no other species which are closely related genetically (Pouyau & Agnèsè, 1995), in contrast to the case of cichlids of the subgenus *Coptodon* (see Pariselle & Euzet, 1996).

On the other hand, we identified a very high specificity among the monogenean forms found on *S. occidentalis*, with six specialised species. Although the seventh monogenean, i.e. *C. halli*, has been found on different host species of the genus *Oreochromis* and *Sarotherodon* in West Africa, we consider that this might represent a specialised form only found on *S. occidentalis*. Interestingly, using molecular methods, Pariselle has shown in his thesis (1997) that the species *C. halli*, which was first identified on the basis of morphological characters and which was known to parasitise *Oreochromis niloticus*, *Sarotherodon melanotheron* and *S. galileus*, in fact represents a species com-



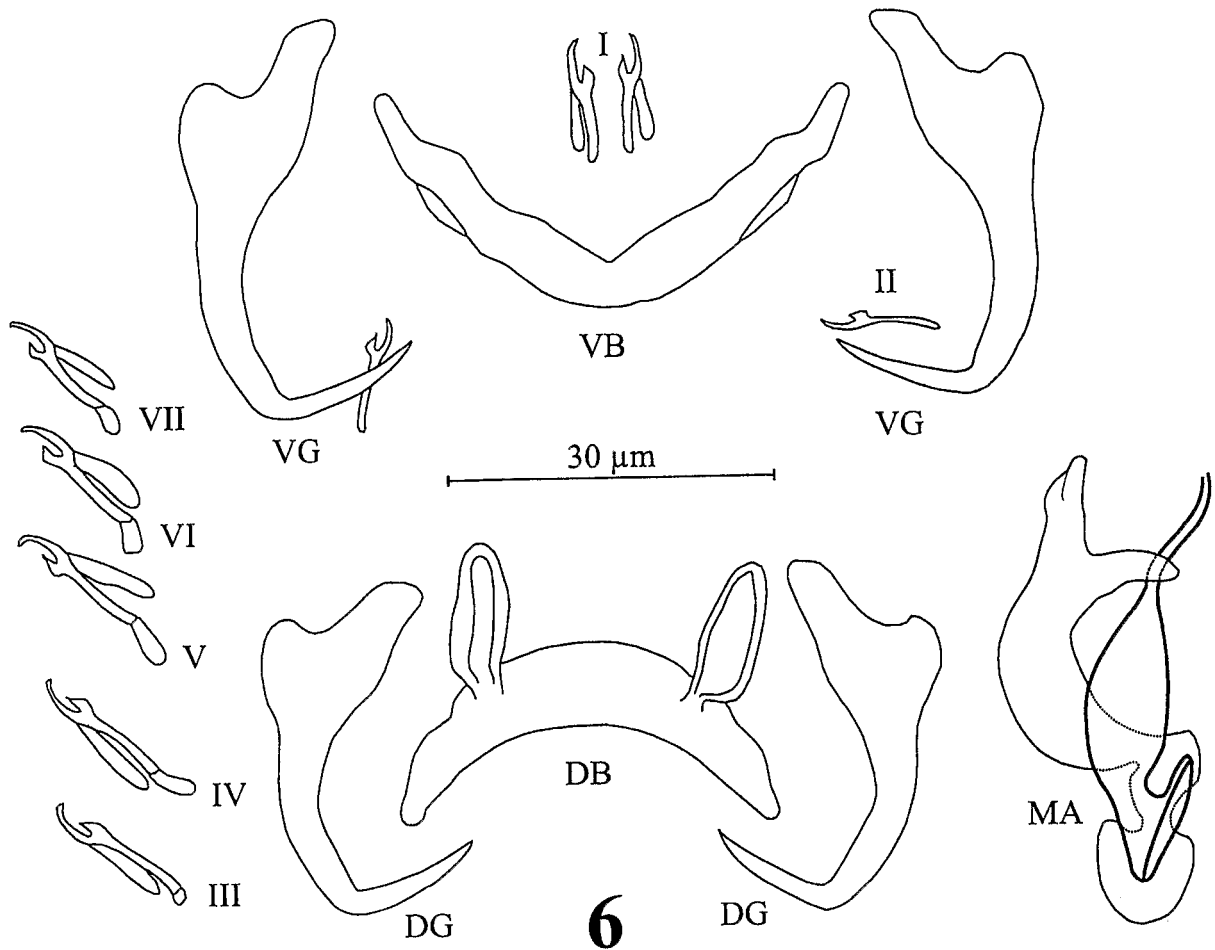


Figure 6. *Cichlidogyrus sanjeani* n. sp. Abbreviations: DB, dorsal transverse bar; DG, dorsal gripus; MA, male apparatus; VB, ventral transverse bar; VG, ventral gripus; I to VII, uncinuli.

plex. This oioxenous specificity might be explained by the absence of host species genetically related to *S. occidentalis*, thereby reducing the probability of lateral transfers between congeneric forms.

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