Description of three new species of Quadriacanthus (Monogenea: Ancyrocephalidae) gill parasites of Clarias submarginatus (Siluriformes: Clariidae) from Lake Ossa (Littoral region, Cameroon)

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ABSTRACT. Clariidae is a group that includes many species that have great economic importance in both fisheries and fish culture. Monogenean parasites of fishes assigned to this family have been well studied in Cameroon, but there have been no studies on Clarias submarginatus Peter, 1882, a fish that is traditionally consumed by the local people. The examination of 43 specimens identified as C. submarginatus from Lake Ossa (first record of this fish species in the Sanaga basin), revealed that some of them belong to Quadriacanthus and are new. Their identification was made based on the morphology and the size of sclerotized parts of the haptor and the male and female copulatory complexes. Quadriacanthus macruncus Bahanak, Nack & Pariselle sp. nov. and Quadriacanthus submarginati Bahanak, Nack & Pariselle sp. nov. are characterized by the morphology of their accessory piece, pointed, slightly curved and wider at medium level, equipped with two subterminal, symmetrical and similar spines for Q. macruncus sp. nov. and made up of one long tip flanked by a short spine and a bulb for Q. submarginati sp. nov., while Quadriacanthus ossaensis Bahanak, Nack & Pariselle sp. nov. is distinguished by the unique morphology of the penis, ending in a fork. The new species of Quadriacanthus are herein described and their host specificity is discussed.

KEY WORDS. Quadriacanthus macruncus sp. nov., Quadriacanthus submarginati sp. nov., Quadriacanthus ossaensis sp. nov.
MATERIAL AND METHODS

Specimens (n = 43) of *C. submarginatus* examined in this study were caught using gill nets, cast nets, fish-traps or hook lines by fishermen and were purchased on shore market (SM in Fig. 1) or at the Edéa fish market (EFM in Fig. 1). Fish were immediately placed in a cool box containing ice, and were transported to the laboratory, where they were frozen at -21°C. After thawing, gills arches were removed by dorsal and ventral sections, and placed in a Petri-dish containing tap water. The parasites were dislodged from the gill filaments with the aid of a dissection needle. The monogeneans were fixed between the gill filaments with the aid of a dissection needle. The monogeneans were fixed between slides and cover slips into a drop of glycerin ammonium-picrate mixture (GAP) (1957). After 24 hours the preparations were sealed using nail varnish. Specimen’s identification, based on the morphology and the size of sclerotized pieces of the haptor and the copulatory complex, followed (1988), (1999) and (2001). The measurements and drawings of the sclerotized pieces of the haptor and copulatory complex were made with the aid of microscope Leica DM 2500, LAS software (3.8) and Corel Draw X4® software, version 14.0.0.701. These measurements and the numbering of haptorial pieces were carried out based on (1999) (Fig. 2). Measurements were given in micrometers as follows: average (minimum – maximum); the standard deviation is given when n ≥ 30. Types where deposited in the Musée Royal de l’Afrique Central (MRAC, Tervuren, Belgium).

TAXONOMY

Class Monogenea Van Beneden, 1858
Dactylogyridae Bychowsky, 1937
Ancyrocephalidae Bychowsky, 1937


*Quadriacanthus macruncus*
Bahanak, Nack & Pariselle, sp. nov.

Description (based on 9 specimens, all mounted in GAP): adults measure 428.3 (209.7-737.6) long, 83.4 (47.8-101.5) wide at level of ovary. Pharynx circular is 26. 9 (25.8-27.9) wide. Straight tubular penis widened at basal extremity and tapering at distal one, Pe = 28.7 (25.1-31.5) long. Accessory piece pointed, slightly curved and wider at median level, equipped with two subterminal, symmetrical and similar spines, Ap = 21.6 (18.1-23.3). Vagina not observed. Hooklets pair I = 12.9 (12.2-13.7), II = 12.9 (11.8-13.8), III = 13.6 (12.9-13.9), IV = 25.6 (24.9-26.7), V = 13.4 (12.4-14.3), VI = 14 (13.1-15.9), VII = 13.5 (12.9-14.1). Dorsal bar composed of developed rectangular centre, Ct = 24.7 (24.1-25.7), w = 9.1 5 (6.5-14.2) wide, with one median triangular...
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**Quadriacanthus ossaensis**

Bahanak, Nack & Pariselle, **sp. nov.**

Fig. 4

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Description (based on 33 specimens, all mounted in GAP): adults measure: 368 ± 86.8 (188.9-597.7) long, 65. 5 ± 16. 1 (33.7 - 98.9) wide at level of ovary). Pharynx circular is 21 (18-24) wide. Winding tubular penis, widened at basal extremity, regularly

**Etymology.** The specific name, *macruncus*, refers to the large size of the anchors of this species.

Remarks. The morphology of the male copulatory complex of *Q. macruncus* resembles *Q. levequei* Birgi, 1988 and *Q. euzeti* Nack, Pariselle & Bilong Bilong, 2015; *Q. macruncus* can be distinguished by its smaller size: (Pe = 25.1-31.5 vs 45-50, 36-40; Ap = 18.1-23.3 vs 30-35, 25-28), and by the morphology of the median process, directed posteriorly to the dorsal bar, triangular. This structure is in the shape of a stick in *Q. levequei* and a funnel in *Q. euzeti*.
tapering to the distal one Pe = 28.2 ± 3.1 (23.9-32.4). Accessory piece, tubular, slightly arched and ending with two expansions: one fork shaped, the other one chevron shaped, Ap = 26.5 ± 2.9 (22-30.1). Tubular vagina, Vg = 24.9 ± 5 (20.9-30.6). Hooklets pair I = 13.5 ± 0.9 (11.7-15.4), II = 13.3 ± 0.8 (12-15.6), III = 14.3 ± 0.6 (12.1-15.7), IV = 24.8 ± 0.5 (23.8-25.7), V = 12.9 ± 0.7 (11.7-14.3), VI = 13.2 ± 0.8 (11.9-15), VII = 12.7 ± 0.8 (11-14.2). Dorsal bar composed of a developed trapezoidal centre, Ct = 17.4 ± 2.7 (14.5-21.9), w = 9.7 ± 0.8 (8.2-10.7) wide, with one posteriorly directed rectangular process, h = 8.6 ± 1.4 (7.1-9.9), and two lateral expansions, x = 20.4 ± 1.2 (18.9-22). Dorsal anchor without shaft, but with curved blade and short point, a = 28.3 ± 1.2 (26.9-30.8), ba = 9.1 ± 0.6 (8.1-9.8), e = 6.2 ± 1.2 (5.2-8.6), triangular dorsal cuneus (or patch) slightly curved, i = 5.2 ± 0.5 (4.8-5.8), j = 15.7 ± 0.6 (15-16.8). Ventral bar V-shaped, made up of two branches medially articulated, x = 32.6 ± 1.3 (30.4-36.2), w = 4.3 ± 0.5 (3.3-5.3), ventral anchor quite similar to dorsal one, a = 19.9 ± 1 (18.6-21.4), ba = 4.8 ± 0.3 (4.1-7.7), e = 9.8 ± 1.2 (7.7-12.1), triangular ventral cuneus, i = 2.4 ± 0.4 (1.6-3.3), j = 4.1 ± 0.7 (3.5-5.8).

Type host. *Clarias submarginatus* Peter, 1882.
Site. Gills.
Type locality. Lake Ossa, Cameroon (3°45'-3°51'N, 9°58'-10°03'E).
Materials studied. 43 host individuals and 33 monogeneans.
Parasitic indices. Prevalence = 81.8%, mean abundance = 4.4 ± 5.8.
Etymology. The specific name, *ossaensis*, refers to the type locality of this species.
Remarks. The morphologies of the penis and of the accessory piece of *Q. ossaensis* sp. nov. are similar to *Quadriacanthus ayameensis* N’Douba, Lambert & Euzet, 1999, a gill parasite of *Heterobranchus longifilis* (Valenciennes, 1840) and *Heterobranchus isopterus* Bleeker, 1863 in the rivers Bia, Agnéby and in Lake Ayamé (Ivory Coast). *Quadriacanthus ossaensis* can be distin-

Figure 3. Sclerotized parts of *Quadriacanthus macruncus* sp. nov.: (Cc) copulatory complex, (Da) dorsal anchor, (Db) dorsal bar, (Dcn) dorsal cuneus, (H) hooklets, (Va) ventral anchor, (Vb) ventral bar, (Vcn) ventral cuneus, (Vg) vagina. Scale bar: 20 µm.
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Quadriacanthus submarginati
Bahanak, Nack & Pariselle sp. nov.

Description (based on 22 specimens, all mounted in GAP): adults measure 399.6 (250.6-572.3) length, 63.8 (11.6-113.6) wide at level of ovary. Pharynx circular is 21.7 (20.2-21.6) wide. Penis wide-opened at basal extremity, tapering, bent and forked at the distal extremity, Pe = 29.7 (25.8-31.6). Accessory piece tubular, slightly curved, with a complex structure made up of one long tip flanked by a short tip and by a bulb, Ap = 21.8 (19.2-25.8). Tubular curved vagina, slim and slightly sclerotized at basal zone, and connected to a large seminal receptacle which opens near vaginal pore, Vg = 26.9 (25.3-32.1). Hooklets pair I = 13.7 (12.7-14.7), II = 14 (12.9-14.7), III = 14.3 (12.5-15.7), IV = 21.1 (19.7-24.3), V = 13.6 (12.3-14.8), VI = 14.1 (12.5-15.1), VII = 14.1 (11.7-15.7). Dorsal bar with a rectangular centre, Ct = 19.1 (16.7-23.3), w = 8.5 (6-11.5) wide, a median posteriorly directed triangular process, h = 5.3 (4-6.5), and two lateral expansions, x = 29.2 (26.4-32.9), dorsal anchor lacking shaft, but with reduced guard, curved blade at distal region and mean point, a = 32.7 (30-34.7), ba = 9.1 (7.7-10), e = 8.4 (6.1-9.7), triangular and slightly curved dorsal cuneus (or patch), i = 3.5 (2.1-3.1), j = 6.3 (5.1-7.1), ventral bar made up of two branches medially articulated, x = 43 (37.9-47.7), w = 5.5 (3.5-7.6), ventral anchor without shaft, but with reduced guard, curved blade, and with long point, a = 24.7 (22.8-26.9), ba = 5.8 (5.1-6.3), e = 10.8
(8-11.7), ventral cuneus (or patch) smaller than dorsal one, i = 1.7(1.2-2), j = 3.8 (4.6-4.9).

Type host. *Clarias submarginatus* Peter, 1882.
Site. Gills.
Type locality. Lake Ossa, Cameroon (3°45'-3°51'N, 9°58'-10°03'E).


Materials studied. 43 host individuals and 22 monogeneans.

Parasitic indices. Prevalence = 45.5%, mean abundance = 2.8 ± 3.8.

Etymology. The specific name, *submarginati* refers to specific name of the host.
Remarks. This species is close to *Q. macruncus* sp. nov. in the morphology of the dorsal and ventral bars, dorsal and ventral anchors; it differs from it in the morphology of the copulatory complex and the size of the point of its dorsal (e = 6.1-9.7 vs 1.9-3.1) and ventral (e = 8-11.7 vs 3.2-4.3) anchors.

**DISCUSSION**

This is the first record of *C. submarginatus* in the Sanaga basin, precisely at Lake Ossa. Up to now, this fish species was recorded in the rivers Kienké (at Kribi), Lobé (misspelled Lobi)
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The authors wish to thank A.R. Bitja Nyom for his technical advice in the host identification, and MM. A.P. Ebbah, N. Yomba, Sok Nguimbat, and N. Biname for their assistance during the fieldwork.

**ACKNOWLEDGMENTS**

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**LITERATURE CITED**


and Ntem (in Cameroon), Komo and Ogôoué (in Gabon) (STIASSNY et al. 2007).

In Cameroon, only two studies by Birgi (1988) and NACK et al. (2015) have been conducted on *Quadriacanthus* species. They resulted in the description of five species: *Quadriacanthus levequei* from *Clarias pachynema* Boulenger, 1903; *Quadriacanthus dageti* Birgi, 1988 from *C. jaensis* Boulenger, 1909, and *Quadriacanthus nyongensis* Birgi, 1988 and *Quadriacanthus teugelsi* Birgi, 1988 from *C. pachynema* and *C. jaensis* (Nyong basin); and Q. euzeti from *Papycroanus afer* Günther, 1868 (Notopteridae) in Lake Ossa (Sanaga basin). Monogenean parasites are known for their narrow host specificity (EUZET & COMBES 1980); even so lateral transfers have happened numerous times in lakes, most likely promoted by ecological and ethological changes (COMBES 1990, NORTON & CARPENTER 1998). For example in Lake Ossa where *Quadriacanthus euzeti* was recently described on a host belonging to Osteoglossiformes (see above), when *Quadriacanthus* spp. are specific of *Clarias, Heterobranchus* and *Bagrus* fishes (NACK et al. 2015); the same is true for *Scutogyrus vanhovei* Pariselle, Bitja Nyom & Bilong Bilong, 2013 described on *Tilapia mariae* in the same lake, while *Scutogyrus* spp. were only known from *Santherodon* and *Oreochromis* hosts species (PARISELLE et al. 2013).

In this context of variable specificity according to ecological conditions, it would be interesting to determine the range of the host spectrum of *Quadriacanthus* species from *Clarias pachynema, C. jaensis, P. afer* and the newly studied *C. submarginatus* in the Lake Ossa system, where these fish are sympatric (STIASSNY et al. 2007).


