MONOGENEANS FROM PANGASIIDAE (SILURIFORMES) IN SOUTHEAST ASIA: VII. SIX NEW HOST-SPECIFIC SPECIES OF *THAPAROCLEIDUS* JAIN, 1952 (ANCYLODISCOIDIDAE) FROM *PANGASIUS POLYURANODON*

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Summary:

The examination of gill parasites from *Pangasius polyuranodon* Bleeker, 1852 (Siluriformes, Pangasiidae) revealed the presence of six new host-specific species of Monogenea, all belonging to *Thaparocleidus* Jain, 1952 (Monogenea, Ancylodiscoididae) as defined by Lim (1996) and Lim *et al.* (2001): *T. caestus* n. sp., *T. crassipenis* n. sp., *T. legendrei* n. sp., *T. levangi* n. sp., *T. slembroucki* n. sp. and *T. virgula* n. sp.

KEY WORDS : Monogenea, Ancylodiscoididae, *Thaparocleidus caestus* n. sp., *Thaparocleidus crassipenis* n. sp., *Thaparocleidus legendrei* n. sp., *Thaparocleidus levangi* n. sp., *Thaparocleidus slembroucki* n. sp., *Thaparocleidus virgula* n. sp., Freshwater fish, Siluriformes, Pangasiidae, *Pangasius polyuranodon*, Southeast Asia.

Résumé : MONOGÈNES DE PANGASIIDAE (SILURIFORMES) EN ASIE DU SUD-EST : VII. SIX ESPÈCES NOUVELLES DE *THAPAROCLEIDUS* JAIN, 1952 (ANCYLODISCOIDIDAE) SPÉCIFIQUES DE *PANGASIUS POLYURANODON*

L'examen des parasites branchiaux spécifiques de Pangasius polyuranodon *Bleeker, 1852 (Siluriformes, Pangasiidae) a révélé la présence de six nouvelles espèces de Monogenea appartenant toutes au genre* Thaparocleidus *Jain, 1952 (Ancylodiscoididae) tel que défini par Lim (1996) et Lim* et al. *(2001) :* T. caestus *n. sp.,* T. crassipenis *n. sp.,* T. legendrei *n. sp.,* T. levangi *n. sp.,* T. slembroucki *n. sp. et* T. virgula *n. sp.*

MOTS CLÉS : *Monogenea, Ancylodiscoididae,* Thaparocleidus caestus *n. sp.,* Thaparocleidus crassipenis *n. sp.,* Thaparocleidus legendrei *n. sp.,* Thaparocleidus levangi *n. sp.,* Thaparocleidus slembroucki *n. sp.,* Thaparocleidus virgula *n. sp., poisson d'eau douce, Siluriformes, Pangasiidae,* Pangasius polyuranodon, *Asie du Sud-Est.*

INTRODUCTION

Within the framework of an European Commission project on the biodiversity and culture of Southeast Asian catfishes, the gills from pangasiid fishes (Siluriformes, Pangasiidae) were examined for monogeneans. This paper presents the descriptions of six new host-specific species of *Thaparocleidus* Jain, 1952 (Monogenea, Ancylodiscoididae) found on *Pangasius polyuranodon* Bleeker, 1852. The monogeneans from the other *Pangasius* species or the non specific species from *P. polyuranodon* will be described elsewhere. To date 28 species of monogenean parasites (27 belonging to *Thaparocleidus* and one to *Pangasitrema* Pariselle, Euzet & Lambert, 2004) have been described from *Pangasius bocourti* Sauvage, 1880; *P. djambal* Bleeker, 1846; *P. gigas* Chevey, 1930; *P. humeralis* Roberts, 1989; *P. hypophthalmus* (Sauvage, 1878); *P. kinabatanganensis* Roberts & Vidthayanon, 1991; *P. krempfi* Roberts & Vidthayanon, 1991; *P. kunyit* Pouyaud, Teugels & Legendre, 1999; *P. lithostoma* Roberts, 1989; *P. mekongensis* Gustiano, Teugels & Pouyaud, 2003; *P. nasutus* (Bleeker, 1862); *P. nieuwenhuisii* (Popta, 1904); *P. pangasius* (Hamilton, 1822); *P. polyuranodon* Bleeker, 1852; *P. rheophilus* Pouyaud & Teugels, 2000 and *P. sabahensis* Gustiano, Teugels & Pouyaud, 2003, from India, Bangladesh, Indonesia, Malaysia, Thailand and Vietnam (see Tripathi, 1957; Lim, 1990; Pariselle *et al.*, 2001a, 2001b, 2002a, 2002b, 2003 and 2004)

MATERIALS AND METHODS

Fish were bought in fish markets or directly from fishermen in Indonesia (Sumatra and Borneo Islands) and Malaysia (Borneo Island). Fish were caught in the rivers using hook and line. The fish were dissected as soon as possible, and the left branchial arches were frozen in liquid nitrogen, until examination. To verify the specific identity of host fishes, the carcasses were numbered, fixed and preserved in formalin. In the laboratory, the gills were thawed and the monogeneans were detached from the gill using a strong water current. The worms were then transferred individually on a slide with a mounted needle, directly into a drop of ammonium picrate-glycerine

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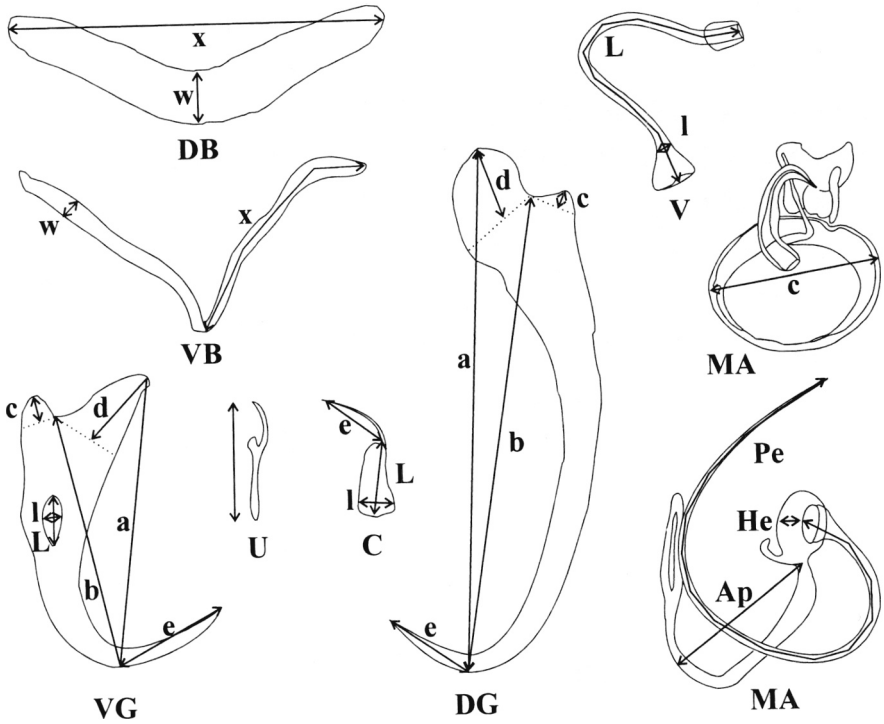

Fig. 1. – Measurements used in this study.
C = cuneus: L = length; l = largest width; e = extension length.
DB = dorsal transverse bar: x = total length; w = width in the middle.
DG = dorsal gripus: a, b, c, d and e = standard measurements.
MA = male apparatus: Pe = total length of the penis; Ap = length of the accessory piece; He = length of the heel.
U = total length of the uncinuli.
VB = ventral transverse bar: x = length of one branch; w = largest width.
VG = ventral gripus: a, b, c, d and e = standard measurements; L and l = length and width of gripus aperture.
V = vagina: L = total length; l = maximum width.

(mixture described by Malmberg (1957)). The preparation was then covered with a round cover slip and sealed with Glyceel (GURR-BDH Chemicals Ltd.). From these preparations, drawings were made of the sclerotised pieces of the haptor and of the copulatory complex using a camera lucida. Measurements, made with a digitiser, in micrometers are presented as the mean ± standard deviation followed by the range in parentheses, are those proposed by Gussev (1962) (Fig. 1). The method of numbering of the haptoral pieces is that adopted at ICOPA IV (Euzet & Prost, 1981). Terminologies used are those of Pariselle and Euzet (1995) and N'Douba *et al.* (1999).

RESULTS

Eight host-specific species[1] of gill Monogenea belonging to *Thaparocleidus* were recorded in Southeast Asia from *Pangasius polyuranodon* (Siluriformes, Pangasiidae). Two are represented by too few individuals (from two to five specimens among the 988 worms collected) to be conclusively described. The six remaining species are considered new to science (see descriptions below), and their anatomy (soft and hard parts) complies with that of *Thaparocleidus* (Monogenea, Ancylodiscoididae) as defined by Lim (1996) and Lim *et al.* (2001): Ancylodiscoididae. Three pairs of head glands. Two pairs of eye-spots. Haptor slightly separated from body. Haptoral sclerites include two pairs of anchors, with patches on dorsal anchor; two connecting bars, with dorsal single and ventral bar single or paired; and seven pairs of marginal hooks. Ovary antero-ventral to testis; uterine pore ventral near copulatory organ. Dextral vaginal opening sclerotised or non-sclerotised. Vas deferens arising from anterior region of testis, crossing to left, looping intestinal caecum to ventral side, ascending, forming blind saccular seminal vesicle; ductus ejaculatorius leaving seminal vesicle entering proximal part of copulatory organ. Parasites of freshwater catfishes of Eurasia and Southeast Asia.

[1] As they have not been recovered from another host species for the time being, these new monogenean species are considered to be host-specific.

DESCRIPTIONS

THAPAROCLEIDUS CAESTUS N. SP. (Fig. 2)

Type host: *Pangasius polyuranodon* Bleeker, 1852.
Site: gills.
Type locality: Barito River at Banjarmasin (South Kalimantan Province, Borneo Island, Indonesia).
Other records: found on the same host in the Batang Hari River at Jambi (Jambi Province, Sumatra Island, Indonesia); and in the Rajang River at Sibu and Kapit (Sarawak State, Borneo Island, Malaysia).
Material studied: 17 individuals.
Type-material: holotype deposited in the Muséum National d'Histoire Naturelle (Paris): n° 178HG, TI 221.

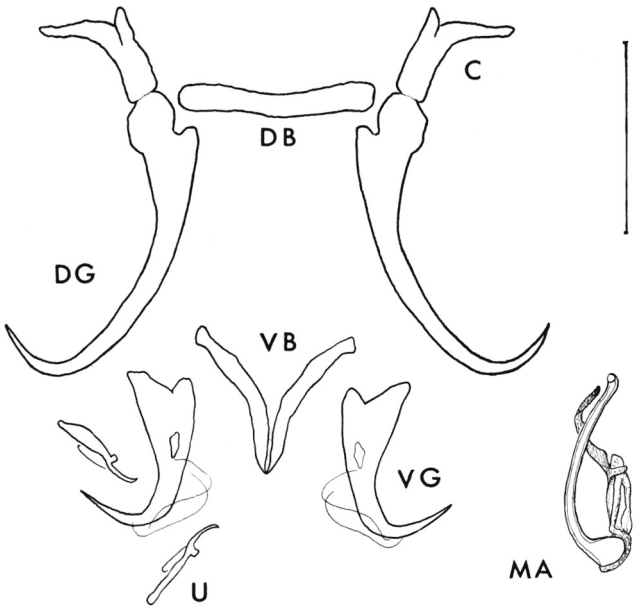

Fig. 2. – *Thaparocleidus caestus* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; U = uncinulus. Bar = 30 µm.

Paratypes deposited in the Muséum National d'Histoire Naturelle (Paris): n° 178HG, TI 221 bis; in The Natural History Museum (London): n° 2004.5.24.1.

Adults: 463 ± 120.2 (310-676) long, 60 ± 16 (28-90) wide at level of penis. Pharynx: 28 ± 6.1 (15-34) wide. Dorsal gripus with blade bent at distal third, marked bubbled guard: a = 45 ± 1.4 (42-48), b = 42 ± 1.3 (39-44), c = 1 ± 0.5 (1-2), d = 7 ± 0.7 (6-9), e = 10 ± 0.9 (8-11). Cuneus with very short extension, well marked protuberance on convex side: L = 19 ± 1.3 (16-21), l = 4 ± 0.4 (4-5), e = 0.4 ± 0.4 (0.1-2). Nearly straight dorsal transverse bar: x = 29 ± 1.1 (26-30), w = 3 ± 0.4 (2-4). Ventral gripus with marked guard, small aperture: a = 23 ± 0.8 (21-25), b = 21 ± 0.7 (18-22), c = 3 ± 0.4 (2-4), d = 6 ± 0.7 (4-7), e = 10 ± 1 (8-12), L = 4 ± 0.4 (4-5), l = 2 ± 0.2 (1-2). V-shaped ventral transverse bar: x = 23 ± 1.3 (20-26), w = 3 ± 0.4 (2-3). Uncinuli II = 18 ± 0.9 (16-20), uncinuli I and III to VII = 15 ± 2.4 (8-18). Thin walled, short penis folded at extremity: Pe = 33 ± 1.7 (29-36). Very small heel: He = 1 ± 0.4 (0.3-2). Simple S-shaped accessory piece linked to basal bulb of penis: Ap = 22 ± 1.7 (19-26). No visible vagina.

Comments

T. caestus n. sp. belongs to the group of *Thaparocleidus* with a large cuneus presenting a bubbled protuberance on the convex side. *T. caestus* n. sp. is easily distinguishable from *T. redebensis* Pariselle, Lim & Lambert, 2001 in having a simple accessory piece (*vs* double); from *T. chandpuri* Pariselle, Lim & Lambert, 2001 in having a short penis (33 *vs* 106 µm) without a spirally coiled thickening at its extremity; and from *T. sabanensis* Pariselle, Lim & Lambert, 2001 and *T. phuongi* Pariselle, Lim & Lambert, 2002 in having a S-shaped accessory piece (*vs* curved one), a shorter penis [33 *vs* 56 (*T. sabanensis*); 53, 52 and 44 µm (the three sub-species of *T. phuongi*)] and smaller ventral and dorsal gripi.

Thaparocleidus caestus n. sp. is named after the cuneus shape which resemble a small glove seen in profile (*caestus* (Latin) = small glove).

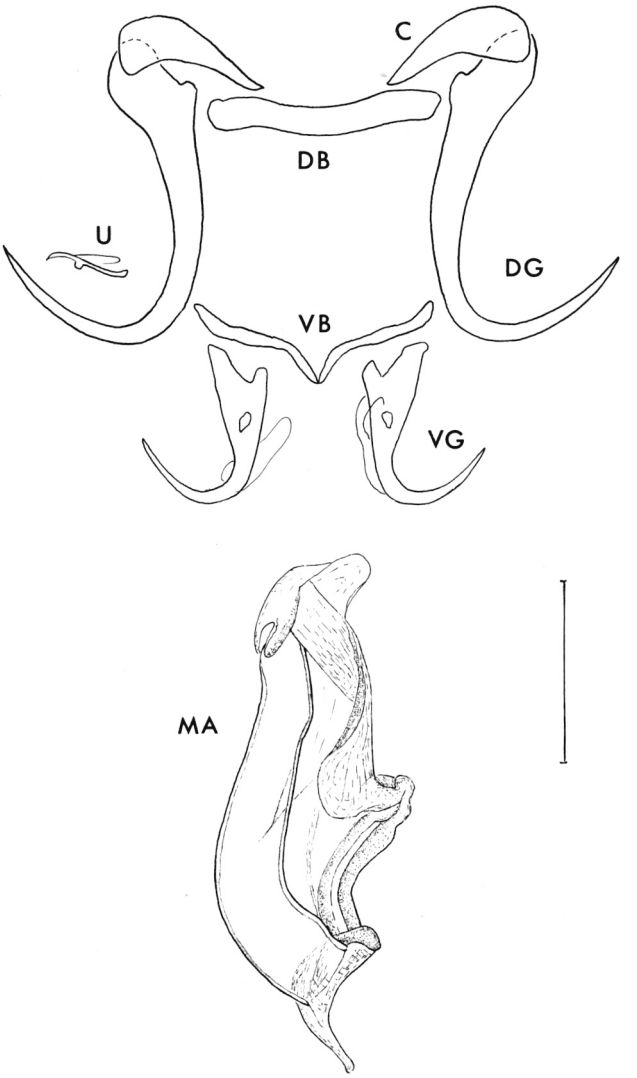

Fig. 3. – *Thaparocleidus crassipenis* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; U = uncinulus. Bar = 30 µm.

THAPAROCLEIDUS CRASSIPENIS N. SP. (Fig. 3)

Type host: *Pangasius polyuranodon* Bleeker, 1852.
Site: gills.
Type locality: Barito River at Banjarmasin (South Kalimantan Province, Borneo Island, Indonesia).

Other records: found on the same host in the Batang Hari River at Jambi (Jambi Province, Sumatra Island, Indonesia).
Material studied: 20 individuals.
Type-material: holotype deposited in the Muséum National d'Histoire Naturelle (Paris): n° 179HG, TI 222. Paratypes deposited in the Muséum National d'Histoire Naturelle (Paris): n° 179HG, TI 222 bis; in The Natural History Museum (London): n° 2004.5.24.2.

Adults: 674 ± 99.4 (453-857) long, 119 ± 24.4 (66-162) wide at level of penis. Pharynx: 53 ± 8.8 (30-71) wide. Dorsal gripus with blade bent at distal third, poorly marked bubbled guard: a = 49 ± 1.3 (46-52), b = 42 ± 1 (40-44), c = 1 ± 0.2 (1-2), d = 11 ± 0.6 (10-12), e = 24 ± 1.3 (21-27). Curved cuneus with very short extension: L = 24 ± 1.4 (21-28), l = 6 ± 0.4 (6-7), e = 1 ± 0.7 (0.1-3). Slightly V-shaped dorsal transverse bar: x = 35 ± 1.5 (33-39), w = 4 ± 0.6 (3-6). Ventral gripus with well marked guard, small apertures: a = 24 ± 0.6 (23-26), b = 19 ± 0.6 (18-21), c = 3 ± 0.5 (2-4), d = 8 ± 0.7 (7-10), e = 15 ± 0.7 (12-16). V-shaped ventral transverse bar: x = 22 ± 1.1 (20-24), w = 3 ± 0.4 (2-4). Uncinuli II = 18 ± 1 (15-20), uncinuli I and III to VII = 12 ± 1 (9-17). Thin walled S-shaped penis with a very large diameter and a large terminal opening: Pe = 73 ± 2.9 (66-78). Large heel: He = 16 ± 1.4 (14-19). Accessory piece in two consecutive parts of same length: first one C-shaped with a gutter like depression in the middle connected to basal bulb of penis, second one triangular with a S-shaped thickening: Ap = 51 ± 4.3 (45-59). Very large and thin walled vagina, always squashed when between slide and cover slip so no measurements could be taken.

Comments

T. crassipenis n. sp. is easily distinguishable from all described species of *Thaparocleidus* species in having a thin-walled S-shaped penis with a very large diameter and a large terminal opening.
Thaparocleidus crassipenis n. sp. is named after the large diameter of the penis tube (*crassus* (Latin) = large).

Thaparocleidus virgula n. sp. (Fig. 4)

Type host: *Pangasius polyuranodon* Bleeker, 1852.
Site: gills.
Type locality: Barito River at Banjarmasin (South Kalimantan Province, Borneo Island, Indonesia).
Other records: found on the same host in the Batang Hari River at Jambi (Jambi Province, Sumatra Island, Indonesia); and in the Rajang River at Sibu[2] (Sarawak State, Borneo Island, Malaysia).

[2] See comments.

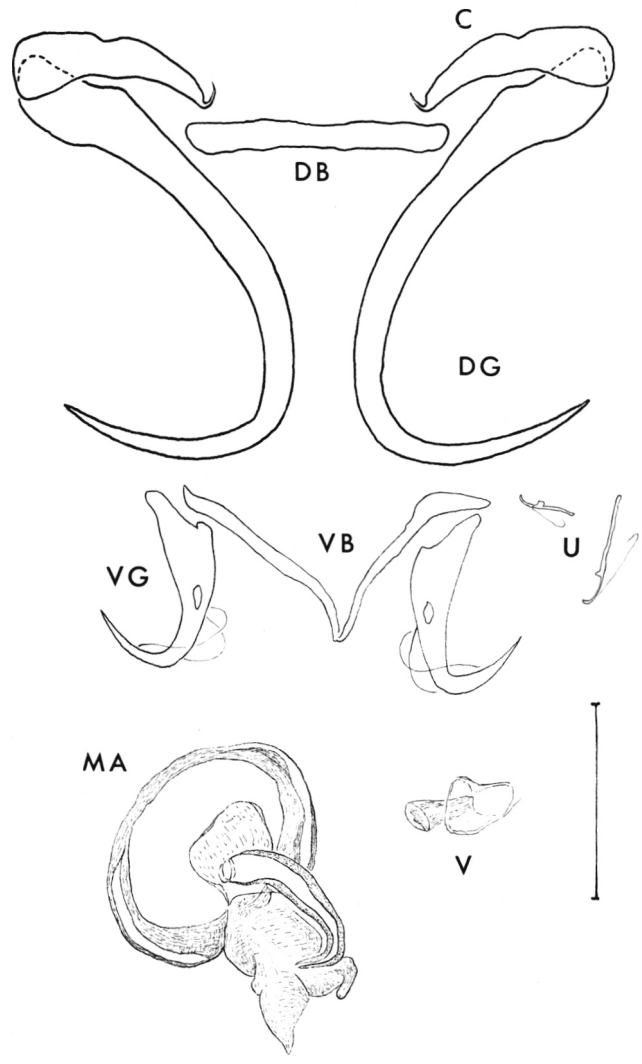

Fig. 4. – *Thaparocleidus virgula* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; V = vagina; U = uncinulus. Bar = 30 µm.

Material studied: 22 individuals.
Type-material: holotype deposited in the Muséum National d'Histoire Naturelle (Paris): n° 183HG, TI 226. Paratypes deposited in the Muséum National d'Histoire Naturelle (Paris): n° 183HG, TI 226 bis; in The Natural History Museum (London): n° 2004.5.24.6.

Adults: 488 ± 130.9 (364-871) long, 83 ± 12.3 (64-108) wide at level of penis. Pharynx: 32 ± 7.6 (22-50) wide. Dorsal gripus with blade bent at distal third, poorly marked guard: a = 65 ± 3.2 (59-70), b = 56 ± 2.9 (50-61), c = 1 ± 0.3 (0.3-2), d = 12 ± 0.9 (11-15), e = 28 ± 1.3 (25-31). Long slightly curved cuneus with short extension: L = 28 ± 1.3 (25-31), l = 7 ± 0.6 (5-8), e = 3 ± 0.9 (2-6). Straight dorsal transverse bar: x = 37 ± 2.2 (33-40), w = 3 ± 0.4 (3-4). Ventral gripus with marked aperture and guard: a = 25 ± 1.3 (21-26), b = 20 ± 1.1

(18-22), c = 1 ± 0.3 (0.4-1), d = 8 ± 0.5 (7-9), e = 13 ± 0.9 (11-15), L = 4 ± 0.4 (3-4), l = 1 ± 0.2 (0.5-1). V-shaped ventral transverse bar: x = 30 ± 1.9 (25-34), w = 3 ± 0.4 (2-4). Thin uncinuli II = 13 ± 1 (11-16), uncinuli I and III to VII = 14 ± 2.8 (8-18). Strong and short C-shaped penis with a poorly marked basal bulb, directly attached on a large cupule-like structure (32 ± 3 (26-39) at its width), no visible heel: Pe = 29 ± 2.2 (26-33). Broad accessory piece with two corners, one forming a thick short hook: Ap = 29 ± 4.8 (21-37). Short nearly straight vagina with thick walls, turned inside out at its distal extremity: L = 9 ± 1.1 (7-11), l = 3 ± 0.5 (1-4).

Comments

Specimens from Malaysia have slightly smaller ventral and dorsal gripi; as only five individuals were sampled from this location, nothing could be concluded (different species?).

T. virgula n. sp. belongs to the group characterised by the presence of a cupule-like structure where the penis is attached. This new species is easily distinguishable from *T. euzeti* Pariselle, Lim & Lambert, 2002, *T. brevicochleus* Pariselle, Lim & Lambert, 2001 and *T. kapuasensis* Pariselle, Lim & Lambert, 2001 by the shape and size of the penis (C-shaped and 29 *vs* spirally coiled and 7,450, 45, and 115 µm, respectively); from *T. citreum* Pariselle, Lim & Lambert, 2003 by the shape of the cupule-like structure (rounded *vs* lemon-shaped) and the size and shape of haptorial sclerotised pieces (e.g. cuneus 28 *vs* 6 µm or dorsal gripus 65 *vs* 39 µm); and from *T. alatus* Pariselle, Lim & Lambert, 2003 by the shape of the penis (C-shaped *vs* bent at distal quarter with wall extensions and lanceolate end). The name *Thaparocleidus virgula* n. sp. is based on the shape of the penis (virgule (French) = comma).

THAPAROCLEIDUS LEGENDREI N. SP. (Fig. 5)

Type host: *Pangasius polyuranodon* Bleeker, 1852.

Site: gills.

Type locality: Barito River at Banjarmasin (South Kalimantan Province, Borneo Island, Indonesia).

Other records: found on the same host in the Batang Hari River at Jambi (Jambi Province, Sumatra Island, Indonesia); and in the Rajang River at Sibu and Kapit[3] (Sarawak State, Borneo Island, Malaysia).

Material studied: 30 individuals.

Type-material: holotype deposited in the Muséum National d'Histoire Naturelle (Paris): n° 180HG, TI 223. Paratypes deposited in the Muséum National d'Histoire Naturelle (Paris): n° 180HG, TI 223 bis; in The Natural History Museum (London): n° 2004.5.24.3.

[3] See comments.

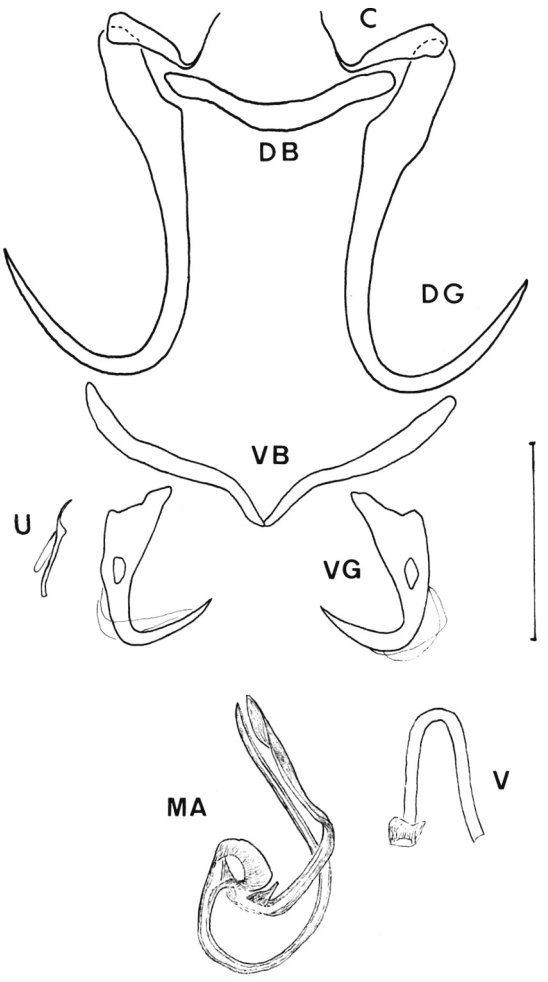

Fig. 5. – *Thaparocleidus legendrei* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; V = vagina; U = uncinulus. Bar = 30 µm.

Adults: 440 ± 84.1 (300-610) long, 68 ± 11.5 (45-92) wide at level of penis. Pharynx: 28 ± 5.5 (19-40) wide. Dorsal gripus with blade bent at distal third, poorly marked guard: a = 50 ± 2.5 (44-54), b = 38 ± 2 (33-41), c = 1 ± 0.3 (0.5-2), d = 14 ± 1.1 (12-16), e = 25 ± 1.6 (23-30). Small cuneus with long and thin extension: L = 12 ± 1.1 (10-15), l = 4 ± 0.5 (3-5), e = 10 ± 1.5 (6-12). Slightly V-shaped dorsal transverse bar: x = 33 ± 1.8 (29-36), w = 4 ± 0.5 (3-6). Ventral gripus with marked aperture and guard: a = 23 ± 0.9 (20-25), b = 19 ± 0.8 (17-21), c = 1 ± 0.3 (0.6-2), d = 8 ± 0.6 (6-9), e = 14 ± 0.8 (12-17), L = 4 ± 0.5 (3-5), l = 2 ± 0.3 (1-2). V-shaped ventral transverse bar: x = 32 ± 1.6 (29-37), w = 3 ± 0.4 (2-4). Thin uncinuli II = 15 ± 1 (13-18), uncinuli I and III to VII = 15 ± 2.8 (8-20). Curved thin penis getting thinner toward extremity, beginning with a poorly marked basal bulb: Pe = 70 ± 5.8 (58-80), rounded heel with a short and thin extension: He = 5 ± 1 (3-7). Very simple and bent at the middle acces-

sory piece, with a gutter depression along last third, linked to basal bulb of penis near extension of heel: Ap = 43 ± 3.1 (38-49). Tubular vagina, bend at the middle, one extremity is funnel-shaped, other one is turned inside out: L = 43 ± 3.9 (36-50), l = 2 ± 0.4 (1-3).

Comments

Specimens from Malaysia have a slightly shorter penis, as it is the only small difference found between the worms from this location and the other one, nothing could be concluded (different species?).

T. legendrei n. sp. belongs to the group with a cuneus having a long extension (more than half the length of the cuneus). *T. legendrei* n. sp. is easily distinguishable mainly by the shape and/or size of the penis from all previously described species of the *Thaparocleidus* in this group: *T. humerus* Pariselle, Lim & Lambert, 2002 and *T. meburus* Pariselle, Lim & Lambert, 2002 (straight with a large diameter); *T. bahari* Pariselle, Lim & Lambert, 2001 (3-shaped); *T. pangasi* (Tripathi, 1957) (folded and 181 µm); *T. mahakamensis* Pariselle, Lim & Lambert, 2001, *T. sinespinae* Pariselle, Lim & Lambert, 2001, *T. sadilii* Pariselle, Lim & Lambert, 2002, *T. vietnamensis* Pariselle, Lim & Lambert, 2002 (169, 152, 129, 91 µm respectively); *T. caecus* (Mizelle & Kritsky, 1969) (S-shaped); *T. culter* Pariselle, Lim & Lambert, 2002 and *T. culteroides* Pariselle, Lim & Lambert, 2002 (curved with a thick wall and large heel). *Thaparocleidus legendrei* n. sp. is named after Dr Marc Legendre from IRD (ex-ORSTOM), coordinator of the EC project in the frame of which this work has been done.

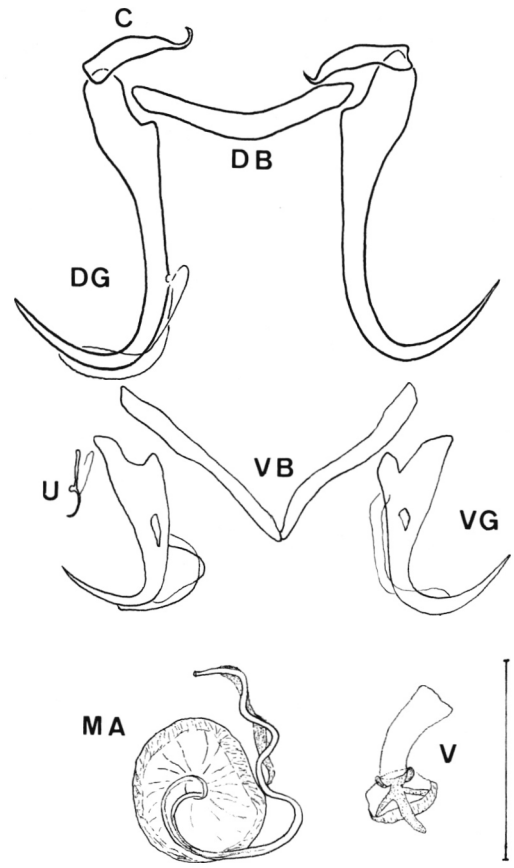

Fig. 6. – *Thaparocleidus levangi* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; V = vagina; U = uncinulus. Bar = 30 µm.

THAPAROCLEIDUS LEVANGI N. SP. (Fig. 6)

Type host: *Pangasius polyuranodon* Bleeker, 1852.
Site: gills.
Type locality: Barito River at Banjarmasin (South Kalimantan Province, Borneo Island, Indonesia).
Other records: found on the same host in the Batang Hari River at Jambi (Jambi Province, Sumatra Island, Indonesia); and in the Rajang River at Sibu and Kapit (Sarawak State, Borneo Island, Malaysia).
Material studied: 30 individuals.
Type material: holotype deposited in the Muséum National d'Histoire Naturelle (Paris): n° 181HG, TI 224. Paratypes deposited in the Muséum National d'Histoire Naturelle (Paris): n° 181HG, TI 224 bis; in The Natural History Museum (London): n° 2004.5.24.4.

Adults: 359 ± 76.9 (177-505) long, 56 ± 11.2 (41-83) wide at level of penis. Pharynx: 27 ± 6.3 (14-41) wide. Dorsal gripus with blade bent at distal third, poorly marked guard: a = 46 ± 3.5 (35-50), b = 37 ± 2.9 (29-41), c = 1 ± 0.2 (0.5-1), d = 11 ± 1.1 (8-13), e = 17 ± 1.4 (13-21). Slightly curved cuneus with strong extension: L = 14 ± 1.6 (10-17), l = 4 ± 0.5 (3-5), e = 3 ± 1 (2-6). Slightly curved dorsal transverse bar: x = 32 ± 2.2 (24-37), w = 4 ± 0.7 (3-6). Ventral gripus with marked aperture and guard: a = 24 ± 1.3 (20-27), b = 20 ± 1 (16-22), c = 2 ± 0.4 (1-3), d = 8 ± 0.9 (6-10), e = 12 ± 0.9 (10-15), L = 4 ± 0.6 (3-5), l = 1 ± 0.2 (1-2). V-shaped ventral transverse bar: x = 29 ± 1.7 (23-31), w = 3 ± 0.5 (2-4). Thin uncinuli II = 13 ± 0.8 (11-15), uncinuli I and III to VII = 14 ± 2.1 (9-19). Penis, with a poorly marked basal bulb, beginning by a single turn followed by a sinuous portion, directly attached on a rounded cupule-like structure (20 ± 2.3 (13-24) at its width), no visible heel: Pe = 64 ± 5.6 (51-77). Simple and very thin accessory piece attached to the cupule-like structure near to penis attachment: Ap = 29 ± 3.2 (21-36). Thin walled and large vagina with two funnel-shaped extremities: L = 11 ± 3.3 (5-16), l = 4 ± 1 (2-7).

Comments

T. levangi n. sp. belongs to the group characterised by the presence of a cupule-like structure where the penis is attached. Within this group only three species

have a spirally coiled penis, the new species is easily distinguishable from:

• *T. brevicochleus* by the shape of the penis, the accessory piece and the vagina (spirally coiled and sinuous, simple and sinuous, double funnel-shaped *vs* strong and spirally coiled, more complex, cylindrical with one folded back and one turned inside out extremity);

• *T. kapuasensis* by the shape and size of the penis [spirally coiled (one turn) and sinuous and 64 *vs.* spirally coiled (two turns) and 115 µm] and the vagina (large vagina with two funnel-shaped extremities and 11 *vs.* thin vagina folded two times in two at proximal third and 58 µm);

• *T. euzeti* by the length and number of turns of the penis (64 and 1 *vs* 7,450 µm and 35).

Thaparocleidus levangi n. sp. is named after Dr Patrice Levang, former representative of IRD (ex-ORSTOM) in Indonesia who facilitated the field work.

THAPAROCLEIDUS SLEMBROUCKI N. SP. (Fig. 7)

Type host: *Pangasius polyuranodon* Bleeker, 1852.
Site: gills.
Type locality: Batang Hari River at Jambi (Jambi Province, Sumatra Island, Indonesia).
Other records: found on the same host in the Barito River at Banjarmasin (South Kalimantan Province, Borneo Island, Indonesia); and in the Rajang River at Sibu[4] (Sarawak State, Borneo Island, Malaysia).
Material studied: 30 individuals.
Type material: holotype deposited in the Muséum National d'Histoire Naturelle (Paris): n° 182HG, TI 225. Paratypes deposited in the Muséum National d'Histoire Naturelle (Paris): n° 182HG, TI 225 bis; in The Natural History Museum (London): n° 2004.5.24.5.

Adults: 366 ± 80.1 (246-579) long, 61 ± 10 (41-87) wide at level of penis. Pharynx: 28 ± 4.4 (20-38) wide. Dorsal gripus with blade bent at distal third, poorly marked guard: a = 41 ± 4.5 (32-48), b = 33 ± 3.4 (26-39), c = 1 ± 0.3 (0.5-2), d = 10 ± 1.2 (7-12), e = 17 ± 1.3 (14-20). Slightly curved cuneus with short extension: L = 12 ± 1.8 (8-16), l = 4 ± 0.5 (3-5), e = 3 ± 0.9 (1-5). Slightly curved dorsal transverse bar: x = 29 ± 3.5 (22-35), w = 4 ± 0.5 (3-5). Ventral gripus with marked aperture and guard: a = 23 ± 1.7 (19-26), b = 19 ± 1.2 (16-21), c = 2 ± 0.4 (1-3), d = 7 ± 0.8 (5-9), e = 12 ± 0.8 (10-14), L = 4 ± 0.5 (3-5), l = 2 ± 0.4 (1-3). V-shaped ventral transverse bar: x = 26 ± 3.3 (21-32), w = 3 ± 0.5 (2-4). Thin uncinuli II = 14 ± 1.1 (11-16), uncinuli I and III to VII = 14 ± 2.2 (8-18). Penis, with poorly marked basal bulb, beginning by a double turn followed by a sinuous portion, directly attached on a rounded cupule-like structure (21 ± 3.1 (14-27) at its width), no visible heel: Pe = 93 ± 12.2 (72-111). Simple and thin accessory piece attached to cupule-like structure near to penis attachment: Ap = 32 ± 5 (24-42). Thin walled and large vagina with a funnel-shaped extremity: L = 9 ± 1.9 (6-14), l = 5 ± 1.7 (2-8).

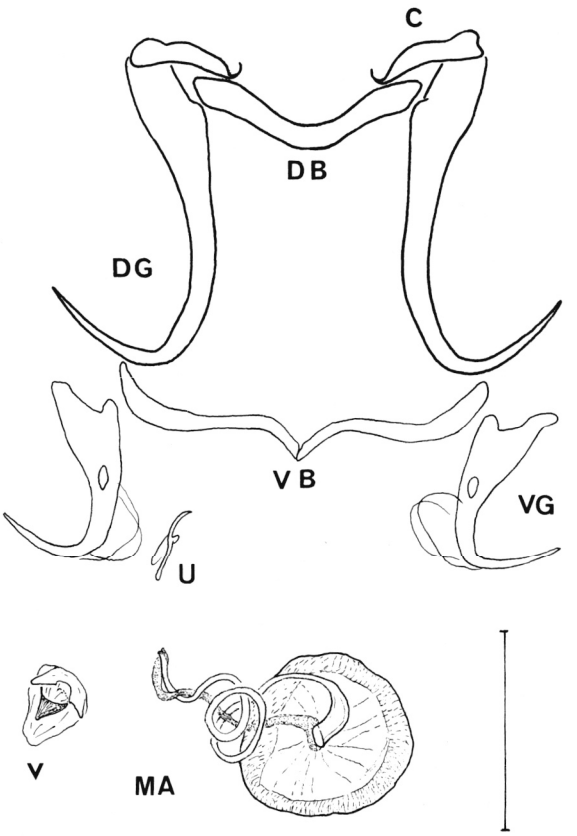

Fig. 7. – *Thaparocleidus slembroucki* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; V = vagina; U = uncinulus. Bar = 30 µm.

Comments

Specimens from Malaysia have slightly different measurments (smaller cupule-like structure and dorsal gripus, shorter dorsal transverse bar), as only three worms were collected from this location nothing could be concluded (different species?).

T. slembroucki n. sp. belongs to the group characterised by the presence of a cupule-like structure where the penis is attached. It is closely related to *T. levangi* n. sp., but could be distinguished from it mainly by the shape and size of the penis (spirally coiled with two turns and 93 *vs* one turn and 64 µm).

Thaparocleidus slembroucki n. sp. is named after Jacques Slembrouck IRD (ex-ORSTOM) engineer who help in collecting fish samples.

[4] See comments.

CONCLUSIONS

Some of the new species described above have morphometrical differences according to the locations (Malaysian populations of *T. virgula*, *T. legendrei* and *T. slembroucki*). These differences, and the number of worms collected, seem to be too small to permit establishment of different species, but may be the sign that the host populations are isolated and that the parasites are subject to genetic drift. A similar phenomenon has been observed among *Thaparocleidus phuongi* from *Pangasius kunyit*, *P. sabahensis* and *P. mekongensis* where the differences have been considered sufficient to describe location-specific sub-species (see Pariselle *et al.*, 2002 b); in this case, the host population isolation may be more ancient, and therefore the genetic drift more significant.

The six new species described herein bring the number of monogenean parasitic species described from 16 species of pangasiid hosts (*P. bocourti*, *P. djambal*, *P. gigas*, *P. humeralis*, *P. hypophthalmus*, *P. kinabatanganensis*, *P. krempfi*, *P. kunyit*, *P. lithostoma*, *P. mekongensis*, *P. nasutus*, *P. nieuwenhuisii*, *P. pangasius*, *P. polyuranodon*, *P. rheophilus* and *P. sabahensis*) to 34.

The diversity of monogenean species on the 16 host species increase from 0 to 9[5] monogenean species per host species (before the maximum was 7).

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[5] On *P. polyuranodon*, including the two rare non described monogenean species and the one belonging to *Pangasitrema*.

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