

## MONOGENEANS FROM PANGASIIDAE (SILURIFORMES) IN SOUTHEAST ASIA: II. FOUR NEW SPECIES OF *THAPAROCLEIDUS* JAIN, 1952 (ANCYLODISCOIDINAE) FROM *PANGASIUS HUMERALIS*

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### Summary :

The examination of gills from two rare endemic species of *Pangasius Valenciennes*, 1840 (Siluriformes, Pangasiidae): *P. humeralis* Roberts, 1989 (five specimens) and *P. lithostoma* Roberts, 1989 (six specimens) from the Kapuas River (West Kalimantan province, Borneo Island, Indonesia) revealed the presence of four new species of Monogenea belonging to the genus *Thaparocleidus* Jain, 1952 (Monogenea, Ancylo-discoidinae) on *P. humeralis*: *T. sinespinae* n. sp., *T. brevicochleus* n. sp., *T. kapuasensis* n. sp. and *T. gustiano* n. sp., and not any on *P. lithostoma*.

**KEY WORDS :** Monogenea, Ancylo-discoidinae, *Thaparocleidus sinespinae* n. sp., *Thaparocleidus brevicochleus* n. sp., *Thaparocleidus kapuasensis* n. sp., *Thaparocleidus gustiano* n. sp., freshwater fish, Siluriformes, Pangasiidae, *Pangasius humeralis*, *Pangasius lithostoma*, South East Asia, Indonesia.

**Résumé :** MONOGENÈS DE PANGASIIDAE (SILURIFORMES) EN ASIE DU SUD-EST. II. QUATRE ESPÈCES NOUVELLES DE *THAPAROCLEIDUS* JAIN, 1952 (ANCYLODISCOIDINAE), CHEZ *PANGASIUS HUMERALIS*

L'examen des parasites branchiaux de deux espèces rares et endémiques de *Pangasius Valenciennes*, 1840 (Siluriformes, Pangasiidae): *P. humeralis* Roberts, 1989 (cinq spécimens) et *P. lithostoma* Roberts, 1989 (six spécimens) du fleuve Kapuas (province Kalimantan Ouest, Ile de Bornéo, Indonésie) a révélé la présence de quatre nouvelles espèces de Monogenea du genre *Thaparocleidus* Jain, 1952 (Monogenea, Ancylo-discoidinae): *T. sinespinae* n. sp., *T. brevicochleus* n. sp., *T. kapuasensis* n. sp. et *T. gustiano* n. sp. décrites chez *P. humeralis*. Par contre, aucun parasite branchial n'a été observé sur *P. lithostoma*.

**MOTS CLÉS :** Monogenea, Ancylo-discoidinae, *Thaparocleidus sinespinae* n. sp., *Thaparocleidus brevicochleus* n. sp., *Thaparocleidus kapuasensis* n. sp., *Thaparocleidus gustiano* n. sp., Poissons d'eau douce, Siluriformes, Pangasiidae, *Pangasius humeralis*, *Pangasius lithostoma*, Asie du Sud Est, Indonésie.

## INTRODUCTION

Within the framework of an EC project on the bio-diversity and culture of Southeast Asian catfishes, the gills from pangasiid fishes (Siluriformes, Pangasiidae) were examined for monogeneans. This second paper (see Pariselle *et al.*, 2001) presents the descriptions of four new species of *Thaparocleidus* Jain, 1952 (Monogenea, Ancylo-discoidinae) found on *Pangasius humeralis* Roberts, 1989 (five specimens) rare endemic species from the Kapuas River (West Kalimantan province, Borneo Island, Indonesia). Another rare endemic species *P. lithostoma* Roberts, 1989 (six specimens only) from the same location did not yield monogenean parasites. These two host species have not been previously examined for parasites.

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To date only eight species of *Thaparocleidus* have been described from *Pangasius hypophthalmus* (Sauvage, 1878); *P. kinabatanganensis* Roberts & Vidthayanon, 1991; *P. nieuwenhuisii* (Popta, 1904); *P. pangasius* (Hamilton, 1822) and *P. rheophilus* Pouyaud & Teugels, 2000 from India, Bangladesh, Indonesia, Malaysia and Thailand (see Tripathi, 1957; Lim, 1990 and Pariselle *et al.*, 2001).

## MATERIAL AND METHODS

Fish were bought in fish markets or directly from fishermen in Indonesia (West Kalimantan province, part of Borneo Island). Fish were caught in the rivers using lines. The fish were dissected as soon as possible, the left branchial arches, separated by dorsal and ventral sections, 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 using a strong water current. Monogeneans were then transferred individually on a slide with a mounted needle, directly into a drop of ammonium picrate-glycerine (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 as the mean  $\pm$  the 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). Thus far several terminologies have been proposed and used in monogenean studies, for example, Pariselle & Euzet (1995) proposed: uncinulus for the marginal hooklets/hooks, gripus for the

large median hooks or anchors, and by N'Douba *et al.* (1999): cuneus for the patch or sclerotised piece associated with dorsal gripus or anchor.

## RESULTS

Four species of Monogenea were recorded on *P. humeralis*, they all belong to the genus *Thaparcloleidus* (Ancylo-discoidinae, Monogenea) as defined by Lim (1996). No monogenean species were found on the gills of *P. lithostoma*.

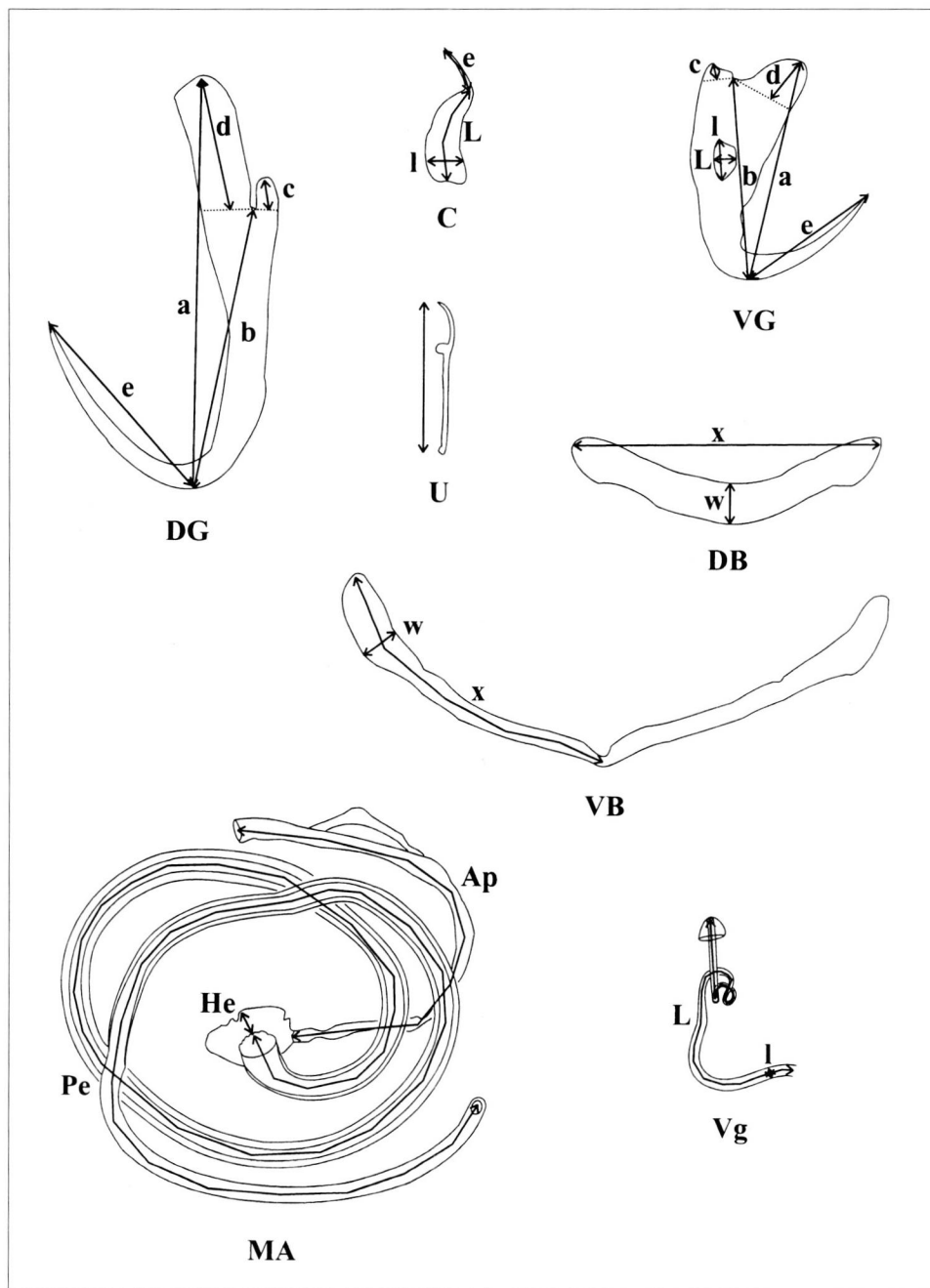


Fig. 1. – Measurements used in this study.

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.

Vg = vagina: L = total length; l = maximum width.

DESCRIPTIONS

*THAPAROCLEIDUS SINESPINA* N. SP. (Fig. 2)

Type-host: *P. humeralis* Roberts, 1989.

Site: gills.

Type-locality: Kapuas River at Sintang (West Kalimantan province, Borneo Island, Indonesia).

Material studied: 30 individuals fixed and mounted in Malmberg solution.

Type-material: holotype deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 160. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 161; The Natural History Museum (London): n° 2001.5.14.4.

Adults measure  $727 \pm 201.6$  (527-1300) long,  $126 \pm 35.6$  (77-203) wide at the level of the penis. Pharynx is  $57 \pm 10.8$  (40-85) at its width. Dorsal gripus with blade bent at distal third and poorly marked guard:  $a = 50 \pm 2.6$  (45-56),  $b = 41 \pm 2.4$  (35-47),  $c = 1 \pm 0.4$  (0.8-3),  $d =$

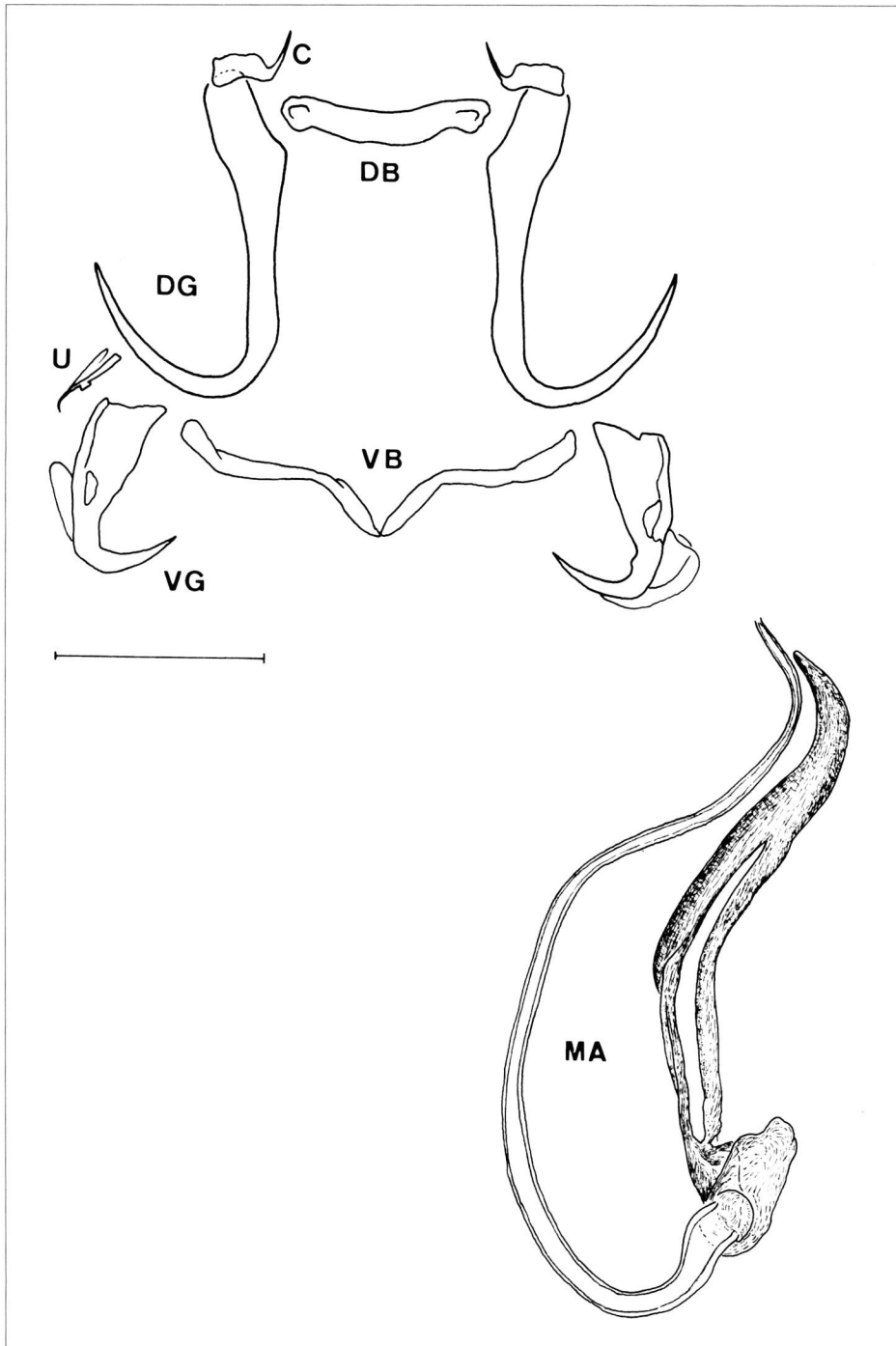


Fig. 2. - *Thaparocleidus sinespinae* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; U = uncinulus. Bar = 30  $\mu$ m.

13 ± 1.2 (10-15), e = 28 ± 1.3 (25-32). Small cuneus with long extension: L = 9 ± 1.3 (6-12), l = 4 ± 0.5 (3-6), e = 7 ± 1.2 (5-10). Slightly curved and short dorsal transverse bar: x = 31 ± 1.4 (28-35), w = 5 ± 0.4 (4-6). Ventral gripus with well-marked aperture and poorly developed guard: a = 24 ± 0.7 (22-25), b = 22 ± 0.7 (20-23), c = 1 ± 0.3 (0.4-2), d = 5 ± 0.7 (4-7), e = 14 ± 0.5 (13-15), L = 5 ± 0.5 (4-6), l = 2 ± 0.4 (1-3). Thin V-shaped ventral transverse bar with bubbled extremities: x = 33 ± 1.6 (30-37), w = 4 ± 0.5 (2-5). Uncinuli II = 13 ± 0.9 (10-15), uncinuli I and III to VII = 12 ± 0.8 (9-17). Long and thin penis folded just after the ovoid basal bulb, well-developed heel: Pe = 152 ± 9.7 (136-168), He = 6 ± 1.8 (3-10). Long, large and S-shaped accessory piece linked to the basal bulb of the penis: Ap = 79 ± 6.4 (69-95). No visible vagina.

Comments

Among the eight described species belonging to the genus *Thaparocleidus* on *Pangasius* hosts only three have a penis longer than 100 µm. *T. sinespinae* n. sp. is easily distinguishable (no overlapping between the range of measurements) from:

- *T. chandpuri* Pariselle *et al.*, 2001 by the shape and size of all the haptorial sclerotised parts, by the shape (no spirally coiled thickening at the extremity) and the size (152 µm *vs.* 106 µm) of the penis.

- *T. pangasi* (Tripathi, 1957) by the size of the male apparatus: accessory piece (79 µm *vs.* 54 µm), penis (152 µm *vs.* 181 µm) and the size of the cuneus (9 µm *vs.* 20 µm) (measurements from Pariselle *et al.*, 2001).

*T. sinespinae* n. sp. is close to *T. mabakamensis* Pariselle *et al.*, 2001 but may be distinguished by the absence of small spine-like structure at its distal third of the penis, a shorter heel (6 µm *vs.* 12 µm) and a smaller ventral gripus (24 µm *vs.* 27 µm).

*Thaparocleidus sinespinae* n. sp. is named after the absence of spine-like structure on the penis (*sine spinae* (Latin) = without spine).

*THAPAROCLEIDUS BREVICOCHEUS* N. SP. (Fig. 3)

Type-host: *P. humeralis* Roberts, 1989.

Site: gills.

Type-locality: Kapuas River at Sintang (West Kalimantan province, Borneo Island, Indonesia).

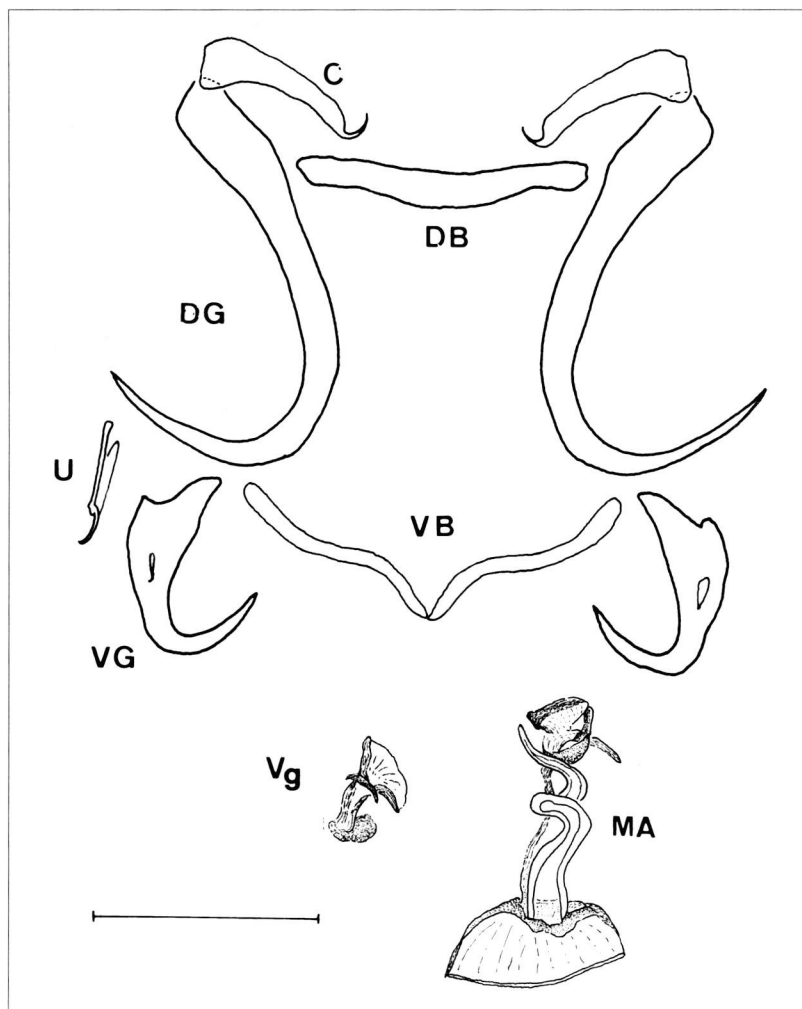


Fig. 3. - *Thaparocleidus brevicochleus* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; Vg = vagina; U = uncinulus. Bar = 30 µm.

Material studied: 19 individuals fixed and mounted in Malmberg solution.

Type-material: holotype deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 166. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 167; The Natural History Museum (London): n° 2001.5.14.1.

Adults measure  $585 \pm 70.5$  (459-706) long,  $84 \pm 15.4$  (59-120) wide at the level of the penis. Pharynx is  $41 \pm 7.1$  (31-58) at its width. Dorsal gripus with blade bent at distal third and poorly marked guard:  $a = 51 \pm 2.6$  (46-55),  $b = 43 \pm 2.2$  (39-47),  $c = 0.9 \pm 0.2$  (0.4-1),  $d = 11 \pm 0.7$  (9-12),  $e = 26 \pm 1.4$  (24-29). Long cuneus with medium extension:  $L = 23 \pm 1.1$  (20-25),  $l = 6 \pm 0.4$  (5-7),  $e = 5 \pm 1.2$  (3-8). Slightly straight dorsal transverse bar:  $x = 40 \pm 1.7$  (37-42),  $w = 4 \pm 0.5$  (3-5). Ventral gripus with small aperture and poorly developed

guard:  $a = 23 \pm 0.7$  (21-24),  $b = 19 \pm 0.5$  (18-20),  $c = 1 \pm 0.2$  (1-2),  $d = 8 \pm 0.6$  (6-9),  $e = 13 \pm 0.7$  (11-14),  $L = 3 \pm 0.5$  (2-5),  $l = 1 \pm 0.3$  (0.4-2). Thin V-shaped ventral transverse bar:  $x = 28 \pm 1.1$  (26-30),  $w = 3 \pm 0.4$  (2-4). Uncinuli II =  $13 \pm 0.8$  (12-16), uncinuli I and III to VII =  $14 \pm 3$  (7-18). Short, strong and spirally coiled (1 to 1.5 turns) penis attached on a cupule-like structure, no heel:  $Pe = 45 \pm 3.6$  (37-51), diameter of the basal bulb =  $21 \pm 1.5$  (17-24). Short accessory piece linked to the basal bulb of the penis:  $Ap = 34 \pm 2.6$  (21-32). Short cylindrical vagina, folded back at one extremity, the other one is turned inside out:  $L = 12 \pm 2$  (9-16), aperture diameter =  $9 \pm 1.6$  (5-11).

#### Comments

*T. brevicochleus* n. sp. is easily distinguishable from all *Thaparocleidus* species found on *Pangasius* in having

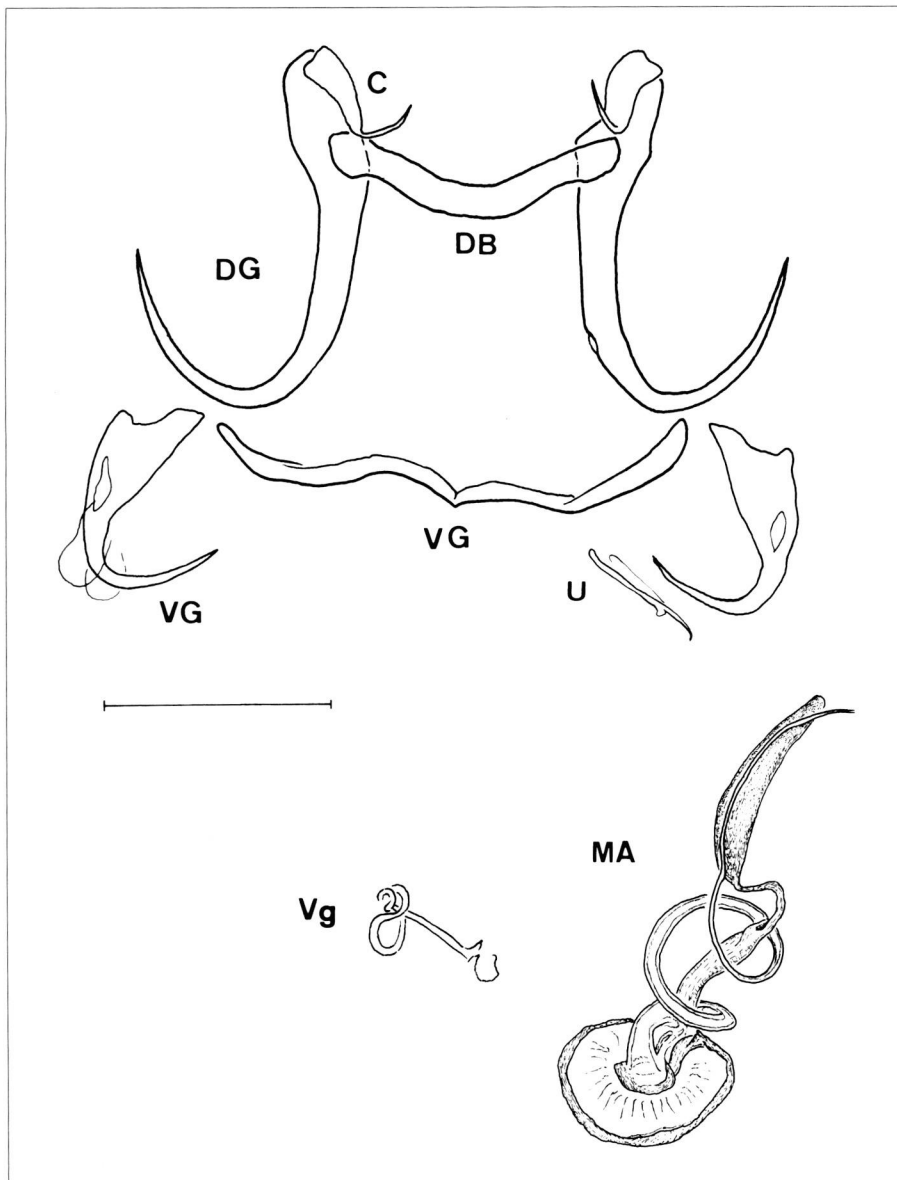


Fig. 4. – *Thaparocleidus kapuasensis* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; Vg = vagina; U = uncinulus. Bar = 30  $\mu$ m.

a spirally coiled penis. This species seems to be the rarest one, as we found only 19 specimens when 57 *T. sinespinae* n. sp., 101 *T. kapuasensis* n. sp. and 61 *T. gustiano* n. sp. were found on the *Pangasius humeralis* dissected.

*Thaparocleidus brevicoccleus* n. sp. is named after the shape and length of the penis (*brevis coccleus* (Latin) = short spiral).

#### *THAPAROCLEIDUS KAPUASENSIS* N. SP. (Fig. 4)

Type-host: *P. humeralis* Roberts, 1989.

Site: gills.

Type-locality: Kapuas River at Sintang (West Kalimantan province, Borneo Island, Indonesia).

Material studied: 30 individuals fixed and mounted in Malmberg solution.

Type-material: holotype deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 162. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 163; The Natural History Museum (London): n° 2001.5.14.3.

Adults measure  $506 \pm 69.6$  (393-641) long,  $104 \pm 18$  (76-168) wide at the level of the penis. Pharynx is  $54 \pm 10.5$  (40-87) at its width. Dorsal gripus with blade bent at distal third and poorly marked guard:  $a = 46 \pm 1.5$  (41-49),  $b = 36 \pm 1.3$  (32-39),  $c = 1 \pm 0.3$  (0.4-2),  $d = 12 \pm 0.9$  (10-14),  $e = 24 \pm 1.1$  (22-27). Short cuneus with long extension:  $L = 11 \pm 0.9$  (10-13),  $l = 4 \pm 0.5$  (3-6),  $e = 10 \pm 1.7$  (6-13). Slightly curved dorsal transverse bar:  $x = 37 \pm 1$  (36-40),  $w = 4 \pm 0.6$  (3-5). Ventral gripus with well-marked aperture and poorly developed guard:  $a = 25 \pm 1$  (22-28),  $b = 21 \pm 0.8$  (18-23),  $c = 1 \pm 0.3$  (1-2),  $d = 8 \pm 0.8$  (7-10),  $e = 16 \pm 0.9$  (14-20),  $L = 4 \pm 0.5$  (3-5),  $l = 2 \pm 0.4$  (1-3). Thin V-shaped ventral transverse bar:  $x = 33 \pm 1.4$  (30-36),  $w = 3 \pm 0.4$  (3-4). Uncinuli II =  $15 \pm 1.1$  (13-19), uncinuli I and III to VII =  $15 \pm 2.3$  (9-20). Spirally coiled (2 turns) penis with a short heel and an ovoid basal bulb attached on a large cupule like structure:  $Pe = 115 \pm 6.5$  (104-130), heel =  $2 \pm 0.4$  (1-3), cupule like structure =  $22 \pm 1.5$  (19-24). Long and thin accessory piece linked to the basal bulb of the penis:  $Ap = 60 \pm 3.9$  (51-68). Long and thin vagina folded two times in two at proximal third:  $L = 58 \pm 8.5$  (42-77), diameter =  $1 \pm 0.3$  (1-2).

#### Comments

*T. kapuasensis* n. sp. is the second *Thaparocleidus* species found on *Pangasius* with a spirally coiled penis. *T. kapuasensis* n. sp. is easily distinguishable from *T. brevicoccleus* n. sp. by the length of the penis (115  $\mu$ m vs. 45  $\mu$ m), of the accessory piece (60  $\mu$ m vs. 24  $\mu$ m), of the vagina (58  $\mu$ m vs. 12  $\mu$ m), the cuneus (11  $\mu$ m vs. 23  $\mu$ m), etc.

*Thaparocleidus kapuasensis* n. sp. is named after the location (Kapuas River).

#### *THAPAROCLEIDUS GUSTIANO* N. SP. (Fig. 5)

Type-host: *P. humeralis* Roberts, 1989.

Site: gills.

Type-locality: Kapuas River at Sintang (West Kalimantan province, Borneo Island, Indonesia).

Material studied: 30 individuals fixed and mounted in Malmberg solution.

Type-material: holotype deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 164. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): n° Tg 165; The Natural History Museum (London): n° 2001.5.14.2.

Adults measure  $1023 \pm 218$  (606-1656) long,  $142 \pm 25.7$  (93-199) wide at the level of the penis. Pharynx is  $69 \pm 7$  (56-83) at its width. Dorsal gripus with blade bent at distal third and very well marked guard:  $a = 45 \pm 1.3$  (42-48),  $b = 33 \pm 1.3$  (31-37),  $c = 2 \pm 1$  (0.8-5),  $d = 14 \pm 1.2$  (11-17),  $e = 25 \pm 0.9$  (22-27). Very small cuneus with very short extension:  $L = 6 \pm 0.8$  (4-7),  $l = 3 \pm 0.5$  (2-5),  $e = 3 \pm 0.5$  (2-5). Slightly curved dorsal transverse bar:  $x = 35 \pm 1.3$  (32-37),  $w = 4 \pm 0.4$  (3-5). Ventral gripus with large aperture and visible guard:  $a = 25 \pm 0.7$  (23-26),  $b = 21 \pm 0.8$  (19-23),  $c = 2 \pm 0.4$  (1-3),  $d = 7 \pm 0.9$  (4-8),  $e = 16 \pm 0.8$  (13-18),  $L = 5 \pm 0.6$  (3-6),  $l = 3 \pm 0.4$  (2-3). Thin V-shaped ventral transverse bar with bubbled extremities:  $x = 36 \pm 1.5$  (31-40),  $w = 4 \pm 0.5$  (3-5). Long uncinuli II =  $22 \pm 1.5$  (18-25), uncinuli I and III to VII =  $17 \pm 2.6$  (10-22). Long and large spirally coiled (2 turns) penis with a short heel:  $Pe = 304 \pm 16.3$  (276-348), heel =  $3 \pm 0.5$  (2-4). Long and thin accessory piece linked to the basal bulb of the penis:  $Ap = 57 \pm 4.5$  (45-68). No visible vagina.

#### Comments

*T. gustiano* n. sp. is the third *Thaparocleidus* species found on *Pangasius* host with a spirally coiled penis.

*T. gustiano* n. sp. is easily distinguishable from *T. brevicoccleus* n. sp. and *T. kapuasensis* n. sp. by the shape (large tube vs. thin) and length of the penis (304  $\mu$ m vs. 45  $\mu$ m or 115  $\mu$ m), the shape of dorsal gripus (very well marked guard vs. poorly marked one) and no visible vagina (vs. visible one).

The name *Thaparocleidus gustiano* n. sp. is proposed for Rudy Gustiano researcher at the Central Research Institute for Fisheries (Jakarta) who provided the samples from the rare *Pangasius humeralis* and *P. lithostoma*.

## CONCLUSIONS

The present four new species bring the number of *Thaparocleidus* species found on seven species of pangasiids (*P. hypophthalmus*, *P. kinabatangan*

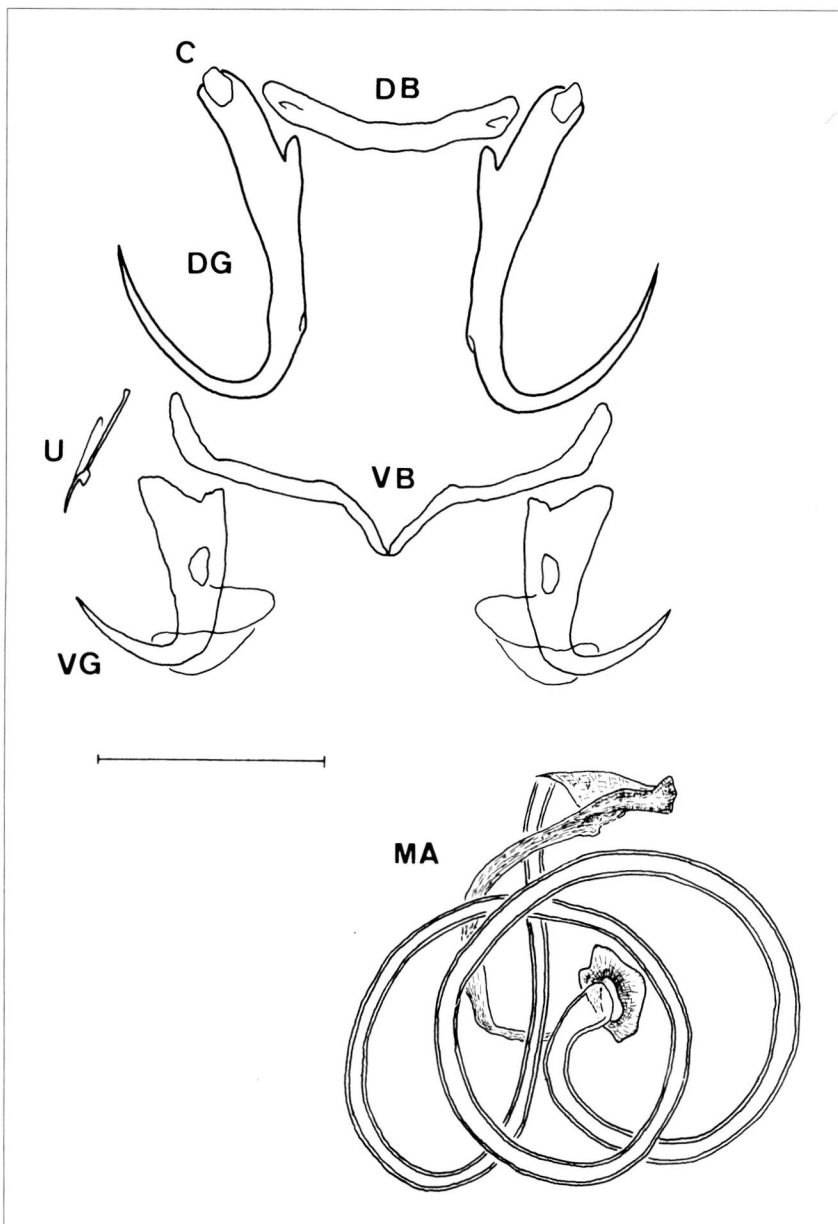


Fig. 5. – *Thaparocleidus gustianoï* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; U = uncinulus. Bar = 30  $\mu$ m.

*ganensis*, *P. nieuwenhuisii*, *P. pangasius*, *P. rheophilus*, *P. humeralis* and *P. lithostoma*) to 12. No monogenean was found on the rare endemic *P. lithostoma*; as only six specimens have been obtained, nothing could be concluded concerning its parasitic species richness, which even so have to be seen as nil at the present time. The diversity of monogenean species on the seven studied host species is now variable from zero to four.

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## REFERENCES

- EUZET L. & PROST M. Report of the meeting on Monogenea: problems of systematics, biology and ecology. *In*: Slusarski W. (Eds) *Review of advances in parasitology*. Warsaw: P.W.N. Polish Scientific Publishers, 1981, 1003-1004.
- GUSSEV A.V. *In*: Key to parasites of freshwater fish of the USSR. Bychovskaya-Pavlovskaya, I.E. *et al.* (Eds) *Moscow-Leningrad: Academiya Nauk SSSR*, 1962, 919 pp. (In Russian: English translation IPST, Ser. No. 1136, Jerusalem, 1964).

- LIM L.H.S. *Silurodiscoides* Gussev, 1961 (Monogenea: Ancyrocephalidae) from *Pangasius sutchi* Fowler, 1931 (Pangasiidae) cultured in Peninsular Malaysia. *Raffles Bulletin of Zoology*, 1990, 38, 55-63.
- LIM L.H.S. *Thaparocleidus* Jain, 1952, the senior synonym of *Silurodiscoides* Gussev, 1976 (Monogenea: Ancyrodiscoidinae). *Systematic Parasitology*, 1996, 35, 207-215.
- MALMBERG G. On the occurrence of *Gyrodactylus* on Swedish fishes. *Skifterutgivna av Södra Sveriges Fiskeriförening*, (1956), 1957, 19-76. (In Swedish, with description of species and a summary in English).
- N'DOUBA V., LAMBERT A. & EUZET L. Gill parasites of the genus *Quadriacanthus* Paperna, 1961 from *Heterobranchus longifilis* and *H. isopterus* with description of seven new species from Côte d'Ivoire, West Africa. *Systematic Parasitology*, 1999, 44, 105-118.
- PARISELLE A. & EUZET L. Gill parasites of the genus *Cichlidogyrus* Paperna, 1960 (Monogenea, Ancyrocephalidae) from *Tilapia guineensis* (Bleeker, 1862), with descriptions of six new species. *Systematic Parasitology*, 1995, 30, 187-198.
- PARISELLE A., LIM L.H.S. & LAMBERT A. Monogeneans from Pangasiidae (Siluriformes) in Southeast Asia: I. Five new species of *Thaparocleidus* Jain, 1952 (Ancyrodiscoidinae) from *Pangasius pangasius*, *P. kinabatanganensis*, *P. rheophilus* and *P. nieuwenhuisii*. *Parasite*, 2001, 8, 127-135.

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