INTRODUCTION

Within the framework of an EC project on the biodiversity and culture of Southeast Asian catfishes, the gills from pangasiid fishes (Siluriformes, Pangasiidae) were examined for monogenean parasites. Twenty two of the 23 known species of fishes belonging to this family have been examined. This paper presents the descriptions of the five new species of Thaparocleidus Jain, 1952 (Anchylodiscoidinae) found on four Pangasius pangasius, P. kinabatanganensis, P. rheophilus and P. nieuwenhuisii.

**KEY WORDS**: Monogenea, Pangasiidae, Thaparocleidus, P. chandpuri n. sp., T. bahari n. sp., T. sobonensis n. sp., T. redebens n. sp., T. mohokamensis n. sp.

**P. pangasius** (Hamilton, 1822) and a redescription of Thaparocleidus pangasi. The first three fish species from Borneo (Indonesia and Malaysia) have not been examined for parasites; while the fourth species (from Bangladesh), was examined by Tripathi (1957) in India. Monogenea from the other 18 pangasiid species will be described elsewhere.

To date a total of three species of Thaparocleidus have been described from P. pangasius and P. hypophthalmus (Sauvage, 1878) from India and Peninsular Malaysia, respectively (see Tripathi, 1957; Lim, 1990).

**MATERIALS AND METHODS**

Fish were caught in fish markets or directly from fishermen in Indonesia (East Kalimantan region, South part of Borneo Island), Malaysia (Sabah state, North part of Borneo Island) and Bangladesh. 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 section, were frozen in liquid nitrogen, until examination. To verify the specific identity of host fishes, the carcasses were num-

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* IRD (ex ORSTOM), Catfish Asia Project, Instalasi Penelitian Perikanan Air Tawar, Jalan Ragunan, Pasar Minggu, P.O. Box 7220, Jakarta 12540, Indonesia.

** GAMET, B.P. 5095, 34053 Montpellier Cedex 1, France.

*** Institute of Biological Sciences, University of Malaya, 50603 Kuala Lumpur, Malaysia.

**** Laboratoire Génome, Populations, Interactions, UMR 5000, cc 105, Université Montpellier II, Sciences et Techniques du Languedoc, Place Eugène Bataillon, 34095 Montpellier Cedex 5, France.

Correspondence : Alain Lambert.
E-mail: lambert@criI.univ-montp2.fr
bered, 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 (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 ± 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). The terminologies proposed by Pariselle and Euzet (1995) and by N'Douba et al. (1999) are used.

RESULTS

Six species of Monogenea were recorded; one, *Thaparocleidus pangasi* (Tripathi, 1957), had already been described, while the other five are new species of *Thaparocleidus* (Ancylopodiscoidinae, Monogenea) as defined by Lim (1996).

REDESCRIPTION

*THAPAROCLEIDUS PANGASI* (TRIPATHI, 1957) (Fig. 2)

Type-host: *Pangasius pangasius* (Hamilton, 1822).

Site: gills.

Type-locality: Rivers Malta, Ganga (Buxar), Cauvery and Hoogly.

Other locality: also found on the same host at Chandpur, Ganges Delta, Bangladesh.

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 uncinulus. 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.
Material studied: 30 individuals stained and mounted in Malmberg solution.

Adults $534 \pm 103.5 (407-800)$ long, $109 \pm 12.3 (76-129)$ wide at the level of the penis. Pharynx $49 \pm 6.1 (37-63)$ wide. Dorsal gripus with blade bent in middle, very short guard: $a = 61 \pm 1.7 (55-64)$, $b = 50 \pm 1.6 (44-55)$, $c = 2 \pm 0.5 (1-4)$, $d = 14 \pm 1.2 (12-17)$, $e = 30 \pm 1.1 (26-32)$. Cuneus with long extension: $L = 20 \pm 1.1 (17-22)$, $l = 6 \pm 0.5 (5-8)$, $e = 11 \pm 1.4 (8-15)$. Slightly curved dorsal transverse bar: $x = 38 \pm 1.5 (35-42)$, $w = 6 \pm 0.6 (5-7)$. Ventral gripus with well marked aperture, poorly marked outer root: $a = 28 \pm 0.8 (25-30)$, $b = 25 \pm 0.8 (23-26)$, $c = 2 \pm 0.4 (1-3)$, $d = 9 \pm 0.7 (7-10)$, $e = 18 \pm 0.9 (15-19)$, $L = 4 \pm 0.5 (3-5)$, $l = 2 \pm 0.3 (1-2)$. Thin V-shaped ventral transverse bar: $x = 33 \pm 1.4 (29-36)$, $w = 4 \pm 0.5 (3-4)$. Uncini II = $16 \pm 1.3 (13-21)$, uncini I and III to VII = $16 \pm 1.8 (9-19)$. Long and folded penis, with ovoid basal bulb and large heel: $Pe = 181 \pm 4.7 (169-192)$, $He = 11 \pm 1.5 (8-15)$. Curved accessory piece linked to the basal bulb of the penis: $Ap = 54 \pm 2.1 (50-58)$. No sclerotised vaginal system.

Comments

This species is identified as Thaparocleidus pangasi first described by Tripathi (1957) from Pangasius pangasius in India. The measurements for the present specimens are not different from those given by Tripathi (1957). The shape of the sclerotised parts are also similar. The parasites were recovered from the same fish species, P. pangasius which is the only Pangasius species occurring naturally in India and the present host species were from one of the type localities River (Ganga), as noted by Tripathi (1957).

DESCRIPTION

THAPAROCLEIDUS CHANDPURJ N. SP. (Fig. 3)

Type-host: Pangasius pangasius (Hamilton, 1822).
Site: gills.
Type-locality: Chandpur, Ganges Delta, Bangladesh.
Material studied: 29 individuals fixed and mounted in Malmberg solution.
Fig. 3. – *Thaparocleidus chandpuri* 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.


Adults 1434 ± 227.1 (992-1929) long, 180 ± 21.6 (148-220) wide at the level of the penis. Pharynx 73 ± 9.4 (58-95) wide. Dorsal gripus with blade regularly bent and well marked guard: a = 82 ± 3.1 (67-86), b = 74 ± 2.3 (69-79), c = 4 ± 0.9 (2-6), d = 19 ± 1.8 (15-23), e = 33 ± 2.5 (23-37). Large cuneus with very short extension: L = 39 ± 2.5 (32-46), l = 16 ± 1.6 (11-19), e = 3 ± 1 (1-7). Nearly straight dorsal transverse bar: x = 68 ± 2.5 (63-74), w = 11 ± 1.1 (8-13). Ventral gripus with well marked aperture and well developed guard: a = 27 ± 0.8 (25-28), b = 21 ± 0.9 (19-23), c = 7 ± 0.8 (5-8), d = 10 ± 1 (6-12), e = 17 ± 0.9 (14-19), L = 4 ± 0.7 (2-5), l = 2 ± 0.5 (1-4). Thin V-shaped ventral transverse bar with bubbled extremities: x = 41 ± 2 (37-47), w = 8 ± 0.8 (6-10). Uncinuli II = 17 ± 1.3 (13-19), uncinuli I and III to VII = 15 ± 1.6 (11-21). Long and thin penis folded just after the ovoid basal bulb, with a spirally coiled thickening (5-7 turns) at its extremity, small heel: Pe = 106 ± 3.1 (98-113), He = 5 ± 1.4 (4-9). Long, straight and thin slightly sclerotised accessory piece linked to the basal bulb of the penis: Ap = 45 ± 3 (38-50). Slightly sclerotised vagina with round well sclerotised part: diameter = 11 ± 1.3 (9-16).

Comments

Besides *T. pangasi* (see above) only two other species belonging to *Thaparocleidus* have already been described from pangasiid hosts: *T. caecus* (Mizelle & Kristsky, 1969) and *T. siamensis* (Lim, 1990) from *P. hypophthalmus* (syn. *P. suitchi*) (see Lim, 1990).

This species is the only species of *Thaparocleidus* with the dorsal gripus having a regularly arched blade, a spirally coiled thickening at the extremity of the copulatory tube and a sclerotised part of the vagina.

*Thaparocleidus chandpuri* n. sp. is named after the type locality, Chandpur Riverine Station (Bangladesh).
**THAPAROCLEIDUS BAHARI** n. sp. (Fig. 4)


Site: gills.

Type-locality: Kinabatangan River, Sukau, Sabah State (North part of Borneo Island), Malaysia.

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


Adults $659 \pm 107$ (456-1060) long, $124 \pm 13.5$ (88-157) wide at the level of the penis. Pharynx $45 \pm 4.8$ (34-57) wide. Dorsal gripus with blade bent in middle and very short guard: $a = 53 \pm 1.3$ (50-56), $b = 43 \pm 1.3$ (40-45), $c = 1 \pm 0.3$ (0.4-2), $d = 14 \pm 0.8$ (12-17), $e = 28 \pm 1.1$ (25-31). Cuneus with long extension: $L = 16 \pm 1.1$ (13-19), $l = 6 \pm 0.6$ (4-7), $e = 12 \pm 1.6$ (9-17). Slightly curved dorsal transverse bar: $x = 40 \pm 1.3$ (37-42), $w = 5 \pm 0.4$ (4-6). Ventral gripus with well marked aperture and short guard: $a = 27 \pm 0.6$ (26-28), $b = 23 \pm 0.8$ (21-24), $c = 1 \pm 0.5$ (1-3), $d = 9 \pm 0.7$ (7-11), $e = 17 \pm 0.6$ (16-18), $L = 4 \pm 0.6$ (3-6), $l = 2 \pm 0.4$ (1-3). Thin V-shaped ventral transverse bar: $x = 39 \pm 1.6$ (35-43), $w = 3 \pm 0.4$ (3-4). Thin uncini I and III to VII $= 15 \pm 1.7$ (12-19). 3-shaped, thin walled and large penis with ovoid basal bulb and large heel: $P_e = 89 \pm 5.9$ (75-99), $H_e = 9 \pm 1$ (6-12). Curved accessory piece with slightly sclerotised vast extension linked to the basal bulb of the penis: $P_e = 35 \pm 1.5$ (31-39). No sclerotised vaginal system.

Comments

This species is easily distinguished from *T. caecus*, *T. chandpuri* n. sp. and *T. pangasi* by having a large penis shaped like a 3 (vs. *T. caecus* with thin and curved one and *T. siamensis* with a sinuous one) and in having a long extension on the cuneus (vs. no extension). *Thaparocleidus bahari* n. sp. is proposed for M. Basri Bahar responsible for the Sukau River Lodge (Wildlife Expedition SDN. BHD.) who kindly found, bought and provided the rare *Pangasius kinabatanganensis* specimens.

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**Fig. 4.** - *Thaparocleidus bahari* n. sp. C = cuneus; DB = dorsal transverse bar; DG = dorsal gripus; MA = male apparatus; VB = ventral transverse bar; VG = ventral gripus; U = unciniulus. Bar $= 30 \mu$m.
**T†HAPAROCLEIDUS SABANENSIS** n. sp. (Fig. 5)

**Type-host:** *Pangasius kinabatanganensis* Roberts & Vidthayanon, 1991.

**Site:** gills.

**Type-locality:** Kinabatangan River, Sukau, Sabah State (North part of Borneo Island), Malaysia.

**Material studied:** 6 individuals stained and mounted in Malmberg solution.

**Type-material:** holotype deposited at the Muséum National d'Histoire Naturelle (Paris): n° 5 HG, slide Tg 122. Paratypes deposited at the Muséum National d'Histoire Naturelle (Paris): Tg 123; the Natural History Museum (London) n° 2000.9.14.3.

Adults $1289 \pm 151.7$ (1017-1462) long, $165 \pm 37.3$ (128-231) wide at the level of the penis. Large and well marked pharynx: $94 \pm 9.8$ (79-107) at its width. Dorsal gripus with regularly arched blade and short guard: $a = 77 \pm 3.1$ (72-82), $b = 66 \pm 2.6$ (61-70), $c = 3 \pm 0.5$ (2-4), $d = 15 \pm 1.1$ (14-18), $e = 34 \pm 1$ (32-36). Large cuneus with very short extension: $L = 35 \pm 0.8$ (33-36), $l = 10 \pm 0.8$ (9-11), $e = 3 \pm 1.3$ (2-6). Slightly curved dorsal transverse bar: $x = 56 \pm 1.6$ (54-58), $w = 9 \pm 0.7$ (8-9). Ventral gripus with small aperture and short guard: $a = 33 \pm 0.7$ (32-34), $b = 27 \pm 0.8$ (26-28), $c = 2 \pm 0.7$ (1-3), $d = 10 \pm 0.7$ (8-11), $e = 19 \pm 1$ (18-21), $L = 4 \pm 0.5$ (3-4), $l = 2 \pm 0.3$ (1-2). Thin V-shaped ventral transverse bar: $x = 36 \pm 1.7$ (34-39), $w = 4 \pm 0.6$ (4-6). Thin uncinuli II = 18 ± 1 (16-19), uncinuli I and III to VII = 17 ± 1.9 (12-20). Curved and short penis with ovoid basal bulb and medium heel: $Pe = 56 \pm 3.8$ (52-62), $He = 8 \pm 1.9$ (5-9). Slightly curved and short accessory piece with gutter-like depression, linked to the basal bulb of the penis: $Ap = 31 \pm 1$ (30-33). No sclerotised vaginal system.

**Comments**

Only six specimens of this species were recovered from two of five fishes sampled, while 125-350 specimens of *T. babari* n. sp. were found on the same fishes. *Thaparocleidus sabanensis* n. sp. is easily distinguishable from *T. stamensis* and *T. babari* by the shape.

![Diagram](image)

**Fig. 5.** - *Thaparocleidus sabanensis* 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.
of the penis (sinuous or M-shaped vs. curved); from *T. caecus* and *T. pangas* mainly by having a very short extension on the large cuneus (vs. long extension and small cuneus) and from *T. chandpur* by the shape and size of the penis (simple and 56 μm long vs. spirally coiled thickening at the extremity and 106 μm long). *Thaparocleidus sabanensis* n. sp. is named after the type locality (Sabah State).

**Thaparocleidus mahakamensis** n. sp. (Fig. 6)

Type-host: *Pangasius nieuwenhuisi* (Popta, 1904).
Site: gills.

Type-locality: Mahakam River, Samarinda, East Kalimantan (Southeast part of Borneo Island), Indonesia.

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


Adults 1004 ± 157.5 (716-1320) long, 182 ± 24.3 (135-218) wide at the level of the penis. Pharynx 61 ± 6 (50-75) wide. Dorsal gripus with blade bent in the middle and very short guard: a = 59 ± 2.5 (53-65), b = 49 ± 2.1 (45-54), c = 1 ± 0.3 (0.5-2), d = 14 ± 1.3 (11-17), e = 32 ± 1.5 (29-36). Cuneus with medium extension: L = 13 ± 1.4 (13-19), l = 5 ± 0.5 (4-7), e = 8 ± 1.3 (4-10). Nearly straight dorsal transverse bar: x = 33 ± 1.4 (31-39), w = 6 ± 0.4 (5-7). Ventral gripus with well marked aperture and very short guard: a = 27 ± 0.7 (26-29), b = 25 ± 0.7 (23-27), c = 1 ± 0.3 (1-2), d = 5 ± 0.6 (4-7), e = 16 ± 0.7 (14-17), L = 6 ± 0.6 (5-8), l = 3 ± 0.3 (2-3). Thin V-shaped ventral transverse bar: x = 34 ± 1.5 (30-38), w = 4 ± 0.4 (3-5). Thin uncini II = 13 ± 1 (10-16), uncini I and III to VII = 13 ± 0.7 (11-15). Long, thin and regularly folded penis with a small spine-like structure at its distal third, an ovoid basal bulb and a large heel: Pe = 169 ± 7 (155-181), He = 12 ± 1.3 (10-16). Curved accessory piece with a central gutter-like depression, linked to the basal bulb of the penis: Ap = 80 ± 3.7 (72-87).

No sclerotised vaginal system.

![Diagram](image-url)

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

This species is easily distinguished from:
- *T. pangasi* by the size of the accessory piece of the penis (80 μm vs. 54 μm), the cuneus (13 μm vs. 20 μm in length), the presence of a spine-like structure at the distal third of the penis (vs. absence) and the shape of ventral gripus (thick vs. thin) even if the measurements are similar;
- *T. caecus* by the sizes of the sclerotised parts which are larger in the present species *T. mahakamensis*, even if the shapes are morphologically similar (i.e. same spine-like structure at the distal third of the penis), penis is 169 μm in length (vs. 62 μm), dorsal gripus 59 μm (vs. 43 μm), accessory piece 80 μm (vs. 41 μm);
- *T. chandpuri* by the shape of the penis (spirally coiled thickening), the shape and size of dorsal gripus (regularly curved blade, total length 82 μm vs. bent in the middle, total length 59 μm) and ventral gripus (well-developed guard 7 μm vs. very short outer root 1 μm);
- *T. siamensis* and *T. babari* n. sp. by the shape of the penis (regularly folded vs. sinuous or 3-shaped);
- *T. sabanensis* n. sp. by the size of the sclerotised parts: i.e. penis (169 μm vs. 56 μm), cuneus (L = 13 μm vs. 35 μm or extension = 8 μm vs. 3 μm), etc.

The name *Thaparocleidus mahakamensis* n. sp. refers to the type locality.

**THAPAROCLEIDUS REDEBENSIS** N. SP. (Fig. 7)

Type-host: *Pangasius rheophilus* Pouyaud & Teugels, 2000.

Site: gills.

Type-locality: Berau River, Tanjung Redeb, East-Kalimantan state (East part of Borneo Island), Indonesia.

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


Adults 1489 ± 180.6 (1238-1985) long, 233 ± 23.4 (175-198) μm.
295) wide at the level of the penis. Pharynx 80 ± 6 (70-91) wide. Large dorsal gripus with blade bent in the middle and very short guard: a = 97 ± 2.9 (91-103), b = 83 ± 2.9 (77-89), c = 2 ± 0.6 (1-4), d = 21 ± 1.8 (16-25), e = 48 ± 2.3 (44-54). Large cuneus with short extension: L = 44 ± 2.1 (40-49), l = 12 ± 0.9 (11-16), e = 8 ± 2.1 (5-12). Slightly curved and long dorsal transverse bar: x = 66 ± 2.3 (62-71), w = 9 ± 0.7 (8-12). Ventral gripus with well marked aperture and short guard: a = 38 ± 1.3 (35-42), b = 34 ± 1.1 (31-36), c = 2 ± 0.6 (1-4), d = 11 ± 1 (9-13), e = 25 ± 0.9 (22-26), L = 5 ± 0.6 (4-7), l = 2 ± 0.4 (2-3). Thin and long V-shaped ventral transverse bar: x = 47 ± 2 (42-53), w = 6 ± 0.5 (5-7). Long uncini II = 19 ± 1.4 (14-22), uncini I and III to VII = 19 ± 3 (11-25). Short large and 3-shaped penis with a long thin branchted wall expansion at the first quarter, an ovoid basal bulb and a large heel: Pe = 68 ± 3.9 (60-78), He = 9 ± 1.8 (7-14). Curved accessory piece with a central gutter-like depression, linked to the basal bulb of the penis: Ap = 40 ± 1.6 (38-44). No sclerotised vaginal system.

Comments
This species is different from the other Thaparocleidus species from pangasiids by the presence of a branched expansion at the first quarter of the penis wall and in having large anchors and bars. Thaparocleidus redebensis n. sp. is named after the type locality.

CONCLUSIONS

The present five new species bring the number of Thaparocleidus species found on five species of pangasiids (P. pangasius, P. hypophthalmus, P. rheophilus, P. nieuwenhuissi and P. kina-batanganensis) to eight. In India only one species, T. pangasi, has been recorded on P. pangasius, while the same host species in Bangladesh harbours two species of Thaparocleidus. The diversity of monogenean species on the five host species is low, ranging from one to two monogenean species per host species.

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Drawings by: Dr. Nathalie Le Brun, laboratoire Génome, Populations, Interactions UMR 5000, cc105, Université Montpellier II, place E. Bataillon, 34095 Montpellier cedex 05.

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