DESCRIPTION OF A NEW *CLARIAS* SPECIES FROM SOUTHEAST ASIA BASED ON MORPHOLOGICAL AND GENETICAL EVIDENCE (SILURIFORMES, CLARIIDAE)

by

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ABSTRACT. *Clarias intermedius* n. sp. is described from Central Kalimantan (Indonesia). The new species belongs to the group of Asian *Clarias* species recognised by a very short distance between the occipital process and the dorsal fin origin and including *C. macrocephalus* and *C. meladerma*. From the former, it is distinguished amongst others by fewer gill rakers on the first branchial arch (16-23 *vs*. 27-33); from the latter is it easily recognised by the more numerous serrae on the anterior side of the pectoral spine (26-46 *vs*. 14-22). *Clarias meladerma* and the new species are sympatric in Central Kalimantan. In this area, the existence of diagnostic enzymatic loci and the absence of intermediate genotypes between both species demonstrated their reproductive isolation.

RÉSUMÉ. Description d'une nouvelle espèce de *Clarias* d'Asie du Sud-Est sur la base de données morphologiques et génétiques (Siluriformes, Clariidae).

Clarias intermedius n. sp. est décrite en provenance de la partie centrale de Kalimantan (Indonésie). La nouvelle espèce appartient au groupe des *Clarias* asiatiques reconnus par une très courte distance entre le processus occipital et l'origine de la nageoire dorsale ; ce groupe comprend *C. macrocephalus* et *C. meladerma*. *C. intermedius* se distingue de la première espèce, entre autres, par un nombre plus faible de branchiospines sur le premier arc branchial (16-23 *vs*. 27-33) ; elle diffère de *C. meladerma* par un nombre plus important de serratures sur le bord antérieur de l'épine pectorale (26-46 *vs*. 14-22). La nouvelle espèce se trouve en sympatrie avec *C. meladerma* dans la partie centrale de Kalimantan. L'existence de loci enzymatiques diagnostiques entre ces deux espèces et l'absence de génotypes intermédiaires prouvent qu'elles sont reproductivement isolées.

Key words. Clariidae - *Clarias intermedius* - Indonesia - New species - Taxonomy.

Clariidae or walking catfishes naturally occur in Africa, Minor Asia, the Indian subcontinent and Southeast Asia. The diversity of these airbreathing catfishes is highest in Africa. In Asia, only three genera are known of which *Clarias* Scopoli, 1777 is the most diversified with some 17 species presently recognised as valid (Teugels, 1996; Lim and Ng, 1999; Ng, 1999). Although many of the species are of great economical importance in both fisheries and fish culture, the taxonomy of the Asian *Clarias* species is poorly known. The lack of reliable basic taxonomic information greatly hampers an efficient and sustainable exploitation of these

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resources.

Whilst studying new *Clarias* collections as part of a multidisciplinary project on the characterisation of Asian Clariidae, some specimens seemed morphologically closely related to those *Clarias* species showing a very short distance between the occipital process and the dorsal fin origin. The new material was originally identified as *C. teleladerma* Bleeker, 1846 but closer morphological examination revealed that it was not conspecific. An allozyme study showed similar results. Therefore we consider this material as representing a species new to science. Its description is given below.

MATERIAL AND METHODS

Morphology

Twenty five specimens of the new species were examined. They were deposited in the Musée Royal de l'Afrique Centrale, Tervuren (Belgium) (MRAC), the Muséum National d'Histoire Naturelle, Paris (France) (MNHN), the Museum Zoologicum Bogoriense, Cibinong (Indonesia) (MZB) and the Zoological Reference Collection, Singapore (ZRC). Comparative material included all available types of Southeast Asian *Clarias* species and other specimens studied by Bleeker, housed in the Museum Naturalis, Leiden (The Netherlands) (RMNH) and the Natural History Museum, London (England) (BMNH). Additional material examined included over 500 *Clarias* specimens from allover Southeast Asia and housed in different natural history museums. The list of specimens examined can be requested at the address of the first author.

On each specimen, 30 measurements were taken using dial calipers. They are: total length (TL); standard length (SL); maximal body depth (MBD); caudal peduncle depth (CPD); head length (HL); head width (HW); snout length (SNL); interorbital width (IOW); eye diameter (ED); nasal barbel length (NBL); maxillary barbel length (MBL); inner mandibular barbel length (IMBL); outer mandibular barbel length; (OMBL) occipital process length (OPL); occipital process width (OPW); frontal fontanelle length (FFL); frontal fontanelle width (FFW); premaxillary toothplate width (PMW); vomerine toothplate width (VMW); predorsal length (PDL); preanal length (PAL); prepelvic length (PPL); prepectoral length (PPEL); dorsal fin length (DFL); length between dorsal and caudal fin (DCL); length between occipital process and dorsal fin base (OPDF); pectoral spine length (PESL); pectoral fin length (PEFL); pelvic fin length (PFL); and anal fin length (AFL). Measurements follow Teugels *et al*. (1999b). The following meristic counts were made: number of gill rakers on the first branchial arch, number of dorsal fin rays, number of anal fin rays, total, abdominal and caudal vertebrae (using radiographs; the vertebrae forming the Weberian apparatus were not included) and the number of serrations on the anterior side of the pectoral spine. Special morphological observations include the shape of the occipital process, the shape of the frontal fontanelle, the shape of the pectoral spine, the position of the secondary openings of the lateral line system, the position of dorsal, caudal and anal fins and the coloration.

A principal component analysis (PCA) was carried on the morphometric data using the CSS STATISTICA (StatSoft, Inc.) version 4.5 package. Measurements were log-transformed before the PCA was run on the covariance matrix (Bookstein *et al*., 1985). The first factor of this analysis is considered as the size factor and was not taken into account in order to minimise the effect of size differences between the samples. Missing data were case-wise deleted.

Genetics

Enzymatic polymorphism was screened for sympatric populations of *Clarias meladerma* and the new species from Central Kalimantan. Fifty specimens were analysed for each species. The allozyme analysis (tissue extraction, migration buffers and staining procedures) was conducted from the standard methods of horizontal starch gel electrophoresis following the procedure given by Guyomard and Krieg (1983), Krieg and Guyomard (1985) and Pouyaud and Agnèse (1995). The resulting zymograms were scored for variation at 20 loci. Table I shows the enzyme systems and the buffers used as well as the source tissues in which the different loci were expressed. The nomenclature is that proposed by Shaklee *et al.* (1990). Because of its occurrence in most of the Asian farms, the African clariid *C. gariepinus* (Burchell, 1822) is represented as the species of reference for allelic designation. Twenty specimens from the CRIFI strain (Indonesia) were studied. Alleles were designed according to electrophoretic mobility, meaning that the most common allele in the reference species was considered as *100.

RESULTS

Morphology

A PCA was carried out using 23 log-transformed measurements (excluding total length, standard length, barbel lengths and the distance between dorsal and caudal fins) taken on 512 specimens. The plot of the second and the third factors of this PCA, explaining 2.4858% of the total variation, is given in figure 1. The second factor is merely defined (in decreasing order of importance) by the distance between the occipital process and the dorsal

Table I. Enzyme systems analysed, migration buffers used, tissue expression and genetic interpretations.

Enzyme system	Abbreviation	*Locus*	Tissue	Electrode buffer
Alcohol dehydrogenase	ADH, E.C. 1.1.1.1	*ADH**	Liver	POULIK 1/2
Creatine kinase	CK, E.C. 2.7.3.2	*CK-1**	Eyes	MC 2
		*CK-2**	Eyes	MC 2
Fructose biphosphatase	FBP, E.C. 3.1.3.11	*FBP**	Liver	MC 2
Glucose-6-phosphate isomerase	GPI, E.C. 5.3.1.9	*GPI-1**	Muscle/Eyes	RW
		*GPI-2**	Muscle/Eyes	RW
Isocitrate dehydrogenase	IDHP, E.C. 1.1.1.42	*IDHP-1**	Muscle	MC 2
		*IDHP-2**	Liver	MC 2
L-Lactate dehydrogenase	LDH, E.C. 1.1.1.27	*LDH-1**	Eyes	MC 2
		*LDH-2**	Eyes	MC 2
Malate dehydrogenase	MDH, E.C. 1.1.1.37	*MDH-1**	Eyes	MC 2
		*MDH-2**	Eyes	MC 2
Mannose phosphate isomerase	MPI, E.C. 5.3.1.8	*MPI**	Liver	POULIK 1/2
Phosphoglucomutase	PGM, E.C. 5.4.2.2	*PGM**	Muscle	TEB
6-phosphogluconate dehydrogenase	6PGDH, E.C. 1.1.1.44	*6PGD**	Liver	RW
Protein total	PT	*PROT-1**	Muscle	MC 2
		*PROT-2**	Muscle	MC 2
Superoxide dismutase	SOD, E.C. 1.15.1.1	*SOD-1**	Liver	MC 2
		*SOD-2**	Liver	MC 2
Sorbitol dehydrogenase	SDH, E.C. 1.1.1.14	*SDH**	Liver	POULIK1/2

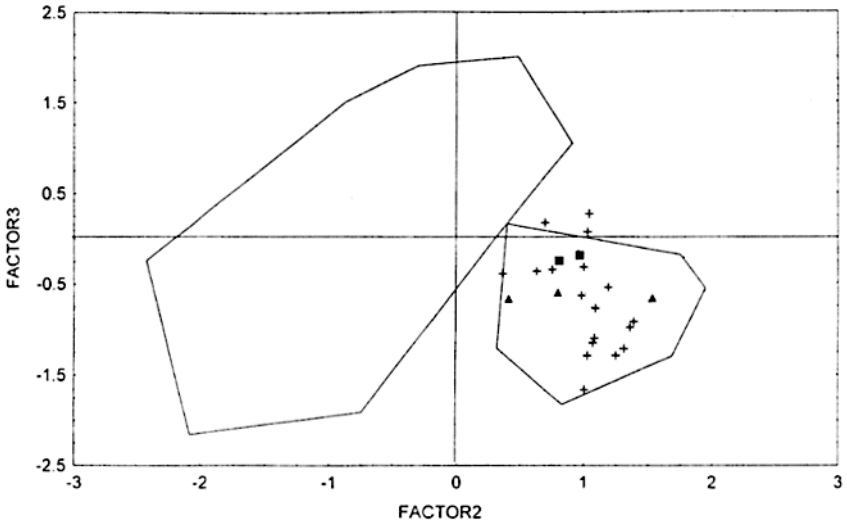

Fig. 1. Plot of the second and the third principal components of a PCA using 23 log-transformed measurements (see material and methods, excluding total length, standard length, barbel lengths and the distance between dorsal and caudal fins) taken on 512 *Clarias* specimens from Asia. + *C. intermedius* n. sp.; ■ types of *C. macrocephalus*; ▲ types of *C. theladerma* and *C. thelasoma*.

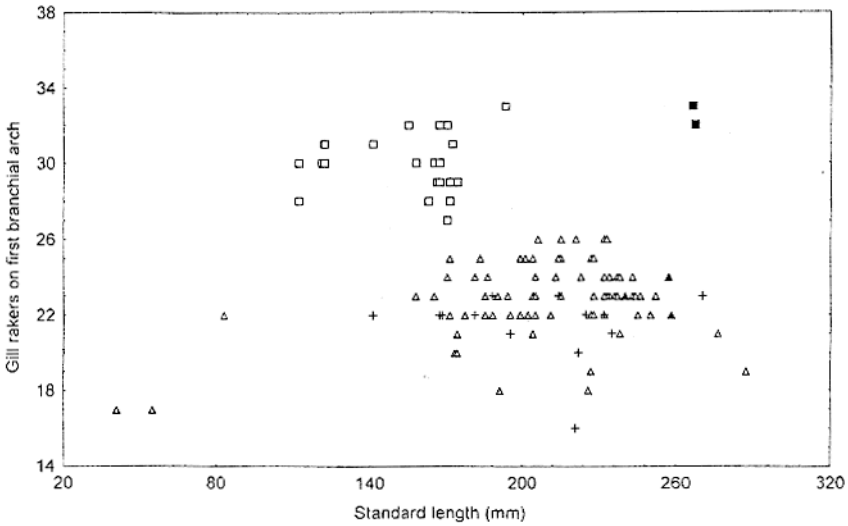

Fig. 2. Correlation between the number of gill rakers on the first branchial arch and the standard length (in mm) in Asian *Clarias* specimens. + *C. intermedius* n. sp.; ■ types of *C. macrocephalus*; □ other specimens of *C. macrocephalus*; ▲ types of *C. theladerma* and *C. thelasoma*; ▯ other specimens of *C. theladerma*.

fin, the eye diameter, the frontal fontanelle length and the occipital process length. The third factor is defined (in decreasing order of importance) by the anal fin length, the pectoral spine length, the dorsal fin length and the frontal fontanelle width. The specimens of the new

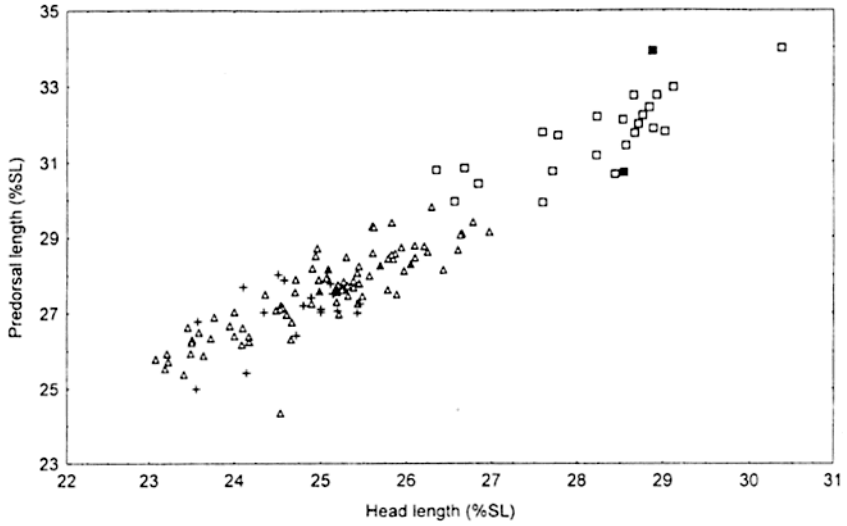

Fig. 3. – Correlation between the predorsal length (in% standard length) and the head length (in% standard length) in Asian *Clarias* specimens. + C. *intermedius* n. sp.; ■ types of *C. macrocephalus*; □ other specimens of *C. macrocephalus*; ▲ types of *C. maladerma* and *C. melasoma*; △ other specimens of *C. maladerma*.

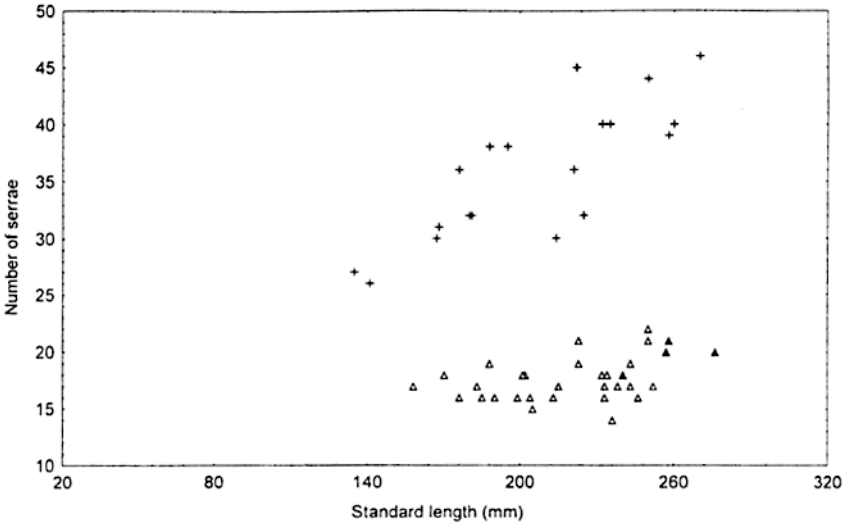

Fig. 4. – Correlation between the number of serrae on the anterior margin of the pectoral spine and the standard length (in mm) in Asian *Clarias* specimens. + C. *intermedius* n. sp.; ▲ types of *C. maladerma* and *C. melasoma*; △ other specimens of *C. maladerma*.

species are all situated on the positive sector of the second axe and mostly on the negative sector of the third axe, in a polygon which includes the lectotype and the paralectotype of *C. macrocephalus* Günther, 1864 (see Teugels *et al.*, 1999a), the type specimens of

C. meladerma and its junior synonym *C. melasoma* Bleeker, 1852 (cf. *infra*) and conspecific material of those two species.

From *Clarias macrocephalus*, our new species is easily distinguished by fewer gill rakers on the first branchial arch (16-23 *vs*. 27-33) (Fig. 2). Morphometric characters such as head length and predorsal distance (Fig. 3) also enable to distinguish *C. macrocephalus* from *C. meladerma* and our new species.

Morphometrically not a single clearly marked character enables to distinguish between our new species and *C. meladerma*. The latter however is recognised by the anterior side of the pectoral spine provided with few, big serrae (14-22) while the posterior side is smooth (Bleeker, 1846). Our new species has numerous small serrations on the anterior side of the spine (26-46). This character enables to distinguish unambiguously the new species from *C. meladerma* (Figs 4, 5c, 5d).

Allozyme data

The new species occurs sympatrically with *C. meladerma* in Central Kalimantan. *Clarias macrocephalus* does not occur in this area. We compared allozyme data of the new species and *C. meladerma*. Among the 20 loci screened, seven are diagnostic between *C. meladerma* and the new species. This means that for these loci, each species is characterised by private alleles. Table II presents the relative mobility for each diagnostic locus.

CLARIAS INTERMEDIUS N. SP.

(Fig. 5 a-c)

Material examined

Holotype.– MZB 10574, 214 mm standard length, a male collected at Palangkaraya market, Central Kalimantan, Indonesia, coll. Sudarto, 1995

Paratypes.– ZRC 46110-46113, 4 specimens, 176-195 mm SL, three females and one male, Kereng Bengkirai, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999; MNHN 2000-1212-1213, 2 specimens 264-275 mm SL, 2 females, Bukit Pinang, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999; MNHN 2000-1214-1217, 4 spms, 290-310 mm SL, 4 females, Bereng Bengkel, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999; MNHN 2000-1218-1219, 2 spms, 258-259 mm SL, one male and one female, Bangkal, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999; MRAC 96-050-P-120-121, 2 spms 135-141 mm SL, one female and one male and MRAC 96-050-P-129-132, 4 spms 167-225 mm SL, one female and three males, same data as the holotype.

Other specimens examined.– MNHN 2000-1220-1221, 2 spms 160-200 mm SL, Kereng Bengkirai, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999; MNHN 2000-1222-1225, 4 specimens, 115-145 mm SL, Bereng Bengkel, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999.

Table II. – Diagnostic loci between *Clarias intermedius* n. sp. and *C. meladerma* in Central Kalimantan, using *C. gariepinus* as the reference species.

Species	n	*SOD-2**	*6PGD**	*PGM**	*GPI-2**	*MPI**	*SDH**	*ADH**
Clarias intermedius	50	220/250	100	100	120	100	-100	-100
Clarias meladerma	50	200	50	150	100	105	-105	005
Clarias gariepinus	20	100	100	100	100	100	-100	-100

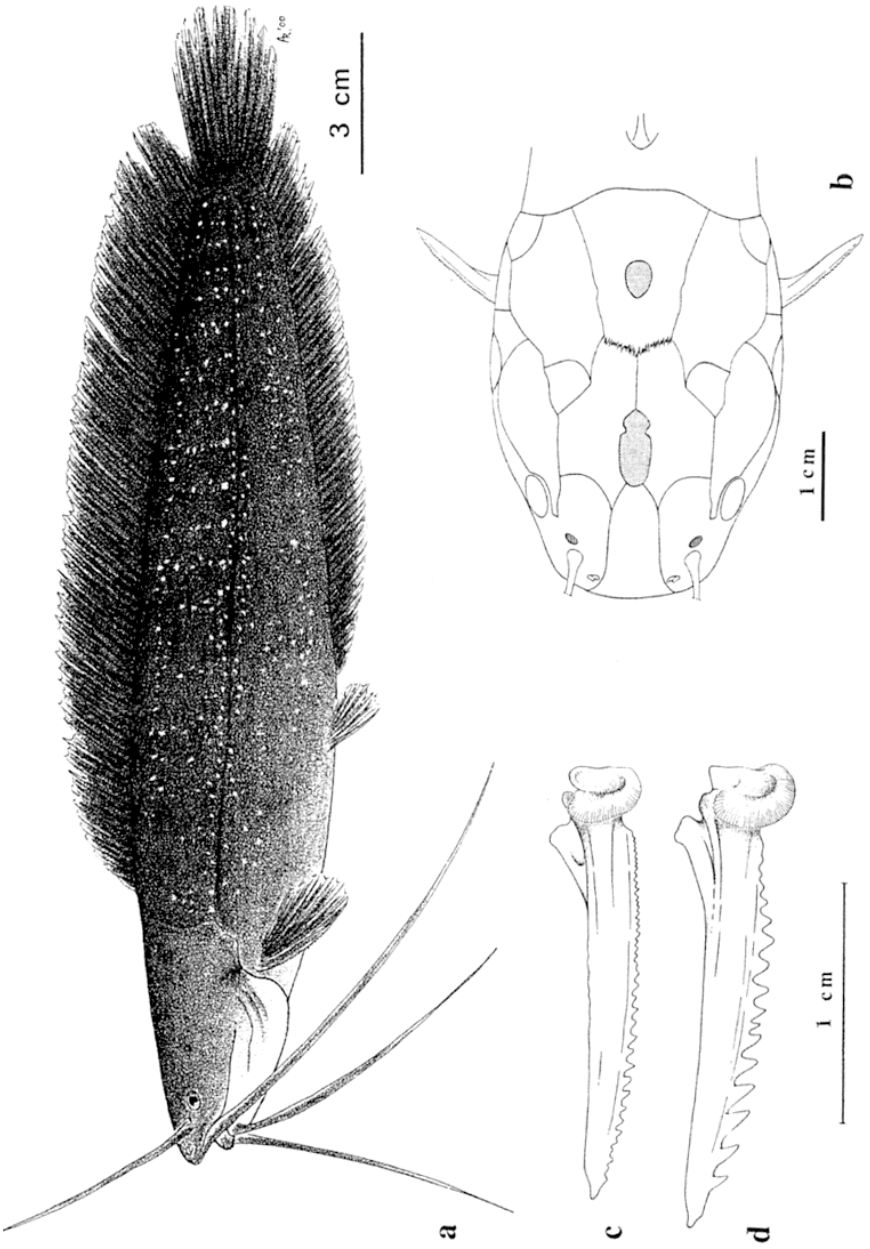

Fig. 5. *Clarias intermedius* n. sp. **a**: lateral view of the holotype; **b**: dorsal view of the head in a paratype (MRAC 96-050-P-129-132); **c**: pectoral spine of a paratype (MRAC 96-050-P-129-132); **d**: pectoral spine in a specimen of *C. heteroderma* (MRAC 96-050-P-105-118).

Diagnosis

Clarias intermedius is distinguished from all other *Clarias* species by the combination of the following characters: a very short distance between the occipital process and the origin of the dorsal fin (1.8-3.8% SL), 16-23 gill rakers on the first branchial arch and 26-46 small serrae on the anterior side of the pectoral spine.

Description

Based on the holotype, 18 paratypes and six other specimens examined. Measurements are given in table III.

The head is oval-shaped in dorsal outline (Fig. 5b). The snout is somewhat pointed and the mouth is small. The interorbital distance is about two fifths of the head length. The eyes are small and latero-dorsally placed. The frontal fontanelle is short and squad ("sole-shaped" - see Teugels, 1986); its anterior tip reaches slightly beyond the virtual line between the posterior eye borders. The fourth infraorbital and the suprapreopercle are normally developed and sutured in all specimens examined. The occipital fontanelle is small and oval-

Table III. - Measurements for the holotype, 18 paratypes and six other specimens of *Clarias intermedius* n. sp. For abbreviations see Material and Methods.

Variable	Holotype	Paratypes				
		n	min	max	mean	SD
TL (mm)	248	24	140.0	310.0		
SL (mm)	214	24	115.0	270.0		
In % standard length						
MBD	17.3	18	14.0	18.1	16.7	1.0
CPD	5.8	18	4.6	6.8	6.0	0.6
HL	25.0	18	23.6	25.4	24.7	0.6
PDL	27.1	18	25.0	28.0	27.1	0.8
PAL	49.2	18	47.6	51.4	49.3	0.9
PPL	43.0	18	40.4	45.3	42.9	1.1
PPEL	20.1	18	17.8	21.6	19.2	1.2
DFL	71.6	17	72.2	77.7	74.6	1.3
DCL	0.9	6	-1.2	1.6	-0.6	0.6
OPDF	2.6	18	1.8	3.8	2.8	0.6
PESL	10.4	18	8.1	11.3	9.7	0.8
PEFL	13.0	18	9.8	14.6	13.0	1.0
PFL	8.9	18	8.0	14.5	9.4	1.4
AFL	56.0	18	50.0	55.4	52.1	1.5
In % head length						
HW	17.7	18	16.8	19.2	17.9	0.7
SNL	19.6	18	18.8	24.3	21.1	1.3
IOW	43.2	18	40.5	44.0	42.4	0.9
ED	7.9	18	7.4	10.4	8.4	0.8
OPL	7.1	17	5.8	14.3	10.4	2.8
OPW	33.6	17	28.5	35.6	32.2	1.7
FFL	16.3	18	12.5	21.1	17.2	1.8
FFW	8.6	18	5.1	10.5	8.3	1.2
PMW	24.7	18	22.4	27.5	24.6	1.4
VMW	21.5	18	20.0	24.5	22.5	1.4

shaped. It is always situated anterior to the occipital process. In all specimens examined, the occipital process is markedly rounded.

The toothplates are small; the premaxillary width is slightly larger than the vomerine width. Premaxillary and mandibular teeth are conical while vomerine teeth are subgranular. Occasionally a median posterior process is present on the vomerine toothplate.

The nasal barbel reaches the dorsal fin origin; the maxillary barbel reaches the origin of the pelvic fin; the inner mandibular barbel reaches the tip of the pectoral spine, while the outer mandibular barbel attains the tip of the pectoral fin.

The dorsal fin origin is situated close to the tip of the occipital process. The dorsal fin reaches the caudal fin, but both are clearly distinguished and no confluency is noted. The dorsal fin is very high. There are 70-72 (n=6) (72 in holotype) dorsal fin rays. The anal fin origin is notably closer to the tip of the snout than to the caudal fin base. As in the dorsal fin, the anal fin reaches the caudal fin base, but they are not confluent. There are 61-62 (n=6) (62 in holotype) anal fin rays. The pelvic fins reach the origin of the first anal fin rays. There are always six pelvic fin rays. The pectoral fins reach from the operculum to the level of the first dorsal fin rays. The pectoral spine shows numerous (26-46; 34 in holotype) small, but clearly marked serrae on its anterior border; the number of serrations varies with size; the posterior border of the spine is smooth (Fig. 5c). There are eigth soft pectoral fin rays. The caudal fin is rather long and has 18 principal rays (n=2). The parhypural and the five hypurals are long and slender.

Sixty one total vertebrae were counted in the holotype and one paratype; they include 15 abdominal and 46 caudal vertebrae.

The number of gill rakers on the complete first branchial arch varies between 16 and 23 (23 in holotype). The gill rakers are long and slender and somewhat crenated on the inner side.

The suprabranchial organ is well developed: both the second and the fourth gill arches show well diverticulated folds.

The lateral line is visible as a thin line running from the posterior end of the head to the middle of the caudal fin base. Its secondary openings display a regular pattern of vertical lines formed by small white spots above the lateral line.

Coloration

Live coloration varies from dark brown to black on dorsal and lateral sides of head and body. The fins are dark. The ventral surface of head and body is dark grey to dark brown. Contrary to *C. teladerma*, no black blotches are observed in the new species, not even in the smallest specimens examined. Irregular and discrete white spots (diameter ≤ 0.5 mm) are visible on lower side of flanks along the ventral border.

Habitat and ecology

The new species inhabits black water in forest swampy areas. Because *C. intermedius* and *C. teladerma* are always collected in the same fish-traps we suspect that they display a rather similar ecology, which, however, is hardly known at present.

Distribution

Clarias intermedius is only known from Central Kalimantan (Indonesia) in the area between the Sampit and the Barito Rivers.

Etymology

Intermedius: referring to the intermediate external morphology of the new species between *C. macrocephalus* and *C. meladerma*.

Note on the type material and the nomenclature of *Clarias meladerma*

Clarias meladerma was originally described on at least two specimens (no lengths given in the original description, but the variation in fin ray numbers indicate that more than one specimen were available), originating from "Batavia", the present Jakarta (Java, Indonesia). The original description, in Latin, is short but does include the combination of two characters which, in our opinion, are diagnostic for the species: the anterior side of the pectoral spine is provided with big serrae, while the posterior side is smooth and the occipital process is very obtuse (Bleeker, 1846).

Bleeker (1852a) described *Clarias melasoma* on two specimens (170 and 300 mm TL) originating from Sumatra and Borneo (Kalimantan). He stated that the species is closely related to *C. meladerma* but that it differs in a more elongated body, less fleshy vertical fins and a less higher dorsal fin. Bleeker (1852b and subsequent papers) erroneously cited *C. melasoma* as *C. melanosoma*. Bleeker (1857) synonymised *C. melasoma* with *C. meladerma* which he erroneously cited as *C. melanoderma.* Following the International Code of Zoological Nomenclature, both *C. melanosoma* and *C. melanoderma* should be considered as unjustified emendations.

According to Eschmeyer *et al*. (1998) two RMNH specimens are syntypes of *C. meladerma*: RMNH 13709 and RMNH 16413. The same authors listed in the same volume the following material as syntypes and/or Bleeker specimens for *C. melanoderma* (sic): BMNH 1880.4.21.201, MSNG (Museo Civico di Storia Naturale di Genova 'Giacomo Doria', Genova, Italy) 8215 and NMV (National Museum of Victoria, Melbourne, Australia) 46087. They further mentioned that *C. melanoderma* is "regarded as an unneeded replacement for or unjustified emendation of *Clarias melasoma* (sic) Bleeker. Synonym of *Clarias meladerma* Bleeker 1846". For *C. melasoma*, Eschmeyer *et al*. (1998) mentioned two syntypes (no other data given) and referred to *C. melanoderma* for details. Van Oijen (pers. comm.) mentioned that in 1858, ten specimens of *C. meladerma*, measuring between 170-340 mm TL, were listed in the Bleeker collection (the specimen of 170 mm being one of the syntypes of *C. melasoma*). Bleeker (1862) in his Atlas, also listed ten specimens. Following the register of the RMNH, these specimens were divided in five series (A to E). The A-series, including the types contained six specimens and was bought by the RMNH. One of these was sent on loan or in exchange to the MSNG. Therefore five specimens should be in the RMNH collection.

During this study we examined the available RMNH and BMNH material. The RMNH material contains four specimens: RMNH 13709 is labelled "type? (lectotype?)" of *C. meladerma*; it is undoubtedly one of the type specimens used by Bleeker for his description of *C. meladerma*: as RMNH bought the types and based on the resemblance in dorsal and anal fin ray numbers, we consider this specimen as the lectotype of *C. meladerma.*

RMNH 16413 is labelled "type (paratype)" of *C. melanosoma*/*C. melasoma*/*C. melanoderma*; the locality on the label (Palembang, Rivier Moesi, Sumatra) is one of the two type localities listed by Bleeker (1852) in his description of *C. melasoma*; moreover the specimen fits entirely with the original description. We conclude that it is one of the two syntypes of *C. melasoma.*

RMNH 6802 is labelled "Lectotype" of *C. melasoma* and RMNH 17113 is labelled *C. melasoma*. These two specimens however are not conspecific with *C. melasoma* (= *C. meladerma*) and differ in several characters from the original description. Van Oijen

(pers. comm.) informed us that the person who labelled these specimens as types could not be identified. We could not find the second syntype of *C. melasoma*.

In the BMNH, two Bleeker specimens of *C. meladerma* are found: BMNH 1862.2.4.8 (purchased through Mr. Frank) and BMNH 1880.4.21.201 (Bleeker mentioned as collector). Based on the resemblance in dorsal and anal fin ray numbers, we consider these specimens as paralectotypes of *C. meladerma*.

Comparison between the only available syntype of *C. melasoma* and the lectotype and the two available paralectotypes of *C. meladerma* confirmed the synonymy of the two species.

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REFERENCES

BLEEKER P., 1846. Overzicht der Siluroiden welke te Batavia voorkomen. *Nat. Geneeskd. Arch. Ned. Indian*., 3: 135-184.

BLEEKER P., 1852a. Zesde bijdrage tot de kennis der ichthyologische fauna van Borneo. Visschen van Pamangkat, Bandjermassing, Praboekarta en Sampit. *Nat. Tijdschr. Ned. Indian*., 3: 407-442.

BLEEKER P., 1852b. Nieuwe bijdrage tot de kennis der ichthyologische fauna van het eiland Banka. *Nat. Tijdschr. Ned. Indian*., 3: 715-738.

BLEEKER P., 1857. Index descriptionum specierum piscium Bleekerianarum in voluminibus I ad XIV diarii societas scientiarum Indo-Batavae. *Nat. Tijdschr. Ned. Indian*., 14: 447-486.

BLEEKER P., 1862. Atlas ichthyologique des Indes Orientales Néerlandaises, publié sous les auspices du Gouvernement colonial néerlandais. II. Siluroïdes, Chacoïdes et Heterobranchoïdes. 53 pls.

BOOKSTEIN F.L., CHERNOFF B., ELDER R., HUMPHRIES J., SMITH G. & R. STRAUSS, 1985. Morphometrics in evolutionary Biology. The Geometry of Size and Shape Change, with Examples from Fishes. Spec. Publ., 15: 277 p. Philadelphia: Academy of Natural Sciences.

ESCHMEYER W.N., FERRARIS C.J. Jr., MYSI DANG HOANG & D.J. LONG, 1998. Part I. Species of Fishes. *In:* Catalog of Fishes, Vol. 2: Species of Fishes (M-Z) (Eschmeyer W.N., ed.), pp. 959-1820. San Francisco: California Academy of Science.

GUYOMARD R. & F. KRIEG, 1983. Electrophoretic variation in six populations of brown trout (*Salmo trutta* L.). *Can. J. Genet. Cytol.*, 25: 403-413.

KRIEG F. & R. GUYOMARD, 1985. Population genetics of French brown trout (*Salmo trutta* L.): Large geographical differentiation of wild populations and high similarity of domesticated stocks. *Génet. Sél. Evol.*, 17: 225-242.

LIM K.K.P. & H.H. NG, 1999. *Clarias batu*, a new species of catfish (Teleostei: Clariidae) from Pulau Tioman, Peninsular Malaysia. *Raffl. Bull. Zool.*, Suppl. 6: 157-167.

NG H.H., 1999. Two new species of catfishes of the genus *Clarias* from Borneo (Teleostei: Clariidae). *Raffl. Bull. Zool.*, 47: 17-32.

POUYAUD L. & J.F. AGNESE, 1995. Phylogenetic relationships between 21 species of three tilapiine genera *Tilapia*, *Sarotherodon* and *Oreochromis* using allozyme data. *J. Fish Biol.*, 47: 26-38.

SHAKLEE J.B., ALLENDORF F.W., MORIZOT D.C. & G.S. WHITT, 1990. Gene nomenclature for protein-coding loci in fish. *Trans. Am. Fish. Soc.*, 119: 2-15.

TEUGELS G.G., 1986. A systematic revision of the African species of the genus *Clarias* (Pisces; Clariidae). *Ann. Mus. R. Afr. Cent.*, 247: 1-199.

TEUGELS G.G., 1996. Taxonomy, phylogeny and biogeography of catfishes (Ostariophysi; Siluroidei): An overview. *Aquat. Living Resour.*, 9: 9-34.

TEUGELS G.G., DIEGO R.C., POUYAUD L. & M. LEGENDRE, 1999a. Redescription of *Clarias macrocephalus* (Siluriformes, Clariidae) from South-East Asia. *Cybium*, 23: 285-295.

TEUGELS G.G., GUSTIANO R., DIEGO R., LEGENDRE M. & SUDARTO, 1999b. Preliminary results on the morphological characterisation of natural populations and cultured strains of *Clarias* species (Siluriformes, Clariidae) from Indonesia. *In:* The biological Diversity and Aquaculture of Clariid and Pangasiid Catfishes in South-East Asia. Proc. of the mid-term Workshop of the "Catfish-Asia project" (Legendre M. & A. Pariselle, eds), pp. 31-36. IRD (Paris).

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