



A revision of the akysid catfish genus *Acrochordonichthys* Bleeker

H. H. NG*†‡ AND P. K. L. NG†

*Fish Division, Museum of Zoology, University of Michigan, 1109 Geddes Avenue, Ann Arbor, Michigan 48109-1079, U.S.A. and †Department of Biological Sciences, National University of Singapore, 10 Kent Ridge Crescent, Singapore 119260

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The taxonomy of the South-east Asian catfish genus *Acrochordonichthys* (Akysidae) is revised. The shapes of the snout, humeral process and adipose fins are diagnostic species characters. Only four out of 11 species and one sub-species described prior to this study are considered valid, namely *A. rugosus* (Bleeker, 1847), *A. ischnosoma* Bleeker, 1858, *A. chamaeleon* (Vaillant, 1902), and *A. pachyderma* Vaillant, 1902. An additional five new species (*A. guttatus*, *A. septentrionalis*, *A. mahakamensis*, *A. strigosus* and *A. falcifer*) are described.

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Key words: Akysidae; *Acrochordonichthys*; South-east Asia; taxonomy.

INTRODUCTION

The South-east Asian catfish family Akysidae includes nearly 40 nominal species in four genera (*Acrochordonichthys*, *Akysis*, *Breitensteinia*, *Parakysis*), most of which are generally found in deeper parts of relatively swift rivers and forest streams. The genus *Acrochordonichthys* Bleeker, 1858, is characterized by a highly rugose skin with tubercles arranged in longitudinal rows along the side of the body, presence of a long, low adipose fin, and truncate caudal fin. Eleven nominal species and one nominal subspecies of *Acrochordonichthys* are known (Roberts, 1989).

During the past few years, the authors and their colleagues have been revising gradually the taxonomy of the family Akysidae (Ng & Lim, 1995; Ng & Kottelat, 1998; Ng & Siebert, 1998) and as part of this project, a revision of the genus *Acrochordonichthys* is presented here.

MATERIALS AND METHODS

The species concept used is the phylogenetic species concept, which considers a species to be a single lineage of an ancestor–descendant population that maintains its identity from other such lineages and has its own evolutionary tendencies and historical fate (Wiley, 1981). Because of the paucity of the material available, a detailed phylogenetic study is not possible and relationships have been inferred based on the fact that the species are recognizably different

‡Author to whom correspondence should be addressed. Tel.: +1 734 647 2192; fax: +1 734 763 4080; email: heokheen@umich.edu

and can be diagnosed by a unique set of characters exhibited by all members of the species. In this respect, this is closer to the pragmatic species concept of Kottelat (1995), but as pointed out by Cracraft (1989), the results can be very close.

Measurements were made with dial callipers and recorded to 0.1 mm. Counts and measurements were made on the left side of a specimen whenever possible and follow Ng & Kottelat (1998) throughout with the following additions: head depth is measured at the base of the occipital process, occipital process length is measured from the base to the tip, and occipital process width is measured at the base of the occipital process. All measurements of body parts are given as proportions of standard length (L_S) and head length (L_H).

Fin-ray counts were obtained under transmitted light using a binocular dissecting microscope; the terminology of Hubbs & Lagler (1947) is used. Gill raker counts were reported using the method and terminology of Roberts (1992). Vertebral counts were taken from radiographs using the method and terminology of Roberts (1994). Numbers in parentheses following particular fin-ray, vertebral, branchiostegal-ray or gill-raker count are the numbers of specimens examined.

Drawings were made with a Nikon SMZ-10 microscopic camera lucida. Institutional codes for the repositories of specimens follow Eschmeyer (1998), with the following additions: collection of the Fisheries Department of Sarawak, Kuching (FDS) and Sabah Museum, Kota Kinabalu (SSM).

RESULTS

ACROCHORDONICHTHYS BLEEKER, 1858

Acrochordonichthys Bleeker, 1858 (type species *Acrochordonichthys platycephalus* Bleeker, 1858, by subsequent designation in Bleeker, 1862: 13). Gender: masculine.

Sosia Vaillant, 1902 (type species *Sosia chamaeleon* Vaillant, 1902, by monotypy). Gender: feminine.

Differential diagnosis

A genus of akysid catfishes characterized by highly rugose skin with tubercles arranged in longitudinal rows along the side of the body, a long, low adipose fin (absent in *Breitensteinia*), and weakly emarginate caudal fin and in possessing the following series of synapomorphies (de Pinna, 1996), which are shared with *Breitensteinia*: proximal end of anterior ceratohyal with narrow anterior extension directed anterolaterally, mesethmoid cornua with dorsal sub-division and paired fontanels between supraoccipital, frontals and sphenotics.

Remarks

Identification of *Acrochordonichthys* species has been difficult because of morphological similarity. Roberts (1989) believed that failure to recognize variation in colouration, sexual dimorphism, development of epidermal structures and the occipital process was the primary cause of the present taxonomic confusion. Many samples of *Acrochordonichthys* have been represented by a single specimen, exacerbating the problem (Roberts, 1989).

Based on external morphology, two groups of species can be distinguished easily, both of which may be artificial. However, the recognition of groups will aid in the discussion of the complicated taxonomy of the various species. The first group consists of species with a more slender caudal peduncle (depth of caudal peduncle 4.7–5.3% L_S), narrower head (head width 18.3–21.9% L_S), and 39–41 vertebrae. *Acrochordonichthys ischnosoma* is the only species described in this group: the present paper describes four more species, namely *A. guttatus*, *A. mahakamensis*, *A. septentrionalis* and *A. strigosus*. The second group consists of species with a deeper caudal peduncle (depth of caudal peduncle 5.5–8.8% L_S), broader head (head width 22.0–29.6% L_S), and 35–37 vertebrae. The other 10 nominal species and one nominal sub-species described previously, namely *A. buettikoferi*, *Sosia chamaeleon*, *S. chamaeleon* var. *pallida*, *A. melanogaster*, *A. obscurus*, *A. pachyderma*, *A. platycephalus*, *A. pleurostigma*, *A. rugosus*, *A. varius*, and *A. zonatus*, belong to this group. One more species, *A. falcifer*, is described in this paper. For the purposes of convenient discussion, the species will be compared with congeners in their respective species groups only.

Sexual dimorphism has been reported in *Akysis* by Ng & Kottelat (1996, 1998), *Breitensteinia* by Ng & Siebert (1998), and *Acrochordonichthys* by Ng & Rachmatika (1999). Males have the anus situated immediately in front of a genital papilla, which is located posterior to the pelvic fin base. The genital opening is situated at the tip of the papilla, covered by a fleshy flap. In females, the anus is situated more posteriorly and the genital opening is located at the tip of a short genital appendage. Male specimens of *A. chamaeleon* and *A. strigosus* dissected possessed testes with elongate digitiform lateral processes similar to those reported in *Breitensteinia* by Roberts (1989), while a single female *A. chamaeleon* dissected had numerous ripe ova of *c.* 0.8 mm in diameter.

The biology of *Acrochordonichthys* is unusual and would make a fascinating subject for study. The axillary pore (or *porus pectoralis*) lying just below the humeral process in *Acrochordonichthys* is unusually large, and produces a milky-white mucus-like secretion when the fish is severely disturbed (pers. obs.). The exact function of this secretion is unknown, but it has ichthyocidal properties: a large specimen of *c.* 90 mm L_S was placed in a tank with a few other fishes, and upon production of the mucus, all the other fishes in the tank died within the space of a few minutes (pers. obs.). This secretion may therefore be defensive in nature.

A total of 55 specimens of *A. rugosus* from five different drainages in the Malay Peninsula, namely the Bernam, Pahang, Perak, Terengganu and Mae Nam Sungai Kolok rivers were examined for intraspecific variation in colouration, morphology, and the development of epidermal structures, the results of which are presented below.

Head width: The shape of the head, which is partly due to its width, has been used to differentiate various akysid species, e.g. by Kottelat *et al.* (1993) for *Acrochordonichthys*, Ng (1996) and Ng & Kottelat (1996) for *Akysis*, and by Ng & Lim (1995) for *Parakysis*. The head width of *Acrochordonichthys* is positively allometric with size (and presumably age) ($r=0.675$, $P<0.001$, $n=52$). The differences in head shape between juveniles and adults are substantial enough to have suggested they are separate species, especially if specimens of intermediate sizes are not available for study (Fig. 1). This difference in head width is not

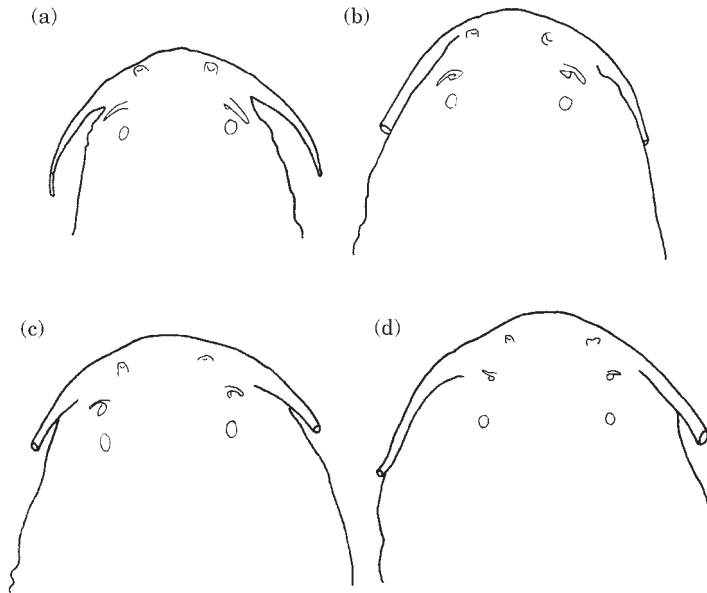


FIG. 1. Dorsal view of heads of *Acrochordonichthys rugosus*, showing ontogenetic change in head shape: (a) ZRC 38443, 44.5 mm L_S ; (b) ZRC 5182, 63.5 mm L_S ; (c) ZRC 5187, 84.5 mm L_S ; (d) ZRC 24517, 111.0 mm L_S .

sex-related: both sexes show the same trend as they increase in size. Even though there may be considerable changes in head width during growth, the shape of the snout does not change significantly and is useful as a diagnostic character.

Body depth: The depth of the body at the anus for *Acrochordonichthys* increases with age ($r=0.673$, $P<0.001$, $n=52$) and is not sex-related.

Colouration (Fig. 2): The colouration is extremely variable, even among specimens from the same locality. Most have a light-brown saddle extending for the length of the adipose fin and some have spots on the side of the body in place of the saddle. Eleven out of 55 had a reversed colour pattern, with the body a predominantly light brown with a few dark brown patches *v.* dark brown body with light-brown patches. This variation could be due to skin moulting (see below). In the closely related *Breitensteinia*, skin moulting is accompanied by a temporary loss in pigmentation: the underlying skin is devoid of pigmentation and the fish is a very pale pink (*pers. obs.*). This condition is likely to exist in *Acrochordonichthys* as well.

Even though the colouration is highly variable, some general patterns are evident: no individual *A. rugosus* had distinctive small blotches of various shades of brown (as seen in *A. falcifer*). Therefore, colour is a useful diagnostic character when variation is taken into account.

Occipital process: The length of the occipital process relative to its width has been used as a diagnostic character separating the species by various authors (Bleeker, 1858; Weber & de Beaufort, 1913, Hora & Gupta, 1941). The present study showed that this ratio cannot be used as a diagnostic character, because of much intraspecific variation. Among 55 *A. rugosus*, the ratio ranged from 2.27 to 4.25, with no apparent ontogenetic pattern.

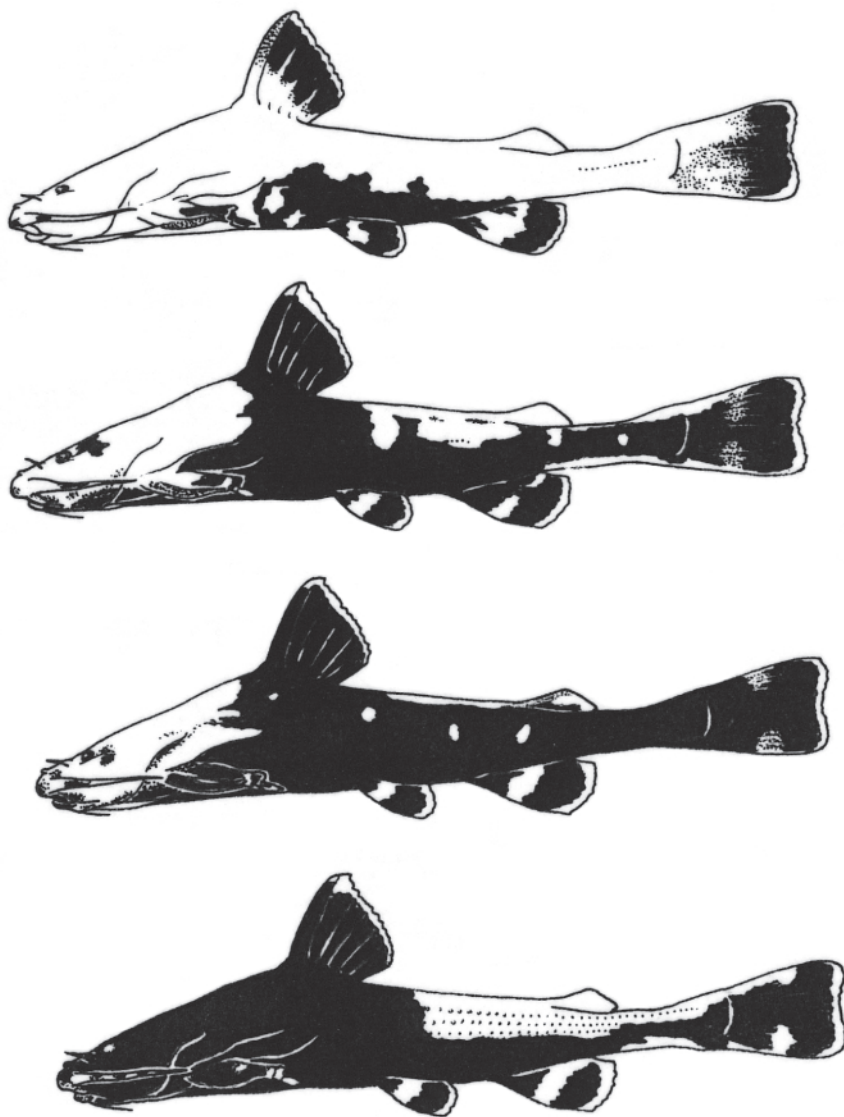


FIG. 2. Schematic illustration showing variation in the colour of *Acrochordonichthys rugosus*.

Fontanels: **Bleeker (1858)** used the shape, number and disposition of fontanels to distinguish species of *Acrochordonichthys*, based on the extent of the median cranial fontanel, the presence or absence of the fonticuli laterales and whether they were positioned in the middle or the posterior part of the neurocranium. Presumably, the fonticuli laterales in the middle referred to the paired fontanels among the supraoccipital, frontals and sphenotics and those at the posterior to the supratemporal fossae. This scheme was largely adhered to by **Weber & de Beaufort (1913)**, although they considered all of **Vaillant's (1902)** and **Popta's (1904)** species to be conspecific with *A. melanogaster* '... though their median fontanel is far distant from the base of the occipital process, at the base of which

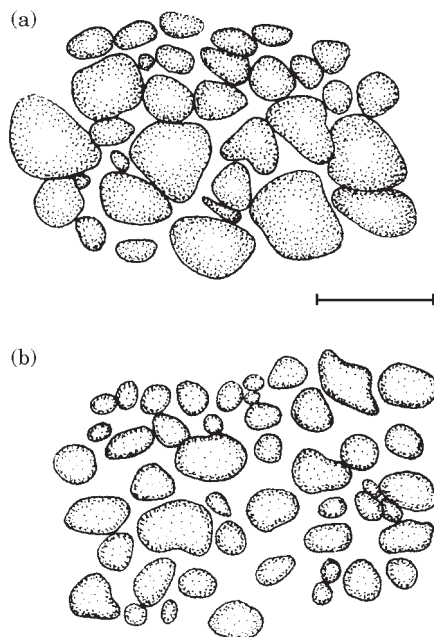


FIG. 3. Close-up view of tubercles of *Acrochordonichthys rugosus* seen dorsally: (a) better developed (more rounded and tightly packed; ZRC 5167, 46.2 mm L_S); (b) less developed (more squamous and situated further apart; ZRC 24514, 56.1 mm L_S). Scale bar 1 mm.

lies a separate small hollow. It may be that Bleeker has overlooked the fact that these fontanels are separated' (Weber & de Beaufort, 1913: 370).

Examination of many specimens showed that both the median and the paired fontanels are present consistently in the same positions in all *Acrochordonichthys* species, as are the supratemporal fossae. The size of the fontanels and supratemporal fossae increase with age, with most of the smaller specimens having poorly-developed fontanels. Thus the presence of fontanels and supratemporal fossae is useful in distinguishing *Acrochordonichthys* from other akysid genera (de Pinna, 1996), but cannot be used to separate the different *Acrochordonichthys* species.

Epidermal structures: Skin moulting within the Akysidae was hypothesized first by Roberts (1989) for *Acrochordonichthys* and reported by Ferraris (1991) for *Breitensteinia*. Examination of preserved and live specimens confirms Roberts' (1989) hypothesis that the tubercles on *Acrochordonichthys* may become either greatly hypertrophied or greatly reduced at different stages of the moulting cycle. When they are most developed, the tubercles appear more rounded and tightly packed [Fig. 3(a)], but are more squamous (flattened) and further apart [Fig. 3(b)] when least developed. The shape and distribution of tubercles have been used as diagnostic characters in differentiating the species (Vaillant, 1902), but due to their variation within individuals, this character cannot be used reliably.

Given the allometric changes in head width and body depth at anus, these characters can still be used diagnostically when comparing specimens of similar

sizes. Other characters useful for distinguishing were the shapes of the adipose fins and the humeral processes.

KEY TO THE SPECIES OF *ACROCHORDONICHTHYS*

- 1a Caudal peduncle slender (depth of caudal peduncle 4.7–5.3% L_S); head narrow (head width 18.3–21.9% L_S); vertebrae 39–412
 1b Caudal peduncle deep (depth of caudal peduncle 5.5–8.8% L_S); head broad (head width 22.0–29.6% L_S); vertebrae 35–376
 2a Dorsal to adipose distance 4.4–5.7% L_S ; branchiostegal rays 4; body with few small dark brown spots *A. septentrionalis*
 2b Dorsal to adipose distance 6.2–9.8% L_S ; branchiostegal rays 5–6; body with numerous small dark brown spots3
 3a Body depth at anus 10.9–12.8% L_S ; humeral process relatively slender (maximum width of humeral process 10.0–11.8% its length). *A. guttatus*
 3b Body depth at anus 9.4–10.0% L_S ; humeral process relatively thick (maximum width of humeral process 13.2–18.4% its length)4
 4a Anterior margin of anal fin rounded *A. mahakamensis*
 4b Anterior margin of anal fin angular5
 5a Body depth at anus 9.7% L_S ; depth of caudal peduncle 4.5% L_S ; posterior margin of adipose fin rounded; genital papilla of male short and thick *A. strigosus*
 5b Body depth at anus 10.0% L_S ; depth of caudal peduncle 5.5% L_S ; posterior margin of adipose fin angular; genital papilla of male long and slender *A. ischnosoma*
 6a Posterior edge of pectoral spine without serrations7
 6b Posterior edge of pectoral spine with serrations8
 7a Posterior margin of adipose fin rounded; length of dorsal-fin base 10.8–13% L_S ; colour pattern generally consisting of small blotches of various shades of brown *A. falcifer*
 7b Posterior margin of adipose fin angular; length of dorsal-fin base 7.9–10.5% L_S ; colour pattern uniformly cream *A. pachyderma*
 8a Nasal barbels short (1.0–6.0% L_H); head with gently-sloping lateral margins and a broadly rounded snout when viewed dorsally . . . *A. chamaeleon*
 8b Nasal barbels long (6.5–23.9% L_H); head narrow with steeply-sloping lateral margins and a convex snout when viewed dorsally . . . *A. rugosus*

ACROCHORDONICHTHYS ISCHNOSOMA BLEEKER, 1858 (FIG. 4)

Acrochordonichthys ischnosoma Bleeker, 1858: 232 (type locality: Tjitarum [=Citarum] River, Java); Bleeker, 1859: 136; Bleeker, 1862: 70, pl. 84, fig. 4; Günther, 1864: 96; Weber & de Beaufort, 1913: 367; Kottelat *et al.*, 1993: 74 (in part).

Material examined

BMNH 1863.12.11.151, 1 ex., holotype, 97.4 mm L_S ; Java: Parongkalong, provinciae Preanger, in flumine Tjitarum.



FIG. 4. *Acrochordonichthys ischnosoma*, BMNH 1863.12.11.151, holotype, 97.4 mm L_S ; Java: Citarum River drainage.

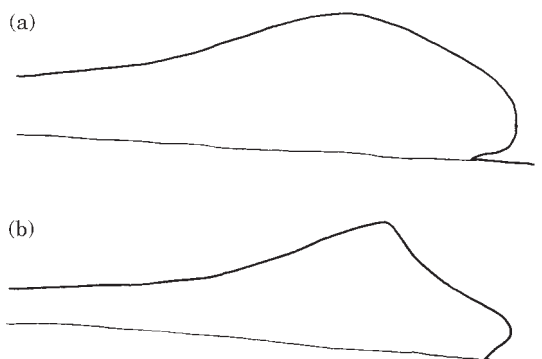


FIG. 5. Schematic illustration of posterior parts of adipose fins showing: (a) rounded posterior margin of *Acrochordonichthys strigosus* and *A. falcifer* (*A. falcifer*, ZRC 43323, paratype, 78.7 mm L_S illustrated); (b) angular posterior margin of other *Acrochordonichthys* species (*A. rugosus*, ZRC 39290, 93.6 mm L_S illustrated).

Differential diagnosis

Acrochordonichthys ischnosoma can be differentiated from congeners of the *A. ischnosoma* species group by a greater dorsal to adipose distance (9.8% L_S v. 4.4–8.7) and a longer snout (snout length 39.0% L_H v. 28.8–38.4). It can be further differentiated from *A. guttatus* in having a more slender body (body depth at anus 10.0% L_S v. 10.9–12.8) and a thicker humeral process (maximum width of humeral process 18.4% its length v. 10.0–11.8); from *A. mahakamensis* by an angular (v. rounded) anterior margin of the adipose fin (Fig. 5); from *A. septentrionalis* by a narrower head (18.3% L_S v. 19.6–21.9; Fig. 6); and from *A. strigosus* by an angular (v. rounded) posterior margin of the adipose fin (Fig. 7) and a long, slender (v. short, thick) male genital papilla (Fig. 8).

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal

to origin of anal, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband partially exposed when mouth closed. In % L_S : head length 21.9, head width 18.3, head depth 10.7, predorsal distance 35.4, preanal length 69.5, prepelvic length 51.0, prepectoral length 24.5, body depth at anus 10.0, length of caudal peduncle 19.6, depth of caudal peduncle 5.5, pectoral-spine length 18.4, pectoral-fin length 18.8, length of dorsal-fin base 8.5, pelvic-fin length 11.6, length of anal-fin base 11.1, caudal-fin length 16.7, length of adipose-fin base 31.2, dorsal to adipose distance 9.8; in % L_H : snout length 39.0, interorbital distance 34.7, eye diameter 4.2, length of nasal barbel 8.9, length of maxillary barbel 62.0, length of inner mandibular barbel 23.9, length of outer mandibular barbel 44.6. Branchiostegal rays 5 (1). Gill rakers 0+4 (1). Vertebrae 20+19=39 (1).

Fin ray counts: dorsal I,4,i (1); pectoral I,6,i (1); pelvic i,5 (1); anal iii,5,ii (1); caudal 7/6 (1). Dorsal fin origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 7 (1) large serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body brown, with dark brown spots scattered randomly on dorsal surface of head. Belly, chest and ventral surface of head cream, without spots. Dorsal, pectoral, pelvic and anal fins cream with two dark brown bands, one at base of fins and another near edge. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream, with dark brown spots on dorsal surfaces.

Distribution

Known only from the Citarum River drainage in western Java (Fig. 9).

Remarks

Acrochordonichthys ischnosoma is known only from the holotype (BMNH 1863.12.11:151), which is not well preserved and is somewhat dehydrated. This calls in question the diagnostic value of the morphometric characters used here. However, *Acrochordonichthys* and *Breitensteinia* have little flesh, especially on the dorsal surfaces, and so do not suffer much shrinkage from dehydration. Therefore the morphometric data obtained from old museum specimens are reasonably accurate, a supposition supported by present measurements of Bleeker specimens of other *Acrochordonichthys* species, which are in a similar state of preservation as the holotype of *A. ischnosoma* (see material examined for *A. rugosus*) and show no significant morphometric differences. Similarly, old museum specimens of *Breitensteinia* (that were not very well preserved) did not differ morphometrically from fresh ones of the same species (Ng & Siebert, 1998).

ACROCHORDONICHTHYS GUTTATUS SP. NOV. (FIG. 10)

Acrochordonichthys ischnosoma (non Bleeker)—de Pinna, 1996: 7.

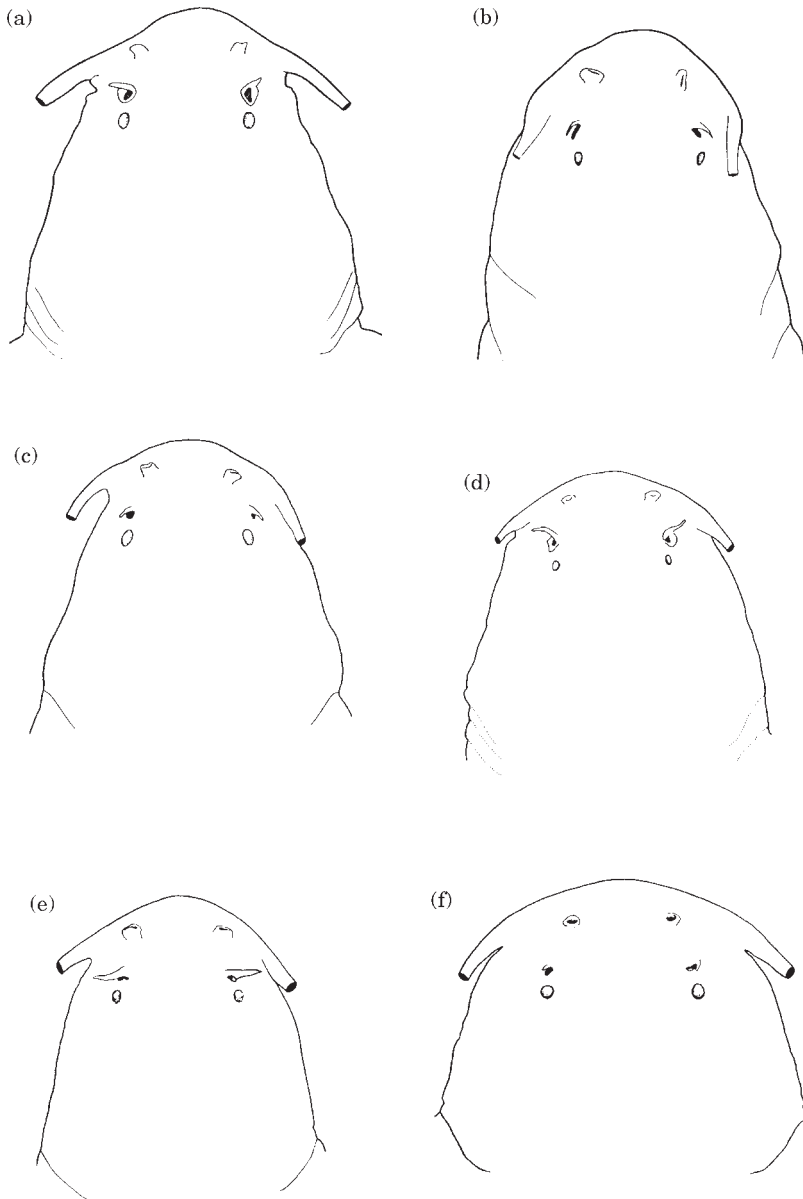


FIG. 6. (a-f).

Holotype

MZB 9301, 1 ex., 76.3 mm L_S ; Borneo: Kalimantan Tengah, Barito River drainage, Sungai Barito at Muara Laung; D. Siebert, A. Tjakradiwdjaja & O. Crimmen, 20–22 February 1991.

Paratypes

BMNH 1997.7.17.2, 1 ex., 75.6 mm L_S ; MZB 7024, 1 ex., 78.0 mm L_S ; Borneo: Kalimantan Tengah, Barito River drainage, Sungai Laung at Desa Maruwei;

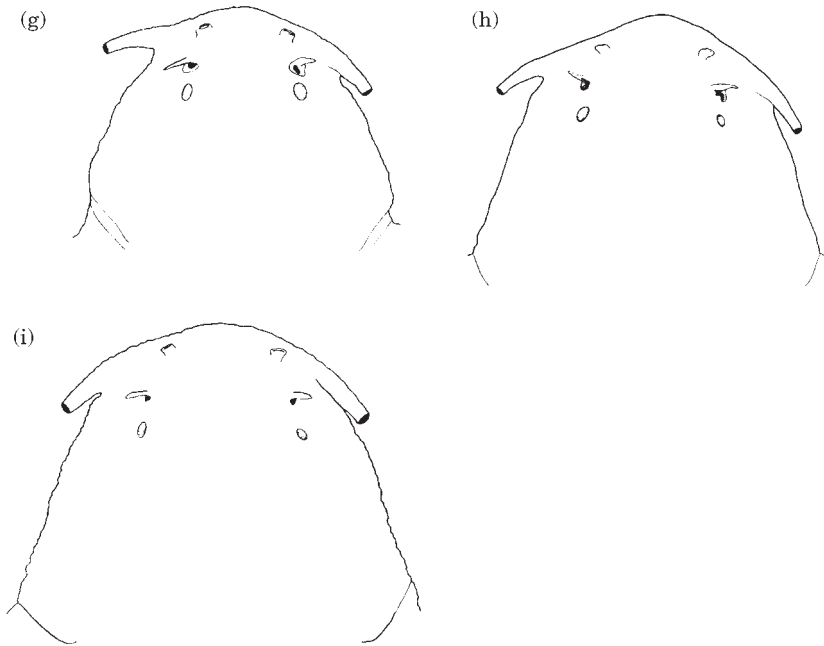


FIG. 6. (g-i).

FIG. 6 Dorsal view of heads of: (a) *Acrochordonichthys guttatus*, BMNH 1997.7.17.8, paratype, 97.7 mm L_S ; (b) *A. ischnosoma*, BMNH 1863.12.11.151, holotype, 97.4 mm L_S ; (c) *A. mahakamensis*, MZB 5952, holotype, 83.2 mm L_S ; (d) *A. septentrionalis*, NIFI 3128, holotype, 101.3 mm L_S ; (e) *A. strigosus*, MZB 9333, holotype, 83.5 mm L_S ; (f) *A. chamaeleon*, MZB 7553, 64.2 mm L_S ; (g) *A. falcifer*, ZRC 43323, paratype, 78.8 mm L_S ; (h) *A. pachyderma*, ZMA 119.419, 94.1 mm L_S ; (i) *A. rugosus*, ZRC 39290, 93.6 mm L_S .

D. Siebert, A. Tjakradiwdjaja & O. Crimmen, 15–18 July 1992. BMNH 1997.7.17.8, 1 ex., 97.7 mm L_S ; Borneo: Kalimantan Tengah, Barito River drainage, Sungai Teweh above Desa Lampeong II; A. Tjakradiwdjaja & A. Mun'im, 2 October 1995. BMNH 1997.7.17.9–13, 6 ex., 63.5–83.9 mm L_S ; MZB 8187, 1 ex., 80.8 mm L_S ; MZUSP 42468, 2 ex., 70.5–75.3 mm L_S ; ZRC 41966, 2 ex., 74.1–77.7 mm L_S ; data as for holotype. CMK 11847, 1 ex., 67.0 mm L_S ; Borneo: Kalimantan Tengah, middle Barito drainage, Barito River between Muara Jan and Muara Untu; M. Kottelat, 22 June 1995.

Differential diagnosis

Acrochordonichthys guttatus can be differentiated easily from congeners of the *A. ischnosoma* species group by a slender (v. moderately thick) humeral process (maximum width 10.0–11.8% its length v. 13.2–18.4). It can be differentiated further from *A. ischnosoma* by a smaller dorsal to adipose distance (7.7–8.7% L_S v. 9.8), a longer and deeper head (head length 23.2–26.9% L_S v. 21.9; head depth 12.7–14.3% L_S v. 10.7) and a shorter snout (snout length 31.4–38.4% L_H v. 39.0); from *A. mahakamensis* by an angular (v. rounded) anterior margin of the anal fin (Fig. 7); from *A. septentrionalis* by a larger dorsal to adipose distance (7.7–8.7% L_S v. 4.4–5.7), more branchiostegal rays (6 v. 4) and a variegated colour pattern

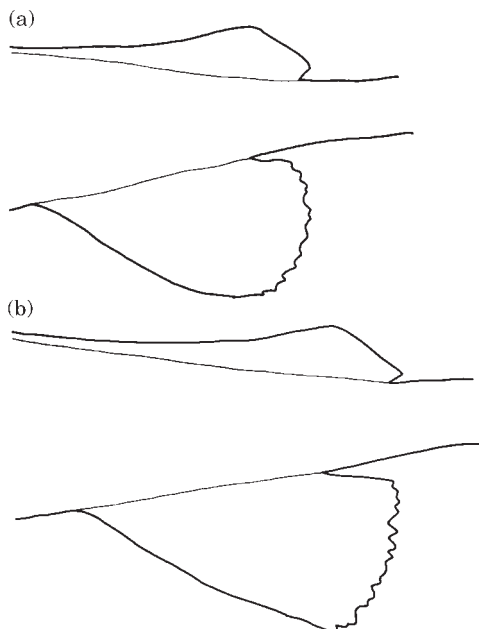


FIG. 7. Schematic illustration of anal fins showing: (a) rounded anterior margin of *Acrochordonichthys mahakamensis* (MZB 5952, holotype, 83.2 mm L_S); (b) angular anterior margin of other *Acrochordonichthys* species (*A. guttatus*, BMNH 1997.7.17.8, paratype, 97.7 mm L_S illustrated).

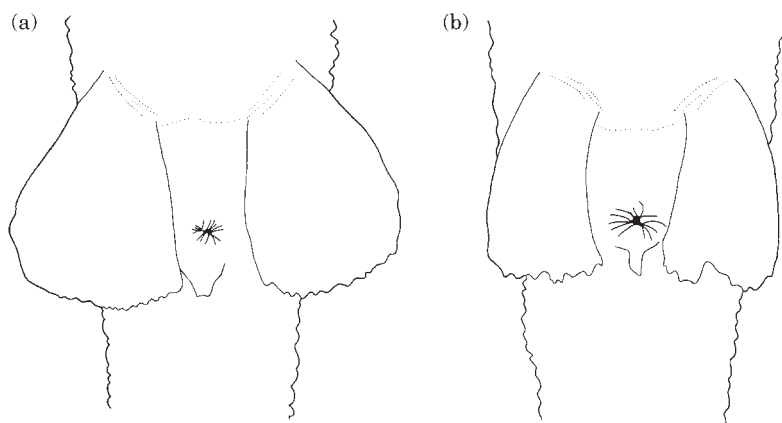


FIG. 8. Schematic illustration of male genital papilla in: (a) *Acrochordonichthys strigosus* (MZB 9333, holotype, 83.5 mm L_S); (b) other members of the *A. ischnosoma* species group (*A. guttatus*, BMNH 1997.7.17.8, paratype, 97.7 mm L_S illustrated).

with numerous brown patches (v. almost uniformly cream colour pattern with few very small brown spots); and from *A. strigosus* by an angular (v. rounded) posterior margin of the adipose fin (Fig. 5), a long, slender (v. short, thick) male genital papilla (Fig. 8), and a relatively deeper body (body depth at anus 10.9–12.8% L_S v. 9.7; depth of caudal peduncle 4.7–5.3% L_S v. 4.5).

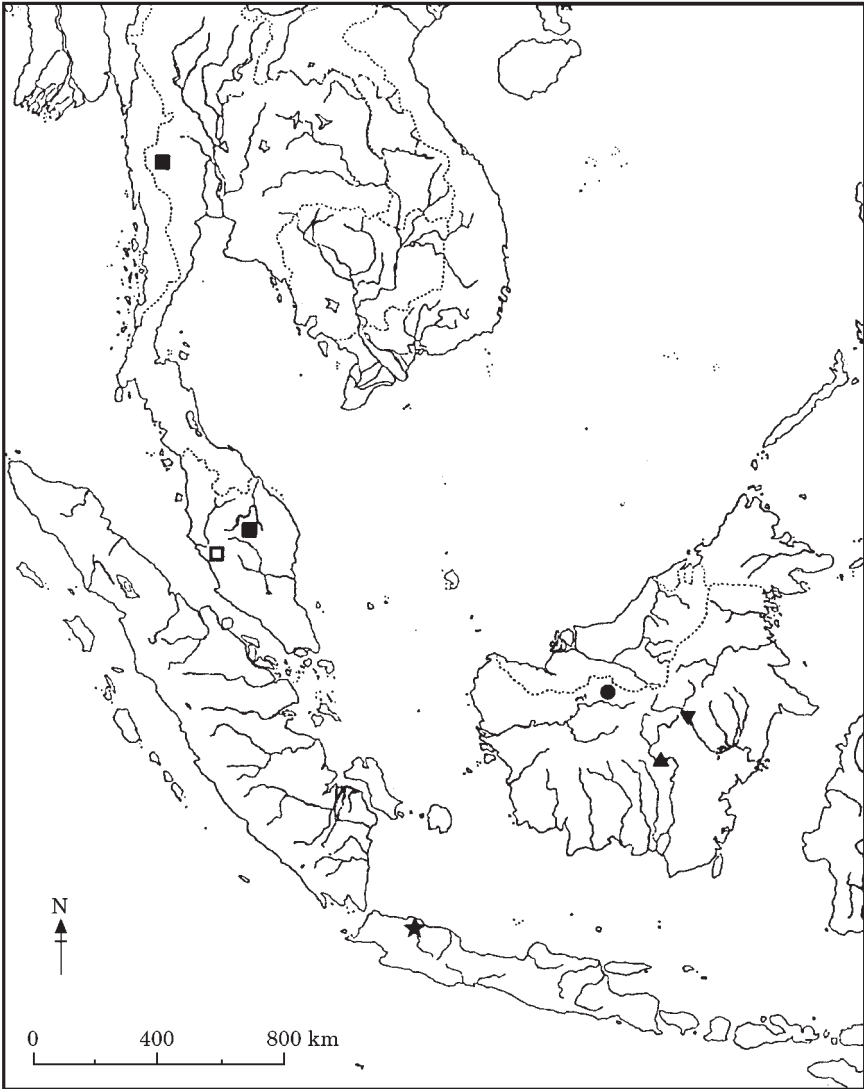


FIG. 9. Map showing distribution of members of *Acrochordonichthys ischnosoma* species group: *A. ischnosoma* (★); *A. guttatus* (▲); *A. mahakamensis* (▼); *A. septentrionalis* (■); *A. strigosus* (●). Solid symbols represent records based on specimens; open symbols represent records based on literature.

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary



FIG. 10. *Acrochordonichthys guttatus*, BMNH 1997.7.17.8, paratype, 97.7 mm L_S ; Borneo: Barito River drainage.

toothband not exposed when mouth closed. In % L_S : head length 23.2–26.9, head width 19.3–21.2, head depth 12.7–14.3, predorsal distance 35.7–38.4, preanal length 66.3–71.4, prepelvic length 51.0–55.9, prepectoral length 22.5–27.9, body depth at anus 10.9–12.8, length of caudal peduncle 19.7–23.1, depth of caudal peduncle 4.7–5.3, pectoral-spine length 17.5–20.9, pectoral-fin length 21.2–24.3, length of dorsal-fin base 8.5–10.4, pelvic-fin length 11.5–13.4, length of anal-fin base 9.2–13.8, caudal-fin length 15.5–19.4, length of adipose-fin base 28.2–32.6, dorsal to adipose distance 7.7–8.7; in % L_H : snout length 31.4–38.4, interorbital distance 30.7–37.7, eye diameter 3.5–5.3, length of nasal barbel 6.2–9.7, length of maxillary barbel 49.2–70.7, length of inner mandibular barbel 14.8–28.9, length of outer mandibular barbel 33.9–54.7. Branchiostegal rays 6 (3). Gill rakers 0+4 (2) or 0+6 (1). Vertebrae 20+20=40 (2), 21+19=40 (7) or 21+20=41 (1).

Fin ray counts: dorsal I,4,i (10); pectoral I,6,i (10); pelvic i,5 (10); anal ii,5,i (1), ii,6,i (6), iii,6,i (1), ii,7,i (1) or iii,7,i (1); caudal 7/6 (10). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 6 (5)–7 (1) large serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body cream to dark yellow, with dark brown spots scattered randomly on dorsal surface of head. Dorsolateral and lateral surfaces of body dark brown, with about five cream or dark yellow spots on dorsolateral surface, sometimes forming a reticulate pattern. Belly, chest and ventral surface of head cream or dark yellow, without spots. Dorsal, pectoral, pelvic and anal fins cream with one or two dark brown bands, one occasionally present at base of fins and another near edge. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream or dark yellow, with dark brown spots sometimes present on dorsal surfaces.

Distribution

Known only from the Barito River drainage in southern Borneo (Fig. 9).



FIG. 11. *Acrochordonichthys mahakamensis*, MZB 5952, holotype, 83.2 mm L_S ; Borneo: Mahakam River drainage.

Etymology

From the Latin *guttatus*, meaning speckled; in reference to the pattern of small brown spots on the dorsal surface of the head and body.

ACROCHORDONICHTHYS MAHAKAMENSIS SP. NOV. (FIG. 11)

Acrochordonichthys cf. *ischnosoma*—Christensen, 1992: 601; Kottelat, 1994: 414.

Holotype

MZB 5952, 1 ex., 83.2 mm L_S ; Borneo: Kalimantan Timur, Mahakam River, boulders upstream of Melak (0°12' S; 115°47' E); M. Kottelat, 6 August 1991.

Differential diagnosis

Acrochordonichthys mahakamensis can be differentiated from congeners of the *A. ischnosoma* species group by a rounded (v. angular) anterior margin of the anal fin (Fig. 7), and a relatively more slender body (body depth at anus 9.4% L_S v. 9.6–12.8; depth of caudal peduncle 4.2% L_S v. 4.5–5.4).

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five to six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband not exposed when mouth closed. In % L_S : head length 23.8, head width 21.8, head depth 13.5, predorsal distance 37.3, preanal length 67.2, prepelvic length 51.8, prepectoral length 24.4, body depth at anus 9.4, length of caudal peduncle 22.0, depth of caudal peduncle 4.2, pectoral-spine length 18.4, pectoral-fin length 21.0, length of dorsal-fin base 10.0, pelvic-fin length 12.3, length of anal-fin base 11.5, caudal-fin length 16.0, length of adipose-fin base 31.5, dorsal to adipose distance 8.2; in % L_H : snout length 37.4, interorbital distance 31.8, eye diameter 4.5, length of nasal barbel 6.1, length of maxillary



FIG. 12. *Acrochordonichthys septentrionalis*, NIFI 3128, holotype, 101.3 mm L_S ; Thailand: Mae Khlong drainage.

barbel 63.1, length of inner mandibular barbel 17.6, length of outer mandibular barbel 41.9. Branchiostegal rays 6 (1). Gill rakers 1+4 (1). Vertebrae 20+21=41 (1).

Fin ray counts: dorsal I,4,i (1); pectoral I,6,i (1); pelvic i,5 (1); anal ii,6,I (1); caudal 7/6 (1). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 6 (1) or 7 (1) large serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body cream, with dark brown spots scattered randomly on dorsal surface of head. Dorsolateral and lateral surfaces of body posterior to dorsal fin base with irregular dark brown blotches. Belly, chest and ventral surface of the head cream, without spots. Dorsal and pectoral fins dark brown, with cream distal margins. Pelvic and anal fins cream with a dark brown band near edge. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream, with dark brown spots on dorsal surfaces.

Distribution

Known only from the Mahakam River drainage in eastern Borneo (Fig. 9).

Etymology

The name refers to the type locality of this species (the Mahakam River).

ACROCHORDONICHTHYS SEPTENTRIONALIS SP. NOV. (Fig. 12)

Acrochordonichthys ischnosoma (non Bleeker)—Hora & Gupta, 1941: 29, figs 4–5; (?) Mohsin & Ambak, 1982: 101, fig. 1; (?) Mohsin & Ambak, 1983: 122, fig. 89; Zakaria-Ismail, 1984: 25; Kottelat *et al.*, 1993: 74, pl. 36 (in part); Lim *et al.*, 1993: 7; (?) Vidthayanon *et al.*, 1998: 46.

Holotype

NIFI 3128, 101.3 mm L_S ; Thailand: Kanchanaburi province, Kwaie Noi River; collector unknown, 10 April 1975.

Paratypes

NIFI 3129, 2 ex., 88.4–91.0 mm L_S ; data as for holotype. ZRC 2341, 1 ex., 95.5 mm L_S ; Malaysia: Pahang, King George V National Park; E. O. Shebbeare, 1939. ZRC 2360, 1 ex., 99.4 mm L_S ; Malaysia: Pahang, Kuala Tahan; M. W. F. Tweedie, April 1940.

Differential diagnosis

Acrochordonichthys septentrionalis can be differentiated from congeners of the *A. ischnosoma* species group by a smaller dorsal to adipose distance (4.4–5.7% L_S v. 6.2–9.8), fewer branchiostegal rays (4 v. 5–6) and an almost uniformly cream colour pattern with few very small brown spots (v. variegated colour pattern with numerous brown patches).

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to the end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband not exposed when mouth closed. In % L_S : head length 22.0–24.4, head width 19.6–21.9, head depth 12.8–15.8, predorsal distance 34.2–37.8, preanal length 67.0–72.9, prepelvic length 51.0–56.7, prepectoral length 20.9–25.5, body depth at anus 9.6–12.4, length of caudal peduncle 20.0–21.5, depth of caudal peduncle 4.9–5.4, pectoral-spine length 16.1–20.8, pectoral-fin length 20.4–22.9, length of dorsal-fin base 8.4–9.9, pelvic-fin length 10.9–12.7, length of anal-fin base 10.2–11.9, caudal-fin length 15.0–17.3, length of adipose-fin base 30.9–33.9, dorsal to adipose distance 4.4–8.6; in % L_H : snout length 28.8–35.4, interorbital distance 31.5–35.2, eye diameter 4.3–6.9, length of nasal barbel 6.9–11.8, length of maxillary barbel 65.0–77.3, length of inner mandibular barbel 20.7–27.0, length of outer mandibular barbel 51.7–53.7. Branchiostegal rays 4 (3) or 6 (2). Gill rakers 1+3 (2) or 1+4 (2). Vertebrae 19+21=40 (2) or 20+20=40 (1).

Fin ray counts: dorsal I,4,i (5); pectoral I,6,i (5); pelvic i,5 (5); anal ii,5,i (1) or iii,6,i (4); caudal 7/6 (5). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 5 (2), 6 (1) or 7(2) large serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body cream with dark brown spots scattered randomly on dorsal surface of head. Dorsolateral and lateral surfaces of body cream with small dark brown patches on dorsolateral surface. Belly, chest and ventral surface of head cream or dark yellow, without spots. Dorsal and pectoral fins brown with a hyaline distal margin. Pelvic and anal fins hyaline with a brown band in middle of fin. Caudal fin cream, with dark brown band near edge



FIG. 13. *Acrochordonichthys strigosus*, MZB 9333, holotype, 83.5 mm L_S ; Borneo: Kapuas River drainage.

and dark brown patch at base of caudal peduncle connected by thin brown longitudinal stripe. Barbels and pectoral spines cream or dark yellow, with dark brown spots sometimes present on dorsal surfaces.

Distribution

Known only from the Mae Khlong River drainage in Thailand and the Pahang River drainage in Peninsular Malaysia; it may be found in the Bernam River drainage in Peninsular Malaysia (Fig. 9).

Etymology

From the Latin *septentrionalis*, meaning northern, in reference to the distribution of this species.

Remarks

The record of *A. septentrionalis* from the Bernam River in western Peninsular Malaysia by Davies & Abdullah (1989) is based on a photograph seen by the second author; the present disposition of this specimen remains unknown. The photograph of *A. ischnosoma* provided in Kottelat *et al.* (1993) is that of *A. septentrionalis* and the record of *A. ischnosoma* from the Chao Phraya by Vidthayanon *et al.* (1998) may refer to this species as well.

ACROCHORDONICHTHYS STRIGOSUS SP. NOV. (FIG. 13)

Holotype

MZB 9333, 1 ex., 83.5 mm L_S ; Borneo: Kalimantan Barat, Sungai Sibau, from mouth of Sungai Putan to 3 km downstream (1°2'28.0" N 112°59'58.6" E); Y. Y. Goh *et al.*, 5 May 1998.

Differential diagnosis

Acrochordonichthys strigosus can be differentiated from congeners of the *A. ischnosoma* species group by a rounded (v. angular) posterior margin of the adipose fin (Fig. 5) and a relatively more slender body (body depth at anus 9.7% L_S v. 9.6–12.8; depth of caudal peduncle 4.5% L_S v. 4.7–5.4). The genital papilla

in male *A. strigosus* is also morphologically different from other members of the *A. ischnosoma* species group (short and thick v. long and thin; Fig. 8).

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband not exposed when mouth closed. In % L_S : head length 22.6, head width 20.5, head depth 12.0, predorsal distance 36.4, preanal length 69.2, prepelvic length 50.5, prepectoral length 24.3, body depth at anus 9.7, length of caudal peduncle 21.4, depth of caudal peduncle 4.5, pectoral-spine length 21.0, pectoral-fin length 23.1, length of dorsal-fin base 8.4, pelvic-fin length 11.4, length of anal-fin base 11.4, caudal-fin length 16.8, length of adipose-fin base 30.2, dorsal to adipose distance 7.2; in % L_H : snout length 39.2, interorbital distance 36.5, eye diameter 5.3, length of nasal barbel 9.5, length of maxillary barbel 77.2, length of inner mandibular barbel 37.6, length of outer mandibular barbel 52.4. Branchiostegal rays 5 (1). Gill rakers 1+3 (1). Vertebrae 20+20=40 (1).

Fin ray counts: dorsal I,4,i (1); pectoral I,6,i (1); pelvic i,5 (1); caudal 7/6 (1). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 6 (1) or 7 (1) large serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal and lateral surfaces of head and body brown, with dark brown spots scattered randomly on dorsal surface of head. Belly, chest and ventral surface of head cream, without spots. Dorsal, pectoral, pelvic and anal fins cream with dark brown band near edge. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream, with dark brown spots on dorsal surfaces.

Distribution

Known only from the Kapuas River drainage in western Borneo (Fig. 9).

Etymology

From the Latin *strigosus*, meaning slender; in reference to the relatively slender body of this species.

ACROCHORDONICHTHYS CHAMAELEON (VAILLANT, 1902) (FIG. 14)

Sosia chamaeleon Vaillant, 1902: 82, figs 19–21 (in part) (type locality: Mandai and Sibau Rivers, Kapuas basin, Borneo); Bertin & Estève, 1950: 32.

Sosia chamaleon—Weber & de Beaufort, 1913: 370.

Acrochordonichthys chamaleon—Roberts, 1989: 137, fig. 105; Kottelat *et al.*, 1993: 74, fig. 171.

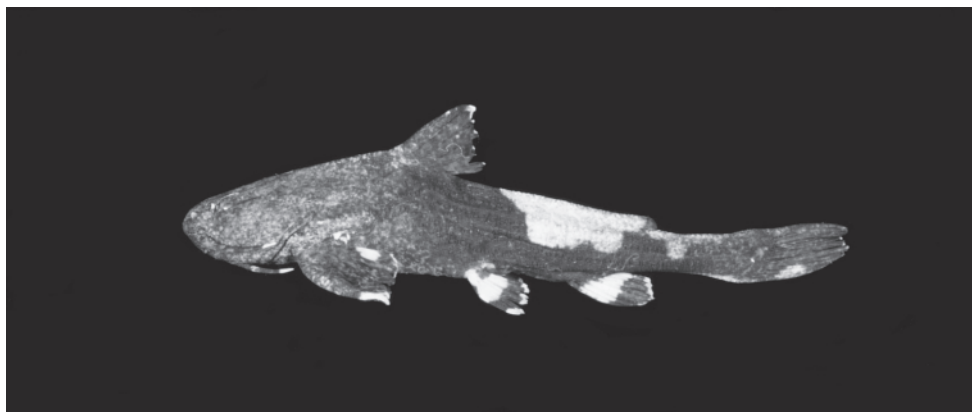


FIG. 14. *Acrochordonichthys chamaeleon*, ZRC 38830, 51.5 mm L_S ; Borneo: Kapuas River drainage.

Acrochordonichthys chamaeleon—Ng & Rachmatika, 1999: 169, figs 2–3a.

Material examined

RMNH 7849, 1 ex., lectotype, 90.0 mm L_S ; Borneo: Raoen/Mandai. RMNH 7851, 3 ex., paralectotypes, 57.5–98.0 mm L_S ; Borneo: Sibau. CMK 6899, 2 ex., 34.1–76.9 mm L_S ; Borneo: Kalimantan Barat, Kapuas River drainage, Sungai Sibau where it splits into two branches, c. 2 km upstream of Putussibau. CMK 11711, 5 ex., 37.5–96.8 mm L_S ; ZRC 38830, 1 ex., 51.5 mm L_S ; Borneo: Kalimantan Barat, Kapuas River drainage, Danau Sentarum area, Sungai Hulu Leboyan at Keluwin. MZB 7553, 1 ex., 64.2 mm L_S ; Borneo: Kalimantan Barat, Kapuas River drainage, Sungai Putan, a tributary of Sungai Sibau. MZB 9423, 1 ex., 83.0 mm L_S ; Borneo: Kalimantan Barat, Kapuas River drainage, Sungai Mendalam. MZB 9431, 1 ex., 97.9 mm L_S ; Borneo: Kalimantan Barat, Kapuas River drainage, Sungai Mentibat, a tributary of Sungai Mendalam.

Differential diagnosis

Acrochordonichthys chamaeleon can be differentiated from congeners of the *A. rugosus* species group by shorter nasal barbels (1.0–6.0% L_H v. 6.5–23.9), wide-set eyes (interorbital distance 38.9–47.5% L_H), a head with gently-sloping lateral margins and a broadly rounded snout when viewed dorsally (Fig. 6).

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband not exposed when mouth closed. In % L_S : head length 23.7–31.6, head width 24.6–29.3, head depth 14.7–19.3, predorsal distance 34.8–40.3, preanal length 68.5–73.6, prepelvic length 50.8–56.5, prepectoral length 23.1–28.4, body depth at anus 12.3–14.7, length of caudal peduncle 19.9–23.0, depth

of caudal peduncle 5.0–6.1, pectoral-spine length 20.9–22.3, pectoral-fin length 23.3–26.2, length of dorsal-fin base 8.6–10.3, pelvic-fin length 11.0–13.7, length of anal-fin base 9.1–12.1, caudal-fin length 15.6–20.1, length of adipose-fin base 27.8–31.7, dorsal to adipose distance 5.6–9.0; in % L_H : snout length 31.3–41.9, interorbital distance 38.9–47.5, eye diameter 3.6–7.3, length of nasal barbel 1.0–6.0, length of maxillary barbel 53.2–71.5, length of inner mandibular barbel 19.5–37.8, length of outer mandibular barbel 39.5–50.3. Branchiostegal rays 5 (1) or 6 (1). Gill rakers 1+4 (1). Vertebrae 17+18=35 (1) or 18+18=36 (1).

Fin ray counts: dorsal I,4,i (6); pectoral I,6,i (4), I,7 (1) or I,7,I (1); pelvic i,5 (6); anal ii,4,I (1), ii,5,I (4) or ii,7 (1); caudal 6/6 (2) or 7/6 (4). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 3 (1) serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body chestnut brown, sometimes with small dark brown patches scattered randomly on dorsal surface of head. Dorsolateral, lateral and sometimes ventral surfaces of body posterior to dorsal-fin base dark brown, with a chestnut brown saddle on dorsolateral surface over adipose fin. In some specimens, saddle is absent, replaced by longitudinal series of chestnut brown spots, coalescing to form patches. Belly, chest and ventral surface generally lighter in colour, without spots. Dorsal, pectoral, pelvic and anal fins cream with one or two dark brown bands, one occasionally present at base of fins and another near edge. In some specimens, colour pattern of fins is reversed and fins are overall dark brown with cream bands. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream or dark yellow, with dark brown spots sometimes present on dorsal surfaces. Some specimens overall dark brown throughout and lack both spots and saddle.

Distribution

Known only from the Kapuas River drainage in western Borneo (Fig. 15).

Remarks

Vaillant (1902) described *Sosia chamaeleon* and a subspecies, *S. chamaeleon* var. *pallida*, from the Kapuas River drainage in western Borneo. Roberts (1989) was the first to suggest that the type series consisted of two species and present examination of the syntypes has since corroborated this, with the smaller specimens referable to *A. rugosus* and the larger to *A. chamaeleon*. To stabilize the name *A. chamaeleon*, RMNH 7849 is designated as the lectotype for *Sosia chamaeleon* and RMNH 7848 for *Sosia chamaeleon* var. *pallida* in accordance to Article 75 of the International Code for Zoological Nomenclature (International Commission for Zoological Nomenclature, 1999).

This species, previously considered a synonym of *A. melanogaster* (itself considered a synonym of *A. rugosus* here) by Weber & de Beaufort (1913), was regarded as a valid species by Roberts (1989), who differentiated it from all other *Acrochordonichthys* species by a relatively wide head, extremely short nasal barbels, absence of tubercles on nearly the entire caudal fin and a pale-coloured

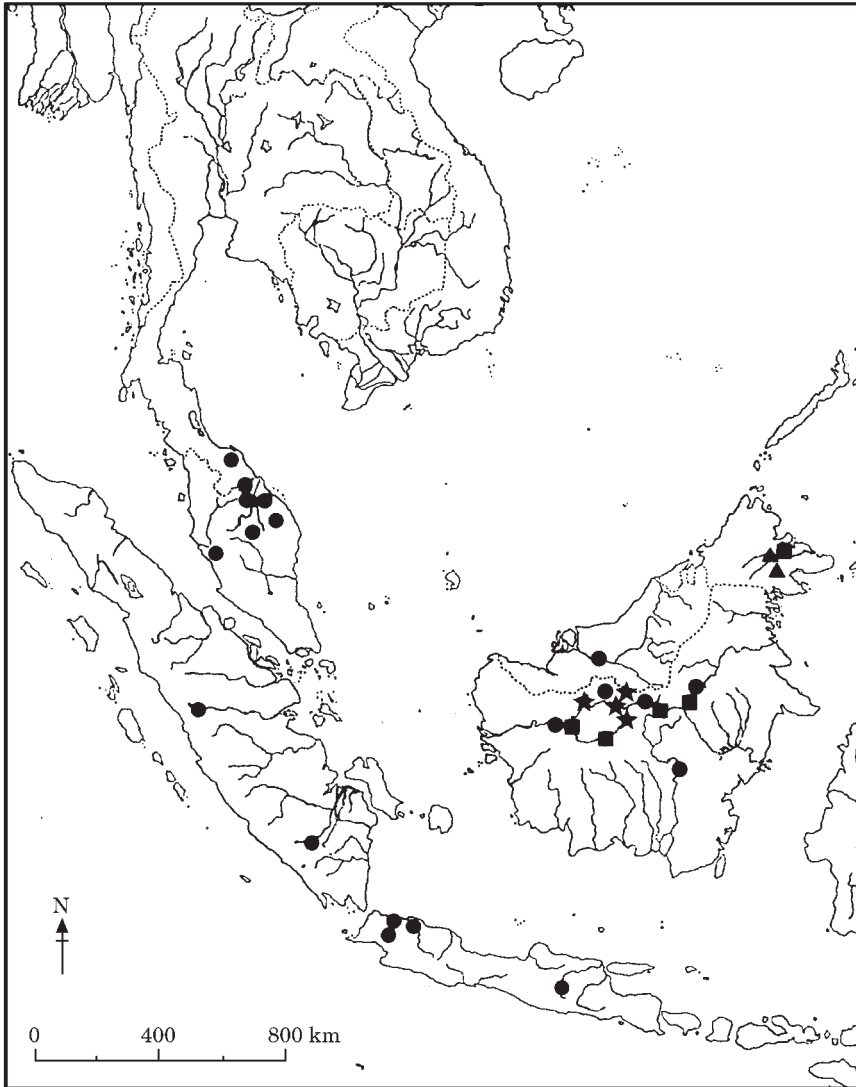


FIG. 15. Map showing distribution of members of *Acrochordonichthys rugosus* species group: *A. chamaeleon* (★); *A. falcifer* (▲), *A. pachyderma* (■); *A. rugosus* (●).

snout and occipital region. Present examination of the types and fresh material indicates that only the broad head (whose appearance is due to the gently-sloping lateral margins) and extremely short nasal barbels are useful diagnostic characters for this species. There is no trace of any pale colour on the snout or occipital region, and considering the fact that considerable colour variation exists in members of this genus (possibly related to the phenomenon of skin moulting, see above), it is to be expected that colour is not a useful diagnostic character. Also, tubercles were present on the caudal-fin rays of fresh specimens of *A. chamaeleon* and their absence in the type specimens examined by Roberts (1989) may have



FIG. 16. *Acrochordonichthys falcifer*, SSM, paratype, 68.6 mm L_S , Borneo: Segama River drainage.

been due to loss through inadequate preservation and long-term storage in alcohol.

ACROCHORDONICHTHYS FALCIFER SP. NOV. (FIG. 16)

Acrochordonichthys melanogaster (non Bleeker)—Inger & Chin, 1962: 134, fig. 67; Lim & Wong, 1994: 55.

Acrochordonichthys obscurus (non Popta)—Martin-Smith & Tan, 1998: 591, fig. 12.

(?) *Acrochordinichthys* [sic] *pachyderma*—Rendahl, 1922: 201.

Holotype

ZRC 43321, 76.6 mm L_S ; Borneo: Sabah, Sungai Segama; K. Martin-Smith, 5 December 1996.

Paratypes

FMNH 68008, 1 ex., 79.5 mm L_S ; Borneo: Sabah, East Coast Residency, Kinabatangan District, Deramakot Camp, Kinabatangan River; R. F. Inger, 12 May 1956. FMNH 68009, 4 ex., 30.0–41.3 mm L_S ; Borneo: Sabah, Kinabatangan District, Deramakot Camp, Kinabatangan River, below mouth of Malubok River; R. F. Inger, 8 May 1956. ZRC 43322, 1 ex., 92.1 mm L_S ; Borneo: Sabah, Sungai Segama, opposite Palum Tambun; K. Martin-Smith, 27 November 1996. ZRC 43323, 2 ex., 66.5–78.8 mm L_S ; Borneo: Sabah, Sungai Segama; K. Martin-Smith, 5 December 1996. ZRC 43324, 1 ex., 74.8 mm L_S ; SSM, 2 ex., 68.1–68.6 mm L_S ; data as for holotype.

Differential diagnosis

Acrochordonichthys falcifer can be differentiated from congeners of the *A. rugosus* species group by an adipose fin with a rounded (v. angular) posterior margin (Fig. 5) and a longer dorsal-fin base (10.8–13.1% L_S v. 7.9–10.5). Generally the colour pattern of *A. falcifer* is also different in having many small blotches (v. few large blotches) of various shades of brown, with many small dark brown spots (v. no spots) on the dorsal surfaces of the head. Both *A. falcifer* and

A. pachyderma lack serrations on the pectoral spine, but the two species can be separated based on their colouration (cream with numerous small blotches of various shades of brown in *A. falcifer* v. overall cream in *A. pachyderma*) and the shape of the posterior margin of the adipose fin (see above).

Description

Head depressed and broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, its tip tapering and reaching interneural. Premaxillary toothband not exposed when mouth is closed. In % L_S : head length 22.4–28.0, head width 24.0–28.6, head depth 14.5–19.5, predorsal distance 36.7–40.8, preanal length 67.1–71.8, prepelvic length 51.0–56.5, prepectoral length 22.3–30.2, body depth at anus 10.9–13.6, length of caudal peduncle 20.1–22.5, depth of caudal peduncle 5.4–6.6, pectoral-spine length 16.2–22.0, pectoral-fin length 20.1–25.8, length of dorsal-fin base 10.8–13.1, pelvic-fin length 12.9–15.0, length of anal-fin base 9.4–10.9, caudal-fin length 16.3–20.3, length of adipose-fin base 25.7–31.8, dorsal to adipose distance 5.5–7.7; in % L_H : snout length 36.8–40.9, interorbital distance 34.1–38.4, eye diameter 5.4–8.1, length of nasal barbel 7.4–13.0, length of maxillary barbel 67.8–92.9, length of inner mandibular barbel 19.4–30.2, length of outer mandibular barbel 44.2–76.3. Branchiostegal rays 5 (7) or 6 (1). Gill rakers 1+5 (3). Vertebrae 17+18=35 (1), 17+19=36 (3) or 18+18=36 (2).

Fin ray counts: dorsal I,4,i (8); pectoral I,6 (1) or I,6,i (7); pelvic i,5 (8); anal ii,5,i (1), ii,6,i (2), iii,4,i (1) or iii,5,i (4); caudal 6/6 (1), 6/7 (3) or 7/6 (4). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, without serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body cream to dark yellow, with dark brown spots scattered randomly on dorsal surface of head. Dorsolateral and lateral surfaces of body posterior to dorsal-fin base cream with brown patches of various shades forming a reticulate pattern. Belly, chest and ventral surface of head cream or dark yellow, without spots. Dorsal, pectoral, pelvic and anal fins cream with one or two dark brown bands, one occasionally present at base of the fins and another near edge. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream or dark yellow, with dark brown spots sometimes present on dorsal surfaces. Some specimens overall dark brown, with dark brown pectoral fins and brown stripes on other fins as for light-coloured specimens.

Distribution

Known only from the Kinabatangan and Segama River drainages, and possibly from the Kayan River drainage, in north-eastern Borneo (Fig. 15).



FIG. 17. *Acrochordonichthys pachyderma*, FMNH 68007, 85.9 mm L_S ; Borneo: Kinabatangan River drainage.

Etymology

From the Latin *falx*, meaning scythe and *ferre*, meaning to bear; in allusion to the smooth, recurved pectoral spine of this species.

Remarks

The lack of serrations in the pectoral spines of *A. falcifer* and *A. pachyderma* is not a sex-related character, as it is seen in both males and females.

All the specimens of *A. falcifer* were obtained from the edge of a river, which had a sand substrate overlaid with a 15–20 cm layer of leaf and small woody debris. The water was relatively shallow (<40 cm) and slow-flowing and most specimens were caught on rising or falling waters following floods.

Rendahl's (1922) record of *A. pachyderma* from Bulungan in the Kayan River drainage may refer to this species, but this specimen could not be found to ascertain its identity.

ACROCHORDONICHTHS PACHYDERMA VAILLANT, 1902 (FIG. 17)

Acrochordonichthys pachyderma Vaillant, 1902: 66, figs 11–13 (type locality: Bloeoe [=Bluu] River, Mahakam basin, Borneo); Popta, 1906: 66; Weber & de Beaufort, 1913: 370; Inger & Chin, 1962: 134, fig. 62D; Lim & Wong, 1994: 55.

Acrochordonichthys melanogaster (non Bleeker)—Kottelat, 1994: 414.

Acrochordonichthys cf. *melanogaster*—Roberts, 1989: 138 (in part); Christensen, 1992: 601.

Material examined

RMNH 7560, 1 ex., syntype, 144.8 mm L_S ; Borneo: Bo. RMNH 7843, 1 ex., syntype, 105.4 mm L_S ; Borneo: Bloeoe. FMNH 68007, 1 ex., 85.9 mm L_S ; Borneo: Sabah, East Coast Residency, Kinabatangan District, Deramakot Camp, Kinabatangan River. ZMA 119.419, 1 ex., 94.1 mm L_S ; Borneo: Lebang Hara, Sungai Serawai (0°20' S; 112°27' E).

Differential diagnosis

Acrochordonichthys pachyderma can be differentiated from congeners of the *A. rugosus* species group in its colouration (overall cream v. generally dark

brown with many irregular patches of light brown) and, except for *A. falcifer*, lack (v. presence) of serrations on the posterior edge of the pectoral spine.

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband not exposed when mouth closed. In % L_S : head length 24.3–26.1, head width 24.4–28.1, head depth 15.9–21.4, predorsal distance 37.5–39.2, preanal length 67.6–69.8, prepelvic length 50.7–55.3, prepectoral length 23.8–29.0, body depth at anus 12.1–17.2, length of caudal peduncle 21.1–23.6, depth of caudal peduncle 4.8–5.6, pectoral-spine length 17.2–18.2, pectoral-fin length 19.3–21.3, length of dorsal-fin base 8.2–10.1, pelvic-fin length 11.2–12.9, length of anal-fin base 8.6–10.8, caudal-fin length 16.8–20.5, length of adipose-fin base 27.2–31.7, dorsal to adipose distance 4.8–8.4; in % L_H : snout length 36.1–40.2, interorbital distance 34.2–41.2, eye diameter 4.2–7.4, length of nasal barbel 6.9–9.0, length of maxillary barbel 55.5–72.2, length of inner mandibular barbel 15.9–21.9, length of outer mandibular barbel 37.3–63.9. Branchiostegal rays 5 (2). Gill rakers 1+4 (1) or 1+5 (1). Vertebrae 17+20=37 (1).

Fin ray counts: dorsal I,4,i (4); pectoral I,6,i (4); pelvic i,5 (4); anal iii,5,i (1) or ii,6,i (3); caudal 6/6 (1) or 7/6 (3). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, without serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal and ventral surfaces of head and body cream, without any trace of dark spots. Dorsal, pectoral, pelvic and anal fins cream with one or two dark brown bands, one present occasionally at base of fins and another near edge. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream or dark yellow, with dark brown spots sometimes present on dorsal surfaces.

Distribution

Known only from the Kapuas, Mahakam and Kinabatangan River drainages in western, eastern and north-eastern Borneo, respectively (Fig. 15).

ACROCHORDONICHTHYS RUGOSUS (BLEEKER, 1847) (FIG. 18)

Pimelodus rugosus Bleeker, 1847: 11 (type locality: Surakarta, Java); Bleeker, 1850: 10; Bleeker, 1854a: 65; Bleeker, 1857: 477.

Pimelodus melanogaster Bleeker, 1854a: 89 (type locality: confluence of Lamatang and Enim rivers, Palembang province, Sumatra).

Pimelodus pleurostigma Bleeker, 1854b: 442 (type locality: Batavia [=Jakarta], Java).

Pimelodus zonatus Bleeker, 1854b: 444 (type locality: Batavia [=Jakarta], Java).

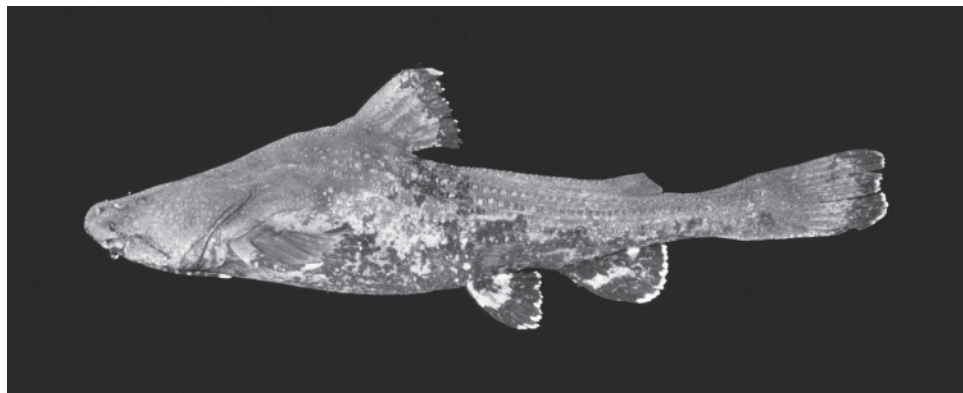


FIG. 18. *Acrochordonichthys rugosus*, ZRC 39290, 93.6 mm L_S ; Thailand: Mae Nam Sungai Kolok drainage.

Acrochordonichthys platycephalus Bleeker, 1858: 224; Bleeker, 1859: 136; Bleeker, 1862: 67, pl. 84, fig. 2; Günther, 1864: 94.

Acrochordonichthys melanogaster—Bleeker, 1858: 225; Bleeker, 1859: 136; Bleeker, 1862: 67, pl. 84, fig. 3; Günther, 1864: 94; Weber & de Beaufort, 1913: 369; Hora & Gupta, 1941: 30, fig. 6; Zakaria-Ismail, 1984: 25; Kottelat *et al.*, 1993: 74, pl. 36; Lim *et al.*, 1993: 7; Vidthayanon *et al.*, 1998: 46.

Acrochordonichthys rugosus—Bleeker, 1858: 227; Bleeker, 1859: 136; Bleeker, 1862: 68, pl. 83, fig. 4; Günther, 1864: 95; Weber, 1894: 420; Weber & de Beaufort, 1913: 368; Hora, 1941: 8, figs 1–2, pl. 1 fig. 4; Hora & Gupta, 1941: 31; Zakaria-Ismail, 1984: 25; Kottelat *et al.*, 1993: 75, pl. 36; Lim *et al.*, 1993: 7; de Pinna, 1996: 7; Vidthayanon *et al.*, 1998: 46.

Acrochordonichthys zonatus—Bleeker, 1859: 136; Bleeker, 1862: 69, pl. 84 fig. 5; Günther, 1864: 95.

Acrochordonichthys pleurostigma—Bleeker, 1862: 68, pl. 83 fig. 5; Bleeker, 1859: 136; Günther, 1864: 95; Weber & de Beaufort, 1913: 368, fig. 149.

Sosia chamaeleon var. *pallida* Vaillant, 1902: 87, figs 22–24 (type locality: Sintang, Borneo).

Acrochordonichthys obscurus Popta, 1904: 187 (type locality: Bongan River, Kapuas basin, Borneo); Popta, 1906: 55, pl. 3 figs 11a–b; Weber & de Beaufort, 1913: 370.

Acrochordonichthys Büttikoferi Popta, 1904: 188 (type locality: Bongan River, Kapuas basin, and Bo River, Mahakam basin, Borneo); Popta, 1906: 58, pl. 3 figs 12a–b.

Acrochordonichthys varius Popta, 1904: 189 (type locality: Bo River, Mahakam basin, Borneo); Popta, 1906: 63, pl. 4 figs 13a–b; Weber & de Beaufort, 1913: 370.

Acrochordonichthys büttikoferi—Weber & de Beaufort, 1913: 370.

Acrochordonichthys ischnosoma (non Bleeker, 1858)—Mohsin & Ambak, 1982: 101, fig. 1; Mohsin & Ambak, 1983: 122, fig. 89.

Acrochordonichthys cf. *melanogaster*—Roberts, 1989: 138, fig. 106; Kottelat *et al.*, 1992: 11; Khan *et al.*, 1996: 39; Tan & Ng, 2000: 288.

Acrochordonichthys cf. *rugosus*—Ng & Rachmatika, 1999: 171, Fig. 3(b).

Material examined

Java/Sumatra: BMNH 1863.12.11.161, 1 ex., syntype ?, 73.6 mm L_S ; Bleeker collection. RMNH 6883, 2 ex., syntype(s) ?, 73.5–89.0 mm L_S ; Bleeker collection.

Java: RMNH 4188, 1 ex., 79.1 mm L_S ; Bleeker collection (syntype of *A. pleurostigma*). RMNH 6879, 4 ex., 41.3–48.2 mm L_S ; Bleeker collection (syntypes of *A. pleurostigma*). RMNH 6880, 5 ex., 44.4–64.7 mm L_S ; Batavia; Bleeker collection (syntypes of *A. zonatus*). ZMA 119.420, 1 ex., 89.7 mm L_S ; ZMA 119.976, 1 ex., 69.3 mm L_S ; Buitenzorg.

Sumatra: BMNH 1863.12.11.152, 1 ex., 89.7 mm L_S ; Palembang; Bleeker collection (holotype of *A. platycephalus*). BMNH 1863.12.11.160, 1 ex., 94.9 mm L_S ; 'Provincia Palembang, ubi confluunt flumina Lamatang et Enim'; Bleeker collection (holotype of *A. melanogaster*). RMNH 15972, 1 ex., 99.5 mm L_S ; Lampung. ZMA 101.956, 2 ex., 75.0–81.3 mm L_S ; highlands of Padang, Batang Si Nama (=Kumanis).

Borneo: RMNH 7848, 1 ex., 68.5 mm L_S ; Sintang (lectotype of *S. chamaeleon* var. *pallida*). RMNH 33551, 1 ex., 68.1 mm L_S ; data as for RMNH 7848 (paralectotype of *S. chamaeleon* var. *pallida*). RMNH 7556, 1 ex., 107.9 mm L_S ; Bongan (holotype of *A. obscurus*). RMNH 7557, 1 ex., 124.9 mm L_S ; Bongan (syntype of *A. buettikoferi*). RMNH 7558, 2 ex., 85.6–91.1 mm L_S ; Bo (syntypes of *A. buettikoferi*). RMNH 7559, 2 ex., 94.8–127.1 mm L_S ; Bo (syntypes of *A. varius*). RMNH 7850, 1 ex., 58.3 mm L_S ; Raoen (syntype of *A. chamaeleon*). BMNH 1997.7.17.7, 1 ex., 97.5 mm L_S ; Kalimantan Tengah, Sungai Barito drainage, Desa Kerendan (Sungai Lahei and surrounding habitats). BMNH 1997.7.17.17, 1 ex., 87.7 mm L_S ; Kalimantan Tengah, Sungai Barito drainage, Sungai Idow above a waterfall c. 7 km upstream from Sungai Kerendan (a tributary of Sungai Lahei). FDS, 1 ex., 104.5 mm L_S ; Sarawak, Rajang River near Kanowit. MZB 3690, 1 ex., 68.4 mm L_S ; Kalimantan Barat, Sungai Belantian, 87 km ENE of Pontianak and 6 km by road E of Ngabang. MZB 7102, 1 ex., 72.0 mm L_S ; Kalimantan Tengah, Sungai Laung, Desa Maruwei, Laung Tuhup. MZB 9170, 1 ex., 66.2 mm L_S ; Borneo: Kalimantan Barat, Kapuas River drainage, Sungai Peyang, a tributary of Sungai Embaloh. MZB 9424, 1 ex., 102.1 mm L_S ; Kalimantan Barat, Kapuas River drainage, Sungai Sebaya, a tributary of Sungai Embaloh. ZMH 12012, 1 ex., 93.0 mm L_S ; Tandjung.

Peninsular Malaysia: CAS 94929, 1 ex., 89.7 mm L_S ; Kelantan, Sungai Pergau at Belimbing. FMNH 51741, 1 ex., 79.5 mm L_S ; FMNH 62309, 1 ex., 46.3 mm L_S ; ZRC 2361, 3 ex., 74.2–87.7 mm L_S ; ZRC 2362, 1 ex., 78.4 mm L_S ; ZRC 2363, 1 ex., 79.2 mm L_S ; ZRC 2496, 2 ex., 61.3–74.6 mm L_S ; ZRC 3216, 1 ex., 81.5 mm L_S ; ZRC 7764, 1 ex., 46.3 mm L_S ; ZRC 14765, 1 ex., 81.9 mm L_S ; Pahang, Kuala Tahan. ZRC 2342, 2 ex., 55.3–66.0 mm L_S ; Perak, Jalong, hill stream 1000–2000 ft. ZRC 5167–5187, 21 ex., 46.2–84.5 mm L_S ; Pahang, Taman Negara, Chaga Sireh, Sungai Tahan. ZRC 7770–7771, 2 ex., 50.2–56.0 mm L_S ; Kelantan, Sungai Sok. ZRC 23413–23415, 3 ex., 64.6–111.0 mm L_S ; ZRC 24514–24517, 4 ex., 56.1–111.0 mm L_S ; CMK 8178, 3 ex., 66.9–78.0 mm L_S ; Terengganu, Sungai Brang, tributary of Sungai Terengganu immediately downriver of Sekayu Waterfall Park. ZRC 27598, 1 ex., 47.6 mm L_S ; Selangor, Sabak Bernam, Sungai Bernam. ZRC 27667, 1 ex., 68.5 mm L_S ; Selangor, Sungai Bernam.

headworks. ZRC 38443, 1 ex., 44.5 mm L_S ; Selangor, Sungai Bernam headworks.

Thailand: ZRC 39290, 7 ex., 44.7–93.6 mm L_S ; Narathiwat province, Sungai Kolok. ZRC 43349, 3 ex., 46.0–68.1 mm L_S ; CMK 12195, 3 ex., 52.2–77.1 mm L_S ; Narathiwat province, Mae Nam Sungai Kolok at Ban Sac, 7 km south of Ban Bu Ke Ta (5°47'31" N 101°51'43" E). CMK 12878, 13 ex., 46.7–85.5 mm L_S ; Narathiwat province, Mae Nam Sai Buri at Sukhirin. NIFI, 3 ex., 64.0–99.0 mm L_S ; Pattani River at Yala.

Differential diagnosis

Acrochordonichthys rugosus differs from *A. chamaeleon* in having longer nasal barbels (6.5–15.6% L_H v. 1.0–6.0) and a head with steeply-sloping (v. gently-sloping) lateral margins and a convex (v. broadly rounded) snout when viewed dorsally (Fig. 6); from *A. falcifer* in having an adipose fin with an angular (v. rounded) posterior margin (Fig. 5); from *A. pachyderma* in its colouration (generally dark brown with many irregular patches of light brown v. overall cream) and presence (v. lack) of serrations on the posterior edge of the pectoral spine.

Description

Head depressed, broad, body moderately compressed. Dorsal profile rising evenly but not steeply from tip of snout to origin of dorsal fin, then sloping gently ventrally from there to end of caudal peduncle. Ventral profile horizontal to origin of anal fin, then sloping dorsally to end of caudal peduncle. Head covered with small tubercles with poorly demarcated and indistinct margins, body with such tubercles arranged in five or six longitudinal rows on each side. Occipital process narrow, tip tapering, reaching interneural. Premaxillary toothband not exposed when mouth closed. In % L_S : head length 20.5–28.3, head width 19.6–28.6, head depth 13.3–19.4, predorsal distance 32.4–40.4, preanal length 66.6–74.2, prepelvic length 49.6–57.8, prepectoral length 20.9–28.6, body depth at anus 9.6–14.3, length of caudal peduncle 18.9–26.1, depth of caudal peduncle 4.6–6.5, pectoral-spine length 17.5–21.1, pectoral-fin length 19.8–26.3, length of dorsal-fin base 7.9–10.5, pelvic-fin length 10.3–14.0, length of anal-fin base 7.4–12.7, caudal-fin length 15.7–23.2, length of adipose-fin base 26.1–34.5, dorsal to adipose distance 5.2–10.8; in % L_H : snout length 30.5–42.6, interorbital distance 29.8–48.5, eye diameter 4.3–8.0, length of nasal barbel 6.5–15.6, length of maxillary barbel 51.0–83.3, length of inner mandibular barbel 15.9–31.1, length of outer mandibular barbel 47.6–61.1. Branchiostegal rays 5 (7) or 6 (4). Gill rakers 1+3 (1), 1+4 (5) or 1+5 (3). Vertebrae 18+17=35 (2), 19+16=35 (1), 17+19=36 (3), 18+18=36 (4), 19+17=36 (3), 18+19=37 (2), 19+18=37 (9) or 20+17=37 (2).

Fin ray counts: dorsal I,3,i (1), I,4 (1) or I,4,i (65); pectoral I,5,i (5), I,6 (1), I,6,i (57), I,7 (3) and I,7,i (1); pelvic i,5 (67); anal ii,4,ii (1), iii,4,i (9), iii,4,ii (4), ii,5,i (3), ii,5,ii (1), iii,5 (1), iii,5,i (38), ii,6,i (7), iii,6 (1), and iii,6,i (2); caudal 6/6 (3), 6/7 (1) or 7/6 (63). Dorsal origin nearer tip of snout than caudal flexure. Pectoral spine stout, with 1 (1), 2 (1), 3 (2), 4 (12), 5 (23), 6 (15) or 7 (3) serrations on posterior edge. Caudal fin weakly emarginate.

Colouration

Dorsal surface of head and body chestnut brown, sometimes with small dark brown patches scattered randomly on dorsal surface of head. Dorsolateral, lateral and sometimes ventral surfaces of body posterior to dorsal-fin base dark brown, with chestnut brown saddle on dorsolateral surface over adipose fin. In some specimens, saddle is absent and replaced by longitudinal series of chestnut brown spots present, sometimes coalescing to form patches. Belly, chest and ventral surface generally lighter in colour, without spots. Dorsal, pectoral, pelvic and anal fins cream with one or two dark brown bands, one present occasionally at base of fins and another near edge. In some specimens, colour pattern of fins is reversed and fins are overall dark brown with cream bands. Caudal fin cream, with dark brown band near edge and dark brown patch at base of caudal peduncle. Barbels and pectoral spines cream or dark yellow, with dark brown spots sometimes present on dorsal surfaces. Some specimens overall dark brown throughout and lack both spots and saddle.

Distribution

Known from the Solo, Ciliwung and Citarum River drainages in Java; the Barito, Kapuas, Mahakam and Rajang River drainages in Borneo; the Bernam, Terengganu, Mae Nam Sungai Kolok, and Pattani River drainages in Peninsular Malaysia and southern Thailand; and the Musi and Tulangbawan River drainages in Sumatra (Fig. 15).

Remarks

After examining the types of the six nominal species described by Bleeker, the one nominal sub-species described by Vaillant, and the four nominal species described by Popta, it is concluded that they are all conspecific. The characters that were used in diagnosing the species (colouration, length of the occipital process and presence of fontanels) show considerable intraspecific variation, as discussed above. No other distinct morphological differences were found among the types.

Bleeker (1847) described *Pimelodus rugosus* from Surakarta in Java, but gave no indication of the size or number of specimens examined. Later, he obtained at least one more specimen from Palembang in Sumatra (Bleeker, 1854a: 65) again without any indication of size. In his Atlas (Bleeker, 1862), he lists a total of three specimens from both Java and Sumatra, but did not correlate the sizes of the specimens with their collection localities, so there is no way to determine which specimen(s) came from Sumatra. This makes it extremely difficult to determine the holotype (or syntypes) from among the three specimens. As *A. rugosus* appears to be relatively widespread and there is little problem with the identities of this species, it would be desirable, but not necessary to designate a lectotype or even a neotype, especially since fresh specimens could not be obtained from Java.

Vaillant (1902) described the specimens of *Sosia chamaeleon* from Sintang in the middle part of the Kapuas River drainage as var. *pallida*, stating that they differed from the other syntypes in having a narrower head and interorbital distance, as well as a different colour pattern. Present examination of the

syntypes reveal that these specimens, as well as one of the other smaller syntypes of *A. chamaeleon* (RMNH 7850, 58.3 mm L_S) are a distinct species and conspecific with the types of the species described by Popta (1904).

Popta (1904) described three species of *Acrochordonichthys*, using mainly the differences in colour pattern to distinguish them. The colour pattern shows considerable intraspecific variation and the differences observed by Popta fall within the range of colour variation described for *A. rugosus*.

In the north-eastern Malay Peninsula, *A. rugosus* occurs in clear, swiftly flowing forested streams with a pH of 7.0 and sandy or rocky bottoms. The fish were hiding under submerged logs or rocks with some leaf litter in the swifter parts of the stream. Alfred (1969) reported that *A. rugosus* was 'buried in sand under rocks at a water velocity of 2 feet per second and well away from the main channel of the river' in the headwaters of the Pahang River. *Acrochordonichthys rugosus* is a predatory fish; one specimen obtained from Sungai Brang in Terengganu in Peninsular Malaysia regurgitated three balitorid loaches of the genus *Nemacheilus* and one sisorid catfish of the genus *Glyptothorax*. Its general lethargy suggests that it is an ambush predator rather than an active hunter.

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