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# Two new species of cobitid fish (Teleostei, Cobitidae) from the River Nanliu and the River Beiliu, China

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**Abstract.** Two new species of *Cobitis*, *C. multimaculata* sp. nov. and *C. microcephala* sp. nov. are described and illustrated from the River Nanliu and the River Beiliu, Guangxi Province, China. *Cobitis multimaculata* can be distinguished from congeners by its unique colour pattern of scattered, small, elongated, oval blotches on the side of the body; well developed mental lobes; and cardioid *lamina circularis*. It is similar to *C. arenae*, but can be distinguished from it by possessing a stumpy body (body depth 6.1-6.6 in standard length in males and 5.7-7.3 in females versus 7.9 in standard length in male and 7.3-9.6 in females), shorter caudal peduncle (caudal peduncle depth 1.4-1.7 of its length in males and 1.6-1.8 in females versus 2.5 in male and 2.3-3.1 in females); and 17-22 small, elongate oval blotches along lateral line (versus 20-25 spots). *Cobitis microcephala* can be distinguished from congeners by possessing small and solitary irregular spots scattered on the side of the body; a slender and finely serrated (16-18 serrae on the inner margin) *lamina circularis*; and a much smaller jet black spot on upper half of caudal-fin base

**Key words:** *Cobitis*, taxonomy, Guangxi Province

## Introduction

Loaches of the genus *Cobitis* Linnaeus, 1758, one of the largest in the family Cobitidae, are small benthic freshwater fishes with a wide distribution area covering large parts of Eurasia and one species occurs in north-west Africa (Bănărescu 1990). Cobitids prefer microhabitat characteristics such as open, shallow areas with slow-flowing or stagnant water (Chen 1981). The genus *Cobitis* presents a difficult taxonomic problem, because some its species are morphologically little differentiated (Nalbant 1993). Investigations on the genus *Cobitis* have shown *C. taenia*, previously accepted as widely distributed species, to be composed of a number of separated species as well as of several polyploidy unisexual gynogenetic forms (Vasil'eva 2000, Papoušek et al. 2008). On the other hand, a number of species referred previously to this genus belong now to other genera such as *Niwaella*, *Bibarba* and others (Chen & Chen 2007, Kim 2009). Several species and polyploidy forms are indistinguishable based on external characters but were proved to be different using genetic characters, while some species can be clearly distinguished based on the pigmentation pattern, number and shape of *lamina circularis* in males, body scale and suborbital spine (Vasil'eva 2000).

The River Nanliu, in southern Guangxi Province, flows independently to the Gulf of Beibu following north-east to south-west trend. The River Pearl basin is the largest river in southern China, flows to the South China Sea following a general north-west to south-east trend. The upper reaches of the River Pearl is in Guangxi Province, including the Rivers Nanpan, Hongshuihe, Qianjiang, Xunjiang and

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Xijiang. The lower reaches of the River Pearl is in Guangdong Province, including the Rivers Beijiang, Dongjiang and Pearl Delta (Fig. 1). From the River Pearl Lin (1934) was *Cobitis arenae* first described in Huiyang City in Guangdong Province as *Misgurnus arenae*. Nichols (1943) transferred this species to the genus *Cobitis*, based on the suborbital spine and the body shape. Kottelat (2001) recorded this species in the River Lo basin in northern Vietnam, and transferred it to the genus *Acantopsis*, the identification needs confirmation. While investigating the *Cobitis* specimens collected from the Guangxi and Guangdong Provinces, kept in the Freshwater Fishes Museum (FFM) of the Institute of Hydrobiology (IHB) at the Chinese Academy of Sciences (CAS) in Wuhan (Hubei Province), material collected from the River Nanliu, previously identified as *C. arenae* (Dai 1981), was examined and it was found that this material represented a distinct, undescribed species. To establish their present status, a field survey was conducted in April 2006, during which an additional new species was also collected.

## Material and Methods

The study was based on specimens collected using hand nets and electrofishing. Material used are preserved in 10 % formalin, and are stored in the FFM of the IHB at the CAS in Wuhan (Hubei Province).

Nineteen morphometric variables were measured. The measurements were made with dial calipers and recorded to 0.1 mm. Total, standard, predorsal, preventral, preanal, head and preorbital lengths (TL, SL, PrDL, PrVL, PrAL, HL, PrOL) were measured from the tip of snout to the end of the longest caudal end lobe, to the extremity of the hypural complex at the mid-height of the caudal fin base, to the anterior origin of dorsal fin, to the anterior origin of ventral fin, to the anterior origin of anal fin, to the mid-lateral end of operculum and to the nearest point of the eye rim, respectively. Length between the pectoral and ventral fin (PVL) was measured point to point from the base of the last posterior ray to the base of the first anterior ray. Length of the caudal peduncle (CPL) was measured from the base of the last anal ray to the extremity of the hypural complex, at the lower edge of the caudal base. Pectoral, ventral and anal fin lengths (PFL, VFL, AFL) were measured from the base of the first ray to the extremity of the last ray. The length of the caudal fin (CL) was that of the longest ray from the posterior margin of the hypural complex. The depth of the body and least depth of the caudal peduncle (BD, CPD) were measured as the vertical distance from

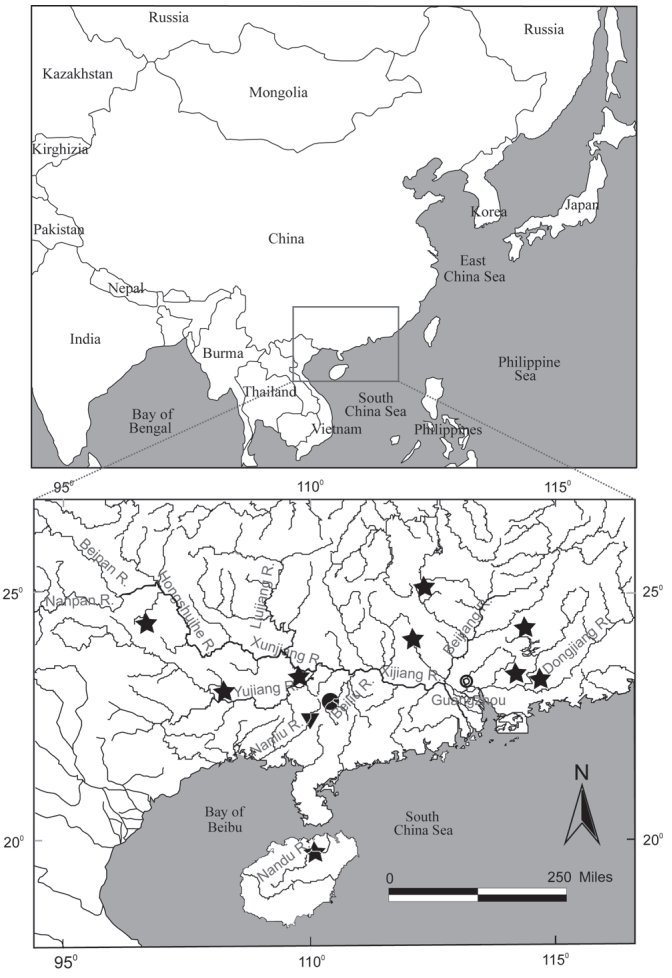


***Fig. 1.*** *Map showing the collection sites (i.e, currently known localities) of three species of loaches (Cobitidae) in southern China. (▼) type locality of* C. multimaculata *sp. nov. and* C. microcephala *sp. nov., (●) the second locality of* C. microcephala*, (★)* C. arenae*, (◎) Guangzhou City.*

the mid-line of insertion of the anterior dorsal fin to the midline position of its opposite ventral surface, and at the narrowest part of the caudal peduncle. The lengths of the bases of the dorsal and anal fins (DBL, ABL) included the respective bases of the first and last rays and the distances between them. The eye diameter (ED) was taken at the longitudinal length of the eye. The interorbital width (IW) was determined as the narrowest distance between the orbital rims. Measurements were made on the left side of the specimens.

Fin-rays (simple and branched) were counted under transmitted light using a binocular dissecting microscope. Simple rays of the dorsal, ventral and anal fins were counted anteriorposteriorly and dorsoventrally for the caudal and pectoral fins.

Vertebrae (including the Weberian ossicles and the hypural complex) were counted by examination of the negatives of roentgenograms. The roentgenograms were made of the lateral aspect of the fish using a medical X-ray system. Scales were collected from the subdorsal region between dorsal fin and lateral line and photographed by using a Leica DC180 camera attached to a Leica GZ6 stereomicroscope.

## Results

*Cobitis multimaculata* sp. nov. (Figs. 2A-E, 4A)

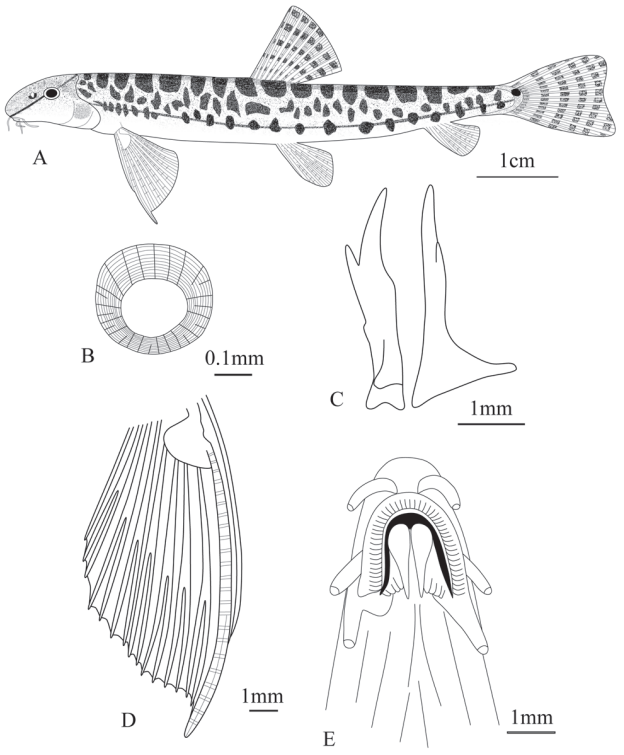


***Fig. 2.*** C. multimaculata *sp. nov. A, holotype, IHB 75v3203, male, 77.2 mm TL, 64.9 mm SL. The River Nanliu drainage, China; B, subdorsal scales; C,suborbital spine; D, lamina circularis in the pectoral fin of male; E, mouth characters.*

*Holotype:* IHB 75v3203, male, 77.2 mm TL, 64.9 mm SL; China: Guangxi Province, Bobai County, the River Nanliu drainage, 22°28′ N, 109°95′ E, May 1975.

*Paratypes:* IHB 75v3188, 75v3190, 75v3192, 75v3194-5, 75v3198, 75v3202, 75v3205, eight males, 72.0-79.8 mm TL, 60.3-68.8 mm SL; IHB 75v3100, 75v3186, 75v3189, 75v3193, 75v3196-7, 75v3204, seven females, 80.0-108.0 mm TL, 68.4-92.0 mm SL; data as for holotype.

*Diagnosis: C. multimaculata* can be distinguished from congeners by its unique colour pattern of scattered small elongated oval blotches on the body side; well developed mental lobes, posteriorly ending in a single filiform tip; heart-form *lamina circularis*. It is most similar to *C. arenae*, but can be further distinguished from it in stumpy body [body depth 6.1-6.6 (mean 6.3) in standard length in males and 5.7-7.3 (mean 6.4) in females versus 7.9 in standard length in male and 7.3-9.6 (mean 8.1) in females], shorter caudal peduncle [caudal peduncle depth 1.4-1.7 (mean 1.6) of its length in males and 1.6-1.8 (mean 1.8) in females versus 2.5 in male and 2.3-3.1 in females] (both species morphometric measurements in Table 1); and 17-22 small, elongate oval blotches along lateral line (versus 20-25 spots); the upper jet black spot at the base of caudal fin strongly pigmented and larger spot (versus less distinct and small spot).

*Description:* Head, body and caudal peduncle laterally compressed. Depth of between nape and dorsal fin base homogenous and slightly decreasing towards caudal-fin base. Depth of caudal peduncle 1.7-2.1 (mean 1.9) in females and 1.6-1.8 (mean 1.7) in males in body depth at dorsal-fin origin. Abdomen rounded. Head small, snout bluntly rounded. Preorbital part of the head slightly longer than postorbital part. Eyes located on upper part and middle of head. Mouth small, inferior, with three pairs of relative long barbels. Maxillo-mandibular barbel extends caudally to underneath the eyes. Lips thin and mental lobes of lower lip well developed and two superficial longitudinal lobes present, posteriorly ending in a single filiform tip. Anterior nasal tube near the posterior orifice. Suborbital spine situated in front of eyes; bifid, slender, and with no medio-lateral process, extends caudally to underneath the eyes. D. III-7; A. III-5; V. I-6; P. I-9; C. VI-16-V. Vertebrae 4 + 37 – 38 + 1.

Head without scales, body scales minute, round, very hard to count, with a large and excentric (being closer to the base) focal area, 18-21 radial grooves, and 5-8 supplementary grooves. Lateral line incomplete, reaching as far as end of pectoral fin.

Dorsal fin long, located on anterior half of body; dorsal fin length equal or shorter than head length. Length of the third dorsal fin ray 1.0-1.3 (mean 1.1) in head length in males and 1.3-1.5 (mean 1.4) in females. In males, pectoral fins long, the second pectoral ray being longest and thicker, length of the second pectoral fin ray 1.0-1.2 (mean 1.1) in head length. In females, pectoral fins slightly shorter, the third pectoral fin ray being longest, length of the third pectoral fin ray 1.5-1.7 (mean 1.6)

***Table 1.*** *Morphometric and meristic characters for* Cobitis multimaculata *sp. nov. and* Cobitis arenae *type series. Variables are described in Methods (SD = standard deviation).*

| Variable | *Cobitis multimaculata* sp. nov. | | | | | | | *Cobitis arenae* | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Males (n = 9) | | | | Females (n = 7) | | | Male | Females (n = 8) | | |
| | Holotype | Range | Mean | SD | Range | Mean | SD | (n = 1) | Range | Mean | SD |
| TL | 72.0 | 72.0-78.3 | 76.4 | 1.91 | 80.0-108.2 | 93.5 | 8.93 | 94.6 | 73.1-92.3 | 81.1 | 5.71 |
| SL | 60.1 | 60.6-68.3 | 65.1 | 2.33 | 68.3-92.1 | 79.9 | 8.91 | 78.7 | 62.6-78.9 | 69.6 | 5.00 |
| SL/BD | 6.5 | 6.1-6.6 | 6.3 | 0.20 | 5.7-7.3 | 6.4 | 0.57 | 7.9 | 7.3-9.6 | 8.5 | 0.74 |
| SL/HL | 5.1 | 4.7-5.1 | 4.9 | 0.17 | 4.6-5.1 | 4.9 | 0.14 | 4.7 | 4.9-5.4 | 5.2 | 0.20 |
| SL/CPL | 7.8 | 6.1-7.8 | 6.9 | 0.60 | 6.5-7.2 | 6.7 | 0.21 | 5.2 | 5.4-6.4 | 5.9 | 0.30 |
| SL/CPD | 10.7 | 10.5-1.4 | 11.0 | 0.33 | 11.5-12.5 | 12.0 | 0.34 | 13.0 | 14.3-16.6 | 15.2 | 0.75 |
| SL/PVL | 3.3 | 3.3-3.7 | 3.4 | 0.14 | 3.1-3.4 | 3.3 | 0.12 | 3.4 | 2.8-3.1 | 3.0 | 0.08 |
| SL/CL | 4.9 | 4.9-5.8 | 5.4 | 0.25 | 5.3-5.6 | 5.4 | 0.14 | 5.0 | 5.3-6.6 | 5.8 | 0.47 |
| SL/DFL | 5.3 | 5.3-5.7 | 5.5 | 0.16 | 6.5-7.0 | 6.7 | 0.17 | 6.2 | 6.5-7.2 | 6.8 | 0.25 |
| SL/DBL | 9.0 | 8.5-9.9 | 9.3 | 0.50 | 9.1-10.7 | 10.0 | 0.53 | 10.1 | 11.3-12.9 | 12.1 | 0.52 |
| SL/PFL | 5.2 | 5.0-5.5 | 5.3 | 0.20 | 7.5-8.3 | 7.8 | 0.25 | 4.7 | 7.5-8.7 | 8.2 | 0.47 |
| SL/VFL | 6.8 | 6.8-8.0 | 7.4 | 0.40 | 8.7-9.7 | 9.0 | 0.41 | 7.7 | 9.0-10.4 | 9.7 | 0.42 |
| SL/AFL | 7.5 | 7.0-8.8 | 7.8 | 0.61 | 8.6-9.8 | 9.2 | 0.49 | 7.3 | 7.6-9.0 | 8.3 | 0.51 |
| SL/ABL | 13.4 | 12.0-14.2 | 13.2 | 0.85 | 14.6-15.9 | 15.4 | 0.49 | 13.5 | 13.3-15.2 | 14.2 | 0.58 |
| SL/PrDL | 2.1 | 2.0-2.1 | 2.0 | 0.02 | 2.0-2.1 | 2.0 | 0.03 | 2.0 | 1.9-2.0 | 1.9 | 0.02 |
| SL/PrVL | 1.9 | 1.8-1.9 | 1.9 | 0.02 | 1.8-1.9 | 1.9 | 0.03 | 1.8 | 1.7-1.8 | 1.8 | 0.04 |
| SL/PrAL | 1.2 | 1.2-1.3 | 1.3 | 0.02 | 1.3-1.3 | 1.3 | 0.01 | 1.3 | 1.3-1.3 | 1.3 | 0.01 |
| HL/PrOL | 2.0 | 1.9-2.3 | 2.1 | 0.11 | 2.0-2.2 | 2.1 | 0.07 | 2.1 | 2.0-2.3 | 2.1 | 0.08 |
| HL/ED | 5.2 | 5.2-7.0 | 5.8 | 0.57 | 7.4-8.6 | 8.0 | 0.42 | 5.7 | 6.7-8.4 | 7.2 | 0.57 |
| HL/IW | 7.6 | 7.1-9.9 | 8.3 | 0.99 | 8.0-9.3 | 8.4 | 0.51 | 9.7 | 8.7-10.6 | 9.4 | 0.72 |
| CPL/CPD | 1.4 | 1.3-1.9 | 1.6 | 0.17 | 1.6-1.8 | 1.8 | 0.07 | 2.5 | 2.3-3.1 | 2.5 | 0.23 |

in head length. The pectoral fin in both sexes far from the ventral fin origin. Ventral fins short, small, and approximately at the same level as the third branched dorsal fin ray, length of the third ventral fin ray 1.3-1.6 (mean 1.5) in head length in males and 1.7-2.0 (mean 1.8) in females. The ventral fin not reaching anus in both sexes. Anal fin small, almost located on the half of the space between the ventral and caudal fins, length of the third anal fin ray 1.4-1.8 (mean 1.6) in head length in males and 1.7-2.0 (mean 1.9) in females. Anal fin not reaching caudal fin base. Caudal fin long, length of the caudal fin 1.0-1.2 (mean 1.1) in head length in males and 1.1-1.2 (mean 1.1) in females. Distal margin of dorsal fin slightly convex. Caudal fin emarginated, its upper lobe slightly shorter than its lower lobe. Caudal peduncle with ventral adipose crest. Anus near the anal fin.

*Pigmentation pattern: C. multimaculata* is characterized by scattered elongated oval brown blotches on dorsolateral surface. On dorsum 16-18 saddle-shaped brown blotches from the occiput to base of the caudal fin: first smaller than others, 8-9 saddle-shaped blotches at anterior dorsal fin base, one saddle-shaped blotches at dorsal fin base, 8-9 saddle-shaped blotches from the posterior dorsal fin base to the caudal fin. The gaps between the saddle-shaped blotches are narrower than the length of the blotches. Below them, some small, unregular pattern of vertically elongated oval light brown blotches randomly scattered on the body. 17-22 small, elongated oval blotches along lateral line: 8-11 of which predorsal, 1-2 dorsal and 7-9 post-dorsal. In front of the first blotch, there are often 1-3 small spots merging into a dark stripe. The last blotch along the line is prolonged vertically reaching ventral midline in some specimens. The upper caudal spot forms an intensive black coloured

spot, which is smaller than the eye. There are four or five light brown bars on the dorsal fin and caudal fin. Upper part of head, operculum and snout are covered by small brown spots. A black stripe extends from the occiput through the eye to the insertion of the rostral barbel. Barbels are whitish.

*Sexual dimorphism:* Males are overall smaller than females with proportionally longer pectoral, dorsal, anal and ventral fins (as the above description). Compared to females, males have a prolonged somewhat thickened first pectoral branched ray with a heart-shaped *lamina circularis*. In males, the barbels and the base of dorsal fin are also longer, Maxillo-mandibular barbel length 4.3-5.6 (mean 5.0) in head length in males and 5.4-6.4 (mean 5.7) in females; bases of the dorsal length 8.5-10.7 (mean 9.7) in standard length in males and 9.2-10.7 (mean 10.0) in females. The caudal peduncle is higher in males, caudal peduncle depth 1.3-1.8 (mean 1.6) in its length in males and 1.6-1.8 (mean 1.8) in females.

*Distribution:* Known from the type locality in the River Nanliu drainage, southern China.

*Etymology:* From the Latin *multus*, meaning many, and the Latin *macula*, meaning spot, in reference to the small similar elongated oval blotches scattered on the body of this species. Used as a noun.

*Remarks:* We have only 16 individuals collected in 1975 of the new species. In May 2002, we collected one specimen in type locality, but the specimen was damaged in the dissection process. In April 2006, we conducted again a field survey, but did not find this species. *C. multimaculata* may be extinct.

In May, most females had ripe or developing gonads. The value of the depth of the body may be high.

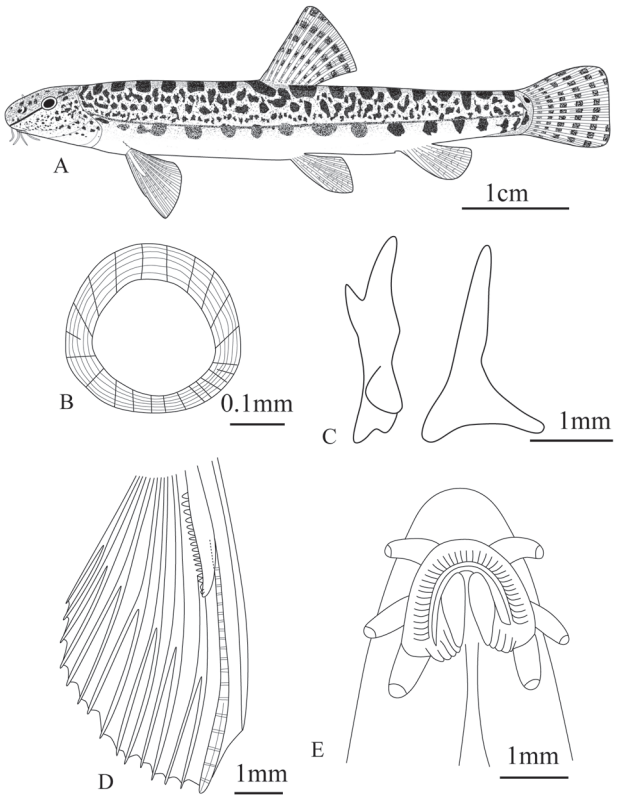


***Fig. 3.*** C. microcephala *sp. nov. A, holotype, IHB 0605135, male, 60.5 mm TL, 51.8 mm SL. The Nanliu River drainage, China; B, subdorsal scales; C, suborbital spine; D, lamina circularis in the pectoral fin of male; E, mouth characters.*

*Cobitis microcephala* sp. nov. (Figs. 3A-E, 4B)

*Holotype:* IHB 0605135, male, 60.5 mm TL, 51.8 mm SL; China: Guangxi Province, Bobai County, the River Nanliu drainage, 22°28′ N, 109°95′ E, May 2006.

*Paratypes:* IHB 0605138, male, 57.1 mm TL, 47.9 mm SL; IHB 0605205-210, 6 females, 59.2-69.5 mm TL, 50.4-59.8 mm SL; data as for holotype.

*Diagnosis: C. microcephala* can be distinguished from congeners by the following characters: small and solitary unregular spots scattered on the body side (Gambetta-zones 1 to 3) (Gambetta 1934); slender and finely serrated (16-18 serrae at the inner margin) *lamina circularis*; much small jet black spot in upper half of caudal-fin base. *C. microcephala* can be found sympatrically with *C. multimaculata*, the former can be further distinguished from the latter in shorter snout (preorbital length 2.4 in standard length both in males and females versus 2.1 both in males and females), shorter caudal peduncle (caudal peduncle length 5.9-6.6 in standard length in males and 5.3-7.0 in females versus 6.2-7.8 and 6.5-7.1, respectively), and undeveloped mental lobes (versus developed mental lobes, posteriorly ending in a single filiform tip).

*Description:* Morphometric measurements in Table 2. Body and caudal peduncle laterally compressed. Depth of between nape and dorsal fin base homogenous and slightly decreasing towards caudal-fin base. Depth of caudal peduncle 1.6-2.1 (mean 1.8) in females and 1.6-1.8 (mean 1.7) in males in body depth at dorsal-fin origin. Abdomen rounded. Head small, slightly laterally compressed, snout bluntly rounded. Preorbital part of the head shorter than postorbital part. Eyes located on upper part and middle of head. Interorbital width narrower than eye diameter. Mouth small, inferior, with three pairs of short barbels, two rostral, two maxillary and two maxillo-mandibular barbels. Maxillo-mandibular barbel extends caudally to underneath the posterior nasal orifice. Lips thin

and mental lobes of lower lip developed and two superficial longitudinal lobes present. Suborbital spine situated in front of eyes, which bifid, slender, and with no medio-lateral process, extends caudally to underneath the anterior eyes. D. III-7; A. III-5; V. I-6; P. I-9; C. VI-16-V. Vertebrae 4 + 37 – 38 + 1.

Head without scales, body scales minute, round, very hard to count, with a large and excentric (being closer to the base) focal area, 20-21 radial grooves, and few supplementary grooves. Lateral line incomplete, reaching posteriorly to beneath the length of pectoral fin.

Dorsal fin long, distal margin slightly convex, located on anterior half or middle of body; dorsal fin length equal or shorter than head length. The length of the third dorsal fin ray 1.0-1.1 (mean 1.0) in head length in both sexes. In males, pectoral fins long, the second pectoral ray being longest, length of the second pectoral fin ray 1.0-1.2 (mean 1.1) in head length. In females, pectoral fins slightly shorter, the third pectoral fin ray being longest, length of the third pectoral fin ray 1.2-1.4 (mean 1.3) in head length. The pectoral fin far from the ventral fin origin in both sexes. Ventral fins short, small, and approximately at the same level as the third branched dorsal fin ray, length of the third ventral fin ray 1.2-1.6 (mean 1.4) in head length in males and 1.3-1.6 (mean 1.5) in females. Anal fin small, almost located on the half of the space between the ventral and caudal fins, length of the third anal fin ray 2.7-2.9 (mean 2.8) in head length in males and 2.3-3.1 (mean 2.6) in females. Anal fin not reaching caudal fin base. Caudal fin long, distal margin truncate, length of the caudal fin 1.0-1.2 (mean 1.1) in head length in males and 0.9-1.1 (mean 1.0) in females. Anus near the anal fin. Caudal peduncle with ventral adipose crest.

*Pigmentation pattern:* Body colour is a variable dark brown pigmentation pattern organised in four zones as described by Gambetta (1934). Dorsal pigmentation is composed of 14-18, small ovoid or quadratic blotches,

***Table 2.*** *Morphometric and meristic characters for* Cobitis microcephala *sp. nov. type series. Variables are described in Methods.*

| *Cobitis microcephala* sp. nov. | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Males (n = 4) | | | | Females (n = 20) | | |
| Variable | Holotype | Range | Mean | SD | Range | Mean | SD |
| TL | 60.5 | 56.3-61.6 | 58.3 | 2.2 | 59.2-72.8 | 65.6 | 3.17 |
| SL | 51.8 | 47.3-52.3 | 49.8 | 2.59 | 50.4-61.6 | 55.9 | 3.24 |
| SL/BD | 5.8 | 5.8-6.2 | 5.9 | 0.19 | 5.0-6.5 | 5.6 | 0.40 |
| SL/HL | 5.1 | 4.8-5.1 | 5.0 | 0.12 | 5.0 -5.9 | 5.5 | 0.19 |
| SL/CPL | 5.9 | 5.9-6.6 | 6.3 | 0.37 | 5.3-7.2 | 6.3 | 0.49 |
| SL/CPD | 10.4 | 9.1-10.6 | 10.0 | 0.67 | 8.9-12.3 | 10.3 | 0.95 |
| SL/PVL | 2.9 | 2.9-3.1 | 3.0 | 0.11 | 2.7-3.0 | 2.8 | 0.06 |
| SL/CL | 5.9 | 5.1-5.9 | 5.5 | 0.38 | 5.3-6.4 | 5.7 | 0.29 |
| SL/DFL | 5.5 | 4.6-5.5 | 5.1 | 0.37 | 4.9-6.0 | 5.5 | 0.27 |
| SL/DBL | 11.0 | 9.3-11.0 | 10.1 | 0.79 | 9.0-11.3 | 10.4 | 0.60 |
| SL/PFL | 6.3 | 5.3-6.3 | 5.7 | 0.46 | 6.7-7.9 | 7.4 | 0.36 |
| SL/VFL | 8.0 | 6.0-8.0 | 6.0 | 0.83 | 7.5-8.8 | 8.2 | 0.37 |
| SL/AFL | 7.4 | 6.0-7.4 | 6.6 | 0.58 | 6.6-8.0 | 7.3 | 0.43 |
| SL/ABL | 14.3 | 13.4-14.6 | 14.0 | 0.60 | 12.7-16.9 | 14.4 | 0.99 |
| SL/PrDL | 2.0 | 2.0-2.1 | 2.0 | 0.01 | 2.0-2.2 | 2.0 | 0.05 |
| SL/PrVL | 1.8 | 1.7-1.8 | 1.8 | 0.02 | 1.7-1.8 | 1.8 | 0.04 |
| SL/PrAL | 1.3 | 1.3-1.3 | 1.3 | 0.00 | 1.2-1.3 | 1.3 | 0.02 |
| HL/PrOL | 2.4 | 2.3-2.4 | 2.4 | 0.03 | 2.1-2.7 | 2.4 | 0.14 |
| HL/ED | 6.0 | 5.6-6.3 | 6.0 | 0.29 | 5.2-6.8 | 5.8 | 0.43 |
| HL/IW | 6.0 | 5.5-6.1 | 5.8 | 0.37 | 4.5-7.4 | 5.8 | 0.65 |
| CPL/CPD | 1.8 | 1.4-1.8 | 1.6 | 0.15 | 1.3-2.0 | 1.6 | 0.17 |

which less regular behind head. These blotches could as well form nearly small spot (more than 20) in few individuals. Below them, a zone with small unregular spots is found. These could be very small and solitary or bigger. These spots, homologous to first zone described by Gambetta (1934), are reduced posteriorly in most specimens. The second Gambetta-zone is characterised by small rounded or horizontal elongated spots, these spots are less regular behind dorsal fin base. Post-dorsally, these spots could confluent with Gambetta-zones 1 and 2 forming an unregular pattern of unregular and solitary spots. The third Gambetta-zone is spotted with one line of dots, which might be reduced to few spots behind dorsal fin base. The fourth zone consists of 5-6 predorsal, 1-2 dorsal and 7-8 post-dorsal unregular, rounded blotches. In front of the first blotches, these blotches are less regular behind head, there are often 1-3 small spots forming an irregular longitudinal line in some specimens. The last blotch of fourth zone is prolonged vertically reaching ventral midline. No sexually dimorphic colour patterns could be observed. There is an in distinctive dark small spot in upper half of caudal-fin base and a faint black, large spot in lower half of caudal fin. Upper part of head, operculum and snout are covered by small dots. The head is sprinkled with many brown dots, and a black stripe extends from the occiput through the eye to the insertion of the rostral barbel. There are six or seven light brown striations on the dorsal fin and caudal fin. Paired fins are hyaline. Barbels are whitish.

*Sexual dimorphism:* Males are overall smaller than females with proportionally longer pectoral, dorsal, anal and ventral fins (as the above description). Compared to females, males have a prolonged somewhat thickened first pectoral branched ray with a slender and finely serrated (16-18 serrae at the inner margin) *lamina circularis*.

*Distribution:* Known from the type locality in the River Nanliu drainage and the River Beiliu (tributary of the River Pearl), in Guangxi Province, southern China.

*Etymology:* From the Greek mikros, meaning small, and kephale, meaning head, in reference to the small head of this species. Used as a noun.

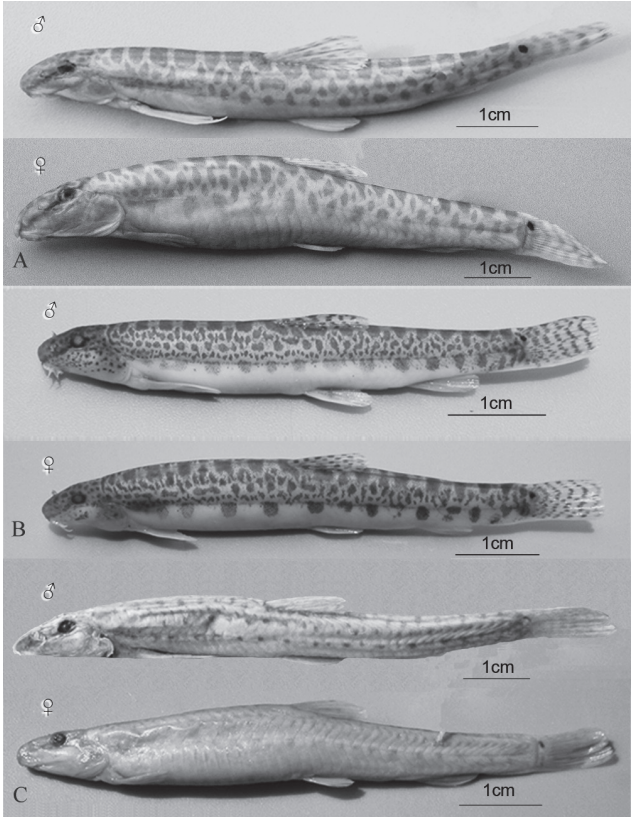


***Fig. 4.*** C. multimaculata *sp. nov. A, male, holotype, IHB 75v3188, female, IHB 75v3197; B,* C. microcephala *sp. nov. male, holotype, IHB 0605135, female, IHB 0605134; C,* C. arenae*, male, IHB 82077, female, IHB 4321.*

*Key to known Chinese species of* Cobitis

**1.** Body colour without Gambetta's pigmentation pattern; 17 to 25 small blotches or spots along lateral sides ..... 2

Body colour with Gambetta's pigmentation pattern; 7 to 17 moderate blotches along lateral sides (the fourth Gambetta-zone) ..... 3

**2.** 20 to 25 spots along lateral sides; body slender [body depth 7.9 in standard length in male and 7.3-9.6 (mean 8.1) in females]; peduncle more than twice as long as deep [caudal peduncle depth 2.5 of its length in male and 2.3-3.1 (mean 2.5) in females] (the River Pearl) ..... *C. arenae* (Lin, 1934)

17 to 22 small oval blotches along lateral sides; body stumpy [body depth 6.1-6.6 (mean 6.3) in standard length in males and 5.7-7.3 (mean 6.4) in females]; peduncle less than twice as long as deep [caudal peduncle depth 1.4 -1.7 (mean 1.6) of its length in males and 1.6-1.8 (mean 1.8) in females] (the River Nanliu) …..…… *C. multimaculata* sp. nov.

**3.** Peduncle more than twice as long as deep [caudal peduncle depth 2.1-2.2 (mean 2.1) of its length in males and 2.0-2.4 (mean 2.2) in females]; 5 to 9 big blotches along lateral sides; dorsal fin length equal or longer than head length (lakes of central China).…… ……*C. macrostigma* Dabry, 1872

Peduncle less than twice as long as deep; more than nine moderate blotches along lateral sides; dorsal fin length equal or shorter than head length .....… 4

**4.** Lamina circularis slender and long, with 16-18 serrae at the inner margin; small and solitary or bigger unregular spots scattered on the dorsolateral sides of the body (Gambetta-zones 1 to 3) [the Rivers Nanliu and Beiliu (tributary of the River Pearl)] ……..……... *C. microcephala* sp. nov.
Lamina circularis slender without serrae or plate; three differentiable longitudinal lines of speckles, or stripe on the dorsolateral sides of the body (Gambetta-zones 1 and 3) …….....……. 5
**5.** Caudal peduncle long, caudal peduncle depth 1.8-2.9 of its length; vertebrae 4 + 45 – 46 .....…6
Caudal peduncle short, caudal peduncle depth 1.1-1.6 of its length; vertebrae 4 + 37 – 40 ..... 7
**6.** 10 to 14 blotches along lateral sides; jet black spot on upper caudal base conspicuous; barbels long, longer than eye diameter (the Rivers Heilongjiang, upper Luanhe and Huagshui) ..... *C. granoei* Rendhal, 1935
12 to 16 blotches along lateral sides; spot on upper caudal base inconspicuous or absent; barbels short, equal to or shorter than eye diameter (upper middle the Rivers Yellow, Haihe, Liaohe and Heilongjiang) ……..…….. *C. melanoleuca* Nichols, 1925
**7.** Barbels long, maxillary reaching the anterior border or midway of the eye; two spots on caudal base, the upper one jet black, the lower one jet black or inconspicuous; a dark stripe along lateral sides in some males (the Rivers Heilongjiang, Liaohe and Haihe) .....…... *C. lutheri* Rendahl, 1935)
Barbels short, maxillary not reaching the anterior border of eye; one spot on caudal base, spot on lower caudal base inconspicuous or absent; a row of blotches along lateral sides ….....…… 8
**8.** Lamina circularis slender and long; 6 to 9 blotches on lateral sides and 8 to11 blotches on the back (the Rivers Jialingjiang and Hanjiang) ……..…….. *C. rara* Chen, 1981
Lamina circularis plate; more than nine small or moderate blotches along lateral sides and more than 11 blotches on the back ..... 9
**9.** 15 to 18 small blotches on lateral sides and 16 to 21 small blotches on the back; caudal peduncle length 2.3-2.5 in head length; head long [head length 4.5-4.8 (mean 4.7) in standard length in males and 4.3-5.1 (mean 4.7) in females] (the Rivers Jiulongjiang, Mulanxi and Zhangpu) ..... *C. dolichorhynchus* Nichols, 1918
10 to15 blotches on lateral sides and 12 to19 blotches on the back; caudal peduncle length 1.9-2.2 in head length; head short [head length 5.2 in standard length in males and 5.0-5.9 (mean 5.3) in females] (the upper middle River Yangtze) .....
..... *C. sinensis* Sauvage & Dabry, 1874

## Discussion

Three species of *Cobitis* are found in southern China: *C. arenae*, *C. multimaculata* and *C. microcephala*. *Cobitis arenae* is known from the Rivers Pearl and Nandujiang drainages; *Cobitis microcephala* is known from the Rivers Nanliu and Beiliu drainages; *C. multimaculata* is known only from the River Nanliu drainage (Fig. 1). *Cobitis multimaculata* shows similarities with *C. arenae* by the colour pattern, and previously was identified as *C. arenae* (Dai 1981). Though *C. multimaculata* closely resembles *C. arenae* in colour pattern, the spots on the body side of *C. multimaculata* are large, elongated oval. Lin (1934) showed *C. arenae* to possess some small spots and bands on back and side of body; looking from above its colouration is very similar to the general appearance of sand in and on which this little fish was found (the specimens of this species I examined have the colour pattern strongly faded or missing). Furthermore, the two species have a clear distinctive character in the shape of spots at the base of caudal fin, a conspicuous large jet black spot on upper caudal base of *C. multimaculata* versus a small, less jet black spot of *C. arenae* (Figs. 2A, 4A, 4C, 5A). The shape

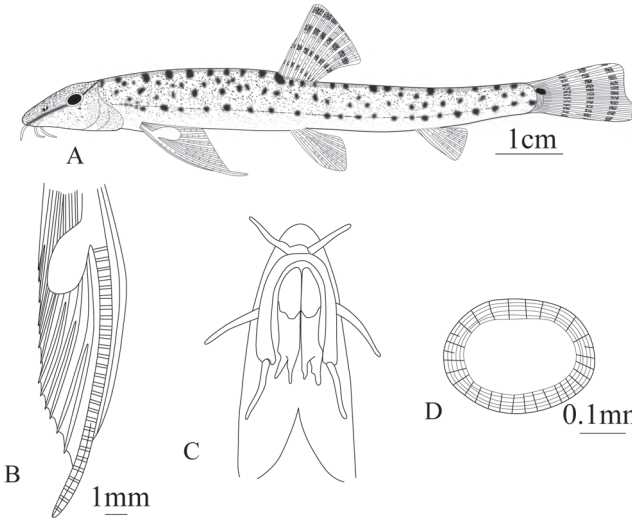


***Fig. 5.*** C. arenae*, A, male, IHB 82077, B, lamina circularis in the pectoral fin of male; C, mouth characters (from Lin 1934); D, subdorsal scales.*

of *lamina circularis* of *C. arenae* is of cystiform-like shape (Fig. 5B), in contrast to *C. multimaculata*, the structure is of heart-shaped. The two-lobed labial of lower lip of *C. arenae* produced four barbel-like fringes (Fig. 5C), versus mental lobes produced two barbel-like fringes of *C. multimaculata*. The structure

of scales of *C. arenae* is small, with a very large focal area (Fig. 5D), versus scales with a relative small focal area of *C. multimaculata*.

*Cobitis microcephala* is similar to Korean species *C. choii* (Kim & Son 1984) in both colour pattern and pectoral fin morphology. There is no consensus about the valid name of the Korean species. *C. choii* was transferred from *Cobitis* to *Iksookimia* by Nalbant (1993), and is referred as *I. choii* by some authors (Kim & Park 1997, Kim et al. 1999). Vasil'eva & Vasil'ev (1998) and Vasil'eva (2000) re-examined this species and identified it as a member of the genus *Cobitis*. In this paper, I confirmed this point of view. *C. microcephala* differs from *C. choii* in having a very small dot in upper half of caudal-fin base, versus a large rounded spot (Vasil'eva 2000); the fourth Gambetta-zone do not fused, versus two or more blotches fused in a band; scales round with a large and excentric (being closer to the base) focal area, versus scales elongated oval, with a very large and centric focal area (Vasil'eva 2000); caudal peduncle depth 1.3-2.0 of its length, versus 1.9-2.3 of *C. choii* (Kim & Park 1997). *C. choii* occurrs in the River Amur basin, Dalai Nor Lake, the River Kerulen and in rivers west of the Taebaik and Noryong mountain chains of Korea (Kim & Park 1997, Vasil'eva 2000).

About the distribution of freshwater fish in Vietnam, a little is known. At present, seven species of *Cobitis* are known to occur in Vietnam. Chevey & Lemasson (1937) reported *C. dolychorhynchus* from the Quang Ninh Province, which is the most north coastal province of Vietnam at the frontier to China. Mai (1978) as well reported this species only north-east of Hanoi. Kottelat (2001) reported this species as *C. cf. sinensis* from the River Ca basin northwards. Based on the picture by Kottelat (2001), this species differs from *C. multimaculata* and *C. microcephala* by the colour pattern, consisting of 14 large, round blotches along lateral line: in front of the fists blotch, two blotches merge. There are some large, unregular vertically elongated blotches randomly scattered on dorsolateral.

*Comparative material*

*C. arenae*: IHB 82077 (1), male, 94.6 mm total length, 80.1 mm standard length, China: from the River Pearl in Huaiji County, in Guangdong Province; IHB 863-867, 6294-6296 (8), females, 70.3-91.3 mm total length, 61-78.8 mm standard length, China: from the River Pearl in Lingyun County and Guiping City in Guangxi Province; IHB 0509404 (1), male, China: from the River Nandujiang in Ding'an County in Hainan Province.

*C. macrostigma*: IHB 0509147, 0509149, 0509153-6, 0509157-8 (8), males 112.0-125.8 mm total length, 94.4-109.2 mm standard length; IHB 0509139-146, 0509148, 0509151-2 (11), females, 130.7-158.9 mm total length, 111.9-137.4 mm standard length, China: from the Dongting Lake in Anxiang County in Hubei Province.

*C. dolichorhynchus*: IHB 74v0402, 74v0409, 74v0436, 74v0439-40, 74v0443-4, 74v0448, 74v0627 (9), males 67.2-80.4 mm total length, 56.1-66.0 mm standard length; IHB 74v0401, 74v0408, 74v0432, 74v0413-6, 74v0437, 74v0445, 74v0448, 74v0612-3, 74v0615, 74v0617-20, 74v0621-5, 74v0629-30, 74v0641 (25), females 96.9-126.4 mm total length, 83.1-107.8 mm standard length, China: from the River Jiulongjiang in Zhangzhou City in Fujiang Province.

*C. melanoleuca*: IHB 800742, 900044 (2), females 63.7-74.6 mm total length, 53.3-74.5 mm standard length, China: from the Liujiaxia reservoir in Gansu Province.

*C. granoei*: IHB 6331, 6335, 6354, 6356-8, 6360-1 (8), males, 55.5-61.6 mm total length, 47.4-51.9 mm standard length; IHB 6329-30, 6336-8, 6340-1, 6343, 6344-6, 6366 (12), females, 60.7-72.4 mm total length, 51.9-62.5 mm standard length, China: from the River Huangshui in Xining City in Qinghai Province.

*C. rara*: IHB 80vi0905, 80vi0909-10, 80vi0913, 80vi0915-6, 80vi1070, 80vi1072, 80vi1074-5, 80vi1058 (11), 86.4-96.9 mm total length, 73.2-80.8 mm standard length; IHB 80vi0473, 80vi0475-6, 80vi0694, 80vi0904, 80vi0911-2, 80vi0914, 80vi1055, 80vi1057, 80vi1059, 80vi1063, 80vi1065, 80vi1067, 80vi1194, 80vi1201 (16), femals, 89.9-117.2 mm total length, 76.2-99.6 mm standard length, China: from the River Jialingjiang in Shaxi Province.

*C. sinensis*: IHB 8840712, 8840702 (2) males, 92.7-100.8 mm total length, 78.9-85.3 mm standard length; IHB 701, 703-8, 710, 713 (9), females, 89.4-131.9 mm total length, 75.4-113.9 mm standard length, China: from the River Yuangjiang in Songtao County in Guizhou Province.

*C. lutheri*: IHB 58908, 58924, 58927, 58932-5, 58937 (8), males, 47.7-72.6 mm total length, 40.8-61.8 mm standard length; IHB 58903, 58910-4, 58917, 58919-20, 58930-1, 58935, 58939 (13), females, 61.0-74.9 mm total length, 52.5-64.4 mm standard length, China: from the River Haila'er in Neimenggu Province; IHB 6031-2, 6035-6, 6038, 6040, 6046-8, 6052 (10), males, 50.0-66.6 mm total length, 43.2-56.8 mm standard length, China: from the River Fabiela in Aihui County in Heilongjiang Province.

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