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A New Blind Loach *Triplophysa lihuensis* sp. nov. (Teleostei: Balitoridae) from Guangxi, China

Tie-Jun Wu[1], Jian Yang[2,*], and Jia-Hu Lan[3]

[1]*Guangxi Institute of Fisheries, Nanning 530021, China*

[2]*School of Chemistry and Life Sciences, Guangxi Teachers Education University, Nanning, 530001, China*

[3]*Du'an Fishery Technique Popularization Station, Du'an 530700, China*

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Tie-Jun Wu, Jian Yang, and Jia-Hu Lan (2012) A new blind loach *Triplophysa lihuensis* sp. nov. (Teleostei: Balitoridae) from Guangxi, China. *Zoological Studies* **51**(6): 874-880. *Triplophysa lihuensis* sp. nov., is described based on 5 specimens collected from a cave in Renguang Village, Lihu Town, Nandan County, Guangxi, China. It is distinguished from all other congeneric species by having the following combination of characters: eyes and scales absent; lips with furrows; outer rostral barbel 42.9%-54.5% of lateral head length and longer than the other 2 pairs of barbels; anterior nostril with elongate barbel-like tip; dorsal-fin rays 2/7 or 8; pelvic-fin rays 1/6; anal-fin rays 2/6; pectoral-fin rays 1/10-12; branched caudal-fin rays 13 or 14; distal margin of dorsal-fin truncate, dorsal fin origin much closer to caudal-fin base than to snout tip; dorsal-fin origin posterior to vertical line of pelvic-fin origin; pectoral fins flabellate, pectoral-fin length 53.3%-58.0% of distance between pectoral-fin origin and pelvic-fin origin; pelvic fins short, not reaching anus; caudal fins emarginate; dorsal and ventral crests present on caudal-peduncle; and posterior chamber of gas-bladder developed, reaching pelvic-fin origin. http://zoolstud.sinica.edu.tw/Journals/51.6/874.pdf

Key words: New species, Cave fish, *Triplophysa*, Taxonomy.

Members of the subfamily Nemacheilinae (Balitoridae) in China were revised by Zhu (1989), who recognized 91 valid species and subspecies belonging to 14 genera. Zhu's revision contained 47 species and subspecies of *Triplophysa* in China. Chen and Yang (2005) stated that there were 68 species of *Triplophysa* documented from China. Sixteen hypogean fishes of this genus were recorded in southwestern China (Li et al. 2008, Romero et al. 2009, Zheng et al. 2009, Yang et al. 2011 2012): eyes normal in *T. nandanensis* Lan et al. 1995, *T. xiangshuingensis* Li 2004, *T. nasobarbatula* Wang et Li 2001, *T. zhenfengensis* Wang et Li 2001, and *T. yunnanensis* Yang 1990; eyes vestigial in *T. rosa* Chen et Yang 2005, *T. tianeensis* Chen et al. 2004, *T. aluensis* Li et Zhu 2000, *T. qiubeiensis* Li et Yang 2008, *T. longipectoralis* Zheng et al. 2009, and *T. macrocephala* Yang et al. 2012; and eyes absent in *T. gejiuensis* Chu et Chen (1979), *T. longibarbatus* Chen et al. 1998, *T. shilinensis* Chen et Yang 1992, *T. xiangxiensis* Yang et al. (1986), and *T. huanjiangensis* Yang et al. 2011.

Cave-adapted *Triplophysa* species are more common in regions with karst limestone caves (Chen and Yang 2005). The karst environment is common in Yunnan, Guizhou, and Guangxi Provinces and adjacent regions. Only 6 *Triplophysa* species are presently known and documented from Guangxi: *T. nandanensis*, *T. flavicorpus* Yang et al. 2004, *T. tianeensis*, *T. longipectoralis*, *T. macrocephala*, and *T. huanjiangensis* (Lan et al. 1995, Yang et al. 2004 2011 2012, Chen et al. 2004, Zheng et al. 2009);

*To whom correspondence and reprint requests should be addressed. Tel: 86-771-3908065. Fax: 86-771-3908065.
E-mail:yangjian81@gmail.com

all these species except *T. flavicorpus* are cave-dwelling fishes.

In Apr. 2007, 5 specimens of a blind loach were collected from a cave in Renguang Village, Lihu Town, Nandan County, Guangxi, China. Subsequent examination showed that these specimens should be recognized as a new species belonging to the genus *Triplophysa*.

MATERIALS AND METHODS

Counts and most measurements followed Kottelat (1990), except for the following characters: the length of the median caudal ray is the length of the shortest of the branched caudal-fin rays; the caudal-peduncle depth was measured at the posterior of anal-fin base (the narrowest part of caudal-peduncle) and includes the dorsal crest (adipose keel); the minimum caudal-peduncle depth is the narrowest depth and excludes the dorsal and ventral crests; and the depths of the dorsal and ventral crests of caudal-peduncle are defined as the maximum depth of each crest. Measurements were taken with digital calipers and recorded to the nearest 0.1 mm. Abbreviations used in this study are as follows: Co., county; HL, lateral head length; Prov., province; and SL, standard length; Vill., village. Specimens examined and type specimens were deposited in the collection of the Kunming Institute of Zoology (KIZ), Chinese Academy of Sciences, Kunming, China and the collection of Guangxi Institute of Fisheries (GIF), Nanning, China. Data of *T. longibarbatus* followed Du et al. (2008). Data of *Paracobitis maonanensis* and *P. posterodorsalus* followed Li et al. (2006) and Ran et al. (2006), respectively.

***Triplophysa lihuensis* sp. nov.**

(Figs. 1-3, Table 1)

Holotype: KIZ 2010003082, 61.8 mm SL. Type locality: a cave in Renguang Vill., Lihu Town, Nandan Co., Guangxi Zhuang Autonomous Region, China; 25°09'45.5"N, 107°43'4.5"E; Nov. 2009, collected by Mr. Jiahu Lan; holotype is deposited in KIZ.

Paratypes: KIZ 2010003083-4, 09110323, 09110327, 4 specimens, 58.1-61.0 mm SL, collected with holotype. KIZ 2010003083 and KIZ 2010003084 are deposited in KIZ; 09110323 and 09110327 are deposited in GIF.

Diagnosis: *Triplophysa lihuensis* sp. nov. is easily separated from all other congeners by having a unique combination of the following characters: eyes and scales absent; lips with furrows; outer rostral barbel longer than other 2 pairs of barbels, at 42.9%-54.5% of HL; anterior nostril with elongate barbel-like tip (Fig. 2); dorsal-fin rays 2 (spines)/7 or 8 (branched rays); pelvic-fin rays 1/6; anal-fin rays 2/6; pectoral-fin rays 1/10-12; branched caudal-fin rays 13 or 14; distal margin of dorsal-fin truncate, dorsal fin origin much closer to caudal-fin base than snout tip; dorsal-fin origin posterior to vertical line with pelvic-fin origin; pectoral fins flabellate, pectoral-fin length 53.3%-58.0% of distance between pectoral-fin origin and pelvic-fin origin; pelvic fins short, not reaching anus; caudal fin slightly emarginate; dorsal and ventral crests present on caudal-peduncle; posterior chamber of gas-bladder developed, reaching pelvic-fin origin.

Description: Morphometric data of type specimens of *T. macrocephala* are given in table 1. Dorsal-fin rays 2/7 or 8; pelvic-fin rays 1/6; anal-fin rays 2/6; pectoral-fin rays 1/10-12; branched

Fig. 1. *Triplophysa lihuensis* sp. nov., holotype, KIZ 2010003082, 61.8 mm standard length.

caudal-fin rays 13 or 14.

Body elongate, slightly compressed anteriorly and more laterally compressed posteriorly. Head depressed, maximum head width greater than head depth, almost equal to body depth. Greatest body depth anterior to dorsal-fin origin. Snout slightly pointed. Both anterior and posterior nostrils closely situated, slit of posterior one bigger; anterior one in short tube with elongated barbel-like tip; length of nasal barbel equal to inner rostral barbel length. Eyes absent. Mouth inferior, mouth gape arched. Lips thick with irregular furrows (Fig. 2). Upper jaw covered by upper lip; lower jaw spoon-like with obtuse edge. Three pairs of barbels; inner rostral barbels reaching corner of mouth; outer rostral barbel longest, extending beyond posterior margin of nostril. Gill membranes united with isthmus.

Dorsal-fin origin slightly posterior to vertical line of pelvic-fin origin; edge of dorsal-fin truncate; 1st branched dorsal-fin ray longest; height of

Fig. 2. Lateral and ventral views of head of *T. lihuensis* sp. nov., holotype, KIZ 2010003082, 61.8 mm standard length.

Table 1. Morphometric data of type specimens of *Triplophysa lihuensis* sp. nov.

	Holotype	Paratypes				Mean
Catalog number	KIZ2010003082	09110327	KIZ2010003083	09110323	KIZ2010003084	
Standard length (SL; mm)	61.8	61.0	60.4	59.0	58.1	60.1
Lateral head length (mm)	15.2	14.4	13.5	13.5	13.2	14.0
Percentage (%) of SL						
Body depth	13.0	12.9	11.8	13.8	12.8	12.9
Dorsal head length	21.4	19.2	17.6	19.1	18.8	19.2
Lateral head length (HL)	24.6	23.7	22.3	22.9	22.7	23.2
Prepelvic length	57.1	54.6	53.0	54.4	52.4	54.3
Preanal length	74.4	73.4	73.9	74.6	72.5	73.8
Preanus length	69.5	71.1	68.7	70.2	67.8	69.5
Caudal-peduncle length	18.6	17.9	18.4	18.1	20.5	18.7
Caudal-peduncle depth	8.1	9.0	8.7	9.0	8.5	8.6
Maximum head width	13.7	12.8	11.5	12.9	12.2	12.6
Height of dorsal fin	13.0	13.7	13.5	13.0	11.7	13.0
Pectoral-fin length	17.3	18.5	18.2	18.6	16.2	17.7
Pelvic-fin length	12.6	13.2	12.4	13.6	12.3	12.8
Anal-fin length	14.9	14.2	13.5	15.3	14.0	14.4
Length of upper caudal lobe	18.2	18.0	17.1	18.6	17.0	17.8
Length of median caudal ray	12.8	14.1	12.8	14.0	12.4	13.2
Percentage (%) of HL						
Inner rostral barbel length	22.5	25.8	20.7	24.6	23.0	23.3
Outer rostral barbel length	51.7	46.1	54.5	42.9	47.0	48.5
Maxillary barbel length	30.6	33.4	34.0	38.6	27.7	32.9
Maximum head depth	49.9	43.6	45.8	47.4	45.2	46.4
Maximum head width	55.6	53.9	51.4	56.2	53.9	54.2
Pectoral-fin length/DPV	53.3	58.0	56.4	57.7	54.9	56.1
CPD/CPL	43.3	50.3	47.3	49.8	41.3	46.4
Dorsal crest/minimum CPD	62.9	57.5	70.8	57.8	86.7	67.1
Ventral crest/minimum CPD	55.9	52.5	51.5	35.2	62.5	51.5

DPV, distance between pectoral-fin origin and pelvic-fin origin; CPD, caudal-peduncle depth; CPL, caudal-peduncle length.

dorsal-fin shorter than head length. Pectoral fin length 53.3%-58.0% (mean, 56.1%) of distance between pectoral-fin origin and pelvic-fin origin. Pelvic-fin far removed from anus. Anus close to anal-fin origin. Anal fin short, truncate. Caudal peduncle long, caudal-peduncle depth < 1/2 of caudal-peduncle length. Dorsal and ventral crests present on caudal-peduncle; depth of upper crest greater than depth of lower crest; depth of upper crest 57.5%-86.7% (mean, 67.1%) of minimum caudal-peduncle depth, depth of lower crest 35.2%-62.5% (mean, 51.5%) of minimum caudal-peduncle depth. Caudal fin emarginate, tips slightly arched.

Body scaleless. Intestine short, bending in zigzag fashion beyond stomach. Gas-bladder bipartite; anterior chamber enclosed in bony capsule; posterior chamber developed, connected to anterior one by long, slender tube, tip of posterior chamber reaching pelvic-fin origin.

Color: Coloration of live *T. lihuensis* sp. nov. given in figure 3. In fresh condition, dorsal part of body light milky-white, sides of body pinkish; fins transparent; no pigments on body sides. After fixation in 10% formalin, whole body light milky-white. Dorsum of head, cheek, and body dorsum anterior to dorsal-fin origin covered with irregular pigment, or pigments indistinct.

Distribution: Known from a cave (25°09' 45.5"N, 107°43'4.5"E) in Renguang Vill., Lihu Town, Nandan Co., Guangxi Zhuang Autonomous Region, China (Fig. 4). The underground river drains into the Dagou River, which flows into the Hongshui River. *Triplophysa lihuensis* sp. nov. lives in a round pool with a muddy bottom.

Etymology: The specific name, *lihuensis*, is named after the town where the type specimens were collected.

DISCUSSION

The genus *Triplophysa* can be diagnosed by the following combination of characters: nostrils close together; 1st preethmoideum present; posterior wall of the bony capsule of the swim bladder present, and with a specific type of sexual dimorphism (males with brush-like aggregations of breeding tubercles at sides of head and on rays of pectoral fins) (Zhu 1989, He et al. 2006, Zheng et al. 2009, Prokofiev 2009 2010). This new species was assigned to the genus *Triplophysa* by the following additional characters: head compressed; upper jaw arched and covered by upper lip; lower jaw spoon-shaped; and an enlarged agglomeration present on each side of head. Sexual dimorphism was not observed in specimens of the new species. This phenomenon of degenerate or absent sexual dimorphism was recorded by other researchers, e.g., agglomerations of tubercles on the sides of head were absent from some species of *Triplophysa* (Prokofiev 2002 2006), males with breeding tubercles on sides of head were undeveloped (Zheng et al. 2009), and sexual dimorphism was not observed in the original description of *T. longibarbatus* (Chen et al. 1998). Du et al. (2008) also stated that sexual dimorphism is weakly pronounced in *T. longibarbatus*.

Triplophysa lihuensis sp. nov., *T. gejiuensis*, *T. huanjiangensis*, *T. longibarbatus*, *T. shilinensis*, and *T. xiangxiensis* are known blind *Triplophysa* species in China. Distributions of blind *Triplophysa* species are presented in figure 4. *Triplophysa lihuensis* sp. nov. is distinguished from *T. gejiuensis* and *T. shilinensis* in having the upper and lower crests present on the caudal-peduncle (vs. crests absent in *T. gejiuensis* and *T. shilinensis*), and the dorsal-fin origin posterior

Fig. 3. Coloration of *T. lihuensis* sp. nov. when alive (photographed by JH Lan).

to the pelvic-fin origin (vs. anterior to the pelvic-fin origin in *T. gejiuensis* and above or anterior to the pelvic-fin origin in *T. shilinensis*). *Triplophysa lihuensis* sp. nov. is distinguished from *T. xiangxiensis* and *T. longibarbatus* by the short, flabellate pectoral fin; the pectoral-fin length is 53.3%-58.0% of the distance between the pectoral-fin origin and pelvic-fin origin (vs. pectoral fin long and narrow; almost reaching pelvic-fin origin in *T. longibarbatus* and reaching beyond pelvic-fin origin in *T. xiangxiensis*). *Triplophysa lihuensis* sp. nov. is further distinguished from *T. longibarbatus* by the following characters: caudal-fin with 13 or 14 branched rays (vs. 16 in *T. longibarbatus*); tip of pelvic fin not extending to anus (vs. pelvic fin extending slightly beyond anus in *T. longibarbatus*); dorsal head length 17.6%-21.4% of SL (vs. 21.4%-30.9% in *T. longibarbatus*); caudal-peduncle length 17.9%-20.5% of SL (vs. 12.3%-16.8% in *T. longibarbatus*); height of dorsal fin 11.7%-13.7% of SL (vs. 14.7%-19.6% of SL in *T. longibarbatus*); pectoral-fin length 16.2%-18.6% of SL (vs. 20.0%-26.6% in *T. longibarbatus*); and pelvic-fin length 12.3%-13.6% of SL (vs. 14.2%-19.0% in *T. longibarbatus*). *Triplophysa lihuensis* sp. nov. is distinguished from the largest cave-dwelling *Triplophysa* species, *T. huanjiangensis* (124.2 mm SL) by a maximum head depth of 43.6%-49.9% HL (vs. 36.6%-42.4%) and a maximum head width of 51.4%-56.2% HL (vs. 42.8%-48.6%).

Key to blind *Triplophysa* species in China

1a. Dorsal and ventral crests absent from caudal-peduncle ... 2
1b. Dorsal and ventral crests present on caudal-peduncle 3
2a. Anus close to anal fin; lips furrowed ..... *T. gejiuensis*
2b. Anus a short distance from anal fin; tip of anterior nostril barbel-like elongated; lips smooth ..... *T. shilinensis*
3a. Pectoral fin long and narrow, reaching or extending beyond pelvic-fin origin 4
3b. Pectoral fin short, far from pelvic-fin origin 5
4a. Distance between dorsal-fin origin and snout shorter than distance between dorsal-fin origin and caudal fin base; anterior nostril located at end of short, obliquely cut tube ...

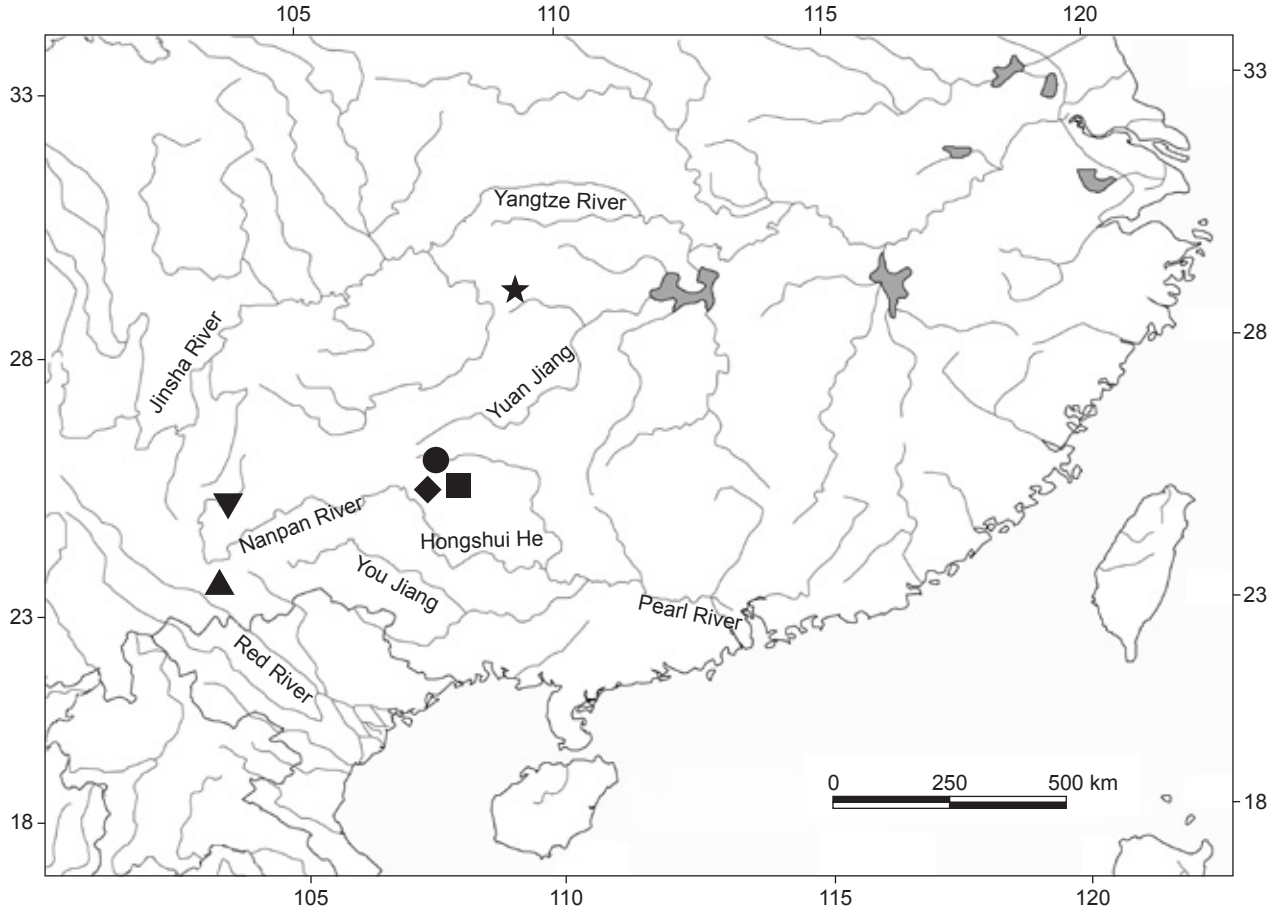

Fig. 4. Map showing the distribution of blind *Triplophysa* fishes. *Triplophysa gejiuensis* (▲), *T. huanjiangensis* (■), *T. lihuensis* sp. nov. (◆), *T. longibarbatus* (●), *T. shilinensis* (▼), *T. xiangxiensis* (★).

..... *T. xiangxiensis*

4b. Distance between dorsal-fin origin and snout larger than distance between dorsal-fin origin and caudal fin base; tube flap of anterior nostril elongated into barbel-like structure ... . *T. longibarbatus*

5a. Maximum head depth 36.6%-42.4% of HL, and maximum head width 42.8%-48.6% of HL ..... *T. huanjiangensis*

5b. Maximum head depth 43.6%-49.9% of HL, and maximum head width 51.4%-56.2% of HL ..... *T. lihuensis* sp. nov.

Triplophysa longibarbatus was thought to be a species of *Paracobitis* (Chen et al. 1998). Du et al. (2008), on the other hand, concluded that it should be a species of *Triplophysa*. Hu and Zhang (2010) discussed the Chinese nemacheiline species that were usually placed in the genus *Paracobitis* and concluded that this generic name could only be used for a group of very distinctive species from the Middle East, and that the Chinese "*Paracobitis*" species must be moved to the distinct genus, *Homatula*. There are 2 blind *Homatula* species, namely, *H. maolanensis* Li et al. (2006) and *H. posterodorsalus* Li et al. (2006) (Li et al. 2006, Ran et al. 2006). Hu and Zhang (2010) mentioned these 2 species but excluded them from *Homatula*. The generic status of the 2 species is still unclear. It remains to be demonstrated whether these 2 species are in *Homatula* or belong to another genus. They share a similar body shape with *T. lihuensis* sp. nov., but *T. lihuensis* sp. nov. is distinguished from "*H. maolanensis*" by the following characters: barbels developed, long, tubular flap of anterior nostril elongated into barbel-like tip (vs. barbels short, tubular flap of anterior nostril lacking barbel-like tip in "*H. maonanensis*"); dorsal-fin origin posterior to pelvic-fin origin (vs. above or anterior in "*H. maonanensis*"); and caudal fin emarginate, tips slightly arched (vs. caudal fin deeply forked, the 1st branched caudal-fin ray elongated with pointed tip in "*H. maonanensis*"). *Triplophysa lihuensis* sp. nov. is further distinguished from "*H. posterodorsalus*" by the following characters: dorsal-fin origin slightly posterior to vertical line of pelvic-fin origin (vs. obviously posterior in "*H. posterodorsalus*"); pectoral fin flabellate (vs. pectoral fin narrow, elongated with pointed tip in "*H. posterodorsalus*"); and caudal fin emarginate, tips slightly arched (vs. caudal fin deeply forked, lobes ended with pointed tips in "*H. posterodorsalus*").

Comparative materials: *T. gejiuensis*: KIZ 7803001-5, KIZ 7803007-8, 7 specimens, syntypes, 36.5-45.8 mm SL, Gejiu Co., Yunnan Prov., China. *T. longipectoralis*: KIZ 2001004573, Holotype, 52.1, Xunle Town, Huanjiang Co., Guangxi Zhuang Autonomous Region, China. *Triplophysa shilinensis*: KIZ 913001-2, syntypes, 59.1-59.6 mm SL, Shilin Co., Yunnan Prov., China. *T. tianeensis*: KIZ 200301001-6, 6 specimens, syntypes, 35.8-58.6 mm SL, Tian'e Co., Guangxi Zhuang Autonomous Region, China. *T. xiangxiensis*: KIZ 863001, 73.7 mm SL, Longshan Co., Hunan Prov., China. *T. huanjiangensis*: GIF 07040316, holotype, 90.0 mm SL; GIF 07040308, 07040314, 07040319, paratypes, 3 specimens, Huanjiang Co., Guangxi, China.

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