

***Triplophysa rosa* sp. nov.: a new blind loach from China**

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A new blind loach of *Triplophysa* Rendahl 1933 was collected from a subterranean pool in a cave at Wulong County, Chongqing City, China, in November 2002. The new species, named *Triplophysa rosa* sp. nov., can be distinguished from its congeners by the following unique characters: eyes vestigial; 9 branched dorsal-fin rays; 12 branched pectoral-fin rays; 7 branched pelvic-fin rays; 6 branched anal-fin rays; 7 + 7 branched caudal-fin rays; distal margin of dorsal-fin concave; tip of pelvic-fin surpasses vertical level of anus; caudal-fin deeply forked; whole body scaleless and colourless.

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Key words: cave fish; China; Chongqing; loach; new species; *Triplophysa*.

INTRODUCTION

Since the first observed record of a blind fish by Zheng Zu-Guang in 1839 (Qian & Li, 2002) and the first scientific description of a blind cave fish from China, *Noemacheilus gejiuensis* (Chu & Chen) (Chu & Chen, 1979), a total of 27 species of cave fishes has been described in China. With the exception of *Typhlobarbus nudiventris* Chu & Chen, most blind fishes in China belong to two groups: 13 species of *Sinocyclocheilus* (Cyprinidae, Cypriniformes) and 13 species of nemacheiline loaches (Balitoridae, Cypriniformes). Five species of the 13 species of loaches belong to the genus *Triplophysa* (Fig. 1). This genus mainly occurs in the Qinghai-Tibet Plateau and its adjacent regions, with a total of 68 species in China.

Members of the Hongmeigui Caving Club collected one specimen of a cave fish from a cave pool (c. 10 m long and 0.5 m deep) in Wulong County, Chongqing City, China, on 26 November 2002. It was thought to be a new species of the genus *Triplophysa*.

MATERIALS AND METHODS

Counts and measurements of the captured fish (Fig. 2) followed that of Kottelat (1990). Measurements were made with dial callipers and recorded to the nearest 0.1 mm. Other species of *Triplophysa* examined belonged to the collections of the

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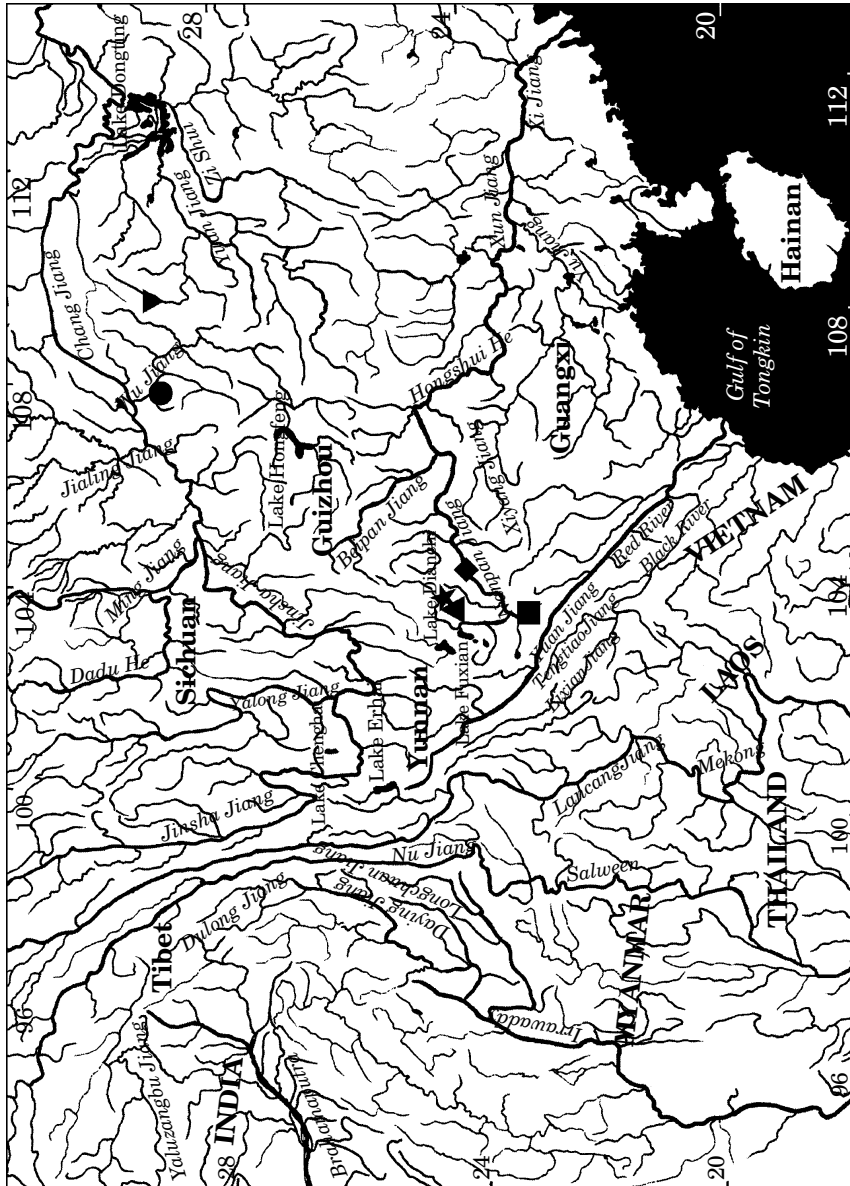


FIG. 1. Map showing the distribution of cave-dwelling *Triplophysa* fishes [*Triplophysa yunnanensis* (◆), *Triplophysa aluensis* (◆), *Triplophysa shiliniensis* (▲), *Triplophysa rosa* (●), *Triplophysa gejiuensis* (■) and *Triplophysa xiangxiensis* (▼)] in China.

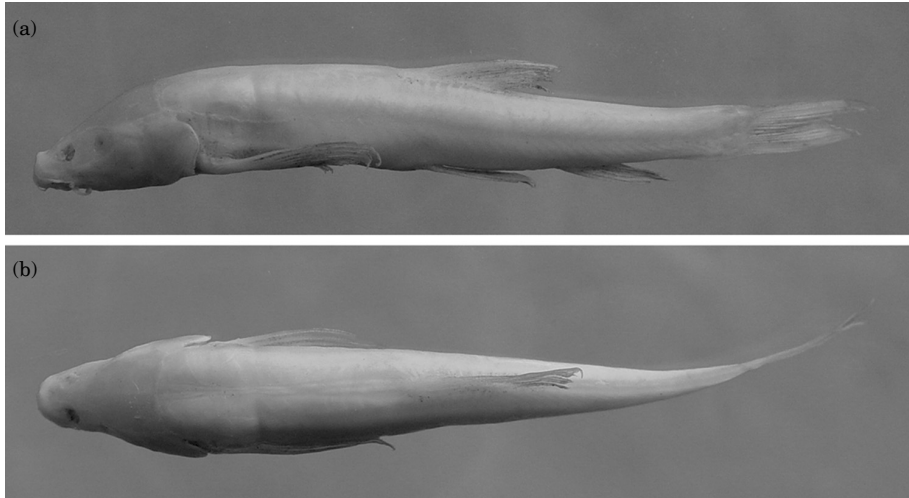


FIG. 2. *Triplophysa rosa* (holotype KIZ 200211001, 56.0 mm L_S): (a) lateral and (b) dorsal views.

Kunming Institute of Zoology (KIZ), Chinese Academy of Sciences. Abbreviations used in this paper are: A, number of anal-fin rays; BD, body depth, measured at the dorsal-fin origin; BIR, inner rostral barbel; BOR, outer rostral barbel; C, number of branched caudal-fin rays; CML, length of median ray of caudal-fin; CPL, caudal peduncle length; CPD, caudal peduncle depth; CUL, length of upper lobe of caudal-fin; D, number of dorsal-fin rays; DPV, distance from pectoral-fin origin to pelvic-fin origin; L_H , head length, from tip of snout to posterior edge of opercule; L_S , standard length; MW, mouth width; P, number of pectoral-fin rays; PL, pectoral-fin length; V, number of pelvic-fin rays.

RESULTS

Holotype

KIZ 200211001, female, 1 ex., 56.0 mm L_S ; from a small pool 581 m underground of Dongba Cave, cave entrance 29°13'40.44" N; 107°55'16.46" E (altitude of cave entrance 895 m; Wu Jiang drainage), Tianxing Town, Jiangkou Town, Wulong County, Chongqing City, China, 26 November 2002; collected by E. Lynch, M. Ryan & D. Collis.

Diagnosis

Triplophysa rosa can be distinguished from its congeners by possessing the following combination of characters: eyes vestigial; 9 branched dorsal-fin rays; 12 branched pectoral-fin rays; 7 branched pelvic-fin rays; 6 branched anal-fin rays; 7 + 7 branched caudal-fin rays; distal margin of dorsal-fin concave; tip of pelvic-fin surpasses vertical level of anus; caudal-fin deeply forked; whole body scaleless and colourless.

Description

Morphometric measurements are given in Table I. Snout pointed and head slightly depressed. Dorsal head length and head length larger than head width. Maximum head width 1.2 times head depth at nape and larger than body width

TABLE I. Morphometric measurements of *Triplophysa rosa* sp. nov.

Character	Measurement (mm)
Standard length (L_S)	56.0
Total length (L_T)	71.6
Head length (L_H)	13.8
Dorsal head length	12.4
Predorsal length (PreDL)	30.2
Preventral length	31.3
Preanal length	40.6
Head depth	6.9
Body depth (BD)	7.8
Caudal peduncle length (CPL)	9.7
Caudal peduncle depth (CPD)	4.2
Snout length	5.3
Head width	8.6
Mouth width (MW)	2.8
Body width	6.0
Interorbital width	4.2
Inter-naris width	1.9
Dorsal-fin length	12.4
Anal-fin length	10.7
Pelvic-fin length	10.3
Pectoral-fin length (PL)	14.9
Length of upper lobe of caudal-fin (CUL)	14.6
Length of lower lobe of caudal-fin	13.5
Length of median ray of caudal-fin (CML)	10.0
Distance from pectoral-fin to pelvic-fin origin (DPV)	17.2
Distance from pelvic-fin to anal-fin origin	10.2
Distance from anus to anal-fin origin	2.4
Inner rostral barbel length (BIR)	3.0
Outer rostral barbel length (BOR)	6.1
Maxillary barbel length (BM)	5.4

at dorsal-fin origin. Head shorter than maximum length of pectoral and caudal fins, longer than length of dorsal, pelvic and anal fins. Eyes vestigial [Figs 2(a) and 3(a)]. Mouth inferior, small and curved. Upper and lower jaws without processus dentiformis (Kottelat, 1990). Lips thick with furrows. Upper jaw visible at middle of mouth and covered by upper lip at sides and corners of mouth. Lower lip completely bisected longitudinally by a groove at dentary symphysis. Lower jaw not covered by lower lip at dentary symphysis. Three pairs of barbells (Fig. 3). Inner rostral barbel reaches to corner of mouth, outer rostral barbel reaches to orbital cavity, maxillary barbel surpasses orbital cavity but does not reach to anterior edge of opercle. Anterior nostril forms an elongated barbel-like process [Fig. 3(a)].

Body slightly compressed anteriorly, posterior portion of body and caudal peduncle compressed. Distal margin of dorsal-fin concave. Tip of pectoral-fin close to pelvic-fin origin. Dorsal-fin origin closer to snout tip than to caudal-fin base. Tip of dorsal-fin surpasses vertical level of anus but does not reach to

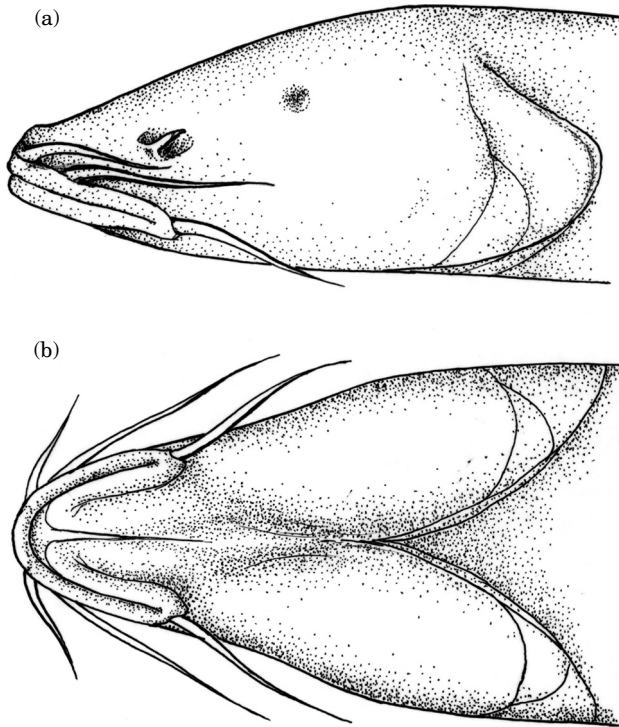


FIG. 3. *Triplophysa rosa* (holotype KIZ 200211001, 56.0 mm L_S): (a) lateral and (b) ventral views of head.

anal-fin origin. Dorsal-fin shorter than head. Pelvic-fin origin posterior to level of dorsal-fin origin and much closer to anal-fin origin than to pectoral-fin origin. Tip of pelvic-fin surpasses vertical level of anus, and not quite reaching vertical level of anal-fin origin. Auxiliary pelvic lobe absent. Distal margin of anal-fin straight. Anal-fin origin closer to pelvic-fin origin than to caudal-fin base. Posterior tip of anal-fin reaches about two thirds of distance from anal-fin origin to caudal-fin base. Caudal peduncle slender, its length 2.3 times its depth. Caudal-fin deeply forked, upper lobe longer than lower lobe, longest upper lobe ray 1.5 times the length of the shortest medial ray. Caudal adipose keel low and transparent, within posterior half of caudal peduncle.

Body entirely scaleless and smooth. Lateral-line complete and straight. The single specimen is a female, therefore there are no tubercles on the cheek and dorsal surface of the pectoral-fin.

Fin ray counts: P: 1, 12; D: 3, 9; V: 1, 7; A: 3, 6; C: 7 + 7.

Colouration (preserved in 75% alcohol)

Body pale, without any pigment on skin. All the fin rays transparent.

Habitat

The specimen was collected from a small population of several individuals in a pool 581 m underground (altitude of the pool 314 m above sea level).

The pool is *c.* 10 m long and 0.5 m deep. Air temperature 16–17°C, water temperature *c.* 13°C. About 12 individuals were seen in another adjacent pool.

Etymology

From Latin, rose, gender feminine, refers to the Hongmeigui (Red Rose) Caving Club.

DISCUSSION

Triplophysa rosa shares the following characters with other cave-dwelling *Triplophysa* species, *Triplophysa gejiuensis* (Chu & Chen), *Triplophysa xiangxiensis* Yang, Yuan & Liao, *Triplophysa yunnanensis* Yang, *Triplophysa shilinensis* Chen & Yang and *Triplophysa aluensis* (Li): eyes reduced; scales rudimentary or absent; pigmentation highly degenerated; barbels developed; nostril valve elongated into a barbel-like process; upper and lower jaws without processus dentiformis; upper lip without incision in middle of mouth; lower lip completely bisected longitudinally by a groove at dentary symphysis; all fins developed; pelvic-fin origin posterior to dorsal-fin origin; caudal-fin forked or emarginate; lateral-line complete. *Triplophysa rosa* can be distinguished from the five species by several morphometric (Table II) and morphological characters.

Artificial key to the cave-dwelling *Triplophysa* species in China

1. Body and fins with bars and blotches; tip of pelvic-fin not surpass anus. 2
Body and fins without pigment; tip of pelvic-fin surpasses anus. 3
2. Scales absent; caudal-fin forked; adipose keel absent. *T. aluensis*
Scales present; caudal-fin emarginate; adipose keel present. *T. yunnanensis*
3. Lips with furrows. 4
Lips smooth. *T. shilinensis*
4. Eyes absent; distal margin of dorsal-fin truncate; adipose keel within anterior half of caudal peduncle; branched dorsal-fin ray 7–8; branched pectoral-fin ray 9–11; branched pelvic-fin ray 6. 5
Eyes vestigial; distal margin of dorsal-fin concave; adipose keel within posterior half of caudal peduncle; branched dorsal-fin ray 9; branched pectoral-fin ray 12; branched pelvic-fin ray 7. *T. rosa*
5. Snout blunt; tip of pelvic-fin not quite reaching vertical level of anal-fin origin; tip of caudal-fin lobe blunt; branched caudal-fin ray 14–15. *T. gejiuensis*
Snout rectangle-like; tip of pelvic-fin surpassing vertical level of anal-fin origin; tip of caudal-fin lobe sharp; branched caudal-fin ray 16. *T. xiangxiensis*

According to Chu & Chen's (1979) original description of *T. gejiuensis*, it has 9–10 branched pectoral-fin rays, 5 branched pelvic-fin rays and 4–6 branched anal-fin rays. A reanalysis of the type materials of this species indicates it actually has 9–11 branched pectoral-fin rays, 6 branched pelvic-fin rays and 4–7 branched anal-fin rays. Besides the differences shown in the artificial key to the cave-dwelling *Triplophysa* species in China, *T. rosa* can be further distinguished from *T. gejiuensis* by the following characters: snout sharp *v.* blunt; tip of caudal-fin lobe sharp *v.* blunt; $L_S:BD$ 7.2 *v.* 4.9–5.7; $L_S:CPD$ 13.3 *v.* 8.8–10.8; $L_H:MW$ 4.9 *v.* 3.2–3.9; $CPL:CPD$ 2.3 *v.* 1.3–1.6; $PL:DPV(\%)$ 86.6 *v.* 58.9–72.1.

TABLE II. Comparison of morphometric characters (see Table I and footnote) among cave-dwelling *Triplophysa* fishes in China

	<i>Triplophysa</i> <i>rosa</i> sp. nov.	<i>Triplophysa</i> <i>gejuensis</i>	<i>Triplophysa</i> <i>xiangxiensis</i>	<i>Triplophysa</i> <i>yunnanensis</i>	<i>Triplophysa</i> <i>shilinensis</i>	<i>Triplophysa</i> <i>atuenis</i>
<i>L</i> _S : BD	7.2	4.9-5.7	6.1-7.0	5.9-8.2	6.4-7.5	10.2-10.3
<i>L</i> _S : <i>L</i> _H	4.1	4.3-4.7	3.1-3.7	3.9-4.1	4.0-4.4	3.6-4.5
<i>L</i> _S : CPL	5.8	6.0-7.4	5.5-7.0	5.8-6.0	5.5-6.0	5.0-6.3
<i>L</i> _S : CPD	13.3	8.8-10.8	13.3-15.2	10.5-12.2	12.0-13.6	15.7-18.3
<i>L</i> _S : PreDL	1.9	1.8-2.0	1.9-2.0	2.0-2.1	1.8-1.9	2.0-2.1
<i>L</i> _H : MW	4.9	3.2-3.9	3.2-4.0	3.8-4.2	5.6-7.2	4.4-5.2
<i>L</i> _H : BIR	4.6	3.1-5.0	5.5-6.3	4.3-6.8	3.7-4.2	4.2-5.7
<i>L</i> _H : BOR	2.3	1.8-2.3	2.7-3.3	2.1-3.1	1.8-1.9	2.2-2.6
<i>L</i> _H : BM	2.6	2.5-2.9	2.5-2.8	2.6-3.4	2.4	2.7-2.9
CPL: CPD	2.3	1.3-1.6	4.2-4.5	1.8-2.1	2.1-2.5	2.7-3.4
CUL: CML	1.5	1.5-1.6	1.3-1.6	1.2-1.3	1.5	1.3-1.5
PL: DPV(%)	86.6	58.9-72.1	122.1-198.0	61-74	62.8-63.2	54.6-83.6
D	3, 9	3, 7-8	3, 8	3, 7	3, 7	3, 7-8
P	1, 12	1, 9-11	1, 11	1, 10-11	1, 8-10	1, 9-10
V	1, 7	1, 6*	1, 6	1, 7	1, 6	1, 6-7
A	3, 6	3, 4-7	3, 6	3, 5	3, 5	3, 6
C	14	14-15	16	16	14	16

A, number of anal-fin rays; C, number of broadened caudal-fin rays; D, number of dorsal-fin rays; P, number of pectoral-fin rays; V, number of pelvic-fin rays.

Besides the differences shown in the key, *T. rosa* can be further distinguished from *T. xiangxiensis* by the following characters: snout sharp v. slight rectangle-like; tip of pelvic-fin not quite reaching vertical level of anal-fin origin v. surpasses anal-fin origin; branched caudal-fin ray 14 v. 16; $L_S:L_H$ 4.1 v. 3.1–3.7; $L_H:MW$ 4.9 v. 3.2–4.0; $L_H:BIR$ 4.6 v. 5.5–6.3; $L_H:BOR$ 2.3 v. 2.7–3.3; $CPL:CPD$ 2.3 v. 4.2–4.5; $PL:DPV(\%)$ 86.6 v. 122.1–198.0.

Besides the differences shown in the key, *T. rosa* can be distinguished from *T. yunnanensis* by the following characters: eye vestigial v. present; scales absent v. present; snout sharp v. slight rectangle-like; distal margin of dorsal-fin concave v. truncate; caudal-fin forked v. emarginate; branched dorsal-fin ray 9 v. 7; branched pectoral-fin ray 12 v. 10–11; branched pelvic-fin ray 7 v. 6; branched anal-fin ray 6 v. 5; branched caudal-fin ray 14 v. 16; $L_S:CPD$ 13.3 v. 10.5–12.2; $L_H:MW$ 4.9 v. 3.8–4.2; $CPL:CPD$ 2.3 v. 1.8–2.1; $CUL:CML$ 1.5 v. 1.2–1.3; $PL:DPV(\%)$ 86.6 v. 61–74.

There is an adipose keel within the posterior half of the caudal peduncle in the paratype of *T. shilinensis*, but it is recorded in the original description as having 'no adipose keel' (Chen *et al.*, 1992). Besides the differences shown in the key, *T. rosa* can be further distinguished from *T. shilinensis* by the following characters: eyes vestigial v. present; snout less sharp; distal margin of dorsal-fin concave v. truncate; tip of pelvic-fin not quite reaching vertical level of anal-fin origin v. reaching level of anal-fin origin; branched dorsal-fin ray 9 v. 7; branched pectoral-fin ray 12 v. 8–10; branched pelvic-fin ray 7 v. 6; branched anal-fin ray 6 v. 5; $L_H:MW$ 4.9 v. 5.6–7.2; $L_H:BIR$ 4.6 v. 3.7–4.2; $L_H:BOR$ 2.3 v. 1.8–1.9; $PL:DPV(\%)$ 86.6 v. 62.8–63.2.

Li & Zhu (2000) described *T. aluensis* from one specimen collected from Alugudong, Luxi, Yunnan. According to an examinations of the holotype and another three specimens also collected from the type locality in the same month and year, *T. aluensis* shows the following characters not reported by Li & Zhu (2000): the dorsal-fin origin is closer to the snout than the caudal-fin base; the adipose keel is present on the posterior half of the caudal peduncle in small individuals and is absent in large ones. The number of dorsal, pectoral and pelvic-fin rays are given in Table II; there are 16 branched caudal-fin rays in the holotype and all three KIZ specimens examined, compared to 13 reported in Li & Zhu (2000). Besides the differences shown in the key, *T. rosa* can be further distinguished from *T. aluensis* by the following characters: eyes vestigial v. present; snout sharp v. blunt; distal margin of dorsal-fin concave v. truncate; branched dorsal-fin ray 9 v. 7–8; branched pectoral-fin ray 12 v. 9–10; branched caudal-fin ray 14 v. 16; $L_S:BD$ 7.2 v. 10.2–10.3; $L_S:CPD$ 13.3 v. 15.7–18.3; $CPL:CPD$ 2.3 v. 2.7–3.4; $PL:DPV(\%)$ 86.6 v. 54.6–83.6.

According to Ding (1994), there is only one species of *Triplophysa* occurring in surface rivers of the Wu Jiang drainage, *Triplophysa bleekeri* (Sauvage & Dabry de Thiersant, 1874). *Triplophysa bleekeri* and *T. rosa* share some common characters such as a scaleless body; complete lateral-line; upper and lower jaws without processus dentiformis; lips thick with furrows; lower lip completely bisected longitudinally by a groove at dentary symphysis; lower jaw not covered by lower lip at dentary symphysis; dorsal-fin shorter than head. Besides all the typical features of cave fishes, eyes vestigial, barbels developed, body and fins without pigment, *T. rosa* can be further distinguished from *T. bleekeri* by the

following characters: D, 3, 9 v. 3, 7–8; P, 1, 12 v. 1, 10–11; A, 3, 6 v. 3, 5; L_S :BD 7.2 v. 5.0–6.6; L_S : L_H 4.1 v. 4.3–5.1; L_S :CPD 13.3 v. 5.1–7.8; CPL:CPD 2.3 v. 1.2–2.0; anterior nostril elongated into a barbel-like process v. valve-like; distal margin of dorsal-fin concave v. truncate; dorsal-fin origin closer to snout tip than to caudal-fin base v. closer to caudal-fin base than to snout tip; tip of pectoral-fin close to pelvic-fin origin v. reaching midpoint of the distance from pectoral-fin origin to pelvic-fin origin; tip of pelvic-fin surpasses anus v. not reaching level of anus; caudal-fin deeply forked v. emarginate.

The distribution pattern of the six cave-dwelling *Triplophysa* species is interesting. *Triplophysa xiangxiensis* occurs in western Hunnan; *T. rosa* in south-eastern Chongqing; *T. gejiuensis*, *T. yunnanensis*, *T. shilinensis* and *T. aluensis* are in eastern Yunnan. All these regions have developed karst limestone caves. Surface waters usually connect with underground rivers and springs and form complicated water networks. Given the small population sizes of cave-dwelling fishes, the relatively isolated habitat, and the difficulty in observing the ethology of the species, very little is known of their ecology, preferred habitat, breeding and ontogeny. Species of *Triplophysa* mainly inhabit the Qinghai-Tibet Plateau and its adjacent regions. The karst environment provides very different habitats from surface water bodies for these loaches; it is possible that in process of acclimating to underground limestone cave-living the ancestors of these loaches gradually attained some cave-dwelling features. Among these six species of cave-dwelling *Triplophysa* loaches, the degree of degeneration of eyes and development of sense organs and fins is quite different. This suggests that they probably attain these features respectively by adapting to more or less different environments. A phylogenetic study is required to test this hypothesis in the future. As very little is known about the biogeography of caves in Yunnan, Guizhou, Guangxi and adjacent regions, it is possible that there are still more new species of cave-dwelling fishes awaiting discovery.

COMPARATIVE MATERIAL

Triplophysa aluensis (Li), holotype, Heilongtan Reservoir of Shilin County, Yunnan 20000620001, 1 ex., 75.2 mm L_S , Alugudong (=Alu ancient cave), Luxi County, Yunnan, China, June, 2000; KIZ 20006005–007, 3 ex., 43.9–83.2 mm L_S , collected at the same locality and at the same month and year.

Triplophysa gejiuensis (Chu & Chen), paratypes, KIZ 7803002–005, 007–008, 5 ex., 39.3–48.5 mm L_S , Bajiaoqing, Kafang, Gejiu City, Yunnan, China, March, 1978.

Triplophysa shilinensis Chen & Yang, holotype, KIZ 913001, 1 ex., 61.0 mm L_S ; paratype, KIZ 913002, 1 ex., 60.0 mm L_S , a subterranean cave in Weiboyi Village, near Stone Forest, Lunan County, Yunnan, China, March, 1991.

Triplophysa xiangxiensis (Yang, Yuan & Liao), paratype 863001, 1 ex., 79.4 mm L_S , Feihu (=flying tiger) cave, Huoyan Twonship, Longshan County, Hunan, China, March, 1986, presented by Yang Ganrong and now kept in KIZ; KIZ 9705001–005, 5 ex., 50.3–102.4 mm L_S , Panon (=Panlong) cave and Xiao (=small) cave, Huoyan Twonship, Longshan County, Hunan, China, May, 1997.

Triplophysa yunnanensis Yang, holotype, KIZ 874200, 1 ex., 62.8 mm L_S , paratypes, KIZ 874197, 874199, 2 ex., 50.0, 64.3 mm L_S , Jiuxiang, Yiliang, Yunnan, China, April, 1987; 3 examined, KIZ 9405201-03, 52.2-73 mm L_S , Jiuxiang, Yiliang, Yunnan, China, May, 1994.

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