

A new cave species of the Genus *Triplophysa* from Yunnan, China

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ABSTRACT

In September and October 2015, a new species of the family Nemacheilidae, *Triplophysa tianxingensis* sp. nov., was discovered from underground water in Qiubei County, Yunnan Province, China. It can be distinguished from all other troglomorphic *Triplophysa* species occurring in Yunnan by the following combination of characters: eyes small, a little degenerated; barbels longer; ventral profiles greatly convex; pectoral fin short, attaining a third of the distance from the pectoral-fin base to pelvic fin base; body with many brown blotches; caudal peduncle with fin fold; caudal fin shallowly forked, and free posterior chamber of swim bladder cylindrical.

Keywords: *Triplophysa*; Cave fish; New species; Yunnan

INTRODUCTION

The genus *Triplophysa* Rendahl, 1933, one of the largest in the family Nemacheilidae, comprises 170 currently recognized species, with most occurring in the Qinghai-Tibet Plateau and its adjacent regions (Froese & Pauly, 2016; Zhu, 1989). The genus *Triplophysa* is distinct from other genera by the following combination of characters: close together nostrils, dumbbell-shaped bony bladder, bony posterolateral bladder capsule, and marked sexual dimorphism. In males, the lateral sixth to eighth branched rays of the pectoral fins are thickened, broadened and covered by breeding tubercles; breeding tubercles are also present on the sides of the head, extending from the eye almost to the insertion of the maxillary barbels (Yang, 1990; Zhu, 1989). Species divergence is very high in numerous isolated rivers and lakes. Due to their small body size and little interest to the fishery industry, their taxonomy has lagged compared with other larger-sized fish, and many undescribed species have been discovered in recent years. This genus occurs widely in central Asia, from Afghanistan and Baluchistan through the High Asian

Region to the Balkhash and Uvs-Nuur lakes, Outer Mongolia and China. In China, in addition to the Qinghai-Tibetan plateau and Inner Mongolia, the genus also occurs in Sichuan, Yunnan, Chongqing, Hunan, Guizhou and Guangxi provinces. To date, only seven troglomorphic *Triplophysa* species have been described in the Yunnan Province, namely, *T. gejiuensis* Chu & Chen (1979), *T. nanpanjiangensis* Zhu & Cao (1988), *T. shilinensis* Chen et al. (1992), *T. aluensis* Li & Zhu (2000), *T. yunnanensis* Yang (1990), *T. xiangshuiqingensis* Li (2004), and *T. qiubeiensis* Li et al. (2008). Among them, six species demonstrate degenerated small eyes or no eyes at all.

In September and October 2015, we collected specimens of the genus *Triplophysa*, representing an undescribed species, from a seasonal pond connected to subterranean waters in Longtao Village (altitude: 1 257 m), Tianxing Township, Qiubei County, Yunnan Province, China (Figure 1). We herein provide a description of the new species and comparison to other troglomorphic *Triplophysa* species occurring in Yunnan.

MATERIALS AND METHODS

Specimens were collected with a cage net and were fixed in 10% formalin and then transferred to 75% ethanol for long-term storage. Fish were cataloged and stored in the collections of the Heilongtan Reservoir of Shilin County (20151002001-6, 20151004001, 20151004002) and the Kunming Institute of Zoology, Chinese Academy of Sciences (2015005390, 2015005391).

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Figure 1 Sampling site of *Triplophysa tianxingensis* (marked with *)

Measurements were taken point to point with digital calipers and data were recorded to 0.1 mm. Counts and measurements were made on the left side of specimens whenever possible. Methods of counts and measurements followed Kottelat (1990) and Chu & Chen (1989). Subunits of the head are percentages of head length (HL). Head length itself and measurements of body parts are expressed as proportions of standard length (SL).

RESULTS

Triplophysa tianxingensis sp. nov. (Figures 2, 3)

Holotype

20151002001, 118.0 mm SL, 136.0 mm total length; seasonal pond connected to subterranean waters in Longtao Village, N23°56'29.0"; E104°13'04.0" (altitude: 1 257 m), Tianxing Township, Qiubei County, Yunnan Province, China.

Paratypes

20151002002-6, 20151004001-2, (2015005390, 2015005391),



Figure 2 *Triplophysa tianxingensis* sp. nov. (20151002001, 118.0 mm SL)
A: Lateral view; B: Ventral view; C: Dorsal view.



Figure 3 Head of *Triplophysa tianxingensis* sp. nov. (20151002001, 118.0 mm SL)

A: Lateral view; B: Ventral view; C: Dorsal view.

70.0-114.0 mm SL, 81.0-132.0 mm total length; nine specimens, collected with holotype.

Diagnosis

This species can be distinguished from all other troglobiotic *Triplophysa* species occurring in Yunnan by the following combination of characters: eyes small, a little degenerated; barbels longer; ventral profiles greatly convex; pectoral fin short, attaining one third of the pelvic fin base; body with many brown blotches; caudal peduncle with fin fold; caudal fin shallowly forked, free posterior chamber of swim bladder cylindrical.

Description

Dorsal fin iii, 8; anal fin ii, 5; pectoral fin i, 9; pelvic fin i, 5; caudal fin with 16 branched rays; 2+12~13 gill rakers on the outside of the first gill arch (two specimens); 4+38 vertebrae (two specimens).

Proportional measurements of *Triplophysa tianxingensis* sp. nov. are shown in Table 1. Body elongated; cylindrical anteriorly and a little compressed posteriorly; dorsal profile slightly convex and ventral surface distinctly convex. Dorsal-fin origin near midpoint of body, somewhat closer to caudal-fin base than to

snout tip. Head slightly depressed, profile of head triangular, width greater than height at nape; head length greater than body depth. Snout obtuse and depressed, length less than postorbital length of head. Nose valve triangular. Both anterior and posterior nares close together, the latter larger than the anterior one and enclosing anterior posteriorly; anterior nostril pierced in the front side of a flattened tube; its tip reaching the posterior margin of the posterior nostril. Interorbital space convex. Mouth inferior and arched. Both lips thick and well-developed, with a few very shallow furrows. Lower lip broad, with a median notch. No processus dentiformis presenting on upper jaw, no corresponding notch on lower jaw. Eyes small and not visible in ventral view. Inner rostral barbel reaching vertical of the anterior margin of the nostril; outer rostral barbel surpassing vertical of the posterior margin of the eye. Maxillary barbel surpassing vertical of the posterior margin of the eye. Bony capsule of the airbladder dumbbell-shaped, posterior process cylindrical. Intestine simple, with no coil. Peritoneum light yellow ventrally and yellow gray dorsally.

Table 1 Proportional measurements of *Triplophysa tianxingensis* sp. nov.

ID number	2015100	2015100	2015100	2015100	2015100	2015100	2015100	2015100	2015005	2015005	Range	Mean
	2001	2002	2003	2004	2005	2006	4001	4002	390	391		
Total length	136.0	120.0	126.0	132.0	123.0	130.0	121.0	109.0	81.0	100.0	81.0-136.0	117.8
Standard length (SL)	118.0	105.0	111.0	114.0	108.0	112.0	106.0	93.0	70.0	86.0	70.0-118.0	102.3
Percentage of SL												
Head length (HL) (%)	22.9	21.9	21.6	21.9	21.3	21.4	21.7	23.7	21.4	23.3	21.3-23.3	22.1
Body depth at dorsal fin origin (%)	16.9	14.3	16.2	16.7	18.5	16.1	17.0	18.3	15.7	17.4	14.3-18.5	16.7
Predorsal length (%)	55.9%	57.1	52.3	54.4	53.7	52.7	53.8	57.0	52.9	57.0	52.3-57.0	54.7
Caudal peduncle length (%)	18.6	19.0	19.8	19.3	19.4	17.0	20.8	17.2	20.0	18.6	17.0-20.8	19.0
Caudal peduncle depth (%)	9.3	10.5	9.9	10.5	10.2	8.9	9.4	9.7	10.0	10.5	8.9-10.5	9.9
Percentage of HL (%)												
Snout length	44.4	50.0	43.8	46.0	43.5	41.7	43.5	40.9	40.0	45.0	40.0-50.0	43.9
Eye diameter	5.6	6.5	6.3	6.0	4.3	4.2	4.3	4.5	6.7	5.0	4.2-6.7	5.3
Interorbital width	22.2	30.4	20.8	24.0	21.7	20.8	17.4	18.2	23.3	20.0	17.4-24.0	21.9
Percentage of caudal peduncle length												
Caudal peduncle depth (%)	50.0	55.0	50.0	54.5	52.4	52.6	45.5	56.3	50.0	56.3	50.0-56.3	52.3

Distal margin of dorsal fin truncate. Pectoral fin extending about one third of the distance between the pectoral and pelvic fin origins. Axillary pelvic lobe present as vestige, indistinct. Pelvic fin reaching near half the distance between the pelvic and anal fin origins. Tip of the pelvic fin not attaining anus. Anus situated in front of anal fin origin, in the middle distance between the posterior tip of the pelvic fin and anal fin origin. Caudal fin shallowly forked, tips round.

Skin smooth, no scales on the whole body. Lateral line complete, straight.

Sexual dimorphism

No sexual dimorphism was observed in the ten specimens.

Usually, sexual dimorphism can be seen in mature individuals of *Triplophysa* species, namely, the pre-suborbital area might be thickened, and the pectoral fin might become broadened, thickened, stiffened and covered by blunt tubercles. These phenomena were not present in the ten individuals of *T. tianxingensis* sp. nov., which could be due to the sampling time being outside the propagation season of the species.

Color pattern

Color in life. Ground color of body light yellow, slightly lighter ventrally. Body with many brown blotches. Dorsal fin dark gray, with no distinct transverse gray bars. Caudal fin with three indistinct brownish transverse bars. Pectoral fin gray dorsally and pale ventrally. Pelvic and anal fin pale. Rostral barbel

brown to yellow. Maxillary barbel light yellow (Figure 4).



Figure 4 Live specimens of *Triplophysa tianxingensis* sp. nov.

Color in formalin. Ground color of body light yellow, slightly lighter or pale ventrally. Body with many brown blotches. Dorsal fin dark grey, with no distinct transverse bars. Caudal fin with three indistinct dark brownish transverse bars. Pectoral fin gray. Pelvic and anal fin light grey. Rostral barbel dark grey. Maxillary grey (Figure 2).

Habitat description

This species was collected from a seasonal pond connected to subterranean waters in Longtao village, N23°56'29.0"; E104°13'04.0"(altitude: 1 257 m), Tianxing Township, Qiubei County, Yunnan Province, China. Water temperature 22 °C, 13: 00 pm, Oct., 2nd, 2015. This region is famous for its well-developed karst landforms, as well as seasonal and subterranean rivers. These special geological conditions might provide very limited habitat for each species in this area (Figure 5A, B).

Distribution

So far, this species is known only from the type locality (Figure 5A, B). This seasonal pond is connected with subterranean waters belonging to the Qingshuijiang River basin (a tributary of the Nanpanjiang River, upper reaches of the Pearl River).

Etymology

The specific name, *tianxingensis* (天星), is based on the Tianxing Township sampling site, but is also an allusion to the unique color pattern of *T. tianxingensis* sp. nov., specifically, the striking brown blotches resembling stars (tianxing means stars in the sky in Chinese).

DISCUSSION

By 2008, seven troglotrophic *Triplophysa* species had been described in Yunnan Province, namely, *T. gejiuensis* Chu & Chen (1979), *T. nanpanjiangensis* Zhu & Cao (1988), *T. shilinensis* Chen et al. (1992), *T. aluensis* Li & Zhu (2000), *T. yunnanensis* Yang (1990), *T. xiangshuiqingensis* Li (2004), and



Figure 5 Habitat of *Triplophysa tianxingensis* sp. nov.

A: Seasonal pool; B: Dry cave through which the seasonal pool connects with subterranean waters.

T. qiubeiensis Li et al. (2008). Among them, six demonstrate degenerated small eyes or no eyes at all. The new species described in this paper can be differentiated from *T. qiubeiensis*, *T. gejiuensis* and *T. shilinensis* by the character of degenerated, but distinct eyes; differentiated from *T. nanpanjiangensis*, *T. aluensis*, *T. yunnanensis* and *T. xiangshuiqingensis* by the profile of head triangular and caudal peduncle with fin fold.

An identification key is summarized below based on the of external characters of the eight troglotrophic *Triplophysa* species occurring in Yunnan.

Key to eight troglotrophic *Triplophysa* species occurring in Yunnan:

- 1(6) Eyes completely degenerated
- 2(3) Head conical, nose valve triangular (Qiubei, Yunnan).....
.....*T. qiubeiensis* Li et Yang
- 3(2) Head a little flat, nose valve beared
- 4(5) Pelvic fin i, 5; anus situated immediately in front of anal fin origin (Gejiu, Yunnan) *T. gejiuensis* Chu et Chen
- 5(4) Pelvic fin i, 6; length between anus and anal fin origin about 1-2 mm (Shilin, Yunnan)..... *T. shilinensis* Chen et Yang
- 6(1) Eyes normal or a little degenerated, small
- 7(8) Eyes normal (Zhanyi, Yunnan).....
..... *T. nanpanjiangensis* Cao et Zhu

8(7) Eyes a little degenerated, small
 9(14) Head depressed or a little depressed, caudal peduncle with no fin fold
 10(11) Anterior part of body depressed (Luxi, Yunnan)
 *T. aluensis* Li et Zhu
 11(10) Anterior part of body cylindrical
 12(13) Posterior part of body with small scales (Yiliang, Yunnan)..... *T. yunnanensis* Yang

13(12) No scales on body (Shilin, Yunnan)
 *T. xiangshuiqingensis* Li
 14(9) Profile of head triangular, caudal peduncle with fin fold (Qiubei, Yunnan).....
 *T. tianxingensis* Li, Yang et Chen, sp. nov.

Comparisons of the characters among the eight troglotic *Triplophysa* species occurring in Yunnan are presented in Table 2.

Table 2 Comparisons of characters among the eight troglotic *Triplophysa* species occurring in Yunnan

	<i>T. nanpanjiangensis</i>	<i>T. gejiuensis</i>	<i>T. yunnanensis</i>	<i>T. shilinensis</i>	<i>T. aluensis</i>	<i>T. xiangshuiqingensis</i>	<i>T. qiubeiensis</i>	<i>T. tianxingensis</i>
Specimens	5	8	5	2	1	1	11	10
Sampling site	Zhanyi	Gejiu	Yiliang	Shilin	Luxi	Shilin	Qiubei	Qiubei
Dorsal fin	iii, 7-8	iii, 7-8	iii, 7	iii, 7	iii, 7	iii, 6	iii, 7	iii, 8
Anal fin	ii, 5	iii, 4-6	iii, 5	iii, 5	iii, 5	iii, 5	iii, 5	ii, 5
Pectoral fin	i, 9-10	i, 10-11	i, 9-10	i, 8-10	i, 9	i, 9	i, 7-9	i, 9
Ventral fin	i, 6	i, 5	i, 7	i, 6	i, 6	i, 6	i, 5	i, 5
Caudal-fin rays	16	14-15	15-16	14	13	14	14-15	16
Scales	Absent	Absent	Present	Absent	Absent	Absent	Absent	Absent
Head shape	Depressed	Depressed	Depressed	Depressed	Depressed	Depressed	Conical	Triangular
Anterior part of body	Cylindrical	Cylindrical	Cylindrical	Cylindrical	Depressed	Cylindrical	Cylindrical	Cylindrical
Eyes	Normal	Completely degenerated	Small	Completely degenerated	Degenerated	Small	Completely degenerated	Small
Caudal fin	Emarginate	Forked	Emarginate	Forked	Forked	Forked	Forked	Shallowly forked
Distal margin of dorsal fin	Truncate	Truncate	Emarginate	Truncate	Truncate	Emarginate	Emarginate	Truncate
Bar/Blotch	Present	Absent	Present	Absent	Present	Present	Absent	Present
Position of dorsal fin origin	Closer to snout tip	Closer to caudal fin base	At midpoint of body	Closer to caudal fin base	At midpoint of body	Closer to snout tip	At midpoint of body	Closer to caudal fin base
Fin fold	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present

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