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***Triplophysa pseudostenura*, a new nemacheiline loach (Cypriniformes: Balitoridae) from the Yalong River of China**

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Abstract

A new species of nemacheiline loach, *Triplophysa pseudostenura*, is described from the Yalong River, a tributary of the upper Yangtze River drainage in China. Previous collectors misidentified the species as *T. stenura*. *Triplophysa pseudostenura* can be separated from *T. stenura* and other valid species of *Triplophysa* by the following combination of characters: body smooth and without scales; head tapering; lips thin and smooth; trunk and caudal peduncle slender, laterally compressed; depth of caudal peduncle tapering posteroventrally approaching caudal fin; posterior chamber of gas bladder reduced or absent; intestine short, forming a zigzag loop posterior to bottom of 'U'-shaped stomach; insertion of pelvic fins anterior to dorsal-fin origin; caudal fin deeply concave.

Key words: Teleost, new species, Upper Yangtze River, fish

Introduction

The genus *Triplophysa* is a species-rich group in the subfamily Nemacheilinae, and is currently hypothesized to have 126 species, 108 of which are thus far known from China (He 2008; He *et al.* 2008; Xu & Wang 2009; Zheng *et al.* 2010; Froese & Pauly 2012). Species of the genus occur primarily in the Qinghai-Tibet Plateau and adjacent areas (Zhu 1989; Ding 1994). They are known to occur in the upper and middle Yangtze, Red, Yellow, and Pearl river drainages of China, upper Indus and Tigris river drainages of western Asia, and in river drainages of Central Asia (Zhu 1989; Zhou & Cui 1997). Species of the genus are uniquely distinguished from those of other genera in possessing marked sexual dimorphism: males have breeding tubercles, elevated skin on both sides of the head, and a thickened tuberculate pad on the dorsal surface of the outer broadened pectoral-fin rays (Zhu 1989; Li *et al.* 2007; Prokofiev 2007).

Surveys by our team from 2004 to 2007 throughout the Yalong River yielded an unidentified species of *Triplophysa*. Following comparisons with Yalong River specimens deposited in the Museum of Aquatic Organisms at the Institute of Hydrobiology, Chinese Academy of Sciences (IHB), the unidentified species could not be distinguished from IHB specimens originally identified as *T. stenura* (Herzenstein). After further study and analysis, these unidentified specimens were determined to represent a distinct species described herein.

Materials and methods

All counts and measurements of captured and museum specimens follow methods outlined by Prokofiev (2007) and He *et al.* (2008). Measurements were taken point to point to the nearest 0.1 mm with digital calipers. Head depth was measured at its greatest depth; prepectoral length was measured from snout tip to pectoral-fin origin; postorbital length was measured from the posterior margin of the eye to the posterior edge of operculum;

postdorsal length of head was measured from the base of the last dorsal ray to the caudal base; depth and width of caudal peduncle were both taken at its narrowest part; vent-anal distance was taken from the vent to anal-fin origin.

Materials examined were deposited in the collection of the Museum of Aquatic Organisms at the Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan. Abbreviations used in this paper are: SL, standard length; HL, head length.

***Triplophysa pseudostenura* sp. nov.**

(Figures 1, 2, 3)

Holotype. IHB 20070703001, male, 120.3 mm SL, Yalong River (tributary of upper Yangtze River drainage), at Gala village (99°58'2.20"E, 31°37'2.76"N; 3350 m above sea level), Ganzi County, Ganzi Prefecture, Sichuan Province, China, July 3, 2007, collected by Chunlin He, Peng Cheng and Deqing Tan.

Paratypes. Twenty-nine paratypes. IHB 20070703002–006, 20070703017–018, 53.4–103.7 mm SL, paratopotypes; IHB 820819–20, 820824, 820826–28, 820831, 820833, 79.9–140.8 mm SL, Xianshui River (tributary to Yalong River), Luhuo County, Ganzi Prefecture, August, 1982; IHB 820705, 820707, 820714, 820717, 820724, 820733, 83.4–132.1 mm SL, Xianshui River (tributary to Yalong River), Daofu County, Ganzi Prefecture, July, 1982; IHB 821158, 821203, 821205, 821208, 821214, 821218, 821241, 821249, 118.0–142.0 mm SL, Yalong River, Dege County, Ganzi Prefecture, June, 1982.

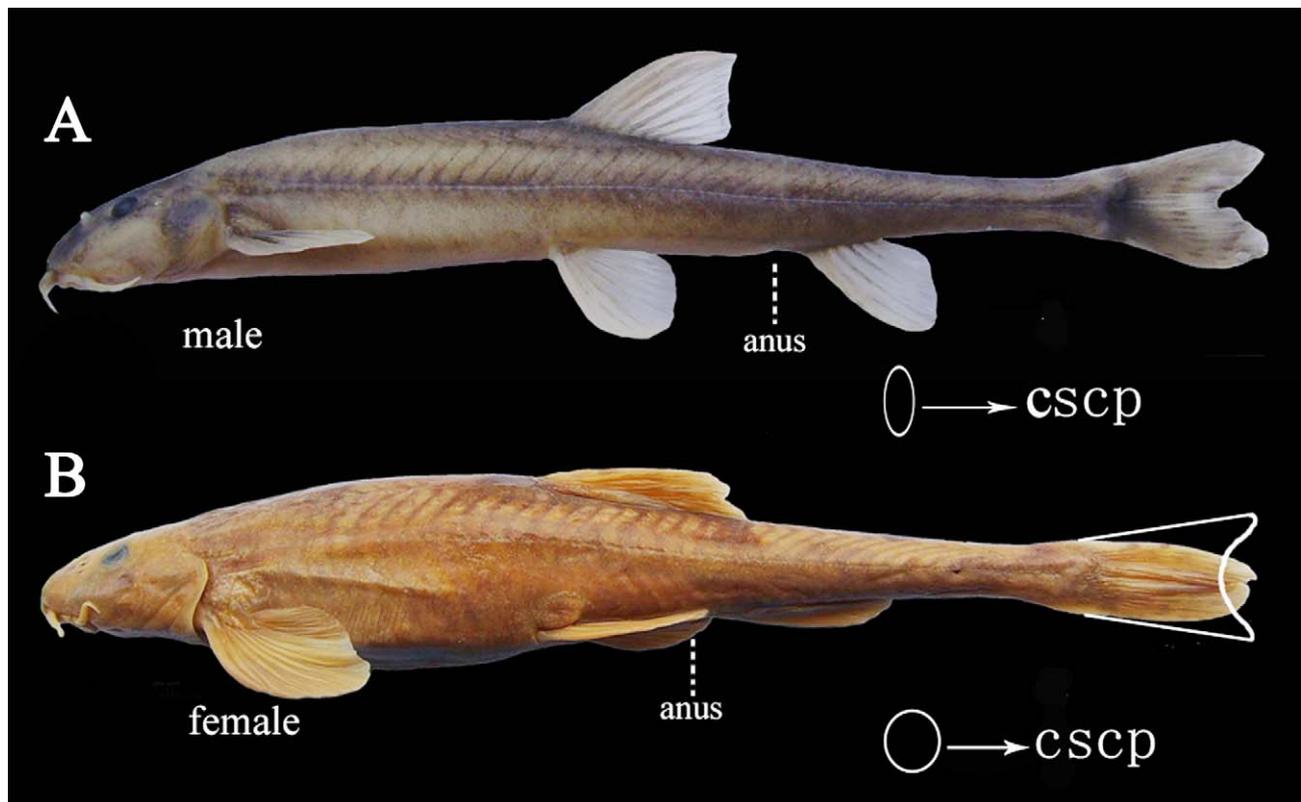


FIGURE 1. Lateral views of (A) *Triplophysa pseudostenura*, IHB 20070703001, 120.3 mm SL, and (B) *Triplophysa stenura*, IHB 880022, 106.4 mm SL. Note: cscp = cross-section of caudal peduncle of *T. pseudostenura* (top) and *T. stenura* (below).

Diagnosis. Body smooth and without scales; head tapering and relatively narrow (head width 47.6–54.0% HL); eye small (eye diameter 12.1–17.6% HL); lips thin and smooth; trunk slender and laterally compressed; caudal-peduncle length 20.0–23.8% SL; caudal peduncle slender, laterally compressed (cross-section of caudal peduncle elliptic), and tapering, with trunk towards the base of caudal fin; pelvic fin insertion anterior to dorsal-fin origin; dorsal-fin origin closer to caudal-fin base than to snout tip; caudal fin deeply concave; lateral line complete; posterior chamber of gas bladder reduced or absent; intestine short, in zigzag pattern posterior to bottom of 'U'-shaped stomach (= stomach-like structure *sensu* Zhu 1989).

Description. Meristic and morphometric characteristics are provided in Table 1. General appearance and characteristics of head, mouth and intestine are provided in Figures 1A, 2A, 2C, 3A, and 3B. Body elongate, smooth and without scales. Anterior portion of trunk very slender and laterally compressed and with a uniform body depth. Posterior trunk without uniform depth but tapering sharply posteriorly towards caudal-fin base, especially along the caudal peduncle. Caudal peduncle slender, laterally compressed and with elliptical-shaped cross-section; caudal peduncle lowest at posterior 2/3 portion. Predorsal body straight; dorsal-fin base and postdorsal profile oblique. Ventral profile of head horizontal; trunk laterally compressed from breast area to caudal-fin base; anal-fin base straight; postanal profile slightly concave. Lateral line complete, running along middle of flank.

TABLE 1. Morphometric characteristics for *Triplophysa pseudostenura*.

Morphometric characters	Holotype	Paratypes (n = 29)			
		Min	Max	Mean	SD
SL (mm)	120.3	53.4	142		
In % SL					
Body depth	12.6	11.7	16.6	13.7	1.2
Body width	9.9	10.1	11.9	11.1	0.7
Head length (HL)	22.5	20.8	26.3	23.0	1.3
Dorsal-fin length	14.0	16.2	22.2	18.3	1.3
Pectoral-fin length	15.8	14.6	18.6	16.6	1.0
Pelvic-fin length	13.8	13.3	17.8	14.8	1.0
Anal-fin length	14.0	13.6	17.3	15.4	0.9
Caudal-fin length	15.8	15.9	19.0	17.4	0.9
Predorsal length	51.6	49.7	54.9	52.7	1.2
Prepectoral length	22.5	20.6	25.9	22.6	1.4
Prepelvic length	49.1	48.0	52.6	50.4	1.2
Preanal length	70.8	68.4	73.7	70.5	1.3
Postdorsal length	40.7	36.0	47.5	38.9	2.1
Pecto-ventral distance	29.0	27.4	30.6	29.0	0.9
Ventro-anal distance	22.4	18.7	22.7	20.6	1.1
Caudal-peduncle length	21.9	20.0	23.8	22.0	1.0
HL (mm)	27.1	13.6	30.7		
In % HL					
Head depth	44.5	40.1	49.8	45.1	2.2
Head width	52.7	47.6	54.0	50.8	2.6
Snout length	46.8	37.7	48.3	44.6	2.1
Inner rostral barbel length	21.4	17.6	26.7	22.0	2.3
Outer rostral barbel length	36.5	28.9	40.3	34.5	2.9
Maxillary barbel length	30.6	29.8	44.8	35.5	3.3
Eye diameter	12.1	10.7	17.6	14.2	1.8
Postorbital length	44.8	42.6	55.6	46.1	2.5
Interorbital width	19.7	18.3	23.0	20.3	1.1
Vent-anal distance	14.1	9.5	12.9	11.0	1.2
Caudal-peduncle depth/length	20.1	18.9	27.1	22.9	2.0
Caudal-peduncle width/depth	50.9	44.1	68.5	54.8	7.1

Head depressed, depth less than width, and nearly triangular in shape when viewed dorsally. Snout acuminate, nearly equal to or slightly less than postorbital head length; interorbital space slightly convex. Eye small and near

dorsal profile of head; positioned near midpoint of head. Nostrils closer to anterior margin of eye than to snout tip; anterior and posterior nostrils closely spaced; anterior nostrils smaller than posterior nostrils and pierced at extremity of short tube.

Mouth inferior, horse-shoe shaped. Lips thin; upper lip smooth or slightly furrowed (furrows deepening near corner of mouth) and without median incision. Lower lip with well-marked median incision, slightly furrowed medially and smooth laterally. Upper jaw covered by upper lip; lower jaw scoop-shaped and uncovered medially by lower lip. Barbels in three pairs; inner rostral pair reaching corners of mouth or bases of maxillary barbels; outer rostral pair extending slightly beyond nostrils; maxillary pairs reaching posterior margins of eyes.

Dorsal-fin rays iii/7–8; pectoral-fin rays i/10–12; pelvic-fin rays i/6–7; anal-fin rays ii/5; caudal-fin rays 8–9+8 = 16–17 branched rays. Dorsal fin with truncate distal margin; origin slightly closer to caudal-fin base than to snout tip; posterior end of dorsal-fin base opposite midpoint between pelvic-fin insertion and vent; tip of depressed dorsal-fin rays extending anterior to anal-fin origin. Tip of pectoral fin acuminate, reaching or nearing midway to pelvic-fin insertion. Pelvic-fin insertion midway between snout tip and caudal-fin base, or slightly anterior to dorsal-fin origin; tip of pelvic fin not extending to anus. Anus midway between the tip of pelvic fin and anal-fin origin; distance between anus and anal-fin origin subequal to eye diameter. Distal margin of anal fin truncate or slightly concave, reaching midway to caudal-fin base; anal-fin origin closer to pelvic-fin insertion than to caudal-fin base. Caudal fin deeply concave; lower lobe subequal to or slightly longer than the upper; longest branched ray of lower lobe 5/3–4/3 times of median ray.

Gas bladder bipartite; anterior chamber enclosed in dumbbell-like bony capsule and posterior chamber greatly reduced or absent. Intestine short, forming a zigzag loop just below the bottom of the ‘U’-shaped stomach (Figs. 3A, B), 1.7 times as long as SL.

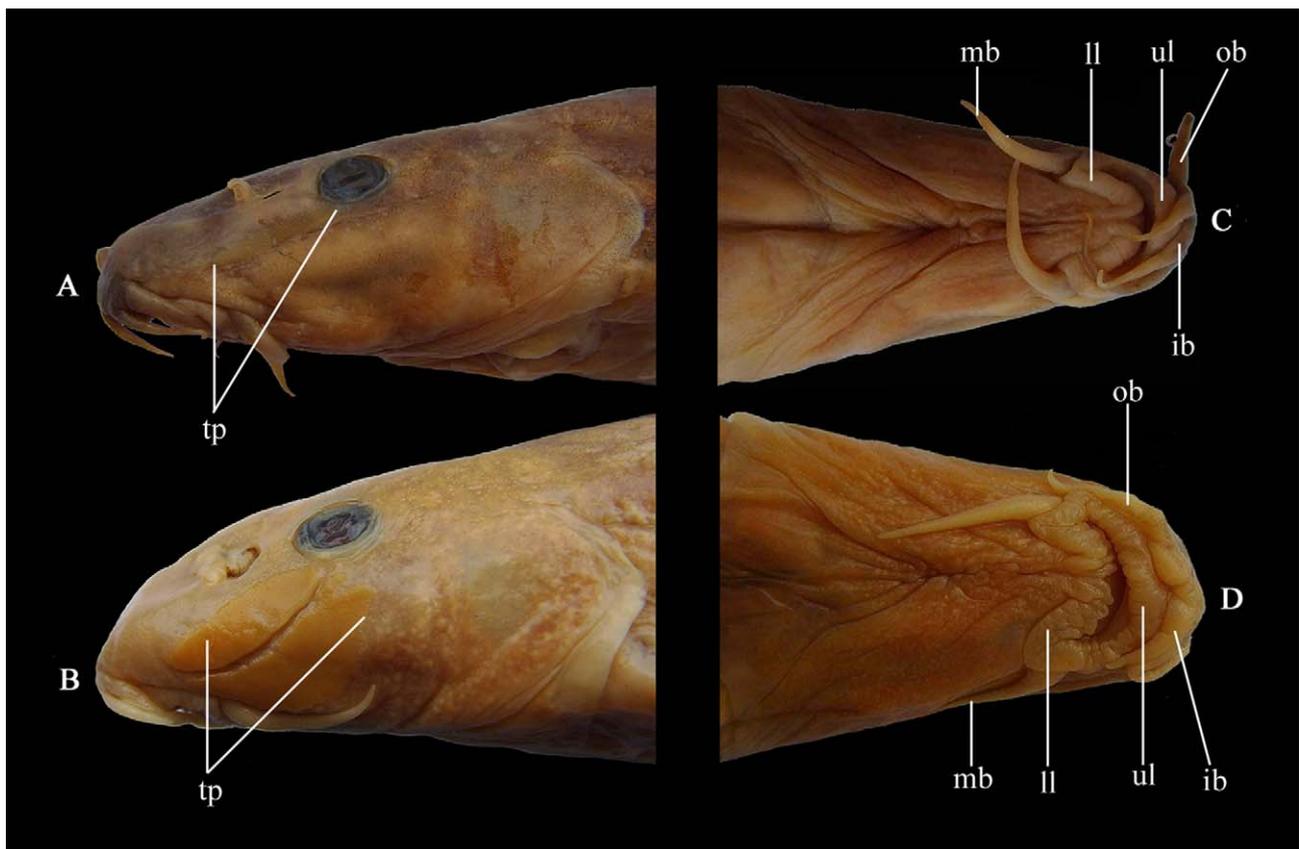


FIGURE 2. Heads of *Triplophysa pseudostenura* and *T. stenura*. (A) *T. pseudostenura*, paratype, IHB 821214, 118.0 mm SL, male, lateral view. (B) *T. stenura*, topotype, IHB 880025, 114.7 mm SL, male, lateral view. (C) *T. pseudostenura*, paratype, IHB 821214, 118.0 mm SL, male, ventral view. (D) *T. stenura*, topotype, IHB 880020, 115.6 mm SL, male, ventral view. Note: tp = tubercle pads on both sides of head, ib = inner rostral barbel, ob = outer rostral barbel, mb = maxillary rostral barbel, ul = upper lip, ll = lower lip.

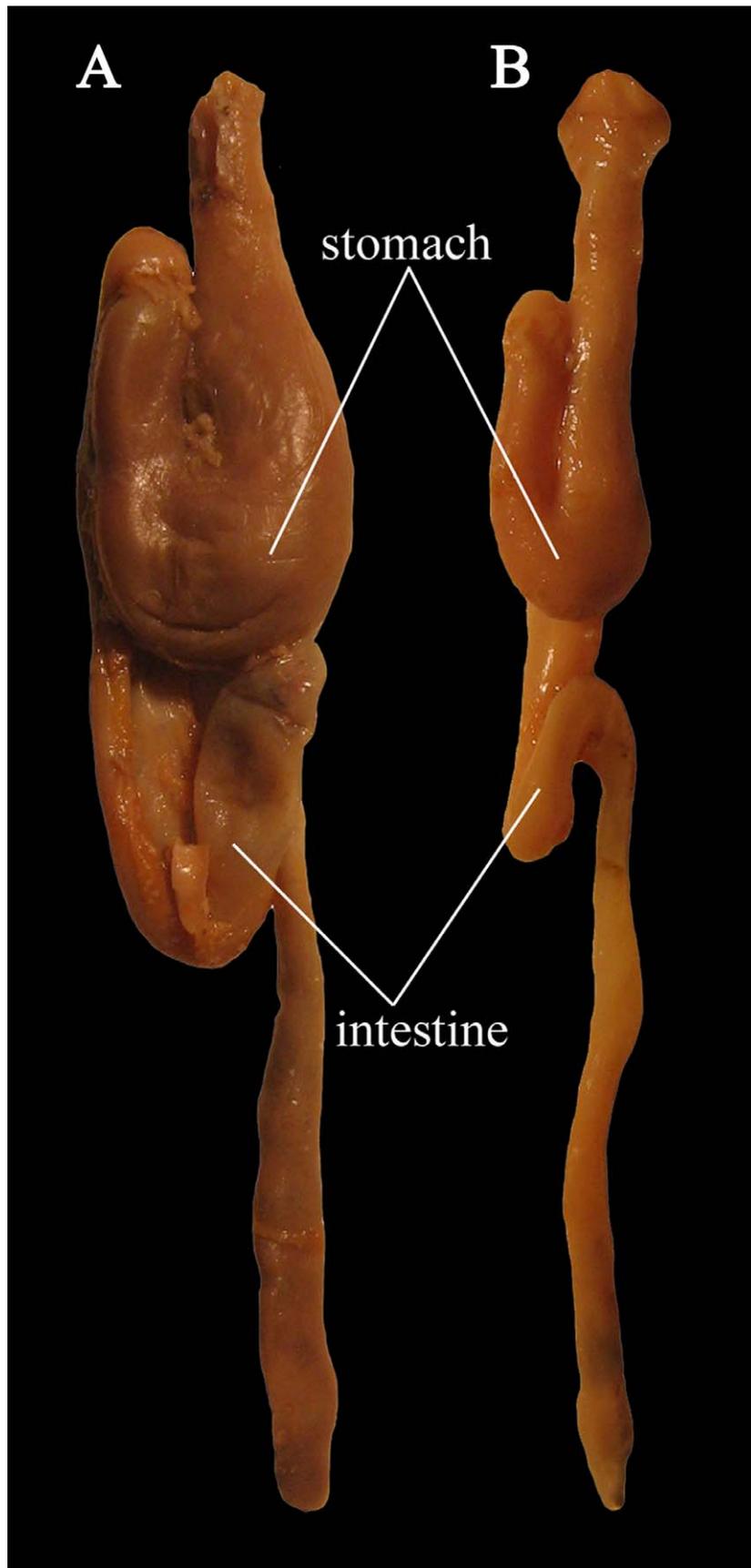


FIGURE 3. Abdominal view of intestine of *Triplophysa pseudostenura*. (A) IHB 820828, (B) IHB 821214.

Sexual dimorphism. Brush-like pads of tubercles present on the heads of males. Males possess a weakly delimited pad of minute, granular tubercles on each side of preorbital region (Fig. 2A), and have broadened and thickened external (the first 6 or 7) branched pectoral-fin rays, dorsally covered by small, round and condensed epidermal tubercles. In females tip of pectoral fin acuminate and length is subequal to or slightly longer than that of males. Females without tubercles on head and pectoral-fin rays.

Coloration. Trunk and dorsum of living fish gray and venter white. All fins hyaline; anterior part of caudal fin slightly gray. In formalin-preserved specimens, head and body yellowish-brown. Dorsum of body fawn; head, upper half of flank above the lateral line light yellowish; lower half of flank below the lateral line and abdomen flaxen. Upper half of body above lateral line with eight to nine beige transverse bars. Both sides of head and abdomen yellowish, and with no bars or spots present. Dorsal and caudal fins fulvous with some brown spots. Pectoral fins of females flaxen and slightly hyaline; in males pectoral fins fulvous and hyaline along inner distal margin. Pelvic and anal fins flaxen and hyaline; each with dusky basal portion on dorsal surface of outside rays.

Distribution. Occurs in the main stream of Yalong River between Dege and Yajiang counties, and the Xianshui River, a tributary of the Yalong River, between Luhuo and Yajiang counties (Fig. 4).

Etymology. Derived from Greek “pseudo”, alluding to the fact that the species, *T. pseudostenura*, was first misidentified as *Triplophysa stenura*.

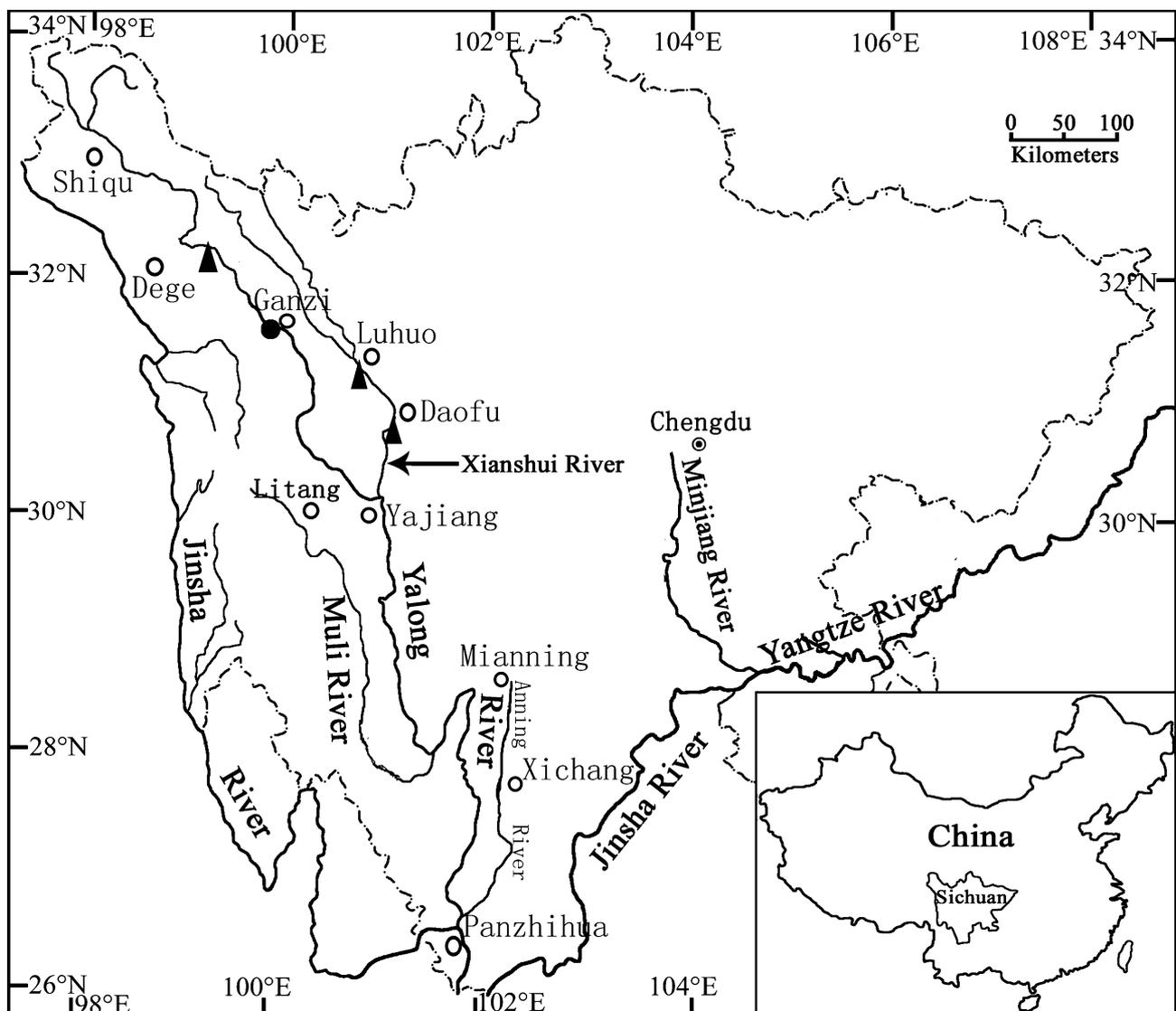


FIGURE 4. Collection sites for the holotype (solid circle) and paratypes (solid triangles) of *Triplophysa pseudostenura*.

Discussion

The new species *Triplophysa pseudostenura* has been historically misidentified as *T. stenura* (Herzenstein) by some collectors, largely due to its slender caudal peduncle. However, based on our examination of type and topotypic specimens, *T. pseudostenura* differs from specimens and descriptions of *T. stenura* in meristic and morphometric characteristics. *Triplophysa stenura* can be easily identified by its slender and tapering caudal peduncle with its cross-section being roughly round, and its length being subequal to head length (Zhu 1989); cross-section of the caudal peduncle of *T. pseudostenura* is elliptical (Figs. 1A, B). Additionally, on each side of the preorbital region of male *T. pseudostenura* exists a weakly delimited pad with minute granular tubercles. In males of *T. stenura* the pad is thick (Figs. 2A, B). Other diagnostic traits for *T. pseudostenura* include thin and nearly smooth upper and lower lips (vs. thick and strongly furrowed in *T. stenura*) (Figs. 2C, D); pelvic fins not reaching anus (vs. extending beyond anus) (Figs. 1A, B); caudal-fin margin deeply concave (vs. concave) (Fig. 1); intestine forming a zigzag shape (Fig. 3) (vs. 2–3 helix coils).

Our sampling efforts along the whole reach of the Yalong River during our four-year survey (2004–2007) hardly yielded any specimens of *T. stenura*. Thus, we suggest that specimens misidentified as *T. stenura* should be correctly reported as *T. pseudostenura*.

Triplophysa pseudostenura and *T. stoliczkae* (Steindachner) possess many similar characteristics, such as trunk tapering towards caudal-fin base, laterally compressed caudal peduncle, caudal-peduncle depth gradually reduced towards caudal-fin base, dorsal-fin origin closer to caudal-fin base than to tip of snout, length of barbels greater than eye diameter, and free portion of air-bladder absent. *Triplophysa pseudostenura* can be diagnosed from *T. stoliczkae* using the following characteristics: margin of caudal fin deeply concave, upper and lower jaws unexposed, intestine zigzag in shape (vs. margin of caudal fin slightly concave, upper and lower jaws exposed, and intestine with 4–6 helix coils in *T. stoliczkae*) (Li *et al.* 2007; Prokofiev 2007).

Triplophysa pseudostenura is sympatric with *T. leptosoma* (Herzenstein) in the Yalong River. They share very close characteristics of appearance when compared with other species of *Triplophysa*, especially the very slender trunk, lips almost smooth or slightly furrowed, and posterior chamber of gas bladder greatly reduced. However, *T. pseudostenura* is diagnosed from *T. leptosoma* using the following characteristics: insertion of pelvic fin anterior to dorsal-fin origin (vs. posterior to), dorsal-fin origin closer to caudal-fin base than to tip of snout (vs. slightly closer to snout tip than to caudal-fin base), and caudal fin being deeply concave (vs. concave).

Triplophysa pseudostenura can be separated from other congeners, *T. gerzeensis* Cao and Zhu, *T. pappenheimi* (Fang), *T. yarkandensis* (Day), and *T. yakandensis macroptera* (Herzenstein), by having a more tapering head and smaller head width (head width 47.6–54.0% HL vs. 55.2–72.0% in congeners). *Triplophysa pseudostenura* is distinct from *T. gerzeensis* in having thin and smooth lips (vs. thick and furrowed), pelvic-fin insertion anterior to dorsal-fin origin (vs. posterior to), and a deeply concave caudal fin (vs. concave). Distinctions from *T. pappenheimi*, *T. yarkandensis*, and *T. yakandensis macroptera* include the more slender and tapering caudal peduncle (length of which is 20.0–23.8% SL vs. 13.1–19.2%), longer postdorsal length (36.0–47.5% SL vs. 31.4–34.7%), and smaller interorbital width (18.3–23.0% HL vs. 26.3–39.8%). In addition to characteristics listed above, *T. pseudostenura* can be further distinguished from these congeners using other characteristics in Table 2.

Based on a thorough literature review, evaluation of specimens in collections and our investigations over the past four years, we hypothesize that there are eight valid species of *Triplophysa* in the Yalong River (He *et al.* unpublished data). These include *T. orientalis*, *T. xichangensis*, *T. leptosoma*, *T. brevibarba*, *T. stoliczkae*, *T. pseudostenura*, *T. bleekeri*, and *T. daqiaoensis*. A key to species known from the Yalong River is as follows.

- 1a. Posterior portion of gas bladder free and long 2
- 1b. Posterior portion of gas bladder absent 3
- 2a. Posterior portion of gas bladder constricted medially; margin of anal fin truncate *T. orientalis* (Herzenstein 1888)
- 2b. Posterior portion of gas bladder without medial constriction, appearing cylindrical; margin of anal fin convex
..... *T. xichangensis* Zhu & Cao 1989
- 3a. Dorsal-fin origin slightly closer to snout tip than to caudal-fin base *T. leptosoma* (Herzenstein 1888)
- 3b. Dorsal-fin origin closer to caudal-fin base than to snout tip 4
- 4a. Trunk tapering towards caudal-fin base, with a varied depth of the caudal peduncle from beginning to end 5
- 4b. Trunk not tapering towards caudal-fin base, and with a uniform depth of the caudal peduncle from beginning to end 7
- 5a. Cross-section of caudal peduncle round at the beginning; length of each barbel less than eye diameter; intestine 'Z'-shaped and with two loops *T. brevibarba* Ding 1993

- 5b. Cross-section of caudal peduncle elliptic at the beginning; length of each barbel greater than the eye diameter; intestine may be 'Z'-shaped 6
- 6a. Caudal-fin margin slightly concave; upper and lower jaws exposed; intestine helix with 4–6 coils *T. stoliczkae* (Steindachner 1866)
- 6b. Caudal-fin margin deeply concave; upper and lower jaws unexposed; intestine 'Z'-shaped and with two loops *T. pseudostenura* sp. nov.
- 7a. Caudal-fin margin forked; insertion of pelvic fin posterior to dorsal-fin origin. *T. bleekeri* (Sauvage & Dabry de Thiersant 1874)
- 7b. Caudal-fin margin truncate or slightly concave; insertion of pelvic fin anterior to dorsal-fin origin. *T. daqiaoensis* Ding 1993

TABLE 2. Comparisons of major diagnostic characters among *Triplophysa pseudostenura* and congeners.

Characters	<i>T. pseudostenura</i>	<i>T. gerzeensis</i>	<i>T. leptosoma</i>	<i>T. pappenheimi</i>	<i>T. yarkandensis</i>	<i>T. yarkandensis macroptera</i>
Number of examined specimens	30	28	8	2	7	5
Caudal-peduncle length/SL	20.0–23.8	21.6–24.5	23.0–27.0	18.9–19.2	14.9–16.9	13.1–17.5
Caudal-fin length/SL	15.9–19.0	20.2–23.1	18.7–21.5	16.9–21.4	24.7–26.0	23.0–26.1
Postdorsal length/SL	36.0–47.5	33.4–37.6	37.2–40.0	33.4–34.5	31.4–34.7	32.4–34.4
Head width/HL	47.6–54.0	55.2–60.5	63.4–67.8	65.5–72.0	62.4–67.7	60.6–69.5
Interorbital width/HL	18.3–23.0	21.6–31.9	19.9–23.6	26.3–28.1	36.7–39.8	31.0–35.3
Caudal-peduncle depth/length	18.9–27.1	20.9–25.4	21.6–26.6	25.3–31.2	50.5–53.0	37.9–56.2
Upper and lower lips	thin and smooth	thick and furrowed	thick and slightly furrowed	thick and furrowed	thin and furrowed	thin and smooth
Insertion of pelvic fin	anterior to dorsal-fin origin	posterior to dorsal-fin origin	posterior to dorsal-fin origin	anterior to dorsal-fin origin	posterior to dorsal-fin origin	posterior to dorsal-fin origin
Margin of caudal fin	deeply concave	concave	concave	forked	concave	forked

Comparative material

***Triplophysa gerzeensis*. China: Xizang:** A tributary to Tongchacuo Lake: IHB 76IX0166–90, 76IX0201–3, 57.5–74.8 mm SL, 28 type specimens, Mami Region, Gaize County.

***Triplophysa pappenheimi*. China: Qinghai:** Yellow River drainage: IHB 560739 (topotype), 105.4 mm SL, Huangshui River, Xining City. **Sichuan:** Yangtze River drainage: IHB 821507, 140.0 mm SL, Jialing River, Nanping County, Aba Prefecture.

***Triplophysa leptosoma*. China: Qinghai:** IHB 772359, 83.67mm SL; IHB 772352, 772354–56, 772360–61, 772363, 66.3–78.7 mm SL, Geermu River, Geermu City.

***Triplophysa stenura*. China: Qinghai:** Jinsha River: ZIN 7354 (syntype) 100 mm SL, Batang River (upper reaches of Tongtian He), Yushu County in Qinghai Province (photograph examined); IHB 880010–6, 880019–25, topotypes, 9 specimens, 81.9–115.6 mm SL; Tongtian He in Yushu County.

***Triplophysa stoliczkae*. China: Sichuan:** Yangtze River drainage: IHB 813731, 813740, 813750–1, 813763, 813771, 813780, 813796, 8 specimens, 63.7–82.1 mm SL, Litang River (a tributary of Yalong River) in Litang County, Ganzi Prefecture; IHB 821379, 821410, 821429, 821453, 821448, 820623, 6 specimens, 53.5–64.4 mm SL, Xinluohai Lake (upper reaches of Yalong River), Manigange Town, Dege County, Ganzi Prefecture; IHB 591432, 590357–8, 591457, 591476, 5 specimens, 39.4–60.8 mm SL, Xianshui River (a tributary of Yalong River), Luhuo County, Ganzi Prefecture; IHB 20070630017–27, 11 specimens, 67.4–118.5 mm SL, Zaqu River (upper reaches of Yalong River), Shiqu County, Ganzi Prefecture.

***Triplophysa yarkandensis*. China: Xinjiang:** Tarim River drainage: IHB 622164–10, 7 specimens, 47.2–79.8 mm SL, Kaidu River, Yanqi City.

***Triplophysa yarkandensis macroptera*. China: Gansu:** IHB 772479–83, 5 topotype specimens, 71.7–78.9 mm SL, Yueyaquan River, Dunhuang County.

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