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A new species of *Paratanakia* (Teleostei: Cyprinidae) from Guangdong, China

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Abstract

A new species of bitterling, *Paratanakia haifengensis* **sp. nov.** was collected from Guangdong Province in southern China is described in this study. *P. haifengensis* **sp. nov.** can be well distinguished from *P. himantegus* (Günther, 1868) and *P. chii* (Miao, 1934) based on the following morphological characters: (1) meristic counts: dorsal fin rays 3, 9; anal fin rays modally 3, 12; pectoral fin rays modally 1, 13; lateral-line scales modally 36; (2) specific longitudinal blue stripe on body side: the longitudinal blue stripe extending forward to the position below the third spine of dorsal fin in maximum and usually not exceeding the anterior margin of dorsal fin, its anterior tip inserted above the 13th–14th lateral-line scales; and (3) specific dorsal fin color pattern: dorsal fin with a broad shiny yellow stripe, and with an indistinct, very thin gray margin in male. In this study, the coloration, morphometric measurements and meristic features of *P. haifengensis* **sp. nov.** will be provided and the comparison of morphological characters between *P. haifengensis* **sp. nov.** and other species of *Paratanakia* will be discussed. In addition, a diagnostic key to all species of *Paratanakia* will be provided in this paper.

Keywords: Bitterling, new species, taxonomy, freshwater, southern China

Introduction

The Cyprinid fishes are the most speciose group of mainland China and Taiwan (Wu 1977; Chen & Fang 1999). The genus *Paratanakia* was established by Chang, Chen and Mayden in 2014 based on *P. himantegus* (Günther, 1868). The species *P. himantegus* is comprised of two subspecies, *P. himantegus himantegus* and *P. himantegus chii*, forming a monophyletic clade (Chang *et al*. 2014). However, these subspecies were categorized as species in Li *et al.* (2017).

Paratanakia is a genus of small bitterling fish usually occur in the lower and middle reaches of river systems and lakes in southern China and Taiwan. So far, only *Paratanakia chii* (Miao 1934) and *P. himantegus* have been listed as valid species in the world (Chen & Fang 1999; Fricke *et al.* 2023). *Paratanakia chii* was considered widely distributed around southeastern coastal areas of China and northern Taiwan (Chen 2009). *P. himantegus* was considered endemic to Taiwan and was widely distributed in the low altitude inland waters of Taiwan (Chen *et al.* 2012).

Wu (1977) mentioned that *Paratanakia himantegus* was widely distributed in Zhejiang Province and Fujian Province in China as well as Taiwan. However, the detail distribution of *P. himantegus* group remains unclear in mainland China.

When the field investigation of freshwater fish fauna was carried out in southern China during 2009, several individuals of *Paratanakia* were captured from a tributary of the Huang River (Huangjiang), near Lianhua Mountain in Haifeng County, Guangdong Province. This is the first record of *Paratanakia* collected in Guangdong thus far. In order to reassess the taxonomic status of *Paratanakia* collected from the Huang River, more specimens of other

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Paratanakia species such as the Chi's bitterling (*P. chii*) from Zhejiang Province in China, and also the Taiwan bitterling (*P. himantegus*) from Taiwan were collected as comparative materials in this study. Our study results indicate that the populations of *Paratanakia* collected from the Huang River in Guangdong belong to a previously unnamed species and will be described in this study.

Materials and Methods

Specimen collection and preservation. All examined specimens were collected by hand net or fish traps. The sampling localities of all examined specimens were shown in Fig. 1. Specimens used for morphological studies were fixed in 10% formalin solution for three to five days, followed by 70% ethanol for long-term preservation. Tissue samples used for molecular analysis were preserved in 95% ethanol.

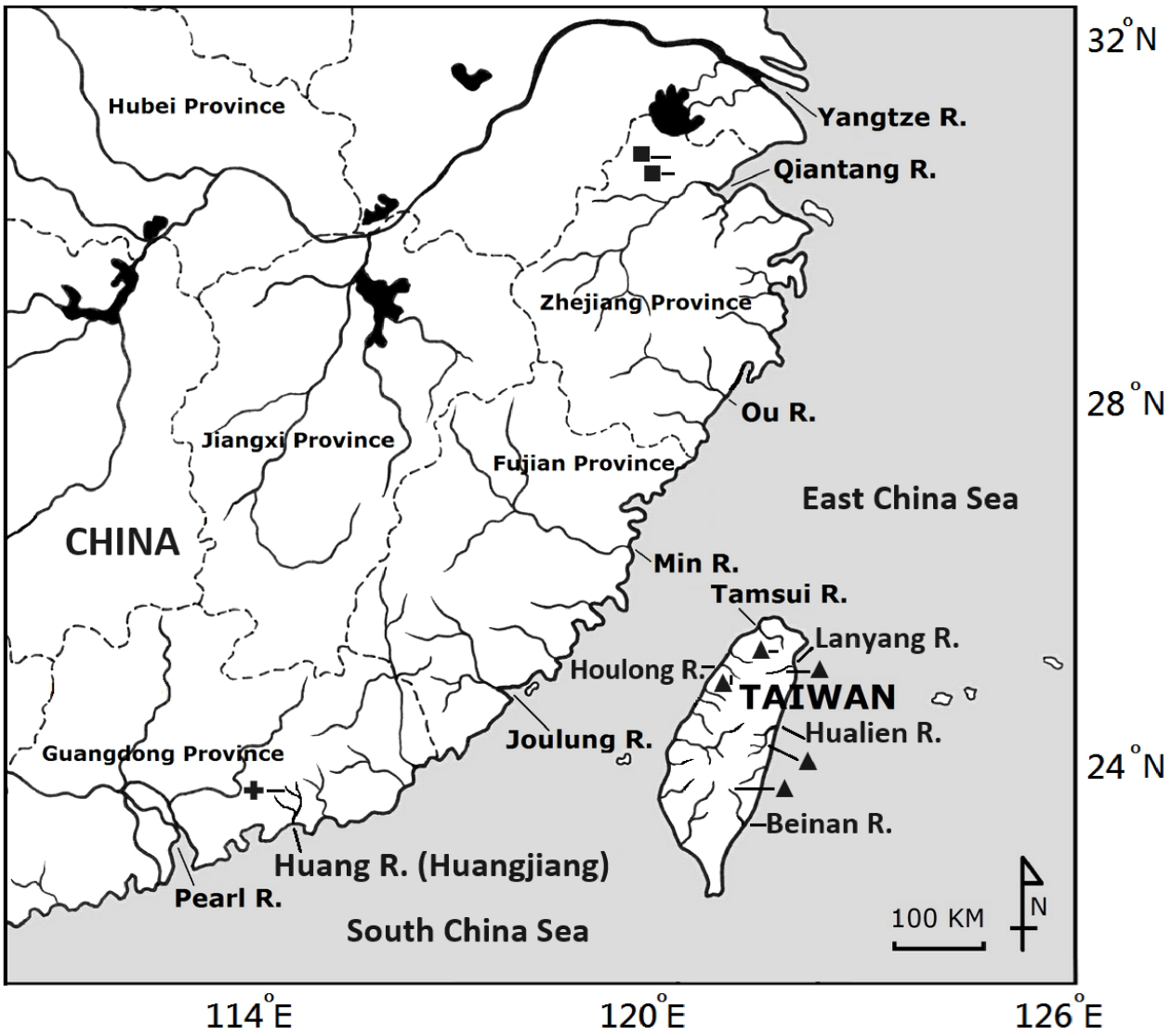

FIGURE 1. The Sampling localities of *Paratanakia haifengensis* **sp. nov.**, and other two species of *Paratanakia*. ✚ *P. haifengensis* **sp. nov.**; ■ *P. chii*; ▲ *P. himantegus.*

Morphological studies. All morphometric measurements followed Hosoya *et al.* (2002) and meristic counts followed Chen *et al*. (2009). All lengths used in this study are standard length (SL). All examined specimens were deposited at the National Taiwan Ocean University, Keelung (NTOUP) and Biodiversity Research Museum,

Academia Sinica, Taipei (ASIZP). Abbreviated names of all institution codes followed Fricke and Eschmeyer (2023). The abbreviations used in this study are as follows: D: Dorsal fin rays; A: Anal fin rays; P1: Pectoral fin rays; P2: Pelvic fin rays; LL: Lateral-line scales; TR: Transverse scales; PreD: Pre-dorsal scales.

Taxonomy

***Paratanakia haifengensis* sp. nov.**
(海豐石鮒)
(Figs. 2A, 2B, 3, 4A)

Material examined

Holotype.—NTOUP 2009-11-001, 66.3 mm SL, male, a tributary of the Huang River (Huangjiang), near Lianhua Mountain in Haifeng County, Guangdong Province, China, coll. Shih-Pin Huang, 2 April 2009.

Paratypes.—NTOUP 2009-11-002, 10 specimens, 2 males, 8 females, 49.6-62.9 mm SL. ASIZP0081785, male, 1 specimen, 47.6 mm SL. ASIZP0081786, female, 1 specimen, 61.6 mm SL. Paratypes were collected with holotype.

Diagnosis. *P. haifengensis* **sp. nov.** can be well distinguished from other congeners by the following unique combination of features: (1) meristic counts: dorsal fin rays 3, 9; anal fin rays 3, 11–13 (modally 3, 12); pectoral fin rays 1, 12–13 (modally 13); lateral-line scales 36–37 (modally 36); and (2) color patterns: a distinct longitudinal blue stripe on posterior half of body, starting from caudal fin base and extending forward to the position below the third spine of dorsal fin in maximum, its anterior tip inserted above the 13th–14th lateral-line scales, and usually not exceeding the anterior margin of dorsal fin; dorsal fin gray with a broad shiny yellow stripe, and with an indistinct, very thin gray margin in male.

Description. Dorsal fin rays 3, 9. Anal fin rays 3, 11–13 (modally 3, 12). Pectoral fin rays 1, 12–13 (modally 13). Pelvic fin rays 1, 7. Lateral-line scales 36–37 (modally 36). Transverse scales 10. Pre-dorsal scales 12–13 (modally 13). A frequency distribution of meristic features of current new species—*P. haifengensis* **sp. nov.**, and other two species of *Paratanakia* is listed as Table 1.

Body compressed and roughly spindle shaped. The highest position of dorsal line located at the anterior margin of dorsal fin base. Head small, snout slightly prominent, tip slightly rounded. Mouth small, a pair of barbels at mouth corner. Eye moderately large and located on lateral side of head, the proportion of orbit diameter in female is slightly bigger than in male, orbit diameter was measured as 30.2–35.7% (33.7% on average) of head length in female, and 30.2–33.3% (31.6% on average) in male (Table 2). Belly slightly rounded in both sexes. Lateral-line complete and running slightly downward abruptly above the anus and along the ventral profile into middle of caudal fin base. Body covered with moderate-sized cycloid scales. Belly from inter-pectoral fin basal region extending backward to anal fin anterior base, always covered with cycloid scales.

Pectoral fin can reach anterior margin of pelvic fin when compressed in both sexes. Pelvic fin slightly rounded. Anterior margin of anal fin inserted below second branched ray of dorsal fin. The length of dorsal fin in male is distinctly longer than in female when compressed, length of depressed dorsal fin was measured as 35.7–40.9% (38.4% in average) of standard length in male, and 29.2–33.5% (31.7% in average) in female (Table 1). Caudal fin deeply forked and rear margin of caudal fin lobe rounded. Two patches of turbucles appeared on snout in adult male, absent in female. All female specimens were examined with a spawning tube. The morphometric measurements of *P. haifengensis* **sp. nov.** were provided in table 1.

Coloration in alive fish. Upper areas of head and body generally pale yellowish. Scales on upper area of body side with gray margin. Belly silver white. A distinct longitudinal blue stripe on posterior half of body, starting from caudal fin base and extending forward to the position below the third spine of dorsal fin in maximum, but usually extending to the position below the 1st–2nd branched ray of dorsal fin in most individuals and not exceeding the anterior margin of dorsal fin; its anterior tip inserted above the 13th–14th lateral-line scales. Middle belly from inter-pectoral region to anterior margin of anal fin is grayish black in mature male, but white in female. Eye grayish white with orange pigments around the pupil in mature male, but grayish white in female (Fig. 3).

TABLE 1. Morphometric measurements of *Paratanakia haifengensis* **sp. nov.**

type	Holotype	Holotype + Paratypes				Paratypes			
character	male	male				female			
n		4			Ave.	9			Ave.
Percentage of standard length (%)									
Head length	22.5	22.5	–	24.6	23.5	22.1	–	23.9	23.3
Body depth	32.9	32.4	–	37.1	33.9	31.6	–	35.4	33.7
Body width	10.0	10.0	–	13.2	11.2	10.6	–	12.2	11.6
Depth of caudal peduncle	11.6	11.6	–	13.6	12.1	11.3	–	12.9	12.0
Length of caudal peduncle	21.1	21.1	–	24.8	23.4	23.1	–	25.0	23.9
Predorsal length	52.3	51.2	–	54.5	53.0	52.9	–	56.2	54.4
Preanal length	45.9	45.9	–	50.5	48.6	47.7	–	54.0	50.6
Prepelvic length	40.9	40.9	–	45.4	43.5	41.2	–	46.2	43.6
Height of dorsal fin	18.3	17.7	–	20.4	18.9	19.5	–	22.6	20.4
Length of depressed dorsal	40.7	35.7	–	40.9	38.4	29.2	–	33.5	31.7
Length of dorsal fin base	21.1	19.3	–	21.8	20.8	17.6	–	19.9	19.1
Height of anal fin	14.6	14.6	–	15.0	14.7	14.6	–	17.2	15.5
Length of depressed anal	38.3	33.0	–	38.3	35.8	30.2	–	34.3	31.9
Length of anal fin base	24.4	21.5	–	24.2	22.3	20.4	–	22.9	21.6
Pectoral fin length	18.4	18.0	–	20.6	18.8	18.0	–	20.8	19.4
Pelvic fin length	15.1	15.1	–	16.6	15.9	15.7	–	18.1	16.5
Percentage of head length (%)									
Head depth	60.4	60.4	–	65.8	64.1	61.9	–	69.8	65.1
Head width	51.7	50.4	–	54.3	51.7	52.5	–	56.0	54.4
Snout length	29.5	29.1	–	31.4	30.2	28.3	–	33.6	30.5
Orbit diameter	30.2	30.2	–	33.3	31.6	30.2	–	35.7	33.7
Interorbital width	39.6	38.6	–	40.7	39.6	35.9	–	40.5	38.2

TABLE 2. Frequency distribution of meristic features of *Paratanakia haifengensis* **sp. nov.**, and other two species of *Paratanakia*. * denotes data from the holotype.

	D			A						P1				P2		
	3,8	3,9	x	3,9	3,10	3,11	3,12	3,13	x	1,11	1,12	1,13	x	1,6	1,7	x
P. haifengensis **sp. nov.**	–	13*	9.0	–	–	2	10*	1	11.9	–	7	15*	12.7	–	26*	7.0
P. chii	1	13	8.9	–	2	9	3	–	11.1	1	10	3	12.1	2	26	6.9
P. himantegus	15	–	8.0	1	13	1	–	–	10.0	11	15	3	11.7	–	30	7.0

	LL							TR			PreD			
	32	33	34	35	36	37	x	9	10	x	12	13	14	x
P. haifengensis **sp. nov.**	–	–	–	–	24*	2	36.1	–	26*	10.0	2	11*	–	12.8
P. chii	1	8	14	2	–	–	33.7	–	26	10.0	–	7	7	13.5
P. himantegus	10	15	5	–	–	–	32.8	4	26	9.9	1	7	7	13.4

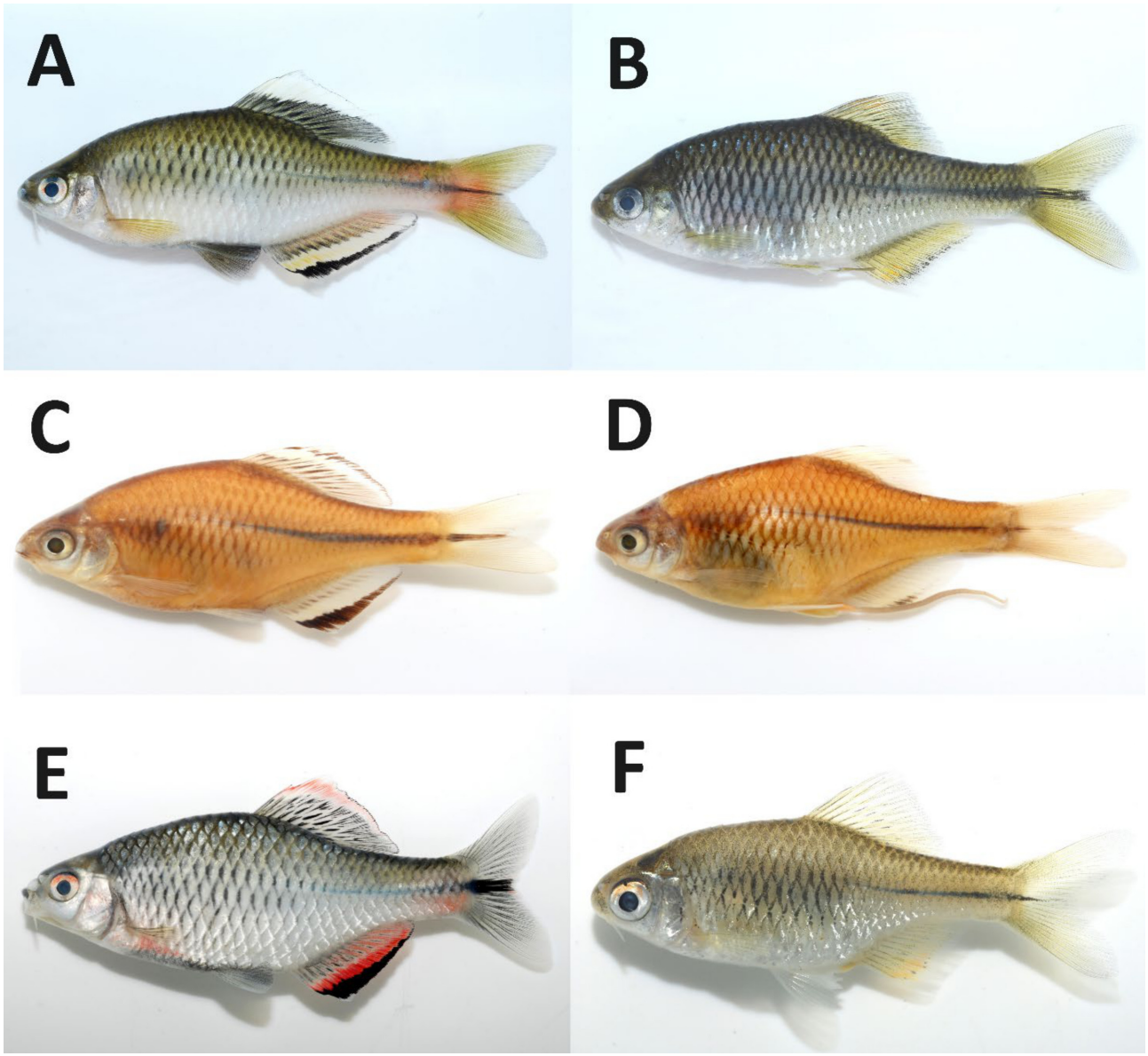

FIGURE 2. The specimen photographs of three species of *Paratanakia*. (A) *P. haifengensis* **sp. nov.**, male, holotype, NTOUP 2009-11-001, 66.3 mm SL. (B) *P. haifengensis* **sp. nov.**, female, paratype, ASIZP0081786, 61.6 mm SL. (C) *P. chii*, male, NTOUP 2012-11-181, 44.0 mm SL. (D) *P. chii*, female, NTOUP 2012-11-181, 41.9 mm SL. (E) *P. himantegus*, male, NTOUP 2010-06-421, 63.0 mm SL. (F) *P. himantegus*, female, NTOUP 2010-05-243, 33.9 mm SL.

Color of all fins in male and female is completely different. In male, dorsal fin gray with a broad shiny yellow stripe, and with a very thin gray margin. Anal fin gray with broad yellowish orange stripe, and with broad grayish black margin. Pectoral fin pale yellow. Pelvic fin grayish black. Caudal fin yellow, central area with a longitudinal black stripe. In female, dorsal fin usually uniformly grayish, but some individuals with indistinct pale yellow stripe. Anal fin usually uniformly grayish, but some individuals with indistinct pale yellow stripe. Pectoral fin cream yellow. Pelvic fin grayish white. Caudal fin cream yellow, central area with a longitudinal black stripe (Fig. 3).

Coloration in preserved specimen. Head and body generally pale yellowish. Scales on upper area of body side with grayish black margin. A distinct longitudinal blackish blue stripe on posterior half of body. Middle belly from inter-pectoral region to anterior margin of anal fin is grayish black in mature male, but white in female. Eye grayish white in both sexes. Dorsal fin gray with a broad white stripe, and with a very thin gray margin in male, but uniformly grayish in female. Anal fin gray with broad white stripe, and with broad grayish black margin, but uniformly grayish in female. Pectoral fin grayish white in both sexes. Pelvic fin grayish black in male, grayish white in female. Caudal fin grayish white, central area with a longitudinal black stripe in both sexes (Fig. 2).

FIGURE 3. Live fish photographs of *Paratanakia haifengensis* **sp. nov.**, (A) male, holotype, NTOUP 2009-11-001, 66.3 mm SL. (B) female, paratype, NTOUP 2009-11-002, 58.4 mm SL.

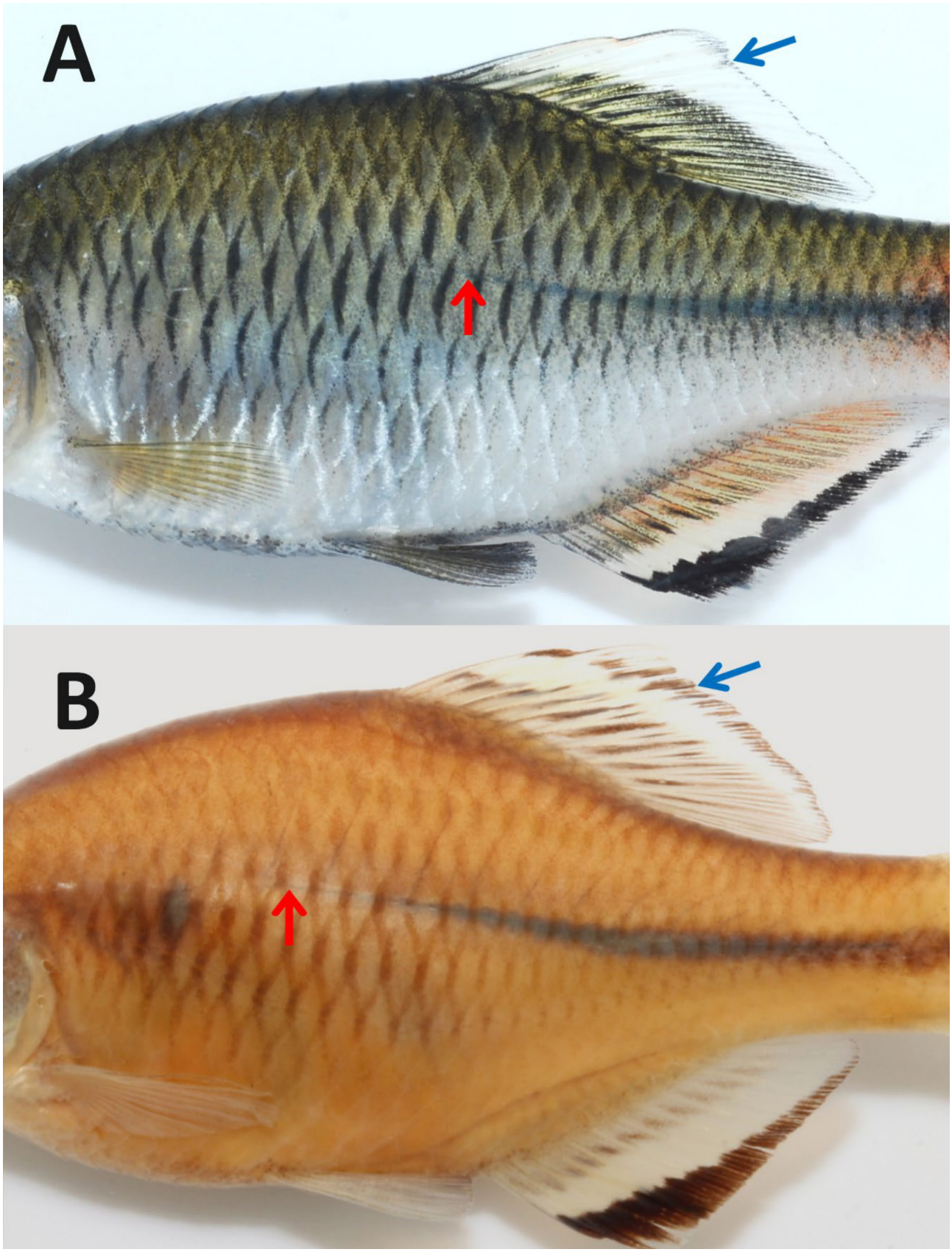

FIGURE 4. Terminal of longitudinal blue stripe on body side (red arrow), and gray margin of dorsal fin (blue arrow). (A) *Paratanakia haifengensis* **sp. nov.**, male, paratype; ASIZP0081785, male, 47.6 mm SL. (B) *P. chii*, male, NTOUP 2012-11-181, 44.0 mm SL.

Distribution. Known only from the upper reaches of the Huang River (Huangjiang), a river located in eastern Guangdong Province, southern China (Fig. 1).

Etymology. The Latinized specific name, "*haifengensis*" refers to "Haifeng County," located in eastern region of Guangdong Proivne, China, wherein lies the type locality.

Remarks. When compared to the two valid species of *Paratanakia*, *P. haifengensis* **sp. nov.** can be immediately distinguished from *P. himantegus* by their meristic features and color patterns: (1) when compared to *P. himantegus*, *P. haifengensis* **sp. nov.** has more dorsal fin rays (3, 9 vs. 3, 8), more pectoral fin rays (modally 1, 13 vs. modally 1, 12), more anal fin rays (modally 3, 12 vs. modally 3, 10), and more lateral-line scales (36–37 vs. 32–34). (2) These two species also have different color patterns in mature male: in *P. haifengensis* **sp. nov.**, dorsal fin and anal fin with a broad yellow stripe in male; in *P. himantegus*, dorsal fin with a broad red stripe, anal fin with black distal edge and a thin red band in male.

Paratanakia haifengensis **sp. nov.** is most similar to *P. chii*: both species share similar broad yellow stripe on dorsal fin and anal fin. However, *P. haifengensis* **sp. nov.** can be well recognized based on following meristic features and color patterns: (1) *P. haifengensis* **sp. nov.** with more pectoral fin rays (modally 1, 13 vs. modally 1, 12), more anal fin rays (modally 3, 12 vs. modally 3, 11), and more lateral-line scales (36–37, modally 36 vs. 32–35, modally 34). (2) In *P. haifengensis* **sp. nov.**, the longitudinal blue stripe on body side extending forward to the position below the third spine of dorsal fin in maximum and usually not exceeding the anterior margin of dorsal fin, its anterior tip inserted above the 13th–14th lateral-line scales (Fig. 4A). In *P. chii*, the longitudinal blue stripe on body side always exceeding the anterior margin of dorsal fin, its anterior tip inserted above the 8th-9th lateral-line scales (Fig. 4B). (3) In *P. haifengensis* **sp. nov.**, the dorsal fin with an indistinct, very thin gray margin in male (Fig. 4A). In *P. chii*, the dorsal fin with a distinct, broader gray margin in male (Fig. 4B).

Discussion

So far, this is evidently the first record of the *Paratanakia* species to be collected and reported in Guangdong. Furthermore, as far as we know, it is the southernmost record of the genus *Paratanakia* in the world. As previous record, *Paratanakia himantegus* was listed as a widely distributed species in Zhejiang Province and Fujian Province in China and Taiwan (Wu 1977). *Paratanakia chii* was considered as a junior synonym of *P. himantegus* in Wu (1977). In current study, all examined specimens were collected from Lin-An in northern Zhejiang which is close to Jiangsu, the type locality of *P. chii*. The river system in northern Zhejiang formed a network and is linked to Taihu Lake in Jiangsu. In addition, the description about morphological characters of *P. himantegus* in Wu's study published in 1977 showed that the species with a broad orange red stripe and with broad grayish black margin. Since *P. chii* was also characterized by the same color pattern, the *P. himantegus* recorded in Wu (1977) should be identified as *P. chii*. We propose that the *P. himantegus* collected from China and recorded in previous studies (e.g. Wu 1977) should be regarded as *P. chii* or other cryptic species close to *P. chii* or *P. haifengensis* **sp. nov.** In other words, the true *P. himantegus* should be regarded as an endemic species of Taiwan.

A diagnostic key to all species of *Paratanakia*

1a. Dorsal fin and anal fin with broad red stripe in male; first dorsal fin rays 3, 8 . . . . . *P. himantegus*

1b. Dorsal fin and anal fin with yellow stripe in male; first dorsal fin rays modally 3, 9 2

2a. Lateral-line scales 32–35; the longitudinal blue stripe on body side always exceeding the anterior margin of dorsal fin, its anterior tip inserted above the 8th–9th lateral-line scales; the dorsal fin with a distinct, broader gray margin in male . . . . *P. chii*

2b. Lateral-line scales 36–37; the longitudinal blue stripe on body side extending forward to the position below the third spine of dorsal fin in maximum, and usually not exceeding the anterior margin of dorsal fin, its anterior tip inserted above the 13th–14th lateral-line scales; the dorsal fin with an indistinct, very thin gray margin in male. . . . . ***P. haifengensis* n. sp.**

Other comparative materials

***Paratanakia chii*:**

NTOUP 2012-11-179, 1 specimen, 43.3 mm SL, Dongtiaoxi creek basin, Jingshan Town, Zhejiang, China, 11 July 2010, coll. Chien-Chin Liu. NTOUP 2012-11-180, 1 specimen, 50.0 mm SL, Dongtiaoxi creek basin, Jingshan Town, Zhejiang, China, 11 July 2010, coll. Chien-Chin Liu. NTOUP 2012-11-181, 7 specimens, 41.9–46.7 mm SL, Dongtiaoxi creek basin, Jingshan Town, Zhejiang, China, 11 July 2010, coll. Chien-Chin Liu. NTOUP 2012-11-182, 5 specimens, 40.4–51.0 mm SL, Dongtiaoxi creek basin, Jingshan Town, Zhejiang, China, 11 July 2010, coll. Chien-Chin Liu. NTOUP 2012-11-183, 1 specimen, 44.5 mm SL, Dongtiaoxi creek basin, Xiaofeng Town, Zhejiang, China, 13 July 2010, coll. Chien-Chin Liu.

***Paratanakia himantegus*:**

ASIZP0058508, 1 specimen, 43 mm SL, Houlong River, Miaoli County, Taiwan, 6 March 1997, coll. Shen-Chih, Wang. ASIZP0081784, 8 specimens, 31.6–39.6 mm SL, Dapo Pond, Taitung County, Taiwan, 25 April 2009, coll. Shih-Pin Huang. NTOUP 2009-10-083, 3 specimens, 33.2–37.3 mm SL, Hualien River, Mijhan, Hualien County, Taiwan, 25 April 2009, coll. Shih-Pin Huang. NTOUP 2010-06-420, 2 specimens, 31.3–34.7 mm SL, Jinlong Lake, New Taipei City, Taiwan, 14 September 2009, coll. Shih-Pin Huang. NTOUP 2010-06-421, 2 specimens, 59.3–63.0 mm SL, Dongshan River, Yilan County, Taiwan, 25 June 2010, coll. Shih-Pin Huang.

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