



Hemimyzon yushanensis, a new species of balitorid fish (Teleostei: Balitiordae) from southern Taiwan

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Abstract

The new balitorid fish was collected in the Kaoping river basin from southern Taiwan. The new balitorid, *Hemimyzon yushanensis* n. sp. can be well distinguished from other congeneric species by following combination of features: (1) dorsal fin rays 3 + 8; pectoral fin rays 11-13 + 9-11 (total 22-23; modally 22); (2) lateral-line scales 69-72 (modally 70); predorsal scales 25-30 (26-27); (3) pelvic fin moderate large, extending to rear vertical of dorsal fin; (4) the position of anus with larger distance of pelvic rear tip to anus about 1.2-1.7 times of that of anus to anal fin origin; and (5) specific coloration: predorsal region and head with rounded creamy yellow spots, pectoral and pelvic fins with several small whitish spots on greenish brown background. The morphological comparison of congeners and diagnostic key of Taiwanese species would be also provided in this paper.

Key words: *Hemimyzon*, New species, Balitoridae, Fish fauna, Taiwan

Introduction

The freshwater and estuarine fish fauna of Taiwan has been reviewed by Chen and Fang, 1999. There are at least 224 freshwater and brackish fish species recorded in Taiwanese waters. Among them, there are three genera with 6 valid, endemic nominal species of balitorid loaches: *Formosania lacustre* (Steindachner, 1908); *Hemimyzon formosanus* (Boulenger, 1894); *Hemimyzon taitungensis* Tzeng & Shen, 1982; *Hemimyzon sheni* Chen & Fang, 2009; *Sinogastromyzon puliensis* Liang, 1974; and *Sinogastromyzon nantaiensis* Chen *et al.*, 2002 (Shen 1993; Chen & Fang 1999; Chen & Chang 2005; Chen & Fang 2009).

In recent years, many fish collections of hill stream survey which have been conducted from the Kaoping river basin originating from southern slope of the Yushan mountain Ridge, Taiwan and the undescribed balitorid fish would be formally describe as the new species herein. Its morphological comparison with congeners and artificial key to all nominal species in Taiwan would be also addressed.

Materials and methods

Type specimens were collected by hand-net. Other comparative, congeneric specimens were collected by casting-net or electro-fishing. The counts and measurement followed those of Kottelat and Chu (1988) and Doi and Kottelat (1998), except the anal fin base length followed Chen *et al.* (2002). Abbreviation used: NTOUP, the Pisces collection of National Taiwan Ocean University, Keelung; and NTUM, National Taiwan University, Taipei. Other comparative materials listed in the Appendix I.

Systematics

Hemimyzon Regan, 1911

(Type species, *Homaloptera formosana* Boulenger, 1894)

Hemymizon yushanensis new species

(Figure 1)

Holotype.- NTOUP-2021-12-325, 55.3 mm SL, Nar-Mar-Shar County, Nan-Tsi-Shien River, Kaoping River basin, coll. C.C. Han, July, 20, 2021, Kaohsiung City, Taiwan, ROC.

Paratypes.- NTOUP-2021-12-326, 8 specimens, 51.9–66.6 mm SL, Nar-Mar-Shar County, Nan-Tsi-Shien River, Kaoping River basin, Coll. C.C. Han, July, 20, 2021, Kaohsiung City, Taiwan, ROC.

Non-types.- NTOUP-2007-12-175, 5 specimens, 37.6–55.0 mm SL, Jo-Kou River, Kaoping River basin, Coll. By I-S. Chen, Oct. 15, 1995.

Diagnosis

The new species can be well distinguished from other congeneric species by following combination of features: (1) dorsal fin rays 3 + 8; pectoral fin rays 11–13 + 9–11 (total 22–23; modally 22); (2) lateral-line scales 69–72 (modally 70); predorsal scales 25–30 (26–27); (3) pelvic fin moderate large, extending to rear vertical of dorsal fin; (4) position of anus with larger distance of pelvic rear tip to anus about 1.5–2.0 times of that of anus to anal fin origin; and (5) specific coloration: predorsal region and head with rounded creamy yellow spots, pectoral and pelvic fins with several small whitish spots on greenish brown background.

Description

The morphometrics of this new species as percentages of standard length are listed in Table 1 and meristic features are listed in Table 2. Head and body strongly depressed with flat ventral side anteriorly. Posterior trunk from anus to caudal peduncle rather compressed. See Table 1 for morphometric characters. Head with a few tiny tubercles. Upper lip with 16–18 small papillae; no distinct papillae on lower lip except a pair of somewhat crescent projections on inner side. Four rostral barbels and two barbels at both corners of mouth which anterior one much larger than the very tiny posterior one. The length of anterior barbels less than the eye diameter. Interorbital region rather wide. Gill-opening small and very restricted, merely extending above anterior origin of pectoral fin. The location of anus is closer to anal fin origin, with large distance of rear tip of pelvic fin to anus about 1.2–1.7 times to that of anus to anal fin origin.

Dorsal fin 3+8; anal fin 2+5; pectoral fin 11–13 + 9–11 (total 22–23; modally 22); pelvic fin 4–6 + 9–10 (totally 13–15 modally 14). Origin of dorsal fin behind origin of pelvic fin origin. Pectoral fin rather large, its rear margin extending beyond origin of pelvic fin. Pelvic fin well separate, the gap between the attachment of their innermost rays about 1.5–2.0 times of eye diameter; its rear margin extending to or beyond the rear tip of dorsal fin when depressed. Caudal fin forked, its lower lobe longer than upper one.

Dorsal part of body with very small cycloid scales, larger specimens with reduced, smaller cycloids which not reaching the nape. Larger specimens with reduced, smaller size of predorsal scales. Ventral region between the paired fins naked. Body scales slightly larger posteriorly. Lateral-line scales 69–72 and predorsal scales 25–30.

Coloration in fresh

Dorsum of body olive brown. Predorsal region and head olive brown to deep brown with rounded creamy yellow spots, pectoral and pelvic fins with several small whitish spots on greenish brown background. The rear part of dorsal region behind dorsal fin with some irregularly creamy yellow marks. Lateral body uniformly olive brown to deep brown. Ventral side unique pale white. Dorsal fin pale white with deep brown rays with 2 major horizontal rows of creamy white spots. Anal fin pale white with deep brown rays. Caudal fin with broad black outer margin with 3–4 oblique, zigzag creamy white streaks.

Distribution

The new species is only found from the several localities of hill streams of the Kaoping River basin, both Kaohsiung City and Pingtung County and also the southern region of the Yushan National Park.

Etymology

The specific name, *yushanensis* is referred to the main drainages of Kaoping River originating and southward from the highest mountain of Taiwan, the Yushan mountain Ridge.

TABLE 1. Morphometry of *Hemimyzon yushanensis* from southern Taiwan

Type	H	P	P	P	P	P
SL (mm)	55.3	51.9	53.2	60.2	66.3	66.6
Lateral head length	24.6%	23.6%	24.8%	24.6%	23.3%	24.7%
Dorsal head length	24.4%	22.7%	22.5%	23.8%	21.6%	21.6%
Ventral head length	15.8%	13.3%	13.4%	14.0%	13.7%	13.0%
Head width	20.9%	21.0%	20.1%	20.4%	19.3%	19.5%
Snout length	14.1%	12.7%	13.9%	14.4%	13.4%	14.0%
Eye diameter	3.9%	4.0%	3.6%	3.1%	3.4%	3.0%
Interorbital length	10.8%	10.5%	11.9%	10.1%	10.1%	10.6%
Mouth width	10.4%	10.3%	10.3%	10.3%	9.8%	10.6%
Body width at pectoral fin origin	21.8%	21.0%	20.5%	20.4%	18.8%	20.8%
Body width at anal fin origin	24.6%	25.3%	24.1%	24.6%	13.4%	25.1%
Body depth at dorsal fin origin	16.9%	17.7%	16.3%	13.2%	12.7%	12.9%
Caudal peduncle length	11.0%	11.5%	11.8%	11.7%	11.2%	13.0%
Caudal peduncle depth	10.2%	10.9%	10.6%	8.8%	10.1%	9.5%
Length of last simple pectoral fin rays	18.1%	20.5%	18.6%	23.1%	17.7%	20.9%
Pectoral fin length	31.8%	31.9%	32.2%	34.7%	29.8%	33.4%
Pelvic fin length	25.6%	24.8%	27.1%	28.8%	26.1%	26.6%
Length of upper caudal fin lobe	23.3%	24.5%	22.1%	24.2%	21.2%	23.9%
Length of lower caudal fin lobe	25.5%	27.5%	26.7%	27.7%	24.4%	28.3%
Distance between pelvic fin bases	6.7%	8.1%	6.4%	7.2%	7.2%	9.0%
Predorsal length	49.2%	51.8%	50.9%	52.0%	51.1%	51.1%
Prepectoral length	16.7%	18.7%	16.9%	17.8%	15.5%	16.7%
Distance between pelvic and pectoral fins	29.6%	29.8%	31.6%	32.9%	27.4%	30.5%
Anal fin base	8.1%	6.8%	7.1%	8.4%	7.4%	7.7%
Anus to A origin	4.8%	5.0%	4.9%	4.2%	5.7%	5.7%
Anus to Rear V	6.0%	6.9%	6.6%	6.8%	9.7%	7.0%
Anus ro Rear V / Anus ro A origin	1.24	1.40	1.34	1.59	1.68	1.23

H: Holotype; P: Paratype.

TABLE 2 Comparison of distribution frequency of meristic features from four endemic species of *Hemimyzon* in Taiwan

Species	Pectoral fin																			
	Simple rays						Branched rays						total rays							
	10	11	12	13	14	M	9	10	11	12	13	M	20	21	22	23	24	25	26	M
<i>H. yushanensis</i> n.sp.	-	11	7	2	-	11.6	4	15	1	-	-	9.9	-	-	13	7	-	-	-	22.4
<i>H. formosanus</i>	1	19	12	-	-	11.3	7	18	7	-	-	10.0	1	19	12	-	-	-	-	21.3
<i>H. sheni</i>	-	-	-	3	-	13.0	-	-	3	-	-	11.0	-	-	-	-	3	-	-	24.0
<i>H. taitungensis</i>	-	-	1	7	4	13.3	-	-	1	8	3	12.2	-	-	-	-	-	7	5	25.4

Species	Dorsal fin'				Pelvic fin				total rays										
	Branched rays				Simple rays				Branched rays					total rays					
	7	8	M	M	4	5	6	7	M	9	10	11	M	13	14	15	16	17	M
<i>H. yushanensis</i> n.sp.	-	10	8.0	-	16	3	1	-	4.3	6	14	-	9.7	2	17	1	-	-	14.0
<i>H. formosanus</i>	16	-	7.0	-	16	16	-	-	4.5	20	12	-	9.4	4	27	1	-	-	13.9
<i>H. sheni</i>	-	3	8.0	-	3	-	-	-	4.0	-	3	-	10.0	-	3	-	-	-	14.0
<i>H. taitungensis</i>	-	6	8.0	-	-	-	6	6	6.5	-	6	-	10.5	-	-	-	-	12	17.0

Species	Lateral-line scales																		
	68	69	70	71	72	73	74	78	79	80	83	84	85	86	87	88	M		
<i>H. yushanensis</i> n.sp.	-	5	6	4	5	-	-	-	-	-	-	-	-	-	-	-	-	70.5	
<i>H. formosanus</i>	1	8	9	6	5	2	1	-	-	-	-	-	-	-	-	-	-	70.5	
<i>H. sheni</i>	-	-	-	-	-	-	-	1	2	1	-	-	-	-	-	-	-	79.0	
<i>H. taitungensis</i>	-	-	-	-	-	-	-	-	-	-	1	2	4	2	2	1	85.4		

Species	Predorsal scales																		
	0	-	25	26	27	28	29	30	31	32	33	34	35	36	37	38	M		
<i>H. yushanensis</i> n.sp.	-	-	1	3	3	1	1	1	-	-	-	-	-	-	-	-	27.1		
<i>H. formosanus</i>	-	-	-	-	-	-	-	-	-	-	-	-	6	7	3	36.8			
<i>H. sheni</i>	-	-	-	-	-	-	-	1	1	1	-	-	-	-	-	31.5			
<i>H. taitungensis</i>	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0			

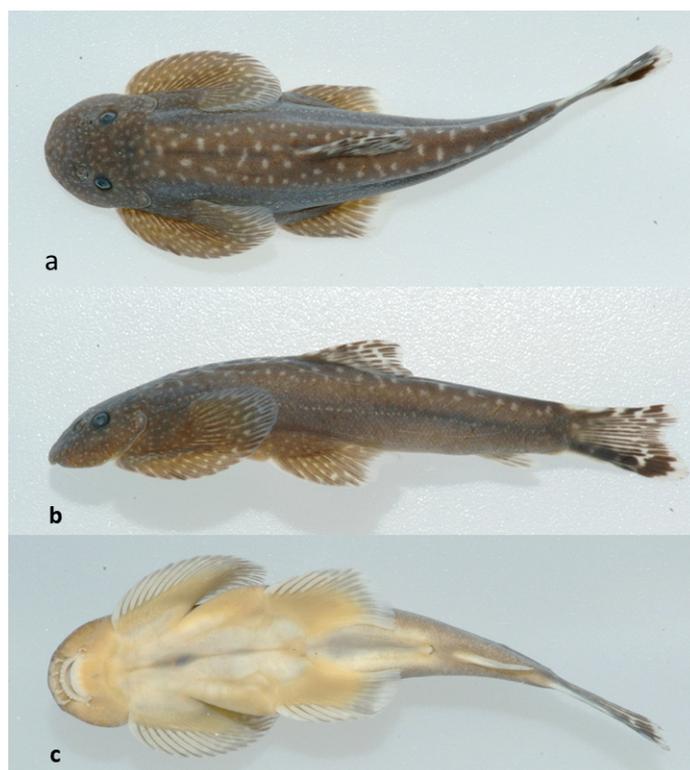


FIGURE 1. *Hemimyzon yushanensis*, holotype, NTOUP-2021-12-325, 55.3 mm SL, a, dorsal view; b, lateral view; c. ventral view; Nan-Tsi-Shien River, Kaoping River basin, Kaohsiung City, Taiwan, ROC.

Discussion

In the taxonomy of *Hemimyzon*, four nonimal species were documented in mainland China (Yue 2000) while recorded two endemic species (Tzeng & Chen 1982; Shen 1993) before 2000. After then, Chen and Fang (2009) described *Hemimyzon sheni* from eastern Taiwan added the third endemic species to Taiwan.

Before the current species description of this new balitorid fish, Chen & Chang (2005) firstly mentioned for the potential, undescribed species (*Hemimyzon* sp.) from Kaoping River basins. Therefore, soon after Wang *et al.* (2007) published the molecular phylogenetics of this balitorid genus in Taiwan based on mtDNA D-loop sequences. Wang *et al.* (2007) clearly mentioned the results: the deep mtDNA genetic divergence implies that cryptic species might have arisen from southern population of *H. formosanus*, which is unique in differing from others in Taiwan; a recent study (Chen & Chang 2005) described several morphological differences between southern population of *Hemimyzon formosanus* and other populations of *H. formosanus*, which supports the southern population being a cryptic species. In summary, both independent studies strongly suggest that the so-called “southern population” from the Kaoping river basin should be classified as a distinct species.

In the zoo-geographical pattern of primary freshwater fishes in Taiwan, the distribution of the new species, *H. yushanensis*, shares the same geographical region with the *Opsariichthys kaopingensis*, *Gobiobotia intermedia*, *Sinogastromyzon nantaiensis*, *Rhinogobius nantaiensis* and also *Rhinogobius* sp. It reflects the same congruent speciation event for those fish genera which happened in “the same historical event of great isolation” of the Kaoping River basin, southern Taiwan (Chen & Chang 2005; Chen unpublished data).

Since their high endemicity in Taiwanese waters, the new species *H. yushanensis* established, this species at least can be found from hill tributaries of the Kaoping River basin in the both regions of Kaohsiung City and Pingtung County. Therefore, the true range of *H. formosanus* would be restricted to further northern regions as all river basins from the Ilan County, Taipei City, Taipei City, Taoyuan City, Shinchu County, then southward to Tainan City which mainly in the western slope of Central Mountain Ridge. *H. taitungensis* can be seen from 3 main river basins from Hualian to Taitung County. *H. sheni* can only be seen in Tarchu river basin of Taitung County. Among them, all of them share allopatric distribution pattern without range overlapping.

Among the three endemic species of Taiwan, about the differentiation of dorsal fin rays, there are apparently two groups of *Hemimyzon* in Taiwan. One group is dorsal fin rays 3+7 which seen in wide distributed species, *H. formosanus*; another group is dorsal fin rays 3+8 which can be seen in the following three species as *H. taitungensis*, *H. sheni* as well as *H. yushanensis*. The 3+8 group only can be seen in eastern Taiwan as both *H. taitungensis* and *H. sheni*. *H. yushanensis* can be only found from the Kaoping River basin originating from southern slope of the Yushan mountain Ridge in southern Taiwan.

H. yushanensis shares the same dorsal fin ray formula, 3+8 with both *H. taitungensis* and *H. sheni*. However, *H. yushanensis* can be well distinguished from *H. taitungensis* by the pectoral fin rays 22–23 vs. 25–26; pelvic fin rays 13–15 vs. 17. It also can be well distinguished from *H. sheni* by the lower counts of pectoral fin rays 22–23 vs. 24; lateral-line scales 69–72 vs. 78–80; rear tip of pelvic fin extending to or beyond dorsal fin when depressed vs. rear tip of pelvic fin not extending to dorsal fin when depressed. The limited distribution of current species is needed for further concern of conservation issue.

An artificial key to 4 endemic species *Hemimyzon* in Taiwan:

1a	Dorsal fin rays 3+7	.....	<i>H. formosanus</i>
1b	Dorsal fin rays 3+8	.....	2
2a	Pelvic fin rays 17	.....	<i>H. taitungensis</i>
2b	Pelvic fin rays usually 14	.....	3
3a	Pectoral fin rays 24; lateral-line scales 78-80; the distance of pelvic rear tip to anus about 3 times to that of anus to anal fins	.....	<i>H. sheni</i>
3b	Pectoral fin rays modally 22; lateral-line scales 69-72; the distance of pelvic rear tip to anus about 1.2-1.8 times to that of anus to anal fins	.....	<i>H. yushanensis</i> n. sp.

Appendix I.

Comparative materials. *Hemimyzon formosanus* (Boulenger):

NTOUP-2005-09-233, 6 specimens, 36.8–55.0 mm SL, Fan-Fan Brook, Lang-Yang River basin, I-Lan County, Taiwan, coll. M. Chang, Spt. 5, 2005. NTOUP-2007-09-057, 59.2 mm SL, Kong-Long River basin, Maio-Li County, Taiwan, coll. I-S. Chen, July 12, 1999. NTUM-05276, 10 specimens, Her-Sher, Jo-Shuei River, Nan-Tou County, Taiwan, coll. C.S. Tzeng, July 27, 1980. NTUM-05278, 4 specimens, 50.2–58.0 mm SL, Pu-Li, Wu River basin, Nan-Tou County, Taiwan, coll. C.S. Tzeng, July 20, 1980. TUM-05283, 14 specimens, 32.1–61.6 mm SL, Tung-Shih, Ta-Chia River basin, Taiwan, coll. C.S. Tzeng, Jan 30, 1981. NTUM-05307, 45.8 mm SL, Chow-Lan, Ta-An River basin, Maio-li County, Taiwan, coll. C.S. Tzeng, Jan 30, 1981. ***Hemimyzon sheni* Chen & Fang: Holotype.** NTOUP- 2007-07-077, 50.1 mm SL, small tributary (3 km south to Yi-Ting mountain) in upper reaches of the Tar-Ju River, Tar-Ren Village, Taitung County, Taiwan, ROC. Coll. S.H. Chen, July 11, 1993. **Paratypes.** NTOUP- 2007-07-078, 2 specimens, 11.2–30.6 mm SL, other data same as holotype. ***Hemimyzon taitungensis* (Tzeng & Shen):** NTOUP-2007-05-273, 63.0 mm SL, Shin-Wu-Liu River, Pei-Nan River basin, Taitung County, Taiwan, coll. I-S. Chen, May 16, 2005. NTOUP-2007-09-051, 5 specimens, 46.0–59.2 mm SL, Shin-Wu-Liu River, Pei-Nan River basin, Taitung County, Taiwan, coll. I-S. Chen, Oct. 25, 1994.

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