



## A new species of *Cryptocentrus* (Teleostei: Gobiidae) from northern Taiwan

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### Abstract

A new marine, shrimp-associated goby of *Cryptocentrus* was discovered from the coastal waters of New Taipei City, Taiwan but it is very rare merely with three adult specimens. The new species, *Cryptocentrus taiwanensis* n. sp. can be well distinguished from all other congeners by the unique combination of the following features: (1) fins: second dorsal fin rays I/11; anal fin rays I/10; pectoral fin rays 16; (2) squamation: longitudinal scale series 100–101, transverse scale rows 29–31, peridorsal scales 15–17; (3) vertebral count 26; (4) head canal pores: anterior oculoscapular canal with terminal pore  $\sigma$ ; single pore  $\lambda$ ; lateral section of anterior oculoscapular canal with three pores  $\alpha$ ,  $\beta$  and  $\rho$ ; posterior oculoscapular canal with two pores  $\theta$ ,  $\tau$ ; preopercular canal present with three pores  $\gamma$ ,  $\delta$  and  $\epsilon$ ; sensory papillae: 5 major transverse rows of infraorbital region; (4) rear edge of mouth: extending beyond the vertical of rear margin of pupil in male and (5) specific coloration: body scattered with many white spots and a middle longitudinal row of 8 blackish brown blotches, second dorsal fin with vertical blackish brown bars on branched rays on distal half, anal fin with three horizontal rows of blackish brown blotches and connected to stripe in middle row, caudal fin translucent radiating with thick blackish stripes in middle 1/3 region in male. The brief morphological comparison with its own related species would be also addressed.

**Key words:** *Cryptocentrus*, coral reef fish; shrimp goby, systematics, fish taxonomy, Taiwan

### Introduction

The coral reef gobies are most speciose group within Family Gobiidae. The shrimp-associated gobies are common inhabitants of sand and mud substrates throughout the tropical Indo-Pacific region. Among them, a good variety of gobies associate with shrimps: 13 genera and approximately 150 species are currently known (Eschmeyer *et al.* 2018), of which *Amblyeleotris* Bleeker, 1874 (39 species), *Cryptocentrus* Valenciennes in Cuvier & Valenciennes, 1837 (37 species), and *Vanderhorstia* Smith, 1949 (29 species) contain the majority of species (Greenfield & Allen 2018; Hoese 2019).

Hoese & Larson (2004) characterized the genus *Cryptocentrus* and divided the group into at least 5 morphological groups. The genus is also very close to *Myersina*. Among them, the so-called “*Cryptocentrus leucostictus* group” with rather slender body and high counts of first dorsal fin rays always 10–11 including the following 7 nominal species: *Cryptocentrus niveatus* (Cuvier & Valenciennes, 1837) from Java, Indonesia; *Cryptocentrus leucostictus* (Günther, 1872) from Tonga islands; *Cryptocentrus maudae* Fowler, 1937 from Bangkok, Thailand; *Cryptocentrus liolepis* Bleeker, 1876 from Borneo; *Cryptocentrus malindiensis* (Smith, 1959) from Malindi, Kenya, western Indian Ocean; *Cryptocentrus nigrocellatus* (Yanagisawa, 1978) from Shiramizu, Kikai Island, Nansei Islands, Japan and *Cryptocentrus albidorsus* (Yanagisawa, 1978) from Sonai, Iriomote Island, Nansei Islands, Ryukyu Islands, Japan. After then, Allen & Randall (2011) described two new species with unique dentition within the genus: one species with vomerine teeth and the other with large fangs anteriorly in both jaws. Greenfield & Allen (2018) described a dwarf species from Fiji, *Cryptocentrus nanus* Greenfield & Allen, 2018. Hoese (2019) revised the *Cryptocentrus strigiliceps* complex, distinguished within the genus mainly by having ctenoid scales posteriorly on the body and named a new goby, *Cryptocentrus altipinna* Hoese, 2019, let the total number of species in the genus up to 37.

During our recent survey for the slender group in Taiwanese waters, there are three discrete species within this group. One of them can not be seen as other nominal species which is very similar to *Cryptocentrus albidorsus* (Yanagisawa, 1978). However, under more recently both morphological and molecular survey, one undescribed species turned to light. The aim of this paper is to describe herein the new species as the 38th species of *Cryptocentrus*. The brief comparison of this new species would be also addressed in this paper.

## Materials and Methods

Sample collection and morphological survey from type specimens of the new goby were collected by hand-net by SCUBA diving. All counts and measurements were made from specimens finally preserved in 70% ethanol. Morphometric methods follow Miller (1988) and meristic methods follow Akihito *et al.* (1984) and Chen and Shao (1996).

Terminology of cephalic sensory canals and free neuromast organs (sensory papillae) was from Wongrat and Miller (1991), mainly based on Sanzo (1911). Meristic abbreviations were as follows: A = anal fin; C = caudal fin; D1 = first dorsal fin; D2 = second dorsal fin; LR = longitudinal scale rows; P = pectoral fin; PreD = predorsal scales; SDP = scale series from origin of first dorsal fin to upper pectoral fin origin; TR = transverse scale series from second dorsal to anal fins; V = pelvic fin; VC = vertebral count. All fish lengths were expressed by standard length (SL).

The type specimens of the current new species would be deposited at the Pisces collection of National Taiwan Ocean University, Keelung (NTOUP). The comparative material of *Cryptocentrus albidorsus* (Yanagisawa, 1978) is listed herein.

## Comparative material

*Cryptocentrus albidorsus* (Yanagisawa, 1978)

NTOUP-2024-06-248, 25.5 mm SL, Ji-Huei, Chengkong Township, Taitung County, Taiwan, ROC; 2–3 m depth; Coll. Y.C. Yang; June 26, 2024.

NTOUP-2024-06-249, 47.9 mm SL, Rei-bin, Rui-Fang District, New Taipei City, Taiwan, ROC; 3–4 m depth; Coll. Y.C. Yang; June 27, 2024.

NTOUP-2024-08-250, 67.5 mm SL, Rei-bin, Rui-Fang District, New Taipei City, Taiwan, ROC; 3 m depth; Coll. Y.C. Yang; Aug. 25, 2024.

NTOUP-2024-08-251, 30.7 mm SL, Tofujar, Soau, Ilan County, Taiwan, ROC; 7–8 m depth; Coll. Y.C. Yang; Aug. 27, 2024.

NTOUP-2024-09-252, 72.7 mm SL, Rei-bin, Rui-Fang District, New Taipei City, Taiwan, ROC; 3–4 m depth; Coll. Y.C. Yang; Spt. 15, 2024.

NTOUP-2024-09-253, 66.1 mm SL, Rei-bin, Rui-Fang District, New Taipei City, Taiwan, ROC; 3–4 m depth; Coll. Y.C. Yang; Spt. 21, 2024.

## Systematics

### *Cryptocentrus taiwanensis* n. sp.

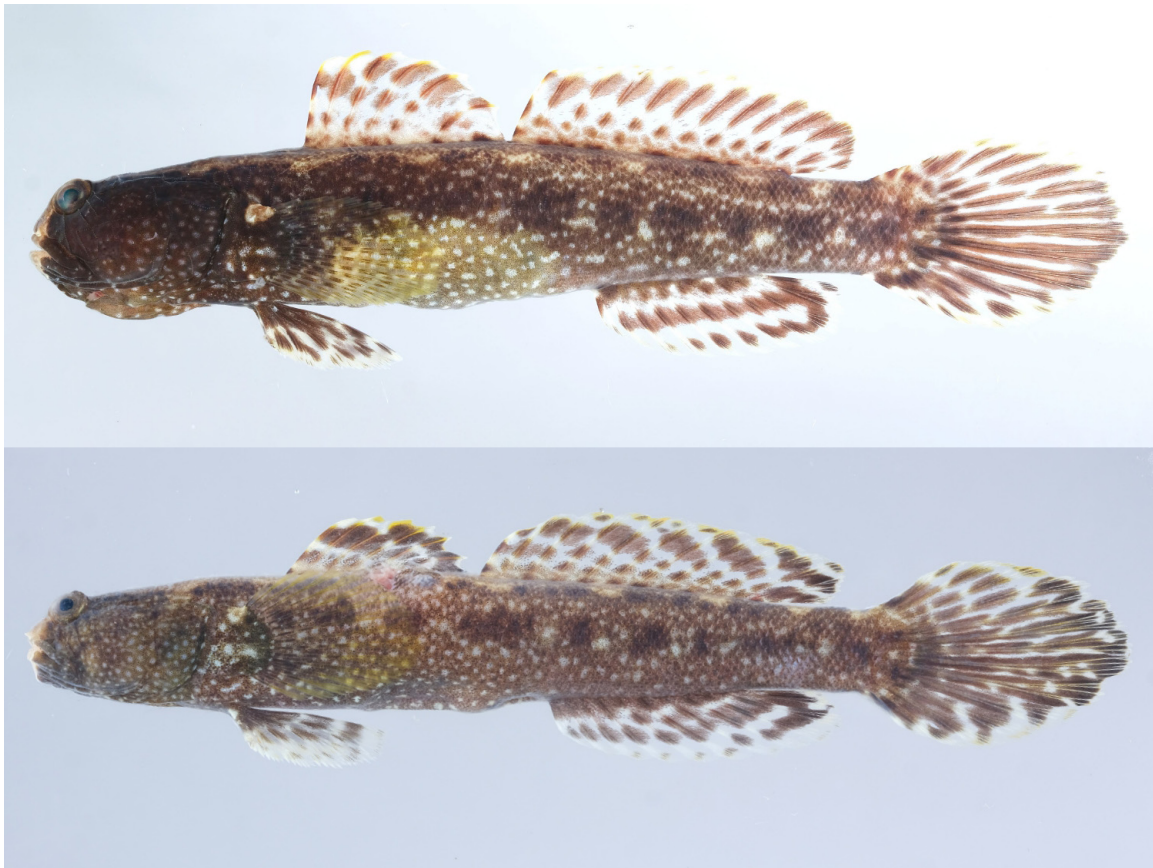
(臺灣猴鯊)

(Figs. 1–3, 5)

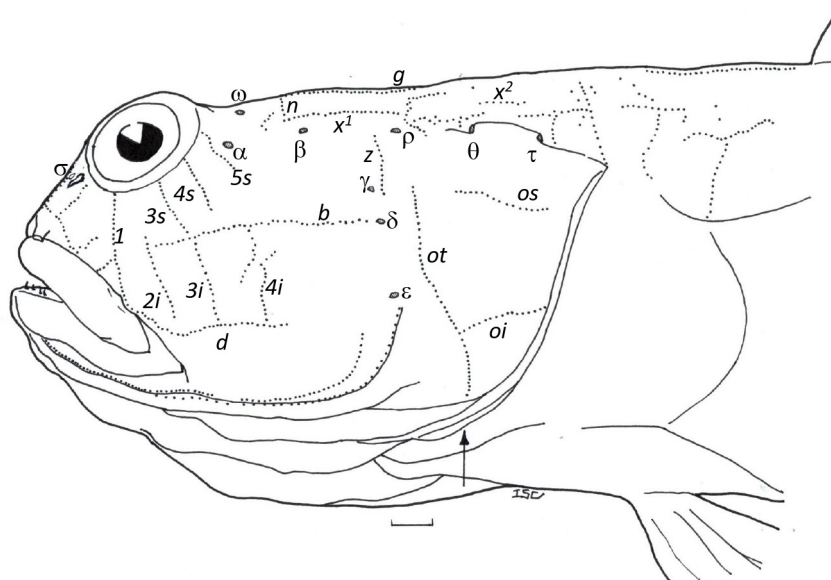
## Material examined

**Holotype.**—NTOUP-2024-09-255, 71.8 mm SL, Longdong Bay, Gong-Liao District, New Taipei City, Taiwan, ROC; 7–9 m depth; Coll. Y.C. Yang; Spt. 29, 2024.

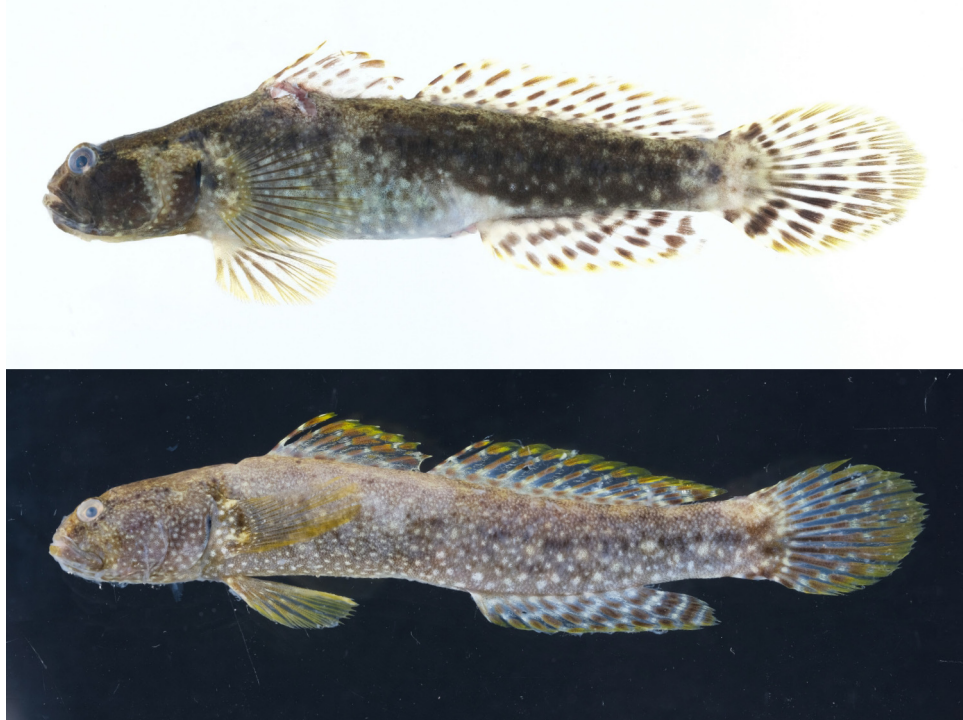
**Paratypes.**—NTOUP-2024-09-256, 2 specimens, 60.4–63.0 mm SL, collection date and other data same as holotype.



**FIGURE 1.** *Cryptocentrus taiwanensis* n. sp., holotype, male, 71.8 mm SL (above); paratype, female, 60.4 mm SL (below), Longdong Bay, Gong-Liao District, New Taipei City, Taiwan, ROC.



**FIGURE 2.** Head lateral-line system of *Cryptocentrus taiwanensis* n. sp., holotype (above), 71.8 mm SL, Longdong Bay, Gong-Liao District, New Taipei City, Taiwan, ROC.



**FIGURE 3.** *Cryptocentrus albidorsus*, male, 72.7 mm SL (above); female, 66.1 mm SL (below), Rei-bin, Rui-Fang District, New Taipei City, Taiwan, ROC.

### Diagnosis

*Cryptocentrus taiwanensis* n. sp. can be well distinguished from all other congeners by the unique combination of the following features: (1) fins: second dorsal fin rays I/11; anal fin rays I/10; pectoral fin rays 16; (2) squamation: longitudinal scale series 100–101, transverse scale rows 29–31, no perdorsal scale; (3) normal vertebral count 26; (4) head canal pores: anterior oculoscapular canal with terminal pore  $\sigma$ ; single pore  $\lambda$ ; lateral section of anterior oculoscapular canal with three pores  $\alpha$ ,  $\beta$  and  $\rho$ . posterior oculoscapular canal with two pores  $\theta$  and  $\tau$ ; preopercular canal present with three pores  $\gamma$ ,  $\delta$  and  $\epsilon$ . papillae: 5 major transverse rows of infraorbital region; (4) rear edge of mouth: extending beyond the vertical of rear margin of pupil and (5) specific colouration: body scattered with many white spots and a middle longitudinal row of 8 blackish brown blotches, second dorsal fin with vertical blackish brown bars on branched rays on distal half, anal fin with three horizontal rows of blackish brown blotches and connected to stripe in middle row, caudal fin translucent radiating with thick blackish stripes in middle 1/3 region in male.

### Description

Body proportions are listed in Table 1. Body rather slender, subcylindrical anteriorly, compressed posteriorly. Head subcylindrical and somewhat compressed. Snout profile somewhat straight but steeply oblique. Cheek slightly fleshy in male. Lips thick. Eye relatively high and somewhat small. Eye diameter somewhat smaller than snout length. Outer profile of eye above dorsal-profile projection. Tongue margin rounded. rear edge of mouth: extending beyond the vertical of rear margin of pupil. Anterior nostril at end of short tube, projecting downward just behind upper margin of upper lip. Posterior nostril as an oblong pore anterior to lower part of eye. Postorbital range rather long. Upper jaw extending to a point beyond the rear margin of pupil. Gill-opening extending ventrally to about vertical of midline of opercle. Vertebral count  $10+16=26$  ( $n=3$ ).

**TABLE 1.** Morphometry of both *Cryptocentrus taiwanensis* and *C. albidorsus* from Taiwan.

	<i>C. taiwanensis</i> n. sp.			<i>C. albidorsus</i>		
	Holotype	Paratype	Paratype	Male	Male	Female
	Male	Female	Female			
Standard length(mm)	71.8	60.4	63	72.7	67.5	66.1
Percent of standard length(%)						
Head length	21.8%	22.1%	24.7%	24.5%	22.9%	20.9%
Predorsal length	29.5%	29.5%	31.0%	32.2%	30.3%	29.3%
Snout to 2nd dorsal length	51.4%	49.3%	54.8%	53.1%	50.7%	49.9%
Snout to anus	56.9%	53.3%	59.5%	56.1%	59.6%	53.3%
Snout to anal fin origin	59.5%	57.1%	63.2%	58.9%	61.8%	55.3%
Prepelvic length	24.0%	22.0%	22.9%	25.3%	24.2%	23.8%
Caudal peduncle length	13.1%	12.7%	14.0%	16.2%	15.1%	14.7%
Caudal peduncle depth	11.8%	10.7%	10.5%	10.7%	10.5%	11.2%
1st dorsal fin base	21.7%	20.7%	20.2%	19.6%	18.1%	20.8%
2nd dorsal fin base	31.8%	32.7%	30.7%	32.6%	30.1%	30.4%
Anal fin base	20.4%	22.1%	20.5%	22.2%	21.0%	26.0%
Caudal fin length	28.0%	29.7%	25.8%	22.2%	27.5%	23.9%
Pectoral fin length	19.7%	20.5%	21.0%	19.1%	20.2%	23.3%
Pelvic fin length	16.9%	17.2%	15.9%	18.9%	17.6%	18.4%
Body depth at pelvic fin origin	17.1%	14.7%	17.3%	14.9%	17.4%	16.0%
Body depth at anal fin origin	15.6%	13.7%	15.1%	13.4%	16.2%	15.4%
Body width at anal fin origin	10.7%	10.0%	10.6%	8.7%	9.8%	11.0%
Pelvic fin origin to anus	33.6%	32.6%	38.0%	32.3%	35.0%	29.7%
Percent of head length(%)						
Head width in maximum	68.5%	59.8%	62.4%	59.0%	70.1%	67.5%
Head width in upper gill	53.5%	44.3%	41.8%	48.3%	55.8%	52.0%
Eye diameter	21.2%	19.4%	15.6%	15.6%	19.2%	19.7%
Bony interorbital width	5.0%	5.6%	4.9%	5.7%	6.1%	5.9%
Fleshy interorbital width	17.2%	20.2%	17.1%	16.9%	20.2%	18.5%
Snout length	16.3%	13.3%	15.3%	15.5%	15.7%	19.9%
Low jaw length	36.2%	33.9%	35.6%	30.8%	29.1%	39.8%
Cheek depth	29.2%	22.1%	29.1%	28.5%	38.0%	30.2%
Postorbital length	71.5%	63.5%	66.4%	63.7%	64.5%	71.8%

**Fins.**—D1 VI, D2 I/11; A I/10; P 16; V I/5+I/5 (as in Table 2). D1 rounded, all anterior 5 spinous rays about equal. Origin of A inserted below about third branched rays of D2. Rear tips of D2 and A fin rays almost not extending to procurrent rays of C in both sexes. P moderate moderate large and oblong, rear tip merely reaching about vertical line of last spinous rays in male. V moderate size and rounded, the distal frantum margin rather straight. C elliptical and middle extension somewhat pointed.

**Scales.**—Body mostly covered with rather small cycloid scales, predorsal area entirely naked. LR 100–101; TR 29–31; Pred 15–17; and SDP 15 (as in Table 2). Head and prepelvic region entirely naked.

**TABLE 2.** Distribution frequency of fin-ray and scale counts of both *Cryptocentrus taiwanensis* and *C. albidorsus* from Taiwan.

	D2		A		P		
	I/11	X	I/10	X	16	17	X
<i>C. taiwanensis</i> n. sp.	3	I/11	3	I/10	3	-	16.0
<i>C. albidorsus</i>	6	I/11	6	I/10	1	5	16.8

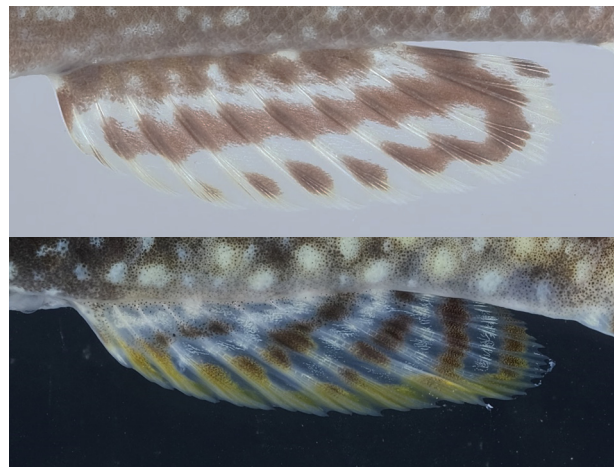
	LR												
	99	100	101	102	103	104	105	106	107	108	109	110	X
<i>C. taiwanensis</i> n. sp.	-	1	2	-	-	-	-	-	-	-	-	-	100.7
<i>C. albidorsus</i>	1	1	-	-	1	1	-	1	-	-	-	1	103.7

	TR										SDP		
	29	30	31	32	33	34	35	36	37	X	14	15	X
<i>C. taiwanensis</i> n. sp.	1	1	1	-	-	-	-	-	-	30.0	-	3	15.0
<i>C. albidorsus</i>	-	-	-	-	2	-	2	1	1	34.8	6	-	14.0

	PreD					
	0	-	15	16	17	X
<i>C. taiwanensis</i> n. sp.	-	-	1	1	1	16.0
<i>C. albidorsus</i>	6	-	-	-	-	0.0



**FIGURE 4.** Anal-fin pigmentation pattern of both *Cryptocentrus taiwanensis* (above) and *Cryptocentrus albidorsus* (below) in male.

## Head lateral line system (Fig. 2)

**Canals:** Nasal extension of anterior oculoscapular canal with terminal pore  $\sigma$  located in above posterior nostrils. Anterior interorbital sections of oculoscapular canal with a single pore  $\lambda$ . A single pore  $\kappa$  in near rear of interorbital region and with paired pore  $\omega$ . Lateral section of anterior oculoscapular canal with the front pore  $\alpha$ , median pore  $\beta$ , and posterior terminal pore  $\rho$ . Posterior oculoscapular canal with two terminal pores  $\theta$  and  $\tau$ . Preopercular canal present with three pores including pore  $\gamma$ ,  $\delta$  and  $\epsilon$ .

**Sensory papillae:** Typically cheek with transverse infraorbital papillae pattern. 5 major transverse rows of papillae below eye. In the middle crossing with very long row *b* starting from midline vertical of eye to corner of preopercule. Row *d* as the ventrally terminal points of all 5 transverse rows. Row 1 simple transverse. Row 2

mainly located below the longitudinal mid-line as row *b*. Row 3 long and crossing the row *b*. Row 4*i* mostly as linear transverse row below row *b* but only one side interrupted into two rows seen in left side of holotype (seen in Fig. 2). Row 5 only seen as 5*s* as all papillae above row *b*. Row *f* as paired longitudinal row. Anterior edge of row *oi* connecting to lower region of row *ot*.

### Coloration while fresh (Figs.3, 5)

Head and body almost brown to blackish brown. Head with minute rounded white spots on lower half in male, and the spots on entirely lateral side in female. Body scattered with many small rounded white spots and a middle longitudinal row of 8 oblong blackish brown blotches. Dorsal view of head and body with a broad light brown band. Caudal fin base with two rounded brown spots.

First dorsal fin translucent with two somewhat horizontal rows of blackish brown blotches on dorsal half and a row of rounded brown spots on basal half.

Second dorsal fin translucent with vertical blackish brown bars on branched rays on dorsal half and 2 main horizontal rows of small brown spots on basal 1/3 region in male; it with 5–6 large oblique blackish brown blotches on dorsal half and 2 main horizontal rows of small brown spots on basal 1/3 region in female.

Anal fin translucent with three major horizontal rows of blackish brown blotches or connected to stripe in middle row in male; the three rows somewhat oblique in female. Pectoral fin translucent brown, with almost entirely scattered 8–9 vertical rows of brown dots. Pectoral fin base brown background scattered with several minute round white spots and an upper somewhat triangular, large creamy white mark. Pelvic fin pale white to snow white background; blackish brown in basal half and following with two transverse brown bands on distal region and narrow outer snow white margin in male; it scattered with several brown blotches in some smaller female. Caudal fin translucent radiating with thick blackish stripes which interrupted into 2 sections on upper and lower 1/3 region in male; it scattered with three main vertical rows of brown blotches in smaller female. Urogenital papilla pale, with melanophores on basal region.

### Etymology

The specific name, *taiwanensis*, is referred to the type locality of current goby merely found from coastal waters of Taiwan.

### Distribution

The new species is very rare and only found from coastal waters of coral-reef or reef in New Taipei City, Taiwan. It is still possible to be found in other locality of eastern Taiwan after more intensive survey for further field exploration.

### Remarks

Although the new species *Cryptocentrus taiwanensis* n. sp. is rather similar to *C. albidorsus* than any other 6 nominal species grouping as the so-called “*Cryptocentrus leucostictus*” group defined by Hoese and Larson (2004) (due to seniority among 7 nominal species, it had better to call *Cryptocentrus niveatus* group defined for such 7 related slender species). It can be well separated from both two nominal species: *C. malidiensis* and *C. nigrocellatus* by (1) second dorsal fin rays I/11 vs. modally I/10; (2) anal fin rays I/10 vs. modally I/9. It can be separated from *C. niveatus* by rather different caudal and anal fin dark mark as well as pigmentation patterns. It can be also differentiated from *C. liolepis* by pectoral fin rays 16 vs. 18. It can be well separated from *C. leucostictus* by (1) lacking any distinct head oblique stripes vs. three conspicuous head dark oblique stripes and (2) different caudal fin marks. It can be also differentiated from *C. maudae* by (1) a horizontal row of 8 blackish brown blotches on lateral side vs. none of the pattern seen in lateral side; and (2) very different caudal fin pattern.

Therefore, the new species *Cryptocentrus taiwanensis* n. sp. can be well distinguished from the most close related species *C. albidorsus* among this slender group by the following features: (1) pectoral fin rays 16 vs. modally 17; (2) transverse scale rows 29–31 vs. 33–37; (3) predorsal scales 15–17 vs. predorsal region entirely naked; (4) lateral blotches: 8 oblong or rounded blackish brown blotches vs. at least anterior 4–5 marks as small thin horizontal bars or small dots and posterior 3–4 remaining ones getting larger; (5) anal fin pattern: three major horizontal brown stripes in male vs. four series of rather oblique arranged spots in male; and (6) pelvic fin: a narrow distal snow white margin in male vs. about posterior half entirely pale white in male.

The unpublished mtDNA COI data from YCY (Yang, unpublished data) can also provide the solid evidence as the great mitogenetic differentiation from the two conspicuous, morphological discrete species in Taiwanese waters. Furthermore, the detailed molecular phylogenetic analysis for whole Taiwanese species of *Cryptocentrus* is still in progress for gathering the better or full pictures of speciation of local species.

## Acknowledgments

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