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A NEW SPECIES OF GENUS *Pseudogobius* POPTA (TELEOSTEI: GOBIIDAE) FROM BRACKISH WATERS OF TAIWAN AND SOUTHERN CHINA

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Key words: *Pseudogobius*, new species, goby, Taiwan.

ABSTRACT

A new species of fat-nose goby genus *Pseudogobius taijiangensis* n. sp. is firstly described herein and was collected from brackish waters of Taiwan and southern China. *P. taijiangensis* n. sp. can be well distinguished from other congeners by the unique combinations of the following features: (1) fin rays: 2nd dorsal fin rays modally 7, anal fin rays modally 7, pectoral fin rays modally 17 and first dorsal fin rounded and lacking filaments; (2) squamation: lateral body with large ctenoid scales, longitudinal scale rows 26-28, predorsal scales modally 8; and (3) specific coloration: body with some black thin longitudinal lines; rear region of first dorsal fin membrane with a big blackish blue spot; and caudal fin membrane with 4-7 vertical lines. *P. taijiangensis* n. sp. belongs to the fourth nominal species of *Pseudogobius* from Taiwanese waters after this report.

I. INTRODUCTION

The genus *Pseudogobius* Popta, 1922 [18] is a group of small size of gobies which are mainly lives in mangrove and estuarine brackish water habitat in the Indo-west Pacific region [5, 16, 23]. Previous taxonomic study of mangrove gobies by Larson reveals at least 6 nominal species of *Pseudogobius* as valid as follows: *Pseudogobius poicilosomus* (Bleeker, 1849), *Pseudogobius javanicus* (Bleeker, 1856), *Pseudogobius melanostictus* (Day, 1876), *Pseudogobius olorum* (Sauvage, 1880), *Pseudogobius masago* (Tomiyama, 1936) and *Pseudogobius avicennia* (Herre, 1940) [2, 4, 10, 11, 20, 21], and the *Vaimosa serangoonensis* Herre, 1937 and *Vaimosa adyari Herre*, 1945 [12, 13] be regards as synonym of *P. melanostictus* [16]. Our recently research has revealed that *Pseudogobius gastrospilos* (Bleeker, 1853) should be considered as senior synonym of *Pseudogobius melanostictus* [15].

The *P. javanicus* and *P. masago* were been found in previous studies [5, 23]. In recently years, authors have an overall investigation and survey of mangrove and brackish gobies in brackish habitat of Taiwan and southern China.

The aim of this paper is to formally describe the new *Pseudogobius* species was found in western and northeastern Taiwan and Fujian Province, southern China. The differentiation of this new species and other congeners and the diagnostic key of genus *Pseudogobius* will be discussed and provided herein.

II. MATERIALS AND METHODS

All fresh specimens were collected by hand net from estuary or mangrove habitat of Taiwan, Philippines, Singapore, Malaysia, Palau and southern China. All counts and measurements were made from specimens preserved in 70% ethanol. Morphometric methods follow Miller [17] and meristic methods follow Akihito *et al*., Chen and Shao, and some other authors [1, 6-9, 14]. Terminology of cephalic sensory canals and free neuromast organs (sensory papillae) is from Wongrat and Miller [22], based on Sanzo [19]. Except for holotype specimen of *Pseudogobius gastrospilos* deposited at Department of Marine Zoology (Fishes), Netherlands Center for Biodiversity, Naturalis, Leiden, the Netherlands. Other examined specimens as well as deposited at the Institute of Marine Biology, National Taiwan Ocean University, Keelung (NTOUP).

Meristic abbreviations are as follows: A, anal fin; C, caudal fin; D1 and D2, first and second dorsal fins, respectively; LR, longitudinal scale series; P, pectoral fin; PreD, predorsal scales; SDP, scale series from origin of first dorsal fin to upper pectoral origin; TR, transverse scale series from second dorsal to anal fin; VC, vertebral count. All fish lengths are standard length (SL).

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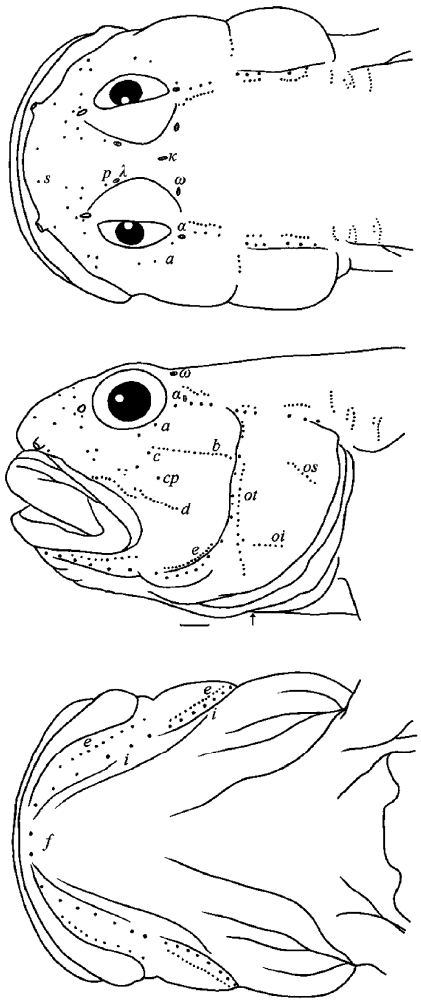

Fig. 1. Head lateral-line system of *Pseudogobius taijiangensis* n. sp., NTOUP 2012-05-145, holotype, male, 40.1 mm SL. Bar = 1 mm. Drawing by Shih-Pin Huang.

III. SYSTEMATICS

***Pseudogobius taijiangensis* n. sp.**
(Figs. 1, 2)

Pseudogobius sp. Chen & Fang, 1999: 230.

Material examined

Holotype. NTOUP 2012-05-145, 40.1 mm SL, mangrove of Beimen District, Tainan City, Taiwan, coll. S. P. Huang and H. M. Huang, 2 March, 2010.

Paratypes. Taiwan: NTOUP 2012-05-146, 30 specimens, 20.6-36.9 mm SL, mangrove of Beimen District, Tainan City, Taiwan, Taiwan, coll. S. P. Huang and H. M. Huang, 2 March, 2010. NTOUP 2012-05-147, 6 specimens, 23.8-31.3 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 22 March, 2010. NTOUP 2012-05-148, 5 specimens, 19.3-32.4 mm SL, estuary of Xiaofanli River, Guanyin Township, Taoyuan County, Taiwan, coll. S. P. Huang and H. M. Huang, 9 July, 2010. NTOUP 2012-05-149, 5 specimens, 22.2-31.4 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 15 July, 2010. NTOUP 2012-05-150, 6 specimens, 22.9-30.2 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang, 15 February, 2012. NTOUP 2013-09-201, 2 specimens, 17.8-18.1 mm SL, mangrove of Taijiang National Park, Qigu District, Tainan City, Taiwan, coll. S. P. Huang, 1 July, 2013.
Mainland China: NTOUP 2012-04-144, 20 specimens, 16.1-29.4 mm SL, mangrove of Haimen Island, Fujian Province, China, coll. S. P. Huang, 6 March, 2012.

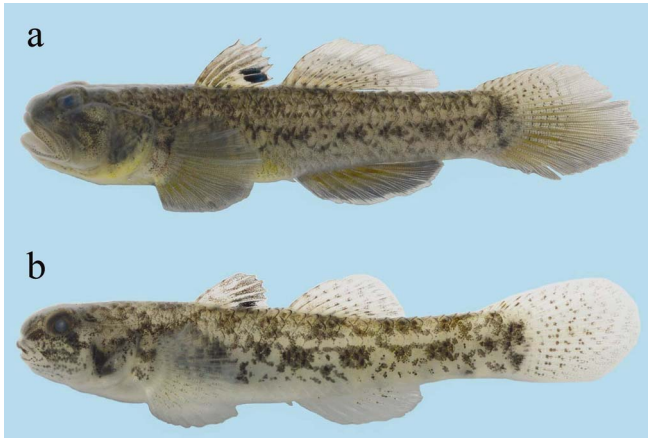

Fig. 2. Fresh specimen photos of *Pseudogobius taijiangensis* n. sp., a, NTOUP 2012-05-145, holotype, male, 40.1 mm SL, mangrove of Beimen district, Tainan City, Taiwan; b, female, NTOUP 2012-05-146, 36.9 mm SL, paratype, other data same as holotype.

Other comparative materials

***Pseudogobius avicennia* (Herre, 1940)**
NTOUP 2011-05-020, 12 specimens, 22.0-25.9 mm SL, Matang mangrove, Malaysia, coll. I-S. Chen and S. P. Huang, 21 April, 2011.

***Pseudogobius gastrospilos* (Bleeker, 1853)**
RMNH.PISC.4676, holotype, 29.7 mm SL, Batavia, Java, Indonesia.
NTOUP 2011-05-049, 20 specimens, 16.8-33.3 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 15 January, 2010; NTOUP 2011-05-050, 15 specimens, 21.5-34.6 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 22 March, 2010; NTOUP 2012-02-123, 10 specimens, 20.1-30.5 mm SL, mangrove of Palau, coll. I-S. Chen and J. T. Chen, 17 November, 2006; NTOUP 2012-11-165, 3 specimens, 18.6-32.4 mm SL, Sai Yuan, Phuket Island, Thailand, coll. S. P. Huang, 23 November, 2012; NTOUP 2012-11-168, 8 specimens, 18.3-30.3 mm SL, Cherngtalay, Phuket Island, Thailand, coll. S. P. Huang, 23 November, 2012.

Table 1. Morphometric measurements of the *Pseudogobius taijiangensis* n. sp.

	Pseudogobius taijiangensis n. sp.	
Characters	Male	Female
n	6	6
Percent standard length (%)		
Head length	25.5 – 28.4 (26.9)	24.4 – 25.5 (25.0)
Predorsal length	35.5 – 37.1 (36.5)	34.0 – 36.0 (35.2)
Snout to 2nd dorsal origin	52.6 – 55.2 (53.8)	54.5 – 55.5 (54.9)
Snout to anus	51.9 – 53.3 (52.7)	50.0 – 53.8 (51.8)
Snout to anal fin origin	56.8 – 58.1 (57.3)	54.7 – 56.4 (55.8)
Prepelvic length	28.0 – 30.4 (29.1)	26.6 – 28.0 (27.1)
Caudal peduncle length	30.3 – 32.8 (31.4)	31.3 – 32.5 (31.8)
Caudal peduncle depth	12.1 – 14.2 (13.4)	12.7 – 13.6 (13.1)
1st dorsal fin base	13.4 – 14.2 (13.8)	12.2 – 13.5 (12.9)
2nd dorsal fin base	17.7 – 20.8 (18.9)	15.9 – 17.0 (16.4)
Anal fin base	15.8 – 16.5 (16.2)	14.0 – 16.0 (15.2)
Caudal fin length	26.5 – 28.4 (27.4)	23.0 – 25.2 (24.3)
Pectoral fin length	23.0 – 24.2 (23.7)	23.2 – 24.0 (23.6)
Pelvic fin length	18.3 – 19.2 (18.3)	18.1 – 20.2 (19.1)
Body depth at pelvic fin origin	18.6 – 20.3 (19.4)	18.3 – 19.6 (18.9)
Body depth at anal fin origin	17.6 – 19.2 (18.4)	18.2 – 19.4 (18.9)
Body width at anal fin origin	13.2 – 14.5 (13.8)	13.4 – 15.4 (14.6)
Pelvic fin origin to anus	24.8 – 26.1 (25.2)	23.5 – 26.2 (24.7)
Percent head length (%)		
Snout length	35.0 – 37.0 (36.2)	32.7 – 34.3 (33.3)
Eye diameter	21.5 – 23.7 (22.9)	24.3 – 27.7 (26.4)
Cheek depth	33.6 – 39.6 (36.3)	28.8 – 31.5 (29.8)
Postorbital length	46.3 – 50.6 (48.9)	45.3 – 47.0 (46.1)
Head width in maximum	79.6 – 83.9 (81.3)	77.1 – 79.0 (78.2)
Head width in upper gill	52.6 – 55.2 (53.8)	55.3 – 57.0 (56.8)
Bony interorbital width	10.7 – 12.0 (11.2)	11.3 – 13.0 (12.3)
Fleshy interorbital width	33.7 – 35.6 (34.8)	30.1 – 32.5 (31.4)
Lower jaw length	52.7 – 58.8 (55.8)	44.9 – 46.0 (45.4)

***Pseudogobius javanicus* (Bleeker, 1856)**

NTOUP 2011-05-052, 12 specimens, 20.8-32.1 mm SL, estuary of Zhuan River, Toucheng Township, Yilan County, Taiwan, coll. S. P. Huang and H. M. Huang, 29 October, 2009; NTOUP 2011-05-054, 18 specimens, 19.3-29.1 mm SL, Beimen Township, Tainan County, Taiwan, coll. S. P. Huang and H. M. Huang, 2 March, 2010; NTOUP 2012-02-126, 20 specimens, 19.9-26.6 mm SL, mangrove of Liehyu Island, Taiwan, coll. S. P. Huang and N. H. Jang-Liaw, 24 November, 2011; NTOUP 2012-02-127, 8 specimens, 14.6-23.7 mm SL, mangrove of Hong Kong, coll. I-S. Chen, 22 November, 2011; NTOUP 2011-05-055, 4 specimens, 25.2-30.1 mm SL, San Fernando City, Luzon Island, Philippines, coll. S. P. Huang, 18 April, 2010; NTOUP 2011-05-056, 52 specimens, 15.9-32.4 mm SL, Sungei Buloh mangroves, Singapore, coll. I-S. Chen, July, 2001; NTOUP 2012-11-164, 22.7 mm SL, Sai Yuan, Phuket Island, Thailand, coll. S. P. Huang, 23 November, 2012.

***Pseudogobius masago* (Tomiyama, 1936)**

NTOUP 2010-11-568, 28 specimens, 17.1-21.0 mm SL, estuary of Puzi River, Dongshi Township, Chiayi County, Taiwan, coll. S. P. Huang and H. M. Huang, 2 March, 2010; NTOUP 2010-11-595, 30 specimens, 14.0-18.6 mm SL, estuary of Xiaofanli River, Guanyin Township, Taoyuan County, Taiwan, coll. S. P. Huang and H. M. Huang, 9 July, 2010; NTOUP 2012-02-119, 5 specimens, 21.9-24.5 mm SL, estuary of Jinsha River, Kinmen Island, Taiwan, coll. S. P. Huang, 19 May, 2010.

Diagnosis

P. taijiangensis n. sp. is well distinguished from other congeners by the unique combinations of the following features: (1) fin rays: D2 I/6-8 (modally 7), A I/6-7 (modally 7), P 14-17 (modally 17) and first dorsal fin low, rounded and lacking filaments; (2) squamation: lateral body with large ctenoid scales, longitudinal scale rows 26-28 (modally 27), predorsal scales 8-9 (modally 8); (3) specific coloration: body with 3-4 longitudinal stripes throughout the trunk, first dorsal fin membrane with a big circle blue spot on their first dorsal fin membrane.

Description

Body elongate, subcylindrical anteriorly and compressed posteriorly. Head large. Snout more prominent than lower lip. Eyes rather large. Mouth maxillary extending to the vertical of center of pupil in male, and merely reach anterior margin of orbit in female. Anterior nasal as short tube, posterior nasal as round hole. Gill-opening restricted, extending ventrally middle vertical line of opercle. VC 10 + 16 = 26 (in 11).

Fins

D1 VI; D2 I/6-8 (modally 7); A I/6-7 (modally 7); P 14-17 (modally 17). First dorsal fin low, rounded and never elongate into filamentous, and first dorsal fin ray II and III longest. Anal fin inserted below first branched rays of second dorsal fin. Pelvic fin large and rounded. Rear margin of caudal fin rounded.

Scales

LR 26-28 (modally 27); TR 8-9 (modally 8); PreD 8-9 (modally 8); SDP 6-7 (modally 7). Body covered with rather large ctenoid scales. Predorsal region with cycloid scales. Belly with smaller cycloid scales. Cheek naked. Few small cycloid scales covered with upper region of opercle.

Head lateral-line system (Fig. 1)

Canals.- Anterior oculoscapular canal present, anterior termination with paired pores λ, a median interorbital pore κ, paired postorbital pores ω, lateral termination with paired pores α. Posterior oculoscapular and preopercular canals entirely absent.

Sensory papillae- Row *a* short, about two third of obit diameter. Row *b* long with densely-set papillae, starting from

Table 2. Frequency distribution of meristic features of the *Pseudogobius taijiangensis* n. sp.

	D1			D2				A				P				
	V	VI	x	I/6	I/7	I/8	x	I/6	I/7	I/8	x	14	15	16	17	x
P. taijiangensis n. sp.	–	33	6.0	5	25	2	6.9	3	30	–	6.9	2	2	26	28	16.4
P. avicennia	–	12	6.0	–	12	–	7.0	1	11	–	6.9	–	2	16	4	16.1
P. gastrospilos	–	20	6.0	–	20	–	7.0	–	20	–	7.0	3	31	4	–	15.0
P. masago	1	19	6.0	–	19	1	7.1	–	18	2	7.1	2	24	13	1	15.3
P. javanicus	–	28	6.0	–	28	–	7.0	–	28	–	7.0	–	35	27	1	15.5

	LR					TR				PreD					
	26	27	28	29	x	8	9	10	x	6	7	8	9	10	x
P. taijiangensis n. sp.	5	39	22	–	27.3	25	8	–	8.2	–	–	24	9	–	8.3
P. avicennia	–	–	19	5	28.2	–	–	12	10.0	–	–	–	11	1	9.1
P. gastrospilos	–	22	18	–	27.5	13	7	–	8.4	–	20	–	–	–	7.0
P. masago	–	–	31	8	28.2	20	–	–	8.0	–	–	3	16	1	8.9
P. javanicus	–	–	41	25	28.4	17	16	–	8.5	4	24	4	–	–	7.0

	SDP					VC		
	5	6	7	8	x	25	26	x
P. taijiangensis n. sp.	–	15	18	–	6.5	–	11	26.0
P. avicennia	–	–	12	–	7.0	–	3	26.0
P. gastrospilos	2	18	–	–	5.9	–	11	26.0
P. masago	–	3	11	6	7.2	4	2	25.3
P. javanicus	1	23	9	–	6.2	1	7	25.9

the posterior margin of pupil. Single *c* papilla. Row *cp* short. Opercular rows with rows *os*, *oi* and *ot*. Rows *oi* and *ot* slightly close. Row *f* with a pair of single papillae. Row *s* with three pair of papillae.

Coloration in life (Fig. 2a, 2b)

Head and body generally pale brownish yellow, middle lateral with 5-6 mainly blackish brown blotches, and with 3-4 longitudinal stripes throughout the trunk. Lateral scales with blackish brown margin. Belly usually yellow in adult male, and creamy white in female. Lower orbit region with an oblique stripes extend to central region of cheek. Pectoral fin base with a blackish brown spot. Caudal fin base with 2 blackish brown bars vertical to each other. First dorsal fin membrane with a circle spot at rear region, the spot usually blue in male and black in female. Second dorsal fin membrane with 2-3 rows of longitudinal blackish brown lines. Anal fin grayish black in adult male, and pale grayish white in female. Caudal fin membrane pale yellow in male and grayish white in female. The caudal fin membrane with 4-7 rows of black lines in both sexes.

Habitat

This new species can be found in the brackish water habitat of estuary, mangrove and earthen pond.

Etymology

The Latin specific name, "*taijiangensis*" referring to this new species mainly distributed in the brackish water habitats and also mangroves around "the Taijiang National Park" and nearby region of western Taiwan.

Remarks

Among the 6 nominal, valid *Pseudogobius* species, *P. taijiangensis* n. sp. can be well distinguished from *P. poicilosomus* by *P. taijiangensis* n. sp. having more count of pectoral fin rays 14-17 (modally 17) *vs.* 12, and fewer second dorsal fin rays I/7 *vs.* I/8.

In the remaining 5 congeners, *P. taijiangensis* n. sp. can be well distinguished from *P. olorum* by in having fewer fin rays as count of second dorsal fin rays modally I/7 *vs.* I/8, fewer count of anal fin rays modally I/7 *vs.* I/8,and fewer longitudinal scale series modally 27 *vs.* 32.

P. taijiangensis n. sp. can be also well distinguished from *P. javanicus* by in having different form of first dorsal fin and color pattern, *P. taijiangensis* n. sp. first dorsal fin low, rouned and never elongate into filamentous in adult male, *P. javanicus* first dorsal fin high, triangular and elongate into filamentous in adult male; *P. javanicus* with an oblique stripe starting from first dorsal fin base rear region, and extending to belly, *P. taijiangensis* n. sp. without any oblique stripe on their trunk.

Furthermore, *P. taijiangensis* n. sp. can be well distinguished from *P. avicennia* by in having different scale series and color pattern, *P. taijiangensis* n. sp. having fewer transverse scale series modally 8 *vs.* 10; and *P. taijiangensis* n. sp. with 4-7 rows of thin vertical line on caudal fin membrane, *P. avicennia* with 1-3 rows of broad oblique stripes on caudal fin membrane.

P. taijiangensis n. sp. can be also well distinguished from *P. masago* by in having color pattern: *P. taijiangensis* n. sp. with a big circular blue spot on their first dorsal fin membrane, *P. masago* first dorsal fin membrane clean and without any spot.

P. taijiangensis n. sp. can be also well distinguished from *P. gastrospilos* by in having different scale series and form of first dorsal fin and color pattern: *P. taijiangensis* n. sp. having more predosal scale series 8-9 (modally 8) *vs.* 7; *P. taijiangensis* n. sp. with lower first dorsal fin, rounded and never elongate into filamentous in adult male, *P. gastrospilos* with higher first dorsal fin high, triangular and elongate into filamentous in adult male; *P. taijiangensis* n. sp. with a big circular blue spot on their first dorsal fin membrane, *P. gastrospilos* with two large black spots on their first dorsal fin membrane.

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