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A new brackish goby of *Drombus* (Teleostei: Gobiidae) from Taiwan with short comments on related gobiid species

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Abstract

The brackish environments of Taiwan were relatively unexplored and therefore houses many cryptic fish species, some of which were still unknown to science till this day. After our repeated estuarine surveys and collections, it was encountered an undescribed species of genus *Drombus*, that can be clearly separated from its congeners by the following unique combinations of characters: (a) dorsal fin elements VI-I, 10; anal fin elements I, 9; pectoral fin elements modally 17; (b) longitudinal scale rows 32–34; transverse scale rows modally 13; predorsal scale rows 9–10; and (c) specific coloration: body brownish with dark red spots scattered; first dorsal fin dusky with a black blotch. The brief morphological comparisons of the new species with its congeners is also provided herein.

Key words: taxonomy, new species, estuary, *Drombus*, Gobiidae

Introduction

Teleosts of family Gobiidae are the most important and diverse group of vertebrates (Chen *et al.* 2007), with members covering freshwater, brackish, and marine. Most of them serves important ecological roles as benthic species (McAllister *et al.* 2022; Brooking *et al.* 2022). Taiwan enjoys a diverse goby fish fauna, from freshwater to marine habitat, with about 77 genera and more than 270 species recorded (Chen & Fang 1999; Shao 2023).

The gobiid genus *Drombus* Jordan & Seale, 1905 was erected based on *Drombus palackyi* Jordan & Seale, 1905, and there are currently 10 species recorded, namely *D. bontii* (Bleeker, 1849), *D. dentifer* (Hora, 1923), *D. globiceps* (Hora, 1923), *D. halei* Whitley, 1935, *D. key* (Smith, 1947), *D. lepidothorax* Whitley, 1945, *D. ocyurus* (Jordan & Seale, 1907), *D. palackyi* Jordan & Seale, 1905, *D. simulus* (Smith, 1960), *D. triangularis* (Weber, 1909), and a fossil species *D. thackerae* Carolin, Bajpai, Maurya & Schwarzhans, 2022. However, the taxonomy of *Drombus* is strenuous and complicated, the generic distinction is not well designated and the actual taxonomical identities of the nominal species are not fully explored, therefore controversies reside within discussions upon this genus (Herre 1933; Shibukawa *et al.* 2010).

The identification key of Larson & Murdy *in* Carpenter & Niem (2001) has given the characteristics of *Drombus* as nape usually with scales with midline may be naked, and the identification for cephalic papillae system patterns as having one vertical papilla row on mid-cheek extend ventrally past lowermost longitudinal cheek row, they've also placed *Ctenogobius globiceps* Hora, 1923, *C. kranjiensis* Herre, 1940, and *Rhinogobius ocyurus* Jordan & Seale, 1907 within *Drombus*. However, subsequent authors had inconsistent opinions, suggesting that the species mentioned above should be placed in *Acentrogobius* base on the disagreements in cephalic papillae patterns (Shibukawa *et al.* 2010; Shibukawa *in* Kimura *et al.* 2009; Kunishima *et al.* 2022). Furthermore, the species *Gobius bontii* Bleeker, 1849 is suggested to be placed in *Amoya* Herre, 1927 by Shibukawa *et al.* (2010) base on examinations of the holotype, and the actual generic identity of the recently described *D. thackerae* is uncertain due to its type description is simply based on otolith fossils. In conclusion, identities of a number of *Drombus* species are still controversial and problematic, this will require a complete phylogenetic analysis to resolve, and therefore we will retain the aforementioned species from further discussions.

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The Taiwanese freshwater and estuarine fish fauna have been thorough-documented and summarized by Chen and Fang (1999), with over 200 species recorded and some of them remained undescribed till this day. Within this exploratory record, Chen and Fang (1999) recorded an undescribed species of *Drombus* from lagoons and estuaries of southern Taiwan, with extensive collections and literature studies recently, we've finally obtained sufficient specimens of this rare goby to give it a formal description herein. Furthermore, its comparison to congeners and comments on the its habitat and ecological behaviour will be also addressed.

Materials & Methods

Samples of the undescribed species were collected with kick nets or trawl nets at estuarine habitats. Collected specimens were taken back alive to the Lab of Ichthyology and Molecular Evolution, located at NTOU, to record both living and freshly dead colourations. After photo record, specimens were preserved in 10% formalin after right pectoral fin is clipped off and preserved in 95% EtOH for future applications in molecular biology researches.

Measurements of every collected individual were carried out by electronic callipers and scales to the nearest 0.01mm under dissecting microscope following the methods of Miller (1988) and Chen and Shao (1996), osteological characters were observed with radiographs and identified following Birdsong *et al.* (1988), naming system for cephalic sensory papillae and pore system followed Sanzo (1911) and Wongrat and Miller (1991). Abbreviations for meristic characters shown as follows: D1, first dorsal fin elements; D2, second dorsal fin elements; A, anal fin elements; P_1, pectoral fin elements; P_2, pelvic fin elements; LR, longitudinal scale rows; TR, transverse scale rows; D-P, scale rows between D1 origin and upper P1 base; Pred, pre-dorsal scales; V, vertebral counts; P-V, dorsal pterygiophore formula; SL, standard length

Systematics

Drombus Jordan & Seale, 1905

Drombus rubropunctatus Chen & Li, new species

(Figs. 1–5)

Materials Examined

Holotype.—NTOUP-2023-04-003, 31.88 mm SL, Estuary of Shih-Ting River, Gongliao County, New Taipei City, Taiwan; coll. H.E. Li, 22 April, 2023.

Paratypes.—NTOUP-2003-06-003, 2 specimens (46.74–47.70 mm SL), Kaoping River, Kaoshiung; coll. I-S. Chen, 3 June, 2003.

NTOU-P2023-04-004, 3 specimens (32.48–35.99 mm SL), Estuary of Shih-Ting River, Gongliao, New Taipei City, Taiwan; coll. H.E. Li & M. Huang, 23 April, 2023.

Diagnosis

The new species *Drombus rubropunctatus* can be distinguished from its congeners from the following unique combination of characters (counts for holotype shown in brackets or marked with asterisk): (1) fin rays: D2 I, 10*; A I, 9*; P_1 modally 17*; (2) squamation: LR 32*–34; TR 12–13*; D-P 6*; Pred 9–10 (10); (3) vertebral count V 10+16=26*; and (4) specific coloration: body colour overall dark brownish, lower half with rows of numerous dark red spots. pectoral fin base with a triangle-shaped spot; D1 dusky with a single dark blotch and transparent, colourless stripe.

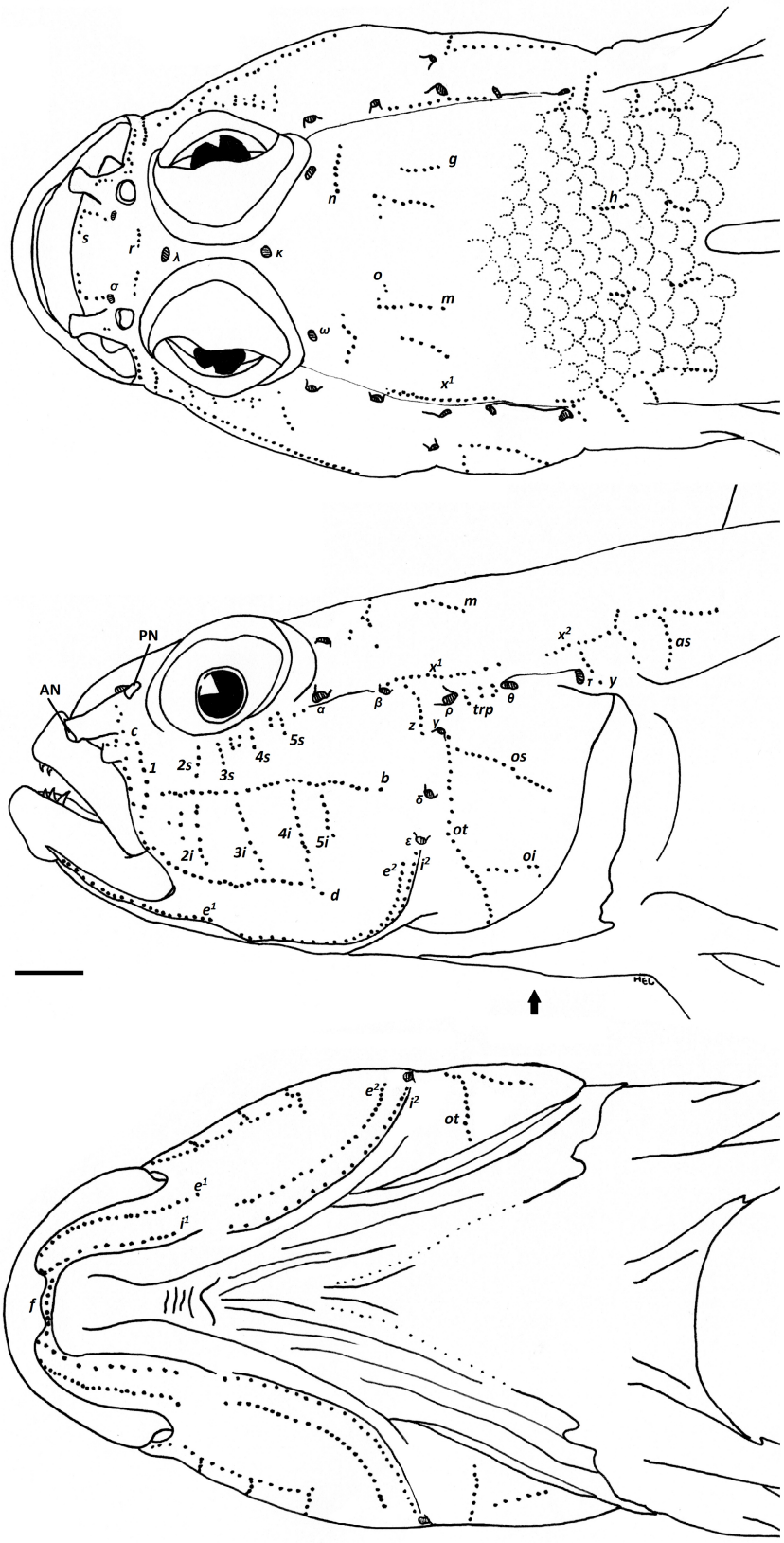

FIGURE 1. Cephalic sensory papillae, canal pore arrangements, and predorsal squamation of *Drombus rubropunctatus* (NTOUP2023-04-003, holotype, male, 31.88 mm SL). AN, anterior nostril; PN, posterior nostril. Arrow indicates the lower edge of gill slits. Scale bar = 0.1 mm.

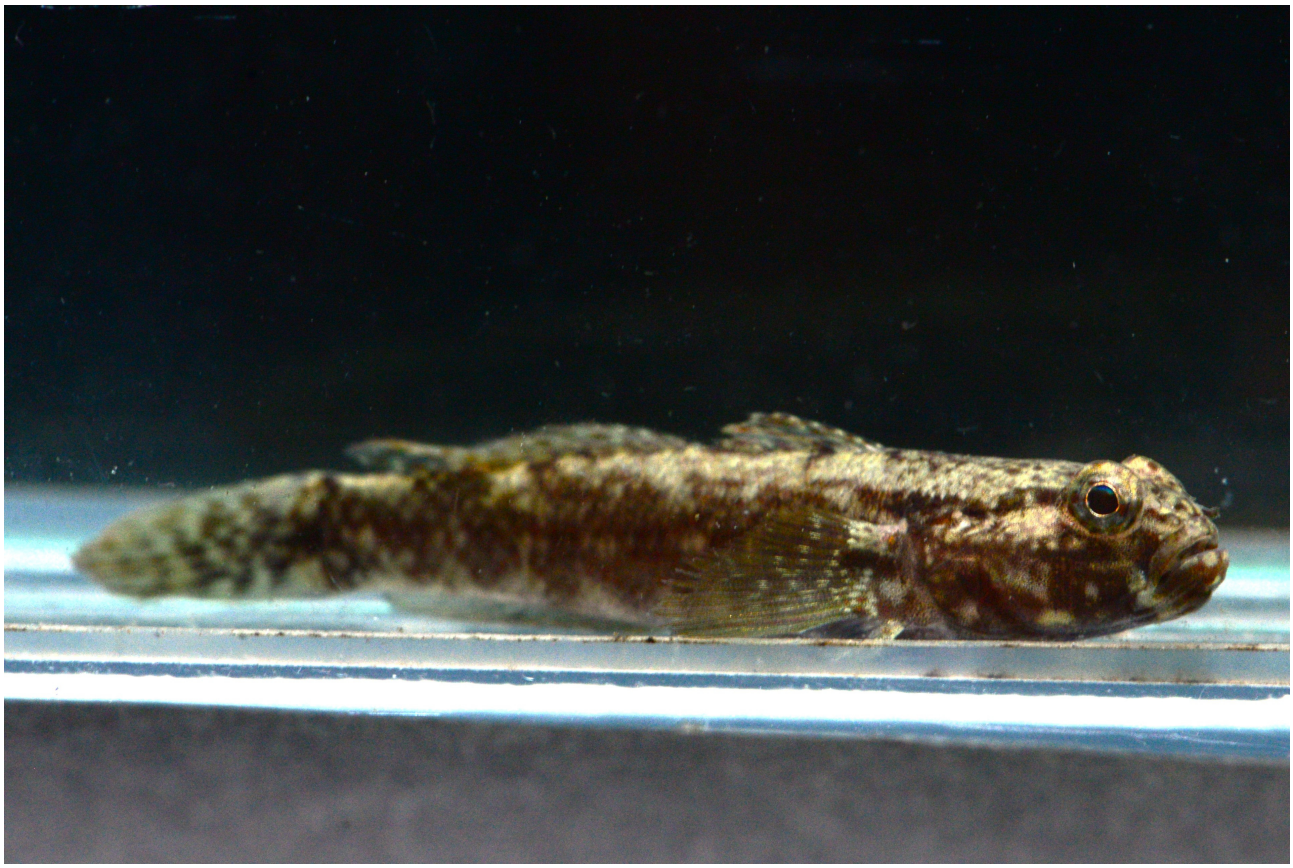

FIGURE 2. Specimen of *Drombus rubropunctatus* (NTOUP2023-04-003, holotype, male, 31.88 mm SL) in life, showing colourations under stress in artificial environment.

Descriptions

Body proportions as shown in Table 1, counts for holotype marked with asterisk. Body subcylindrical anteriorly, laterally compressed posteriorly. Snout moderately pointy in dorsal view. Snout slightly blunt in large individuals (>40 mm SL). Mouth oblique, lower jaw prominent, posterior end of gape doesn't reach beyond middle-vertical position of orbit. Anterior nostril openings with short tube, extends to upper lip anteriorly; posterior nostril with simple pore-like opening. Eye dorsolateral, relatively large, orbit margins almost meet at dorsal side of head. Jaws with enlarged canine teeth. Anterior tip of lower jaw with bulged, pad-like formation. Cheeks slightly prominent but extremely bulgy, heave-like in larger adult males (>40 mm SL). Genital papillae pointy in male (not reaching anal fin) and blunt in female, without any projections or lateral flaps.

TABLE 1. Meristic counts and morphometry measurements for types of *Drombus rubropunctatus*.

Species	***Drombus rubropunctatus* sp. nov.**		
	Holotype	**Paratypes**	
Sex	♂	♂	♀
n	1	3	2
D	VI-I, 10	VI-I, 10	VI-I, 10
A	I, 9	I, 9	I, 9
P_1	17	16–17	16–17
P_2	I, 5	I, 5	I, 5

.....continued on the next page

TABLE 1. (Continued)

Species	*Drombus rubropunctatus* sp. nov.		
	Holotype	**Paratypes**	
LR	32	32–34	32–33
TR	13	12–13	12–13
D-P	6	6	6
Pred	10	9	9–10
SL (mm)	31.88	35.99–47.70	32.48–33.67
Percent in standard length (%)			
Head length	30.43	29.23–30.38 (29.69)	30.00–30.05 (30.02)
Predorsal length	37.23	35.79–37.46 (36.48)	37.10–38.55 (37.83)
Snout to 2nd dorsal origin	57.09	55.14–57.79 (56.57)	59.79–61.36 (60.58)
Snout to anus	55.74	54.65–56.31 (55.64)	57.24–58.66 (57.95)
Snout to anal fin origin	61.01	59.49–63.65 (61.21)	63.11–63.49 (63.30)
Prepelvic length	33.25	28.91–31.37 (30.51)	29.80–33.47 (31.64)
Caudal peduncle length	20.33	17.59–19.89 (18.96)	17.92–19.01 (18.46)
Caudal peduncle depth	12.48	12.14–13.19 (12.64)	11.30–12.53 (11.92)
1st dorsal fin base	20.33	16.71–19.56 (18.15)	19.95–20.70 (20.33)
2nd dorsal fin base	29.86	28.95–30.26 (29.42)	24.97–28.13 (26.55)
Anal fin base	22.71	22.76–24.05 (23.32)	21.37–22.25 (21.81)
Caudal fin length	27.67	24.65–27.84 (26.44)	27.26–27.00 (27.13)
Pectoral fin length	28.48	23.56–25.92 (25.36)	25.37–27.00 (26.18)
Pelvic fin length	24.22	20.87–24.34 (22.57)	23.46–24.48 (23.97)
Body depth at pelvic fin base	19.92	18.47–20.12 (19.13)	20.02–20.54 (20.28)
Body depth at anal fin base	18.63	16.98–18.66 (17.65	14.66–18.71 (16.68)
Body width at anal fin base	11.51	10.06–11.95 (10.78)	10.19–11.08 (10.63)
Pelvic fin origin to anus	23.53	23.03–27.42 (24.98)	26.55–26.63 (26.59)
Percent in head length (%)			
Head width in maximum	74.23	68.80–84.56 (76.75)	74.75–77.46 (76.11)
Head width at upper gill opening	50.41	47.96–57.01 (52.61)	52.28–53.79 (53.03)
Eye diameter	20.93	16.44–19.11 (18.09)	20.70–21.19 (20.94)
Bony interorbital width	1.57	1.49–2.09 (1.83)	1.78–1.64 (1.71)
Fleshy interorbital width	44.33	35.73–45.53 (41.38)	39.34–48.81 (44.08)
Snout length	25.46	25.20–27.61 (26.16)	22.75–27.43 (25.09)
Lower jaw length	30.21	32.98–36.27 (35.02)	29.31–31.79 (30.64)
Cheek depth	29.59	23.87–33.46 (28.32)	25.82–26.83 (26.33)
Postorbital length	54.12	49.43–55.42 (53.27)	53.79–55.25 (54.52)

Fins. First dorsal fin elements VI* (6); second dorsal fin elements I, 10* (6); anal fin elements I, 9* (6); pectoral fin elements 16 (2) or 17*(4); pelvic fin elements I, 5* (6). First dorsal fin with the third and fourth spinous rays the longest, and for larger adult males (> 40 mm SL) the second, third, and fourth spinous rays with filament-like tips, extending to the first segmented ray of second dorsal fin when compressed. Second dorsal fin base longer than anal fin base in both sexes, the latter two segmented rays of second dorsal fin and anal fin slightly longer than the others. Pectoral fin oval-shaped, posterior tip extending beyond the vertical position of anus and reaching the vertical position of the first segmented ray of anal fin in male individuals; fin without any free, loose fin rays. Pelvic fins fused with well-developed frenum between spinous rays and membrane between the innermost segmented rays,

forming a slightly posteriorly elongated, oval-shaped disc, reaching anterior margin of anus while extending beyond anus only in male individuals. Caudal fin oval shaped, slightly vertically compressed and elongated longitudinally in male individuals.

FIGURE 3. In situ photo of *Drombus rubropunctatus* in Shih-Ting River estuary, emerging from burrow exhibiting warning coloration toward intruders.

Squamation. LR 32* (4), 33 (1) or 34 (1); TR 12 (2) or 13* (4); D-P 6*; Pred 8 (1), 9* or 10 (1). Body overall covered in ctenoid scales except for predorsal regions, thorax, pectoral fin base (axillary region with ctenoid scales) and abdomen in cycloid scales. All ctenoid scales roughly equal in size and without enlarged or elongated cteni. Predorsal squamation shown in Fig. 1A, scales small in size than body scales, squamation of the median predorsal region extends anteriorly. Both cheeks naked. Coverage of cycloid scales on thorax and abdomen does not reach beyond vertical position of the preopercle anteriorly and the vertical position of the posterior end of first dorsal fin base, respectively. Pectoral fin base with numerous small cycloid scales.

Cephalic lateral line system. Cephalic lateral line systems including oculoscapular canal openings (sensory pores) and sensory papillae row patterns shown in Fig. 1. Oculoscapular canal pores well-developed, anterior canals with paired pores σ (located beside posterior nostril) and unpaired pores λ and κ (located at interorbital region), posterior edge of orbit with paired pores ω (located dorsally) and α (located laterally), and paired pores β and ρ located above preopercle. Preopercular canals with paired pores γ, δ, and ε. Posterior oculoscapular canals with paired pores θ and τ. Anterior oculoscapular canals separated from posterior canals, with preopercular canals not continuous with oculoscapular canals. All sensory papillae arranged in simple, single rows. Cheek with horizontal rows *c* and *d*, separating vertical rows *2–5*; rows *2s–5s* short, not reaching vertically to row *c*; row *4i* touching row *d* while row *5i* not reaching row *d*; rows *i* and *e* interrupted at around middle point of orbit; row *c* in loosely arranged single papillae on nasal region and snout. Tip of lower jaw with single row *f*, arranged transversely. Vertical rows of papillae located transversely along the middle line of body laterally.

Colouration when in life. In natural state, body overall dark brown. Head with greyish white patches and two rows of dark brown stripe present, one locates behind orbit, reaching until upper edge of operculum, another locates below orbit, from upper lip reaching posteriorly but not reaching beyond preopercle. Pectoral fin membrane of

male individuals with blueish shade while transparent in females; caudal fin dark brown in male with rows of white specks, while transparent with rows of black spots in females. When under stress or warning state (Fig. 2–3), dorsal side of body greyish white, body with four to five dark brown blotches, caudal fin base with one black spot medially. Head dark brown below orbit with yellowish white blotches.

FIGURE 4. Fresh colorations of *Drombus rubropunctatus*. (a) NTOUP2023-04-003, holotype, male, 31.88 mm SL (b) NTOUP2003-06-004, paratype, female, 33.67 mm SL. Scale bar = 0.1 mm.

Colouration when fresh. See Fig. 4, Body overall brown, slight yellowish in female individuals. Upper half of body spotless, lower half with two to three rows of dark red spots (relatively ambiguous in female). Caudal fin base with a single black blotch. Head with two vague brown stripes, position same with living condition; posterior edge of gape dark brown; cheek and operculum with dark red spots. Ventral side of head, thorax, and abdomen greyish, spotless. For first dorsal fin pigmentation see Fig. 5, overall dusky brown, spinous rays lined with rows of dark red spots; an oval to round shaped black blotch located at the second to third ray (ambiguous in female); a transparent, colourless stripe located horizontally or slightly oblique medially. Second dorsal fin with two rows of darkish red spot lined near base and a reddish margin; a bright transparent yellow stripe presents only in male individuals near margin. Anal fin spotless, dusky with black margin and an orangish red stripe near margin in both sexes. Pectoral fins dusky with a large black spot and a small triangle-shaped yellow speck present at the upper half of fin base; fin rays lined with whitish yellow specks at upper half, red spots at lower half. Pelvic fin membrane black. Caudal fin slightly dusky while darker on the lower 1/3-part, fin rays lined with rows of red spots in the upper 2/3 part; a bright, transparent yellow smear located at the posterior tip of the fifth to ninth fin rays.

Colouration in preservatives. Body overall greyish white, spotless. Head with a dark stripe below eye. All fins dusky; second dorsal fin with a whitish, transparent margin and rows of dark specks near fin base; anal fin dusky with a black margin, shade darker near fin base; pectoral fins dusky, spotless, fin base with a large black spot and a small triangle-shaped white speck present; caudal fin dusky, fin rays lined with rows of dark spots in the upper 1/3 part; a transparent white smear located at the posterior tip of the fifth to ninth fin rays.

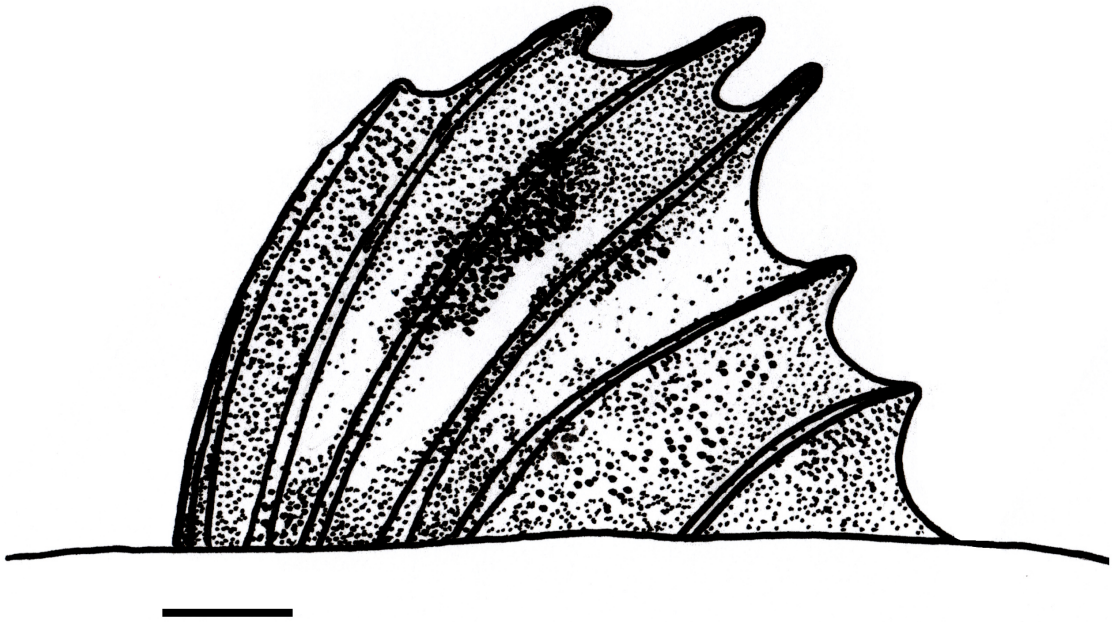

FIGURE 5. First dorsal fin pigmentation of *Drombus rubropunctatus* (NTOUP2023-04-003, holotype, male, 31.88 mm SL). Scale bar = 0.1 mm.

Etymology

The specific name, *rubropunctatus*, is coined with *ruber* and *punctatus*, both in latin meaning "red" and "spotted", respectively, in allusion to the unique specific feature: rows of red spots on lower half of body.

Distribution and habitat

Drombus rubropunctatus n. sp. has so far known from northeastern and southwestern Taiwan, and a literature record from southern Japan, the Okinawa Isl., Hong Kong, Hainan Island and Singapore based on Akihito *et al. in* Nakabo (2013). They prefer to inhabit in silty sand flats or muddy plains, burrowing in crevices of dead corals, rocks or shelter in dead mollusc shells. This species is aggressive, territorial and is a fierce, small carnivore.

Remarks

The new species, *Drombus rubropunctatus* is most similar with the West Pacific species *D. triangularis* (Weber, 1909) in certain meristic counts and fin colorations based on the type description, however the former can be distinguished from the latter by lower anal fin ray counts (9 vs. 8) and longitudinal scale counts (32–34 vs. 35–38), first dorsal fin pigmentations (dusky with transparent stripes and single black spot vs. dusky, black pollenated) and body colorations (dark brown with rows of red spots vs. dark brown with blurred dark spots). *D. rubropunctatus* **sp. nov.** can also be distinguished from another West Pacific species, also the generic type species, *D. palackyii* Jordan & Seale, 1905 by higher counts of anal fin segmented rays (9 vs. 8), pectoral fin rays (17 vs. 18), lateral line scale rows (32–34 vs. 31), and transverse scale rows (12–13 vs. 11), also by first dorsal fin pigmentations (dusky with transparent stripes and single black spot vs. dusky with two or three darker blotches) and body colorations (dark brown with rows of red spots vs. brown with indistinct whitish specks). Comparisons of *D. rubropuncatus* **sp. nov.** with other congeneric species see Table 2.

TABLE 2. Comparison of nominal species of *Drombus* from the Indo-Pacific region.

Species	D2 I-	A I-	P	LR	TR	D1 Markings	Body Markings	Type locality	References
***D. rubropunctatus* sp. nov.**	**10**	**9**	**17**	**32–34**	**12–13**	**Dusky with transparent stripes and single black spot**	**Brownish with brownish red spots on lower half of body**	**Gongliao Township, New Taipei City, Taiwan**	**This study**
D. oligactis	8–10	8–9	15–16	30	8–9	Dark purple	Brownish with iridescent violet green	Singapore	Bleeker, 1875
D. palackyi	10	8	18*	31	11*	Dusky with two or three darker blotches	Brown with indistinct whitish specks	Negros, Philippines	Jordan & Seale, 1905
D. triangularis	10	8	17	35–38	12	Dusky, black pollenated	Dark brown with blurred dark spots	Moluccas, Phillipines	Weber, 1909
D. dentifer	10	9	-	28–31	9	-	Yellowish red	Rambha Bay, east coast of India	Hora, 1923
D. vexillifer	10	8	16	29	11	Grayish medially, blackish brown pale marginally	Brown with 5 saddle-like blotches	Bangkok, Thailand	Fowler, 1937
D. halei	10	8	18	28	11		Back dark brown, lower part lighter and crossed by 8 to 9 darker bands	North Queensland, Australia	Whitley, 1937
D. key	9	8	-	29	12	Light with brownish markings	Olive yellow	Inhaca Island, Mozambique	Smith, 1947

The brackish gobies of Taiwan are probably the more understudied gobiid group of them all (Huang *et al.* 2015), species often inhabit in severely polluted or high turbidity habitats with deep, soft sediments or often effected by strong tidal activities, increasing collection or investigation difficulties. The new species, *D. rubropunctatus* was firstly collected and recorded by Chen and Fang (1999) in southern Taiwan over 30 years ago, though collections of this species is considered rare with distributions and sightings of this species scattered and unclear, we can infer to its specific habitat and further locate its occurrence in muddy or silty substrates, and therefore, in future, with more intense and focused investigations upon these habitats facilitated will surely supply its distributional records and let us gain a better knowledge of them. However, it is still possible the species in Taiwan may be same species to several Japanese specimens but need to further examination for them (Hayashi & Itoh, 1978; Akihito *et al. in* Masuda *et al.*, 1984; Akihito *et al. in* Nakabo *et al.* 2013; Senou *et al.*, 2004, 2021).

Fishes of *Drombus* are generally small in size and distributes mainly in brackish or marine aquatic biomes of the Indian Ocean and Western Pacific (Fricke *et al.* 2023), some individuals were even observed to have taken shelter in burrows of Alpheid snapping shrimps, although it is unclear that they were symbiotic partners of these snapping shrimps like general shrimp gobies (*Amblyeleotris* Bleeker, 1874, *Tomiyamichthys* Smith, 1959 etc.) does or they were simply taking temporary shelter in these burrows (Tan & Jaafar 2017). The new *Drombus* species herein in estuaries were often coupled with Alpheid snapping shrimps with every collection attempt, although diving surveys done by the second author (HEL) has no sighting of *Drombus*-shrimp pairs in burrow or crevices, but base on the sighting record of Tan and Jaafar (2017), possible symbiotic relationship of the new species is suspected and requires visual census by underwater camera traps or more diving survey to confirm.

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