Zoological Studies **61:** 9 (2022)
doi:10.6620/ZS.2022.61-09

Zoological Studies

Open Access

A New Species of *Parascorpaena* Bleeker, 1876 (Teleostei: Scorpaenidae) from Taiwan

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Received 31 August 2021 / Accepted 28 January 2022 / Published 12 April 2022
Communicated by Hin-Kiu Mok

A new species of scorpionfish, Poseidon's scorpionfish *Parascorpaena poseidon*, is described on the basis of ten specimens collected from southwestern Taiwanese waters ranging from Penghu to Chufongbi, Pingtung. The morphological and molecular analyses reveal the new species is clearly separated from the two similar species, *P. aurita* and *P. mossambica*. *Parascorpaena poseidon* is distinguished from congeners by the following combination of characters: three equal-sized suborbital spines without ridge; supraocular tentacle absent or very short; pectoral-fin rays 15–16 (usually 16); pored lateral-line scales 22–26 (usually 22–23); longitudinal scale rows 43–47; pre-dorsal-fin scale rows 2–3 (usually 3); 10–12 scale rows between 6th dorsal-fin spine base and lateral line; 10–12 scale rows between the last dorsal-fin spine base and lateral line; total gill rakers 15–16, gill rakers on hypobranchial 2–3; ratio of 11th and 12th dorsal-fin spine 60%–81% (mean 73%); blackish spots randomly distributed on all fins; absence of a distinct black blotch on spinous dorsal fin in male; body size relatively large.

Key words: Cycloid scales, DNA barcoding, Lacrimal spine, Rocky reefs, Supraocular tentacle.

BACKGROUND

The Indo-Pacific scorpionfish genus *Parascorpaena* Bleeker, 1876 mostly inhabits rocky and coral reefs in shallow waters (Randall 2005; Nakabo and Kai 2013). This genus is distinguished from other fishes of the Scorpaenidae by two distinct characters, viz. posterior lacrimal spines forwardly curved in adults, and body covered by cycloid scales (Smith 1957; Motomura et al. 2009). *Parascorpaena* currently comprises nine valid species: *P. armata* (Sauvage, 1873), *P. aurita* (Rüppell, 1838), *P. bandanensis* (Bleeker, 1851), *P. grandisquamis* (Ogilby, 1910), *P. maculipinnis* Smith, 1957, *P. mcadamsi* (Fowler, 1938), *P. mossambica* (Peters, 1855), *P. moultoni* (Whitely, 1961), *P. picta* (Cuvier in Cuvier & Valenciennes, 1829) (Motomura et al. 2011; Fricke et al. 2015; Wibowo and Motomura 2021).

Poss (1999) listed four species of *Parascorpaena*, including *P. aurita*, *P. mcadamsi*, *P. mossambica* and *P. picta*, in his identification guide for fishery of the Scorpaenidae. He divided these species into two groups based on two characters. The first group, *P. aurita* and *P. picta*, is diagnosed by absence of a suborbital spine below eye and pectoral-fin rays usually 17 or 18. The second group, comprising *P. mcadamsi* and *P. mossambica*, is diagnosed by presence of a suborbital spine below eye and pectoral-fin rays usually 15 or 16. Nakabo and Kai (2013) listed five species of *Parascorpaena* from Japanese waters, including *P. aurita*, *P. mcadamsi*, *P. mossambica*, *P. maculipinnis* and *P.* sp. In their book, *P. aurita* is distinguished from the other four congeners by pectoral-fin rays usually 17 (vs. usually 16), and a ridge below eye (vs. a spine below eye); *P. mossambica* is distinguished from *P. mcadamsi*, *P. maculipinnis* and *P.* sp. by body covered by ctenoid scale (vs. cycloid scales), supraocular tentacle dominant (vs. absent or very short), and body size at maturity about 90 mm SL (vs. less than 80 mm); *P. mcadamsi* can be differentiated from *P. maculipinnis* and *P.* sp. by having two suborbital spines (vs. three unequal-sized

Citation: Chou TK, Liao TY. 2022. A new species of *Parascorpaena* Bleeker, 1876 (Teleostei: Scorpaenidae) from Taiwan. Zool Stud **61**:9. doi:10.6620/ZS.2022.61-09.

suborbital spines); *P. maculipinnis* is distinguished from *P.* sp. by the first suborbital ridge reaching anterior pupil (vs. not reaching anterior pupil), and posterior region of opercle covered by less large scales (vs. covered by many small scales). However, taxonomic revision of the remaining species was poorly studied (Poss 1999; Motomura et al. 2009; Nakabo and Kai 2013; Wibowo and Motomura 2021), and the diagnostic characters were necessary to be re-examined (Motomura et al. 2011 2013).

In a recent survey of fishes killed by cold in January 2021, several specimens were collected from beaches of Kaohsiung and Penghu. These specimens were recognized as a species of *Parascorpaena* representing a member of Poss' (1999) second group, but were unsuccessfully identified as any valid species. In the present study, these specimens were described as a new species of *Parascorpaena* based on morphological and molecular data.

MATERIALS AND METHODS

Fresh individuals were kept in frozen seawater and photographed in the laboratory. Specimens were fixed in 10% formalin and then transferred and permanently stored in 70% ethanol for preservation. For genetic analyses, tissue was independently stored in 95% ethanol and frozen at -20°C. Voucher specimens were deposited in the Biodiversity Research Center, Academia Sinica, Taipei (ASIZP); the Department of Oceanography, National Sun Yat-sen University, Kaohsiung (DOS); and the Pisces Collection of National Museum of Marine Biology and Aquarium, Pingtung (NMMB-P).

Meristic counts followed Motomura et al. (2005a b c) and Motomura and Johnson (2006). The last two soft rays associated with a single pterygiophore of the dorsal and anal fins were counted as one single ray. Morphometric measurements generally followed Motomura (2004a b). Additional measurements (*i.e.*, head width, maxillary depth) followed Motomura et al. (2005b 2006a b). Measurements were taken to nearest 0.1 mm using a digital caliper. Standard length is expressed as SL. Standardization of measurement data were expressed as a percentage of SL. Terminology of head spines generally followed Randall and Eschmeyer (2001). Sex was determined based on gonads from the abdomen of the right side by dissection. Principal component analyses (PCA) were conducted based on all morphometric data using PAST version 4.03 (Hammer et al. 2001).

DNA was extracted from the fin-clips using the GeneMark Easy Tissue & Cell Genomic DNA Purification Kit, following the manufacturer's protocol. PCR amplifications were performed in a 25 µl volume containing 3 µl of 10x Taq Buffer, 2 µl of dNTP mixture at 10 mM each, 1 µl each of forward and reverse primer at 5 µM, 0.125 µl of Pro Taq Plus DNA polymerase (Protech Technology Enterprise, Taiwan), 1 µl of template DNA and 16.875 µl ultrapure water. The fragment of *COI* was amplified by the universal *COI* primer pair, FishF2 and FishR1 (Ward et al. 2005). The thermal cycle was composed of an initial denaturation step at 95°C for 4 min, followed by 35 cycles of 94°C for 30 s, 53°C for 30 s and 72°C for 1 min, with a final step at 72°C for 10 min. The PCR products were run on a 2% agarose gel for verification and were purified by SAP-Exo Kit (Jena Bioscience). The sequencing of PCR products was conducted in the forward and reverse directions by a biotechnology company (Genomics, Taiwan). Forward and reverse sequences were assembled and aligned using BioEdit version 7.2.5 (Hall 1999). The *COI* sequences were deposited into GenBank under accession numbers MZ414209–MZ414219, MZ08500–MZ08515.

The comparative sequences of *Scorpaenopsis neglecta* Heckel, 1837 (MZ08516–MZ08517) were generated by the present study. *Parascorpaena mcadamsi* (FUT280-18), *P. picta* (FSCS609-07) and *Sebastapistes strongia* (Cuvier, 1829) (LIFS522-08) were downloaded from BOLD (the Barcode of Life Data System). The maximum likelihood (ML) tree of *COI* gene was reconstructed by MEGA version 10.1.1 (Kumar et al. 2018). Kimura-2-parameter (K2P) model was selected for tree reconstruction and genetic distance calculations. The branch support value was assessed by the bootstrap approach with 1000 replicates.

RESULTS

Parascorpaena poseidon Chou and Liao sp. nov.

Common name: Poseidon's scorpionfish
(Figs. 1–3)
urn:lsid:zoobank.org:act:64957B21-C998-4899-B603-60D9F8BA3880

Holotype: NMMB-P035691,116.8 mm SL, female, Sizihwan, Kaohsiung, Taiwan, 22°37'26"N, 120°15'44"E, 13 Jan 2021.

Paratypes: Nine specimens, 92.5–127.0 mm SL, all from Taiwan: DOS00182 (108.3 mm, female), Hsuhai, Pingtung, 18 Jan. 2014; NMMB-P035692 (113.7 mm, female), Kezailiao, Kaohsiung, 22°43'26"N, 120°15'3"E, 17 Feb. 2019; NMMB-P035693, two specimens (99.3 mm, sex undetermined; 106.6 mm,

male), Longmen, Penghu, 23°33'53"N, 119°41'3"E, 12 Jan. 2021; ASIZP0080980, two specimens (122.8 mm, female; 127.0 mm, male), Longmen, Penghu, 23°33'53"N, 119°41'3"E, 13 Jan. 2021; ASIZP0080981 (103.0 mm, sex undetermined), Longmen, Penghu, 23°33'53"N, 119°41'3"E, 1 m, 30 Apr. 2021; DOS08351 (118.4 mm, sex undetermined), Southern Taiwanese waters, 21 Jun. 2021; NMMB-P035694 (92.5 mm, sex undetermined), Chufongbi, Pingtung, 20 Apr. 1985.

Etymology: The new species is named after Poseidon, the Greek god of the Sea. A noun in apposition. In allusion to the three equally-sized suborbital spines without ridge similar to the trident of Poseidon.

Diagnosis: *Parascorpaena poseidon* sp. nov. can be distinguished from other congeners by a combination of characters: three equally-sized suborbital spines without ridge (Fig. 4); supraocular tentacle absent or very short; pectoral-fin rays 15–16 (usually 16) (Table 1); pored lateral-line scales 22–26 (usually 22–23); longitudinal scale rows 43–47; pre-dorsal-fin scale rows 2–3 (usually 3); 10–12 scale rows between 6th dorsal-fin spine base and lateral line; 10–12 scale rows between last dorsal-fin spine base and lateral line; total gill rakers 15–16, gill rakers on hypobranchial 2–3; ratio of 11th and 12th dorsal-fin spine 60%–81% (mean 73%) (Fig. 5); blackish spots randomly scattered on all fins (Figs. 1, 2); spinous dorsal fin without a distinct black blotch in male; body size relatively large, largest recorded specimen 127.0 mm SL.

Description: Referred to table 2 for meristic counts and morphometric measurements and figures 1 and 2 for overall body shape. Dorsal fin continuous, fifth spines longest, fifth to eleventh spines progressively shorter, membrane of spinous portion of dorsal fin moderately notched, all soft rays branched with first longest, last soft ray connected to caudal peduncle by membrane. Pectoral-fin rounded, first ray unbranched and thin, second to fifth rays branched, the remaining lower rays unbranched and thickened; sixth or seventh ray longest. Pelvic-fin I, 5, all soft rays branched with second longest, last soft ray connected to abdomen by membrane. Anal-fin III, 5, all soft rays branched with second longest, last soft ray connected to caudal peduncle by membrane. Caudal fin with 11 branched rays; posterior margin of fin rounded. Branchiostegal rays 7. Gill rakers relatively spinous and short; all gill rakers shorter than gill filaments on first gill arch; longer gill rakers present at angle of gill arch. Swim bladder absent.

Body moderately compressed; nape and anterior body slightly arched; several to many small skin flaps on body; scales cycloid and mostly well-exposed, relatively small on pectoral-fin base, gular, chin, and abdomen; some scales of abdomen embedded by thin skin. Head moderately large, postorbital to preopercular region and cheek covered by small embedded cycloid scales; lower posttemporal and supracleithral spines to upper opercular spine covered by small cycloid scales; snout, suborbital and interorbital regions naked. Tips of third to fifth preopercular spines with tiny skin flaps in some individuals.

Mouth moderately large, slightly oblique, maxilla reaching a vertical through middle of orbit; maxilla without scales; upper margin of posterior maxilla with a distinct ridge; several skin flaps present on maxilla in some individuals; under side of lower jaw without ridge and scales; upper and lower jaws with a band of villiform teeth; vomer with a V-shaped tooth patch, forming by villiform teeth; palatine with villiform teeth; lower jaw without symphysial knob.

Anterior and posterior lacrimal with simple and directly forward spines, not present on antero-dorsal and lateral surfaces of lacrimal; lacrimal spines with short barbels; lacrimal ridge present. Suborbital pit absent. Suborbital spines close to ventral margin of eye. Preopercle with five spines, distal end of first spine forked. Upper opercular spine simple with a low median ridge; lower opercular spine simple with a distinct ridge. Spines on skull mostly well developed, except preocular and supraocular spines; nasal spine simple, median interorbital ridge absent; interorbital ridges absent; preocular spine simple and weak; supraocular spine weak (equal to postocular spine in some individuals); postocular spine simple, length equal to tympanic spine; coronal and pretympanic spines absent; interorbital space shallow; tympanic spine simple; occipital pit shallow to moderated, laterally continuous with tympanic and parietal spines, lateral sides of pit without distinct ridges; parietal and nuchal spines simple, parietal spine base curving into occipital pit and continuous with nuchal spine; distal end of sphenotic spine slightly forked; postorbital spine absent; pterotic spine prominent; upper and lower posttemporal, and supracleithral spines simple, upper posttemporal spine shorter than latter two; cleithral spine prominent.

Colouration: Fresh specimens vary in coloration but mainly brownish to grayish. Upper half of lateral body and caudal peduncle brownish to grayish, scattered with irregular whitish blotches. Abdomen pale to grayish. Head brownish to grayish. Underside of mandible pale to grayish with brownish mottles. Small blackish spots randomly distributed on body and each fin. Basis of pelvic-fin white, distally grayish. Anal-fin pale to grayish, mottled with blackish blotches. Other fins brownish to grayish. Specimens in alcohol yellowish to grayish, small blackish spots absent in the

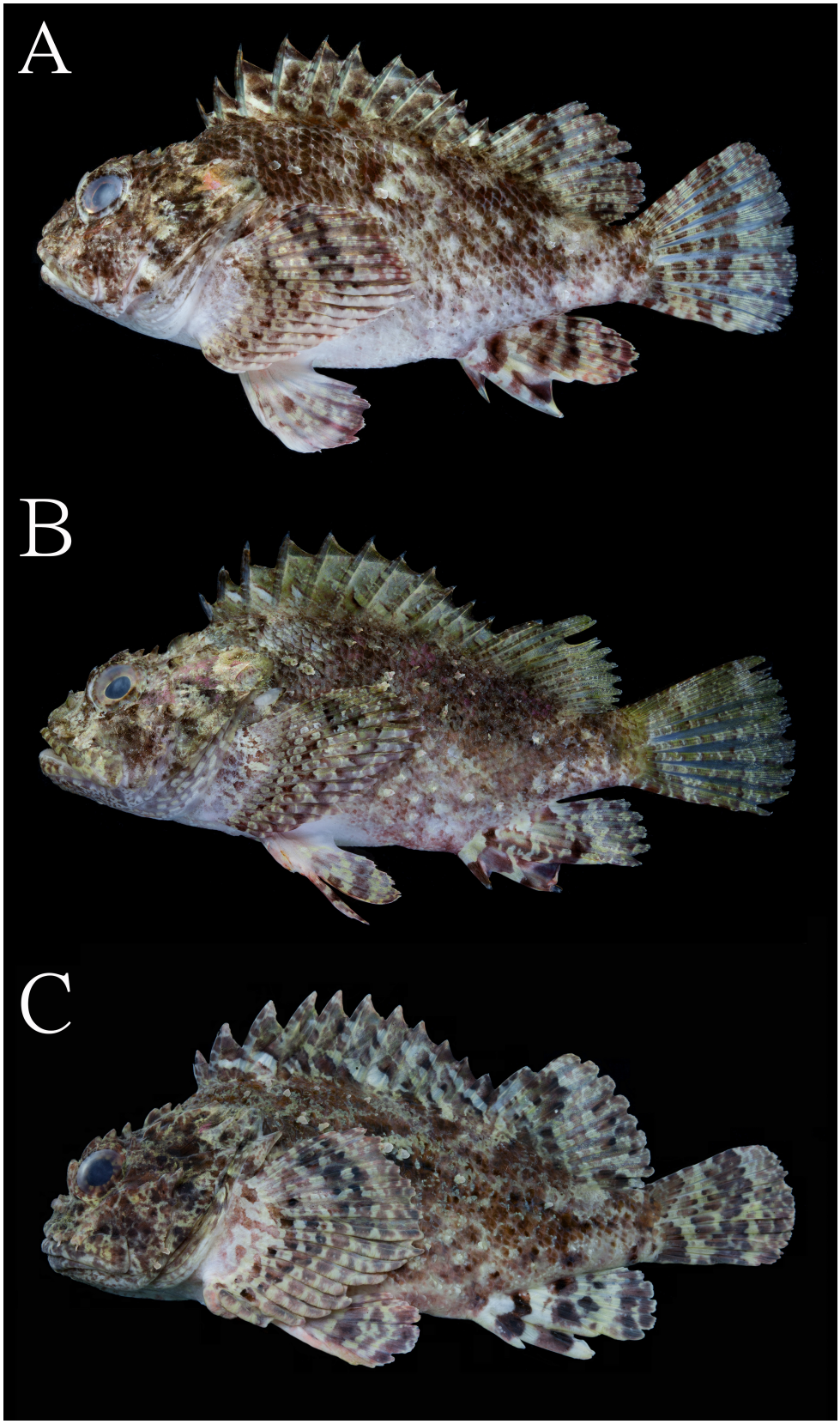

Fig. 1. Fresh specimens of *Parascorpaena poseidon* sp. nov. (A) NMMB-P035691, holotype, 116.8 mm SL, female, (B) ASIZP0080980-1, paratype, 127.0 mm, male, (C) NMMB-P035692, paratype, 113.7 mm, female.

yellowish specimen (Fig. 2B). Other coloration similar to fresh specimens.

Distribution and habitat: The new species is currently known only from southwestern Taiwan ranging from Penghu to Chufongbi, Pingtung. This species mainly inhabits rocky reefs that records in depth of 1 m based on the living individual (Fig. 3).

Principal components analysis (PCA): A PCA plotting graph (Fig. 6) of three species of *Parascorpaena* based on 51 counts and morphometric traits. The first two principal components accounted for 83.58% of the variation. The result showed the new species was well separated from the other species.

Molecular analysis: *COI* fragment of nine

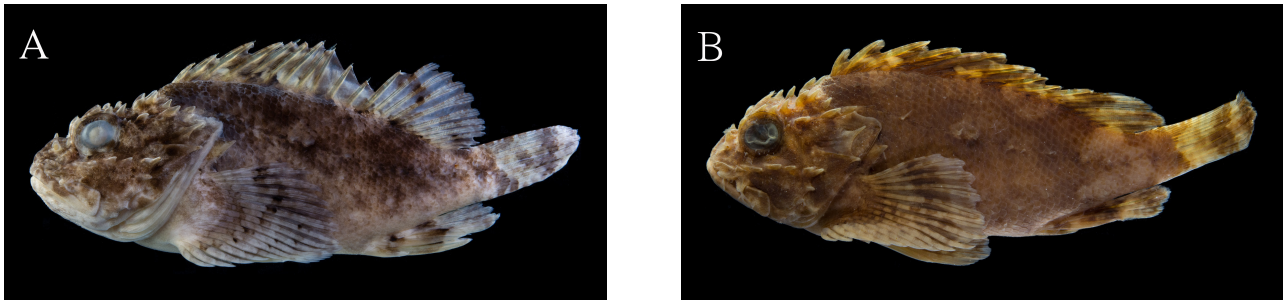

Fig. 2. Preserved specimens of *Parascorpaena poseidon* sp. nov. (A) DOS00182, paratype, 108.3 mm SL, female, (B) NMMB-P035694, paratype, 92.5 mm.

Fig. 3. Underwater photography of *Parascorpaena poseidon* sp. nov. (ASIZP0080981, 103.0 mm SL). Taken in a tide pool of Longmen, Penghu at 1 m depth. Photographed by Yuan-Huan Yu.

individuals of the new species were sequenced. The phylogeny was reconstructed by maximum likelihood (ML) based on 655 bps. In the topology of the ML tree (Fig. 7), four monophyletic groups were recovered representing four species of *Parascorpaena* and were highly supported by bootstrap values. *Parascorpaena picta* was sister to *Scorpaenopsis neglecta* with high bootstrap value. The new species *P. poseidon* formed a monophyletic group with *P. aurita* while *P. mossambica* and *P. mcadamsi* were monophyletic

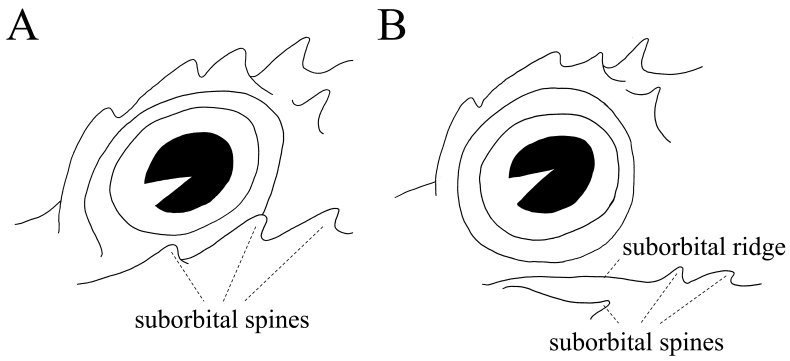

Fig. 4. Drawing of suborbital spines in lateral view of (A) *Parascorpaena poseidon* sp. nov. (DOS00182, 108.3 mm SL) and (B) *P. mossambica* (DOS08024, 83.8 mm).

Table 1. Frequency comparisons of selected meristic characters among *Parascorpaena aurita*, *P. mossambica* and *P. poseidon* sp. nov.

	Pectoral-fin rays (one side/other side)					
	15/15	15/16	16/16	16/17	17/17	17/18
P. aurita			2	1	5	1
P. mossambica	1	5	25	1		
P. poseidon sp. nov.		1	8[H]	1		

	Pored lateral-line scales								
	18	19	20	21	22	23	24	25	26
P. aurita				4	2	1			
P. mossambica	1	1	8	7	7	5	2		
P. poseidon sp. nov.					5[H]	3		1	1

	Longitudinal scale rows																	
	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
P. aurita						1	2		1	3	1							
P. mossambica	2	1	2	1	1	2	3	7	4	5	3		1					
P. poseidon sp. nov.														3[H]	3	2	1	1

	Scales above / below lateral line															
	4	5	6	7	/	9	10	11	12	13	14	15	16	17	18	
P. aurita	1	5	3					1		1	2	1	1	2		
P. mossambica	5	19	8	1		1		2	11	5	7	1	3	1	1	
P. poseidon sp. nov.	1	3	6[H]							3	2	5[H]				

	Scales rows between last dorsal-fin spine base and lateral line							Scales rows between 6th dorsal-fin spine base and lateral line							
	6	7	8	9	10	11	12	6	7	8	9	10	11	12	
P. aurita			3	2	3						3	4	1		
P. mossambica	6	3	15	8				1	2	5	12	12			
P. poseidon sp. nov.					3	6[H]	1					2[H]	5	3	

	Gill rakers on hypobranchial				Total gill rakers							
	0	1	2	3	10	11	12	13	14	15	16	17
P. aurita		2	5	1				1	2	1	4	
P. mossambica	19	8	6		1	10	9	4	5		3	1
P. poseidon sp. nov.			7	2[H]						6	3[H]	

[H] for the counts of the holotype.

based on our phylogenetic analyses. The pairwise K2P genetic distances between the new species, *P. aurita*, *P. mcadamsi* and *P. mossambica* was large, between 13.5% and 25.6% (mean 21.4%).

Comparative materials: *Parascorpaena aurita*: nine specimens, 40.2–109.3 mm SL, Hong Kong: DOS03993, two specimens (87.3–109.3 mm), Yau Ma Tei, Hong Kong, 13 Jan. 2018. Taiwan: DOS00285-1 (68.9 mm), Cijin, Kaohsiung, 28 Sep. 2014; DOS03322, (40.2 mm), 23 Mar. 2017; DOS06304 (58.3 mm), Southern Taiwan, 14 Sep. 2018; DOS06547, two specimens (99.8–102.0 mm), Southern Taiwan, 23

Table 2. Meristic counts and morphometric measurements of *Parascorpaena poseidon* sp. nov., *P. aurita* and *P. mossambica*

	Parascorpaena poseidon sp. nov.		*P. aurita*	*P. mossambica*
	holotype	paratypes, *n* = 9	*n* = 9	*n* = 33
Standard length (mm SL)	116.8	92.5–127.0	40.2–109.3	40.0–94.6
Counts:				
Dorsal-fin	XII,9	XII,9	XII,7–9 (usually 9)	XII,8–9 (usually 9)
Pre-dorsal-fin scale rows	3	2–3 (usually 3)	2–4	2–4 (usually 3)
Gill rakers on upper limb	5	5	4–5 (usually 5)	3–5 (usually 4–5)
Gill rakers on ceratohyal	8	8–9 (usually 8)	7–9 (usually 8–9)	6–10 (usually 7)
Measurements (% of SL):				
Body depth 1	40.8	36.1–40.5 (38.4)	31.1–40.2 (37.3)	34.6–42.1 (38.5)
Body depth 2	33.7	30.5–33.8 (32.1)	28.9–32.8 (30.9)	28.8–35.3 (31.7)
Body width	27.6	24.0–26.8 (25.7)	19.9–26.3 (23.1)	20.5–28.1 (24.3)
Head length	39.2	36.4–39.7 (38.0)	38.7–41.9 (39.8)	32.8–44.7 (41.0)
Snout length	6.4	4.1– 7.9 (6.2)	3.7– 8.5 (5.8)	3.7–10.0 (6.9)
Orbit diameter	10.7	9.5–11.2 (10.2)	9.9–14.2 (11.8)	8.9–13.4 (11.3)
Interorbital width 1	6.1	5.4– 7.7 (6.6)	4.9– 7.1 (5.6)	4.2– 7.8 (5.7)
Interorbital width 2	8.3	6.0– 9.6 (8.1)	5.8– 8.7 (7.5)	4.8– 7.8 (6.3)
Head width	17.0	15.9–18.2 (17.2)	16.3–18.2 (17.2)	15.8–18.7 (17.1)
Upper-jaw length	16.3	14.9–19.6 (17.0)	17.2–19.7 (18.0)	16.2–25.0 (19.4)
Maxillary depth	5.9	5.9– 6.9 (6.2)	5.4– 6.9 (6.3)	4.5– 7.7 (6.1)
Postorbital length	23.2	20.2–23.9 (21.9)	21.4–22.8 (22.1)	19.3–25.0 (22.1)
Between tips of opercular spines	5.2	5.9– 7.6 (6.6)	5.4– 7.1 (6.3)	4.1– 8.0 (6.5)
Predorsal-fin length	27.9	21.5–28.7 (25.7)	25.3–32.4 (28.2)	24.1–32.2 (28.1)
Preanal-fin length	72.3	67.5–72.5 (70.2)	68.9–75.3 (72.5)	65.1–75.5 (70.4)
Prepelvic-fin length	31.2	33.6–36.3 (35.0)	32.6–41.7 (37.2)	30.5–42.7 (36.6)
1st dorsal-fin spine length	6.3	6.2– 8.0 (7.0)	6.8– 9.1 (8.0)	5.2–10.8 (7.5)
2nd dorsal-fin spine length	9.1	9.5–12.7 (11.1)	11.9–13.7 (12.7)	10.4–15.1 (12.3)
3rd dorsal-fin spine length	13.7	13.1–17.1 (15.3)	16.7–19.4 (17.9)	14.0–19.2 (16.5)
4th dorsal-fin spine length	15.3	15.4–18.6 (17.3)	18.7–20.0 (19.4)	16.5–21.4 (18.8)
5th dorsal-fin spine length	16.0	16.2–19.6 (18.0)	18.4–21.0 (19.5)	16.9–23.2 (19.3)
11th dorsal-fin spine length	9.8	8.3–12.0 (10.2)	7.1– 9.6 (8.9)	7.2–13.5 (11.7)
12th dorsal-fin spine length	15.1	11.9–15.1 (13.8)	13.8–16.6 (15.4)	12.9–16.8 (15.1)
Longest dorsal-fin ray length	22.2	19.1–21.6 (20.4)	18.4–22.0 (20.2)	15.7–23.1 (19.6)
Soft-rayed dorsal-fin base length	19.9	13.6–21.0 (18.0)	15.8–18.4 (17.1)	14.0–19.8 (17.6)
1st anal-fin spine length	10.3	8.7–12.1 (10.8)	9.6–12.2 (10.9)	8.7–12.7 (10.6)
2nd anal-fin spine length	21.3	19.3–24.8 (21.7)	19.8–26.6 (23.3)	19.2–25.5 (22.6)
3rd anal-fin spine length	17.7	17.0–20.2 (18.6)	18.5–22.0 (20.4)	17.0–21.3 (19.2)
Longest anal-fin ray length	22.7	23.0–25.8 (24.6)	22.7–26.4 (24.5)	20.7–26.0 (23.4)
Pectoral-fin ray length	29.7	25.4–30.6 (28.1)	25.9–31.6 (29.2)	24.3–33.5 (28.7)
Pelvic-fin spine length	15.6	11.3–18.9 (16.7)	15.9–17.9 (17.0)	11.3–20.0 (17.1)
Longest pelvic-fin ray length	26.5	24.7–27.4 (26.3)	22.8–26.2 (25.1)	21.4–26.8 (25.0)
Caudal-fin length	26.5	21.4–27.4 (25.0)	20.9–28.4 (24.5)	22.3–29.7 (25.3)
Caudal-peduncle length	11.7	10.8–15.6 (13.5)	10.7–13.6 (12.4)	8.3–17.7 (13.3)
Caudal-peduncle depth	12.7	11.2–12.5 (12.0)	10.0–11.9 (11.1)	10.1–12.2 (11.1)

Body depth 1 from 4th dorsal-fin spine to pelvic-fin spine base; body depth 2 at vertical of 1st anal-fin spine base; interorbital width 1 at vertical midline of eye; interorbital width 2 at the base of posterior preocular spine.

Apr. 2019; DOS07016 (84.8 mm), Magong, Penghu, 16 May 2019; DOS08346 (87.2 mm), 15 May 2021. *Parascorpaena mossambica*: 33 specimens, 40.0–94.6 mm SL. All from Taiwan: DOS03168, two specimens (60.7–75.7 mm), Fengpitou, Kaohsiung, 22°30'31"N, 120°21'15"E, 2 m, 02 Sep. 2020; DOS06548 (79.6 mm), Southern Taiwan, 23 Apr. 2019; DOS08024 (83.8 mm), Wanlitong, Pingtung, 21°59'44"N, 120°42'24"E, 0–1 m, 14 Oct. 2020; DOS08253 (60.1 mm), Shanfu, Xiao Liuqiu, Pingtung, 22°20'21"N, 120°21'42"E, 0–1 m, 24 Apr. 2021; DOS08329, three specimens (73.3–90.3 mm), Vase Rock, Xiao Liuqiu, Pingtung, 22°21'20"N, 120°22'51"E, 0–1 m, 11 May 2021; DOS08331 (65.9 mm), Wild Boar Ditch, Xiao Liuqiu, Pingtung, 22°20'19"N, 120°21'41"E, 0–1 m, 13 May. 2021; DOS08334, two specimens (83.9–92.0 mm), Vase Rock, Xiao Liuqiu, Pingtung, 22°21'20"N, 120°22'51"E, 0–1 m, 14 May 2021; NMMB-P731 (65.0 mm), 16 Sep. 2004; NMMB-P736 (66.1 mm), 17 Sep. 2004; NMMB-P737 (68.0 mm), 17 Sep. 2004; NMMB-P1076, three specimens (40.3–65.9 mm), Lyudao, 24 Nov. 2005; NMMB-P1139, two specimens (79.1–71.6 mm), Chufongbi, Pingtung, 21 Apr. 1985; NMMB-P5417, two specimens (58.7–59.4 mm), Xiao Liuqiu, 20 Mar. 1973; NMMB-P6933 (80.6 mm), Xiao Liuqiu, 22 Oct. 2003; NMMB-P31973, ten specimens (40.0–94.6 mm), sampling date unknown; NMMB-P34545 (91.0 mm), sampling date unknown. *Parascorpaena grandisquamis* (based on a photo): 1 specimen, holotype E. 1814 (96.0 mm SL), North West Island, Queensland, Australia, 23°18'S, 151°42'E, 1909.

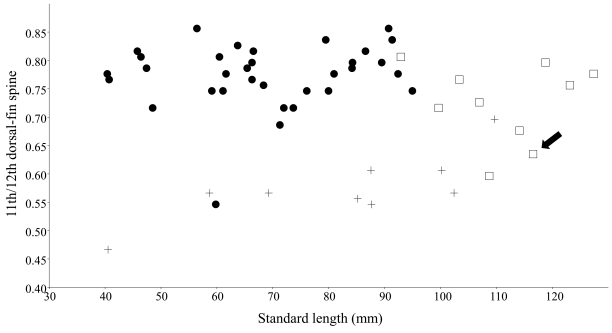

Fig. 5. Relationships of the ratio of 11th and 12th dorsal-fin spine to standard length in *Parascorpaena poseidon* sp. nov. (open square), *P. aurita* (plus), and *P. mossambica* (closed circle). Arrowhead indicates the holotype.

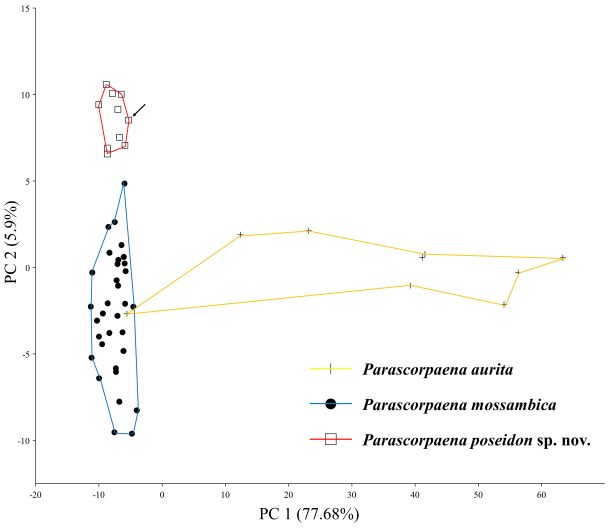

Fig. 6. A principal components analysis (PCA) graph plotting the first two components for three species of *Parascorpaena* based on 51 morphometric traits. Arrowhead denotes the holotype of *Parascorpaena poseidon* sp. nov.

DISCUSSION

In the molecular analysis (Fig. 7), the ML tree highly supports the close interrelationships of *Parascorpaena poseidon* + *P. aurita*, and *P. mossambica* + *P. mcadamsi*, and the monophyly of the new species is well supported. Morphological and molecular approaches support *Parascorpaena poseidon* sp. nov. from Taiwan as a new species. Morphologically, *Parascorpaena poseidon* sp. nov. is most similar to Poss' (1999) second group represented by *P. mossambica* and *P. mcadamsi* based on presence of a suborbital spine below eye and pectoral-fin rays usually 16. Nevertheless, the new species is closely related to *P. aurita* rather than *P. mossambica* and *P. mcadamsi*. This result implies that the two diagnostic characters proposed by Poss (1999) are not synapomorphies. The sequence of *P. picta* (FSCS609-07) from the South China Sea is sister to our *Scorpaenopsis neglecta* with very limited genetic distance. Based on our phylogenetic result and the specimen image from BOLD, it is probably a misidentification of *Scorpaenopsis neglecta.*

The comparison of selected characters of the species of *Parascorpaena* was shown in table 3. *Parascorpaena poseidon* sp. nov. distinctly differed from its closely related taxon, *P. aurita*, and the most similar species, *P. mossambica*, (Figs. 4–6, Tables 1–3) by three equally-sized suborbital spines without a ridge and closed to orbit (Fig. 4; Motomura et al. 2009, Fig. 5), more longitudinal scale rows (43–47 vs. 30–42 in latter two), 10–12 scales rows between last dorsal-fin spine base and lateral line (vs. 6–10), and 10–12 scales rows between 6th dorsal-fin spine base and lateral line (vs 6–11). In addition, *Parascorpaena poseidon* sp. nov. can be easily distinguished from *P. aurita* and *P. picta*

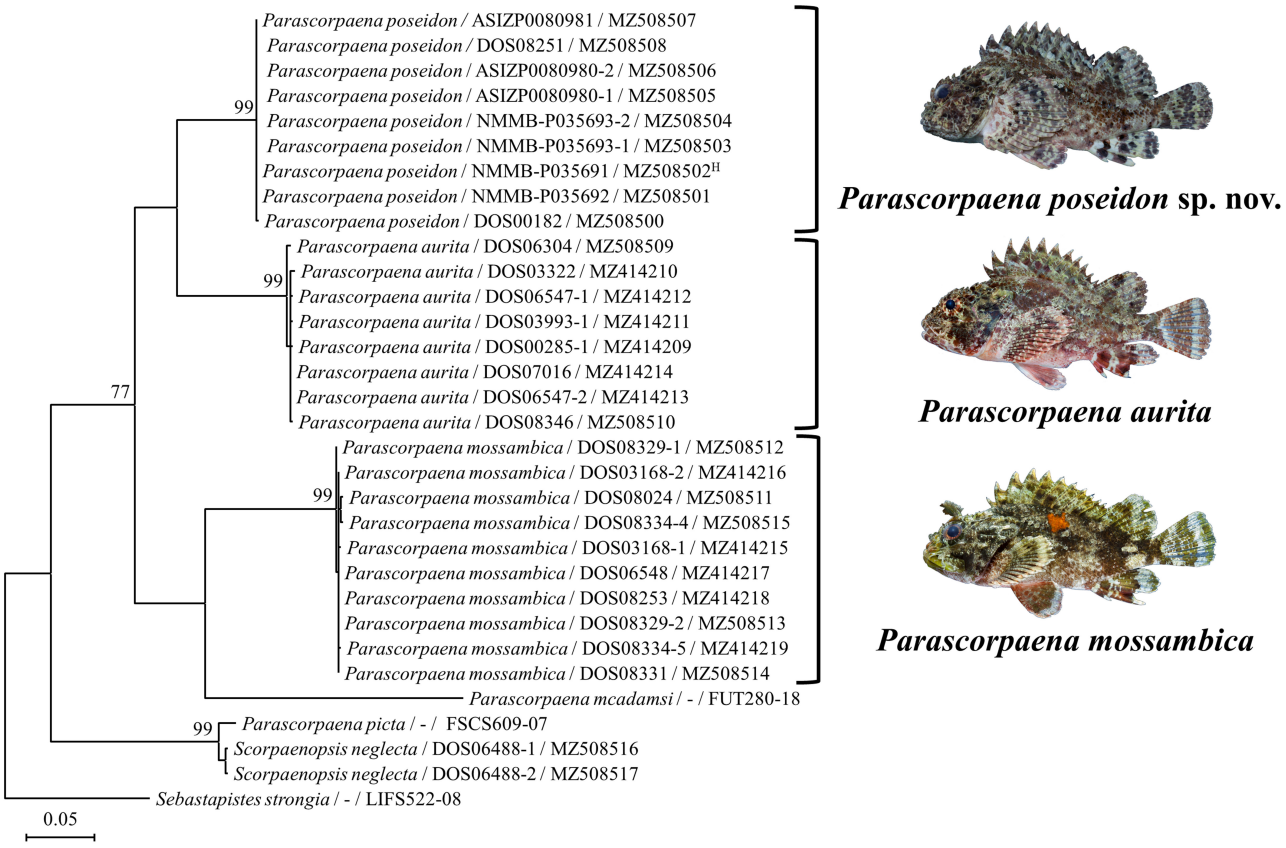

Fig. 7. Maximum likelihood tree based on 655 bps of the *COI* sequences. Numbers shown on nodes denote the bootstrap values and numbers lower than 60 are not shown. Scientific names followed by catalog numbers of voucher specimens/accession numbers. Dashes for downloaded sequences without a catalog number; H for holotype of *Parascorpaena poseidon* sp. nov.

Table 3. Comparison of selected characters among the species of *Parascorpaena*

	Pectoral-fin rays	Suborbital spines	Suborbital ridge	Supraocular tentacle	Pre-dorsal-fin scales	A distinct black blotch on spinous dorsal-fin	Coloration when fresh	Body size	Sources
Parascorpaena armata (Sauvage, 1873)	15	2	present	N/A	N/A	N/A	N/A	N/A	Sauvage 1873
P. aurita (Rüppell, 1838)	usually 17	2	present	absent or weak	2–4	absent	brownish or grayish	relatively large	Motomura et al. 2009; this study
P. bandanensis (Bleeker, 1851)	15	2	N/A	N/A	N/A	N/A	N/A	N/A	Bleeker 1851
P. grandisquamis (Ogilby, 1910)	16	3	present	well-developed	N/A	N/A	N/A	relatively large	This study
P. maculipinnis Smith, 1957	16	3	N/A	weak	1–2	present in male	N/A	small	Smith 1957
P. mcadamsi (Fowler, 1938)	usually 16	2	N/A	weak	5	present in male	red	small	Fowler 1938; Motomura et al. 2013
P. mossambica (Peters, 1855)	usually 16	3	present	well-developed	usually 3	absent	brownish or grayish	relatively large	This study
P. moultoni (Whitley, 1961)	15	2	absent	absent	2	N/A	rosy red	small	Whitley 1961
P. picta (Cuvier in Cuvier & Valenciennes, 1829)	usually 17	2	present	N/A	N/A	absent	N/A	relatively large	Motomura et al. 2009
P. poseidon sp. nov.	usually 16	3	absent	absent or weak	usually 3	absent	brownish or grayish	relatively large	This study

N/A, not available.

by the presence of a suborbital spine below eye (vs. absence), and pectoral-fin rays usually 16 (vs. 17–18 in *P. aurita* and *P. picta*). The new species differs from *P. armata*, *P. bandanensis* and *P. moultoni* by having three suborbital spines (vs. two suborbital spines), and the pectoral-fin rays usually 16 (vs. 15). The new species shares a character, pectoral-fin rays usually 16, with *P. maculipinnis* and *P. mcadamsi*, but it differs from the two species by several characters, including absence of a distinct black blotch on spinous dorsal fin in male (vs. present in *P. maculipinnis* and *P. mcadamsi*), body size relatively large, adult over 80 mm SL (vs. less than 80 mm SL). In addition, the new species differs from *P. mcadamsi* by having three suborbital spines (vs. two suborbital spines) (Fowler 1938), and coloration mainly brownish to grayish (vs. mainly red) (Allen and Erdmann 2012; Motomura et al. 2013). In molecular phylogeny (Fig. 7), the result showed *P. mcadamsi* not closely related to the new species. In Smith (1957)'s drawing of *P. maculipinnis*, its suborbital spines are similar to *Parascorpaena poseidon* sp. nov., but the new species can be further distinguished from *P. maculipinnis* by 3 equally-sized suborbital spines (vs. 3 equally-sized suborbital spines, the third spine smaller than the first two spines), 3 pre-dorsal-fin scale rows (vs. 1–2 in the latter) and longitudinal scale rows 43–47 (vs. 36) (Smith 1957). The new species differs from the Nakabo and Kai (2013)'s *P.* sp. by having three equally-sized suborbital spines without ridge (vs. first suborbital spine below the suborbital ridge, second and third suborbital spines close and continues with the posterior portion of suborbital ridge), and relatively large body size (vs. small, 44 mm SL). In their book, *P. mossambica* was indicated body covered by ctenoid scales, but some studies and our specimens showed its body covered by cycloid scales (Fricke et al. 2015; Naranji et al. 2017). Wibowo and Motomura (2021) reassigned the species, *Scorpaena grandisquamis* Ogilby, 1910 (Fig. 8A),

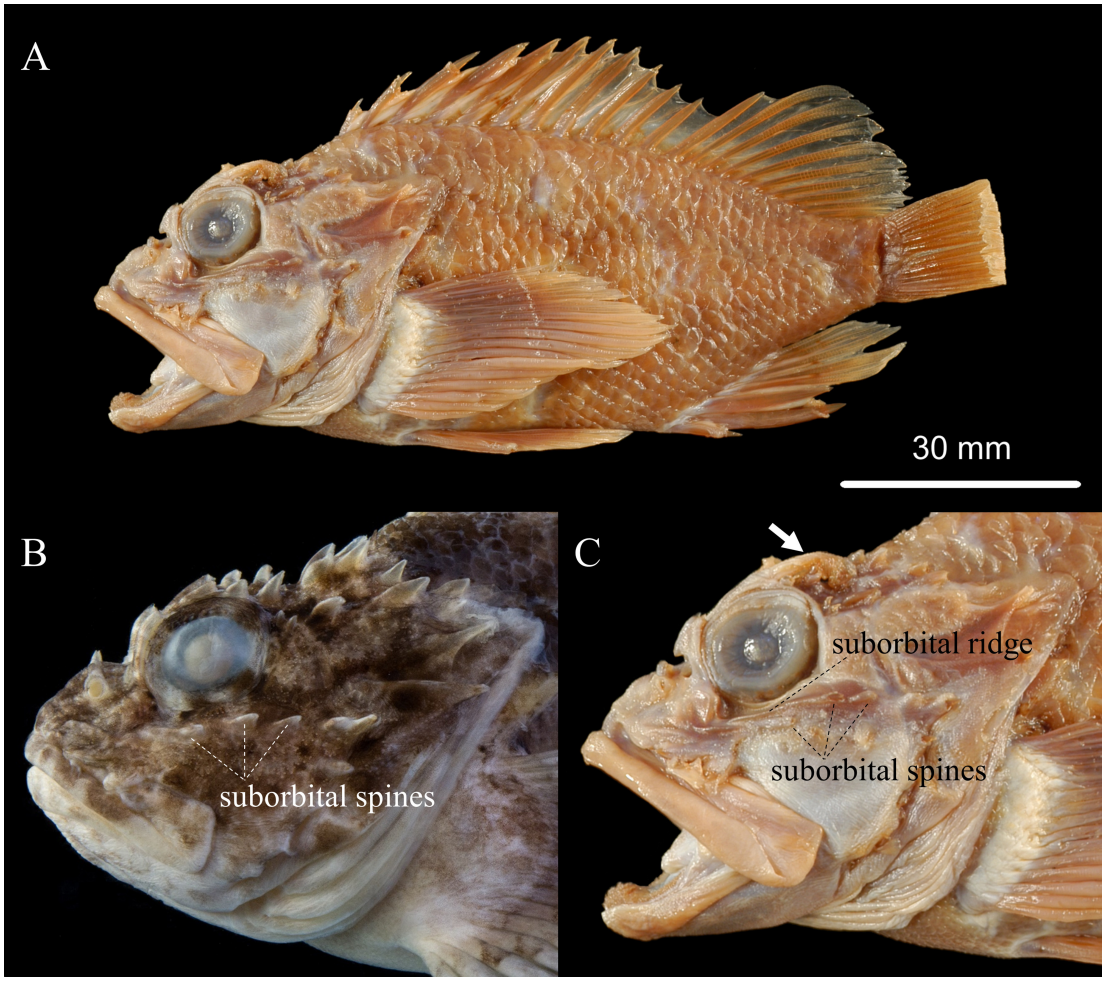

Fig. 8. Photograph of (A) the holotype of *Scorpaena grandisquamis* Ogilby, 1910, E.1418, 96.0 mm SL (photographed by Dr. M. Allen, supplied by Dr. A. Hay), and lateral view of (B) *Parascorpaena poseidon* sp. nov. (DOS00182, 108.3 mm SL) and (C) *P. grandisquamis* (E.1418, 96.0 mm). White arrowhead represents the supraocular tentacle.

to *Parascorpaena* based on the examination of the type specimen and original description. The species *P. grandisquamis* is similar to Poss' (1999) second group based on presence of a suborbital spine below eye and 16 pectoral fin rays. However, *Parascorpaena poseidon* sp. nov. distinctly differed from *P. grandisquamis* by three-equal sized suborbital spines without ridge (Figs. 4A, 8B) (vs. first suborbital spine below the suborbital ridge, second suborbital spine with ridge and larger than third suborbital spine in *P. grandisquamis*; Fig. 8C), supraocular tentacle absent or very short (vs. well developed; Fig. 8C), 43–47 longitudinal scale rows (vs. 35), 10–12 scales rows between last dorsal-fin spine base and lateral line (vs. 6), and 10–12 scales rows between 6th dorsal fin spine base and lateral line (vs. 7), pectoral fin not reaching anal fin origin (vs. beyond anal fin origin; Fig. 8A). Moreover, we considered *P. grandisquamis* a synonym of *P. mossambica* by presence of suborbital ridge (Figs. 4B, 8C), supraocular tentacle well developed (Fig. 8C), longitudinal scale rows 35 in *P. grandisquamis* and 30–42 in *P. mossambica*, scales rows between last dorsal-fin spine base 6 and 6–9, respectively, and lateral line scales rows between 6th dorsal fin spine base and lateral line 7 and 6–10, respectively.

In previous studies in Taiwan, the records of relatively large body size species of *Parascorpaena* were mostly identified as *P. picta* (Chen 1981; Shen 1984; Shao et al. 1992; Shao and Chen 1993; Chen 2003; Chen et al. 2010). Subsequently, Motomura et al. (2009) recognized these photograph records as misidentification and considered the distribution of *P. picta* only restricted to Southeast Asia and Australia, and re-identified the large body size species as *P. aurita*, *Scorpaena miostoma* Günther 1877 and *Scorpaena pepo* Motomura, Poss & Shao 2007. We confirmed Motomura et al. (2009)'s identifications and further checked figures of *P. picta* from two illustrated handbooks (Shao et al. 1992; Chen et al. 2010) not included in Motomura et al. (2009). We re-identified *P. picta* in Shao et al. (1992) and Chen et al. (2010) as *P. aurita* and there is no confirmed record of *P. picta* in Taiwan.

CONCLUSIONS

In the present study, a new species of the genus *Parascorpaena* is described based on morphological and molecular approaches. *Parascorpaena poseidon* sp. nov. can be distinguished from other congeners by the following characters: three equally-sized suborbital spines without ridge; supraocular tentacle absent or very short; pectoral-fin rays usually 16; longitudinal scale rows 43–47; pre-dorsal-fin scale rows usually 3; 10–12 scale rows between last dorsal-fin spine base and lateral line; blackish spots randomly scattered on all fins; spinous dorsal fin without a distinct black blotch in male; body size relatively large, the largest recorded specimen 127.0 mm SL. This species is currently known from southwestern Taiwan.

Acknowledgments: This work and the new species name were registered with ZooBank under urn:lsid:zoobank.org:pub:82F9EAC8-2067-45AD-91F1-A89DF149864. We are grateful to two anonymous reviewers for their constructive comments; C.-C. Ku, H.-C. Chen, J.-S. Lin, N.-W. Lai, T. Guo, T.-J. Jhang, W.-C. Huang for collecting specimens; Y.-H. Yu for the underwater photograph of live specimen. We thank A. Hay (AMRI), S.-P. Huang (ASIZP), C.-H. Chan, T.-W. Wu, H.-C. Ho (NMMB-P), and M. Allen (WAM) for their curatorial assistances; C.-N. Tang for his assist in English editing of the draft.

Authors' contributions: T.K.C. collected the specimens and performed the morphometrics examinations. T.K.C. and T.Y.L. produced and analyzed the data and wrote the manuscript. Both authors read and approved the final version of the manuscript.

Competing interests: The authors declare that they have no competing interests.

Availability of data and materials: All data are available in the paper.

Consent for publication: Not applicable.

Ethics approval consent to participate: Not applicable.

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