Ichthyol Res
DOI 10.1007/s10228-015-0479-2

FULL PAPER

A new species of scorpionfish, *Ebosia vespertina* (Scorpaenidae: Pteroinae), from the southwestern Indian Ocean

Mizuki Matsunuma[1] · **Hiroyuki Motomura**[2]

Received: 7 May 2015 / Revised: 26 June 2015 / Accepted: 26 June 2015

Abstract A new species of scorpaenid fish, *Ebosia vespertina* sp. nov., is described on the basis of 19 specimens from off Mozambique, South Africa, and Madagascar, southwestern Indian Ocean. The new species is most similar to *Ebosia falcata* and *Ebosia saya*, known from the northern and eastern Indian Ocean and Saya de Malha Bank, respectively, in having usually 8 anal-fin soft rays, usually more than 17 pectoral-fin rays, and the elongated parietal spine in males narrow and strongly curved posterodorsally. However, *E. vespertina* can be distinguished from the two latter species by the following combination of characters: pectoral-fin rays 17–18 (modally 18); scale rows above the lateral line 4–6 (5); scale rows between the last dorsal-fin spine base and lateral line 4–5 (5); scale rows between the sixth dorsal-fin spine base and lateral line 4–5 (5); postorbital length 17.4–20.3 (mean 18.7) % of standard length (SL); longest pectoral-fin ray length 54.6–73.9 (65.1) % of SL; longest pelvic-fin soft ray length 32.4–44.0 (37.6) % of SL. The remaining congener, *Ebosia bleekeri*, known from the western Pacific Ocean, usually has 7 anal-fin soft rays and 16 pectoral-fin rays, and the elongated parietal spine in males relatively broad and not so strongly curved.

Keywords South Africa · Mozambique · Madagascar · Sexual dimorphism · Ontogenetic change

Introduction

The Indo-West Pacific scorpionfish genus *Ebosia* Jordan and Starks 1904 (Scorpaenidae: Pteroinae) inhabits sandy or muddy bottoms in depths usually less than 100 m and has therefore been collected mainly by bottom trawl. The genus is characterized by having the coronal, parietal and nuchal spines bases continuous, and the parietal spine elevated, being a thin bony crest in males (Jordan and Starks 1904; Eschmeyer and Rama-Rao 1978; Matsunuma and Motomura 2014). Three valid species are currently recognized in the genus, viz. *Ebosia bleekeri* (Döderlein *in* Steindachner and Döderlein 1884) (western Pacific Ocean), *Ebosia falcata* Eschmeyer and Rama-Rao 1978 (northern and eastern Indian Ocean) and *Ebosia saya* Matsunuma and Motomura 2014 (Saya de Malha Bank, western Indian Ocean).

During a revisionary study of *Ebosia*, 19 specimens of a previously unrecognized species of *Ebosia*, collected off Mozambique, South Africa and Madagascar, were found in South African museums, all having been primarily identified and catalogued as *E. falcata* or a species of a different scorpaenid genus. Following careful examination, it was determined that the southern African specimens represented a distinct species of *Ebosia*, differing from all other

This article was registered in the *Official Register of Zoological Nomenclature* (ZooBank) as 685CE299-1C44-45A2-B99C-F4C9E6313EAE.
This article was published as an Online First article on the online publication date shown on this page. The article should be cited by using the doi number.

✉ Mizuki Matsunuma
k1139853@kadai.jp

Hiroyuki Motomura
motomura@kaum.kagoshima-u.ac.jp

[1] Seikai National Fisheries Research Institute, 1551-8 Taira, Nagasaki 851-2213, Japan

[2] The Kagoshima University Museum, 1-21-30 Korimoto, Kagoshima 890-0065, Japan

Published online: 24 July 2015

known congeners. They are herein described as a new species.

Materials and methods

Measurements generally followed Motomura (2004b, c), with head width, head depth, maxillary depth and body depth at the anal-fin origin following Motomura et al. (2005b, 2006a), Motomura (2004a), Motomura et al. (2006b) and Matsunuma et al. (2013), respectively. Counts generally followed Motomura et al. (2005a–c) and Motomura and Johnson (2006); predorsal scale and cheek scale counts followed Motomura et al. (2006b) and Matsunuma and Motomura (2013), respectively. Measurements of the diameter of the blotch above the pectoral-fin base and blotches on the pectoral-fin membrane followed Matsunuma and Motomura (2014). The last two soft rays of the dorsal and anal fins were counted as single rays, each pair being associated with a single pterygiophore. Counts and measurements were made on the left side wherever possible, except for pectoral-fin rays (counted on both sides). Head spine terminology generally follows Randall and Eschmeyer (2002: fig. 1), Motomura (2004c: fig. 1), and Matsunuma and Motomura (2014: fig. 1). Supplemental preopercular spine and lateral lacrimal spine terminology follows Eschmeyer (1965) and Motomura and Senou (2008: fig. 2), respectively. Sex was determined by direct examination of gonads by light microscope whenever possible. In the lists of specimens examined, (G) indicates sex determined by gonad examination; (P), sex estimated from parietal spine morphology. Standard length is abbreviated as SL. In the description, features for the holotype are presented first, followed by paratype data (if different) in parentheses. The sample sizes for meristic characters, including the holotype, are shown in parentheses. Institutional abbreviations follow Sabaj Pérez (2014).

Ebosia vespertina sp. nov.

(New English name: Western Falcate Lionfish) (Figs. 1–7; Tables 1–2).

Holotype. SAM 41190 (formerly one of SAM 34266), male (G), 99.1 mm SL, off Mozambique (18°20′S, 37°20′E), 68 m, RV *Algoa*, bottom trawl, 17 June 1994.

Paratypes. Eighteen specimens, 50.0–109.9 mm SL (seven males, eight females and three sex undetermined). MOZAMBIQUE: SAM 34265, four specimens, two males and two females (G), 58.9–106.1 mm SL, off Mozambique (19°49′S, 36°05′E), 54 m, RV *Algoa*, bottom trawl, 14 June 1994; SAM 34266, six specimens, three males and three females (G), 70.5–108.3 mm SL, collected with holotype. SOUTH AFRICA: KAUM–I. 75290 (formerly one of SAIAB 76118), female (P), 82.9 mm SL, 9 km off Richards Bay, KwaZulu-Natal (28°50′16″S, 32°11′21″E), 50 m, A. Connell, 7 May 2003; SAIAB 76118, male (P), 86.0 mm SL, collected with KAUM–I. 75290; SAIAB 186409, two specimens, one female (G) and one sex undetermined, 50.0–86.8 mm SL, off Thukela, KwaZulu-Natal (29°21.817′S, 31°48.761′E), 70 m, S. Fennessy, bottom trawl, 19 March 2010; SAIAB 186466, male (P), 109.9 mm SL, off KwaZulu-Natal (28°42.380′S, 32°22.306′E), 108–110 m, ACEP Trawl 3.2, S. Fennessy, bottom trawl, 18 August 2010; USNM 435892 (formerly one of SAIAB 76118), female (P), 65.0 mm SL, collected with KAUM–I. 75290. MADAGASCAR: SAIAB 189715, two specimens, sex undetermined, 57.9–63.1 mm SL, off Tolagnaro (25°22.4′S, 47°02.8′E), bottom trawl, 3 May 2010.

Diagnosis. A species of *Ebosia* distinguished from other members of the genus by the following combination of

Fig. 1 Fresh specimen of *Ebosia vespertinus* sp. nov., Mozambique (not retained). Photo: M. Lee

Table 1 Frequency distribution of selected meristics of *Ebosia vespertina* sp. nov., *E. falcata* and *E. saya*

	Pectoral-fin rays (one/other sides)					Scales above LL		
	16/16	16/17	17/17	17/18	18/18	4	5	6
E. falcata[a]	1	4	26	4	1[H]	33[H]	3	
E. saya			8[H]	1	1		9[H]	
E. vespertina			1		18[H]	3	14[H]	1

	SR between 6th DS and LL				SR between last DS and LL		SR in longitudinal series										
	3	4	5	6	4	5	41	42	43	44	45	46	47	48	49	50	51
E. falcata	1	30	3[H]		18[H]		1	3		4	3	1[H]	2	1			
E. saya		1	6[H]	1	1[H]	4				1		1[H]					
E. vespertina		4	10[H]		2	6[H]							1	2	4	4[H]	1

	Upper gill rakers			Lower gill rakers			Total gill rakers			
	4	5	6	10	11	12	14	15	16	17
E. falcata	1	35[H]	2	15[H]	20	3	1	14[H]	18	5
E. saya	3	7[H]		3	7[H]			6	4[H]	
E. vespertina	12	5	2[H]	12	7[H]		10	3	5	1[H]

DS dorsal-fin spine base, *LL* lateral line, *SR* scale rows

[a] One specimen had 17/19 pectoral-fin rays

[H] indicates holotype

characters: anal-fin soft rays 7–8 (modally 8); pectoral-fin rays 17–18 (18); scale rows above lateral line 4–6 (5); scale rows between last dorsal-fin spine base and lateral line 4–5 (5); scale rows between sixth dorsal-fin spine base and lateral line 4–5 (5); postorbital length 17.4–20.3 (mean 18.7) % SL; longest pectoral-fin ray length 54.6–73.9 (65.1) % SL; longest pelvic-fin soft ray length 32.4–44.0 (37.6) % of SL; elongated parietal spine in males relatively narrow, strongly falcate posterodorsally, its tip reaching the level of second to fifth dorsal-fin spine bases; a blotch above pectoral-fin base and blotches on pectoral-fin membrane relatively large; soft-rayed portions of dorsal and anal fins, and caudal and pectoral fins yellowish in males when fresh.

Description. Selected meristics and morphometrics shown in Tables 1–2. Meristics given in Table 1 not repeated here. Dorsal-fin rays XIII, 9; anal-fin rays III, 8 [III, 7 (2 specimens) or III, 8 (17)]; pectoral fin with 1 (left side) or 2 (right side) upper unbranched rays + 10 (9–12 in paratypes) branched rays + 7 (left side) or 6 (right side) (5–8) lower unbranched rays; pelvic-fin rays I, 5. Pored lateral-line scales lost in all specimens examined; scales below lateral line uncountable in holotype [9 (2) or 10 (1) (based on only paratypes)]; pre-dorsal-fin scale rows 3 [2 (6) or 3 (13)]; oblique cheek scale rows 2 [2 (13) or 3 (4)]; horizontal cheek scale row 1; vertical cheek scale row 0. Lower limb of gill arch with 2 [1 (3), 2 (15) or 3 (1)] gill rakers on hypobranchial. Branchiostegal rays 7. Swim bladder present.

Body oblong, moderately compressed anteriorly, extensively compressed posteriorly; depth moderate, maximum body depth less than longest dorsal-fin spine length. Head large, its length greater than body depth. A short simple, pointed flap with a median ridge on posterior edge of low membranous tube associated with anterior nostril; its tip extending slightly beyond posterior margin of posterior nostril when depressed posteriorly. Supraocular with a small flap, its length 44.0 % of orbit diameter (18.0–72.9 % of orbit diameter; becoming shorter with growth). Two small flaps on preopercle margin below third preopercular spine base; tips not reaching posterior margin of interopercle when laid flat. An extremely small skin flap anterodorsally on orbit surface (usually 1 or 2, rarely 3) [an abnormal 106.1 mm SL specimen (one of SAM 34265) with 18 cirri in left orbit (uncountable in right orbit)]; its length less than one-third of posterior nasal pore diameter. Snout tip with two extremely short barbels; its length subequal to that of orbit surface flap. No other skin flaps on head or body, including ventral margin of lacrimal.

Relatively well-developed ctenoid scales possessing 3–7 spinules on postorbital and suborbital regions; suborbital scale area not extending anteriorly beyond level of mid-orbit; suborbital pit always without scales. Preopercular region bordered by posterior margin of maxilla, suborbital

Table 2 Morphometrics of *Ebosia vespertina* sp. nov., expressed as percentages of standard length

	Holotype (SAM 41190)	Paratypes (n = 18)	Mean
SL (mm)	99.1	50.0–109.9	
Body depth (% SL)	36.5	30.8–39.2	35.7
Body depth at anal-fin origin	25.9	23.5–28.7	25.7
Body width	24.4	15.4–25.5	22.2
Head length	39.9	37.6–41.1	39.4
Head width	14.8	12.8–15.2	14.2
Head depth	16.8	14.4–17.5	16.4
Snout length	14.6	12.2–15.8	13.8
Orbit diameter	11.0	10.3–12.8	11.2
Interorbital width at mid-orbit	8.9	8.0–10.5	9.4
Interorbital width at preocular spine base	7.8	6.6–9.5	8.3
Upper-jaw length	15.7	13.9–16.5	15.7
Maxillary depth	5.7	4.8–6.8	5.5
Suborbital depth	4.2	1.7–4.4	3.4
Postorbital length	18.9	17.4–20.3	18.7
Pre-dorsal-fin length	36.6	31.8–39.5	35.9
Pre-anal-fin length	68.3	64.4–70.2	67.4
Pre-pelvic-fin length	36.6	32.4–38.1	34.8
1st dorsal-fin spine length	26.4	25.4–30.1	27.4
2nd dorsal-fin spine length	33.4	29.6–40.2	35.0
3rd dorsal-fin spine length	38.5	38.9–46.5	41.2
4th dorsal-fin spine length	42.2	38.3–47.9	43.4
5th dorsal-fin spine length	–	44.0–51.0	45.7
6th dorsal-fin spine length	43.1	43.1–51.2	45.5
7th dorsal-fin spine length	43.8	41.7–51.2	45.8
8th dorsal-fin spine length	–	40.7–49.0	43.6
9th dorsal-fin spine length	37.8	35.9–47.6	38.8
10th dorsal-fin spine length	–	30.6–37.9	34.1
11th dorsal-fin spine length	19.7	22.0–28.6	24.6
12th dorsal-fin spine length	12.2	12.0–22.0	15.3
13 dorsal-fin spine length	16.8	15.6–20.9	18.1
1st dorsal-fin soft ray length	25.9	24.4–30.4	27.2
Longest dorsal-fin soft ray length	33.5 (4th)	31.0–37.1 (4th or 5th)	34.5
1st anal-fin spine length	7.3	6.6–10.8	8.6
2nd anal-fin spine length	10.6	10.1–16.0	13.1
3rd anal-fin spine length	16.0	14.7–22.0	17.6
1st anal-fin soft ray length	27.5	25.3–31.5	28.1
Longest anal-fin soft ray length	35.2 (4th)	31.1–41.2 (3rd or 4th)	36.0
1st pectoral-fin ray length	49.7	39.8–59.7	51.0
Longest pectoral-fin ray length	62.1 (7th)	54.6–73.9 (4–7th)	65.1
Pelvic-fin spine length	15.7	13.3–20.6	17.4
Longest pelvic-fin soft ray length	33.9 (3rd)	32.4–44.0 (2nd or 3rd)	37.6
Caudal-fin length	54.4	46.4–59.0	53.8
Caudal-peduncle length	16.0	13.4–17.0	15.1
Caudal-peduncle depth	10.3	8.8–11.1	9.9

ridge and posterior marginal ridge of preopercular, covered with relatively well-developed 16 (14–16) ctenoid scales possessing 3–9 spinules. Opercle covered with a few ctenoid scales possessing 1–6 spinules on upper portion; remaining portion possibly with cycloid scales (most scales lost in all specimens examined; condition estimated from

the remaining scales). Anterior region of occipital area with a few [ca. 7 (7–8)] weakly ctenoid scales; large scales with 3–6 spinules, small scales with a single spinule or without spinules; scales mostly embedded with tip of spinule only exposed. Interorbital region, including frontal surface of preocular, dorsal surface of supraocular and postocular, and interorbital canal without scales. A small patch of weakly ctenoid scales with 1–3 spinules (all cycloid in small specimens) on suprapostorbital region bordered by sphenotic, pterotic and posttemporal spine bases, and coronal, parietal and nuchal ridges. Other regions of head, including snout, lacrimal, maxilla, mandible and interopercle without scales. Weakly developed ctenoid scales with 1–7 spinules anterodorsally on body above lateral line and anterior to level of fifth dorsal-fin spine base; ventral surface of chest with a few ctenoid scales with 3–6 (1–6) spinules; reminder of body with cycloid scales. Basal regions of dorsal and anal fins without scales; caudal-fin base with small cycloid scales; basal scale morphology on pectoral-fin base unknown (few remaining scales cycloid; most scales lost in all specimens examined).

Mouth set relatively low on head, protruding moderately downward; moderately large, slightly oblique, forming an angle of ca. 20° to horizontal axis of head and body. Anterior region of maxilla with a poorly developed median lateral ridge; upper edge of posterior maxilla swollen laterally, forming a low ridge; posterior margin of maxilla extending slightly beyond mid-orbit level. Lips thickened; lower lips broadly extending onto mandible. Lower jaw with a small symphyseal knob. Symphyseal gap separating premaxillary teeth bands distinctly broader than width of each band (gap width approximately twice teeth band width); both jaws with a relatively narrow band of small, slender conical teeth; about 5–8 tooth rows at front of upper jaw; about 3–6 tooth rows at front of lower jaw; teeth bands narrowing posteriorly. Eight to ten rows of small conical teeth forming blunt V-shaped patch on vomer; no palatine teeth. Underside of dentary with three sensory pores on each side; two small pores on each side of symphysial knob of lower jaw on each side. Gill rakers on first gill arch short, tips expanded; longest raker on first gill arch about one-third length of longest gill filament; a small fourth gill slit present.

Dorsal profile of snout steep, forming an angle of ca. 60° to horizontal axis of head and body. Nasal bone without spines. Ascending process of premaxilla intruding slightly into interorbital space, its posterior margin just reaching beyond level of posterior margin of posterior nostril. Preocular with 7 (1–10) spinous points along orbit margin. Supraocular with 7 (1–6) small spines on outer margin. Postocular with 7 (2–12) small spines along orbit margin. Interorbital ridge not developed, lacking spines; diverging anteriorly and posteriorly in dorsal view, distance between interorbital ridges narrowest at vertical midline of eye; interorbital canal moderately broad and deep, its width about one-third of iris diameter. Coronal with a single ridge continued to interorbital and parietal aspects, with a single (1–3) minute spinous point. Parietal with a single ridge; in females, a low elevated ridge with spinous margin, with 1–3 blunt spinous points (based on female paratypes); in males, parietal ridge elongated as a narrow thin bony crest, curved posterodorsally, its tip reaching level of second to fifth dorsal-fin spine bases (based on holotype and male paratypes). Nuchal with a single ridge completely fused to parietal ridge with a single spinous point on posterior end, directed posterodorsally. Coronal–parietal–nuchal ridges of both sides running almost parallel in dorsal view. Tympanic without spines or ridges. Anterior margin of occipital area sloped transversely from between origins of coronal ridges, slightly pointed posteriorly in dorsal view; posterior margin of occipital area bordered by net-like sensory canal. Postorbital spine and exposed sensory canal absent. Sphenotic region with 10 (3–13) small spines surrounding a short sensory canal. Pterotic with a short ridge with 5 (1–4) small spines. Lower posttemporal with a short ridge with 2 (1 or 2) small spines. Cleithrum with two low ridges; upper ridge short without spinous points; lower ridge long, curved posteroventrally with 2 (1 or 2) spinous points posteriorly.

Lateral lacrimal ridge short, with 3 (1–4) small spines; other ridges on lacrimal strongly spinous (not spinous in small specimens). Suborbital with a single ridge seemingly divided into anterior and posterior portions, with 6 (4–10) and 7 (3–9) small spines on anterior and posterior ridges, respectively; 22 (0–13) small associated spines below ridge; 35 (7–29) spines in total. Anterior lacrimal spine with a single (or absent) spinous point directed ventrally. Posterior lacrimal portion plate-like with 3 (2–5) spinous points distally. Preopercle with 5 spines; upper 3 spines of similar length; lower 2 spines reduced and skin-covered; no supplemental spine on first (uppermost) preopercular spine base; a single (or 2) supplemental spine on second preopercular spine base; third preopercular spine base with a single blunt ridge with 3 (1–3) spinous points. A single exposed upper opercular spine directed posterolaterally. Lower opercular spine absent.

Doral-, anal- and pelvic-fin spines with deep grooves (most likely associated with venom glands). Origin of first dorsal-fin spine above pterotic spine base; bases of first and second dorsal-fin spines closer than those of subsequent adjacent spines; fourth or fifth spine longest (based on paratypes; unknown in holotype); penultimate (twelfth) [rarely posteriormost (thirteenth)] spine shortest, its length 62 (47–67) and 73 (68–96) % of that of antepenultimate (eleventh) and posteriormost (thirteenth) spines,

respectively (data on specimen with shortest thirteenth spine not included); membrane of spinous portion of dorsal fin strongly incised. Dorsal-fin soft rays all branched (first ray unbranched in small specimens); fourth (or fifth) ray longest, its length distinctly less than that of longest dorsal-fin spine (71–82 % of longest dorsal-fin spine length; based on paratypes); posteriormost ray free from caudal peduncle. Origin of first anal-fin spine below twelfth dorsal-fin spine base; third spine longest; length of first spine 69 (60–69) and 46 (42–55) % of that of second and third spines, respectively. Anal-fin soft rays all branched; fourth (third or fourth) ray longest, its length subequal to that of longest dorsal-fin soft ray [105 (97–113) % of longest dorsal-fin soft ray length]; posteriormost ray free from caudal peduncle. Pectoral fin long with rounded contour, seventh ray (fourth to seventh) longest; its tip slightly extending beyond level of anal-fin base posterior end (extending beyond caudal-fin base in small specimens); lower five rays weakly thickened. Pelvic-fin spine base below third dorsal-fin spine base; all pelvic-fin soft rays branched; third (second or third) soft ray longest, its tip extending slightly beyond first anal-fin spine base; posteriormost soft ray with membranous connection to abdomen for approximately half (one-fourth to half) of ray length. Caudal fin long with rounded contour, its length 136 (119–148) % of head length, with 2 (rarely 3) procurrent rays, 2 segmented unbranched rays, and 4 segmented branched rays in dorsal and ventral series. Caudal peduncle relatively short, low, its depth 65 (60–76) % of length.

Color of fresh specimen. Based on photograph of a male specimen (Fig. 1). Ground color of head and body pale red, whitish ventrally. Three relatively narrow (width subequal to iris diameter) dark red bands with narrow whitish margins on sides of head; anteriormost band from ventral margin of orbit, running ventrally; middle band from posteroventral margin of orbit, reaching obliquely ventral margin of subopercle; posteriormost band saddling nape at level of central portion of parietal ridge, reaching posteroventral margin of opercle at level of upper origin of pectoral-fin base. Both jaws yellowish; mandible and branchiostegal membrane bright yellow. Eyes orange, iris black, seemingly lacking radial markings. Flaps on posterior margin of preopercular yellow. Five vertical, moderately broad dark red bands (about four or five vertical scale rows width) saddling body; anteriormost band below first to second dorsal-fin spine bases, extending posteroventrally and continuous with a black blotch above pectoral-fin base; second band below fourth to fifth dorsal-fin spine bases; third band below eighth to tenth dorsal-fin spine bases; fourth band below first to third dorsal-fin soft ray bases; fifth band below sixth to seventh or eighth dorsal-fin soft ray bases. A relatively large black blotch (slightly larger than iris) above upper origin of pectoral-fin base.

Spinous dorsal fin coloration similar to ground color of body; soft-rayed portion of dorsal fin pale yellow, somewhat reddish basally. Anal fin pale yellow, somewhat reddish basally. Pectoral fin dark yellow, somewhat reddish basally, with numerous relatively large black blotches (larger than iris). Pelvic fin red, broadly blackish. Caudal fin broadly bright yellow, paler basally, with ca. 6 small black spots (distinctly smaller than iris) scattered basally and dorsally.

Color of preserved specimens. Overall brownish white (or creamy white), slightly darker dorsally (Figs. 2–3); posterior margin of scales or scale pockets blackish. Three relatively narrow brown bands on sides of head; anteriormost band just below eye; middle band from posteroventral margin of orbit, reaching obliquely ventral margin of subopercle; posteriormost band saddling nape at level of parietal ridge, reaching opercle at level of upper origin of pectoral-fin base. Five moderately broad pale brown bands (ca. four vertical scale rows width) on sides of body (based on paratypes; obscured in holotype); anteriormost band below first and second dorsal-fin spine bases, running posteroventrally, continuous with a dark brown or black blotch above pectoral-fin base; second band below fourth to sixth dorsal-fin spine bases; third band below eighth to tenth dorsal-fin spine bases; fourth band below first to second dorsal-fin soft ray bases; fifth band below sixth to eighth dorsal-fin soft ray bases. A relatively large dark brown or black blotch just above pectoral-fin base (maximum diameter subequal to orbit diameter). Eyes darkish blue, iris black.

In large males (including holotype) (>80 mm SL), dorsal and anal fin membrane translucent without spots (or entirely blackish in 82–86 mm SL specimens). Pectoral-fin membrane translucent, blackish marginally, with ca. 9 (6–11) relatively large, scattered black blotches (diameter subequal to orbit diameter). Pelvic fin translucent, broadly blackish, paler basally. Caudal-fin membrane translucent without markings (or blackish posteriorly, with ca. 5 small black spots on basal-dorsal portion in 82–86 mm SL specimens). In large females (>70 mm SL), dorsal-fin membrane translucent with ca. 19–23 small black spots scattered on soft rays. Anal-fin membrane translucent with 0–5 small black spots scattered on soft rays. Pectoral-fin membrane broadly blackish, paler dorsally and basally, with ca. 10 indistinct relatively large scattered black blotches. Pelvic fin as in large males. Caudal-fin membrane translucent with ca. 51–59 small black spots scattered over entire fin (or blackish posteriorly, with ca. 11 black spots on basal-dorsal portion). In small specimens of both sexes (<70 mm SL), dorsal and anal fins entirely blackish without spots (or with ca. 25 and ca. 8–17 small black spots scattered on soft rays of dorsal and anal fins, respectively). Pectoral fin entirely blackish with ca. 5 indistinct black

Fig. 2 Preserved specimens of *Ebosia vespertinus* sp. nov. **a** SAM 34265 (one of four specimens), female, 93.5 mm SL, Mozambique; **b** SAM 41190, holotype, male, 99.1 mm SL, Mozambique

blotches. Pelvic fin entirely dusky. Caudal fin blackish posteriorly, with ca. 15–28 small black spots on basal-dorsal portion.

Distribution. *Ebosia vespertina* has currently been recorded from off Mozambique and the east coast of South Africa between latitudes 18° and 29° S, and southeastern Madagascar in the southwestern Indian Ocean. Sampling data accompanying six specimen lots examined indicated capture by bottom trawl at depths of 54–110 m. A photographed specimen (Fig. 1; not retained) was collected off Tolagnaro (formerly Fort-Dauphin), Madagascar (25°14.6′S, 47°09.1′E), from a depth of 79–80 m.

Etymology. The specific name, *vespertina*, derived from Latin meaning western, alludes to the species having the westernmost distribution within the genus.

Morphological changes with growth. Analyses of 44 measurements taken from 19 specimens (50.0–109.9 mm SL) of *E. vespertina* indicated that the relative body width and depth, head width and depth, and snout length proportions tended to increase as a percentage of standard length with growth. In contrast, orbit diameter and all fin ray length proportions [except dorsal-fin spines (significantly damaged in most specimens examined)] became significantly less with growth. The supraocular skin flap became shorter (reduced in size) with growth in *E. vespertina*, as in congeners (Matsunuma and Motomura 2014). Small specimens (<70 mm SL) had a relatively large supraocular flap, 3.7–5.5 mm (5.8–8.4 % of SL), whereas larger specimens (>90 mm SL) had a small flap, 2.1–5.0 mm (1.9–5.2 % of SL).

The number of pectoral-fin rays with more than three branches tended to increase with growth in *E. vespertina*, from usually absent (rarely 1) in small specimens (<80 mm SL) to 4–9 (22–50 % of the total number of pectoral-fin rays) in large specimens (>90 mm SL) (Fig. 4). However, an abnormal example of a relatively large specimen (93.5 mm SL; one of seven specimens of SAM 34265) lacked such highly divided pectoral-fin rays. Nevertheless, the rate of increased pectoral-fin ray division in *E. vespertina* appeared to be greater than in *E. falcata* (Fig. 4).

The number of spinous points on many head spines significantly increased with growth in *E. vespertina* (except those associated with the coronal, parietal, pterotic, lower posttemporal, supracleithral, opercular, preopercular, supplemental preopercular and anterior lacrimal spines). For example, small specimens (<70 mm SL) possessed a single spinous point on the preocular, 3–6 spines on the sphenotic region, and 7–13 spines on the suborbital ridge, whereas relatively large specimens (>90 mm SL) possessed 1–10, 9–13, and 18–35 spines, respectively. Furthermore, the parietal spine of males became more elongated with growth (Fig. 5b, c).

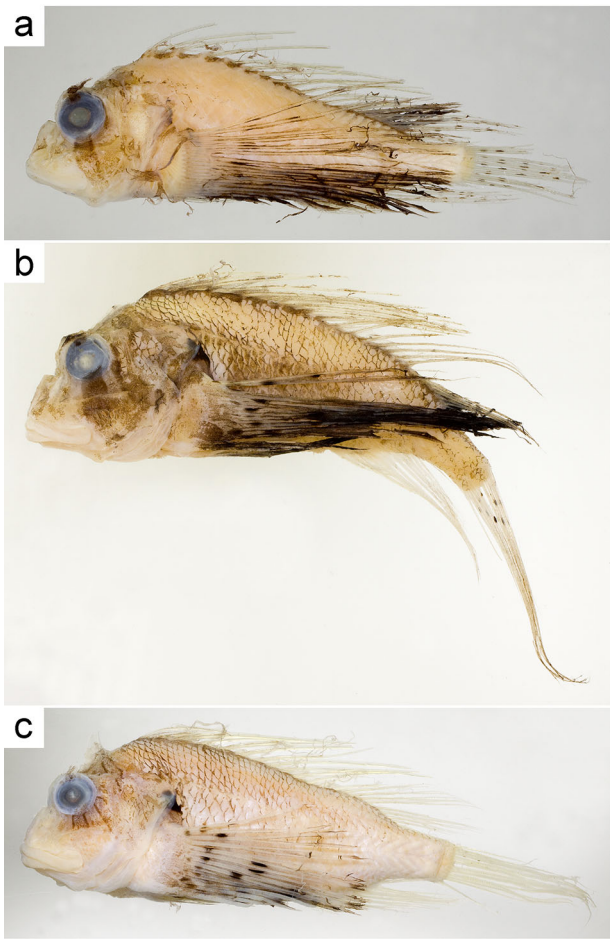

Fig. 3 Preserved specimens of *Ebosia vespertinus* sp. nov., showing black markings on specimens. **a** SAM 34265 (one of four specimens), female, 58.9 mm SL, Mozambique; **b** KAUM–I. 75290, female, 82.9 mm SL, South Africa; **c** SAM 34265 (one of four), male, 106.1 mm SL, Mozambique (parietal spine broken; right side reversed)

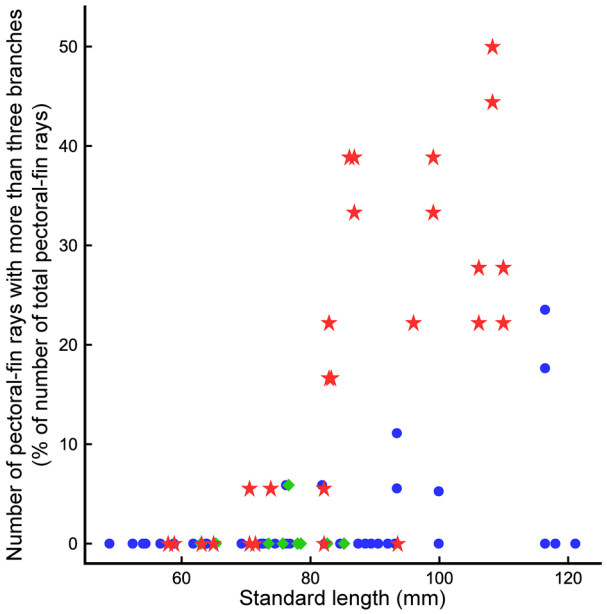

Fig. 4 Relationships of pectoral-fin rays with more than three branches as a percentage of number of total pectoral-fin rays to standard length (mm) in *Ebosia vespertina* sp. nov. (*red stars*); *E. falcata* (*blue circles*); and *E. saya* (*green diamonds*). Counted on both sides whenever possible

Sexual dimorphism and dichromatism. Sexual dimorphism of parietal spine morphology in *E. vespertina* was recognized on the basis of five male (70.5–106.1 mm SL) and six (58.9–96.0 mm SL) female specimens, their sex having been determined by gonad examination (see Matsunuma and Motomura 2014). In males, the parietal spine becomes a thin elongated bony crest, strongly curved posterodorsally with growth, its posterior margin reaching a vertical through the second to fifth dorsal-fin spine bases (Figs. 1, 2b, 5b, c). By contrast, all females examined had a low parietal ridge with a dull spinous margin (Figs. 2a, 5a). Further sexual dimorphism included the third preopercular spine base, with females possessing a spineless ridge or a single spine on the base and males usually a ridge with 1–5 small spines, and the number of supraocular spines, with 1 or 2 in females and 1–7 in males, although the number of spines tended to increase with growth in both sexes.

Sexual dichromatism has been reported for *E. bleekeri* and *E. saya*, wherein males possessed yellowish soft-rayed portions of the dorsal and anal fins (plus a yellow caudal fin in *E. bleekeri* and yellow pectoral fin in *E. saya*), whereas females of both species possessed all red fins (Matsunuma and Motomura 2014). Although life or fresh coloration of female *E. vespertina* was undetermined in this study, males possessed bright yellow soft-rayed portions of the dorsal and anal fins, and yellow caudal and pectoral fins when fresh (Fig. 1). Large preserved female specimens had broadly blackish pectoral fins (Figs. 2a, 3a, b), which are paler in males (membrane almost translucent; Figs. 2b, 3c), indicating that females also had darker pectoral fins than males in life. Considering the morphological similarities between *E. vespertina* and *E. saya*, females of the former likely possess red pectoral fins compared to yellow in males. Moreover, the number of black spots on the soft-rayed portion of the dorsal and caudal fins also differs between the sexes in *E. vespertina*. Large females (> 80 mm SL) possessed 19–23 blackish spots on the dorsal-fin soft-rayed portion and 11–59 blackish spots on the caudal fin in contrast to males (0 and 0–8 spots, respectively). No difference was found between the sexes in the number of spots on the soft-rayed portion of the anal fin, tending to decrease with growth in both sexes.

Species comparisons. Among species of *Ebosia*, *E. vespertina* is characterized by 17–18 (modally 18) pectoral-fin rays, compared with 15–17 (modally 16) in

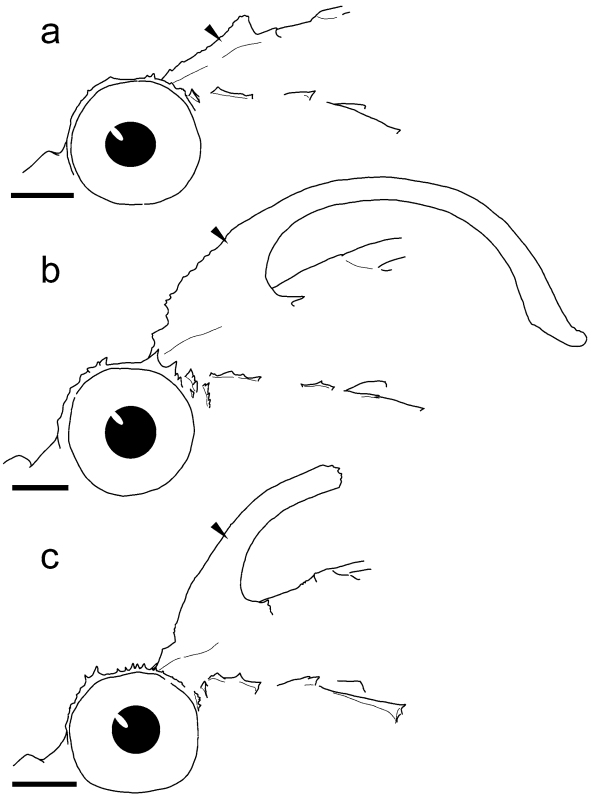

Fig. 5 Lateral views of head of *Ebosia vespertina* sp. nov. (**a**: female; **b**–**c**: male), showing ontogenetic change and sexual difference of parietal spine. **a** SAM 34265 (one of four specimens), 93.5 mm SL; **b** SAM 34266 (one of six), 108.3 mm SL (right side reversed); **c** SAIAB 76118, 86.0 mm SL. *Bars* and *arrowheads* indicate 5 mm and parietal spine, respectively

E. bleekeri and 16–19 (modally 17) in *E. falcata* and *E. saya* (see Matsunuma and Motomura 2014; Table 1). Although a single specimen of *E. falcata* (ZMH 5581) possessed 19 and 17 pectoral-fin rays on the left and right sides of the body, respectively, it was considered to represent an abnormal condition. Moreover, *E. vespertina* can be distinguished from *E. bleekeri* by having 7–8 (modally 8) anal-fin soft rays [versus 6–8 (modally 7) in *E. bleekeri*]; the elongated parietal spine in males narrow and strongly curved posterodorsally, the width of the elongated portion clearly less than the pupil diameter (versus less falcate posterodorsally and relatively broad, its width ca. 1.0–1.5 times pupil diameter); and a yellowish pectoral fin in males (versus entirely red) (Matsunuma and Motomura 2014; this study).

Ebosia vespertina is closely related to *E. falcata* and *E. saya* in sharing modally 8 anal-fin soft rays, and a narrow, strongly curved parietal spine and broadly yellowish pectoral fin in males (the latter when fresh) (Matsunuma and Motomura 2014; this study). However, in addition to the above-mentioned difference in the number of pectoral-fin rays, subtle differences exist in the number of longitudinal series scale rows and gill rakers between *E. vespertina* and the latter two species (Table 1), viz., scale rows 47–51 (modally 49 or 50) in *E. vespertina* versus 41–48 (44) in *E. falcata* and 44 or 46 in *E. saya* (only two specimens available); upper gill rakers 4–6 (4) versus 4–6 (5) and 4 or 5 (5); lower gill rakers 10 or 11 (10) versus 10–12 (11) and 10 or 11 (11); and total gill rakers 14–17 (14) versus 14–17 (16) and 15 or 16 (15). *Ebosia vespertina* also differs from *E. falcata* by having usually one more scale row above the lateral line [4–6 (modally 5) in *E. vespertina* versus 4–5 (4) in *E. falcata*]; scale rows between the last dorsal-fin spine base and lateral line [4–5 (5) versus 4]; scale rows between the last dorsal-fin spine base and lateral line [4–5 (5) versus 3–5 (4)]; and a short postorbital length [17.4–20.3 (mean 18.7) % of SL versus 19.8–24.2 (21.9) % of SL] (Table 1; Fig. 6a, d). Furthermore, *E. vespertina* can be distinguished from *E. saya* by the longer pectoral fin [longest ray length 54.6–73.9 (mean 65.1) % of SL in *E. vespertina* versus 55.9–57.8 (56.5) % of SL in *E. saya*]; longer pelvic fin [longest pelvic-fin soft ray length 32.4–44.0 (37.6) % of SL versus 30.8–37.9 (33.3) % of SL]; a larger blotch above the pectoral-fin base and blotches on the pectoral fin membrane [maximum diameter of blotch above pectoral-fin base 54.7–99.7 (77.7) % of orbit diameter (OD) in *E. vespertina* ($n = 14$) versus 32.6–56.2 (41.2) % of OD in *E. saya* ($n = 6$); that of blotches on the pectoral-fin membrane 25.6–42.0 (34.6) % of OD versus 13.5–34.5 (21.7) % of OD in *E. saya* ($n = 10$)] (Figs. 6b, c, e, f, 7). In addition, relationships between body size and number of pectoral-fin rays with more than three branches may be helpful for the identification of large examples (>80 mm SL) of *E. vespertina* and *E. falcata* (Fig. 4).

Padate et al. (2014) recently recorded three specimens of *E. falcata* from the Gulf of Manner (off southern India) and noted the fresh coloration of one of the specimens. Since the photograph included (Padate et al., 2014: fig. 2C) showed an elongated parietal spine and yellowish pectoral, soft-rayed portions of dorsal and anal, and caudal fins, the specimen was here regarded to have been a male.

Comparative materials. *Ebosia bleekeri* (111 specimens), *E. falcata* (38) and *E. saya* (10) listed in Matsunuma and Motomura (2014) with the following additions. *Ebosia bleekeri*: KAUM–I. 65441, 90.9 mm SL, female (G), Tosa Bay, Kochi Prefecture, Japan, BSKU, bottom trawl, 17 December 2012; MZS Pis892, female (P), 110.2 mm SL, syntype of *Pterois bleekeri*, Tokyo, Japan; NMW 75648, male (P), 109.3 mm SL, syntype of *P. bleekeri*, Tokyo, Japan; SNFR 13580, male (G), 124.6 mm SL, East China Sea, bottom trawl, 2 June 2008; SNFR 13589, male (G), 96.3 mm SL, SNFR 13590, male (G), 93.7 mm SL, East China Sea, bottom trawl, 31 May 2008; SNFR 14108, male

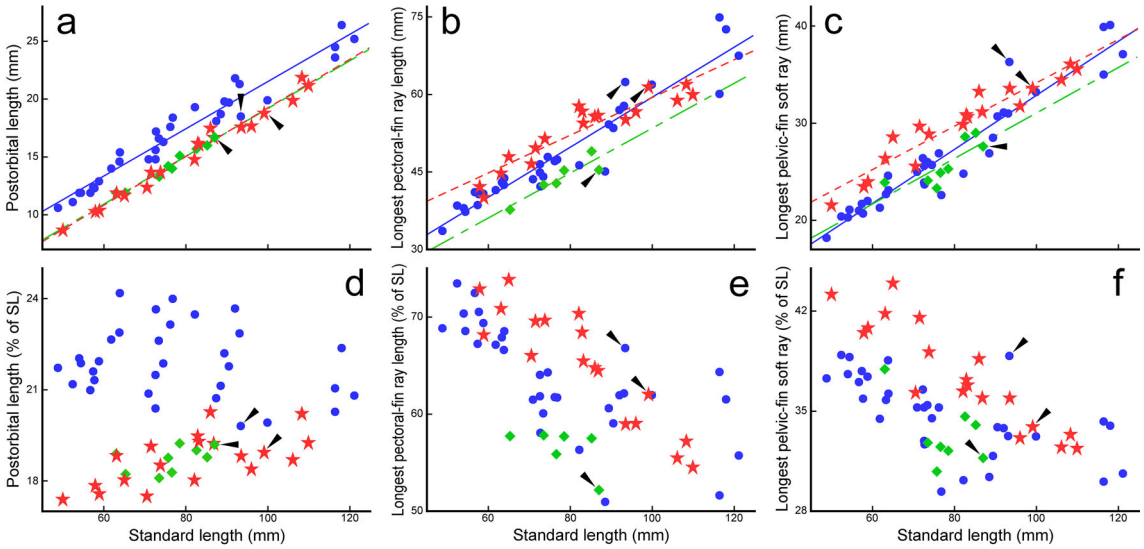

Fig. 6 Relationships of (**a**, **d**) postorbital length, (**b**, **e**) longest pectoral-fin ray length and (**c**, **f**) longest pelvic-fin soft ray (as % of standard length in **d**–**f**) to standard length (mm) in *Ebosia vespertina* sp. nov. (*red stars*; *dotted lines*); *E. falcata* (*blue circles*; *solid lines*); and *E. saya* (*green diamonds*; *dashed lines*). *Arrowheads* indicate holotype

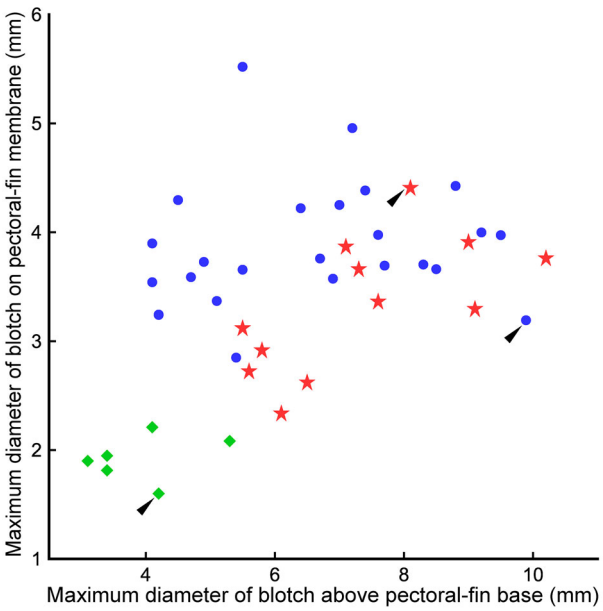

Fig. 7 Relationships of maximum diameter of blotch on pectoral-fin membrane to maximum diameter of blotch above pectoral-fin base (mm) in *Ebosia vespertina* sp. nov. (*red stars*); *E. falcata* (*blue circles*); and *E. saya* (*green diamonds*). *Arrowheads* indicate holotype

(G), 98.2 mm SL, East China Sea, bottom trawl, 1 June 2008. *Ebosia falcata*: ZSI F 7400/2, sex undetermined, 56.0 mm SL, paratype of *Ebosia falcata*, off Somalia (11°04′N, 51°15′E), 76–80 m, bottom trawl, H. Fehlmann onboard RV *Anton Bruun*, 17 December 1964.

Acknowledgments We are deeply grateful to R. Bills, O. Gon and E. Heemstra (SAIAB); M. Bougaardt and D. Clarke (SAM); M. McGrouther, A. Hay and S. Reader (AMS); K.-T. Shao, Y.-C. Liao and M.-Y. Lee (ASIZP); H. Endo, T. Yamakawa, N. Nakayama, R. Asaoka (BSKU), E. Katayama and R. Misawa (formerly BSKU); Y. Kai, A. Tokairin (FAKU), T. Nakabo and N. Muto (formerly FAKU); M. Yabe, H. Imamura and T. Kawai (HUMZ); R. Causse (MNHN); Y. Iwatsuki (MUFS), K. Hidaka and K. Miyamoto (formerly MUFS); M. Meister and M.-D. Wandhammer (MZS); Z. Arifin, R. Pratiwi, M. Adrim, I. Alhakim and K. Wibowo (NCIP); H.-C. Ho (NMMB); A. Palandacic (NMW); M. Gomon and D. Bray (NMV); K. Matsuura and G. Shinohara (NSMT); K.-Y. Wu (NTUM); T. Yoshino (formerly URM); K. Hoshino and M. Okamoto (SNFR); J. Williams (USNM); S. Morrison (WAM); R. Thiel and I. Eidus (ZMH); K. Gopi and S. Mishra (ZSI); and K. Sakamoto (ZUMT) for their kind hospitality during the first author's visits to their institutions. We are especially grateful to E. Heemstra (SAIAB) for providing the photograph of the Madagascar specimen of *E. vespertina* which was taken by M. Lee during the 2010 *Atimo Vatae* expedition to south Madagascar [principal investigator, P. Bouchet (MNHN)]. We are also grateful to R. Feeney (LACM) for providing opportunities to examine specimens; H.-C. Ho (MNHB) and H. Endo, N. Nakayama, R. Misawa and other students of BSKU for donating specimens; and students and volunteers of KAUM for curatorial assistance. G. Hardy (Ngunguru, New Zealand) read the manuscript and provided help with English. This study was supported in part by Grants-in-Aid for Scientific Research (A: 26241027, B: 24370041, and C: 23580259 and 26450265) from the Japan Society for the Promotion of Science, Tokyo, Japan (JSPS), JSPS Asian Core Program ''Establishment of Research and Education Network on Coastal Marine Science in Southeast Asia'', JSPS International Training Program ''Protect Diversity of Bioresources in the Tropical Area'', the Coastal Area Capability Enhancement in Southeast Asia Project of the Research Institute for Humanity and Nature, Kyoto, Japan the ''Biological Properties of Biodiversity Hotspots in Japan'' project of the National Museum of Nature and Science, Tsukuba, Japan, and by a grant awarded to the first author from the Mikimoto Fund for Marine Ecology.

References

Eschmeyer WN (1965) Western Atlantic scorpionfishes of the genus *Scorpaena*, including four new species. Bull Mar Sci 15:84–164

Eschmeyer WN, Rama-Rao KV (1978) A new scorpionfish, *Ebosia falcata* (Scorpaenidae, Pteroinae), from the western Indian Ocean, with comments on the genus. Matsya (3):64–71

Jordan DS, Starks EC (1904) A review of the scorpaenoid fishes of Japan. Proc US Natl Mus 27:91–175

Matsunuma M, Motomura H (2013) A new lionfish of the genus *Dendrochirus* (Scorpaenidae: Pteroinae) from the Tuamotu Archipelago, South Pacific Ocean. Spec Divers 18:1–7

Matsunuma M, Sakurai M, Motomura H (2013) Revision of the Indo-West Pacific genus *Brachypterois* (Scorpaenidae: Pteroinae), with description of a new species from northeastern Australia. Zootaxa 3693:401–440

Matsunuma M, Motomura H (2014) A new species of scorpionfish, *Ebosia saya* (Scorpaenidae: Pteroinae), from the western Indian Ocean and notes on fresh coloration of *Ebosia falcata*. Ichthyol Res doi:10.1007/s10228-014-0445-4 (also appeared in Ichthyol Res 62:293–312)

Motomura H (2004a) Morphological comparison of a poorly known scorpionfish, *Parapterois macrura*, with a related species, *P. heterura* (Scorpaenidae: Pteroinae). Zool Stud 43:1–7

Motomura H (2004b) New species of scorpionfish, *Scorpaena cocosensis* (Scorpaeniformes: Scorpaenidae) from the Cocos Islands, Costa Rica, eastern Pacific Ocean. Copeia 2004:818–824

Motomura H (2004c) Revision of the scorpionfish genus *Neosebastes* (Scorpaeniformes: Neosebastidae) with descriptions of five new species. Indo-Pac Fish 37:1–75

Motomura H, Fricke R, Eschmeyer WN (2005a) Redescription of a poorly known scorpionfish, *Scorpaena canariensis* (Sauvage), and a first record of *Pontinus leda* Eschmeyer from the Northern Hemisphere (Scorpaeniformes: Scorpaenidae). Stuttg Beitr Naturk Ser A (Biol) 674:1–15

Motomura H, Johnson JW (2006) Validity of the poorly known scorpionfish, *Rhinopias eschmeyeri*, with redescriptions of *R. frondosa* and *R. aphanes* (Scorpaeniformes: Scorpaenidae). Copeia 2006:500–515

Motomura H, Last PR, Gomon MF (2006a) A new species of the scorpionfish genus *Maxillicosta* from the southeast coast of Australia, with a redescription of *M. whitleyi* (Scorpaeniformes: Neosebastidae). Copeia 2006:445–459

Motomura H, Last PR, Yearsley GK (2005b) *Scorpaena bulacephala*, a new species of scorpionfish (Scorpaeniformes: Scorpaenidae) from the northern Tasman Sea. Zootaxa 1043:17–32

Motomura H, Last PR, Yearsley GK (2006b) New species of shallow water scorpionfish (Scorpaenidae: *Scorpaena*) from the central coast of Western Australia. Copeia 2006:360–369

Motomura H, Paulin CD, Stewart AL (2005c) First records of *Scorpaena onaria* (Scorpaeniformes: Scorpaenidae) from the southwestern Pacific Ocean, and comparisons with the Northern Hemisphere population. New Zealand J Mar Freshwater Res 39:865–880

Motomura H, Senou H (2008) A new species of the scorpionfish genus *Scorpaena* (Scorpaenidae) from Izu Peninsula, Pacific coast of Japan. J Fish Biol 72:1761–1772

Padate VP, Rodrigues R, Rivonker CU (2014) New records of rare marine fishes from the Gulf of Mannar, India. Acta Ichthyol Piscat 44:241–248

Randall JE, Eschmeyer WN (2002) Revision of the Indo-Pacific scorpionfish genus *Scorpaenopsis*, with descriptions of eight new species. Indo-Pac Fish 34:1–79

Sabaj Pérez MH (2014) Standard symbolic codes for institutional resource collections in herpetology and ichthyology: an online reference. Version 5.0 (22 September 2014). American Society of Ichthyologists and Herpetologists, Washington, DC. http://www.asih.org/resources/standard-symbolic-codes-institutional-resource-collections-herpetology-ichthyology. Accessed 21 October 2014

Steindachner F, Döderlein L (1884) Beiträge zur Kenntniss der Fische Japan. (III). Denkschr Akad Wiss Wien 49:171–212