

A new species of scorpionfish, *Ebosia saya* (Scorpaenidae: Pteroinae), from the western Indian Ocean and notes on fresh coloration of *Ebosia falcata*

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Abstract A new scorpionfish, *Ebosia saya* sp. nov. (Scorpaenidae: Pteroinae), is described on the basis of 10 specimens collected from the Saya de Malha Bank in depths of 95–126 m. Comparisons with two valid Indo-Pacific species, *Ebosia bleekeri* (Döderlein in Steindachner and Döderlein 1884) (western Pacific Ocean) and *Ebosia falcata* Eschmeyer and Rama-Rao 1978 (northern and eastern Indian Ocean), showed *E. saya* to be most similar to the latter, with both species sharing 8 (usually) anal-fin soft rays, 17 (usually) pectoral-fin rays, the elongated parietal spine of males relatively narrow and strongly falcate posterodorsally, and the pectoral fin predominantly yellow in males, whereas *E. bleekeri* has 7 (usually) anal-fin soft rays, 16 (usually) pectoral-fin rays, the elongated parietal spine of males relatively broad and weakly falcate, and the pectoral fins entirely red in males. However, *E. saya* differs from *E. falcata* in having 5 scale rows above the lateral line [vs. 4 or 5 (modally 4) in *E. falcata*], slightly greater total numbers (5–20, mean 12.3) of preocular, supraocular, and postocular spines at 60–90 mm SL (vs. 4–18, 8.4), shorter postorbital length

18.1–19.2 (mean 18.7) % SL [vs. 19.8–23.5 (21.5) % SL], and the blotch above the pectoral-fin base and blotches on the pectoral-fin membrane all relatively smaller. Fresh coloration of *E. falcata* is described for the first time, based on specimens from the Andaman Sea (easternmost record for the species).

Keywords *Ebosia bleekeri* · sexual dimorphism · distribution · Saya de Malha Bank

Introduction

The Indo-West Pacific scorpionfish genus *Ebosia* Jordan and Starks 1904 (Scorpaenidae: Pteroinae) is characterized by having the coronal, parietal, and nuchal spine bases continuous, and the parietal spine elevated, being a thin bony crest in males (Eschmeyer and Rama-Rao 1978; this study). Two valid species, *Ebosia bleekeri* (Döderlein in Steindachner and Döderlein 1884) (western Pacific Ocean) and *Ebosia falcata* Eschmeyer and Rama-Rao 1978 (northern and eastern Indian Ocean), are currently recognized.

During a revisionary study of *Ebosia*, 10 specimens of an unidentified species from the Saya de Malha Bank, western Indian Ocean, were found in several museum collections. The specimens were closely related to *E. falcata* in having usually 8 anal-fin soft rays, usually 17 pectoral-fin rays, and the elongated parietal spine in males relatively narrow and strongly falcate posterodorsally. However, examination subsequently revealed that the Saya de Malha Bank specimens could be distinguished from *E. falcata* on the basis of several characters, including meristics, morphometrics, and coloration, thereby representing an undescribed species of *Ebosia*. Moreover, newly

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collected specimens of *E. falcata* from the Andaman Sea enabled detailed morphological and genetic comparisons with its congeners, and photographs of the specimens taken prior to preservation provided fresh coloration of the species for the first time. Morphological changes with growth, and sexual dimorphism in head spine condition and coloration of the species of *Ebosia* are herein described in detail.

Materials and methods

Measurements generally followed Motomura (2004b, c), with head width, head depth, maxillary depth, and body depth at 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, b, c) and Motomura and Johnson (2006); predorsal scale counts followed Motomura et al. (2006b). The diameter of the blotch above the pectoral-fin base was measured as the least distance between the upper and lower margins of the blotch. The diameter of blotches on the pectoral-fin membrane was represented as the mean of diameter measurements of 3–4 selected blotches on the anterodorsal portion of the pectoral fin (measured as horizontal width of blotch with fin closed). 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 that were counted on both sides.

Head spine terminology, shown in Fig. 1, generally follows Randall and Eschmeyer (2002: fig. 1) and Motomura (2004c: 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 examination of gonad sections embedded in paraffin and stained with Mayer's haematoxylin–eosin, or direct examination of gonads by light microscope whenever possible. In lists of specimens examined, (G) indicates sex determined by gonad examination; (E), sex determined from parietal spine morphology.

The mitochondrial DNA (mtDNA) cytochrome *b* gene was examined following DNA extraction from two specimens of *E. falcata* (KAUM–I. 47529, KAUM–I. 47530, Andaman Sea coast of Thailand) and three specimens of *E. bleekeri* (KAUM–I. 35803, KAUM–I. 35817, East China Sea; KAUM–I. 44331, Kagoshima Prefecture, Japan), performed with the Genra Puregene Tissue Kit (QIAGEN) following the manufacturer's protocols. Using total DNA and the primer pair AJG15 (Akihito et al. 2000) and Simt12-Fb (Kuriwa et al. 2007), approximately 2.3 kbp fragments, including the cytochrome *b* gene and

control region of mtDNA, were amplified under the following PCR conditions. Thirty amplification cycles were performed at 94 °C for 45 sec, 56 °C for 30 sec and 72 °C for 2 min. Sequencing reactions were carried out using the BigDye Terminator v3.1 Cycle Sequencing Kit (Applied Biosystems) with the primer L15369-CYB (Miya and Nishida 2000), following the manufacturer's protocols and utilizing the automated genetic analyzer models 3130 and 3500 (Applied Biosystems). The obtained DNA sequences were subjected to multiple alignments using Clustal X (Thompson et al. 1997). All sequences are available on DDBJ/EMBL/GenBank accession numbers AB971745–971749. The sequence difference (*p*-distance) was calculated using MEGA 6 (Tamura et al. 2013).

Standard length is abbreviated as SL. In the description, features for the holotype are presented first, followed by paratype data (if different) in parentheses. A distributional map was prepared using Quantum GIS 2.2 (Quantum GIS Development Team 2014), with data from Natural Earth. Institutional abbreviations follow Sabaj Pérez (2014), with the following addition: NSMT: National Museum of Nature and Science, Tsukuba. Specimens formerly deposited at KSHS (Kochi Prefectural Kochi Nishi Senior High School, Kamobe, Kochi) have been transferred to NSMT (G. Shinohara, pers. comm.).

Ebosia saya sp. nov.

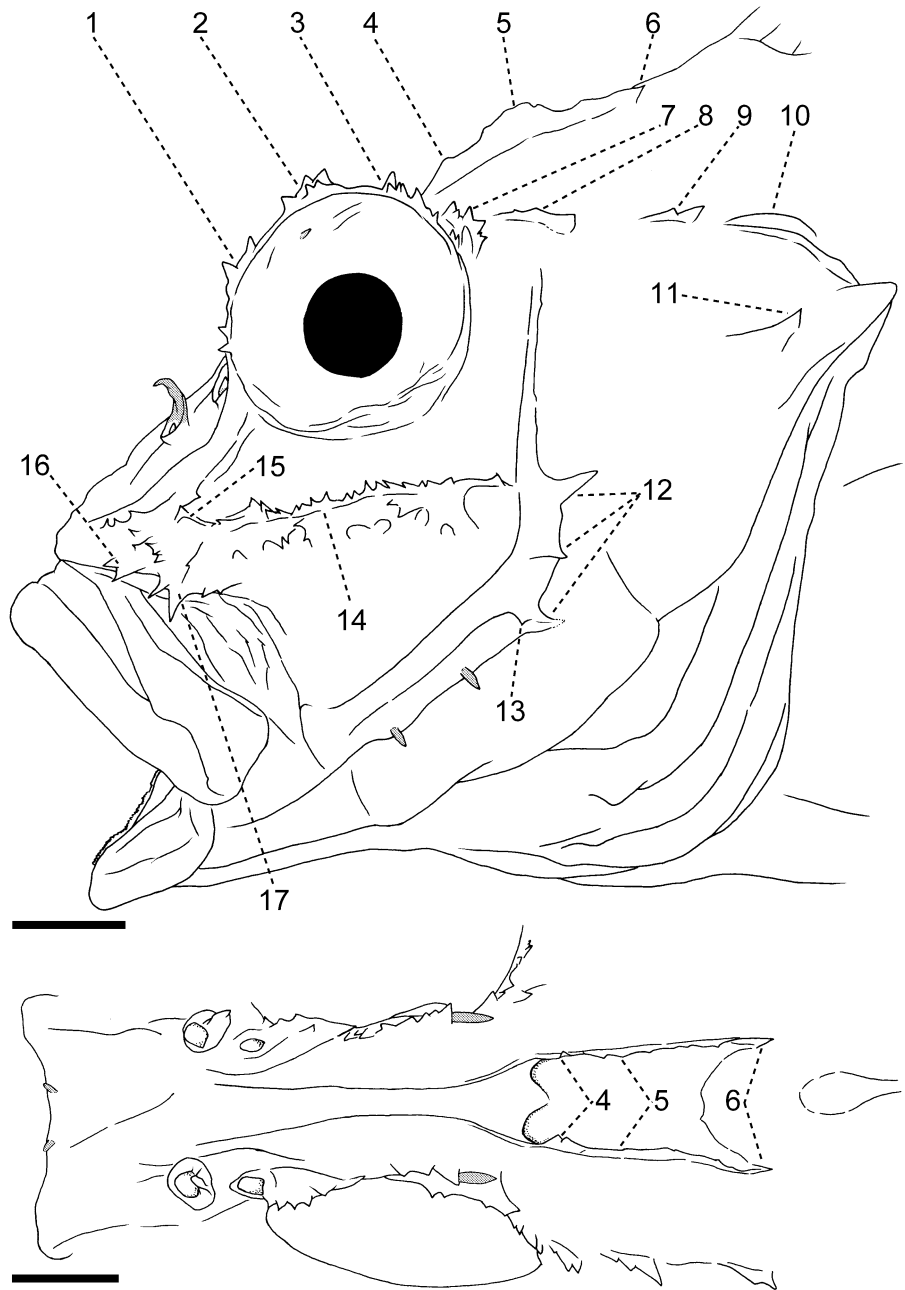
(New English name: Saya Lionfish) (Figs. 1–2, 3a–c, 4a, 5, 8c–f, 10a–c, 12c, 13–16; Tables 1–2)

Holotype. USNM 307910, female (G), 87.0 mm SL, off Madagascar (10°30'S, 61°10'E), 110–115 m, RV *Vityaz*, Cruise 17, Station 2809, 8 January 1989.

Paratypes. Nine specimens, 64.1–89.7 mm SL: HUMZ 73685, female (G), 82.6 mm SL, Saya de Malha Bank (10°59'S, 61°02'E), 126 m, 5 September 1977; HUMZ 73838, male (G), 78.0 mm SL, HUMZ 73840, male (G), 78.2 mm SL, KAUM–I. 70134 (formerly HUMZ 73839), male (G), 85.2 mm SL, Saya de Malha Bank (10°30'S, 61°32'E), 95 m, 3 September 1977; LACM 44793-3, three specimens [one male (G) and two females (G)], 65.3–75.7 mm SL, collected with holotype; USNM 407273 (formerly USNM 307910), two specimens, female (G), 63.0–76.6 mm SL, collected with holotype.

Diagnosis. A species of *Ebosia* distinguished from other members of the genus by the following combination of characters: anal-fin soft rays 8; pectoral-fin rays 17–18 (modally 17); scale rows above lateral line 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 4–6 (5); scales on preopercular region 11–22 (mean

Fig. 1 Lateral (top) and dorsal (bottom) views of head of *Ebosia saya* sp. nov., USNM 307910, holotype, 87.0 mm SL. Shaded areas indicate skin flaps. 1 Preocular spine; 2 Supraocular spine; 3 Postocular spine; 4 Coronal spine; 5 Parietal spine; 6 Nuchal spine; 7 Sphenotic spine; 8 Pterotic spine; 9 Lower posttemporal spine; 10 Supracleithral spine; 11 Upper opercular spine; 12 Preopercular spine; 13 Supplemental preopercular spine; 14 Suborbital ridge/spine; 15 Lateral lacrimal ridge / spine; 16 Anterior lacrimal spine; 17 Posterior lacrimal spine. Bars indicate 5 mm



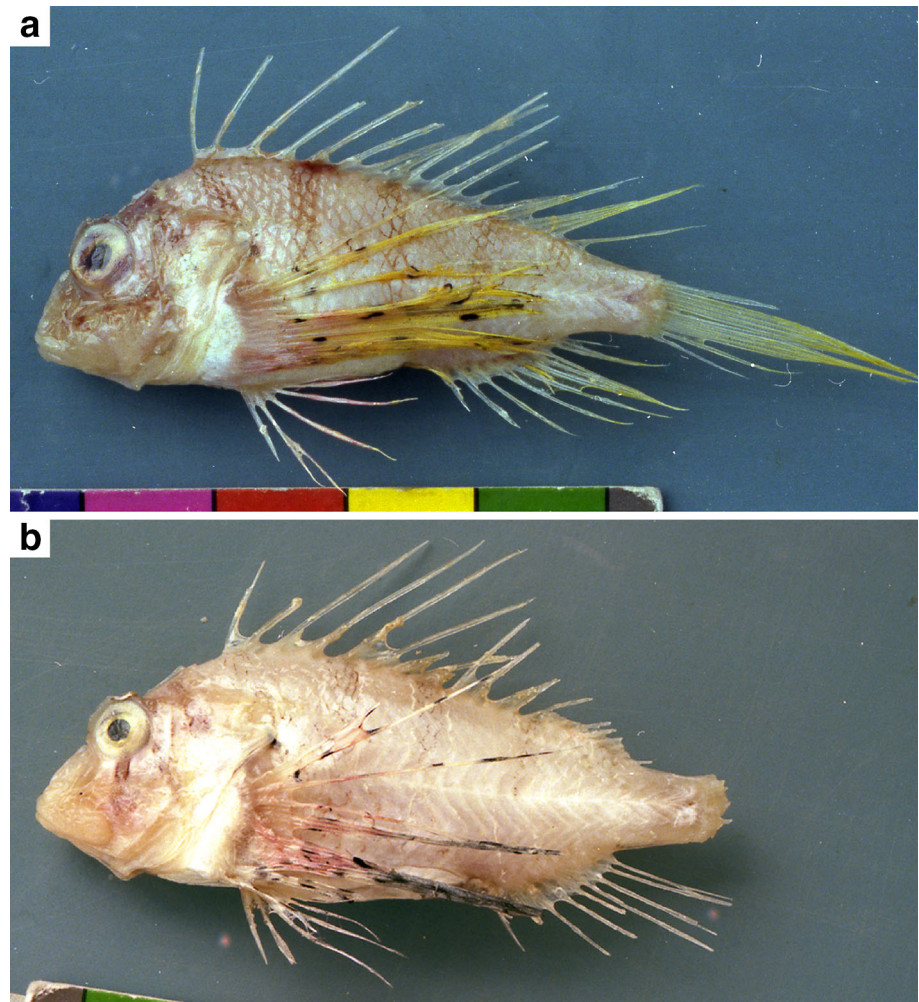
15.4); postorbital length 18.1–19.2 (18.7) % SL; a blotch above pectoral-fin base and blotches on pectoral-fin membrane relatively small; yellowish median fins and yellow pectoral fin in males; elongated parietal spine in males relatively narrow, strongly falcate posterodorsally, its tip reaching third to seventh dorsal-fin spine bases.

Description. Morphometrics and selected meristics are shown in Tables 1–2. Meristics given in Table 1 are not repeated here. Pectoral-fin with 1 (1–3) upper unbranched + 10 (9–11) middle branched + 6 (5–7) lower unbranched rays; 0 or 1 branched ray divided into more than three (based on paratypes; unclear in holotype). Pelvic fin with 1

spine and 5 soft rays. Branchiostegal rays 7. Swimbladder present.

Body oblong, moderately compressed anteriorly, extensively compressed posteriorly; depth moderate, maximum body depth slightly less than longest dorsal-fin spine length. Head large, its length greater than body depth. A short 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 (based on paratypes; tip of flap broken in holotype). Supraocular with a small flap, its length about half of iris diameter (subequal to iris diameter in small

Fig. 2 Fresh specimens of male (a) and female (b) of *Ebosia saya* sp. nov. **a** HUMZ 73840, 78.5 mm SL (parietal spine broken); **b** HUMZ 73685, 82.6 mm SL (right side; reversed), both from Saya de Malha Bank. Photos: HUMZ



specimens). Two extremely small flaps on preopercle margin below third preopercular spine base; its tip not reaching posterior margin of interopercle when laid flat. An extremely small skin flap anterodorsally on orbit surface; its length less than one-third of posterior nasal pore diameter. Snout tip with two extremely short barbels; length slightly shorter than 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 (or slightly) extending anteriorly beyond level of mid-orbit; suborbital pit always without scales. Preopercular region bordered by posterior margin of maxilla, suborbital ridge and posterior marginal ridge of preopercular, covered with relatively well-developed 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 few 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; spinules mostly embedded with tip 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; remainder of body with cycloid scales. Basal regions of dorsal- and anal-fin bases without scales; caudal-fin base with small cycloid scales; basal scale morphology on pectoral-fin base unknown (scales lost in all specimens examined).

Mouth set relatively low on head, protruding moderately downward; moderately large, slightly oblique, forming an

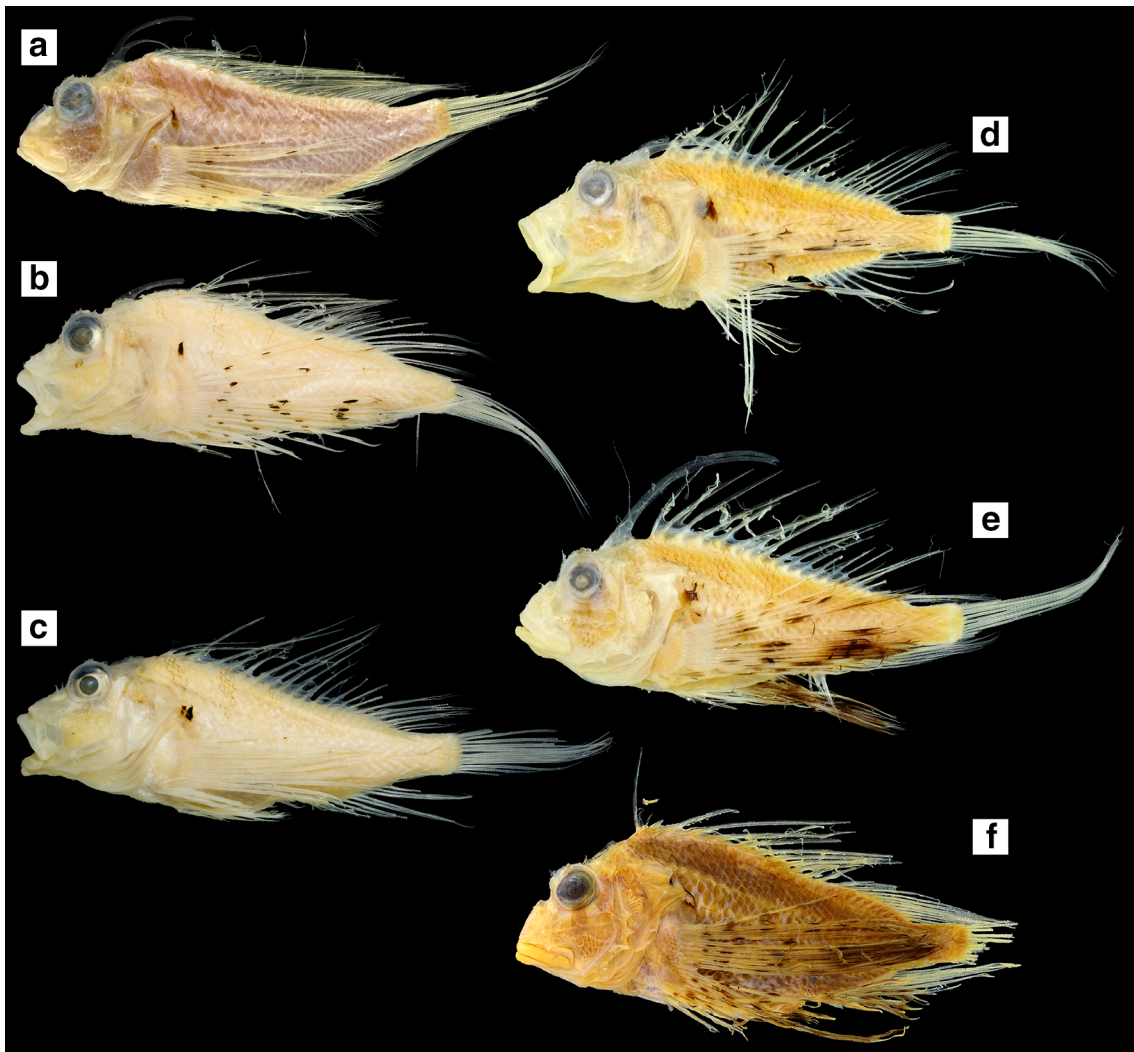


Fig. 3 Preserved specimens of *Ebosia saya* sp. nov. (male: **a–b**; female: **c**) and *E. falcata* (male: **d–e**; female: **f**) at different stages. **a** KAUM-I. 70134, 85.2 mm SL, Saya de Malha Bank; **b** LACM 44793, 73.5 mm SL (one of three specimens), Saya de Malha Bank;

c USNM 307910, holotype of *E. saya*, 87.0 mm SL, Saya de Malha Bank; **d** ZMH 5582, 88.5 mm SL, off India (one of 21 specimens); **e** ZMH 5582, 70.9 mm SL, off India (one of 21 specimens); **f** USNM 218411, holotype of *E. falcata*, 93.4 mm SL, off Somalia

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 just reaching 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; tooth band 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 symphyseal knob of lower jaw

on each side. Gill rakers on first gill arch short, tip 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 6 (2–6) spinous points along orbit margin. Supraocular with 3 (1–6) spinous points on outer margin. Postocular with 7 (2–7) small spines along orbit margin. Interorbital ridge weakly developed, reduced anteriorly, 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.



Fig. 4 Preserved specimens of *Ebosia saya* sp. nov. (a) and *E. falcata* (b), showing black markings on specimens and relatively long supraocular skin flap. **a** USNM 407273 (one of two specimens), 63.0 mm SL, Saya de Malha Bank; **b** ZMH 5582 (one of 21 specimens), 48.8 mm SL, India

Coronal with a single ridge continued to interorbital and parietal ridges, with 2 (1–3) minute spinous points. Parietal with a single ridge; in females, a low elevated ridge with spinous margin, with 3 (3–4) spinous points (based on holotype and female paratypes); in males, posteriormost parietal spine elongated as a thin bony crest, curved posterodorsally, its tip reaching level of third to seventh dorsal-fin spine bases (based on 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 (Fig. 1). 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 with 9 (4–8) small spines surrounding a short sensory canal. Pterotic with a short ridge with 3 (2–5) small spines. Lower posttemporal with 1 (1 or 2) small spine. Cleithrum with two low ridges; upper short ridge without spinous point; lower long ridge curved posteroventrally with 0 (0 or 1) spinous points posteriorly.

Lateral lacrimal ridge with 2 (2–4) small spines; other ridges on lacrimal spinous. Suborbital with a single ridge with 17 (9–15) spines; 5 (1–18) associated small spines below ridge. Anterior lacrimal spine with 2 (0–2) spinous points directed ventrally. Posterior lacrimal spine with 3 (2–4) spinous points. Preopercle with 5 spines; upper 3 spines of similar length; lower 2 spines skin covered; no supplemental spine on first (uppermost) preopercular spine base; 0 (0–2) supplemental spine on second preopercular spine base; 1 (0–3) supplemental spine on third preopercular spine base. 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; fifth or sixth spine likely longest (unclear in all specimens examined); penultimate (twelfth) spine shortest, its length 0.7 (or 0.6) and 0.8–0.9 (based on paratypes) times that of antepenultimate (eleventh) and posteriormost (thirteenth) spines, respectively; membrane

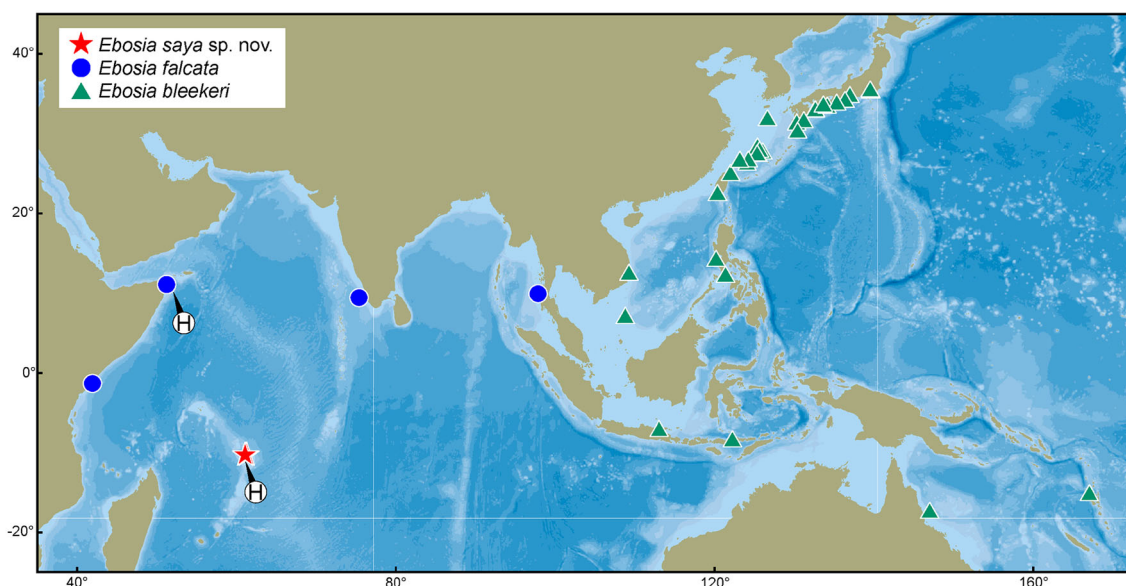


Fig. 5 Distributional map of *Ebosia saya* sp. nov. (stars), *E. falcata* (circles), and *E. bleekeri* (triangles) based on specimens examined in this study. H indicates holotype

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

	Dorsal-fin rays				Anal-fin rays						
	XIII, 8	XIII, 9	XIII, 10	XIII, 11	III, 6	III, 7	III, 8	III, 9			
<i>E. bleekeri</i>	1	106	3		6	100	3				
<i>E. falcata</i>		29 ^H	8	1		2	34 ^H	2			
<i>E. saya</i>		8 ^H	2				10 ^H				
	Pectoral-fin rays (one/other sides)										
	15/15	15/16	16/16	16/17	17/17	17/18	18/18				
<i>E. bleekeri</i>	1	7	91	8	2						
<i>E. falcata</i> ^a			1	4	25	4	1 ^H				
<i>E. saya</i>					8 ^H	1	1				
	Scale rows in longitudinal series										
	41	42	43	44	45	46	47	48	49	50	51
<i>E. bleekeri</i>				1	3	7	15	16	9	2	3
<i>E. falcata</i>	1	3		4	3	1 ^H	2	1			
<i>E. saya</i>			1			1 ^H					
	Scales above LL				Scales below LL						
	4	5	6	7	8	9	10	11	12		
<i>E. bleekeri</i>		31	57	2	6	12	22	1	1		
<i>E. falcata</i>	34 ^H	2			2	1	1				
<i>E. saya</i> ^b		9 ^H									
	SR between 6th DS and LL				SR between last DS and LL			Pre-dorsal-fin scales			
	3	4	5	6	4	5	6	2	3	4	
<i>E. bleekeri</i>		1	36	25	1	40	9	18	65	10	
<i>E. falcata</i>	1	30	2 ^H		18 ^H			14	20 ^H		
<i>E. saya</i>		1	6 ^H	1	1 ^H	4			7 ^H	1	
	Upper gill rakers			Lower gill rakers			Total gill rakers				
	4	5	6	10	11	12	14	15	16	17	
<i>E. bleekeri</i>	18	85	4	11	86	10	2	24	69	13	
<i>E. falcata</i>	1	35 ^H	2	15 ^H	20	3	1	13 ^H	18	5	
<i>E. saya</i>	3	7 ^H		3	7 ^H			6	4 ^H		

^a One specimen had 17/19 pectoral-fin rays

^b No data for scales below lateral line; all examined specimens lacking scales in this region

^H indicates holotype

SR and DS indicate scale rows and dorsal-fin spine, respectively

of spinous portion of dorsal fin strongly incised. Dorsal-fin soft rays all branched (based on paratypes); fourth (or fifth) ray longest, its length distinctly less than that of longest dorsal-fin spine; 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 0.7 (or 0.6) and 0.4 (based on paratypes) times those of

second and third spines, respectively. Anal-fin soft rays all branched (based on paratypes); fourth ray longest (based on paratypes), its length subequal to that of longest dorsal-fin soft ray [longest anal-fin soft ray length 1.0 times that of dorsal fin (based on paratypes)]; posteriormost ray free from caudal peduncle. Pectoral fin long, sixth ray (branched ray) [or eleventh or twelfth ray (unbranched)] longest;

its tip just reaching level with anal-fin base posterior end (or reaching penultimate anal-fin soft ray); lower rays weakly thickened. First pelvic-fin spine base below third dorsal-fin spine base; all pelvic-fin soft rays branched; usually second soft ray longest, its tip just reaching first anal-fin spine base (or anus); posteriormost soft ray with membranous connection to abdomen for approximately one-fourth of ray length. Caudal fin long, its length 1.2 (1.2–1.6) times head length; profile of posterior margin of fin rounded; usually with 2 procurent rays, 2 segmented unbranched rays, and 4 segmented branched rays in dorsal and ventral series (a single specimen of USNM 407273 with 3 segmented branched rays in dorsal series). Caudal peduncle relatively short and low, its depth 0.7 (0.6–0.7) times caudal-peduncle length.

Color of fresh specimens. Based on two paratypes (Fig. 2). Ground color of head and body cream-white to pale pink, darker dorsally, whitish ventrally. Three relatively narrow dark red bands (width slightly less than iris diameter) with narrow brown margin on sides of head; anteriormost band below eye to preopercular region; middle band from posteroventral margin of orbit reaching obliquely to ventral margin of subopercle; posteriormost band saddling nape level with central region of parietal ridge, reaching mid posterior margin of opercle at level of upper origin of pectoral-fin base. Five moderately broad pale brown bands (two or three vertical scale rows width) on sides of body; anteriormost band below first or second dorsal-fin spine bases, running posteroventrally to first pored lateral line scale, with an indistinct connection with a blotch above pectoral-fin base; second band below fourth to sixth dorsal-fin spine bases, running vertically and apparently reaching abdomen; third and fourth bands below eight to tenth dorsal-fin spine bases and posteriormost (thirteenth) dorsal-fin spine to second dorsal-fin soft ray bases, respectively, almost vertical and appearing to reach to abdomen and anal-fin base, respectively; fifth band below last three dorsal-fin soft ray bases, indistinct anteroventral orientation. A relatively small brown to black blotch just above pectoral-fin base (slightly smaller than iris). Eyes yellow, iris black, without radial markings.

Spinous portion of dorsal fin apparently similar to ground color of body (skin mostly lost); soft-rayed portion of dorsal fin translucent and pale yellow in male [Fig. 2a; broken in female (Fig. 2b)]. Anal-fin spines translucent; soft-rayed portion of anal fin translucent and pale yellow in male (reddish in female). Pectoral fin bright yellow, somewhat reddish basally in male (mostly broken, but entirely reddish in remaining portion in female); about 17 small black blotches (smaller than or subequal to iris) sparsely scattered, apparently forming four or five rows of blotches; broadly blackish posteriorly in female (no blackish portion in male). Pelvic-fin rays reddish in both

sexes, tips yellow in male. Caudal fin pale yellow without markings (broken in female).

Color of preserved specimens. Overall creamy white (or pale orange), slightly darker dorsally (Figs. 3a–c, 4a). Three relatively narrow pale brown bands on sides of head; anteriormost band below eye; middle band from posteroventral margin of orbit, reaching obliquely to 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 (two or three vertical scale rows width) on sides of body (two posteriormost bands obscured in holotype); anteriormost band below first or second dorsal-fin spine bases, running posteroventrally; second band below fifth or sixth dorsal-fin spine bases; third band below eighth or ninth dorsal-fin spine bases; fourth band below first or second dorsal-fin soft ray bases; fifth band below sixth or seventh dorsal-fin soft ray bases. A relatively small dark brown blotch just above pectoral-fin base [slightly (or much) smaller than iris]. Eyes darkish blue with silvery sheen (or entirely dark blue), iris black.

Dorsal and anal fins translucent without markings [ca. 6 small brown spots on dorsal soft rays in 63.0 mm SL specimen (USNM 407273; Fig. 4a)]. Pectoral-fin rays and membrane translucent [broadly blackish posteriorly in small specimens, USNM 407273 (one of two), 63.0 mm SL and LACM 44793-3 (one of three), 65.3 mm SL]; about three extremely small brown spots (diameter about one-tenth of iris diameter) scattered on membrane [ca. 16–25 and ca. 6–18 blotches in males and females, respectively; blotch size larger in small specimens]. Pelvic fin translucent without markings. Caudal fin translucent without markings [with ca. 5–8 small brown spots scattered on rays in small specimens].

Distribution. *Ebosia saya* is currently known only from the Saya de Malha Bank, western central Indian Ocean, in depths of 95–126 m (Fig. 5).

Etymology. The specific name *saya* refers to the type locality of the species, Saya de Malha Bank. It is treated as a noun in apposition.

Ebosia falcata Eschmeyer and Rama-Rao 1978

(English name: Falcate Lionfish) (Figs. 3d–f, 4b, 5, 6, 8b–e, 10d–f, 12b, 13–16; Tables 1–2)

Ebosia falcata Eschmeyer and Rama-Rao 1978: 64, figs 1D–F, 2, 3 (type locality: off Somalia); Kotthaus 1979: 20, figs 470, 472a, b (in figure legends; as *Ebosia* sp. in text; off west coast of India and Somalia; short description); Eschmeyer 1986: 465 (western Indian Ocean; list); Mandryta 2001: 276 (as phylogenetic material; key); Manilo and Bogorodsky 2003: S102 (western Indian Ocean; list)

Table 2 Morphometrics of *Ebosia saya* sp. nov., *E. bleekeri*, and *E. falcata*, expressed as percentages of standard length

	<i>Ebosia saya</i> sp. nov.			<i>Ebosia falcata</i>			<i>Ebosia bleekeri</i>	
	Holotype (USNM 307910)	Paratypes (n = 9)	Mean	Holotype (USNM 218411)	Non-types (n = 37)	Mean	Non-types (n = 111)	Mean
SL (mm)	87.0	63.0–85.2		93.4	48.8–121.1		9.4–159.6	
Body D (% SL)	35.2	34.2–38.3	36.0	39.2	31.0–41.5	35.0	29.4–42.7	37.2
Body D ^a	24.8	23.1–29.0	26.1	27.2	21.3–28.4	23.6	22.6–33.0	27.7
Body W	21.7	20.8–25.1	22.3	24.6	18.6–26.6	21.8	16.9–27.0	22.1
Head L	40.2	39.0–42.4	41.1	41.6	38.1–46.9	43.3	35.6–44.5	40.3
Head W	14.7	14.1–15.2	14.5	14.6	13.5–16.8	14.8	12.7–15.4	14.1
Head D	17.8	15.8–17.3	16.7	16.8	15.2–19.7	17.8	13.9–17.8	15.9
Snout L	–	13.2–16.5	14.6	15.3	13.3–15.7	14.3	11.0–17.7	15.5
Orbit diameter	12.1	11.1–12.9	12.1	11.5	9.9–12.9	11.7	9.0–13.6	11.0
Interorbital W ^b	8.0	8.3–10.2	9.2	9.6	8.1–10.7	9.5	7.6–11.0	9.3
Interorbital W ^c	6.9	7.5–8.9	8.0	7.4	6.5–9.6	8.0	6.9–10.4	8.6
Upper-jaw L	14.7	14.8–16.7	15.6	15.1	14.8–17.4	16.2	14.2–18.0	15.9
Maxillary D	5.3	5.2–5.9	5.5	5.0	5.0–6.0	5.4	4.7–7.1	5.7
Suborbital D	3.6	2.6–3.7	3.2	4.1	2.6–4.7	3.5	0.4–4.6	3.2
Postorbital L	19.2	18.1–19.2	18.7	19.8	19.8–24.2	21.9	14.7–19.2	17.1
Pre-dorsal-fin L	36.6	36.2–38.2	37.3	38.0	34.9–39.6	37.1	33.2–39.5	36.9
Pre-anal-fin L	69.0	65.7–70.7	68.1	70.6	63.1–70.8	67.6	65.0–74.6	69.5
Pre-pelvic-fin L	38.2	35.2–37.1	36.3	35.1	34.8–39.6	37.0	33.0–39.8	36.1
1st DS L	24.4	23.4–27.2	24.7	–	20.6–24.7	22.8	19.5–31.3	26.2
2nd DS L	29.8	33.6–35.4	33.4	–	24.0–35.4	30.3	23.6–50.1	33.1
3rd DS L	–	36.7–39.9	38.3	–	31.7–41.7	35.6	27.4–49.4	37.7
4th DS L	35.5	37.1–42.8	38.5	–	34.4–43.0	38.5	31.3–48.2	40.1
5th DS L	36.1	35.2–43.7	39.3	–	35.6–45.4	39.3	31.7–49.4	40.4
6th DS L	–	–	–	–	32.4–41.5	38.0	31.8–48.7	39.7
7th DS L	36.2	44.3	40.2	–	35.1–41.0	37.3	31.5–50.8	41.0
8th DS L	–	–	–	–	27.2–38.1	34.0	30.1–48.9	40.6
9th DS L	29.9	30.1–36.9	32.5	–	25.1–35.3	30.7	31.5–47.3	38.8
10th DS L	–	26.9–32.9	29.9	–	21.9–31.1	27.2	26.7–41.7	33.3
11th DS L	19.3	21.8–25.8	23.6	–	16.3–24.3	20.8	17.7–35.2	24.3
12th DS L	13.6	12.2–16.3	14.0	–	9.6–17.9	13.6	11.6–22.7	14.6
13th DS L	–	15.5–19.0	16.9	13.0	13.0–20.9	17.1	13.7–24.2	17.6
1st DSR L	–	23.1–28.6	25.3	27.5	22.5–30.7	26.2	23.2–29.9	25.7
Longest DSR L	32.1	33.9–36.8	34.3	35.5	30.1–40.4	34.1	28.4–37.8	32.6
1st AS L	6.9	6.5–8.2	7.3	7.0	6.0–9.4	7.5	6.0–10.3	7.8
2nd AS L	10.6	9.9–13.5	11.8	11.3	10.3–16.0	12.2	10.1–16.7	12.2
3rd AS L	–	17.3–19.1	18.0	17.6	14.6–20.0	17.5	13.5–24.9	16.7
1st ASR L	–	23.2–31.9	26.7	–	25.8–32.8	28.7	23.7–32.9	27.6
Longest ASR L	–	32.4–38.6	34.3	37.4	29.5–41.2	35.5	29.0–39.8	34.2
1st P1 L	42.6	43.0–50.4	45.2	45.7	40.6–54.9	49.7	37.8–63.0	47.5
Longest P1 L	52.2	55.9–57.8	56.5	66.8	51.0–73.5	63.7	50.9–91.1	63.3
P2S L	17.0	16.6–18.9	17.7	17.7	14.5–19.5	17.5	13.4–26.3	17.6
Longest P2SR L	31.7	30.8–37.9	33.3	38.9	29.4–38.9	34.8	27.2–48.4	32.8
Caudal-fin L	49.3	50.2–64.6	54.3	–	48.3–61.1	54.5	42.2–65.0	55.3
Caudal-peduncle L	15.6	14.1–16.9	15.4	14.9	12.7–16.8	14.6	12.9–17.6	15.7
Caudal-peduncle D	10.2	9.1–10.4	9.9	9.6	8.5–10.3	9.4	9.2–11.4	10.2

^a at anal-fin origin^b at vertical midline of eye^c at posterior end of preocular spine base

AS: anal-fin spine; ASR: anal-fin soft ray; D: depth; DS: dorsal-fin spine; DSR: dorsal-fin soft ray; L: length; P1: pectoral-fin ray; P2S: pelvic-fin spine; P2SR: pelvic-fin soft ray; W: width

Holotype. USNM 218411, female (G), 93.4 mm SL, off Somalia (11°04'N, 51°15'E), 76–80 m, H. A. Fehlmann on board of RV *Anton Bruun*, bottom trawl, 17 December 1964.

Other specimens examined. Thirty-seven specimens, 48.8–121.1 mm SL: THAILAND (ANDAMAN SEA COAST): KAUM-I. 33281, male (G), 116.4 mm SL, off Ranong Province (obtained at fishing port at Pak Nam), T. Yoshida and G. Ogihara, 7 December 2010; KAUM-I. 47529, male (G), 116.4 mm SL, KAUM-I. 47530, male (G), 121.1 mm SL, KAUM-I. 47531, male (G), 118.0 mm SL, off Ranong Province (obtained at fishing port at Pak Nam), T. Yoshida and H. Nishiyama, 23 June 2012.

INDIA: ZMH 5582, 21 specimens [six males (E), nine females (E), and seven sex undetermined], 48.8–88.5 mm SL, west-southwest of Kochi (9°40'–45'N, 75°38'–39'E), 138–210 m, RV *Meteor*, bottom trawl, 10 February 1965.

PAKISTAN: KAUM-I. 63511, female (G), 72.7 mm SL, KAUM-I. 63512, male (G), 93.1 mm SL, KAUM-I. 63513, male (G), 92.0 mm SL, KAUM-I. 63514, male (G), 90.5 mm SL, KAUM-I. 63515, male (G), 89.4 mm SL, KAUM-I. 63516, female (G), 87.4 mm SL, KAUM-I. 63517, male (G), 76.8 mm SL, KAUM-I. 63518, female (G), 74.5 mm SL, KAUM-I. 63519, male (G), 76.2 mm SL, KAUM-I. 63520, female (G), 63.3 mm SL, KAUM-I. 63521, female (G), 63.9 mm SL, off Pakistan (obtained at West Wharf, Karachi), 50–60 m, bottom trawl, 1999–2000.

SOMALIA: ZMH 5581, female (E), 99.9 mm SL, off Somalia (1°18'–20'S, 41°53'–56'E), 177–243 m, RV *Meteor*, bottom trawl, 15 January 1965.

Diagnosis. A species of *Ebosia* distinguished from other members of the genus by the following combination of characters: anal-fin soft rays 7–9 (modally 8); pectoral-fin rays 16–19 (modally 17); scale rows above lateral line 4–5 (modally 4); scale rows between last dorsal-fin spine base and lateral line 4; scale rows between last dorsal-fin spine base and lateral line 4; scale rows between sixth dorsal-fin spine base and lateral line 3–5 (modally 4); scales on preopercular region 7–14 (mean 10.6); postorbital length 19.8–24.2 (mean 21.9) % SL; a blotch above pectoral-fin base and blotches on pectoral-fin membrane relatively large; yellowish median fins and broadly yellow pectoral fin in males; elongated parietal spine in males relatively narrow and strongly falcate posterodorsally, its tip reaching fourth to eighth dorsal-fin spine bases.

Color of fresh male specimens. Ground color of head and body pale red, darker dorsally, whitish ventrally (Fig. 6). Three relatively narrow (width subequal to iris diameter) dark red bands with narrow brown inner and white outer margins on sides of head; anteriormost band crossing eye, reaching posterodorsal corner of maxilla; middle band from posteroventral margin of orbit, reaching obliquely to ventral margin of subopercle; posteriormost

band saddling nape at level of parietal ridges, reaching posteroventral margin of opercle at level of upper origin of pectoral-fin base. Five vertical moderately broad dark red bands (about three vertical scale rows width) saddling body; anteriormost band below first or second dorsal-fin spine bases, extending posteroventrally and continuous with a blotch above pectoral-fin base; second band below fifth dorsal-fin spine base; 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 eighth dorsal-fin soft ray bases. Chest without markings. A relatively large black blotch above upper origin of pectoral-fin base (subequal to or slightly larger than iris). Eyes bright yellow to orange, iris black, without radial markings. Skin flap on supraocular reddish; flaps on posterior margin of preopercular white.

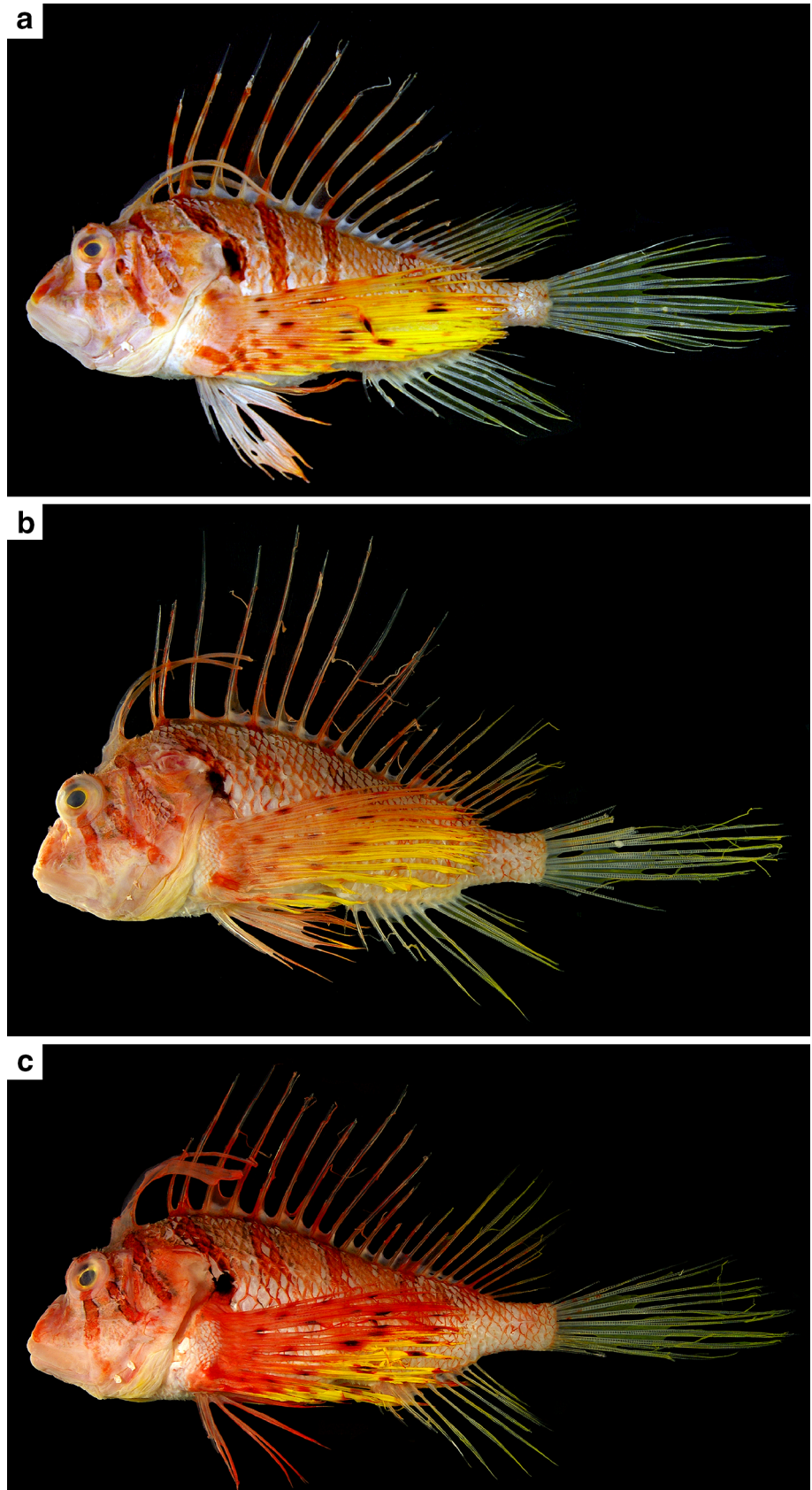
Spinous dorsal fin coloration similar to ground color of body, with 1–4 poorly defined red bands on each spine; soft-rayed portion of dorsal fin pale yellow, somewhat reddish basally. Anal fin pale yellow. Pectoral fin broadly bright yellow, somewhat reddish basally and dorsally (Fig. 6a–b) or about two-thirds of upper portion red (Fig. 6c); with about 12–20 relatively large dark brown to black blotches (subequal to iris) having reddish-brown margins, sparsely scattered, and forming four or five indistinct rows of blotches. Pelvic fin yellowish to reddish without markings. Caudal fin pale yellow, with several indistinct small reddish-yellow to red spots scattered dorsally or basally.

Color of preserved specimens. Overall creamy-white to brown (Figs. 3d–f, 4b); red markings retained as brown; yellow coloration diffuse. Soft-rayed portion of dorsal fin with ca. 10–15 brown spots on rays; soft-rayed portion of anal fin with ca. 5–10 brown spots on rays; caudal fin with numerous (ca. 30–40) brown spots on rays (number of spots on all fins apparently greater in small specimens).

Distribution. *Ebosia falcata* is distributed off Somalia, Pakistan and the west coast of India in the northwestern Indian Ocean, and off the Andaman Sea coast of Thailand (Eschmeyer and Rama-Rao 1978; Kotthaus 1979; this study; Fig. 5). The species has been collected by bottom trawl in depths of 47–243 m (mostly >100 m) (Eschmeyer and Rama-Rao 1978; this study).

Remarks. The present non-type specimens agreed well with the holotype and original description of *E. falcata*, with the exception of minor differences in some meristics and morphometrics, including dorsal-fin rays [XIII, 9–11 in this study vs. XIII, 9–10 in Eschmeyer and Rama-Rao (1978)] and snout length (13.1–16.2 % SL vs. 12–15 % SL), which may simply reflect intraspecific variations. *Ebosia falcata* was originally described by Eschmeyer and Rama-Rao (1978) on the basis of 26 specimens collected off Somalia and the west coast of India, but has not

Fig. 6 Fresh male specimens of *Ebosia falcata*. **a** KAUM-I. 47529, 116.4 mm SL; **b** KAUM-I. 47531, 118.0 mm SL; **c** KAUM-I. 47530, 121.1 mm SL, all from Andaman Sea



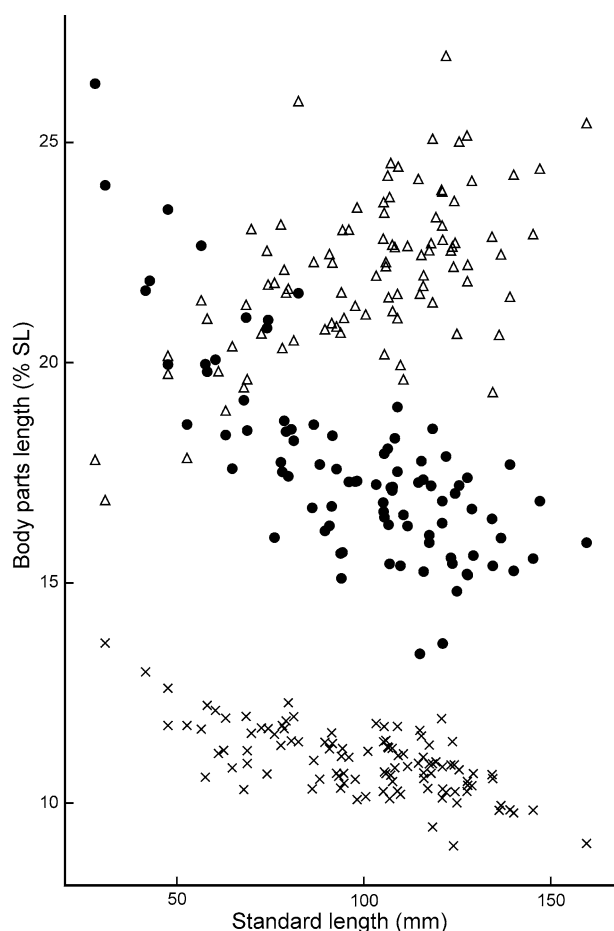


Fig. 7 Relationships of body width (triangles), orbit diameter (circles), and pelvic-fin spine length (crosses) (all as % of standard length) to standard length (mm) in *Ebosia bleekeri*

previously been recorded from the other localities listed above (Eschmeyer and Rama-Rao 1978; Kotthaus 1979; Manilo and Bogorodsky 2003). Accordingly, the specimens taken off Pakistan and in the Andaman Sea represent the first records of *E. falcata* in those areas and suggest a widespread distribution of the species in the northeastern Indian Ocean. Although Eschmeyer and Rama-Rao (1978) provided a detailed description of *E. falcata*, it was based solely on preserved specimens and therefore lacked any description of fresh coloration. Photographs of the four Andaman Sea specimens revealed that males of *E. falcata* have a reddish head and body with yellowish fins when fresh. Fresh female coloration remains unknown.

Genetic divergence. The genetic analysis, based on 555 base pairs of the mtDNA cytochrome *b* gene from two examples of *E. falcata* (Andaman Sea) and three *E. bleekeri* (East China Sea), indicated a substantial degree of genetic divergence between the species, with differences ranging from 2.5 % to 3.4 % in contrast to intraspecific differences of 0 % to 0.9 %.

Discussion

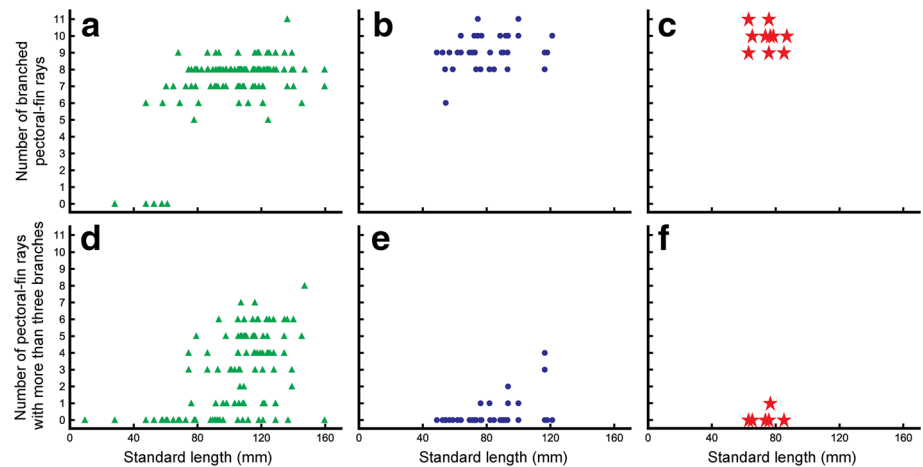
Morphological changes with growth. Analyses of 44 measurements taken from 38 specimens (48.8–121.1 mm SL) of *Ebosia falcata* indicated an absence of any positively growth-correlated morphological changes. However, relative lengths of the orbit diameter, head, thirteenth (last) dorsal-fin spine, first dorsal-fin soft ray, second and third anal-fin spines, and pectoral, pelvic, and caudal fins tended to decrease as a percentage of standard length with growth, with similar changes, except for head length, also occurring in *E. bleekeri* [111 specimens (9.4–159.8 mm SL) (see Fig. 7)]. Additionally, body width and suborbital depth became greater with growth in *E. bleekeri*. Since the numbers and size range of available specimens of *E. saya* were limited ($n = 10$, 63.0–87.0 mm SL), any growth-related changes in relative lengths of body parts were not apparent. Decreasing length of fin rays with growth has already been reported for several members of Scorpaenidae, e.g., *Scorpaena* spp. (Motomura et al. 2005c, 2011b) and *Pterois brevipectoralis* (Mandrytsa 2002) (Matsunuma and Motomura 2013).

The supraocular skin flap tends to become shorter (reduced in size) with growth in *Ebosia*, as in several members of *Pterois* (Pteroinae) (Matsunuma and Motomura 2011, 2013). In *E. saya*, a small specimen (63.0 mm SL, one of two specimens of USNM 407273; Fig. 4a) had a relatively large supraocular flap, its length slightly greater than the pupil diameter, whereas larger specimens (> ca. 70 mm SL) had a small supraocular flap (length about half pupil diameter). No other significant growth-related changes were found for skin flaps.

As in most members of Scorpaenidae, the number of branched pectoral-fin rays in both species of *Ebosia* increases with growth. In *E. bleekeri*, all pectoral-fin rays of a 28.1 mm SL specimen were unbranched. Subsequently, all rays remained unbranched (or 6 or 7 rays became branched at the same time) between 47.6 and 61.1 mm SL, with 6–9 (rarely 5 or 11) rays branched in specimens exceeding 64.8 mm SL (Fig. 8a). Among the branched pectoral-fin rays, 0–8 rays tended to divide into more than three (remaining rays branched into two) with growth, but this was highly variable (Fig. 8d). The number of pelvic-fin soft rays with more than three branches also tended to increase with growth in *E. falcata* and *E. saya*. In *E. falcata*, all pelvic-fin rays of all specimens less than 63.6 mm SL had only two branches, with more than three branches for 1–4 (rarely 0) rays in specimens exceeding 63.9 mm SL.

Sexual dimorphism and dichromatism. Sexual dimorphism of parietal spine morphology in *Ebosia*, already well documented, e.g., Schmidt (1931), Matsubara (1943), Eschmeyer and Rama-Rao (1978), was reconfirmed

Fig. 8 Relationships of number of branched pectoral-fin rays (a–c) and pectoral-fin rays with more than three branches (d–f) to standard length (mm) in *Ebosia bleekeri* (a, d), *E. falcata* (b, e), and *E. saya* sp. nov. (c, f). Pectoral-fin rays counted on both sides whenever possible



here on the basis of specimens for which sex had been determined by gonad examination, e.g., four males and six females of *E. saya* (Figs. 2, 3a–c), 10 males and seven females of *E. falcata* (Figs. 3d–f, 6), and 11 males and nine females of *E. bleekeri* (Fig. 9). The parietal spine of males of the three species becomes a thin elongated bony crest, curved posteriorly with growth (Figs. 10a–b, d–e, 11a–c). By contrast, females have a low parietal ridge with a spinous margin (Figs. 10c, f, 11d).

Matsubara (1943) noted that the supraocular spine of male *E. bleekeri* tends to be stronger than that of females. Chan and Chilvers (1973) also reported that male *E. bleekeri* differed from females in having stronger and a greater number of spines on the preocular, supraocular, and suborbital ridge and lower preopercular spine base (spines on the preopercular spine base refer to supplemental preopercular spines in this study). Among the head spines, significant differences in the number of supplemental spines on the third preopercular spine base were noted here between the sexes in *E. bleekeri* and *E. falcata* (Fig. 12a–b), but not in *E. saya*, probably due to the limited material (Fig. 12c). Moreover, in *E. bleekeri*, males tended to have a single spine larger than adjacent spines on the supraocular (Fig. 11a–c), whereas all supraocular spines of females were small and similarly sized (Fig. 11d). No other significant sex-related differences in head spine condition were apparent in *Ebosia*.

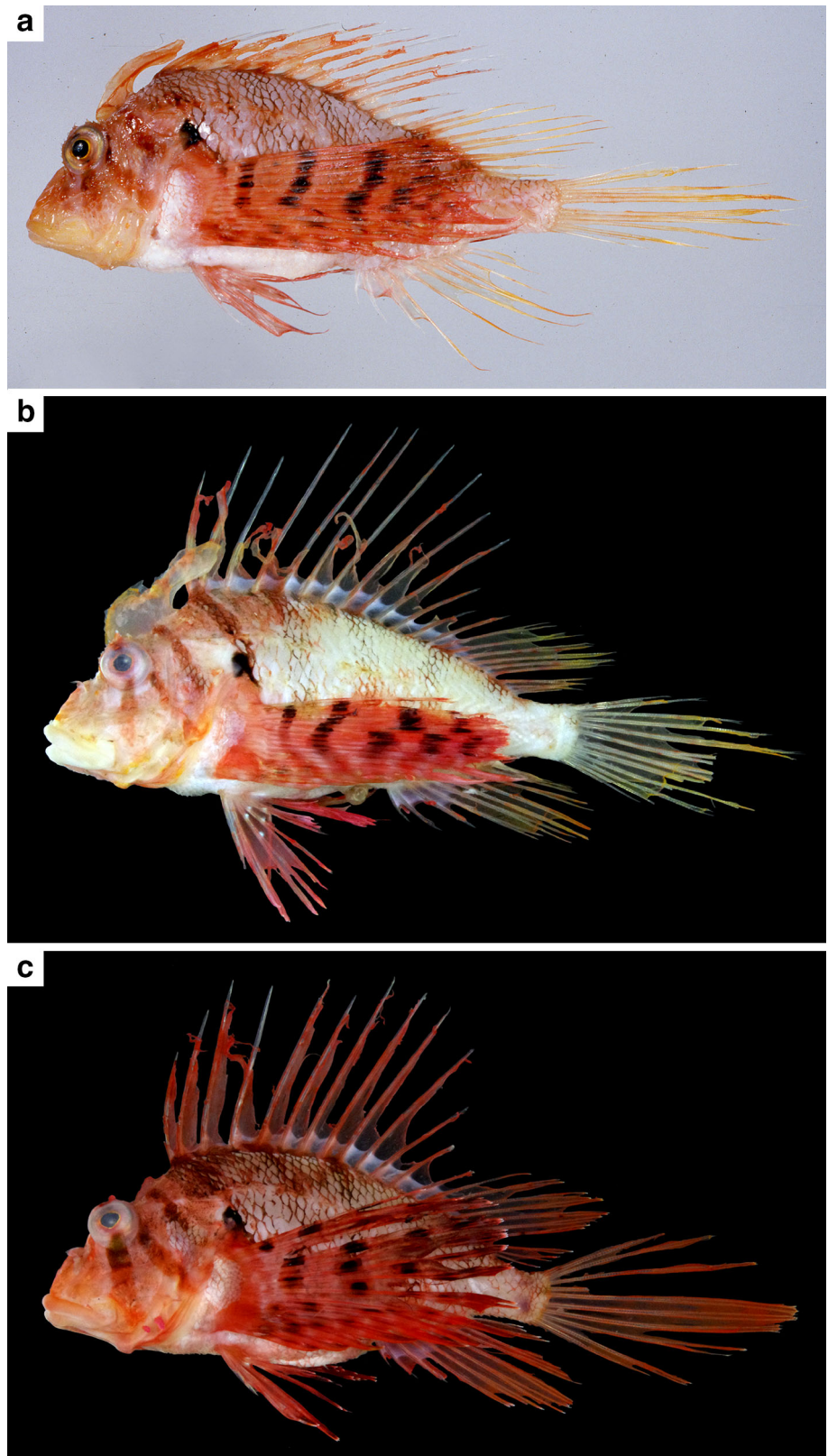
Sexual dichromatism has been reported for several species in the scorpaenid genera *Parascorpaena*, *Scorpaena*, and *Scorpaenopsis*, wherein males only possess a large black blotch on the spinous portion of the dorsal fin (e.g., Poss 1999; Randall and Eschmeyer 2002; Motomura et al. 2005c, 2006b, 2007). Differences in fin coloration between the sexes were also recognized in *E. saya* and *E. bleekeri*. Photographs of two paratypes of *E. saya* taken prior to preservation showed the males with yellowish median fins and entirely yellow pectoral fins (Fig. 2a), in contrast to females (reddish median fins and red pectoral

fins) (Fig. 2b). Moreover, male *E. bleekeri* had yellowish to orange median fins (Fig. 9a–b), such fins being red in females (Fig. 9c). Although male *E. falcata* had yellowish median fins and broadly yellow (about one-third or almost entirely) pectoral fins (Fig. 6), the fresh coloration of females remains unknown. However, considering the morphological similarities between *E. saya* and *E. falcata*, similar sexual dichromatism in the latter is not unlikely.

The elongated parietal spine of males is an important diagnostic character for *Ebosia* species, but is not useful for females and young males. For example, *Pterois lunulata* Temminck and Schlegel 1843, reported by Iwamoto and McCosker (2014; pl. 17, fig. 98, CAS 235752) from the Philippines, was identified here as a female of *E. bleekeri*. In fact, females and young males of the latter have infrequently been misidentified as species of *Pterois*, especially as *P. lunulata* or *Pterois volitans* (Linnaeus 1758), based on our examinations of museum collections during this study. However, *Ebosia* can be readily distinguished from *Pterois* by the continuous coronal and parietal ridges (vs. separated in *Pterois*); branched pectoral-fin rays (vs. all unbranched); the nasal spine usually absent (vs. present); a skin flap on the posterior lacrimal spine tip absent (vs. present) (M. Matsunuma, unpublished data). It was further noted that *Pterois antennata* (Bloch 1787), also reported by Iwamoto and McCosker (2014; pl. 17, fig. 97, CAS 235573), was in fact *P. volitans*.

Species comparisons. Of the three nominal species previously assigned to the genus *Ebosia*, e.g., *Pterois bleekeri* Döderlein in Steindachner and Döderlein 1884 (= *E. bleekeri*), *Ebosia kagoshimae* Oshima 1956, and *Ebosia falcata* Eschmeyer and Rama-Rao 1978, *E. kagoshimae* was originally described on the basis of two specimens from Shibushi Bay, Kagoshima Prefecture, southeastern coast of Kyushu Island, southern Japan. Although the present location of those specimens is unknown, making them unavailable for the present study,

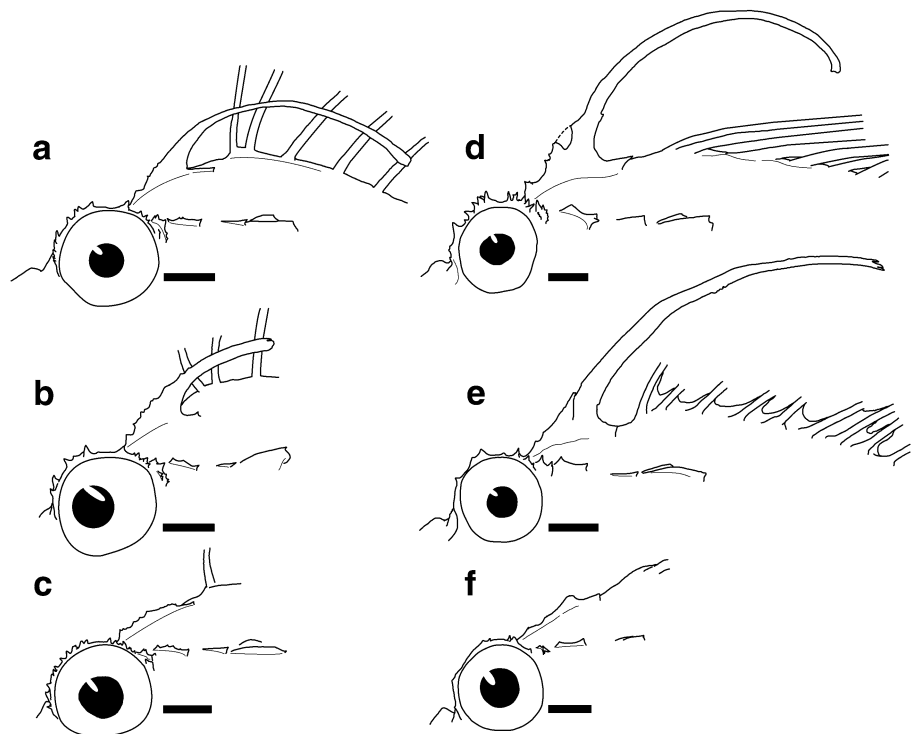
Fig. 9 Fresh specimens of males (**a–b**) and a female (**c**) of *Ebosia bleekeri*. **a** BSKU 38437, 119.0 mm SL, Tosa Bay, Japan (Photo: BSKU); **b** KAUM-I. 35804, 118.0 mm SL, East China Sea; **c** KAUM-I. 35803, 108.2 mm SL, East China Sea



photographs of them plus the description of *E. kagoshimae* given by Oshima (1956), with the exception of dorsal- and anal-fin ray counts (made by different methods), agreed

closely with the original description of *P. bleekeri*. Although Oshima (1956) stated that *E. kagoshimae* differed from *E. bleekeri* in having the relatively long parietal

Fig. 10 Lateral views of head of *Ebosia saya* sp. nov. (male: **a–b**; female: **c**) and *E. falcata* (male: **d–e**; female: **f**), showing ontogenetic changes and sexual differences of parietal and supraocular spines. **a** KAUM–I. 70134, 85.2 mm SL (right side; reversed); **b** LACM 44793-3, 73.5 mm SL (right side; reversed); **c** USNM 307910, holotype of *E. saya*, 87.0 mm SL (right side; reversed); **d** KAUM–I. 33281, 116.4 mm SL; **e** ZMH 5582, 70.9 mm SL; **f** ZMH 5582, 82.2 mm SL. Bars indicate 5 mm



spines of male and lacking a vertical black band on the nape, the parietal spine length is changed with growth and band markings sometimes become defused in preserved specimen. *Ebosia kagoshimae* is therefore regarded as a junior synonym of *P. bleekeri* and conspecific with specimens identified as *E. bleekeri* in this study, as in Eschmeyer and Rama-Rao (1978). Accordingly, only two nominal species, *E. bleekeri* and *E. falcata*, are currently regarded as valid in the genus *Ebosia*.

Ebosia saya is readily distinguished from *E. bleekeri* by having usually one more anal-fin soft ray [8 vs. 6–8 (modally 7) in *E. bleekeri*] (Table 1), one more pectoral-fin ray [17–18 (modally 17) vs. 15–17 (16)], the elongated parietal spines of males relatively narrow (width of elongated portion clearly less than pupil diameter) and strongly falcate posterodorsally, the posteriormost tip reaching to level with the sixth or seventh dorsal-fin spine base at ca. 90 mm SL [vs. relatively broad (width ca. 1.0–1.5 times pupil diameter) and less falcate posterodorsally, its tip reaching to level with the first to fourth dorsal-fin spine base at ca. 90 mm SL] (Figs. 10a–b, 11a–c), and the pectoral fin of males yellow (vs. red in both sexes) (Figs. 2, 9).

Ebosia saya is most similar to *E. falcata* in overall body appearance, with both species sharing the aforementioned characters separating *E. saya* from *E. bleekeri*. However, the former can be distinguished from *E. falcata* by having usually one more scale row above the lateral line [5 vs. 4–5 (modally 4) in *E. falcata*] (Table 1), 4–6 (modally 5) scale rows between the sixth dorsal-fin spine base and the lateral

line [vs. 3–5 (4), 4–5 (modally 5) scale rows between the last dorsal-fin spine base and the lateral line (vs. 4), a slightly higher number of scales on the preopercular region [11–22 (mean 15.4) vs. 7–14 (10.7)] (Fig. 13), and a slightly shorter postorbital length [18.1–19.2 (mean 18.7) % of SL vs. 19.8–24.2 (21.9) % of SL] (Table 2; Fig. 14). Moreover, *E. saya* tended to have a relatively higher number of spines on the preocular, supraocular, and postocular bones compared to *E. falcata* (Fig. 15), although the spine number increased with growth in both species. At 60–90 mm SL, *E. saya* ($n = 10$) had 1–6 (mean 3.1) spines on the preocular, 1–6 (3.7) spines on the supraocular, and 2–9 (5.2) spines on the postocular bones, giving a total number of 5–20 (12.3) spines, whereas *E. falcata* at the same stage ($n = 15$) had 1–7 (2.7), 1–6 (2.9), 2–6 (3.3), and 4–18 (8.4) spines, respectively. Such differences in head spine number between the two species may be indicative of a more rapid growth rate and smaller maximum body size in *E. saya*, compared with *E. falcata* (largest examined specimens of *E. saya* and *E. falcata* 85.2 mm SL and 121.1 mm SL, respectively). *Ebosia saya* also differed from *E. falcata* in having the blotch above the pectoral-fin base and blotches on the pectoral fin smaller (Figs. 3–4, 16) [maximum diameter of blotch above pectoral-fin base 32.6–56.2 (mean 41.2) % of orbit diameter (OD) in *E. saya* ($n = 6$) vs. 26.6–95.2 (66.7) % of OD in *E. falcata* ($n = 25$); that of blotches on pectoral fin 13.5–34.5 (mean 21.7) % of OD in *E. saya* ($n = 10$) vs. 27.1–62.1 (42.0) % of OD in *E. falcata* ($n = 23$)].

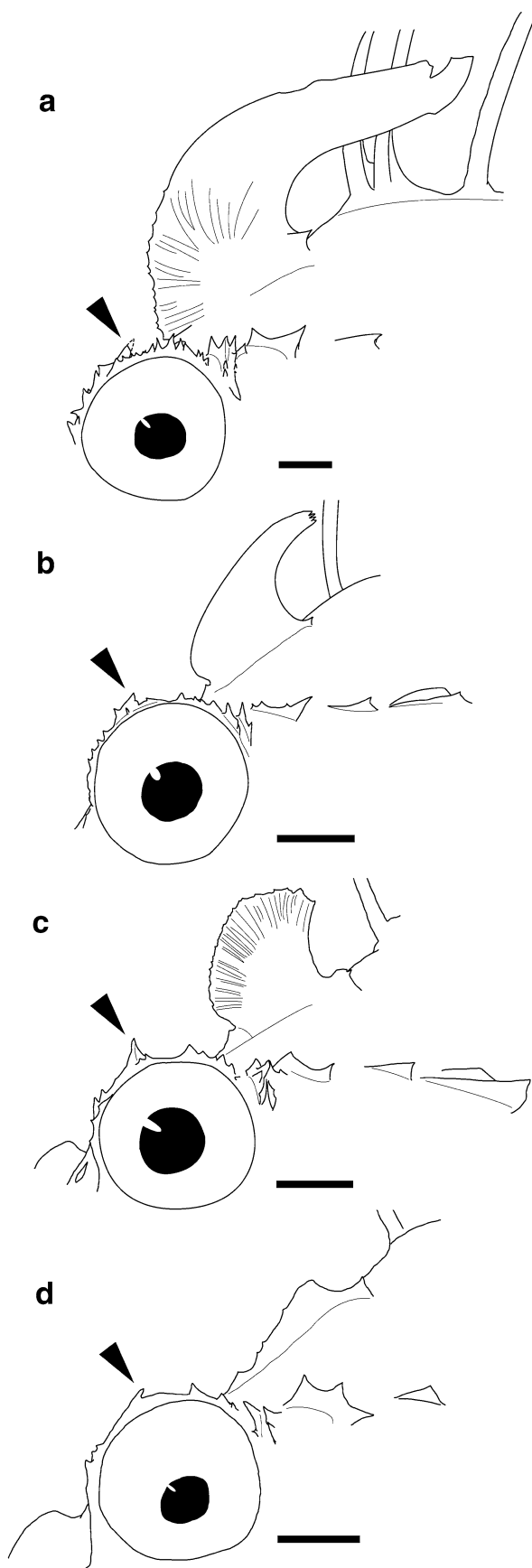


Fig. 11 Lateral views of head of male (a–c) and female (d) *Ebosia bleekeri*, showing ontogenetic changes and sexual differences of parietal and supraocular spines. **a** URM-P 3733, 123.3 mm SL; **b** MNHN2008-1399, 91.4 mm SL; **c** KAUM-I. 39277, 100.5 mm SL; **d** KAUM-I. 35803, 108.2 mm SL. Arrowheads indicate largest supraocular spines. Bars indicate 5 mm

As with *E. saya*, *E. falcata* is readily distinguishable from *E. bleekeri* by having usually one more anal-fin soft ray (7–9, modally 8) (Table 1), usually one more pectoral-fin ray (16–18, modally 17), and males with a narrow strongly falcate parietal spine (Fig. 9d–e) and a broadly yellow pectoral fin (Fig. 6). Moreover, *E. falcata* differed from *E. bleekeri* in having usually one fewer scale rows above the lateral line [5 vs. 5–7 (modally 6) in *E. bleekeri*] (Table 1), 3–5 (modally 4) scale rows between the sixth dorsal-fin spine base and lateral line [vs. 4–6 (5)], 4 scale rows between the last dorsal-fin spine base and the lateral line [vs. 4–6 (5)], slightly fewer scales on the preopercular region (Fig. 13), and a greater postorbital length (Table 2; Fig. 14).

Comparative materials. *Ebosia bleekeri*: 11 specimens, 9.4–159.6 mm SL. JAPAN: BSKU 198, 101.1 mm SL; BSKU 250, 110.6 mm SL; BSKU 1717, 92.7 mm SL; BSKU 2420, 115.4 mm SL; BSKU 8215, 127.7 mm SL; BSKU 9463, 90.8 mm SL; BSKU 9467, 68.8 mm SL; BSKU 12840, 47.6 mm SL; BSKU 13843, 96.0 mm SL; BSKU 36277, 61.1 mm SL; BSKU 38437, 119.0 mm SL; BSKU 52412, 91.6 mm SL; BSKU 55594, 28.1 mm SL; BSKU 68780, 109.0 mm SL; BSKU 69892, 69.9 mm SL; BSKU 70979, 108.3 mm SL; BSKU 74743, 74.4 mm SL; BSKU 78142, 58.1 mm SL; BSKU 86197, 136.7 mm SL; BSKU 97577, 127.4 mm SL; BSKU 103849, 121.0 mm SL; BSKU 103850, 128.9 mm SL; BSKU 103851, 122.0 mm SL; BSKU 109563, 105.9 mm SL; FAKU 1342, 94.6 mm SL; FAKU 3115, 41.6 mm SL; FAKU 4539, 62.5 mm SL; FAKU 4940, 80.6 mm SL; FAKU 28066, 124.0 mm SL; FAKU 59336, 93.3 mm SL; FAKU 97045, 140.1 mm SL; HUMZ 35842, 88.2 mm SL; HUMZ 36256, 86.2 mm SL; HUMZ 177808, 67.9 mm SL; KAUM-I. 44331, 105.9 mm SL; KSHS 22472, 147.1 mm SL; KSHS 22494, 159.6 mm SL; KSHS 22495, 139.1 mm SL; KSHS 22496, 134.3 mm SL; MUF5 5290, 106.4 mm SL; NSMT-P 66383, 82.5 mm SL; USNM 148915, 78.2 mm SL; ZUMT 4608, 122.5 mm SL; ZUMT 47014, 124.4 mm SL; ZUMT 47228, 63.0 mm SL; ZUMT 49647, 47.6 mm SL; ZUMT 50927, 74.1 mm SL.

EAST CHINA SEA: FAKU 69245, 105.5 mm SL; FAKU 81698, 107.7 mm SL; FAKU 81699, 86.6 mm SL; HUMZ 199824, 103.3 mm SL; HUMZ 199871, 115.9 mm SL; HUMZ 199872, 116.0 mm SL; HUMZ 199992, 109.0 mm SL; HUMZ 199993, 123.7 mm SL; HUMZ 200059, 117.5 mm SL; KAUM-I. 35803, 108.2 mm SL;

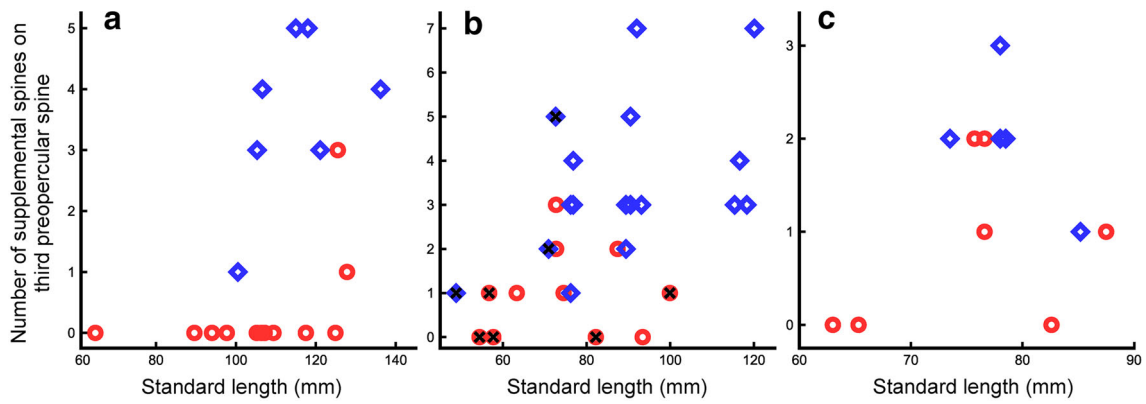


Fig. 12 Relationships of number of supplemental spines on third preopercular spine to standard length (mm) in male (diamonds) and female (circles) *Ebosia bleekeri* (a), *E. falcata* (b), and *E. saya* sp.

nov. (c). Symbols possessing cross indicate sex estimated from parietal spine morphology. Spines counted on both sides whenever possible

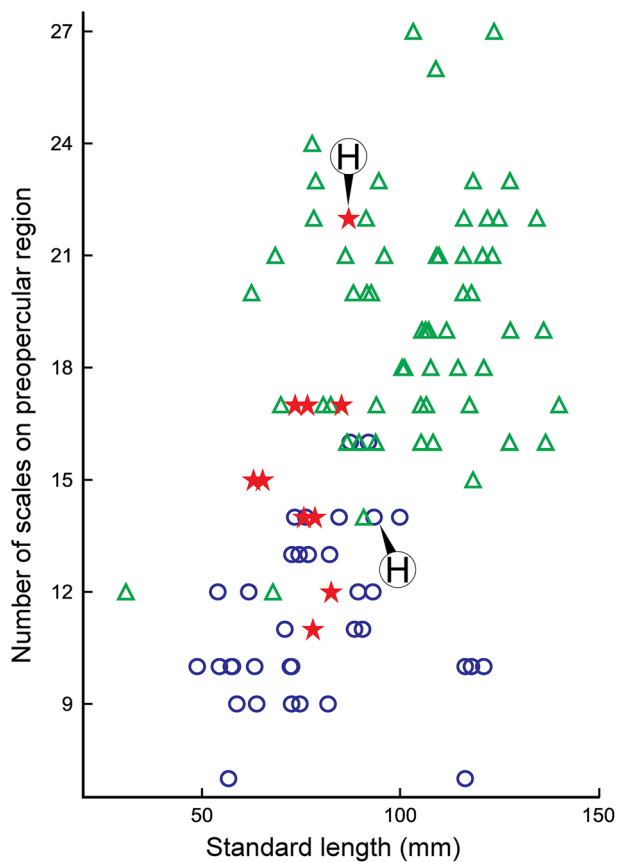


Fig. 13 Relationships of the number of scales on the preopercular region to standard length (mm) in *Ebosia saya* sp. nov. (stars), *E. bleekeri* (triangles), and *E. falcata* (circles). H indicates holotype

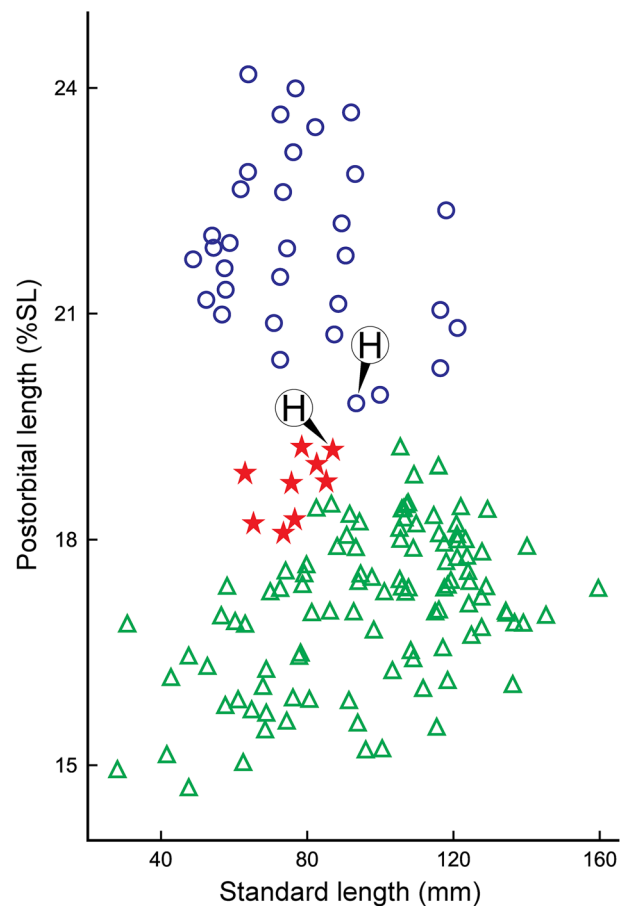


Fig. 14 Relationships of postorbital length (as % of standard length) to standard length (mm) in *Ebosia saya* sp. nov. (stars), *E. bleekeri* (triangles), and *E. falcata* (circles). H indicates holotype

KAUM-I. 35804, 120.2 mm SL; KAUM-I. 35817, 106.6 mm SL; KAUM-I. 35818, 105.3 mm SL; KAUM-I. 57753, 64.8 mm SL; KAUM-I. 57771, 68.8 mm SL; SNFR 362, 117.1 mm SL; SNFR 543, 119.3 mm SL; SNFR 545, 120.1 mm SL; SNFR 1280, 94.7 mm SL; SNFR 11119, 2 specimens, 117.5–125.5 mm SL; SNFR

13098, 5 specimens, 94.3–145.3 mm SL; SNFR 13251, 42.7 mm SL; URM-P 3733, 123.3 mm SL; URM-P 3734, 109.2 mm SL; URM-P 7134, 127.6 mm SL; URM-P 23694, 134.5 mm SL; URM-P 23695, 124.9 mm SL; URM-P 23696, 114.6 mm SL; URM-P 23697, 78.7 mm

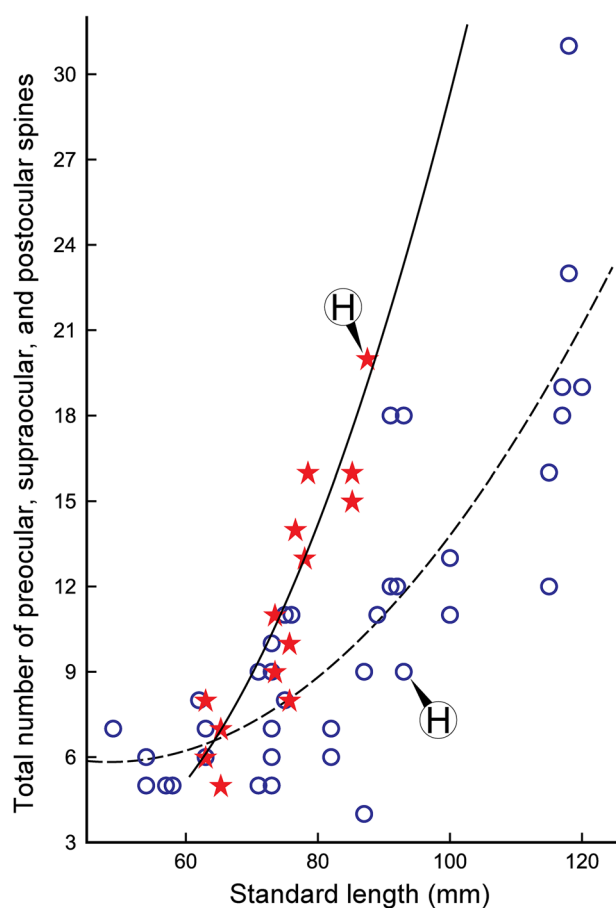


Fig. 15 Relationships of the total number of preocular, supraocular, and postocular spines to standard length (mm) in *Ebosia saya* sp. nov. (stars; solid line) and *E. falcata* (circles; dashed line). Curved lines indicate polynomial trendlines. Spines counted on both sides whenever possible. H indicates holotype

SL; URM-P 25719, 127.8 mm SL; URM-P 25720, 109.8 mm SL; URM-P 43724, 105.2 mm SL; ZUMT 52112, 111.7 mm SL; ZUMT 52120, 118.4 mm SL.

TAIWAN: ASIZP 63066, 120.8 mm SL; ASIZP 61433, 2 specimens, 52.7–57.6 mm SL; KAUM-I. 39276, 136.2 mm SL; KAUM-I. 39277, 100.5 mm SL; KAUM-I. 39278, 89.6 mm SL; KAUM-I. 39279, 94.0 mm SL; KAUM-I. 39280, 121.1 mm SL; KAUM-I. 39281, 93.8 mm SL; KAUM-I. 52578, 115.0 mm SL; KAUM-I. 52579, 68.5 mm SL; NMNB-P 9558, 105.5 mm SL; NMNB-P 9560, 107.6 mm SL; NTUM 3854, 76.1 mm SL.

SOUTH CHINA SEA: BSKU 17282, 79.2 mm SL.

VIETNAM: NMNB-P 12649, 81.3 mm SL.

PHILIPPINES: MNHN 2004-1629, 30.8 mm SL; MNHN 2005-827, 56.5 mm SL.

INDONESIA: NCIP 5003, 79.8 mm SL; WAM P. 30720-002, 9.4 mm SL.

VANUATU: MNHN 2008-1399, 91.4 mm SL.

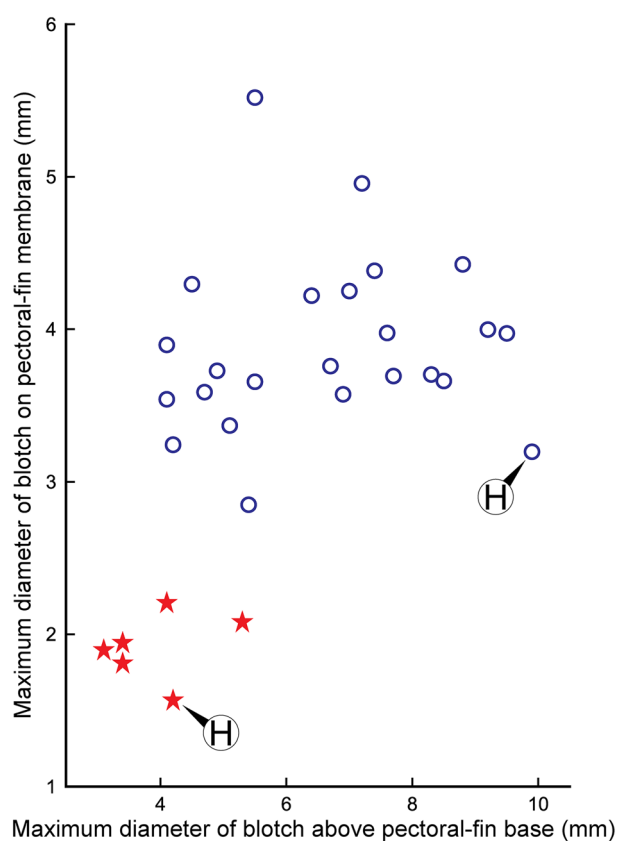


Fig. 16 Relationships of maximum diameter of blotch on pectoral-fin membrane (mm) to maximum diameter of blotch above pectoral-fin base in *Ebosia saya* sp. nov. (stars) and *E. falcata* (circles). H indicates holotype

AUSTRALIA: NMV A4410, 2 specimens, 60.9–72.6 mm SL.

NO DATA: FAKU 103332, 129.3 mm SL; ZUMT 16705, 77.8 mm SL (probably from Japan).

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