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Description of two new species of sandlances, genus *Bleekeria* (Perciformes, Ammodytidae) from the Andaman Sea (northeastern Indian Ocean)

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Abstract

Two new species of *Bleekeria* Günther, 1862 are described from specimens collected in the Andaman Sea off the coast of Myanmar during bottom surveys conducted by the R/V *Dr Fridtjof Nansen* in 2015 and 2018. They are distinguished from each other and from congeners by a combination of morphological and meristic characters as well as fin coloration and genetic variance. *Bleekeria albicauda* **sp. nov.** has pelvic fins, 40–41 dorsal-fin rays, 54–55 total vertebrae, no teeth in jaws, 4 scale rows between dorsal-fin origin and lateral line, a single row of about 10 scales on mid-upper part of opercle, scales on central part of body clearly shorter than their height, caudal fin with white upper and lower lobes when fresh (unique within the genus). *Bleekeria nigrilinea* **sp. nov.** has no pelvic fins, 37–39 dorsal-fin rays, 49–50 total vertebrae, 2½ scale rows between dorsal-fin origin and lateral line (the smallest count within the genus with *B. estuaria* of Mozambique brackish water), 5–6 scales on mid-upper part of opercle arranged in a single row, scales on central part of body clearly longer than their height, upper and lower margins of caudal fin black when fresh (unique within the genus). The COI gene sequences of the two new species showed clear genetic divergence (pairwise K2P, >10 %) from *Bleekeria estuaria* Randall & Ida, 2014 and *Bleekeria mitsukurii* (Jordan & Evermann, 1902). A key to the species of *Bleekeria* is provided.

Key words: *Bleekeria albicauda* **sp. nov.**, *Bleekeria nigrilinea* **sp. nov.**, DNA barcode, identification key, Myanmar , R/V *Dr Fridtjof Nansen*, taxonomy, trawl surveys

Introduction

Members of the family Ammodytidae are small (<30 cm TL), mainly coastal fishes occurring from arctic to tropic seas (Ida *et al*. 1994, Randall & Ida, 2014). They are popularly known as sandlances for their ability to dive into sand to escape predators (Randall & Ida 2014).

The family consists of seven genera and 31 species (Fricke *et al*. 2020). *Bleekeria* is distinguishable from all other genera of the family Ammodytidae by the following combination of characters: teeth usually present in jaws; 37–44 dorsal-fin rays; 13–20 anal-fin rays; subocular sensory canal incomplete, having a short gap below mid-eye; 98–151 lateral-line scales; lateralis system on head continuous with that on body; labial tissues not ossified; haemal and neural spines of caudal vertebrae not expanded; olfactory rosette consisting of four reduced lamellae; two supra-neurals (one before tip of second neural spine and one before tip of third neural spine. The genus *Bleekeria* includes six nominal species: *B. kallolepis* Günther (type locality Madras, now Chennai, India), known from the eastern Indian Ocean; *B. mitsukurii* (Jordan and Evermann) (type locality Giran, Taiwan), wide-ranging in the Indo-Pacific; *B. viridianguilla* (Fowler) (type locality Hong Kong), western Pacific, from Queensland to Taiwan; *B. murtii* Joshi, Zakaria & Kanthan (type locality Tuticorin, India) known from the south-eastern Indian Ocean; *B. estuaria* Randall & Ida (type locality Pomene Estuary, Mozambique), western Indian Ocean; and *B. profunda* Randall & Ida (type

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locality Saya de Malha Bank), Indian Ocean (Akhilesh *et al*. 2019, Fricke *et al*. 2020). According to Akhilesh *et al*. (2019), *B. murtii* is conforming quite well to specimens of *B. kallolepis* from its type locality, suggesting that further investigation is needed to clarify its taxonomic status.

Recent surveys (2013, 2015 and 2018) by the EAF-Nansen Programme of FAO in cooperation with the Myanmar government using the Norwegian R/V *Dr Fridtjof Nansen* along the coast of Myanmar, resulted in the production of a FAO marine species identification guide intended for fishery purposes (Psomadakis *et al*. 2019). Included in the guide are 15 species new to science as well as a number (=51) of undescribed and possibly undescribed fish species. Among them are three species of *Bleekeria*, one of which featuring *B. mitsukurii*, a species previously unknown from the eastern Bay of Bengal, and two (*Blekeeria* sp. A and *Bleekeria* sp. B) which could not be morphologically and genetically associated with any known species. The two new species are described herein and a key to the known species of *Bleekeria* is provided.

Materials and methods

Methods for counts and measurements follow Randall & Ida (2014). Gill raker counts were taken from the first arch of the right side. Pectoral-fin rays were counted on both right and left sides and indicated with unbranched rays in lower case Roman numerals and branched rays in Arabic numerals. Vertebral counts as well as supraneural and dorsal pterygiophore condition was assessed from radiographs. References to "½" scales in counts above and below the lateral line indicate smaller scales located at the base of dorsal and anal fins. Scales were selected at level of anus three scale rows below the lateral line on each side of the type specimens of *Bleekeria albicauda* **sp. nov.** and *Bleekeria nigrilinea* **sp. nov.** for morphological comparison.

The type specimens of *B. albicauda* **sp. nov.** and the holotype of *B. nigrilinea* **sp. nov.** were collected by bottom trawl off the coast of Myanmar and are deposited in the South African Institute for Aquatic Biodiversity, Makhanda, South Africa (SAIAB). In addition to the above material, a single specimen (NICA 1161) collected at Torutua National Park, Andaman Sea, Thailand, previously misidentified as *B. kallolepis* (see Ida *et al*. 1994), is here designated as paratype of *B. nigrilinea*. Collection acronyms follow Fricke & Eschmeyer (2020). Other abbreviations: SL, standard length; R/V, research vessel; NICA, National Institute of Coastal Aquaculture, Thailand; NRF, National Research Foundation of South Africa; FAO, Food and Agriculture Organization of the United Nations.

Genetic methodology. Genomic DNA was extracted from right pectoral-fin tissue using a DNeasy Blood and Tissue kit (Qiagen). A partial fragment of mitochondrial DNA cytochrome *c* oxidase subunit I (COI) gene was amplified by PCR with Fish-F1 and Fish-R2 primers (Ward *et al*, 2005). PCR reaction mixture of 10 µL consisted of 1 µL of 10x KOD Plus version 2 buffer (TOYOBO), 0.2 mM each dNTPs, 1.5 mM magnesium sulphate, 0.3 µM each forward and reverse primers, 0.3U KOD Plus version 2 polymerase (TOYOBO), and 1 µL of DNA sample. The thermal cycling profile was 35 cycles of denaturation at 98 °C for 10 s, annealing at 58 °C for 30 s, and extension at 68 °C for 1 min, with post-cycling extension at 68 °C for 7 min. The products were then purified with an ExoSAP-IT Express PCR Cleanup reagents (Thermo Fisher), and nucleotide sequencing was performed with a BigDye terminator version 3.1 pre-mixed solution on an ABI PRISM 3130*xl* Genetic Analyzer (Applied Biosystems), using Fish-F1 as the primer. Ambiguities in the obtained nucleotide sequences were assessed with the Geneious Pro version 9.1.8 program (Biomatters), and deposited in the DDBJ/EMBL/GenBank databases with accession numbers LC533523 (*Bleekeria albicauda,* **sp. nov.**) and LC533524 (*Bleekeria nigrilinea,* **sp. nov.**).

The COI sequences of *Bleekeria* were retrieved in the Barcode of Life (BOLD) systems (http://www.boldsystems.org), and a total of 19 entries containing two species: *B. estuaria* (*n* = 2), *B. mitsukurii* (*n* = 17) were obtained (Steinke *et al*. 2016; Chang *et al*. 2017; Thu *et al*. 2019). Three *B. mitsukurii* sequences were excluded from the analyses because the sequence was short (FTW905-09) or because the locality of collection was not specified (ANGBF14110-19 and PIND008-18). Neighbour-Joining phylogenetic tree based on Kimura 2-Parameter (K2P), and pairwise K2P genetic distances among the representative specimens were analyzed using MEGA version X (10.1.7) (Kumar *et al*. 2018; Stecher *et al*. 2020).The sequences of *Hyperoplus lanceolatus* (KX679444) and *Ammodytes japonicus* (LC163692) were used as outgroups to root the tree.

***Bleekeria albicauda*, sp. nov.**
(New English name: White-tipped sandlance)
Figures 1, 3–6; Tables 1, 2

Bleekeria sp. A: Psomadakis *et al*. 2019: 534, Pl. XLV, fig. 343 (Myanmar coast).

Holotype. SAIAB 203623–1, 98 mm SL (Fig. 1), off Ayeyarwady Delta, Myanmar, Andaman Sea, Indian Ocean, 14°23.52'N, 93°22.51'E, R/V *Dr Fridtjof Nansen*, station 56, bottom trawl, 77 m depth, P.N. Psomadakis, 08 May 2015.

FIGURE 1. *Bleekeria albicauda* SAIAB 203623–1, 98 mm SL, holotype, off Ayeyarwady Delta, Myanmar, Andaman Sea, Indian Ocean. Photo by Oddgeir Alvheim.

FIGURE 2. *Bleekeria nigrilinea* SAIAB 208209, 104 mm SL, holotype, off Tanintharyi Coast, Myanmar, Andaman Sea, Indian Ocean. Photo by Peter N. Psomadakis.

Paratype. Same collection data as holotype.

Diagnosis. Dorsal-fin rays 40–41; anal-fin rays 15–16; pectoral-fin rays ii,11,ii; pelvic fins present, with 5 rays; lateral-line scales 106–107; scale rows between dorsal-fin origin and lateral line 4; gill rakers 6–7+23–24; vertebrae 28–29+25–26; no teeth in jaws; scales on central part of body clearly shorter than their height (Fig. 3A); pectoral-fin length 8.0–8.5 in SL; pelvic-fin length 21.3–23.3 in SL; head length 3.4–3.5 in SL; body depth at dorsal-fin origin 8.9–9.3 in SL; when fresh, body greyish above, paler below; pectoral fins pale yellowish; caudal fin brownish yellow basally, blackish medially with tips of upper and lower lobes milky white.

Description. Counts and proportional measurements are given in Table 1. Data for the holotype are presented first, followed by paratype data in parentheses (if different). Dorsal-fin rays 40 (41); anal-fin rays 15 (16); all dorsal and anal rays segmented and branched except the first not segmented nor branched and the second segmented but branched; pectoral-fin rays 15, upper and lowermost two rays unbranched; pelvic-fin rays 5, all rays segmented; principal caudal rays 15, the middle 13 branched; upper procurrent caudal rays 15 (16), the posterior two segmented; lower procurrent caudal rays 14 (15), the posterior two segmented; lateral-line scales 106–107; scale rows above lateral line 4 at dorsal-fin origin (Fig. 4A), 3½ at middle and end of fin; scale rows below lateral line 17 (16); median predorsal scales 13, ending above preopercle origin; gill rakers 6+24 (7+23); gill rakers long, longest raker at angle, slightly shorter than longest gill filament and about two thirds of eye diameter; branchiostegal rays 7.

TABLE 1. Proportional measurements expressed as percentace of SL (unless otherwise indicated) and counts of types of two new ammodytid species.

	Bleekeria albicauda **sp. nov.**		*Bleekeria nigrilinea* **sp. nov.**	
	SAIAB 203623–1	SAIAB 203623–2	SAIAB 208209	NICA 1161
Total length (mm)	114	95.1	121	120
Standard length (mm)	98.0	80.0	104	102
Body depth	10.7	11.2	12.5	12.8
Body width	7.6	7.6	6.8	6.5
Head length	28.2	28.4	22.7	24.4
Eye diameter (HL%)	17.0	17.6	20.3	18.6
Interorbital width (HL%)	15.6	13.6	20.9	20.9
Snout length (HL%)	26.8	27.3	27.3	28.3
Postorbital length (HL%)	57.6	54.4	50.9	50.6
Upper-jaw length (HL%)	30.8	28.2	26.7	27.5
Lower-jaw length (HL%)	34.4	33.9	31.3	32.1
Predorsal length	28.4	29.4	25.2	23.6
Preanal length	64.0	63.9	65.3	65.7
Dorsal-fin base	57.3	58.3	61.2	61.8
Anal-fin base	18.2	19.5	19.7	20.1
Caudal-peduncle length	5.8	6.1	6.8	7.0
Caudal-peduncle depth	10.4	11.0	11.4	12.7
Pectoral-fin length	11.8	12.5	14.3	14.4
Pelvic-fin length	4.3	4.7	absent	absent
Dorsal-fin rays	40	41	39	37
Anal-fin rays	15	16	15	14
Pectoral-fin rays	ii,11,ii	ii,11,ii	ii,10,ii	ii,10,ii
Lateral-line (LL) scales	107	106	119	114
Scale rows above LL	4	4	2½	2½
Scale rows below LL	17	16	16	16
Gill rakers	6+24	7+23	7+21	7+20
Vertebrae	29+25	28+26	26+23	26+24

Body subcylindrical, the width at dorsal-fin origin 13.1 in SL; body depth at dorsal-fin origin 9.3 (8.9) in SL; pectoral fins length 8.5 (8.0) in SL; pelvic fins length 23.2 (21.3) in SL; head length 3.5 in SL; eye diameter 5.9 (5.7) in HL; snout length 3.7 in HL; predorsal length 3.5 (3.4) SL; preanal length 1.6 SL; dorsal-fin base 1.7 in SL; anal-fin base 5.5 (5.1) in SL; mouth oblique and moderately large, upper-jaw length 3.2 (3.5) in HL; lower jaw protruding about one third of eye diameter in front of snout; head naked, except for single large scale antero-dorsally and one row of about 10 scales mid-dorsally on opercle (Fig. 4A); scales on body weakly ctenoid; lateralis system on head complete except for a short gap in subocular sensory canal; first dorsal pterygiophore just anterior to tip of fourth neural spine, second and third between fourth and fifth neural spines (first two dorsal pterygiophores of paratype between fourth and fifth neural spines); two supraneurals, one before tip of second neural spine and one before tip of third neural spine (Fig. 5A); olfactory organ count not possible due to its shrunken condition in both types; ventrolateral skin fold absent; nostrils ovoid, anterior one slightly larger than the posterior one.

Colour when fresh (described from two photos): dorsal part of body purplish grey, abruptly silvery white on lateral and ventral parts; pectoral fins pale yellowish; dorsal and anal fins unknown; caudal fin dusky basally, blackish medially with tips of upper and lower lobes milky white (see Fig. 1).

Colour in alcohol: body uniformly straw yellow; upper part of dorsal fin densely pigmented; anal fin hyaline; upper half of pectoral fin pigmented and lower half hyaline; tips of caudal fin paler, basal part darker.

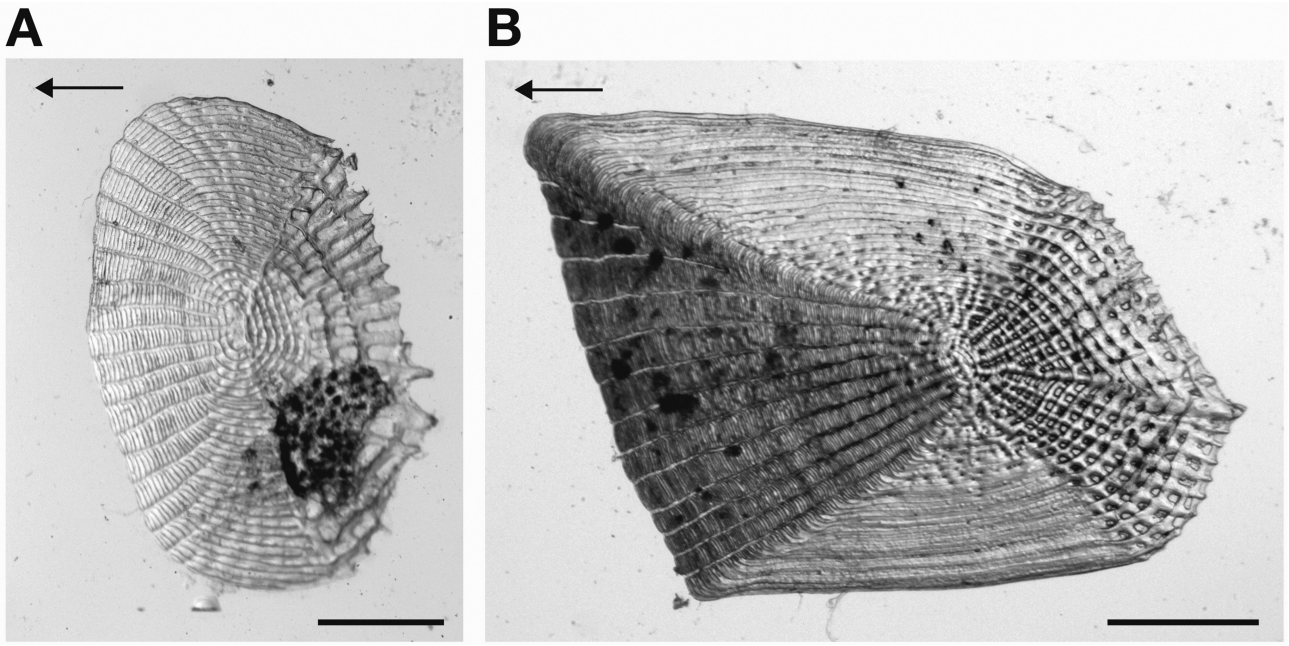

FIGURE 3. Scales at level of anus, three scale rows below lateral-line: **A**, *Bleekeria albicauda*, holotype, SAIAB 203623–1, 98 mm SL; **B**, *Bleekeria nigrilinea*, paratype, NICA 1161, 102 mm SL. Black arrow pointing to head. Scale bar = 0.5 mm. Photos by Hitoshi Ida.

Distribution. *Bleekeria albicauda* is currently known only from the type locality, off Myanmar's Ayeyarwady Delta, in the Andaman Sea. The type specimens were collected in the same haul at a depth of 77 m.

Etymology. This species epithet *albicauda* is a conjunction of the Latin words "*albus"* for white and *"cauda"* for tail in reference to its distinctive white blotches on the tips of the caudal fin (unique among congeners).

Comparisons. *Bleekeria albicauda* **sp. nov.** belongs to a subgroup of *Bleekeria* species (which includes also *B. profunda* and *B. mitsukurii*) characterized by the presence of pelvic fins. This character is unique for this subgroup of species while all other congeners (including *B. nigrilinea* **sp. nov.**) are lacking pelvic fins. Within this subgroup, *B. albicauda* is most similar to *B. mitsukurii* in having short pelvic fins, about 4.3–5.7 % SL (vs. 7 % SL in *B. profunda*); 37–42 (vs. 49 in *B. profunda*) dorsal-fin rays; 14–16 (vs. 20 in *B. profunda*) anal-fin rays; 106–120 (vs. 150 in *B. profunda*) lateral-line scales; 50–56 (vs. 62 in *B. profunda*) vertebrae. *Bleekeria albicauda* is distinguished from *B. mitsukurii* in the absence of teeth in jaws (vs. present in *B. mitsukurii*); scales on central part of body clearly shorter than their height (vs. scales on central part of body of equal length and height) and in fresh caudal fin colouration: dusky with milky white upper and lower lobes (vs. dusky with black-edged yellow inner margin).

***Bleekeria nigrilinea*, sp. nov.**

(New English name: Black-edged fin sandlance)

Figures 2, 3–6; Tables 1, 2

Bleekeria kallolepis (non Günther 1862): Ida *et al*. 1994: 252 (Torutua National Park, Andaman Sea, Thailand).
Bleekeria sp. B: Psomadakis *et al*. 2019: 534, Pl. XLV, fig. 344 (Myanmar coast).

Holotype. SAIAB 208209, 104 mm SL (Fig. 2), off Tanintharyi Coast, Myanmar, Andaman Sea, Indian Ocean, 14°20.78'N, 97°13.64'E, R/V *Dr Fridtjof Nansen*, station 88, bottom trawl, 42–43 m depth, P.N. Psomadakis, 09 September 2018.

Paratype. NICA 1161, 102 mm SL, collected at Torutua National Park, Andaman Sea, Thailand.

Diagnosis. Dorsal-fin rays 37–39; anal-fin rays 14–15; pectoral-fin rays ii,10,ii; pelvic fins absent; lateral-line scales 114–119; scale rows between dorsal-fin origin and lateral line 2½; gill rakers 7+19–21; vertebrae 26+23–24; small teeth in jaws; scales on central part of body distorted, quadrate, length clearly larger than height (Fig. 3B);

pectoral fins length 6.9 –7.0 in SL; head length 4.1–4.4 in SL; body depth at dorsal origin 7.8–8.0 in SL; when fresh, body salmon pink (darker above) with yellow band along belly; caudal fin yellow medially with black-edged upper and lower lobes.

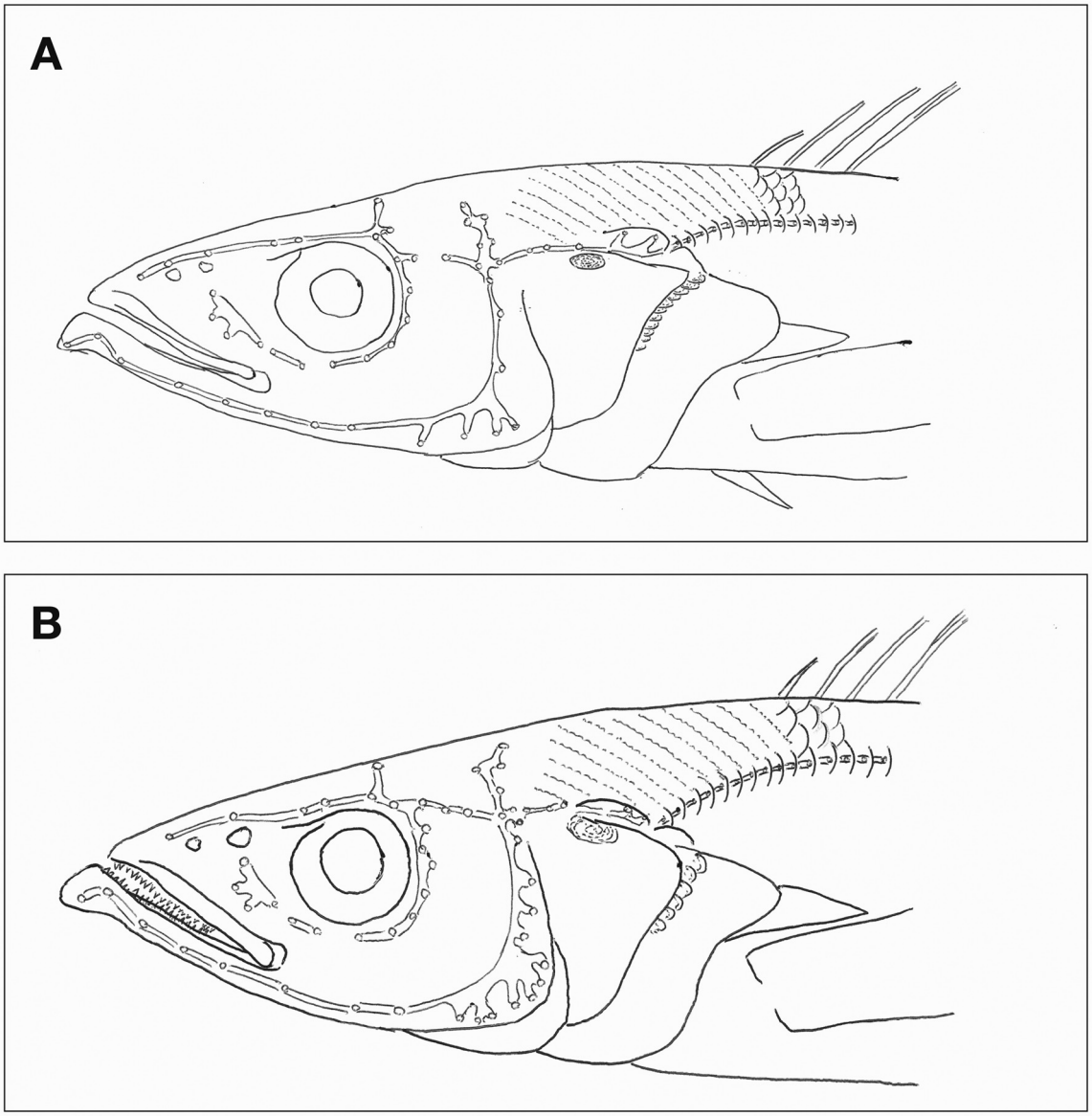

FIGURE 4. Semi-diagrammatic illustration of left lateral head view: **A**, *Bleekeria albicauda*, holotype, SAIAB 203623–1, 98 mm SL; **B**, *Bleekeria nigrilinea*, holotype, SAIAB 208209, 104 mm SL. Drawings by Hitoshi Ida.

Description. Counts and proportional measurements are given in Table 1. Data for the holotype are presented first, followed by paratype data in parentheses (if different). Dorsal-fin rays 39 (37); anal-fin rays 15 (14); all dorsal and anal-fin rays segmented and branched, except the first not segmented nor branched and the second segmented but branched; pectoral-fin rays 14, upper and lowermost two rays unbranched; pelvic fins absent; principal caudal rays 15, the middle 13 branched; upper procurrent caudal rays 16 (15), the posterior one segmented; lower procurrent caudal rays 16 (15), the posterior one segmented; lateral-line scales 119 (114); scale rows above lateral line 2½ at dorsal-fin origin (Fig. 4B) and at middle and end of fin; scale rows below lateral line 16; median predorsal scales 12, ending above preopercle origin; scales on body weakly ctenoid; gill rakers 7+21 (7+20); gill rakers long, longest raker at angle, slightly shorter than longest gill filament and about two thirds of eye diameter; branchiostegal rays 7.

Body slightly compressed, the width at dorsal-fin origin 14.7 (15.4) in SL, becoming progressively more compressed posteriorly; body depth at dorsal-fin origin 8.0 (7.8) in SL; pectoral-fin length 7.0 (6.9) in SL; head length 4.4 (4.1) in SL; eye diameter 4.9 (5.4) in HL; snout length 3.7 (3.5) in HL; predorsal length 4.0 (4.2) in SL; preanal length 1.5 (1.5) in SL; dorsal-fin base 1.6 in SL; anal-fin base 5.1 (5.0) in SL; mouth oblique and moderately large,

upper-jaw length 3.7 (3.6) in HL; teeth on both jaws very fine, arranged in two rows laterally, in a narrow patch anteriorly; lower jaw protruding about one third eye diameter in front of snout; head naked, except for single large scale antero-dorsally and 5–6 scales arranged in a single row mid-dorsally on opercle (Fig. 4B); lateralis system on head complete except for a short gap in subocular sensory canal; first two dorsal pterygiophores between fourth and fifth neural spines; two supraneurals, one before tip of second neural spine and one before tip of third neural spine (Fig. 5B); olfactory organ count not possible due to its shrunken condition in both types; ventrolateral skin fold absent; nostrils ovoid, subequal in size.

Colour when fresh (described from photos of holotype): salmon pink, the scale edges dorsally on body to and excluding those of lateral line stippled with black; postorbital area yellow, nape orangish yellow; basal part of dorsal fin bright orange-yellow; a yellow band running along ventral edge on body; caudal fin hyaline with yellow mid-fork and black upper and lower margins; pectoral and anal fins hyaline (see Fig. 2).

Colour in alcohol: body uniformly light tan, with narrow black band on both upper and lower margins of caudal fin.

Distribution. *Bleekeria nigrilinea* is currently known only from the Andaman Sea: off Myanmar's Ayeyarwady Delta (holotype) and from Torutua National Park in Thailand (paratype). The holotype was collected at a depth of 42 m. Depth information on the paratype is not available.

FIGURE 5. X-rays of *Bleekeria albicauda* SAIAB 203623–1, 98 mm SL (A) and *Bleekeria nigrilinea*, holotype, SAIAB 208209, 104 mm SL (B).

Etymology. This species epithet *nigrilinea* is a conjunction of the Latin words "*nigri"* for black and *"linea"* for line in reference to its distinctive black lines on upper and lower margins of caudal fin (unique among congeners).

Comparisons. *Bleekeria nigrilinea* **sp. nov.** belongs to a subgroup of the genus *Bleekeria* (which includes also *B. kallolepis, B. viridianguilla, B. murtii, B. estuaria*) characterized by the absence of pelvic fins. This character is unique for this subgroup of species while all other congeners (including *B. albicauda* **sp. nov.**) have pelvic fins. Within this subgroup, *B. nigrilinea* is most similar to *B. estuaria* in having 2½ scale rows above lateral line at dorsal-fin origin (vs. 3½–4 in all other congeners), but it is readily distinguished from *B. estuaria* in fresh caudal fin colouration (hyaline with yellow mid fork and black upper and lower margins vs. grey with narrow blackish posterior margin) and by a higher number of lateral-line scales (114–119 vs. 99) and fewer vertebrae (49–50 vs. 53); *B. estuaria* is also distinguished for its very long pectoral fins, 18 % SL (vs. 11–16 % SL in *B. nigrilinea* and all other

congeners); *B. nigrilinea* is distinguished from *B. kallolepis* in fresh body (salmon pink with a thick yellow band running along ventral edge of body vs. light bluish green with 3–4 thin irregular golden yellow stripes on sides) and caudal fin colouration (hyaline with yellow mid fork and black upper and lower margins vs. greyish with thin blackish border) and more lateral-line scales (114–119 vs. 98–112) and fewer total vertebrae (49–50 vs. 51–52); *B. nigrilinea* is distinguished from *B. viridianguilla* in fresh body (salmon pink with a thick yellow band running along ventral edge of body vs. straw yellow without any special marking) and caudal fin colouration (hyaline with yellow mid fork and black upper and lower margins vs. pale with yellow posterior margin) and fewer dorsal-fin rays (37–39 vs. 40–43) and total vertebrae (49–50 vs. 52–56).

Remarks. Akhilesh *et al*. (2019) provided a detailed re-description of *B. kallolepis* from its type locality (i.e. Chennai, India) suggesting that *B. murtii* is probably a junior synonym of *B. kallolepis*. The characters used by Joshi *et al*. (2012) to distinguish *B. murtii* from *B. kallolepis* and other congeners are some body proportions and the general colour pattern. However, the alleged differences in body proportions proposed by these authors are all overlapping (i.e. body depth, eye diameter, head length) with the values showed for *B. kallolepis* and, the colour pattern description matches perfectly with the re-description of *B. kallolepis* (see Akhilesh *et al*. 2019). Fresh colour pattern appears to be particularly useful in the discrimination of *Bleekeria* species, and at the time Joshi *et al*. (2012) described *B. murtii* no detailed description and/or colour images of *B. kallolepis* were available. In accordance with Akhilesh *et al*. (2019) we treat *B. murtii* as junior synonym of *B. kallolepis*, though re-examination of the *B. murtii* type specimens will be necessary to clarify its taxonomic status.

Genetics. The pairwise K2P distances between *B. albicauda* **sp. nov.** and the other *Bleekeria* species were 14.5 ± 2.0 % (mean and standard deviation; range, 11.1–17.8) (Table 2). Similarly, the pairwise K2P distances between *B. nigrilinea* **sp. nov.** and other congeners were 12.6 ± 2.3 % (10.4–16.4). The phylogenetic analysis revealed that the two new species were divided into different clades (Fig. 6). Accordingly, it was found that the two new species described in the present study were genetically divergent from the other *Bleekeria* species, for which COI sequences were available. Based on the N-J tree (Fig. 6), *B. albicauda* **sp. nov.** and *B. nigrilinea* **sp. nov.** are both phylogenetically close to *B. estuaria*, but this grouping is uncertain owing to low bootstrap values (less than 40). Additional analysis with a larger number of specimens from a wider geographic area is needed to reliably resolve the above relationship. Chang *et al*. (2017) recognized two genetically distinct but geographically overlapping lineages for the species morphologically identified as *B. mitsukurii*. Our analysis confirmed that *B. mitsukurii* consists of genetically distinct caldes (see Fig. 6), suggesting that further comprehensive analysis will be necessary to resolve the taxonomic arrangement of the genus *Bleekeria*.

TABLE 2. Percentage sequence divergence in COI gene among *Bleekeria* specimens (Kimura 2-Parameter model). Numbers in the top row correspond to the specimens in the left column. Representative specimens chosen from the phylogenetic tree (Fig. 6) were used for pairwise comparison.

	Species	Localities	1	2	3	4	5	6	7	8	9
1	*Bn*	MY									
2	*Ba*	MY	11.1								
3	*Be*	PE	12.9	13.9							
4	*Bm*	NSCA	10.4	14.4	14.0						
5	*Bm*	YL	10.6	14.2	14.8	1.5					
6	*Bm*	WA	11.6	14.1	15.5	4.8	5.0				
7	*Bm*	KZN	15.9	16.7	17.8	15.6	15.6	14.1			
8	*Bm*	YL	16.4	17.8	18.3	16.1	16.7	15.1	1.3		
9	*Aj*	JP	23.4	21.6	22.1	22.6	23.0	23.5	21.4	21.9	
10	*Hl*	NS	23.6	21.0	21.7	21.6	21.9	21.0	20.7	21.2	10.5

Voucher ID: 1, SAIAB208209; 2, SAIAB203623; 3, DSFSG476-11; 4, SCS977-16; 5, GBMIN130767-17; 6, FOAH035-08; 7, DSLAG682-10; 8, FTW903-09; 9, Ajap-HT001 (LC163692); 10, MT04125 (KX679444).

Species: *Bn*, *B. nigrilinea* **sp. nov.**; *Ba*, *B. albicauda* **sp. nov.**; *Be*, *B. estuaria*; *Bm*, *B. mitsukurii*; *Aj*, *Ammodytes japonicus*; *Hl*, *Hyperoplus lanceolatus.*

Localities: MY, Myanmar; PE, Pomene Estuary, Mozambique; NSCA, Northern South China Sea; YL, Yilan (Giran), Taiwan; WA, Western Australia; KZN, Kwa-Zulu-Natal, South Africa; JP, Japan; NS, North Sea.

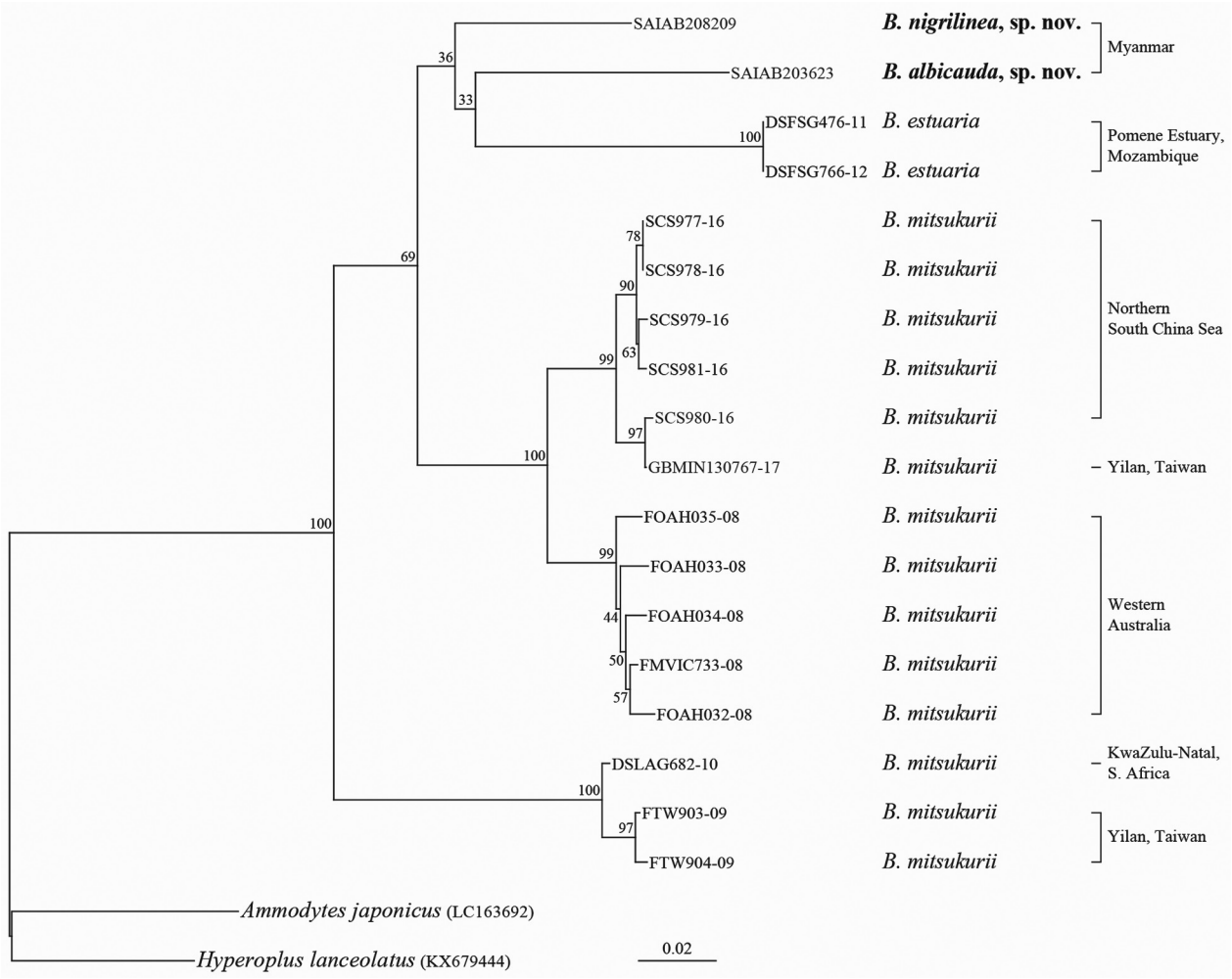

FIGURE 6. Neighbour-Joining tree based on a partial COI sequence (481 bp) showing phylogenetic relationships among *Bleekeria* species. *Hyperoplus lanceolatus* and *Ammodytes japonicus* are assigned as outgroups, and consensus support values obtained by a bootstrap procedure (1000 replicates) are shown at each node. Scale bar denotes number of base substitution per site. Note: species (and localities) are included under the names given in the original sources (see Materials and methods).

Key to the species of *Bleekeria*

A1. Pelvic fins present

B1. Pelvic fins long, about 7 % SL; dorsal-fin rays 49; anal-fin rays 20; lateral-line scales 151 (highest count in the genus); total vertebrae 62 (highest count in the genus); colour when fresh silvery blue green above, paler below . . . . . *Bleekeria profunda* Randall & Ida, 2014 (south western Indian Ocean)

B2. Pelvic fins short, 3.4–4.6 % SL; dorsal-fin rays 37–42; anal-fin rays 14–16; lateral-line scales 114–120; total vertebrae 50–56; colour when fresh tan above, paler below, with two dotted lines below dorsal contour, a large yellow blotch on shoulder, dorsal fin yellow, caudal fin grey with yellow forked area narrowly margined in black . . . . . *Bleekeria mitsukurii* (Jordan & Evermann, 1902) (western Pacific to Red Sea)

B3. Pelvic fins short, 4.3–4.7 % SL; dorsal-fin rays 40–41; anal-fin rays 15–16; lateral-line scales 106–107; total vertebrae 54–55; colour when fresh light tan above, paler below; caudal fin dusky, posterior lobes black with milky white tip . . . . . *Bleekeria albicauda* **sp. nov.** (Myanmar, eastern Indian Ocean)

A2. Pelvic fins absent

C1. Pectoral fins long, 18 % SL . . . . . .*Bleekeria estuaria* Randall & Ida, 2014 (Pomene Estuary, Mozambique)

C2. Pectoral fins short, less than 18 % SL

D1. Dorsal-fin rays 36–40; lateral-line scales 107–112; scale rows above lateral line at dorsal fin origin 3–4; vertebrae 51–52; colour when fresh light bluish green above with 3–4 thin irregular golden yellow stripes, paler below, interradial dorsal-fin membrane yellow except pale basal portion . . . . . *Bleekeria kallolepis* Günther, 1862 (south eastern India)

D2. Dorsal-fin rays 40–43; lateral-line scales 111–116; scale rows above lateral line at dorsal fin origin 4; vertebrae

52–56; colour when fresh straw yellow above, paler below, without any special markings, margin of dorsal and caudal fin yellow . . . . . .*Bleekeria viridianguilla* (Fowler, 1931) (Taiwan to Northern Australia)

D3. Dorsal-fin rays 37–39; lateral-line scales 114–119; scale rows above lateral line at dorsal-fin origin 2½ (lowest count in the genus); vertebrae 49–50 (lowest count in the genus); colour when fresh pinkish tan above, paler below, postorbital area yellow, nape yellow, basal part of dorsal fin bright orangish yellow, caudal fin hyaline with yellow mid-fork and black upper and lower margin . . . . . *Bleekeria nigrilinea* **sp. nov.** (Andaman Sea)

Comparative material examined

Bleekeria estuaria SAIAB 186240 (holotype), 63 mm SL, Pomene Estuary, Mozambique, 5 m depth, multiprong spear, A.D. Connell, 20 November, 2010.

Bleekeria kallolepis SAIAB 208222, 6 specimens, 91–106 mm SL, off south eastern India.

Bleekeria mitsukurii FSKU 70526, 121 mm SL, Makoh Fish Market, Pescadores (Peng-Hu Island), Formosa, probably trawl net, Y. Tominaga, 29, May, 1970; IMP 124, 3 specimens, 96–112 mm SL, Izu Marine Park, Shizuoka, Japan, 20 m depth, hand net using SCUBA, H. Masuda, 22 March, 1983.

Bleekeria profunda SAIAB 84114 (holotype), 121 mm SL, Saya de Malha Bank, Mascarene Plateau, R/V *Dr Fridtjof Nansen*, station 13, bottom trawl, 237–240 m depth, O. Alvheim and D. Tweddle, 23 October 2008.

Bleekeria viridianguilla ZUMT 53973, 137 mm SL, Makoh Fish Market, Pescadores (Peng-Hu Island). Formosa, probably trawl net, Y. Tominaga, 29 May, 1970.

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