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REVIEW OF *STIPHODON* (GOBIIDAE: SICYDIINAE) FROM WESTERN SUMATRA, WITH DESCRIPTION OF A NEW SPECIES

Ken Maeda
Okinawa Institute of Science and Technology Graduate University, 1919-1 Tancha, Onna, Okinawa, 904-0495 Japan
Email: goby@live.jp (Corresponding author)

Heok Hui Tan
Raffles Museum of Biodiversity Research, Department of Biological Sciences, National University of Singapore
6 Science Drive 2, Singapore 117546
Email: heokhui@nus.edu.sg

ABSTRACT. — Three *Stiphodon* species are found on the western slope of Sumatra, Indonesia. They include a new species, *S. maculidorsalis*, distinguished from its congeners by second dorsal- and pectoral-fin ray counts (usually I, 9 and 15, respectively) and relatively high premaxillary teeth counts, pointed first dorsal fin of male, scalation on dorsum of head and trunk, black spots scattering dorsally on head and trunk of male and female, broad black bands on distal part of second dorsal fin and dorsal part of caudal fin of male, fine black spots on pectoral-fin rays of male, and dusky transverse bars laterally on trunk and tail of female. The other two species are *S. ornatus* and *S. semoni*; the latter is first reported from this region, expanding the westernmost limit of the range of this widespread species. These three species appear to form the major components of the *Stiphodon* gobies in the aquarium trade.

KEY WORDS. — *Stiphodon*, Sicydiinae, taxonomy, new species, Sumatra

INTRODUCTION

The sicydiine gobies of the genus *Stiphodon* Weber, 1895, are distributed, in tropical and subtropical freshwater streams, from Sri Lanka and the western coast of Sumatra in the Indian Ocean to southern Japan, north-eastern Australia, and French Polynesia in the Pacific Ocean (Watson, 1995). Although 32 species in this genus are currently considered as valid (Eschmeyer, 2013), taxonomy of this genus is not yet fully understood. For example, the possibility that *Stiphodon allen* Watson, 1996, being a synonym of *Stiphodon semoni* Weber, 1895, was suggested but has not been investigated in depth (Ebner et al., 2012); while some un-named taxa are waiting to be described. Furthermore, it is difficult to understand the accurate distribution range of each *Stiphodon* species based on reports thus far, because the freshwater gobioid fauna on many tropical islands remain to be studied.

In *Stiphodon* species, only the life history of *Stiphodon percnopterygionus* Watson & Chen, 1998, from the Ryukyu Archipelago has been studied to date. This species has the following characteristics: it is amphidromous; it produces small pyriform eggs that are laid on the undersurface of stones in freshwater streams (Yamasaki & Tachihara, 2006); newly hatched larvae, which are small (1.2–1.3 mm in notochord length) and poorly developed, migrate downstream to the sea shortly after hatching at dusk where they develop as pelagic larvae for 2.5–5 months; the larvae migrate into freshwater streams at 13–14 mm in standard length (SL) for further growth and reproduction (Yamasaki et al., 2007; Maeda & Tachihara, 2010). The life histories of the other *Stiphodon* species are expected to be similar to that of *S. percnopterygionus*. Yamasaki et al. (2007) and Maeda et al. (2012a) suggested that the members of this genus are able to colonise distant islands through pelagic larval dispersal, but scant distribution information and unstable taxonomy make such discussion challenging. The reliable knowledge about the distribution of each *Stiphodon* species is highly valuable to the understanding of the actual situation of larval dispersal, and to discuss population structure and speciation history of this genus.

Three *Stiphodon* species have been reported from Sumatra; *S. carisa* Watson, 2008 and *S. semoni* Weber, 1895, both from Lampung Province in the southern tip of Sumatra and *S. ornatus* Meinken, 1974 from West Sumatra Province (Meinken, 1974; Watson, 1994, 1998, 2008). We examined 63 *Stiphodon* specimens collected from Bengkulu, West Sumatra, and Aceh Provinces, deposited in the Zoological Reference Collection of the Raffles Museum of Biodiversity Research, Singapore and the Research and Development Centre for Biology, the Indonesian Institute of Sciences, and found three

species; *S. ornatus*, *S. semoni*, and one undescribed species. Original descriptions of *S. ornatus* (described as a subspecies of *S. elegans*) and *S. semoni* have not provided sufficient information to compare with many other species described in the last two decades. Watson (1994) redescribed *S. ortnatus*, but it examined only one specimen. *Stiphodon semoni* was redescribed by Watson (1996) with 220 specimens from Indonesia, Papua New Guinea, and the Solomon Islands, but description of Sumatran specimens examined in the present study should further increase comparable morphological information of *S. semoni*. In the present study, the new species is described, and morphology of other two species is redescribed to contribute to a better understanding of the distribution of *Stiphodon* in Indonesia where only sporadic information was available. Because these three species are common in the aquarium trade, we also mention the aquarium trade and conservation of the *Stiphodon* species.

MATERIAL AND METHODS

All measurements and counts were taken from the right side of the fish, unless the right side was damaged. Measurements were made point-to-point with a dial calliper or a divider under a stereomicroscope to the nearest 0.1 mm and expressed as a percentage of SL. The measurements and counts followed Nakabo (2002), with the following modifications: SL, head length, snout length, predorsal length, and preanal length were measured to the anterior point of the protruding snout; body depths were measured at the origins of the pelvic and the anal fins; length of caudal peduncle was measured from the posterior end of the second dorsal- and also from the anal-fin bases to the midpoint of the caudal-fin base; first and second dorsal- and anal-fin lengths were measured from the origin of each fin to the farthermost point when the fin was depressed; caudal-fin length was measured as length of the longest ray in central part of the caudal fin (the data was not used if tip of the central rays were damaged); interval between the first and second dorsal-fin bases was measured from the posterior end of the first dorsal-fin base to the second dorsal-fin origin; anus to anal-fin length was measured from the centre of the anus to the anal-fin origin. Scales in longitudinal row were counted from the middle of the posterior end of the hypurals to behind the pectoral-fin base (this did not include the scales above the pectoral-fin base, because they did not form a contiguous row with the scales on the lateral midline of the trunk and tail, of which the anterior end was behind the pectoral-fin base); scales in transverse row were counted along a diagonal line extending posteriorly and ventrally from the first scale anterior to the second dorsal fin, including one scale on the dorsal midline and another scale at the anal-fin base; scales in transverse row in caudal peduncle were counted along a vertical line around the narrowest point of the caudal peduncle in a zigzag manner, and included scales on the dorsal and ventral midlines. Teeth counts of the upper and lower jaws were taken from the right of the symphysis, with terms used in dentition following Watson (2008). Abbreviations pertaining to the cephalic sensory pore system followed Akihito et al. in Nakabo (2002).

Forty nine specimens of the three *Stiphodon* species collected from West Sumatra and Bengkulu Provinces were examined for the morphological descriptions. Additional 14 specimens of *S. ornatus* and the new species recently collected from Aceh Province were also examined and listed to record the distribution but they were not used for the morphological descriptions. All specimens examined in the present study are deposited in the Raffles Museum of Biodiversity Research, Singapore (ZRC) and the Research and Development Centre for Biology (ex Museum Zoologicum Bogoriense), the Indonesian Institute of Sciences (MZB).

TAXONOMY

Stiphodon ornatus Meinken, 1974
(Figs. 1–4; Tables 1, 2)

Stiphodon elegans ornatus Meinken, 1974: 87 (type locality: Barung Belantai, West Sumatra Province, Indonesia; syntypes lost)
Stiphdon ornatus Meinken, 1974: Watson, 1994: 88

Material examined. — West Sumatra Province (12 males, 10 females): ZRC 46620 (5 males, 44.9–50.6 mm SL; 6 females, 45.0–51.8 mm SL), aquarium trade in Singapore (from Padang), donated by P. Yap, 19 Sep.2001; ZRC 51821 (4 males, 38.8–52.5 mm SL; 3 females, 40.3–48.4 mm SL), South Painan, donated by T. Sim, Sep.2004; ZRC 54113 (3 males, 34.9–38.8 mm SL; 1 female, 38.0 mm SL), Persasa Painan, coll. H. H. Tan from local fish collectors, 21 Jul.1997. Aceh Province (2 males, 3 females): ZRC 54181 (1 male, 37.4 mm SL; 1 female, 42.5 mm SL), Air Dingin, Tapaktuan, Aceh Selatan, coll. T. Sim et al., Apr.2009; ZRC 54182 (1 male, 35.0 mm SL; 2 females, 37.2, 39.4 mm SL), Desa Madat, Tapaktuan, Aceh Selatan, coll. T. Sim et al., Apr.2009.

Diagnosis. — Number of soft-rays in second dorsal fin usually 9, pectoral fin usually 15; male having pointed first dorsal fin with elongate spines 3–5; male having large caudal fin (caudal-fin length 29–35% of SL); number of premaxillary teeth 33–45 in <50.0 mm SL; 44–47 in ≥ 50.0 mm SL; male lacking white patch behind pectoral-fin base; nape and posterior half of occipital region always covered by cycloid scales in both sexes. Male usually with 7–11 obscure dusky transverse bars laterally on posterior half of trunk and tail; male sometimes with two broad dusky bars laterally below first and second dorsal-fin bases. Number of black spots on longest pectoral-fin ray 6–12 in male, 0–6 in female.

Description. — Morphometric measurements are given in Table 1. Body elongate, cylindrical anteriorly and somewhat compressed posteriorly. Head somewhat depressed with a round snout protruding beyond upper lip. Anterior nostril short tubular, posterior nostril not tubular. Mouth inferior with upper jaw projecting beyond lower jaw. Upper lip thick with small, medial cleft and faintly crenulated with tiny fimbriate projections. Premaxillary teeth 33–47, fine and tricuspid. Dentary with 1–5 canine-like symphyseal teeth in male, none (n = 5) or with 1 smaller canine-like symphyseal tooth (n = 5) in female; dentary also with a row of unicuspid horizontal teeth (34–50) enclosed in a fleshy sheath. Larger fish having more premaxillary and horizontal teeth (Fig. 1). Urogenital

papilla in both sexes rectangular or rounded with one small projection at both corners of posterior edge.

Dorsal fins VI-I, 9 (n = 21) or VI-I, 10 (n = 1); first dorsal fin in female almost semicircular and usually spine 3 longest; first dorsal fin in male forming parallelogram with spines 3–5 elongate (usually spine 4 longest) but not filamentous, most posterior points of first dorsal fin (tip of spine 4 or 5) extending to base of soft-rays 2–5 of second dorsal fin when depressed. Anal fin I, 9 (n = 1) or I, 10 (n = 21), below second dorsal fin. In female, anterior rays (usually soft-ray 2 or 3) longest in second dorsal and anal fins; in male, posterior rays longer than anterior rays (last and/or next to last rays longest). Caudal fin with 12 (n = 1 with damaged rays), 13 (n = 18) or 14 (n = 3) branched rays within 16 (n = 1) or 17 (n=21) segmented rays, posterior margin rounded or somewhat truncated, male with larger fin than female (caudal-fin length 29–35% of SL in male, 24–27% of SL in female). Pectoral fin with 14 (n = 1), 15 (n = 19), or 16 (n = 2) rays. Pelvic fin I, 5, paired fins joined together to form a strong cup-like disk with fleshy frenum.

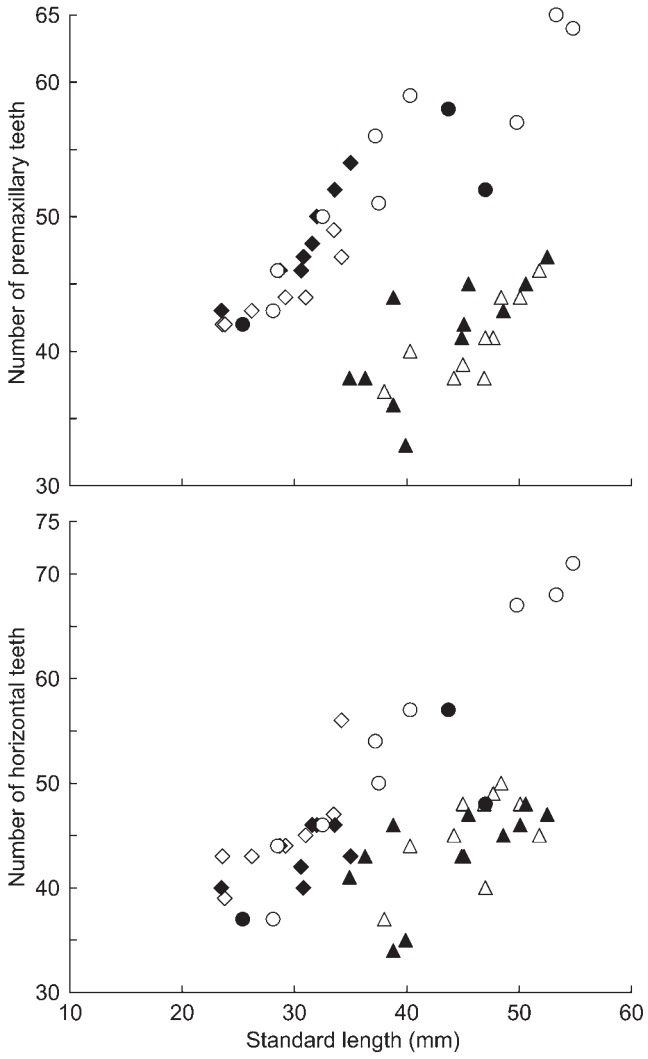

Fig. 1. Number of premaxillary and horizontal dentary teeth of *Stiphodon ornatus* (triangles), *S. semoni* (squares), and *S. maculidorsalis* (circles) from West Sumatra and Bengkulu Provinces, Sumatra. Solid and open symbols represent males and females, respectively.

Scales in longitudinal row 29–33 (Table 2); scales in transverse row 10 (n = 2), 11 (n = 20); scales in transverse row in caudal peduncle 9. Nape and posterior half of occipital region always covered by cycloid scales; most anterior dorsal-scale slightly exceeding middle of occipital region (Fig. 2). Ctenoid scales covering almost entire tail and trunk, but belly covered by cycloid scales. Pectoral-fin base naked. Cycloid scales occurring along first and second dorsal- and anal-fin bases and on proximal part of caudal fin; some scales on most anterior part of lateral sides of trunk (behind pectoral-fin base) and a few scales along dorsal and ventral midlines on posterior part of caudal peduncle sometimes cycloid.

Cephalic sensory pore system always A, B, C, D, F, H, K, L, N, and O; pore D singular, all others paired (Fig. 3). Oculoscapular canal separated into anterior and posterior canals between pores H and K. Cutaneous sensory papillae developed over lateral and dorsal surface of head (Fig. 3).

Colour in preservation. — Sexual dichromatism well developed.

Males (Fig. 4a–c). Background of body and head brown or pale brown; 7–11 obscure dusky transverse bars regularly arranged laterally on posterior half of trunk and tail, but these bars often indistinct; some males with two broad dusky bars laterally below first and second dorsal-fin bases, and with pale brown gap between those two dusky bars and on caudal peduncle (possibly nuptial colour); lateral sides of head and pectoral-fin base blackish. First dorsal-fin membranes grey or blackish, spine 1 with 0–6 black spots, other spines usually entirely blackish without spot. Second dorsal fin dusky with 1–7 whitish spots on spine and each soft-ray or totally blackish. Anal fin dusky or blackish sometimes with

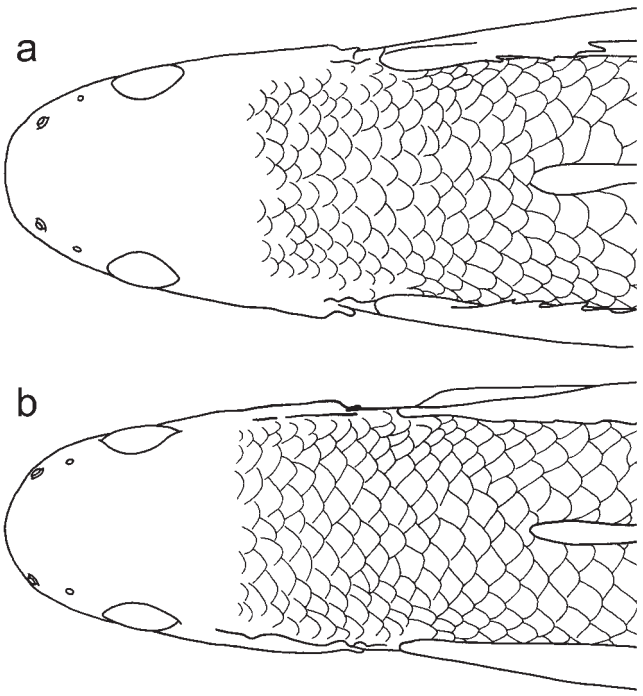

Fig. 2. Dorsal scalation on head and nape in *Stiphodon ornatus*: a, male (50.1 mm SL, ZRC 46620); b, female (45.0 mm SL, ZRC 46620).

translucent narrow margin. Caudal fin pale grey or brown with black spots on central 6–10 rays forming 7–12 black transverse stripes or fin totally blackish; dorsal margin of fin transparent. Pectoral-fin membranes transparent; almost all rays, except ventral 1–2 rays, with distinct black spots distributed over almost entire rays, translucent or whitish between each black spot; number of spots on longest rays (usually rays 7 and/or 8) 8–12, size of each spot similar or smaller than intervals (Fig. 4a, b), but one male having small number (6 on longest ray) of larger spots (Fig. 4c). Middle to proximal part of pelvic-fin rays, fin membranes, and frenum dusky or blackish, distal margin translucent except for around soft-ray 5, which has dusky edge. Blackish fins probably nuptial colour.

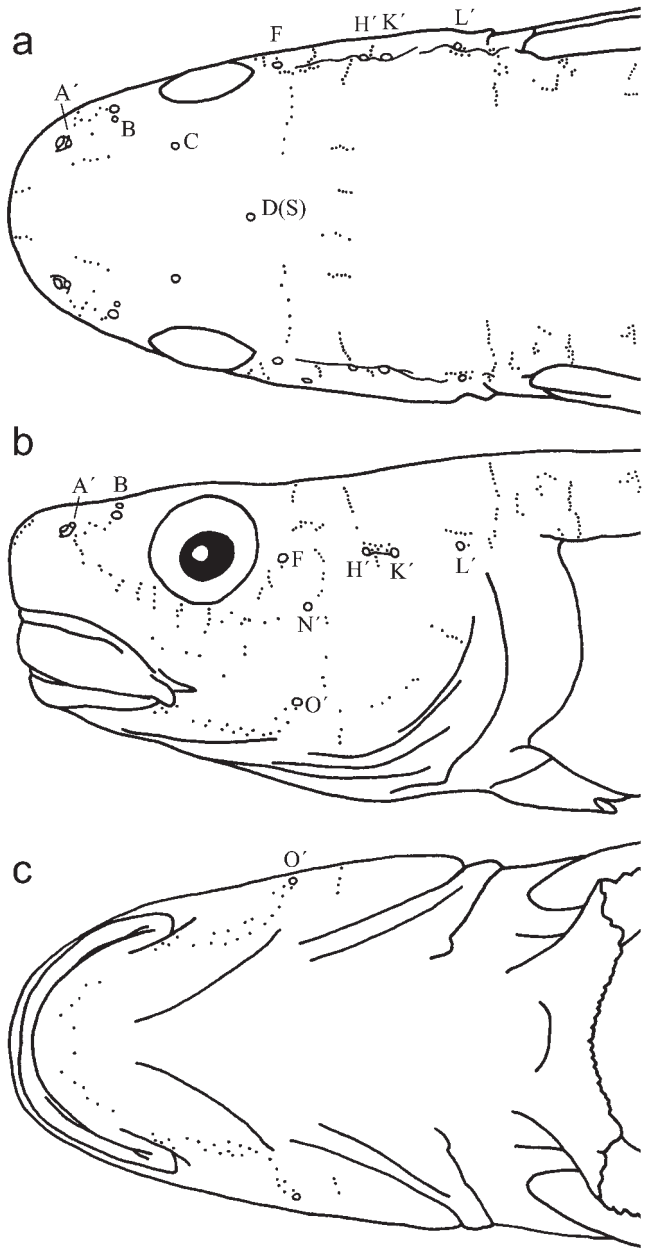

Fig. 3. Diagrammatic illustration of head showing arrangement of the cephalic sensory pores and cutaneous sensory papillae in *Stiphodon ornatus* (50.1 mm SL, ZRC 46620): a, dorsal view; b, lateral view; c, ventral view.

Females (Fig. 4d, f). Background of body and head cream; black longitudinal band extending from snout to below eye and to middle of pectoral-fin base, band continuing from behind pectoral-fin base to posterior end of caudal peduncle through lateral midline, this band sometimes composed of 8–9 obscure black regular spaced blotches on caudal region. Dorsal part of upper lip black. Small black pigments along anal-fin base and ventral midline of caudal peduncle. Another black longitudinal band from just behind eye extending dorsolaterally to base of upper procurrent caudal-fin rays. Dorsum between upper lateral bands brown sometimes with 0–2 and 5 obscure cream blotches on trunk and tail, respectively. Snout with U-shaped black band connecting both eyes; irregular black markings scattered between eyes. First dorsal-fin membranes transparent, spine 1 sometimes with 1–3 black spots, other spines usually dusky without clear markings, but sometimes with 1–4 black spots. Second dorsal-fin spine and soft-rays often with 1–4 black spots, membranes mostly transparent. Anal fin usually without remarkable pigments, but one female having dusky anal fin with transparent margin (Fig. 4e). Black blotch at centre of proximal part of caudal fin; caudal-fin rays usually with black spots, forming 3–7 transverse bars on some central rays, membranes mostly transparent. Black lateral band on pectoral-fin base often spreading to proximal part around rays 5–7 of pectoral fin; pectoral fin usually with 1–6 black spots on central rays, but sometimes lacking black spot; membranes transparent. Pelvic fin translucent without pigment.

Distribution. — All specimens of *S. ornatus* observed in the present study were collected from West Sumatra Province and the southern part of Aceh Province, Sumatra. The specimens reported in Meinken (1974) and Watson (1994, 1998, 2008) were collected from West Sumatra Province. Aceh population extends the range of this species northwards from West Sumatra Province.

Remarks. — *Stiphodon ornatus* closely resembles several congeners (viz. *S. atratus* Watson, 1996, *S. imperiorientis* Watson & Chen, 1998, *S. martenstyni* Watson, 1998, *S. pelewensis* Herre, 1936, *S. pulchellus* (Herre, 1927), *S. weberi* Watson, Allen & Kottelat, 1998) in fin-ray and tooth counts, first dorsal-fin shape in male, and general colouration. Although caudal-fin length of *S. ornatus* male (29–35% of SL, mean 31% of SL) was larger than those of the other species (*S. atratus*, 20–28% of SL in Watson et al., 1998; *S. imperiorientis*, 23–29% of SL in Maeda et al., 2012b; *S. martenstyni*, 24% of SL in Watson, 1998; *S. pelewensis*, 25–27% of SL in Herre, 1936 and Suzuki et al., 2010; *S. pulchellus*, 23–29% of SL in Maeda et al., 2012b; *S. weberi*, 20–25% of SL in Watson et al., 1998), comprehensive and exhaustive studies are required to elucidate the differences in their morphology and to understand phylogeny of this genus.

***Stiphodon semoni* Weber, 1895**

(Figs. 1, 5–7; Tables 1, 2)

Stiphodon semoni Weber, 1895: 270 (type locality: Ambon, Maluku Islands, Indonesia; lectotype: ZMA 110.972)

Material examined. — Bengkulu Province (8 males and 7 females): ZRC 54112 (7 males, 28.7–35.0 mm SL; 5 females, 26.2–34.2 mm SL), aquarium trade in Singapore (from South Bengkulu), coll. H. H. Tan, 18 Mar.2008; ZRC 46979 (1 male, 23.5 mm SL; 2 females, 23.6, 23.8 mm SL), aquarium trade in Singapore (from Bengkulu), donated by P. Yap, 4 Feb.2002.

Diagnosis. — First dorsal fin not pointed in male; number of soft-rays in second dorsal fin 9, pectoral fin 15; premaxillary teeth 42–54 in 23.5–35.0 mm SL; dentary with canine-like symphyseal teeth in both sexes; male having a white patch behind pectoral-fin base; scales in longitudinal row 27–30; male usually without scale on occipital region and anterior part of nape; female usually without scale on anterior two thirds of occipital region. Pectoral-fin rays without clear marking in both sexes; dorsal and anal fins generally pale grey on male. Female having somewhat serrated black longitudinal band laterally on trunk and tail with irregular spaced 4–6 brown obscure blotches.

Description. — Morphometric measurements are given in Table 1. Body elongate, cylindrical anteriorly and somewhat compressed posteriorly. Head somewhat depressed with a

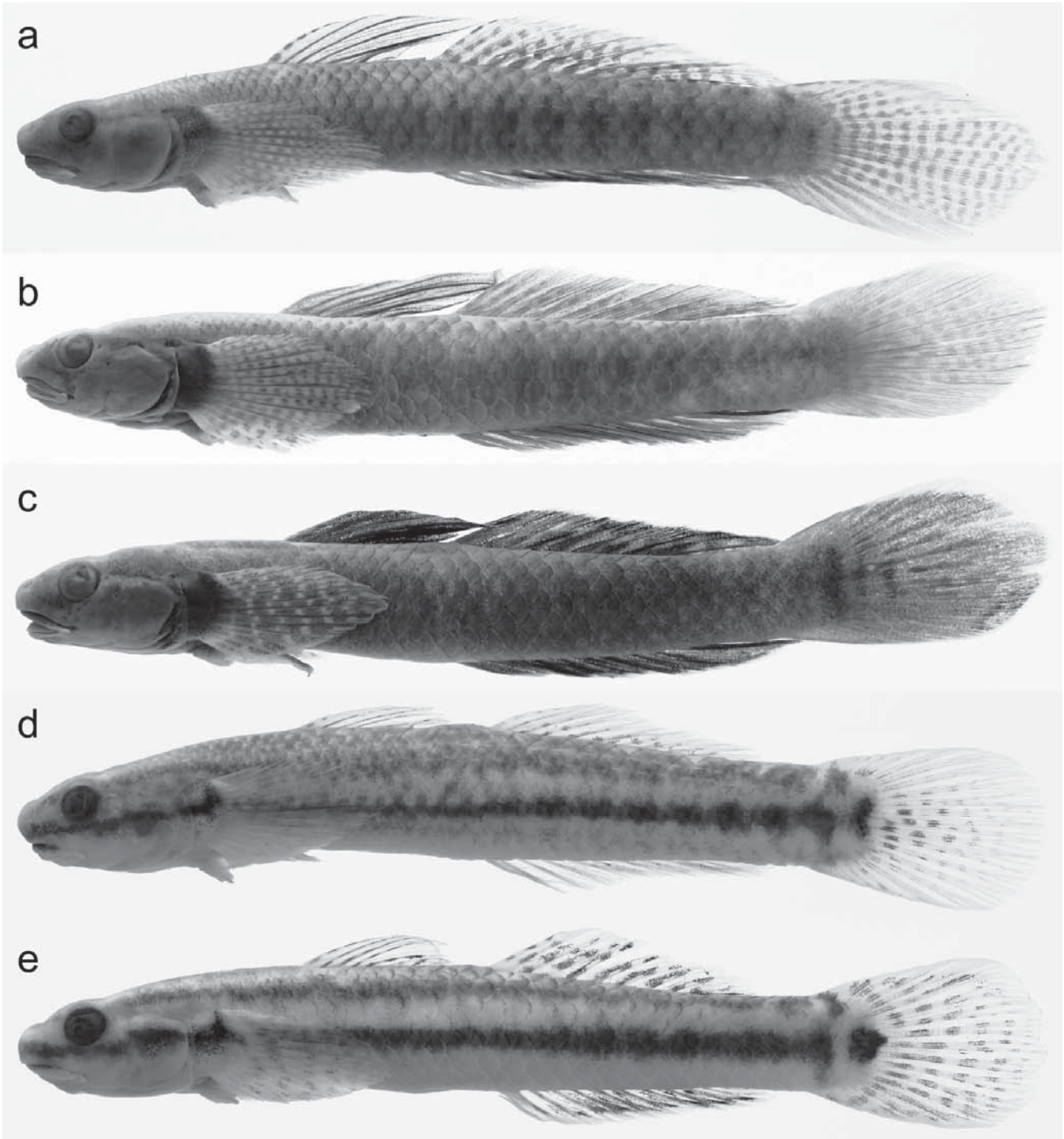

Fig. 4. *Stiphodon ornatus*: a, male, 45.1 mm SL (ZRC 46620); b, male, 52.5 mm SL (ZRC 51821); c, male, 38.8 mm SL (ZRC 51821); d, female, 46.9 mm SL (ZRC 46620); e, female, 40.3 mm SL (ZRC 52821).

Table 1. Morphometric measurements of *Stiphodon ornatus* and *S. semoni* from West Sumatra and Bengkulu Provinces, Sumatra, expressed as a percentage of standard length. D_1, first dorsal fin; D_2, second dorsal fin; A, anal fin; C, caudal fin; P_1, pectoral fin; P_2, pelvic fin.

	S. ornatus		*S. semoni*	
Sex	Male	Female	Male	Female
Number of specimens measured	12	10	8	7
Standard length (mm)	34.9–52.5	38.0–51.8	23.5–35.0	23.6–34.2
Head length	22.4–24.2	22.4–24.3	23.7–25.6	23.3–24.6
Snout length	6.9–8.8	6.6–8.9	7.7–9.1	7.6–8.7
Eye diameter	4.6–6.2	4.5–5.2	5.4–5.7	5.1–5.9
Postorbital length of head	10.3–12.7	11.3–12.9	11.0–12.9	11.6–12.6
Upper jaw length	8.2–9.1	7.6–9.4	8.9–9.8	8.6–9.7
Body depth at P_2 origin	12.4–14.6	12.6–14.9	12.3–14.3	12.3–14.2
Body depth at A origin	12.9–16.3	13.2–16.4	14.0–15.8	13.7–14.8
Depth at caudal peduncle	10.5–12.7	10.0–12.4	10.6–11.7	9.9–11.0
Length of caudal peduncle from A base	17.7–20.5	17.4–18.9	18.3–20.6	18.2–20.8
Length of caudal peduncle from D_2 base	20.1–22.5	19.9–21.0	20.5–22.6	20.3–22.3
Predorsal length	32.3–35.1	33.5–35.6	33.6–35.9	34.9–36.6
Length of D_1 base	16.0–20.0	17.2–20.8	16.2–17.9	15.3–18.7
D_1 length	28.9–35.4	18.7–22.2	17.4–22.1	17.4–20.3
Length of longest spine of D_1	22.9–29.2	14.3–16.0	15.7–17.8	14.6–16.1
Interval between D_1 and D_2 bases	1.6–5.9	4.1–6.6	2.9–5.1	3.9–5.7
Length of D_2 base	25.1–27.4	23.9–25.9	24.0–26.0	21.9–25.4
D_2 length	41.6–50.6	32.4–36.5	34.0–43.4	30.7–31.9
Length of longest ray of D_2	17.8–24.9	12.4–15.4	17.0–20.3	14.6–16.8
Preanal length	47.5–50.5	50.8–55.1	48.9–51.9	51.3–55.2
Length of A base	26.5–30.1	24.7–26.6	24.7–27.9	23.7–27.1
A length	42.1–49.0	33.7–36.5	30.6–42.8	31.9–34.5
Length of longest ray of A	16.5–21.5	11.9–12.9	14.0–17.8	12.3–14.7
Anus to A length	3.8–5.4	2.8–5.9	3.1–3.6	3.4–5.0
Length of longest ray of P_1	20.2–24.0	13.6–21.8	21.1–23.1	19.6–21.4
C length	29.1–34.6	24.0–26.6	24.3–29.7	22.9–26.1

Table 2. Number of scales in longitudinal row (LR) of *Stiphodon ornatus*, *S. semoni*, and *S. maculidorsalis* from West Sumatra and Bengkulu Provinces, Sumatra.

LR	27	28	29	30	31	32	33	34	35
S. ornatus	–	–	1	8	7	5	1	–	–
S. semoni	2	4	8	1	–	–	–	–	–
S. maculidorsalis	–	–	–	1	1	1	1	7	1

round snout protruding beyond upper lip. Anterior nostril short tubular, posterior nostril not tubular. Mouth inferior with upper jaw projecting beyond lower jaw. Upper lip thick and smooth with small, medial cleft. Premaxillary teeth 42–54, fine and tricuspid. Dentary with 1–3 canine-like symphyseal teeth in males except for one male without canine-like teeth on right of symphysis (this individual having 2 canine-like teeth on left side); with 1 or 2 small canine-like symphyseal teeth in females; dentary also with a row of unicuspid horizontal teeth (39–56) enclosed in a fleshy sheath. Larger fish having more premaxillary and horizontal teeth (Fig. 1). Male with a white patch behind pectoral-fin base. Urogenital papilla in male rectangular or rounded; female rectangular with two projections at both sides of tip.

Dorsal fins VI-I, 9; first dorsal fin in both sexes almost semicircular and spines 2 and/or 3 longest; tip of spines usually not extending to origin of second dorsal fin, but it sometimes touching origin of second dorsal fin in male. Anal fin I, 10, below second dorsal fin. In female, anterior rays (soft-ray 1 or 2 in second dorsal fin, soft-ray 2 in anal fin) longest in second dorsal and anal fins; in male, posterior rays longer than anterior rays (last and/or next to last rays longest) except for smallest male (23.5 mm SL). Caudal fin with 13 branched rays within 17 segmented rays, posterior margin rounded or somewhat truncated, male with larger fin than female (caudal-fin length 24% of SL in smallest male, 27–30% of SL in other males, 23–26% of SL in female). Pectoral fin with 15 rays. Pelvic fin I, 5, paired fins joined together to form a strong cup-like disk with fleshy frenum.

Scales in longitudinal row 27–30 (Table 2); scales in transverse row 10 (n = 2), 11 (n = 13); scales in transverse row in caudal peduncle 9. Occipital region and anterior part of nape usually naked in male (Fig. 5a), but occasionally with a few cycloid scales around posterior end of occipital region and anterior part of nape; scales on nape always cycloid. Nape and posterior one third of occipital region usually covered by cycloid scales in female (Fig. 5b). Ctenoid scales covering almost entire tail and trunk, but belly covered by cycloid scales. Pectoral-fin base naked. Small gap between posterior side of pectoral-fin base and anterior terminal of scaled area on lateral sides of trunk; some of most-anterior scales on lateral sides of trunk cycloid. Cycloid scales also occurring along first and second dorsal- and anal-fin bases, and on proximal part of caudal fin; a few scales dorsally and ventrally on posterior part of caudal peduncle often cycloid.

Cephalic sensory pore system always A, B, C, D, F, H, K, L, N, and O; pore D singular, all others paired (Fig. 6). Oculoscapular canal separated into anterior and posterior canals between pores H and K. Cutaneous sensory papillae developed over lateral and dorsal surfaces of head (Fig. 6).

Colour in preservation. — Sexual dichromatism well developed.

Males (Fig. 7a). Background of body and head pale brown; lateral sides of trunk and tail dusky; lateral sides of head, dorsum on snout, upper lip, and pectoral-fin base blackish; other part of dorsum brown. First and second dorsal fin pale grey without clear marking. Anal fin pale grey often with transparent narrow margin. Caudal fin pale grey with dusky spots on central 5–8 rays forming 7–11 black transverse stripes. Pectoral-fin rays grey without clear markings, membranes transparent but pale grey proximally. Pelvic fin grey with translucent margin. Colouration of smallest male very similar to smallest females.

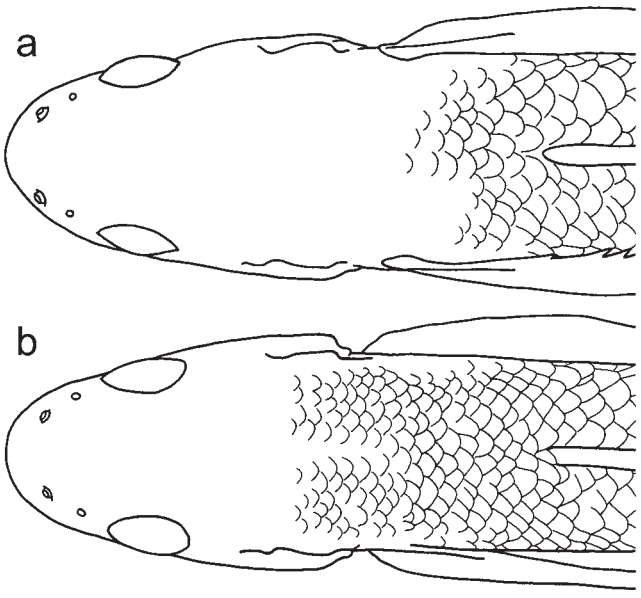

Fig. 5. Dorsal scalation on head and nape in *Stiphodon semoni*: a, male (33.6 mm SL, ZRC 54112); b, female (29.2 mm SL, ZRC 54112).

Females (Fig. 7b). Background of body and head cream; black longitudinal band extending from snout to below eye and to middle of pectoral-fin base, band continuing from behind pectoral-fin base to posterior end of caudal peduncle through lateral midline or slightly lower position of midline; this band usually serrated, and often with 4–6 brown irregular spaced obscure blotches. Dorsal part of upper lip black. Small black pigments along anal-fin base and ventral midline of caudal peduncle. Another black longitudinal band from just behind eye extending dorsolaterally to base of upper procurrent caudal-fin rays. Dorsum between upper lateral bands brown, but 0–1, 0–2, and 5 obscure cream transverse bars interrupt brown dorsum on head, trunk, and tail, respectively. Snout with U-shaped black band connecting both eyes. First and second dorsal-fin membranes transparent; first dorsal-fin spines dusky without clear marking; second dorsal-fin rays with 1–2 black spots. Anal fin with faint black pigments on rays, and often with obscure black band running near its

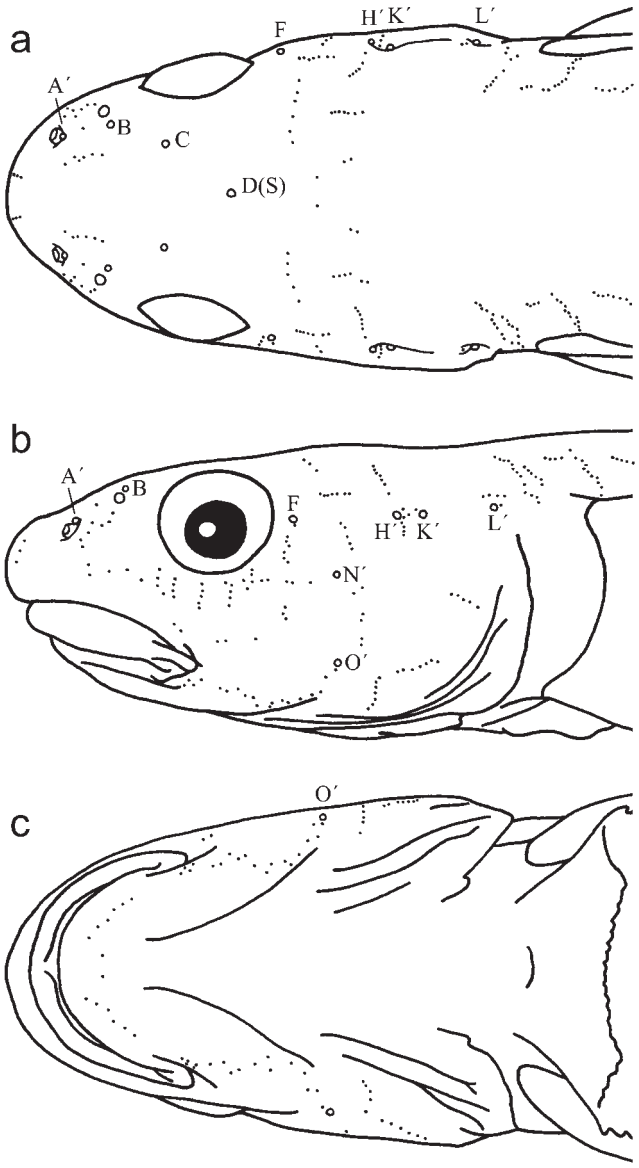

Fig. 6. Diagrammatic illustration of head showing arrangement of the cephalic sensory pores and cutaneous sensory papillae in *Stiphodon semoni* (33.6 mm SL, ZRC 54112): a, dorsal view; b, lateral view; c, ventral view.

margin. Black blotch at centre of proximal part of caudal fin; 1–2 black spots along 3–9 central caudal-fin rays, membrane mostly transparent. Black lateral band on pectoral-fin base often spreading to proximal part around rays 5–8 of pectoral fin; pectoral-fin rays without clear marking or with 1 black spot on some of central rays; membranes transparent. Pelvic fin translucent without pigment. Two smallest females (23.6 and 23.8 mm SL) lacking black spots on second dorsal-, caudal-, and pectoral-fins.

Distribution. — Watson (2008) reported *S. semoni* from Lampung Province, south-eastern Sumatra. The record from Bengkulu Province in the present study is the first report of this species from western Sumatra, and it expands the westernmost limit of the range of this widespread species, which has been known to be distributed on north-eastern Australia, Solomon Islands, Papua New Guinea, and Indonesia (islands of Yapen, New Guinea, Ambon, Ceram, Halmahera, Sulawesi, Flores, Bali, and Sumatra) (Watson, 1996, 2008; Watson et al., 1998; Ebner & Thuesen, 2010; Ebner et al., 2012).

Remarks. — The smallest specimen (23.5 mm SL) is considered to be an immature juvenile and identified as male because its occipital region is totally naked. It is generally observed that male juvenile exhibits resemblance to the female in *Stiphodon* species (Maeda, unpublished data).

Stiphodon semoni is strikingly similar to *S. atropurpureus* (Herre, 1927), but can be distinguished by the dorsal scalation on head and trunk: anterior half of nape is usually naked in *S. semoni* male vs scaled in *S. atropurpureus*; posterior one-third of occipital region is scaled in *S. semoni* female vs two-thirds scaled in *S. atropurpureus*. Scales in longitudinal row of *S. semoni* is fewer than that of *S. atropurpureus* (27–30 vs 29–31). Comparative material of *S. atropurpureus* is listed in Maeda et al. (2012b).

Stiphodon maculidorsalis, new species

(Figs. 1, 8–10, Tables 2, 3)

Material examined. — Holotype: MZB 17213 (male, 43.7 mm SL), South Painan, West Sumatra Province, Sumatra, donated by T. Sim, Sep.2004.

Paratypes: West Sumatra Province (1 male and 3 females): ZRC 51822 (1 male, 47.0 mm SL; 3 females, 37.2–40.3 mm SL), collected with holotype. Bengkulu Province (1 male and 6 females): ZRC 51836 (3 females, 49.8–54.8 mm SL), aquarium trade in Singapore (from Bengkulu), donated by Qian Hu, 22 Jan.2009; ZRC 51445 (1 male, 25.4 mm SL; 3 females, 28.1–32.5 mm SL), aquarium trade in Singapore (from South Bengkulu), coll. H. H. Tan, 18 Mar.2008.

Non-type material: Aceh Province (5 males and 4 females): ZRC 54183 (1 male, 35.0 mm SL), Kreung Susoh, Aceh Barat, coll. H. H. Ng et al., Jun.2010; ZRC 54185 (4 males, 38.8–42.9 mm SL; 4 females, 34.7–37.8 mm SL), Seunaloh, Kreung Sosoh, Aceh Barat, coll. H. H. Ng et al., Jun.2010.

Diagnosis. — The new species is distinguished by the following character combinations: Number of soft-rays in second dorsal fin usually 9, pectoral fin usually 15; male having pointed first dorsal fin with elongate spines 4 and 5; relatively high tooth-counts (premaxillary teeth 42–46 in <30.0 mm SL; 51–56 in 30.0–39.9 mm SL; 52–59 in 40.0–49.9 mm SL; 64–65 in ≥ 50.0 mm SL); dentary with canine-like symphyseal teeth in both sexes; male lacking white patch behind pectoral-fin base; anterior half of nape almost naked in male; most of nape scaled and most of occipital region naked in female. Colourations in both male and female are very unique and also distinguish it from all congeners, such as black spots scattering dorsally on head and trunk of male and female, broad black bands on distal part of second dorsal fin and dorsal part of caudal fin of male; fine black spots on pectoral-fin rays of male; dusky transverse bars laterally on trunk and tail of female.

Fig. 7. *Stiphodon semoni*: a, male, 31.6 mm SL (ZRC 54112); b, female, 33.5 mm SL (ZRC 54112).

Description. — Morphometric measurements are given in Table 3. Body elongate, cylindrical anteriorly and somewhat compressed posteriorly. Head somewhat depressed with a round snout protruding beyond upper lip. Anterior nostril short tubular, posterior nostril not tubular. Mouth inferior with upper jaw projecting beyond lower jaw. Upper lip thick and smooth with small, medial cleft. Premaxillary teeth 42–65, fine and tricuspid. Dentary with canine-like symphyseal teeth, number of teeth 3 or 4 in larger males, 2 in smallest male (25.4 mm SL), usually 1 or 2 in females (but 3 in one female); dentary with a row of unicuspid horizontal teeth (37–71) enclosed in a fleshy sheath. Larger fish having more premaxillary and horizontal teeth (Fig. 1). Urogenital papilla in male rectangular, posterior edge with some faint projections, not smooth; female rectangular or somewhat rounded often with two small projections at both sides of tip.

Dorsal fins VI-I, 9 (n = 9) or VI-I, 10 (n = 3); in female, first dorsal fin almost semicircular and spine 2 or 3 longest; in male, first dorsal fin forming parallelogram with spines 3–5 elongate but not filamentous, except smallest male of which first dorsal-fin shape similar to female. Most posterior points of first dorsal fin of larger males (tip of spine 4 or 5) extending to base of soft-ray 4 or 5 of second dorsal fin when depressed. Anal fin I, 10 (n = 11) or I, 11 (n = 1), below second dorsal fin. In female, anterior rays (usually soft-ray 1 or 2 in second dorsal fin, soft-ray 2 or 3 in anal fin) longest in second dorsal and anal fins; in male, posterior rays longer than anterior rays (last or next to last ray longest) except for smallest male. Caudal fin with 13 (n = 11) or 14 (n = 1) branched rays within 17 segmented rays, posterior margin rounded or somewhat truncated; male with larger fin than female (caudal-fin length 27–30% of SL in larger males but 24% of SL in smallest male, 22–24% of SL in female). Pectoral fin with 15 (n = 10) or 16 (n = 2) rays. Pelvic fin I, 5, paired fins joined together to form a strong cup-like disk with fleshy frenum.

Scales in longitudinal row 30–35 (Table 2); scales in transverse row 10 (n = 3) or 11 (n = 9); scales in transverse row in caudal peduncle 9. Anterior half of nape almost naked in male (Fig. 8a); most of nape scaled in female, some scales occurring on posterior part of occipital region and the rest of occipital region usually naked (Fig. 8b), but sometimes a few scales on middle of occipital region. Scales on nape and occipital region usually cycloid, but sometimes some weak ctenoid scales occur posteriorly. Ctenoid scales covering

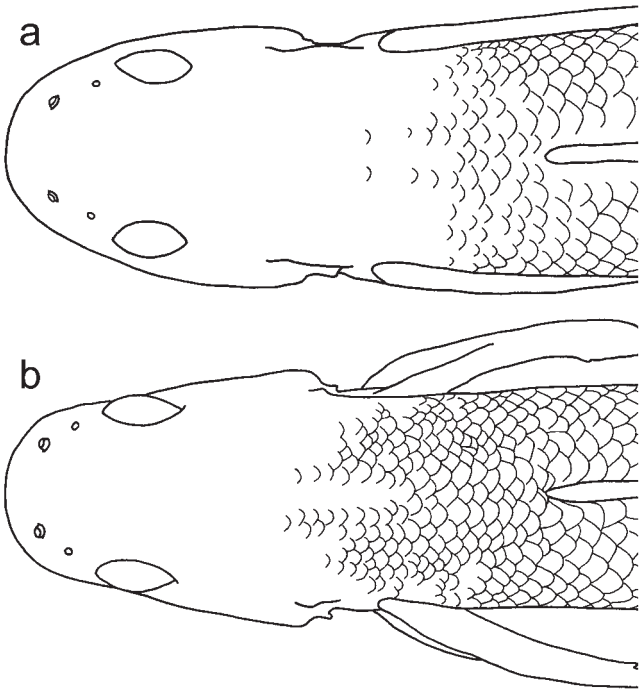

Fig. 8. Dorsal scalation on head and nape in *Stiphodon maculidorsalis*: a, male (47.0 mm SL, ZRC 51822); b, female (37.5 mm SL, ZRC 51822).

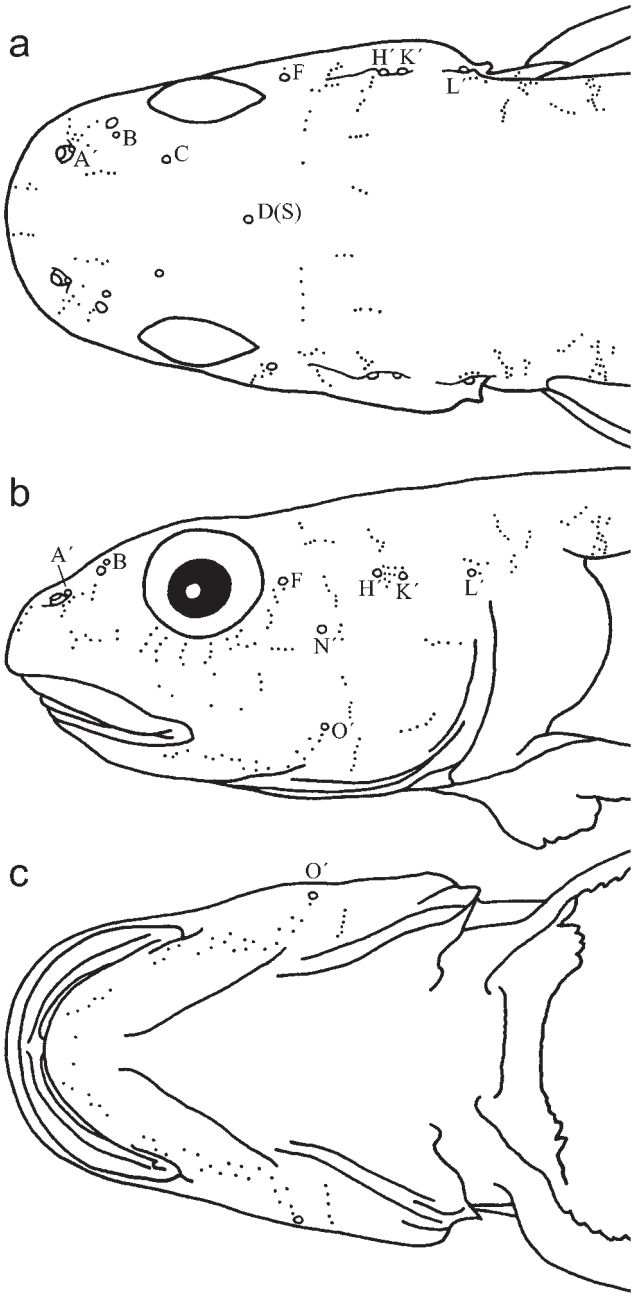

Fig. 9. Diagrammatic illustration of head showing arrangement of the cephalic sensory pores and cutaneous sensory papillae in *Stiphodon maculidorsalis* (37.5 mm SL, ZRC 51822): a, dorsal view; b, lateral view; c, ventral view.

almost entire tail and trunk, but belly covered by cycloid scales. Pectoral-fin base naked. Small gap between posterior side of pectoral-fin base and anterior terminal of scaled area on lateral sides of trunk; some of most-anterior scales on lateral sides of trunk cycloid. Cycloid scales also occurring along second dorsal- and anal-fin base, and proximal part of caudal fin.

Cephalic sensory pore system always A, B, C, D, F, H, K, L, N, and O; pore D singular, all others paired (Fig. 9). Oculoscapular canal separated into anterior and posterior canals between pores H and K. Cutaneous sensory papillae developed over lateral and dorsal surface of head (Fig. 9).

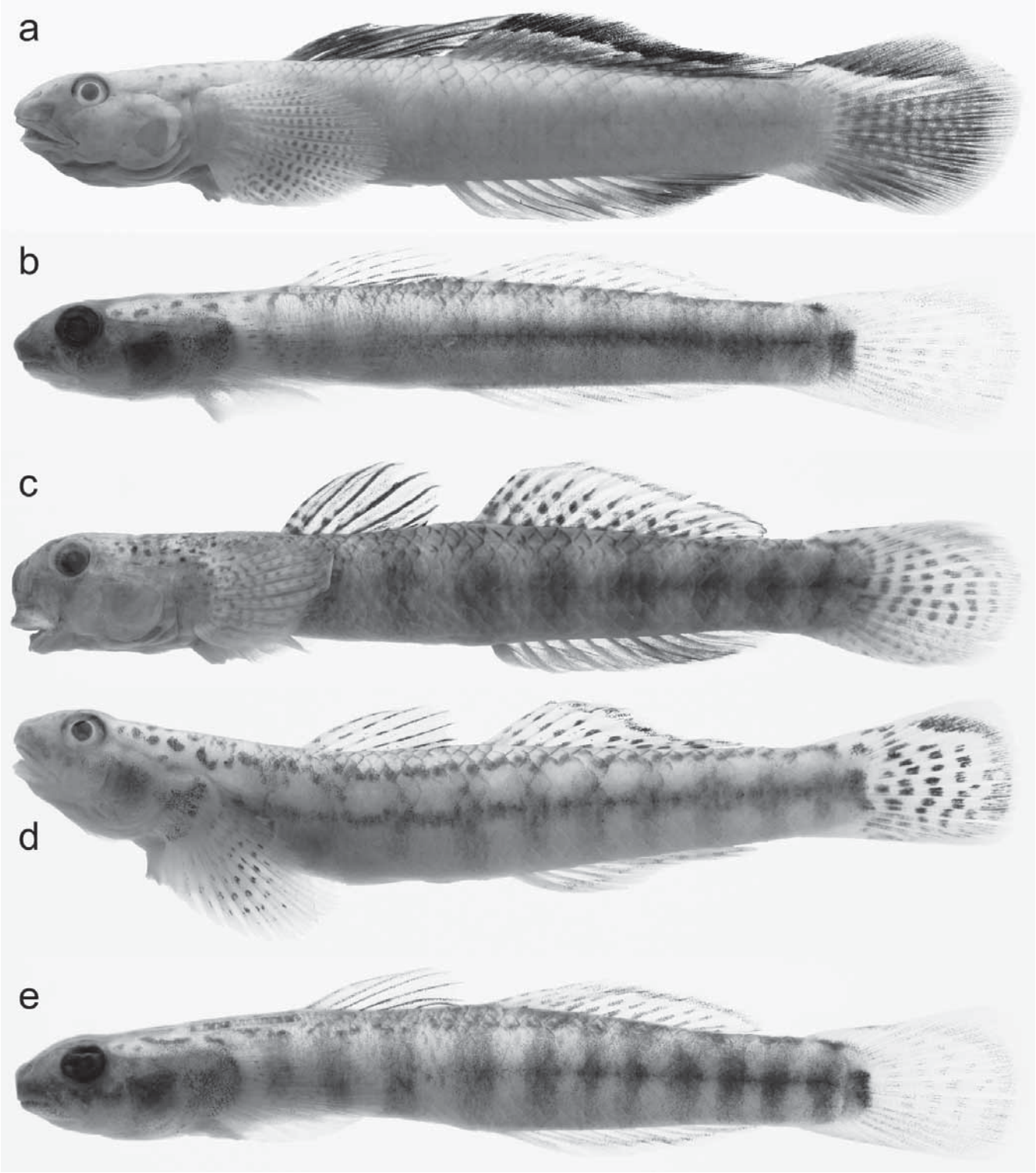

Fig. 10. *Stiphodon maculidorsalis*: a, holotype, male, 43.7 mm SL (MZB 17213); b, paratype, male, 25.4 mm SL (ZRC 51445); c, paratype, female, 54.8 mm SL (ZRC 51836); d, paratype, female, 37.2 mm SL (ZRC 51822); e, paratype, female, 32.5 mm SL (ZRC 51445).

Table 3. Morphometric measurements of *Stiphodon maculidorsalis* from West Sumatra and Bengkulu Provinces, Sumatra, expressed as a percentage of standard length. D_1, first dorsal fin; D_2, second dorsal fin; A, anal fin; C, caudal fin; P_1, pectoral fin; P_2, pelvic fin.

	Holotype	Paratype	
Sex	Male	Male	Female
Number of specimens measured	1	2	9
Standard length (mm)	43.7	25.4–47.0	28.1–54.8
Head length	23.6	23.0–24.4	21.9–24.2
Snout length	8.7	8.3–8.9	8.2–9.2
Eye diameter	5.0	4.7–5.5	4.6–6.0
Postorbital length of head	11.0	10.2–12.6	9.6–12.1
Upper jaw length	9.4	8.7–8.9	8.8–9.8
Body depth at P_2 origin	15.1	12.6–14.3	13.1–14.5
Body depth at A origin	16.5	14.2–15.3	14.6–16.1
Depth at caudal peduncle	11.9	10.6–11.3	10.0–11.3
Length of caudal peduncle from A base	19.5	18.7–19.7	17.4–20.0
Length of caudal peduncle from D_2 base	20.1	19.8–22.0	18.4–20.8
Predorsal length	34.3	33.6–34.6	33.6–37.0
Length of D_1 base	20.4	17.3–19.6	17.5–21.1
D_1 length	34.1	20.5–36.4	19.2–22.1
Length of longest spine of D_1	27.9	16.5–29.1	15.4–17.5
Interval between D_1 and D_2 bases	1.8	2.3–4.3	2.2–5.5
Length of D_2 base	27.0	24.4–26.6	23.2–25.9
D_2 length	48.7	34.3–43.2	32.0–36.9
Length of longest ray of D_2	23.1	15.0–19.1	14.0–15.5
Preanal length	52.9	52.0–54.0	53.3–57.0
Length of A base	27.9	25.6–27.9	23.1–26.1
A length	42.3	33.9–41.7	31.0–34.7
Length of longest ray of A	17.8	13.0–16.0	11.6–13.5
Anus to A length	3.7	2.8–3.1	3.6–5.0
Length of longest ray of P_1	21.7	19.1–20.1	17.5–19.4
C length	29.7	23.6–27.4	21.6–24.0

Colour in preservation. — Sexual dichromatism well developed. The two larger males (43.7 and 47.0 mm SL) and smallest male (25.4 mm SL) exhibit different colouration, thus they are described separately below.

Larger males (Fig. 10a). Background of body and head pale brown; many black spots scattered dorsally on head and trunk; trunk and caudal region without other distinct markings, or with 3 dusky transverse bars on trunk and 6 dusky transverse bars on caudal region dorsally and laterally. First dorsal-fin membranes grey, spine 1 with 2–7 black spots, other spines without distinct marking. Distal one third of second dorsal-fin rays and membranes black forming broad black band; proximal part grey with 2–4 obscure pale grey spots on each ray and middle part along black band lighter grey. Anal fin entirely greyish. Dorsal part of caudal fin black; translucent longitudinal bar immediately below this black part; middle and ventral part of caudal fin dusky with 9–10 black transverse stripes. Pectoral-fin membranes translucent; rays with fine black spots, number of spots on longest rays (rays 7 and 8) 13 or 14. Proximal part of pelvic fin pale brown, distal part somewhat dusky.

Smallest male (Fig. 10b). Similar to female. Number of spots on longest pectoral-fin rays (rays 7 and 8) 7.

Females (Fig. 10c–e). Background of body and head cream; 3 and 6–7 dusky transverse bars laterally on trunk and tail, respectively, these bars linked with those on other side by obscure dusky dorsal bars; dorsal side of body somewhat dusky; a lot of black spots scattering dorsally on head and trunk; dusky longitudinal band running along lateral midline from behind pectoral-fin base to posterior end of caudal peduncle, but this band often obscure; dusky band on upper lip and along lower margin of snout; dusky longitudinal band extending from infraorbital region to middle of pectoral-fin base, but larger females sometimes lack this band. First and second dorsal-fin membranes transparent, but sometimes pale grey; first dorsal-fin spines dusky with 0–4 translucent spots; second dorsal fin bordered by narrow transparent edge with black band running immediately inside of this transparent margin; 2–4 black spots along each of proximal two thirds of second dorsal-fin spine and soft-rays. Anal fin pale grey without clear markings or with black band running near its margin. Black rectangular blotch usually at centre of proximal part of caudal fin; black band (upside-down "L" shape) along dorsal and posterior margin of caudal fin with transparent border; 3–6 black spots on 7–9 central caudal-fin rays often forming transverse bars, membrane mostly transparent. Pectoral-fin rays with black spots, number of

spots on longest rays (rays 7 and/or 8) usually 5–9, but 4 in smaller females (28.1 and 28.5 mm SL, n = 2); membranes transparent. Pelvic fin translucent without pigment.

Etymology. — The name for the new species is from the combination of the Latin words *maculosus*, meaning spotted, and *dorsalis*, meaning dorsal, referring to unique spotted dorsum on head and trunk in both sexes. The new specific name is treated as an adjective.

Distribution. — The specimens of this new species were collected from Bengkulu, West Sumatra, and Aceh Provinces, Sumatra. Currently, no information about occurrence of this species from other places is known.

Remarks. — The smallest specimen (25.4 mm SL) is identified as male because it has few scales on nape and has more black spots on pectoral-fin rays than females of same size-class (<30 mm SL). This male is considered to be an immature juvenile (see remarks for *S. semoni*).

The new species resembles *S. multisquamus* Wu & Ni, 1986 and *S. aureorostrum* Chen & Tan, 2005. They have similar meristic characters, scalation, dusky transverse bars laterally on trunk and tail of female, and fine black spots on pectoral-fin rays of male (Wu & Ni, 1986; Chen & Tan, 2005; Wu & Zhong, 2008; Nip, 2010). But the new species differs from *S. multisquamus* and *S. aureorostrum* in having black spots scattering dorsally on head and trunk of male and female and broad black bands on distal part of second dorsal fin and dorsal part of caudal fin of male. *Stiphodon ornatus*, *S. atratus*, *S. imperiorientis*, *S. martenstyni*, *S. pelewensis*, *S. pulchellus*, and *S. weberi* have similar fin-ray counts and first dorsal-fin shape in male with *S. maculidorsalis* (see remarks for *S. ornatus*), but premaxillary teeth counts of these species are lower than that of *S. maculidorsalis* (except for *S. martenstyni*) and their colourations of male and female are completely different.

Stiphodon *gobies in aquarium trade*. — More than half of the specimens of all three *Stiphodon* species examined in the present study were obtained from aquarium trade in Singapore. *Stiphodon* gobies are often sold commercially as ornamental fish (e.g., Delventhal, 2003; Mukai, 2011). The three species (*S. ornatus*, *S. semoni*, and *S. maculidorsalis*) are common and found in many pet shops often selling them on the Internet. Because *S. ornatus* and *S. maculidorsalis* have been reported only from Bengkulu, West Sumatra, and Aceh Provinces, the western slope of Sumatra is believed to be the main source of *Stiphodon* for the aquarium trade. There exist no expertise for the captive breeding of *Stiphodon* species due to difficulty in feeding to their small larvae and the long pelagic larval duration (Yamasaki & Tachihara, 2006; Yamasaki et al., 2007; Maeda & Tachihara, 2010). Therefore, all aquarium *Stiphodon* species should be collected from the wild.

Live *Stiphodon* gobies are captured for the aquarium trade from the hill stream habitats in Western Sumatra (THH, pers. obs.; see Tan, 1999, for more habitat details). Two methods are commonly used to collect riparian gobies including *Stiphodon* species. The first involves bending down and immersing the head with goggles and visually targeting individual gobies and scooping them using a deep but small mouthed hand net. This method is tedious and involves many hours in high velocity cold water. The second method involves three or more people using a seine net with a heavy metal chain bottom. Two persons drag this net along the rocky bottom, and one or two other person(s) at the front of the net chase fishes into the net. The fishes are then bagged and sent to a middle man who will accumulate sufficient numbers before sending to an exporter. Larger sicydiine gobies are also caught using electricity or seine net and sold as food fish, and commonly observed stringed up by the road side for sale. These larger sicydiine gobies (usually *Sicyopterus*) are gutted and deep fried before consumption. They are sometimes encountered in the aquarium trade as well.

This collection of *Stiphodon* from the wild may not be sustainable in the long-term if brood stock is not monitored closely or the waterways and adjacent habitats become polluted. As the larvae of *Stiphodon* require a marine phase which will migrate back to the freshwater system, this is the most vulnerable stage at which any physical or chemical barrier will impose detrimental effects on future population. Currently, most of the lowland coastal zone in western part of Sumatra is undergoing urbanisation and modification for crop planting (THH, pers. obs.). Already in 1999, feral populations of *Amatitlania nigrofasciatum* (Cichlidae), *Oreochromis mossambicus* (Cichlidae) and *Poecilia reticulata* (Poeciliidae) had been observed in a hill stream habitat near Painan, West Sumatra (Tan, 1999).

Stiphodon species in the aquarium trade are usually not identified correctly as well as one of them is named in the present study. We hope that information of this study could provide basic taxonomic knowledge for proper management and conservation of wild *Stiphodon* populations in Sumatra.

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