A New Species of *Stiphodon* (Gobiidae: Sicydiaphiinae) from Vanuatu

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Abstract *Stiphodon astilbos* sp. nov. is described on the basis of specimens from Espiritu Santo Island, Vanuatu. The species differs from *S. elegans* in male colour pattern and some morphometric features. The interrelationships between *S. elegans* and *S. stevensoni* are briefly discussed.

Tropical South Pacific islands have a sparse freshwater fish fauna which is typically dominated by the Gobioidei. The subfamily Sicydiaphiinae, usually represented by the genera *Sicyopterus* Bleeker (1874) and *Stiphodon* Weber (1895), is an important component of most insular streams. Adult *Sicyopterus* are frequently large (up to 15 cm SL) and can be encountered in great numbers in the upper reaches of streams where they may be the only visible fish species. *Stiphodon*, in contrast, are small (up to 5 cm SL) and although often brilliantly coloured can be easily overlooked in the estuaries and lowland streams in which they are primarily found. Adult *Stiphodon* are poor swimmers which restricts their ability to surmount waterfalls and move upstream.

The Sicydiaphiinae have not been reviewed since 1884, when Ogilvie-Grant revised the genera *Sicydium* Valenciennes (1837) and *Lentipes* Günther (1880). *Stiphodon elegans* was first described as *Sicydium elegans* by Steindachner (1879) and the genus *Stiphodon* was erected by Weber (1895) to accomodate a new species, *S. semoni* which did not fit into *Sicydium*. Koumans (1953) assigned *S. elegans* to *Stiphodon*. The third species of *Stiphodon* is *S. pelewensis* (Herre, 1936a), but Koumans (1953) probably incorrectly synonymised both *S. pelewensis* and *S. semoni* with *S. elegans*. Schultz (1943) synonymised *Vailima stevensoni* Jordan et Seale with *S. elegans*. Koumans (1953) tentatively concurred with this view. Recently, Akihito *et al.* (1984) included *Stiphodon stevensoni* as being part of the Japanese fish fauna.

In the absence of a good differential diagnosis, *Stiphodon* remains monotypic. But there are two hypotheses as follows, (1) *Stiphodon* is genuinely monotypic and is highly variable, and (2) there are a large number of *Stiphodon* taxa spread over most of the tropical Pacific. One problem lies with Steindachner's original description of *S. elegans* which was inadequate and the poor condition of the syntypes. This has made comparison of new taxa with the syntype difficult.

Steindachner's description of *S. elegans* (in Ogilvie-Grant, 1884) and his labels with the syntypes give the type locality as the Society Islands. A visit to Tahiti in the Societies in 1983 enabled our fish collections to be made from a stream 10 km east of Papeete. Thirty-seven specimens of a *Stiphodon* species were caught. These were believed to be the original *Sicydium*

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elegans of Steindachner but all specimens had a different fin ray count from the syntypes thus raising some doubt as to their identity. It had originally been intended to redescribe *S. elegans* from these specimens and to compare them with and describe a new species of *Stiphodon* from Vanuatu. Unfortunately because of the doubts associated with the identity of the Tahiti *Stiphodon* and the type locality, this was not possible. The present description is therefore based on comparisons with Steindachner's syntypes of *Sicydium elegans*.

Methods

Ten specimens of a new species of *Stiphodon* were collected from a ford at the South Santo dispensary, Espiritu Santo, Vanuatu, on February 8, 1982, using quinaldine and a hand net. The four syntypes of *Stiphodon elegans* (Steindachner) were borrowed from the Naturhistorisches Museum Wien. Unfortunately only two specimens were in sufficiently good condition for measurements and counts to be made. Specimens were examined under a stereo microscope, and measurements and drawings made using a drawing tube and calibrated paper. Counting and measuring of meristic features and morphometry followed Miller (1969). One male and one female paratype were cleared and stained with alizarin red for examination of terminal vertebrae, premaxilla, maxilla and dentary. Terminology for sensory pores followed Akihito (1971) and Akihito and Meguro (1975). The following institutional abbreviations are used: Australian Museum, Sydney (AMS); and Naturhistorisches Museum, Wien (NMW).

Stiphodon astilbos sp. nov. (Fig. 1)

Holotype. AMS 25714–001, 23.1 mm SL, male. Vanuatu, Espiritu Santo, small slightly turbid stream approximately 50 m from sea, at South Santo dispensary. Collected on 8 February, 1982, from concrete ford and coral sand bottomed pool immediately upstream, with quinaldine and hand net. Depth 2.5 cm to 25 cm.

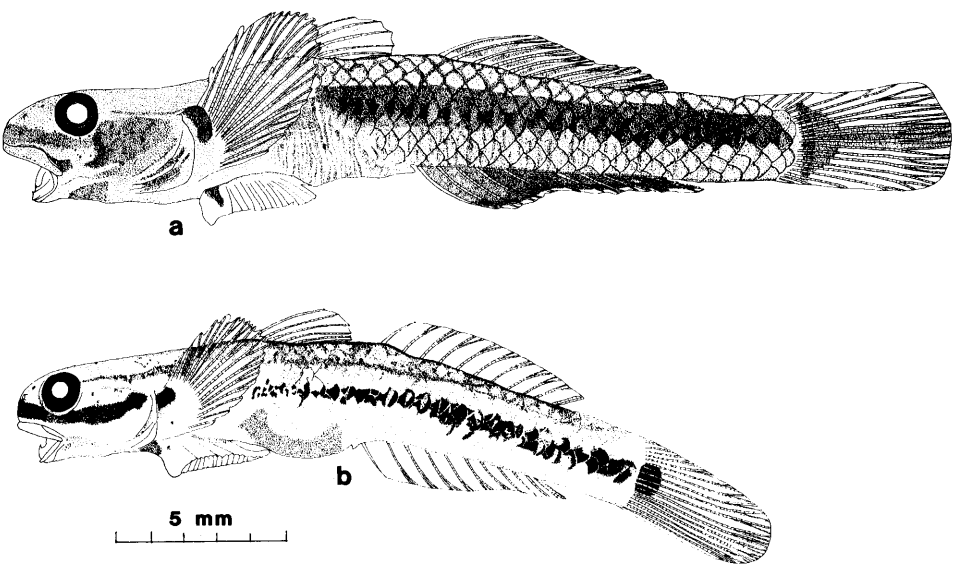

Fig. 1. *Stiphodon astilbos* sp. nov. a, holotype, male; b, paratype, female.

Paratypes. 1 male, 6 entire females, 1 damaged female. Male 20.5 mm SL, females 15.5–16.2 mm SL all from type locality, collected at the same time as the holotype. 3 female paratypes, AMS 25713-001; 1 male and 3 female paratypes, NMW 57858: 1–4. Damaged female cleared and stained in author's collection.

Description

Holotype. Morphometric and meristic features given in Table 1 and Fig. 2. Scales cycloid on nape becoming strongly ctenoid towards caudal. Body fully scaled from axil of

Table 1. Selected morphometric and meristic characters (mean and range, in parentheses, or $2 \times$ S.D.) of the male syntypes of *Stiphodon elegans*, *Stiphodon astilbos* males and *Stiphodon astilbos* females. Abbreviations: BD, body depth; BW, body width; CPD, depth of caudal peduncle; HL, head length; L, length; PDL, length of pelvic disc; SL, standard length.

	S. elegans, ♂ syntypes	*S. astilbos*, ♂	*S. astilbos*, ♀
Number in sample	2	3	6
Standard L (mm)	30.25 (29.0–31.5)	22.6 (20.5–24.3)	16.18 (15.7–16.8)
Head L (in SL)	10.35 (18.1–18.6)	22.4 (20.5–23.9)	24.48 ± 1.55
Head width (in SL)	10.40 (9.8–11)	14.0 (13.6–14.6)	16.53 ± 1.18
Snout-D1 (in SL)	33.1 (31.7–34.5)	35.86 (34.6–38)	37.88 ± 1.62
Snout-D2 (in SL)	56.8 (56–57.6)	58.06 (56.4–61.5)	58.23 ± 1.66
Snout-anus (in SL)	50.1 (49.5–50.7)	49.8 (47.3–51.9)	50.28 ± 3.46
Snout-anal fin (in SL)	55.6 (54.6–56.2)	54.5 (53.6–55.4)	54.2 ± 2.08
Pelvic-anus (in SL)	30.1 (29.2–31)	27.33 (23.4–30.2)	26.1 ± 4.44
Peduncle L (in SL)	15.65 (15.5–15.8)	19.63 (17.3–21.9)	15.53 ± 2.31
D1 Base (in SL)	11.55 (11.4–11.7)	14.43 (12.1–16.9)	10.58 ± 0.99
D interspace (in SL)	10.3 (9.6–11)	9.8 (9.7–9.9)	8.95 ± 1.15
D2 Base (in SL)	23.05 (22.2–26.2)	24.33 (23.4–25.8)	22.18 ± 4.75
Anal fin base (in SL)	24.5 (22.8–26.2)	27.1 (25.1–29.4)	25.95 ± 2.9
Caudal fin L (in SL)	22.2	21.83 (20.5–23.4)	23.38 ± 1.45
Pectoral fin L (in SL)	19.35 (18.4–20.3)	20.6 (20.5–20.8)	21.28 ± 1.28
Pelvic disc L (in SL)	12.55 (12.4–12.7)	14.86 (14.3–15.2)	15.30 ± 0.68
BD at pelvic (in SL)	10.7 (10.3–11.1)	16.56 (15.6–17.6)	14.8 ± 1.15
BD at anal (in SL)	12.7	16.93 (14.7–20.5)	15.1 ± 2.42
BW at anal (in SL)	8.55 (8.2–8.9)	12.13 (11.1–12.7)	10.7 ± 1.45
CPD (in SL)	10.4 (10.1–10.7)	11.03 (10.8–11.2)	10.08 ± 1.27
Snout length (in HL)	22.0 (19.4–24.6)	30.33 (26.4–34)	23.36 ± 6.4
Eye diameter (in HL)	27 (26.3–27.7)	25.0 (24.5–26.0)	26.9 ± 6.26
Postorbital L (in HL)	48.7 (47.4–50)	43.4 (41.5–46.9)	46.16 ± 5.12
Cheek depth (in HL)	13.45 (11.1–15.8)	17.1 (15.1–20)	19.13 ± 3.08
Head width (in HL)	56.8 (54.4–59.2)	62.5 (60.3–66)	67.8 ± 8.24
PDL (in PD-Anus)	45.55 (43.4–47.7)	55.5 (51.6–61.1)	61.7 ± 4.56
Scales in long. ser.	28–31	27–29	24–28
Scales in trans. ser.	9	9	9
Pre-dorsal scales	3–10?	6–11	4–6
D1 rays	VI	VI	VI
D2 rays	I, 10	I, 10	I, 10 (9)
Anal rays	I, 10 (9?)	I, 10	I, 10 (9)
Pectoral rays	14	14	14
Caudal (branched) rays	13 (14?)	13	13

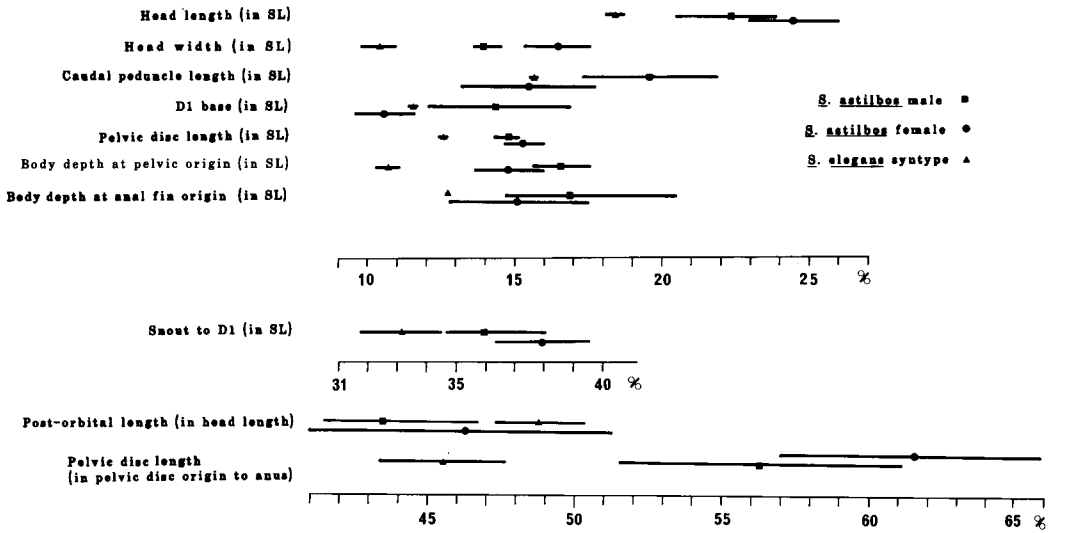

Fig. 2. Mean and range of selected morphometric characters of *Stiphodon elegans* syntypes (triangles), *S. astilbos* males (squares), and mean ± 2S.D. of *S. astilbos* females (circles), all expressed as percentage of indicated relative length in their respective lower scales. SL, standard length.

pectoral to caudal peduncle. Six predorsal scales in poorly differentiated rows.

Colour in life: belly reflective silver, a broad dark blue/grey line runs from axil of pectoral to caudal base along the flanks. A dot on base of pectoral and dark area on operculum join lateral band to single bar around margin of upper lip and eye base. Lower flanks, dorsal surface and head all a nondescript brown grey. No evidence of barring or any other lateral bands. Pectoral fin and the first dorsal fin clear, the second dorsal fin a smoky grey. Anal smoky grey with thin dark band near fin edge, fin margin light grey. Pelvic disc white with a dark brown patch on anterior dorsal surface. Large dark grey spot on base of caudal which lightens, extends into a median bar, and runs to caudal margin. Colour in alcohol after three years storage, slightly lighter than in life.

Female paratype. In life, female paratypes have silver bellies. Background colour on flanks and head light yellow/brown. A pronounced dark brown bar runs along margin of upper lip, touches base of eye and across operculum to pectoral base, a small dark spot on upper edge of pectoral base connects bar with a midlateral band running to caudal base. A thin dorso-lateral band runs from central eye margin to dorsal part of caudal peduncle. Some brown speckling on dorsal surface, but very light on head restricted to a few melanophores. A dark brown spot on middle 5 caudal rays. All other fins clear or slightly opalescent except for pelvic disc which may have dark brown patches on anterior dorsal surface. Colour in alcohol similar.

Osteology (Fig. 3). As only two specimens were cleared and stained (one male and one female) the amount of individual variability is unknown, and unfortunately it was not possible to clear and stain any of the syntypes for comparative purposes. Useful descriptive features appear to be the possession of two fossae in the dentary, one anterior below large canine tooth, the larger at base of articular process (compare with illustration given by Sakai and Nakamura, 1979). The reduced lachrymal possesses a dorso-anterior fossa while the lateral ethmoid has two pronounced latero-anterior spines. The haemal spine of the caudal

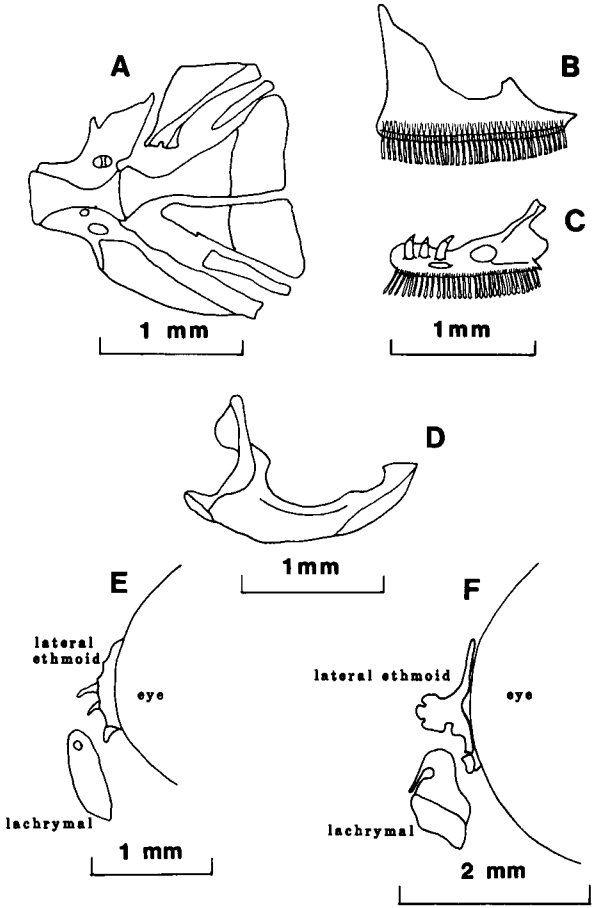

Fig. 3. Osteological features of *Stiphodon astilbos* sp. nov. (A–E) and *S. elegans*? from Tahiti (F). A, caudal skeleton; B, premaxilla; C, dentary; D, maxilla; E, lateral ethmoid and lachrymal of *S. astilbos*; F, lateral ethmoid and lachrymal of *S. elegans*?

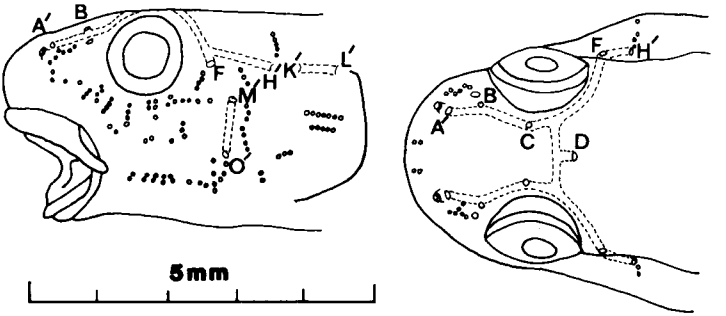

Fig. 4. *Stiphodon astilbos* sp. nov. Sensory canal structure and canal pores and papillae (pit organ) arrangements.

skeleton has one small and one large fossae.

Pores and papillae (Fig. 4). The pores of *S. astilbos* are the same as in most of the

Sicydiaphiinae but the papillae show differences from the pattern given by Akihito *et al.* (1984) for Japanese *S. elegans*. There were no discernible papillae on the syntypes, it is assumed that they have been lost due to handling and long term alcohol storage. The pore pattern appeared to be the same as in other sicydiaphiines (Sakai and Nakamura, 1979).

Systematic Status

Related to *S. elegans* by characters outlined by Weber (1895). It cannot be separated from *S. elegans* by fin ray counts. Steindachner gives D_2 as I, 11 in *S. elegans* but in the two syntypes examined there appeared to be only I, 10. Best characters for separating the two species are the relatively longer head, snout to D_1, and pelvic disc length in *S. astilbos*, refer to Table 1 and Fig. 2. Some osteological characters may be useful for the same purpose. In presumed *S. elegans* from Tahiti the fossa in the lachrymal is not fully closed giving a fish hook like appearance and the processes on the lateral ethmoid are elaborate (Fig. 3F).

Colour pattern readily separates *S. astilbos* from *S. elegans*. There is only one bar on snout compared with 2 bars in *S. elegans*. Colour dull with no iridescent scales, all *Stiphodon* from the Society Islands are reported as possessing brightly reflective green/gold scales in the males (Herre, 1936b; personal observation).

Etymology. The nomen *stilbos* from the Greek meaning shining or bright, prefixed by *a* meaning not, hence *astilbos* not bright, dull, a reference to the nondescript colouration of the male.

Discussion

Stiphodon taxa have been reported from almost all high volcanic islands in the tropical Pacific (Fowler, 1928; Schultz, 1943; Koumans, 1953; Ryan, 1980). Some male specimens from Ponape are blue (Maciolek, pers. comm.) and look quite different from Fiji specimens or the illustration of *S. elegans* in Akihito *et al.* (1984). Morphometric characters are of only limited use in distinguishing taxa. This is due to the relatively uniform proportions of the genus and to the age of the syntypes. Proportions obviously change with long term alcohol storage, and measurements based on soft rather than bony areas are not likely to be useful. *S. astilbos* and *S. elegans* are markedly different in head length and length from snout to the first dorsal fin. Osteological characters are useful, but without cleared and stained syntypes the only alternative is radiographs which are unlikely to show fine enough detail. Even the original colour description of *S. elegans* is inadequate and is probably based on preserved specimens. This is particularly unfortunate as colour, as well as colour pattern, (particularly in reproductive males), is a useful diagnostic feature.

The situation is made even more complicated by *S. stevensoni* (Jordan et Seale, 1906). *S. stevensoni* have been collected sympatrically with *S. elegans* in Fiji and in the Cook Islands. In most cases it is a relatively simple matter to separate the males of the two taxa but the females are practically indistinguishable and to make matters more complex there appear to be occasional males that are intermediate between *S. stevensoni* and *S. elegans*. To compound the confusion there are some male individuals of *S. stevensoni* which have the female colouration and could be undergoing sex reversal. While *S. stevensoni* and *S. elegans* in Japanese waters may be distinct, it is not certain that the same is true in Fiji and the Cook Islands. It seems possible that small males with the colour pattern of *S. elegans* may change as they grow bigger into the pattern seen in *S. stevensoni*. There are precedents for gobies as described by Miller (1984). A good series of *Stiphodon* has been collected from the Cook Islands and it is hoped

that an osteological examination as well as field behavioural observations may resolve the problem.

If the breeding biology of *Stiphodon* is the same as many other Sicydiaphiinae (Manacop, 1953; Dotu and Mito, 1955) then speciation is likely to occur, particularly in widely separated oceanic islands. Larval sicydiaphiines presumably remain close to their home stream while feeding within the lagoon. Some are undoubtedly lost and may be transported large distances by currents. Only high volcanic islands possess the required streams for colonization and not all streams are suitable. *S. astilbos* was found in only one of the large number of streams that were examined around Santo (Luganville). On the island of Efate, also in Vanuatu, a different *Stiphodon* taxon was found but only in two streams although every stream that crossed the coastal ring road was examined. Unlike larval reef fish, the chance of a vagrant larval sicydiaphiine reaching a hospitable environment is remote. Gene flow between islands is therefore likely to be negligible. Differential selection pressures and genetic drift may promote speciation. Even within the relatively compact Fiji group it is possible to recognise morphs from different islands.

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