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# *Pseudanthias tequila*, a new species of anthiadine serranid from the Ogasawara and Mariana Islands

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## Abstract

*Pseudanthias tequila* is described on the basis of two specimens from the Ogasawara Islands. It also is recorded from the Mariana Islands on the basis of colour photographs. The species belongs to a complex that includes *P. randalli* (Lubbock & Allen), *P. pulcherrimus* Heemstra & Randall, *P. flavicauda* Randall & Pyle, *P. oumati* Williams, Delrieu-Trottin & Planes, and a potentially new species from the Line Islands. Species within the complex are distinguished on the basis of male live colouration, morphometric details and gill-raker and scale counts. Colour photos of all five species are provided.

**Keywords:** taxonomy, ichthyology, Japan, Micronesia

## Introduction

The anthiadine serranid genus *Pseudanthias* Bleeker (1871) consists of small, planktivorous fishes found on coral and rocky reefs throughout the Indo-Pacific. Species are often associated with relatively deep reefs, and may be poorly represented in museum collections. Randall & Pyle (2001) listed 69 nominal species in the genus, of which 55 were considered valid. Five other species have been described since (Randall 2011, Heemstra & Akhilesh 2012, Allen & Erdmann 2012, Williams *et al.* 2013). We herein describe an additional species, which has been photographed and collected from the Ogasawara and Mariana Islands.

## Materials and methods

Measurements were recorded to the nearest 0.1 mm using digital calipers. All measurements to the snout tip were made to the mid-anterior part of the upper lip. Lengths of specimens are given in mm standard length (SL), which was measured from the snout tip to the middle of the caudal peduncle at the vertical through the posterior edge of the dorsal hypural plate. Head length was measured from the snout tip to the posteriormost edge of the opercular membrane. Snout length was measured over the shortest distance from the snout tip to the orbital rim. Orbit diameter was measured as the horizontal width of the bony orbit. Bony interorbital width was measured where least. Upper jaw length was measured from the snout tip to the posterior edge of the maxilla. Maxilla width was measured where greatest. Predorsal, preanal and prepelvic lengths were measured from the snout tip to the base of the first spine of the relevant fin. Body width was measured at the bases of the pectoral fins. Caudal peduncle length was measured from the base of the last anal-fin ray to the ventral edge of the caudal fin at the vertical though the posterior edge of the ventral hypural plate. Caudal peduncle depth was measured where least. Pectoral fin length was measured as the length of the longest middle ray. Caudal fin length was measured horizontally from the hypural crease to the tip of the longest ray. Caudal concavity is the horizontal distance from verticals at the tips of the shortest and longest caudal rays. Lengths of fin spines exclude filamentous tips.

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The last ray in the dorsal and anal fins is divided at its base and was counted as a single ray. Counts of principal caudal-fin rays follow Gill *et al.* (2016): the uppermost principal caudal-fin ray is the ray articulating with hypural 5, and the lowermost principal caudal-fin ray is the ray articulating between the distal tips of the parhypural and the haemal spine of preural centrum 2. Counts of principal and branched caudal-fin rays are presented in the form upper + lower, where the upper rays are those associated with hypurals 3–5, and lower rays are those associated with hypurals 1–2 and the parhypural. Procurrent caudal-fin rays are those dorsal and ventral to the principal rays. Gill-raker counts were of the outer rakers on the first arch, including rudiments; the angle raker is included in the lower-limb (second) count. Counts of pseudobranch filaments included all rudiments.

Osteological details were determined from x-radiographs. Vertebral counts are presented as precaudal + caudal. The anterior-most vertebra with a haemal spine was considered as the first caudal vertebra, the urostylar complex as the last. Terminology of intermuscular bones follows Patterson & Johnson (1995) and Johnson & Patterson (2001). The predorsal formula, for configuration of supraneural, dorsal pterygiophores and neural spines, follows Ahlstrom *et al.* (1976).

In the description, data are given first for the holotype, followed where different by data for the paratype in parentheses. Where counts were recorded bilaterally, both counts are given and separated from each other by a slash; the first count presented is the left count.

Comparison with related species are based mostly on literature accounts, particularly Lubbock & Allen (1978), Randall & Pyle (2001), Heemstra & Akhilesh (2012), Allen & Erdmann (2012) and Williams *et al.* (2013).

Type specimens are deposited at the Kanagawa Prefectural Museum of Natural History (KPM-NI). We used some photographs of the Image Database of Fishes housed at KPM-NI, which are assigned unique numbers with the prefix KPM-NR. Note that owing to zero-padding, a seven-digit number is used for the catalogue number in the fish specimen and the fish image collections of the museum because of the convenience on a database software, but zero suppression is adopted for expression of the essential numbers here.

## ***Pseudanthias tequila*** **new species**

New standard Japanese name: Bonin-hanadai
English common name: Cave anthias
Figures 1–7, Table 1

*Pseudanthias randalli* (*non* Lubbock & Allen, 1978); Myers & Shephard, 1980: 316 (Blue Hole, Orote Peninsula, Guam).
*Pseudanthias* sp.; Myers, 1988: 140 (Guam).
*Pseudanthias* sp. 3; Michael, 1998: 576 (colour photo; Guam).
*Pseudanthias* sp. B; Myers 1999: 109, pl. 35 G (colour photo; Guam).
*Pseudanthias flavicauda* [non Randall & Pyle, 2001]; Myers & Donaldson, 2003: 616 (list, Marianas Islands).
*Pseudanthias* cf *randalli*; Kuiter, 2004: 61, unnumbered colour figs A and B (colour photos; Palau, Saipan and Guam).
*Pseudanthias* cf *flavicauda*; Kuiter & Debelius, 2006: 298 (colour photo; Micronesia).

**Holotype.** KPM-NI 3759, 59.3 mm SL, male, Japan, Ogasawara Islands, Chichi-jima Islands, Ototo-jima Island, 40 m, collected by O. Morishita, 16 March 1997.

**Paratype.** KPM-NI 3758, 31.5 mm SL, female, collected with holotype.

**Diagnosis.** The following combination of characters distinguishes *Pseudanthias tequila* from congeners: dorsal rays X,16; anal rays III,7; pectoral rays 18; third dorsal spine prolonged in males; third segmented anal-fin ray longest; lateral-line scales 46–47; no auxiliary scales on body; interopercle and subopercle with distinct serrations in adults; males in life with upper body beneath anterior part of dorsal fin purple to pink with orange-red stripe, dorsal fin greenish yellow anteriorly, posteriorly red with blue basal area, anterior part of anal fin red, and pelvic fins bright yellow.

**Description.** Dorsal rays X,16, all segmented rays branched; each dorsal fin spine with fleshy pennant extending from tip, this best developed on longest (third) spine; anal rays III,7, all segmented rays branched; pectoral rays 18/18, all rays branched except upper 2/2 and lower 1/1 (2/2); pelvic rays 1,5; principal caudal rays 9 + 8; branched caudal-fin rays 7 + 6; upper procurrent caudal-fin rays 8 (9); lower procurrent caudal rays 8 (9); lateral-line scales too damaged (and regrown) on left side of holotype, 46 on right side (49/48); scales above lateral-line to origin of dorsal fin 5/5; scales above lateral-line to base of fifth dorsal spine 4/4 (3/4); scales below

lateral line to origin of anal fin 18/19 (20/19); circumpeduncular scales not determinable in holotype (24); gill rakers 10 + 23 (8 + 21); branchiostegal rays 7; pseudobranch filaments 16 (10).

Vertebrae 10 + 16; supraneurals 3 (posterior two closely applied in paratype, though still separate); predorsal formula 0/0+0/2/1+1; main shaft (proximal component) of first dorsal pterygiophore roughly perpendicular to long axis of body; no trisegmental pterygiophores associated with dorsal and anal fins; ribs present on vertebrae 3 through 10; epineurals present on vertebrae 1 through 12; paired parapophyses present on first caudal vertebra (see Baldwin 1990: fig. 21B); parhypural and hypurals autogenous; well-developed hypurapophysis on parhypural; epurals 3; single uroneural (posterior uroneural absent); ventral tip of cleithrum with well-developed posteroventral process (Figure 3).

Morphometric values are summarised in Table 1.

**TABLE 1**. Morphometric values for *Pseudanthias tequila* expressed as percentage SL.

| | KPM-NI 3759<br>Holotype | KPM-NI 3758<br>Paratype |
|---|---|---|
| SL (mm) | 59.3 | 31.5 |
| Greatest body depth | 35.2 | 33.7 |
| Body depth at anal-fin origin | 32.5 | 29.5 |
| Body width | 16.7 | 16.5 |
| Head length | 30.9 | 30.8 |
| Snout length | 7.4 | 6.3 |
| Orbit diameter | 9.3 | 11.1 |
| Bony interorbital width | 7.6 | 7.6 |
| Upper jaw length | 15.9 | 14.0 |
| Maxilla width | 5.7 | 5.7 |
| Caudal peduncle length | 21.9 | 24.1 |
| Caudal peduncle depth | 13.3 | 11.7 |
| Predorsal length | 27.5 | 29.5 |
| Preanal length | 62.6 | 60.3 |
| Prepelvic length | 34.1 | 32.4 |
| Dorsal fin base length | 65.8 | 63.2 |
| First dorsal spine | 7.1 | 6.3 |
| Longest dorsal spine (number) | 22.3 (3) | 18.1 (3) |
| First segmented dorsal ray | 15.3 | 15.5 |
| Longest segmented dorsal ray (number) | 17.0 (7) | 16.5 (5) |
| Anal fin base length | 19.4 | 17.5 |
| First anal spine | 7.4 | 8.9 |
| Second anal spine | 18.4 | 20.6 |
| Third anal spine | 16.4 | 16.5 |
| First segmented anal ray | 20.9 | 21.3 |
| Longest segmented anal ray (number) | 24.1 (3) | 23.8 (3) |
| Caudal fin length | 37.9 | 42.5 |
| Caudal concavity | 20.2 | 22.5 |
| Pectoral fin length | 28.0 | 27.3 |
| Pelvic fin spine | 18.9 | 19.7 |
| Pelvic fin length | 28.0 | 28.6 |

**FIGURE 1.** *Pseudanthias tequila* n. sp., KPM-NI 3759, 59.3 mm SL male holotype, Ototo-jima Island, Chichi-jima Islands, Ogasawara Islands, Japan. Photo (KPM-NR 51086B) by H. Senou.

**FIGURE 2.** *Pseudanthias tequila* n. sp., KPM-NI 3758, 31.5 mm SL female paratype, Ototo-jima Island, Chichi-jima Islands, Ogasawara Islands, Japan. Photo (KPM-NR 51087B) by H. Senou.

Mouth large, slightly oblique, posterior margin of maxilla reaching to vertical through posterior edge of pupil; mouth terminal, lower jaw projecting slightly; premaxilla with an enlarged recurved canine anterolaterally, a band of small conical teeth about five rows wide at symphysis reducing to two rows on sides of jaw, with the outer row teeth larger and slightly curved, and the three or four teeth nearest symphysis enlarged and caniniform, lying almost flat against roof of mouth; dentary with an enlarged recurved canine at symphysis, followed by a band of small conical teeth about three or four rows wide; sides of lower jaw with single row of slightly curved, conical teeth, with one or two teeth on middle of jaw greatly enlarged and caniniform; vomer with a triangular patch of small conical teeth, three rows wide in midline; palatine with a narrow band of small conical teeth, two rows wide at widest point; ectopterygoid, mesopterygoid and tongue edentate.

Opercle with 3 flat spines, middle spine longest, upper spine mostly concealed by scales; preopercle with 20 (15) fine serrations on vertical portion, 2 (1) enlarged serrations at angle, and 4 (0) weak serrations on ventral portion; interopercle with 5 (2) relatively large serrations; subopercle with 6 (2) relatively large serrations; posttemporal with 4 (3) fine serrations; supracleithrum with 2 fine serrations. Anterior nostril positioned at middle of snout, tubular with small flap on posterior rim, flap almost reaching posterior nostril when laid back; posterior nostril at mid-upper, anterior border of orbit, covered by thin, narrow membrane anteriorly. No papillae on posterior rim of orbit. Snout of holotype slightly hypertrophied with papillae at symphysis.

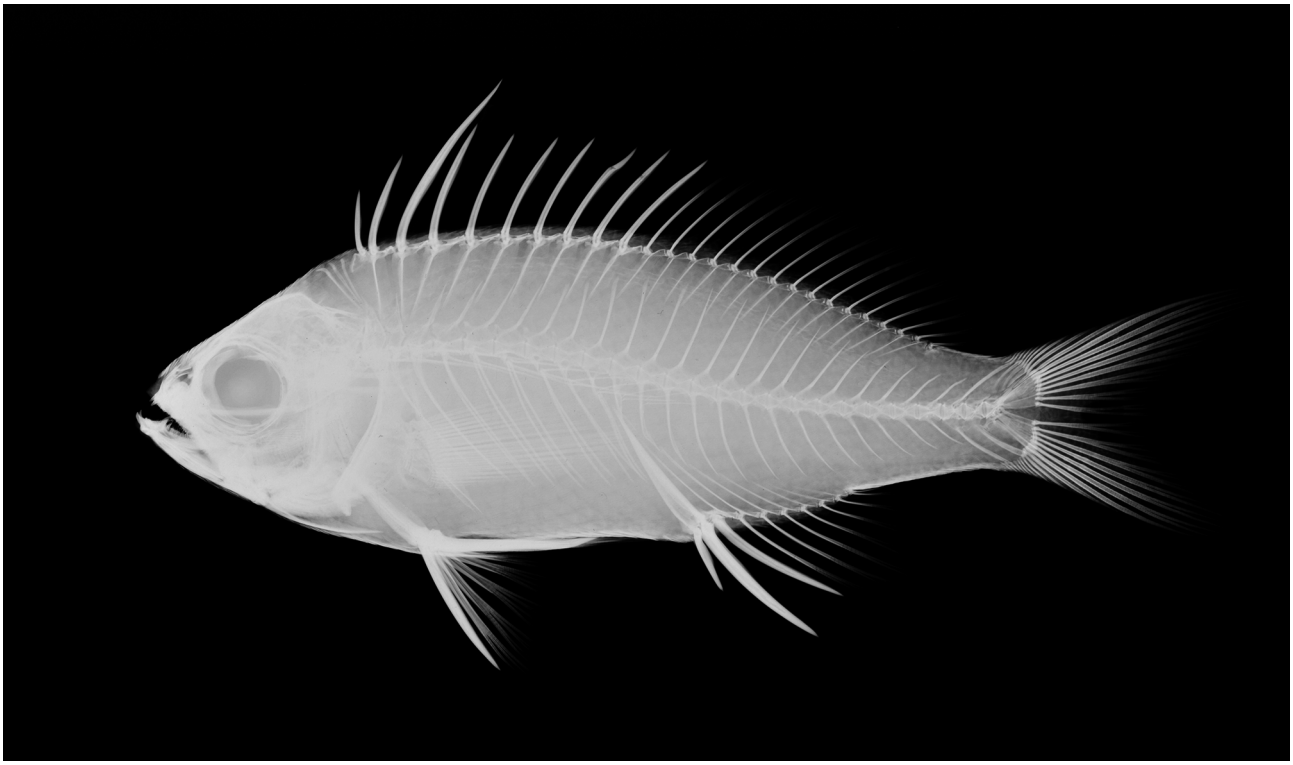

**FIGURE 3.** *Pseudanthias tequila* **n. sp.**, KPM-NI 3759, 59.3 mm SL, holotype, x-radiograph. Radiograph (KPM-NR 51086C) by H. Senou.

Scales ctenoid with peripheral cteni (Roberts 1993); lateral line broadly arched over pectoral fin following body contour to caudal-fin base; head scaled, including dentary, maxilla, snout, and infraorbitals, no scales on lips; no auxiliary scales on body, a few auxiliary scales on cheeks and operculum; low scaly sheath on soft dorsal and anal fins, with indistinct small scales present between segmented rays; caudal fin with scaly basal sheath, with small scales extending over almost all of fin, except for fin tips and posterior part of membranes of middle rays; pectoral fins with basal, wedge-shaped sheath of small scales.

*Colour of males in life* (based on colour photos of holotype when freshly dead, and of live individuals in the Ogasawara and Mariana Islands; Figures 1, 4A & B): head and body purple to pink; bright purple stripe extending from anterior edge of eye around ventral part of orbit to lower part of pectoral-fin base; snout, interorbital area and area above stripe orange to orange-red; indistinct purple stripe sometimes present from behind middle of eye to upper part of pectoral fin base; iris orange to purple, bright yellow around pupil; upper part of body with broad orange-red stripe extending from behind head to caudal peduncle; similar orange-red stripe extending from pectoral-fin base along midside to caudal peduncle; scales on nape and body often dark basally; dorsal fin greenish yellow in front of eighth to tenth spine, bright red posteriorly, with bright blue base and distal margin; anal fin bright red anteriorly, with bright blue wedge extending from near base of first segmented ray to posterior part of fin, distal margin of red region narrowly edged with bright blue; caudal fin variable (probably mood induced), either bright yellow, greenish yellow with purple base, or solid purple, the upper and lower edges of fin bright blue; pelvic fins bright yellow, with spine dusky red to bright orange-red; pectoral fins orangish hyaline.

*Colour of females in life* (based on colour photos of paratype when freshly dead, and of live individuals in the Ogasawara and Mariana Islands; Figures 2, 5 & 6): head and body purple to orange-pink; snout, lips and upper part of head yellow-grey to bright yellow; iris yellow with submarginal purple ring around pupil; scales of nape and body purplish grey or brown to bright red basally; caudal peduncle yellow; dorsal fin greenish to yellowish hyaline anteriorly, reddish to greenish hyaline posteriorly, with bright purple-blue distal margin; anal fin red to yellow anteriorly, becoming reddish hyaline posteriorly, with bright purple-blue leading edge of fin; caudal fin bright yellow, yellowish hyaline distally on central rays, with upper and lower edges of fin narrowly bright purple-blue; pelvic fins yellowish hyaline, bright purple-blue on leading edge; pectoral fins pinkish to orangish hyaline.

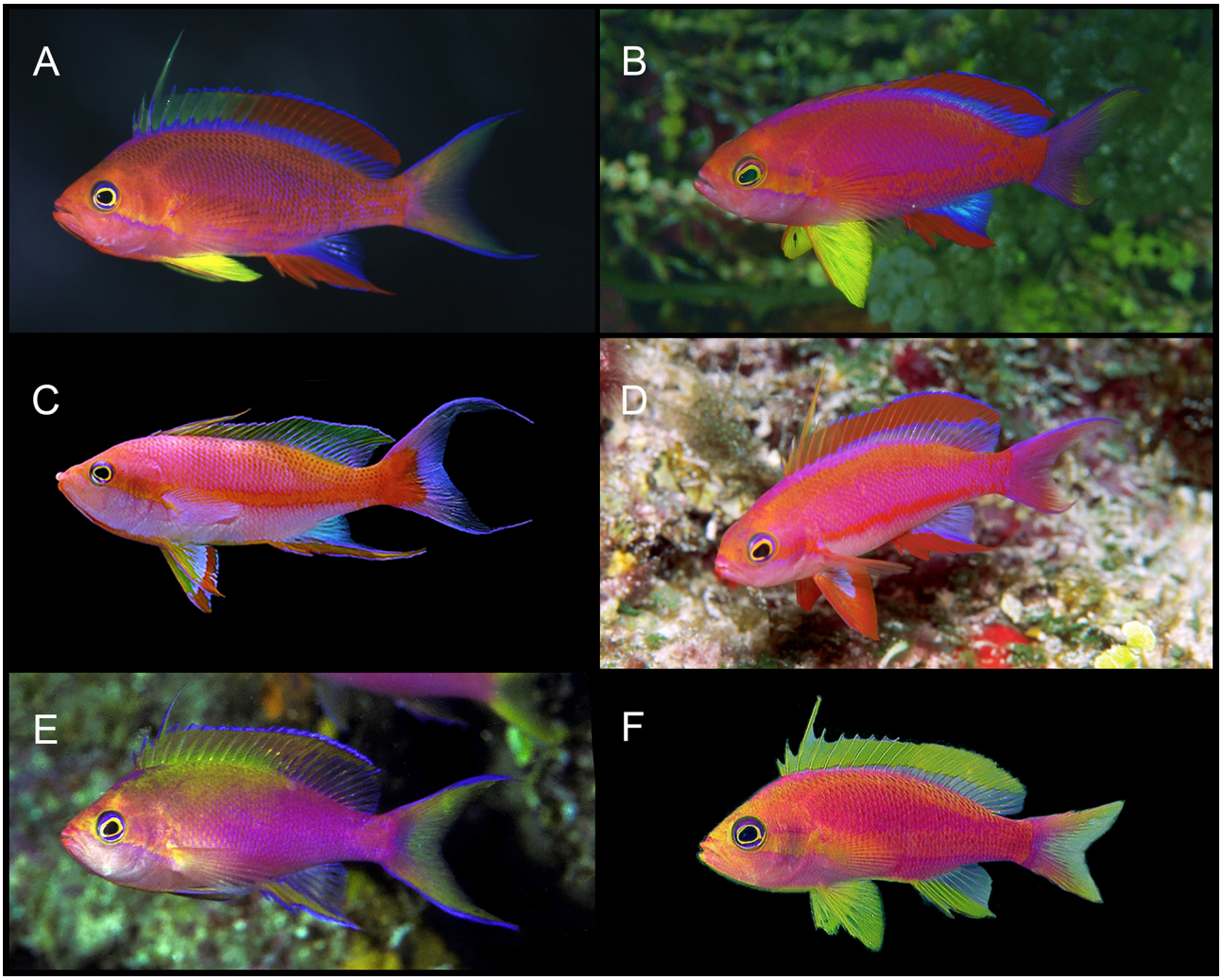


**FIGURE 4.** Males of selected *Pseudanthias* species: A) *P. tequila* n. sp., Ototo-jima, Chichi-jima Islands, Ogasawara Islands, Japan (KPM-NR 179391A, photo by O. Morishita); B) *P. tequila* n. sp., Tinian, Mariana Islands (photo by N. Tsuji); C) *P. pulcherrimus*, aquarium specimen (not retained) from the Maldives (photo by Y.K. Tea); D) *P. randalli*, Kwajalein, Marshall Islands (photo by J. Johnson); E) *P. flavicauda*, Fiji (photo by J.E. Randall); F) *P.* sp., Kirimati, Kiribati (photo by D.J. Linehan).

*Colour in preservative*: both sexes generally pale tan, lighter ventrally; basal markings on nape and body scales remain, becoming greyish brown; other markings on body and fins obsolete.

**Habitat and distribution.** *Pseudanthias tequila* is described on the basis of two specimens from Ototo-jima, Chichi-jima Islands, Ogasawara Islands, Japan. We also record it from Guam, Saipan and Tinian in the Mariana Islands on the basis of photographs (Figure 7). Kuiter's (2004) photograph of an individual of "*Pseudanthias* cf *randalli*", stated to be from Palau, is referable to *P. tequila*. However, R.F. Myers (pers. comm.) advised us that the photograph, by Hiroyuki Kimura, is actually from Saipan. Other photographs from Palau are referrable to the closely related *P. randalli* (Lubbock & Allen, 1978). The original description of *P. randalli* also included paratypes from Palau. *Pseudanthias tequila* appears to be mostly found in caves on reef slopes in 40–60 m, earning it the popular name of "cave anthias". In Saipan and Tinian, however, it occurs in the open on reef slopes dominated by *Halimeda* and *Caulerpa* algae (Figures 4B & 6).

**Comparisons.** *Pseudanthias tequila* most closely resembles *P. randalli* (Lubbock & Allen, 1978) from the West Pacific, *P. pulcherrimus* Heemstra & Randall (1986) from the Indian Ocean, *P. flavicauda* Randall & Pyle (2001) from the south-west Pacific, and *P. oumati* Williams, Delrieu-Trottin & Planes (2013) from the Marquesas. The five species share the following combination of characters: dorsal rays usually X,16; anal rays usually III,7; third dorsal spine prolonged at least in males; third segmented anal-fin ray longest; lateral-line scales 40–50; no auxiliary scales on body; and interopercle and subopercle with distinct serrations in adults. Males of *P. tequila*, *P.*

*flavicauda, P. randalli* and *P. pulcherrimus* are also unusual in exhibiting weak to pronounced hypertrophy of the upper lip (see Remarks below). The condition of the upper lip is unknown in *P. oumati*, as the species is known only from the female holotype.

**FIGURE 5.** *Pseudanthias tequila* n. sp., female, Ototo-jima, Chichi-jima Islands, Ogasawara Islands, Japan. Photo by S. Kobayashi.

*Pseudanthias tequila* is distinguished from at least *P. randalli*, *P. pulcherrimus* and *P. flavicauda* by male live colouration. The live colouration of the single known female specimen of *P. oumati* is distinctive in being more-or-less uniformly yellow. Williams *et al.* (2013) noted that the holotype was collected from a group of similarly coloured individuals. Given that *Pseudanthias* species are protogynous hermaphrodites that typically live in shoals consisting of female and juvenile individuals guarded by a smaller number of males, it is likely that the shoal observed by Williams *et al.* included at least one male, and that males of the species are also predominantly yellow. Males of the remaining species are shown in Figure 4. We also include an additional, undescribed species in the figure. That species, hereafter termed *Pseudanthias* sp., is known on the basis of aquarium specimens collected from Kirimati in the Line Islands. Male colouration characters distinguishing the five species are summarised in Table 2.

Aside from live colouration, *P. tequila* differs: from *P. flavicauda* in being deeper bodied (33.7–35.2 vs 30.1–32.5 % SL), with a longer second anal-fin spine (18.4–20.6 vs 16.8–17.6 % SL), and fewer circumpeduncular scales (24 vs 26–27); from *P. oumati* in being shallower bodied (33.7–35.2 vs 40 % SL), with fewer lower limb gill rakers (21–23 vs 28) and fewer circumpeduncular scales (24 vs 27); from *P. randalli* in having a shorter predorsal length (27.5–29.5 vs 30.2–32.4 % SL), a longer second anal-fin spine (18.4–20.6 vs 15.5 –17.0 % SL) and more pectoral-fin rays (18 vs 16-18, usually 17); and from *P. pulcherrimus* in having more lateral-line scales (46–49 versus 40–45).

In describing *P. mica* from Lembatta Island (Lesser Sunda Islands, Indonesia), Allen & Erdmann (2012) suggested a close relationship to *P. randalli* and *P. pulcherrimus*. Williams *et al.* (2013) also suggested a close relationship between the three species and *P. oumati*. However, aside from several minor differences (such as number of gill rakers), Allen & Erdmann's description of *P. mica* agrees well with Katayama & Masuda's (1982) original description of *Anthias leucozonus* (now *Pseudanthias leucozonus*) from southern Japan, and it is highly

probable that the two species are closely related. Both nominal species depart from *P. tequila, P. oumati, P. randalli* and *P. pulcherrimus* in having fewer lateral-lines scales (36–38 versus 40–50).

**Etymology.** The specific epithet refers to the alcoholic beverage tequila sunrise, alluding to the vibrant life colours of the males of the species. To be treated as a noun in apposition.

**TABLE 2.** Summary of male live colouration characters for selected *Pseudanthias* species.

| | *P. flavicauda* | *P. pulcherrimus* | *P. randalli* | *P. tequila* | *P.* sp. |
|---|---|---|---|---|---|
| Upper body beneath anterior part of dorsal fin | Mostly yellow | Purple to pink with orange-red stripe | Purple to pink with orange-red stripe | Purple to pink with orange-red stripe | Purple to pink with orange-red stripe |
| Dorsal fin | Yellow, with purple/blue basal area posteriorly | Greenish yellow with blue basal area posteriorly | Orange-red anteriorly, posteriorly red with blue basal area | Greenish yellow anteriorly, posteriorly red with blue basal area | Yellow, with purple/blue basal area posteriorly |
| Anterior part of anal fin | Yellow | Yellow to orange-red | Red | Red | Yellow |
| Pelvic fins | Yellowish hyaline with purple leading edge | Yellow to orange anteriorly, bright red posteriorly, with pale blue basal wedge | Bright red, with pale blue basal wedge | Bright yellow | Bright yellow |

**FIGURE 6.** Group of *Pseudanthias tequila* n. sp., Tinian, Mariana Islands, Micronesia. Photo by N. Tsuji.

**Remarks.** Placement of the new species in *Pseudanthias* should be regarded as provisional. The genus is poorly diagnosed and preliminary analysis of morphological characters by the first author suggests some species currently included in the genus may be more closely related to other genera, such as *Nemanthias* Smith (1954), *Tosana* Smith & Pope (1906), *Tosanoides* Kamohara (1953), *Luzonichthys* Herre (1936), *Rabaulichthys* Allen (1984) and *Anatolanthias* Anderson, Parin & Randall (1990). Classification within the genus is also problematic. Generally species have been assigned to either the nominate subgenus (*Pseudanthias*) or to the subgenus *Mirolabrichthys* Herre (1927). Randall & Lubbock (1981) recognised the latter on the basis of a single character, upper lip of males hypertrophied. However, Randall & Pyle (2001) noted that this character is expressed to an intermediate degree in *P. flavicauda*, and Heemstra & Akhilesh (2012) reported similar development of the upper lip in *P. pulcherrimus*. Various degrees of hypertrophy also occur in at least *P. randalli* and *P. tequila*. This might be taken as evidence for placing all four species (and possibly *P. oumati*, for which males are unknown) in the subgenus *Mirolabrichthys*. However, upper lip hypertrophy also occurs in *Nemanthias*. Moreover, taken in the context of other characters (including specialisations associated with orientation of the first dorsal pterygiophore, pectoral ray ornamentation, number of epineural bones, and predorsal formulae), *Mirolabrichthys* as diagnosed by Randall & Lubbock (1981) does not appear to be monophyletic, and hypertrophy appears to have arisen multiple times within anthiadines. Preliminary molecular studies also support this conclusion (e.g. Williams *et al.* 2013: fig. 13).

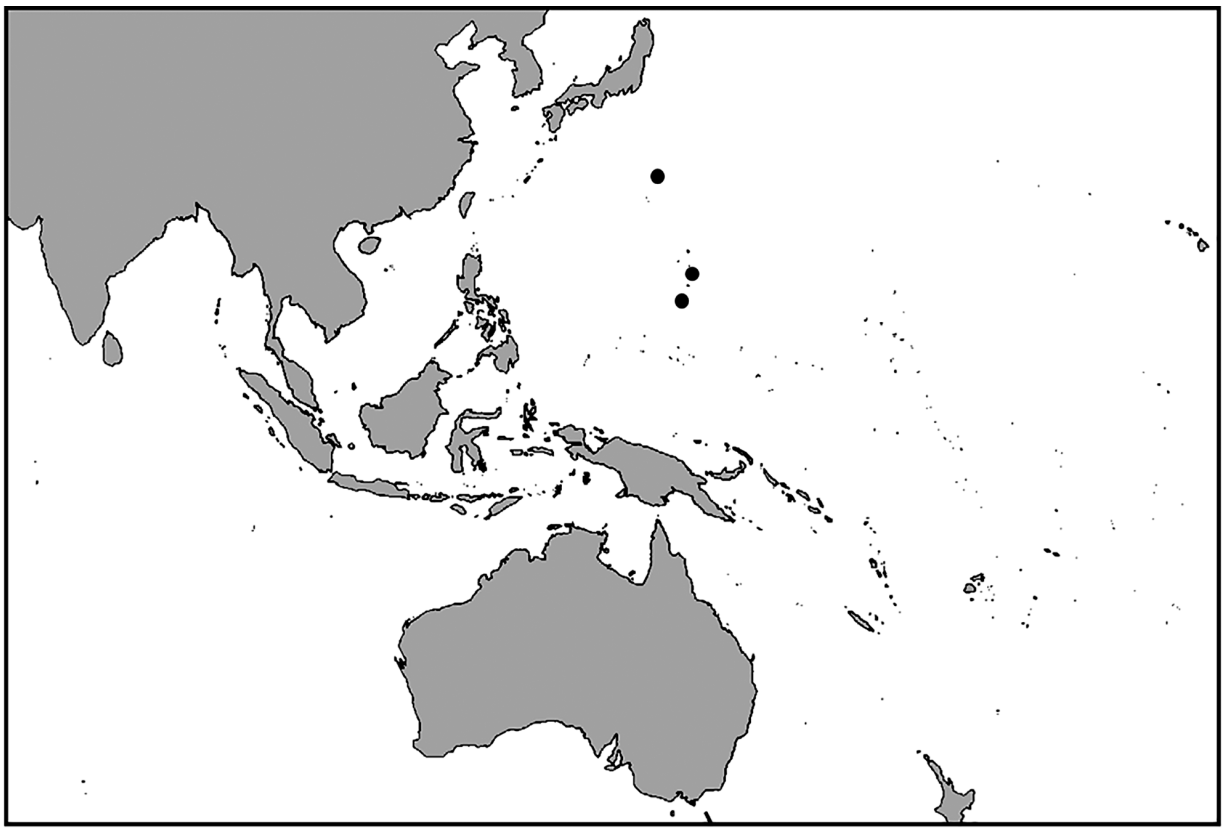

**FIGURE 7.** Distribution records for *Pseudanthias tequila*.


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