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Myersina balteata, a new shrimp-associated goby (Teleostei: Gobiidae) from Guadalcanal, Solomon Islands

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Abstract

A new species of alpheid-shrimp-associated goby is described from Guadalcanal in the Solomon Islands based on the holotype (49.1 mm SL male) taken at a depth of 54 m. Diagnostic features include a dark longitudinal stripe extending midlaterally along the head and body from the eye to the caudal-fin base; the body crossed by a wide gray bar at midbody; the dorsal fins with yellow spots, and yellow margins on first dorsal fin; narrow yellow lines on the postorbital side of head behind the eye; the first dorsal fin of moderate height, less than head length; 20 scales on the predorsal midline; scales in the longitudinal series 62; dorsal-fin elements VI-I,10; anal-fin elements I,9; and the gill membranes fused together and to the isthmus along the ventral midline. A key to the species is provided. The relationship between *Myersina* and *Cryptocentrus* is discussed.

Key words: taxonomy, systematics, ichthyology, coral-reef fishes, gobies, alpheid shrimp, symbiosis, Pacific Ocean, biogeography *Cryptocentrus*.

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Introduction

Myersina Herre, 1934 was described for *Myersina macrostoma* Herre, 1934 from the Philippines. Since that time, 8 more species have been described or placed in that genus: *M. adonis* Shibukawa & Satapoomin, 2006; *M. crocata* (Wongratana, 1975); *M. filifer* (Valenciennes, 1837); *M. lachneri* Hoese & Lubbock, 1982; *M. larsonae* Allen, 1999 (subsequently placed in *Stonogobiops*); *M. nigrivirgata* Akihito & Meguro, 1983; *M. pretoriusi* (Smith, 1958), and *M. yangii* (Chen, 1960). *Gobius papuanus* (Peters, 1877) was listed as *Myersina papuanus* by Larson & Murdy (2001); however Hoese *et al*. (2016) have identified it as a synonym of *Tomiyamichthys russus*. Winterbottom (2002) reviewed the history of the genus, providing a diagnosis, a key to the then known species, and a distribution map.

In 1973, the second author collected fishes while on the dive vessel *El Torito* at the Solomon Islands. On a dive at Guadalcanal, near the stern of the wreck of a Japanese transport ship at 54 m, he speared a goby near a burrow in silty sand that appeared to have been made by an alpheid shrimp, although no shrimp was seen. The fish is described here as a new species.

Materials and Methods

The holotype is deposited at the Bernice P. Bishop Museum in Honolulu, HI, USA (BPBM).

Lengths are given as standard length (SL), measured from the median anterior point of the upper lip to the base of the caudal fin (posterior end of the hypural plate); body depth is measured at both the origin of the pelvic fins and the origin of the anal fin, and body width at the origin of the pectoral fins; head length (HL) is taken from the upper lip to the posterior end of the opercular membrane, and head width over the posterior margin of the preoperculum; nape width is the distance between the dorsalmost ends of the gill openings; orbit diameter is the greatest fleshy diameter, and interorbital width the least bony width; snout length is measured from the median anterior point of the upper lip to the nearest fleshy edge of the orbit; upper-jaw length from the same anterior point to the posterior end of the maxilla; cheek depth is the least depth measured perpendicular from the ventral edge of the suborbital region to the fleshy edge of the orbit; caudal-peduncle depth is the least depth, and caudal-peduncle length the horizontal distance between verticals at the rear base of the anal fin and the caudal-fin base; lengths of bases of the dorsal and anal fins is from the anterior base of the first spine to the point where the membrane behind the last ray contacts the body; lengths of spines and rays are measured from the anterior base to the extreme tip; caudal- and pectoral-fin lengths are the length of the longest ray; pelvic-fin length is measured from the base of the pelvic-fin spine to the tip of the longest pelvic-fin soft ray; the pelvic-fin frenum is measured as the least height. Morphometric data presented as percentage of the standard length given in Table 1.

Scales in the longitudinal series are counted from the scale above the pectoral-fin base, continuing in a longitudinal row in as straight a line as possible to the posterior edge of the hypural plate, the anterior scales on the body are about one-third the diameter of those on the caudal peduncle, making the anterior scales very difficult to count; scales in the transverse series are counted from the origin of the anal fin anterodorsally to the base of the first dorsal fin and posterodorsally to the base of the second dorsal fin; circumpeduncular scale count is along a zigzag vertical line through the narrowest point of the caudal peduncle; gill rakers are counted on the outer side of the first gill arch, those on the upper limb listed first; rudiments are included in the counts. Terminology and abbreviations for cephalic sensory-canal pores and papillae rows follow those presented by Akihito (1984).

Measurements were made to the nearest 0.1 mm using an ocular micrometer or dial calipers. Cyanine Blue 5R (acid blue 113) stain and an airjet were used to make the cephalic sensory-canal pores, papillae, and scales more obvious (Akihito *et al*. 1993, 2002, Saruwatari *et al*. 1991). The key to the species is modified from Winterbottom (2002). Institutional abbreviations follow Sabaj (2016). "The 7-digit number by zero padding is used for the catalog number in the Kanagawa Prefectural Museum of Natural History because of the convenience of a database software, but zero suppression is adopted for expression of essential number in this paper" (per KPMNH protocol).

Myersina balteata, n. sp.

Belted Shrimpgoby

urn:lsid:zoobank.org:act:92BF49B8-BD5E-4A2A-A204-9414226F29A2

Figures 1–4; Table 1.

Holotype. BPBM 39016, 49.1 mm SL male, Solomon Islands, Guadalcanal, 11 km west of Honiara, about -9.3°, 159.98°, off stern of wreck of Japanese transport ship, 54 m, silty sand, spear, J.E. Randall, 11 July 1973.

Diagnosis. A species of *Myersina* with body crossed by a wide gray bar at midbody and a dark longitudinal stripe extending midlaterally along center of body from head to caudal-fin base; first dorsal fin triangular in shape and of moderate height, 23% SL, anterior spines with yellow margin, not filamentous, yellow spots on basal membranes; second dorsal fin with large diffuse yellow spots on all membranes; postorbital side of head with distinct narrow yellow lines; distal end of maxilla yellow; gill membranes fused together and to isthmus at ventral midline; caudal-fin length 37% SL; dorsal-fin elements VI-I,10; anal-fin elements I,9; pectoral-fin rays 17; 20 scales on predorsal midline; scales in longitudinal series 62; gill rakers 4+13.

Description. Dorsal-fin elements VI-I, 10, none filamentous; all dorsal and anal soft rays branched, last to base; dorsal fin of moderate height (less than HL); anal-fin elements I,9; pectoral-fin rays 17, uppermost and lowermost rays unbranched, 15 branched, longest ray reaching posteriorly to front of second dorsal-fin origin; pelvic-fin elements I,5, 5th ray longest, reaching to just before anus and joined medially with membrane, frenum present and 25% of pelvic-fin length; caudal-fin length 37% SL, branched caudal-fin rays 13, segmented caudal-fin rays 17, upper unsegmented caudal-fin rays 5, lower 4; scales cycloid, increasing in size from anterior to posterior on body; lateral-scale series 62; anterior transverse scales 21; posterior transverse scales 19; circumpeduncular scales 18; predorsal midline scales 20, extending forward to a point midway between eye and posterior edge of preoperculum (Fig. 3); scales on side of nape extending as far forward as midline predorsal scales; pectoral-fin base naked; prepelvic scales extending forward past posteroventral edge of preoperculum; first gill slit open; gill membranes fused together and to isthmus at ventral midline; gill rakers short and slender, less than one-half length of longest filament of first arch; gill rakers on outer limb of first arch 4+13; 18 short rakers on lower limb of second arch; pseudobranch with 4 short fleshy lobes.

Figure 1. *Myersina balteata*, fresh holotype, 49.1 mm SL male, BPBM 39016, Guadacanal, Solomon Islands (J.E. Randall).

Figure 2. *Myersina balteata*, preserved holotype, 49.1 mm SL male, BPBM 39016, Guadacanal, Solomon Islands (D.W. Greenfield).

Body elongate, body depth at pelvic-fin origin 5.3 in SL; body depth at anal-fin origin 5.6 in SL; body width at pectoral-fin origin 3.5 in HL; head length 3.1 in SL; head width 2.7 in HL; snout short, length 5.6 in HL; orbit diameter 4.0 in HL; interorbital space very narrow, least width 19.5 in HL; caudal-peduncle depth 3.2 in HL; caudal-peduncle length 1.8 in HL.

Mouth terminal, oblique, forming angle of about 55° to horizontal axis of body; mouth large, maxilla extending just past posterior edge of orbit; upper-jaw length 1.3 in HL; side of upper jaw with outer row of small, conical, curved teeth, 4 large, posteriorly curved teeth at front of upper jaw, parallel to roof of mouth; lower jaw with 4 rows of small, curved, conical teeth and fifth inner row of larger curved teeth; no teeth on vomer; tongue with broadly rounded tip; no distinct mental flap. Posterior nares large, round, in front of eye at level of pupil center; anterior narial tube anteroventral to posterior naris, just reaching posterior margin of upper lip when folded forward.

TABLE 1

Proportional measurements of the holotype of *Myersina balteata*, n. sp. as percentage of the standard length (49.1 mm)

Head length	31.8	Length of 2nd dorsal-fin base	32.6
Head width	11.6	Length of anal-fin base	20.4
Head depth	17.5	Pectoral-fin length	22.4
Snout length	5.7	Pelvic-fin length	22.9
Eye diameter	7.9	Caudal-fin length	36.6
Interorbital width	1.6	Length of 1st spine of 1st dorsal fin	21.4
Least distance jaw to eye	2.0	Length of 2nd spine of 1st dorsal fin	23.4
Nape width	12.0	Length of 3rd spine of 1st dorsal fin	21.4
Jaw length	15.2	Length of 4th spine of 1st dorsal fin	15.9
Body depth at pelvic-fin origin	18.7	Length of spine of 2nd dorsal fin	12.1
Body depth at anal-fin origin	17.7	Length of first ray of 2nd dorsal fin	24
Body width	9.2	Length of longest ray 2nd dorsal fin	21.2
Predorsal length	35.2	Length of anal-fin spine	8.7
Prepelvic length	32.6	Length of 1st anal-fin ray	12
Preanal length	61.7	Length of pelvic-fin spine	9.2
Caudal-peduncle length	17.6	Length of 4th pelvic-fin ray	17.5
Caudal-peduncle depth	10	Length of 5th pelvic-fin ray	19.1
Length of 1st dorsal-fin base	20.3	Height of pelvic-fin frenum	5.7

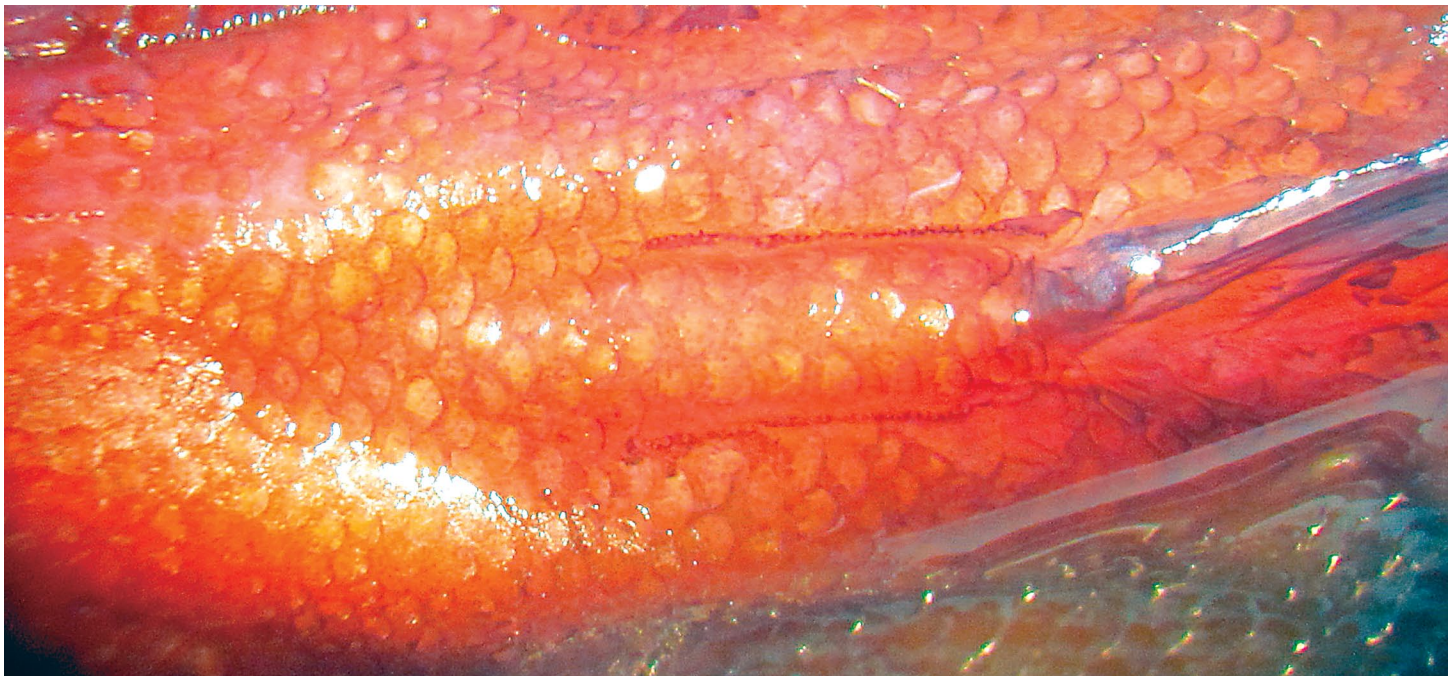

Figure 3. *Myersina balteata*, preserved holotype, predorsal midline scale pattern, BPBM 39016, Guadacanal, Solomon Islands (D.W. Greenfield).

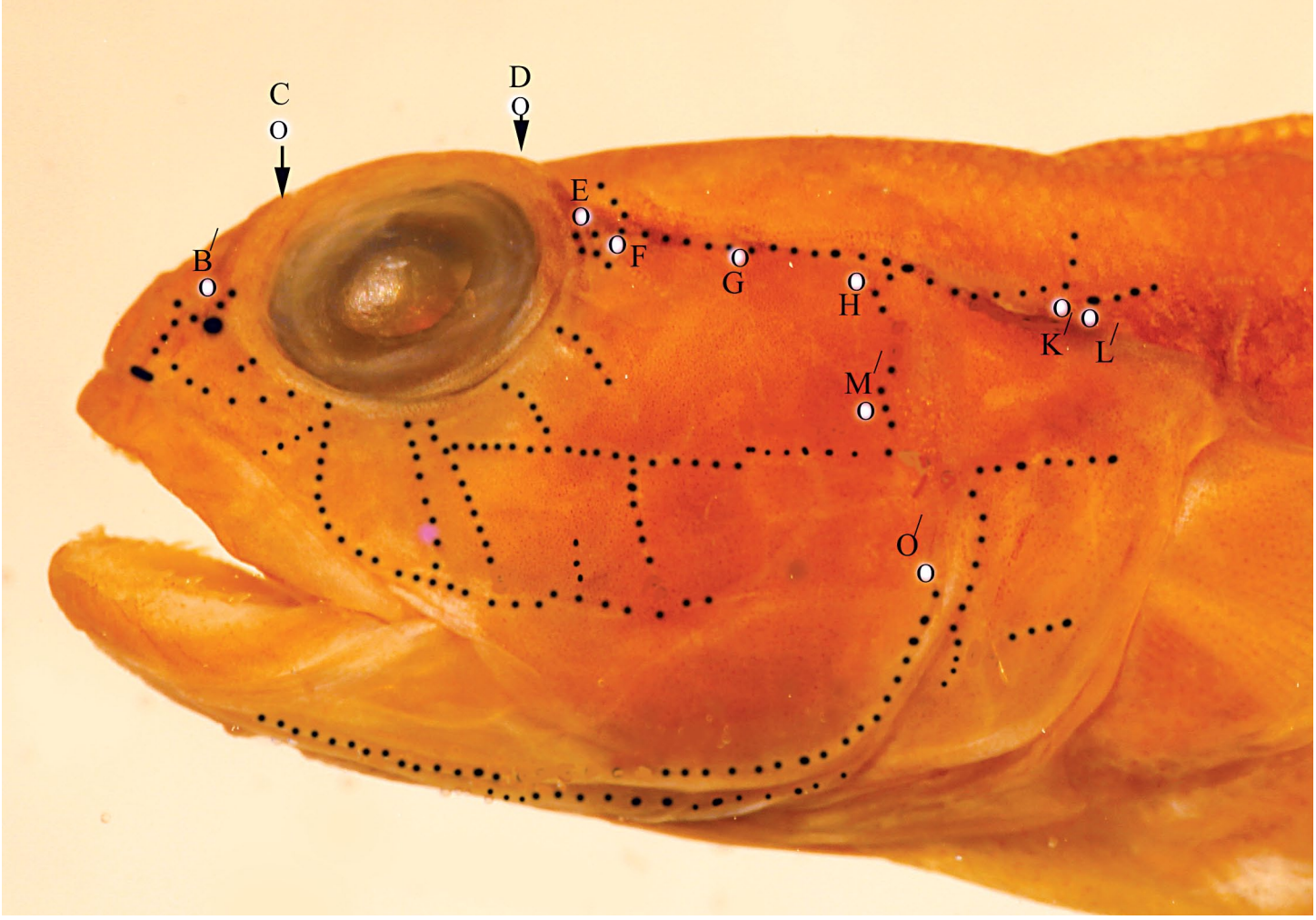

Figure 4. *Myersina balteata*, lateral view of head of holotype, 49.1 mm SL male, BPBM 39016, with cephalic sensory-canal pores and main rows of papillae indicated by white dots and broken lines respectively. Nostrils are shown as larger black spots (D.W. Greenfield).

Pattern of cephalic sensory-canal pores and papilla rows as illustrated in Fig. 4. Anterior oculoscapular-canal pores B´, C (single), D (single), E, F, G, and H´; posterior oculoscapular canal with pores K´ and L´; preopercular-canal with pores M´ and O´. Papillae row b extends anteriorly only to third vertical cheek row.

Color of fresh holotype. (Fig. 1) Color features comprise a dark longitudinal stripe extending midlaterally along head and body from eye to caudal-fin base; body crossed by a wide gray bar, slightly wider than eye, at midbody, extending from first 3 elements of second dorsal fin to around anus and genital papilla in front of anal fin; ventral surface of body below longitudinal dark stripe white; margins of first 4 spines of first dorsal fin yellow; yellowish spots along base of fin; entire second dorsal fin with large diffuse yellow spots; distinct narrow yellow lines on postorbital side of head; posterior end of upper jaw yellow.

Color of preserved holotype. (Fig. 2) After 45 years in preservative, body overall yellowish orange, slightly darker at midbody where dark band is present in life and at caudal-fin base; edges of scales darker, making scale pattern more visible; fins lighter yellow than body, first dorsal fin with membranes of first two spines brown, margins of other spines dark.

Etymology. The specific epithet is from the Latin *balteatus*, meaning 'with a shoulder-band or baldric', in reference to the dark band around the center of the body; it is treated as a feminine adjective.

Comparisons. The new species differs from all described species of *Myersina* in its coloration, and in having 20 scales on the predorsal midline vs. none or a few scattered scales at the midline. *Myersina balteata* has a dark bar across the midbody, wider than the eye, extending from the first 3 elements of the second dorsal fin to the area of the anus and genital papilla in front of anal fin, and a dark longitudinal stripe extending along the lateral midline of the body from the head to the caudal-fin base. The only other described species with a dark bar across the body is *M. yangii*, but in that species the band is narrower, less than the eye diameter, and the other color features are also different. The illustration of *M. yangii* in Chen (1960, Fig. 1) shows a narrow dark bar extending from the end of the first dorsal fin to the anal-fin origin. Senou has an underwater photograph of *M. yangii* from the Philippine Islands, taken by N. Suzuki (http://nh.kanagawa-museum.jp/staff/data/st3.html), that shows a very narrow dark bar followed by a dark area extending to the caudal-fin base (Fig. 5). The photograph also shows the margins of the caudal and pelvic fins blue, a dark spot on the posterior portion of the second dorsal fin, the anal-fin base with a longitudinal yellow stripe, the distal ends of the filamentous dorsal-fin spines blue, and the side of the cheek with distinct narrow blue lines. Allen & Erdmann (2012, p. 881) include a photograph of *M. yangii* (as "Girdled Shrimpgoby, *Myersina* species") from Bali with similar coloration. In addition, Chen (1960) states that the first three spines of the dorsal fin are always produced into a filament, reaching to the end of the second dorsal-fin base and sometimes to the caudal-fin base vs. no filaments; and "nape naked from before the dorsal fin" vs. 20 midline predorsal scales. The divergent features of *M. yangii* were further corroborated by G.R. Allen (pers. comm. 2018) who examined 4 specimens, 37.3–44.6 mm SL, from West Papua (WAM P.34829-001). The dorsal-fin spines of these specimens are variable in length with the first 3–4 notably filamentous, and the posterior spines with at least short filaments; they have noticeably smaller and more numerous scales (89–95 longitudinal scales in the WAM specimens) than *M. balteata* and 11 dorsal-fin rays vs. 10, and 11 anal-fin rays vs. 9.

Myersina pretoriusi also differs in having 11 anal-fin rays as well as a pale elliptical spot greater than the eye diameter in height surrounding the second spine of the first dorsal fin. *Myersina macrostoma* differs by having 9–11 (usually 10) anal-fin rays, a white to yellow lateral stripe down the body, a white stripe below the eye, and a yellow caudal fin with pinkish red streaks.

The remaining species in the genus usually have 9 anal-fin rays, the same count as in *M. balteata*. The first dorsal fin of *M. balteata* is triangular and of moderate height, less than head length vs. greatly elongated, much greater than the head length in *M. adonis* (male only), *M. macrostoma*, and *M. lachneri*. The coloration of the other species also differ: *M. adonis* has a number of dark blotches on the body, a wedge-shaped black spot on the pectoral-fin base, scattered blue spots on the head and body, and a neon-blue blotch on the middle of the basal part of the first dorsal fin; *M. crocata* has yellow-orange spots on the head, pectoral-fin base, and abdomen, the females have 5–6 narrow yellow stripes on the side of the body, and the males have a narrow, dusky brown stripe from the eye to the caudal-fin base; and *M. lachneri* has a white-to-yellow mid-lateral stripe down the body and a dark stripe on the mid-caudal-fin rays.

Myersina nigrivirgata has a dark lateral stripe similar to *M. balteata*, but differs in having 89–120 lateral

Figure 5. *Myersina yangii*, KPM-NR 76222A, Liloan, Cebu Island., Visayas Islands, Philippines, 10 Oct. 2010, ©Kanagawa Prefectural Museum of Natural History (image reversed; Naoshi Suzuki).

scales, the predorsal midline naked or with a few scattered scales, 4–5+17–19 gill rakers on the first arch, and orange to blue spots on the head vs. 62 lateral scales, 20 scales on predorsal midline, 4+13 gill rakers on the first arch, and no blue spots on the head in *M. balteata*. *Myersina filifer* has 80–101 lateral scales and 5 dark bars on the body vs. 62 lateral scales and a single dark bar in *M. balteata*. A number of authors and D. Hoese (pers comm., May 2018) place *Myersina filifer* in *Cryptocentrus* (Eschmeyer *et al*. 2018).

Remarks. The presence of well-developed complete scalation on the midline of the nape of *M. balteata* (see Fig. 3) does not conform with the diagnosis of the genus given by Winterbottom (2002) ("no scales along the midline of the nape") and is more typical of the character state found in *Cryptocentrus* Valenciennes in Cuvier, 1837. The differences between *Myersina* and *Cryptocentrus* do not appear to be clear, as reflected by the comments of both Winterbottom (2002) and Shibukawa & Satapoomin (2006) who agreed that there is no evidence to support the monophyly of *Myersina* as defined by Winterbottom (2002). In his review of the genus, Winterbottom (2002) included species that both had the gill membranes fused together and to the isthmus at the ventral midline and those with the gill membranes fused at the ventral midline but forming a free fold across the isthmus. The type species for the genus, *M. macrostoma*, has a free fold. *Myersina balteata* lacks the free fold. Shibukawa & Satapoomin (2006) reported that the free fold was only present in males and not the females of *M. adonis*.

The cephalic papillae pattern of *M. macrostoma* shows papillae row b extending anteriorly only to the third vertical cheek row, which also is the case for *M. crocata* and *M. nigrivirgata*, whereas it reaches the second cheek row in *Cryptocentrus* (Akihito 1984); however, the drawing in Shibukawa & Satapoomin (2006) of *M. adonis* shows row b reaching the second cheek row. Patterns for the other species in *Myersina* have not been illustrated or described. *Myersina balteata* has row b only reaching the third vertical cheek row as in *M. macrostoma*. D. Hoese (pers. comm., June 2018) has suggested that species of *Myersina* have longer gill rakers and higher gill-raker counts (14–25) than do species of *Cryptocentrus*, and *M. balteata* has 13 gill rakers which are about half the length of the filaments. Detailed measurements of gill-raker lengths are not available for other *Myersina* species for comparison.

Figure 6. *Myersina nigrivirgata*, BPBM 29768, 65.5 mm SL, Lombok, Teluk Sira, Indonesia (J.E. Randall).

Thus, a case could be made for placing the new species either in *Myersina* or *Cryptocentrus*; however, we place more weight on the cephalic papillae pattern in *M. balteata* which is unlike that of *Cryptocentrus*. In addition, the similarity in color pattern of the new species to both *M. yangii* (Fig. 5) and *M. nigrivirgata* (Fig. 6) influenced our decision to classify the species in *Myersina*.

Because of the closeness to *Cryptocentrus*, we also have considered those species in our comparison. Only 5 species of *Cryptocentrus* have lateral scale counts as low as the 62 scales of *M. balteata*: *C. caeruleomaculatus*, *C. cyanospilotus*, *C. epakros*, *C. insignitus*, and *C. strigilliceps*, most having 70–120 (Allen 2015). The live coloration of *M. balteata* clearly differs from these 5 species of *Cryptocentrus*.

We follow Winterbottom (2002) in retaining *M. filifer* in *Myersina* in this discussion, but recognize that should a phylogenetic analysis suggest that this placement is correct, the generic name *Myersina* would need to be changed to *Paragobius* Bleeker, 1872, which has priority. This issue would be moot should it be shown that *M. filifer* actually belongs in *Cryptocentrus*.

Key to the species of *Myersina*

1a. Anal fin with 11 soft rays; body markings as in 2a or 2b 2

1b. Anal fin with 9–10 soft rays; body markings not as in 2a or 2b 3

2a. Narrow (less than eye diameter) midbody dark bar extending from posterior region of first dorsal fin to anal-fin base; no pale spot on second spine of first dorsal fin ..... ***M. yangii***

2b. No dark midbody bar; second spine of first dorsal fin with a pale elliptical spot greater than eye diameter in height ..... ***M. pretoriusi***

3a. First dorsal fin greatly elevated, its height much greater than head length 4

3b. First dorsal fin height not greater than head length 5

4a. Dark stripe on mid caudal-fin rays; white to yellow midlateral stripe along body ..... ***M. lachneri***

4b. No dark stripe on mid caudal-fin rays; no white to yellow midlateral stripe along body, but, if present, also a white stripe below eye 6

5a. A wide (greater than eye diameter) midbody dark bar across body extending from posterior region of first dorsal fin to anal-fin base; margin of first dorsal fin yellow, with yellowish spots along its base; entire second dorsal fin with large diffuse yellow spots; distinct narrow yellow lines on the side of the head; predorsal midline with 20 scales ..... ***M. balteata*, n.sp.**

5b. No midbody dark bar across body; dorsal fins not colored as above; predorsal midline not fully scaled, usually naked 7

6a. Series of dark blotches on side of body; wedge-shaped black spot on pectoral-fin base ..... male ***M. adonis***

6b. No dark blotches on side of body or wedge-shaped black spot on pectoral-fin base; a white to yellow mid-lateral stripe along body; narrow white stripe under eye ..... ***M. macrostoma***

7a. Wedge-shaped black spot on pectoral-fin base; three faint dusky vertical bars on side of belly; minute bright blue spots scattered on head and body in life .....female ***M. adonis***

7b. No wedge-shaped black spot on pectoral-fin base; no vertical bars on belly or scattered blue spots on head and body in life 8

8a. Gill membranes fused at ventral midline but forming a free fold across the isthmus; a well-developed dark, lateral band usually present on body; dorsal fin with a diffuse dark pupil-diameter-sized spot on the distal membrane between fifth and sixth spines ..... ***M. nigrivirgata***

8b. Gill membranes fused together and to the isthmus at ventral midline, no dark lateral band on body 9

9a. Gill rakers on lower limb of first gill arch 11–12; 1–2 dark spots anteriorly on membrane of first dorsal fin near base; pale spots on head light blue in life; body with about five broad diffuse dark bars ..... ***M. filifer***

9b. Gill rakers on lower limb of first gill arch usually 13–14; no discrete dark spots on first dorsal fin; pale spots on head orange in life; usually no broad dark bars on body ..... ***M. crocatus***

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