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Danio tinwini, a new species of spotted danio from northern Myanmar (Teleostei: Cyprinidae)

Sven O. Kullander* and Fang Fang*

Danio tinwini, new species, is described from the upper course of the Mogaung Chaung, a right bank tributary of the Ayeyarwaddy River. It is distinguished from other species of *Danio* above all by the colour pattern, comprised of rows of dark spots along the side, and spotted dorsal, anal, pelvic, and caudal fins. From *D. kyathit*, with similar colour pattern, it is distinguished by the absence of lateral line and rostral barbel. From *D. nigrofasciatus*, which it resembles in small size, absence of lateral line and rostral barbel, and lateral stripe P-1 expressed as a row of spots, it is distinguished by the dorsal-fin count ii.6½ (vs. ii.7½), and stripes P and P+1 expressed as rows of spots instead of as solid stripes. *Danio tinwini* is one of the smallest species of *Danio*, males reaching up to 21.7 mm SL, females up to 25.6 mm SL.

Introduction

The cyprinid fish genus *Danio* includes 15 small species in South and South East Asia (Fang Kullander, 2001; Kullander & Fang, 2009; Kullander et al., 2009). Nine valid species have been reported from Myanmar, including *Danio aesculapii*, *D. albolineatus*, *D. choprae*, *D. erythromicron*, *D. feegradei*, *D. kyathit*, *D. margaritatus*, *D. nigrofasciatus*, and *D. quagga* (Kullander & Fang, 2009; Kullander et al., 2009).

Species of *Danio* have species specific colour patterns, usually in the form of horizontal stripes, more rarely light or dark spots, or vertical bars. *Danio kyathit*, from near Myitkyina on the Ayeyarwaddy River in northern Myanmar is remarkable for its distinctive contrasting colour pattern of dark spots on yellowish ground, although a

striped pattern has also been reported for this species (Fang, 1997; Kullander et al., 2009). Another spotted species, similar to *D. kyathit* in colour pattern, but of much smaller size, has recently been imported as aquarium fish from Myanmar and is marketed as *Danio* sp. “Burma”. Through the courtesy of Tin Win, Hein Aquarium, in Yangon, we have obtained a good series of wild specimens of this species, and the present paper is dedicated to its formal description.

Material and methods

Specimens are kept in the fish collection of the Swedish Museum of Natural History, Stockholm (NRM), and the Museum of Zoology, University of Michigan, Ann Arbor (UMMZ). Measurements

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were taken with digital callipers to a precision of 0.1 mm. Counts and measurements were made according to Fang (1997), and colour pattern terminology follows Fang (1998). Horizontal stripes are identified by alphanumeric annotations: the P stripe is the dark stripe along the middle of the side, those above are numbered P+1, P+2, those below P-1, P-2, P-3; stripes on the anal fin are numbered with the middle one the A stripe, the proximal stripe A+1, and the distal stripe A-1. Fin-ray counts from median fins and vertebral counts were obtained from X-radiographs made with a Philips MG-105 low voltage X-ray unit and Kodak X-Omat V plates. Abdominal vertebrae counts include the Weberian apparatus (assumed to contain four centra). Statistics were calculated using SPSS v. 17 (SPSS, 2008).

Comparative material. *Danio albolineatus* NRM 37308; *D. choprae* NRM 52001; *D. dangila* NRM 51441; *D. erythromicron* NRM 51629; *D. feegradei* NRM 55111; *D. kerri* NRM 36414; *D. kyathit* NRM 50496; *D. margaritatus* NRM 55113; *D. meghalayensis* UMMZ 243666; *D. nigrofasciatus*, NRM 51630; *D. rerio*, NRM 40446; *D. roseus* NRM 44799; and material of *D. aesculapii*, *D. kyathit*, and *D. quagga* already listed in Fang (1998), Kullander & Fang (2009), and Kullander et al. (2009).

Danio tinwini, new species (Fig. 1)

Holotype. NRM 60337, adult male, 21.7 mm SL; Myanmar: Kachin State: Ayeyarwaddy River drainage: stream from Shatrazuyut (Sha Du Zup) village, on the road from Mogaung to Tanai, 25°54'54"N 96°39'48"E; Tin Win & Aung Myint, 20 Feb 2003.

Paratypes. NRM 56838, 39 males, 20.0-21.4 mm SL, 24 females, 20.9-25.6 mm SL; same data as holotype.

Non-types. NRM 49487, 26 males, 16.2-19.4 mm SL, 15 females, 20.3-25.5 mm SL; NRM 49488, 17, tissue samples, not measured; NRM 49489, 6, tissue samples, not measured; Myanmar: locality uncertain: kept in aquarium. 2002-2003; Aung Myint & Zaw Oo, 2002-2003. – NRM 50837. 1, tissue sample, not measured; NRM 50838, 1, tissue sample, not measured; 50840, 3 males, 20.5-23.9, 1 female, 23.4 mm SL; aquarium import; S. O. Kullander, 30 Oct 2004.

Diagnosis. A small-sized *Danio* distinguished by unique colour pattern consisting of three irregular rows of dark spots along the side, and spotted instead of striped or unmarked pelvic (in males), dorsal, anal, and caudal fins. Distinguished also from all other species of *Danio* except *D. aesculapii* by 6½ vs. 7½ or more unbranched dorsal-fin rays, and from all except *D. nigrofasciatus*, *D. margaritatus*, and *D. erythromicron* by the combined absence of rostral barbel and pored lateral line scales.

Description. Measurements and counts were taken from five males and five females, 20.0-24.0 mm SL (Table 1). General body features and pigmentation are illustrated in Figures 1-3.

Body compressed, males elongate (body depth 23.0-26.4 % SL), females with deep and wide abdomen (body depth 27.3-30.3 % SL). Head compressed, slightly deeper than wide. Snout short, obtuse, shorter than eye diameter. Mouth terminal, directed almost vertically. Small bony knob at dentary symphysis. Maxilla not reaching to below anterior margin of orbit; premaxillary ascending processes not reaching to vertical from anterior margin of orbit. Lower jaw projecting beyond upper jaw, ending anteriorly above horizontal through upper ¼ of eye. Lower jaw with anterior fleshy lateral lobe; tubercles absent from lateral lobe except occasionally present in males, with 2-3 lateral pointed tubercles combined with up to five tubercles in single row along lateral margin of dentary. Rostral barbel absent, except a minute projection in 22.9 mm female (NRM 56838) with unusually long maxillary barbel. Maxillary barbel variably developed, shortest ending slightly posterior to orbit, longest at middle of opercle.

Lateral line absent; 28-29 scales in a row representing expected lateral line course. Scales in a row along middle of side 26(3), 27(5), 28(2). Median predorsal scales 15(9), 16(1). Body lateral scale rows 6(6), 7(4). Circumpeduncular scale rows 10(10). A row of scales along anal-fin base.

Dorsal-fin rays ii.6½(10); anal-fin rays iii.9½(1), iii.10½(5), iii.11½(4); pectoral-fin rays i.10(3), i.11(7); pelvic-fin rays i.6(8), i.7(1); principal caudal-fin rays 10+9(10). Dorsal fin inserted at highest point of dorsum, at about ⅓ distance from head to caudal-fin base, slightly anterior to vertical from anal-fin origin. Pectoral-fin insertion at about vertical through posterior margin of opercle. Pectoral-fin rays long, extending to (in



Fig. 1. *Danio tinwini*, holotype, NRM 60337, adult male, 21.7 mm SL; Myanmar: Kachin State: Sha Du Zup village.



Fig. 2. *Danio tinwini*, paratype, NRM 56838, adult female, 23.8 mm SL; Myanmar: Kachin State: Sha Du Zup village.



Fig. 3. *Danio tinwini*; living specimen, ca. 20 mm SL; aquarium import, not preserved.

males) or ending short of reaching pelvic-fin origin (females). Pectoral-fin axial lobe well developed. Dorsal face of five anterior branched pectoral-fin rays in males with 1-3 rows of pointed tubercles. Pelvic-fin origin situated at about middle of body, anterior to dorsal-fin origin; pelvic fin reaching to anal-fin origin in males, shorter in females. Pelvic axillary scale present. Caudal fin forked, lobes of about equal length.

Vertebrae 14 + 16 = 30 (1), 14 + 17 = 31 (3), 15 + 16 = 31 (5), 15 + 17 = 32 (1).

Coloration in preservative. Ground colour whitish to pale yellowish. Dorsum light brownish with dark brown scale margins and dark brown mid-dorsal stripe anterior to dorsal fin. Indistinct brown P+2 stripe from gill cleft to slightly anterior to vertical from dorsal fin origin. Stripes P, P+1, and P-1 represented by irregular horizontal rows of dark brown spots to about root of caudal peduncle, stripes P and P+1 continued by thin horizontal dark brown stripes to caudal fin base, stripe P-1 continued by one or two dark spots or diffuse pigmentation on ventral margin of caudal peduncle. Stripe P-2 represented by one or two dark brown blotches immediately anterior to anal

fin origin. Dorsal fin hyaline, with 5-8 dark brown spots proximally and brownish submarginal stripe. Anal fin with 2-3 dark brown spots basally, a row of brown spots across middle representing the A stripe, and 1-2 rows of brown spots distally. Pelvic fin in females hyaline, in males with a few dark brown spots. Caudal fin with scattered, ill-defined dark brown spots on middle membranes and lobes, and narrow dark brown stripes continuing stripes P+1 and P basally.

Colour in life. Semitranslucent, abdomen and gill cover silvery. Dark spots and stripes deep black. Between spot rows P+1 and P-2 a golden sheen. Fins hyaline with black markings.

Etymology. Named for our friend U Tin Win, dedicated aquarist, knowledgeable collector, and exporter of aquarium fish from Myanmar.

Geographical distribution. Known only from the type locality in the upper Mogaung Chaung drainage, a tributary of the Ayeyarwaddy River (Fig. 4). This is also the type locality of *Danionella dracula* Britz et al. (2009), of which species one specimen (NRM 51436) was found among specimens of *D. tinwini* (NRM 49487; no locality data available).

Table 1. Morphometry of *Danio tinwini*. Measurements are in per cent of standard length, except for standard length and total length (in mm). SD, standard deviation.

	N	min	max	mean	SD
Standard length (mm)	10	20.0	24.1	22.1	1.59
Total length (mm)	10	26.2	31.6	29.0	2.09
Body depth	10	23.0	30.3	26.6	2.63
Head length	10	24.4	25.2	24.7	0.26
Snout length	10	5.2	5.9	5.5	0.23
Head depth	10	15.4	17.4	16.3	0.68
Head width	10	12.2	13.5	13.1	0.36
Upper jaw length	10	7.0	7.7	7.5	0.18
Lower jaw length	10	9.2	10.5	10.0	0.42
Orbital diameter	10	8.3	9.6	8.9	0.42
Interorbital width	10	9.7	10.5	10.1	0.31
Caudal peduncle length	10	18.9	22.6	21.4	1.27
Caudal peduncle depth	10	10.8	12.4	11.4	0.54
Dorsal-fin base length	10	8.0	9.2	8.6	0.40
Anal-fin base length	10	14.3	16.0	15.2	0.57
Predorsal length	10	60.5	64.3	62.3	1.34
Preanal length	10	61.5	67.0	64.3	2.14
Prepelvic length	10	46.9	52.7	49.6	2.13
Pectoral-fin length	10	23.4	27.1	24.7	1.11
Pelvic-fin length	10	13.3	16.2	14.7	0.93
Maxillary barbel length	10	9.2	16.2	12.0	2.20

Discussion

Danio tinwini can be distinguished from the similarly spotted *D. kyathit* by several characters. In *D. tinwini*, the P-2 stripe is represented by only one or two spots close to the anal fin, whereas in *D. kyathit* it is represented by a full row of spots between the cleithrum and the anal-fin base. The unpaired fins, and the pelvic fin in *D. tinwini* are spotted, unlike in *D. kyathit*, in which there are distinct stripes in the dorsal and anal fins, the caudal fin is marked only by extensions of stripes P+1 and P, and markings are absent from the pelvic fin. *Danio kyathit* has well developed rostral and maxillary barbels, the rostral barbel reaching to the gill cover, and the maxillary barbel to the middle of the pectoral fin rays, unlike in *D. tinwini* in which the rostral barbel is absent or rudimentary, and the maxillary barbel is short, reaching at most to the middle of the opercle. *Danio kyathit* also has generally higher meristics, e.g., dorsal-fin rays ii.7½ (vs. ii.6½), anal-fin rays iii.13½ or iii.14½ (vs. iii.9½, iii.10½, or iii.11½),

total vertebrae 33 (vs. 30-32), vertical scale rows 30-32 (vs. 26-28), and lateral line present on 4-9 scales (vs. absent).

The most similar species may be *D. nigrofasciatus* from the lower Ayeyarwaddy and Sittaung basins in southern Myanmar. It is also a relatively small species, with the rostral barbel absent, and the maxillary barbel reaching to the posterior margin of the orbit or to the vertical limb of the preopercle. The lateral line is absent. Meristic data are similar to those of *D. tinwini* except, notably, the dorsal fin with $7\frac{1}{2}$ instead of $6\frac{1}{2}$ branched rays. There is pronounced sexual dimorphism, with males more slender and shorter and reaching a smaller size than females. Both sexes may possess a few tubercles on the lateral process and lateral margin of the dentary, but only males have rows of tubercles on the pectoral fin. The P+2 stripe is absent in *D. nigrofasciatus*, the P+1 stripe is expressed as a thin dark stripe from head to caudal fin, and the P stripe is similarly entire and complete from head to caudal fin, but slightly wider than the P+1 stripe. The P-1 stripe is expressed as a row of blotches as in *D. tinwini*, and the P-2 stripe as 1-2 dark blotches anterior to the anal-fin base as in *D. tinwini*. The pelvic fin bears dark spots as in *D. tinwini*. The anal-fin markings are similar to but not identical to *D. tinwini*. There are two rows of dark spots basally (representing stripes A+1 and A), and one dark submarginal stripe (stripe A-1). There is some diffuse dark pigmentation distally on the caudal fin, and stripes P+1 and P are continued on the caudal-fin base, but there is no pattern of spots as found in *D. tinwini*. The dorsal fin has a complete dark D stripe, unlike in *D. tinwini*, in which the fin is spotted.

The only other species of *Danio* sharing the absence of lateral line and rostral barbel with *D. tinwini* and *D. nigrofasciatus*, are *D. margaritatus*, and *D. erythromicron*. In these species, also the maxillary barbel is absent, and they present colour patterns quite distinct from other small species of *Danio* (vertically barred in *D. erythromicron*; dark with minute light spots in *D. margaritatus*).

Danio tinwini shares exclusively with *D. aesculapii* from the western slope of the Rakhine Yoma the dorsal-fin count of $6\frac{1}{2}$ branched rays, where other species of *Danio* have $7\frac{1}{2}$ or more (Kullander & Fang, 2009). The two species differ in colour pattern, barbel development and meristics. *Danio aesculapii* possesses vertical bars

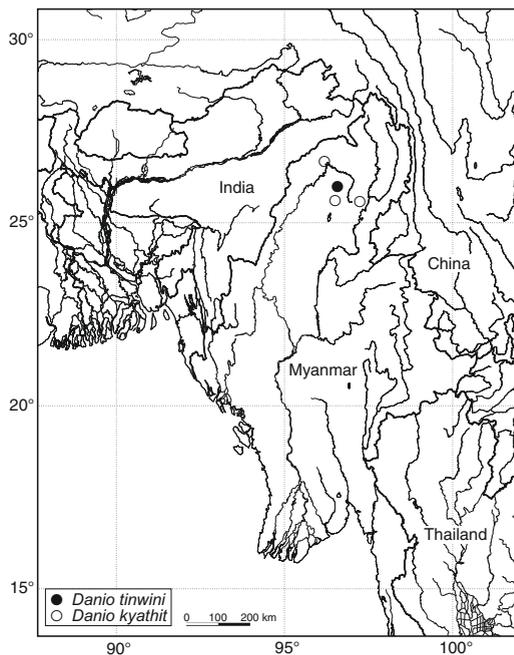


Fig. 4. Map of Myanmar, showing collecting sites of *Danio tinwini* and *D. kyathit*.

anteriorly on the side, and spots are absent from the fins. *Danio aesculapii* also has long rostral and maxillary barbels, and 12 instead of 10 circumpectuncular scales.

It seems therefore that despite the remarkable similarity to *D. kyathit* in overall coloration, *D. tinwini* may be more closely related to *D. aesculapii* by the shared low number of dorsal-fin rays, or to *D. nigrofasciatus*, which it resembles in the absence of rostral barbels and components of the colour pattern. Nonetheless, it is notable that the only two species of *Danio* with a colour pattern composed of dark spots occur in the same general area of distribution (Fig. 1) immediately west and northwest of Myitkyina. So far, however, very little ichthyological collecting has been performed in northern Myanmar, and it is not possible to generalise on the distribution patterns of the freshwater fishes.

Danio tinwini is one of the smallest species of *Danio* reported so far, and qualifies as a miniature fish species under the criteria of Weitzman & Vari (1998) and as applied by Kottelat & Vidhayanon (1993) in a review of Asian miniature species (mature at less than 20 mm SL, or size at maturity unknown and maximum size not exceeding 26 mm SL). The largest wild male is 21.7 mm SL,

the largest wild female 25.6 mm SL. Male aquarium specimens are slightly larger (23.9 mm SL). Six other species of *Danio* range between 19.3 and 30.0 mm SL, viz. *Danio aesculapii* (28.6 mm SL), *D. choprae* (28.6 mm SL), *D. erythromicron* (27.6 mm SL; Kottelat & Witte, 1999), *D. margaritatus* (male, 21.2 mm SL; Roberts, 2007), *D. nigrofasciatus* (27.5 mm SL), and *D. rerio* (30.0 mm SL) based on measurements of wild female or unsexed specimens. All other species of *Danio* reach well over 30 cm SL, viz. *D. albolineatus* (34.5 mm SL), *D. dangila* (68.3 mm SL), *D. feegradei* (45.2 mm SL), *D. kerri* (37.9 mm SL), *D. kyathit* (34.5 mm SL), *D. meghalayensis* (50.1 mm SL), *D. quagga* (35.3 mm SL), and *D. roseus* (36.5 mm SL). Standard length is not known for *D. jaintianensis* but according to Sen (2007), the type series included specimens up to 46 mm TL, and this suggests a standard length up to about 37 mm, based on proportions in the figured specimen in Sen (2007: plate I, fig. A).

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Danio tinwini (photograph by Sven O. Kullander)
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