

***Danio aesculapii*, a new species of danio from south-western Myanmar (Teleostei: Cyprinidae)**

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Abstract

Danio aesculapii, new species, is described from small rivers on the western slope of the Rakhine Yoma in south-western Myanmar. It is superficially similar to *D. choprae* from northern Myanmar in having a series of vertical bars anteriorly on the side, but differs from it and other species of *Danio* in having six instead of seven or more branched dorsal-fin rays, and from all other species of *Danio* except *D. erythromicron* and *D. kerri* in having 12 instead of 10 or 14 circumpeduncular scale rows.

Key words: Rakhine Yoma, Thandwe, *Danio choprae*, endemism

Introduction

The cyprinid fish genus *Danio* Hamilton includes 14 small species in South and Southeast Asia (Kullander *et al.* 2009), as a rule diagnosable by distinct species-specific colour patterns. About half of the species of *Danio* have a pigment pattern that consists of one or more dark or light horizontal stripes (Fang, 1998). Among the others, *Danio kyathit* Fang differs in having the stripes broken up into rows of small brown spots, *D. margaritatus* (Roberts) has a pattern of small light spots on the sides, *D. dangila* (Hamilton) has rows of dark rings with light centres, and *D. choprae* Hora and *D. erythromicron* (Annandale) possess a distinct pattern of vertical bars.

Danio choprae was described by Hora (1928) from near Myitkyina in the upper Ayeyarwaddy River drainage, and noted to have a very characteristic colour pattern, including several dark vertical bars anteriorly on the side. Later, Hora (1937) reported another four specimens, this time in a collection made in Sandoway, located on the west coast of Myanmar, in the Rakhine State and presently known as Thandwe. Hora's (1937) identification appears to have been focused on the vertical bars, and he noticed differences in other colour marks and lateral line development from the type series of *D. choprae*. Collections from near Thandwe made in 1998 included many specimens of a very small species with a diffuse pattern of vertical bars, similar to *D. choprae*, and agreeing with the figure of *D. choprae* reported by Hora (1937: fig 2) from Thandwe (Fig. 1). In the meantime, this species was also imported to Europe as aquarium fish with the code names "pantheri", "snakeskin", and "TW03", and further collected to the north and south of Thandwe. This paper is dedicated to the formal description of this species.

Material and methods

Specimens were fixed in formalin in the field, eventually transferred to 70 % ethanol for storage, and are kept in the fish collection of the Swedish Museum of Natural History, Stockholm (NRM) or the Natural History

Museum, London (BMNH). Comparative material is also preserved in the Museum of Zoology, University of Michigan, Ann Arbor, USA (UMMZ). Measurements were taken with digital calipers 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. A submarginal dark stripe in the dorsal fin is termed D stripe. 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 Kodax 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* (Blyth), NRM 37308; *D. choprae*, NRM 52001; *D. dangila*, NRM 51441; *D. erythromicron*, NRM 51629; *D. feegradei* Hora, NRM 55111; *D. kerri* Smith, NRM 36414; *D. kyathit*, NRM 50496; *D. margaritatus*, NRM 55113; *D. meghalayensis* Sen & Dey, UMMZ 243666; *D. nigrofasciatus* (Day), NRM 37250; *D. rerio* (Hamilton), NRM 40446; *D. roseus* Fang & Kottelat, NRM 44799.

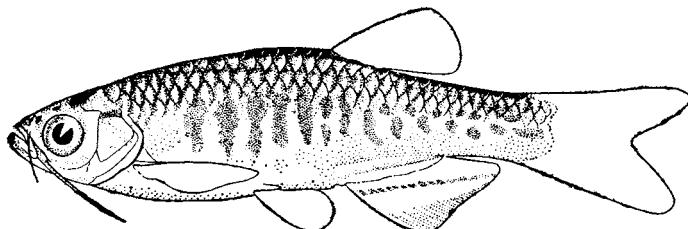


FIGURE 1. *Danio aesculapii*, drawing from Hora (1937: fig. 2), based on a 33 mm TL specimen from Thandwe.



FIGURE 2. *Danio aesculapii*, holotype, NRM 44490, male, 22.5 mm SL; Myanmar: Rakhine State: Thandwe: Kananmae Chaung, near Leldee village.

Danio aesculapii, new species (Fig. 2)

Holotype. NRM 44490, 22.5 mm SL; Myanmar: Rakhine State: Thandwe: Kananmae Chaung, near Leldee village, by foot 45 min from Gwechaung village at km 18 on road Thandwe–Taunggok, 18°35'39"N 94°22'45"E; 20 Mar 1998, S.O. Kullander & R. Britz (SOK-98-007).

Paratypes. All from Myanmar, Rakhine State. NRM 40826, 31, 14.7–22.3 mm SL; same data as holotype. — NRM 40804, 38, 17.1–23.7 mm SL; Thandwe: Kamyit Chaung near Paukdu village, 18°15'57"N 94°30'03"E; 19 Mar 1998, S.O. Kullander & R. Britz (SOK-98-005). — NRM 40812, 78, 15.7–21.3 mm SL; NRM 41269, 5, 17.7–24.4 mm SL; NRM 44907, 19, 19.0–21.1 mm SL; NRM 45662, 1, 22.1 mm SL; Thandwe: Thandwe River drainage: Nan Chaung, a stream at 3 km on road from Thandwe (market) to

Ngapali, 18°27'08"N 94°20'55"E; 20 Mar 1998, S.O. Kullander & R. Britz (SOK-98-006). — NRM 40851, 3, 18.6–21.7 mm SL; Thade River drainage: Taunggok, Yan Khaw Chaung, ca 4 km on logging road from Gwetauk village, 23 km on road Taunggok–Pyay, 18°47'48"N 94°21'46"E; 21 Mar 1998, S.O. Kullander & R. Britz (SOK-98-010). — BMNH 2009.5.5.19. 1, 22.7 mm SL; Kaladan River delta: Chaung Gyi bridge in Myay Pon township, 20°08'05"N 93°27'06"E; 1 Apr 2007, R. Britz & J. Maclaine. — BMNH 2009.5.5.1–18, 18, 23.4–28.6 mm SL; Kyeintali River drainage: Kyeintali Chaung; Mar 2006, U Tin Win *et al.*

Non-types. NRM 52338, 1, 29.6 mm SL; NRM 52341, 25.9 mm SL; Aquarium import; 16 Aug 2005, M. Håkansson. — NRM 52539, 1, 26.0 mm SL; NRM 52542, 24.4 mm SL; Aquarium import; 9 Nov 2005.

Diagnosis. Different from all other species of *Danio* by colour pattern comprising 6–7 brown vertical bars anteriorly on side and two horizontal rows of small brown spots posteriorly, absence of D stripe, and absence of dark stripes on caudal fin; similar to *D. kerri* and *D. erythromicron* in possession of 12 circumpeduncular scale rows vs. 14 in *D. dangila* and 10 in other species of *Danio*; by possession of 6 branched dorsal fin rays, vs. 7–8 in other species of *Danio*.

Description. Measurements and counts were taken from ten specimens, 20.0–22.5 mm SL (Table 1), supplemented by counts from additional X-radiographed specimens. The holotype is well preserved but most other specimens have lost scales. General body features and pigmentation are illustrated in Figs. 1–2. External sexual dimorphism restricted to slightly rounder abdomen and slightly less developed tubercle field on lower jaw in females.

Body compressed, elongate. Head compressed, slightly deeper than wide. Snout short, rounded, shorter than eye diameter. Mouth terminal, obliquely directed upwards. Small bony knob at dentary symphysis. Maxilla reaching to below anterior margin of orbit; premaxillary ascending processes not reaching to vertical from anterior margin of orbit. Lower jaw projecting slightly beyond upper jaw, ending anteriorly at horizontal through middle of eye. Lower jaw with anterior fleshy lateral lobe beset with small conical tubercles; anteriorly on lower jaw several conical tubercles; a row of conical tubercles along lateral margin of dentary posterior to lateral lobe. Tuberculation variably developed, stronger in males. Maxillary barbels about double length of rostral barbels, ending at insertion of pectoral-fin base, except in 24.4 mm specimen (NRM 41269) in which extending posterior to pectoral-fin base. Rostral barbels reaching to posterior margin of orbit.

Squamation incomplete in many specimens due to abrasion. Lateral line short, with 4 (1), 5 (7) scales; scales in lateral row 28 (4), 29 (3), counting scale pockets and remaining scales. Median predorsal scales 15 (2), 16 (4), 17 (1). Lateral scale rows passing between dorsal and pelvic fins 7 (8). Circumpeduncular scale rows 12 (8). A row of scales along anal-fin base.

D. ii.6½ (19); A. iii.10½ (1), iii.11½ (11), iii.12½ (6); P. i.10 (2), i.11 (8); V. i.7 (10). Dorsal fin inserted at highest point of dorsum, at about 3/5 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 osseous opercle. Pectoral-fin rays long, extending to pelvic-fin origin. Pectoral-fin axial lobe well developed. Pelvic-fin origin situated at about middle of body, anterior to dorsal-fin origin; pelvic fin reaching to anal-fin origin. Pelvic axillary scale present. Caudal fin forked, lobes of about equal length.

Vertebrae 15+17=32 (6), 15+18=33 (4), 16+17=33 (4), 17+17=34 (1).

Colouration in preservative. Whitish ground colour. Dorsal scales sparsely pigmented, slightly darker at rim; except dark brown predorsal midline, and dark brown dorsal midline of caudal peduncle. Horizontal stripes absent. A series of 6–7 (usually 6) short light brown vertical bars along middle of side anterior to vertical from anal-fin base, continued posteriorly by two parallel rows of alternating small blotches of the same colour, lower row comprising 5–7 (usually 6) blotches and running along midline, upper row coalescing with dorsal pigmentation. Lightly pigmented above anal-fin base and along caudal peduncle below narrow unpigmented line separating row of blotches. Pigment absent from interspaces between blotches and bars, but bars and dorsal blotches grading dorsally into diffuse dorsal pigmentation. Dorsal fin hyaline without dark markings, except that margins of rays may be dark. Caudal fin hyaline, without markings. Pectoral and pelvic fins hyaline with scattered pigment. Anal fin hyaline, with distinct dark A stripe across middle and less densely pigmented broad dark band distally on fin.

TABLE 1. Morphometry of *Danio aesculapii*. Measurements are in per cent of SL, except for SL and TL (in mm). SD = standard deviation.

	N	Min	Max	Mean	SD
SL (mm)	10	20.0	22.5	21.1	0.93
TL (mm)	8	26.1	30.5	28.2	1.68
Body depth	10	23.1	27.2	25.3	1.13
Head length	10	25.0	27.1	25.4	0.63
Snout length	10	5.7	6.7	6.2	0.34
Head depth	10	15.5	16.9	16.3	0.53
Head width	10	13.1	14.4	13.8	0.40
Upper jaw length	10	8.7	9.5	9.2	0.28
Lower jaw length	10	11.0	12.0	11.6	0.30
Orbital diameter	10	8.5	10.0	9.3	0.38
Interorbital width	10	10.3	11.5	10.9	0.45
Caudal peduncle length	10	18.2	21.0	19.8	0.85
Caudal peduncle depth	10	11.3	12.6	12.0	0.43
Dorsal-fin base length	10	7.7	10.4	9.2	0.85
Anal-fin base length	10	16.9	19.9	18.5	0.95
Predorsal length	10	60.7	64.5	62.6	1.29
Preanal length	10	63.0	65.2	63.9	0.83
Prepelvic length	10	46.5	49.8	48.0	1.09
Pectoral-fin length	9	24.0	26.8	25.4	0.87
Pelvic-fin length	10	11.5	16.1	14.9	1.36
Rostral barbel length	10	7.0	11.3	9.5	1.51
Maxillary barbel length	10	16.8	19.0	18.2	0.69

Molecular data. Nucleotide sequences of the mitochondrial cytochrome *b* gene and a fragment of the nuclear rhodopsin gene were obtained from a specimen from the aquarium trade (NRM 52542) and reported by Fang *et al.* (2009), with GenBank accession numbers EU241365 and EU241430 (as *Danio* sp. “snakeskin”).

Etymology. Genitive of Aesculapius (Latin form of Asklepios, Ἀσκληπιός), Ancient Greek god of medicine, equipped with a staff with one or two snakes wrapped around it; a reference to the snakeskin pattern attributed to this species.

Geographical distribution and habitat. Known only from small streams on the western slope of the Rakhine Yoma, near Thandwe (Fig. 3), Kyeintali and Sittwe. The type locality (Fig. 4) was a small stream flowing out of the forest into cultivations, at most 3 m wide, and about 30 cm deep. The water was clear with only slight current and, at the collecting site, concentrated in four pools. There was no aquatic vegetation and the bottom consisted of pebbles, rock, and gravel. Associated fauna included *Anguilla* sp. (Anguillidae), *Aplocheilus panchax* (Hamilton) (Aplocheilidae), *Batasio elongatus* Ng and *Olyra burmanica* Day (Bagridae), *Schistura* sp. (Nemacheilidae), *Channa* sp. (Channidae), *Lepidocephalichthys berdmorei* (Blyth) and *Pangio pangia* (Hamilton) (Cobitidae), *Danio* sp. aff. *dangila*, *Devario* sp., *Garra flavatra* Kullander & Fang, *G. vittatula* Kullander & Fang, *Puntius binduchitra* (Hora), two species of *Puntius* Hamilton, *Rasbora daniconius* (Hamilton), *R. rasbora* (Hamilton) (Cyprinidae), *Eugnathogobius siamensis* (Fowler) and *Sicyopterus fasciatus* (Day) (Gobiidae), *Mastacembelus armatus* (La Cepède) (Mastacembelidae), and *Pterocryptis berdmorei* (Blyth) (Siluridae). Other localities near Thandwe included one stagnant pool,

remnant of a small river, Nan Chaung, at low water level, with leaf litter and sand for bottom substrate, the other localities being small forest streams with rocky bottoms. The associated fauna varied slightly, but was essentially dominated by *Rasbora*, except in Yan Khaw Chaung where an undescribed large species of *Devario* was the most abundant species.

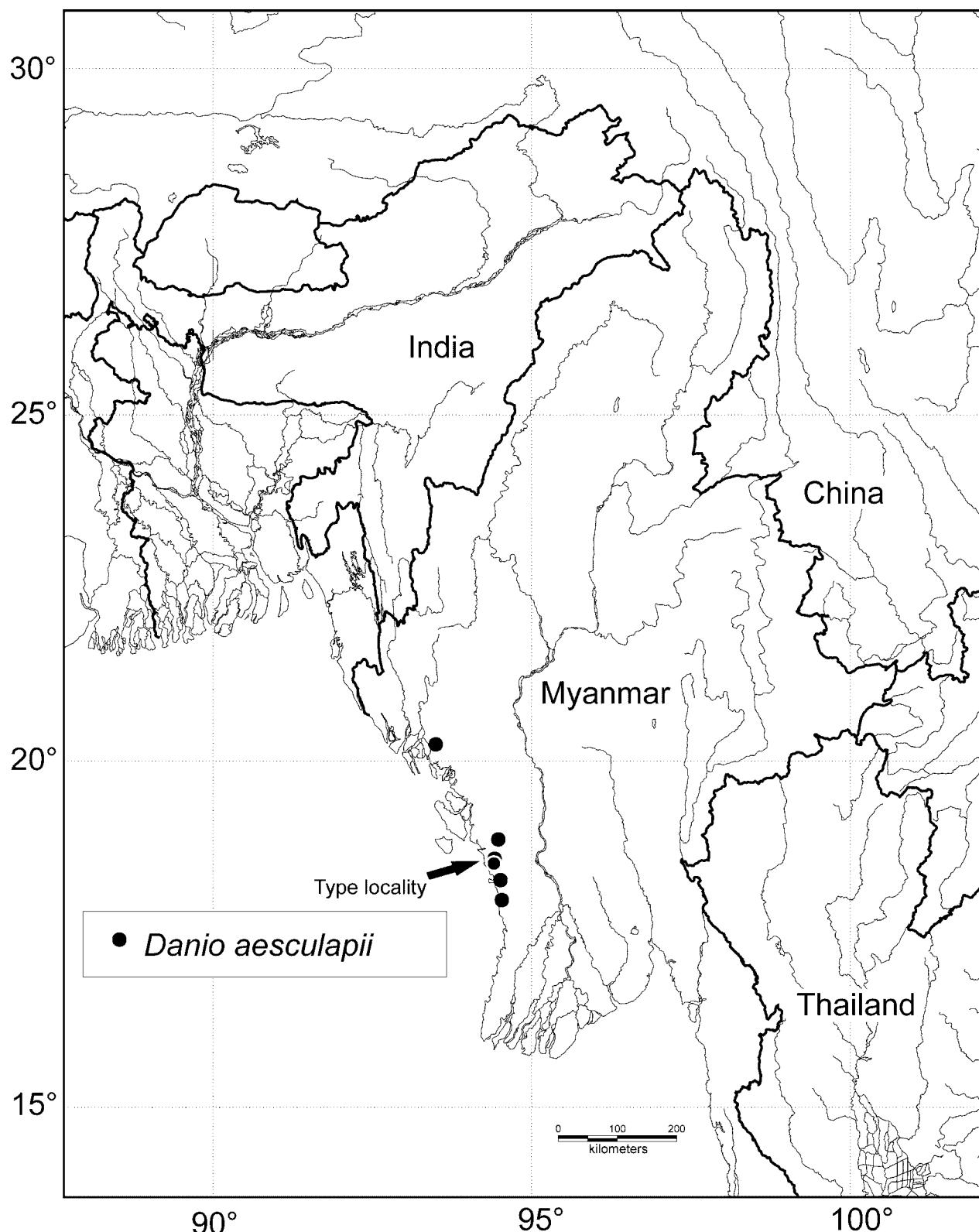


FIGURE 3. *Danio aesculapii*. Collecting sites. The Kyeintali locality at the extreme south is approximate.



FIGURE 4. *Danio aesculapii*. Type locality. Myanmar: Rakhine State: Thandwe: Kananmae Chaung, near Leldee village. 20 March 1998.

Discussion

The fish fauna of the western slope of the Rakhine Yoma includes several endemic species of fishes, most of them described only recently. They are the cyprinids *Puntius binduchitra* and *Danio feegradei* (Hora, 1937), *Garra vittatula*, *G. rakhinica*, *G. flavatra*, and *G. propulvinus* (Kullander & Fang, 2004), the bagrid catfish *Batasio elongatus* (Ng, 2004), the erethistid catfish *Hara spinulus* (Ng & Kottelat, 2007), the akysid catfish *Akysis vespertinus* (Ng, 2008), and the channid *Channa pulchra* (Britz, 2007). We have also identified an

endemic species of *Puntius* as well as one more undescribed species of *Danio*, and one undescribed species of *Devario*.

Danio aesculapii is the eighth species of the genus described from Myanmar. The others are *D. choprae* and *D. kyathit* from the upper Ayeyarwaddy drainage, *D. albolineatus* from the Sittoung, Thanlwin, and Ayeyarwaddy drainages, *D. nigrofasciatus* from the Sittoung drainage, *D. erythromicron* and *D. margaritatus* from Inle Lake and He Ho plains, respectively, and *D. feegradei* from near Thandwe. With the exception of the ubiquitous and abundant *D. albolineatus*, and the reservation that Myanmar is still not extensively surveyed ichthyologically, these species have restricted, well circumscribed distributions.

The general colour pattern of *D. aesculapii* is similar to that of *D. choprae* from the upper Ayeyarwaddy drainage. In that species, there are 6–8 short vertical bars, shorter posteriorly and grading into a series of small spots or short horizontal stripe on the caudal peduncle, representing the P stripe. The P+1 stripe is indistinct in *D. choprae*, but the P+2 stripe is distinct and the two merge dorsally on the caudal peduncle. The caudal-fin stripes characterizing *Danio* species (Fang 1998: fig. 5) are absent in *D. aesculapii*, but present in *D. choprae*. *Danio choprae* has a distinct A stripe, like in *D. aesculapii*, and the distal part of the fin is hyaline, but unlike in *D. aesculapii*, the basal part proximal to the A stripe is grayish in *D. choprae*. *Danio choprae* also has shorter maxillary barbels, not reaching to the pectoral fin, and 10 circumpeduncular scale rows, vs. 12 in *D. aesculapii*.

The colour pattern of *D. aesculapii* bears a definite similarity with that of several species of *Devario*, viz. the barred danios described and illustrated by Fang (1998; 2000). In these species there is a series of short vertical bars on the anterior sides, but followed by a horizontal stripe instead of spots posteriorly. *Danio aesculapii* is clearly referable to *Danio* diagnosed by, e.g., the presence of a lateral pad on the dentary, and absence of a supraorbital groove (cf. Fang, 2003). In position, the lower row of spots in *D. aesculapii* corresponds to the posterior section of the P stripe in other *Danio*, and the upper row of less conspicuous spots to the P+1 stripe. Homologous marks of other horizontal stripes cannot be traced.

Danio aesculapii is distinctive also for the circumpeduncular scale count (12), shared only with *D. kerri*, and *D. erythromicron*. All other small species of *Danio* have 10, the larger species *D. dangila*, *D. feegradei* and *D. meghalayensis* 14. In *D. margaritatus* we obtain counts of 9 and 10. The dorsal-fin count of *D. aesculapii*, with six branched rays, is unique in the genus. In other small species of *Danio* there are two unbranched rays, followed by seven or eight branched rays and one unbranched ray with the same base as the preceding branched ray (the “half-ray” of e.g., Kottelat (2007)), but which is usually included in the preceding ray by most authors. In *D. aesculapii* there are two unbranched followed by six branched rays, and a half-ray that may be closely apposed the preceding ray or slightly distinct from it. Larger species of *Danio* (*D. feegradei*, *D. dangila*, and *D. meghalayensis*) have eight or nine branched dorsal-fin rays. The reduced dorsal-fin count is an autapomorphy within the genus, and not necessarily associated with small size because other small species in the genus have seven branched rays, and one examined specimen of *D. margaritatus* has eight branched rays. Specimens of *D. jaintiaensis* (Sen, 2007) have not been available for examination; the information and illustrations in the original description (Sen, 2007), however, suggest that this species has the usual seven branched dorsal-fin rays and 10 circumpeduncular scale rows.

Danio aesculapii has a relatively basal position in the rhodopsin tree presented by Fang *et al.* (2009: fig. 3), sister to all other *Danio* except *D. dangila*. In the cytochrome *b* and combined trees (Fang *et al.* 2009: figs. 3–4), however, it groups with *D. nigrofasciatus*, *D. kyathit*, and *D. sp. ‘Ozelot’* in a sister group assemblage to *D. kerri*, *D. albolineatus*, *D. roseus*, and *D. rerio*, whereas in turn *D. choprae*, *D. margaritatus*, and *D. erythromicron* form sister group to those two assemblages. This suggests that the similarity in colour pattern between *D. aesculapii* and *D. choprae* must have been independently derived, as *D. aesculapii* is contained in a group of striped species.

Acknowledgements

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