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Two new species of *Microrasbora* from Thailand and Myanmar, with two new generic names for small Southeast Asian cyprinid fishes (Teleostei: Cyprinidae)

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Abstract

Two new species of *Microrasbora* are described, *M. kubotai* from the western (Andaman Sea) slope of Peninsular Thailand and *M. nana* from the lower Sittang basin in Myanmar. *Microrasbora erythromicron* is transferred to *Danio* sensu lato. Two new genera are described, *Sundadanio* (type species: *Rasbora axelrodi*) and *Trigonostigma* (type species: *R. heteromorpha*).

Introduction

The genus *Microrasbora* was created by Annandale (1918: 50) for two species of diminutive cyprinids discovered in Inle Lake, Burma (now Myanmar), *M. rubescens* (the type species of the genus) (Fig. 1) and *M. erythromicron* (Fig. 2). Annandale also tentatively placed in the genus two species known from the Malay Peninsula, *Rasbora maculata* Duncker, 1904 and *R. heteromorpha* Duncker, 1904. These last two species have never been considered as members of *Microrasbora* by later authors who retained them in the genus *Rasbora*. *Rasbora maculata* is now placed in the genus *Boraras* (Kottelat & Vidthayanon, 1993: 162), while *R. heteromorpha* and a few other similar-looking species represent a distinct but still unnamed lineage.

The genus *Microrasbora* was considered to be endemic to Lake Inle until Herre (1939) described *M. gatesi* from the vicinity of Rangoon (Myanmar) (Fig. 3). In 1985, MK collected an additional, diminutive species in Peninsular Thailand, and in 1996 KEW collected another one in Myanmar. The species from Thailand has been regularly exported for the aquarium trade since a few years ago. The purpose of the present paper is to make names available for these two species and for two long-recognised but still unnamed genera of diminutive Southeast Asian cyprinids.

Material and methods

Methods for counts and measurements follow Kottelat & Vidthayanon (1993). The species concept used here is the phylogenetic species concept; see Cracraft (1989), Mayden & Wood (1995) and Kottelat (1997) for discussion. See Kottelat (1995, 1998) for a discussion of the procedures, priorities and needs in biodiversity research for largely unsurveyed areas.

Abbreviations used are: CAS, California Academy of Sciences, San Francisco; CMK, first author's collection; KEW, second author's collection; NIFI, National Inland Fisheries Institute, Bangkok; NRM, Swedish Museum of Natural History, Stockholm; SMNS, Staatliches Museum für Naturkunde, Stuttgart; ZRC, Zoological Reference Collection, National University of Singapore.

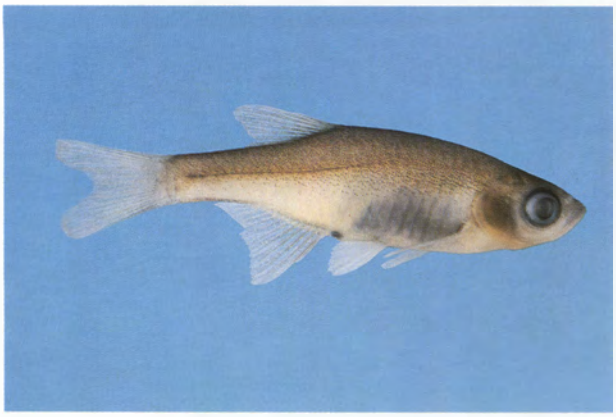

Figure 1. *Microrasbora rubescens*, CMK 14461, 22.8 mm SL; Myanmar: Inle Lake.

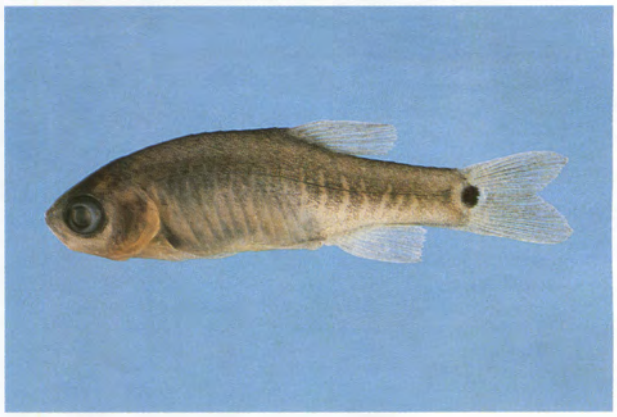

Figure 2. *Danio erythromicron*, CMK 14460, 22.3 mm SL; Myanmar: Inle Lake.

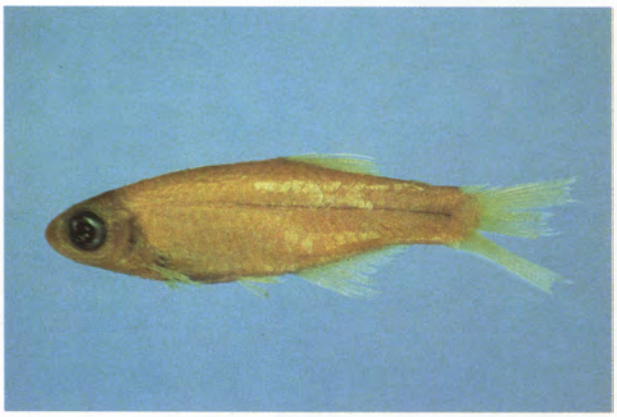

Figure 3. *Microrasbora gatesi*, CAS-SU 33899, paratype, 22.7 mm SL; Myanmar: Hlegu.

Microrasbora Annandale

Microrasbora Annandale, 1918: 50 (type species: *Microrasbora rubescens* Annandale, 1918, by original designation). Gender feminine.

Diagnosis. *Microrasbora* is diagnosed by the following characters, apparently unique to the genus: lower jaw with broad dorsal flange on the anterior dentary not tapering anteriorly and joining at the symphysis (the well developed symphysial process is almost completely hidden behind this 'cutting edge'); melanophore colour pattern strongly reduced to a faint, hardly defined lateral stripe consisting of the interaxial stripe surrounded with scattered melanophores (in addition, large specimens often exhibit a weak reticulated pattern dorsally). Additional usefull diagnostic characters (not unique to the genus) include a broad median flange along ventral dentary (its surface covered with rows of fine tubercles, especially well developed in mature males) and a large foramen at base of pleural rib 4 (wider than osseous bridges surrounding it) and exposed laterally.

Remarks. *Microrasbora erythromicron* does not belong to *Microrasbora* as diagnosed above and displays a very different coloration. It shares the 'danioine notch' (an anterior semicircular indentation of the the median flange of the dentary; Howes, 1983) with several danioine genera: *Danio* s. l., *Danionella*, *Sundadanio*. Since it shares an apomorphic median process on the pleural rib of the 4th vertebra with *Danio dangila* (the type species of *Danio*) we place it in *Danio* pending further studies. Apart from the missing barbels (a character state shared with some members of the *D. shanensis* group; Fang, 1997), *Danio erythromicron* has two unique characters: an ocellus in the middle of caudal fin base and sexual dimorphism in colour pattern with males exhibiting 3-4 times broader bars than females. (Note that *Sundadanio* is sexually dichromatic but that its colour pattern is not sexually dimorphic; see below).

Key to the species of *Microrasbora*

1 - A black blotch at tip of dorsal fin and a greyish one at the tip of anal fin ..... *M. nana*
\- Dorsal and anal fins hyaline 2

2 - 24-25 + 1 scales in longitudinal series; 10-11 predorsal scales; 9-10 branched anal-fin rays ..... *M. kubotai*
\- 28-30 + 1-2 scales in longitudinal series; 12-14 predorsal scales; 10-14 branched anal-fin rays 3

3 - 10-12 branched anal-fin rays; anal papilla black ..... *M. rubescens*
\- 13-14 branched anal-fin rays; anal papilla not distinctly coloured ..... *M. gatesi*

Microrasbora kubotai, new species
(Figures 4-5)

Microrasbora sp. 1: Kottelat & Vidthayanon, 1993: 172.

Holotype. ZRC 43427, 16.4 mm SL; Thailand: Ranong Prov.: Khlong Phrae Sai at Ban Kreo Noi, km 8 on road branching east, 32 km north of Ranong on road from Ranong to Kra Buri; 10°09'51"N 98°41'11"E; M. Kottelat, T. Tan & K. Kubota, 6 November 1995.

Paratypes. ZRC 43428, 14 ex., NIFI uncat., 10 ex., NRM 43013, 8 ex., CMK 12144, 15 ex., 14.7-19.0 mm SL; same data as holotype. - CMK 10730, 8 ex., 16.0-18.8 mm SL; Thailand: Phangnga Prov.: Tha Yu, on road from Phangnga to Phuket; K. Kubota, 1993. - CMK 5339, 4 ex., CMK 5901, 1 ex. C&S, 11.7-16.3 mm SL; Thailand: Phangnga Prov.: tributary of Khlong Khao Thalu at Ban Bang Kan, km 22 on road from Phangnga to Kapong; 8°33'N 98°26'E; M. Kottelat & A. Kottelat-Kloetzli, 22 April 1985.

Diagnosis. *Microrasbora kubotai* is distinguished from the other species of *Microrasbora* by the following unique combination of characters: fins hyaline, 24-25 + 1 scales in longitudinal series, and 9-10 branched anal rays.

Description. General appearance is shown in Figures 4-5 and morphometric data of holotype and five paratypes are given in Table 1. Dorsal fin with 2-3 simple and 7 branched rays, last one split to the base. Pectoral fin slightly falcate, with 10-11 rays; a very small axillary lobe present. Pelvic fin slightly pointed, with 7 rays; a small axillary scale present. Anal with 3 simple and 9-10 branched rays, last one split to the base. Caudal fin with 10+9 principal rays, 9+8 branched. Caudal peduncle 1.6-1.9 times longer than deep. 24+1 (3) or 25+1 (3) scales in longitudinal series (counted along normal course of lateral line in *Rasbora*). No lateral- line pores. 10-11 predorsal scales, ½7½ scales in transverse line in front of pelvic fin origin, ½6½ in transverse line to pelvic fin origin, ½4½ in transverse line on caudal peduncle. Several rows of minute tubercles on lower jaw. Vertebrae 13+16= 29 (CMK 5901, C&S).

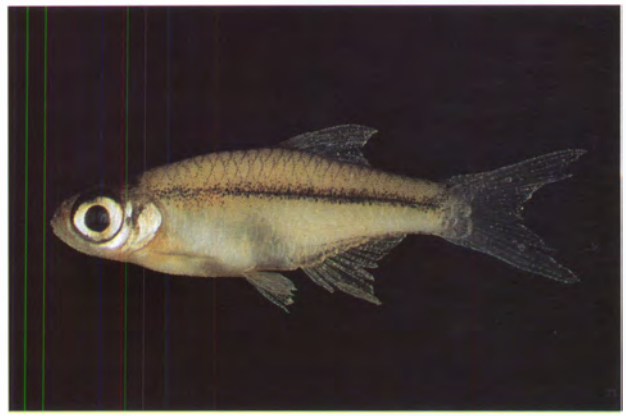

Figure 4. *Microrasbora kubotai*, paratype, CMK 12144, 17.2 mm SL; Thailand: Ranong Province.

Figure 5. *Microrasbora kubotai*, aquarium specimen, about 20 mm SL, not preserved; Thailand: Ranong Province (photograph by A. van den Nieuwenhuizen).

Coloration. Preserved specimens. The body is yellowish with a black interaxial stripe. The stripe is more diffuse anteriorly where melanophores are more scattered; it ends shortly before caudal fin base. A few black pigments over hypural complex. A thin black stripe from top of head to caudal fin origin along dorsal mid-line. A black stripe from anus to caudal-fin base along ventral mid-line. A row of black pigments parallel to this last stripe above anal-fin base. Dorsal half of body with a reticulated pattern made of rows of pigments along edges of the two upper rows of scales. A black botch on nape; a silvery blotch on opercle. Fins hyaline with a few scattered pigments on rays of unpaired and pectoral fins.

Live specimens. In the field, translucent yellow. Aquarium-kept specimens greenish yellow, with a glowing golden lateral stripe, belly, eye and opercle (see Fig. 5).

Distribution. Known from the western slope of Peninsular Thailand, from north of Ranong to Phangnga.

Etymology. Named for Katsuma Kubota, in appreciation for his help in conducting several projects, assistance in the field, and the gift of numerous specimens.

Microrasbora nana, new species (Figs. 6-7)

Microrasbora sp. 2: Kottelat & Vidthayanon, 1993: 172.

Holotype. ZRC 43429, 14.6 mm SL; Myanmar: Sittang River basin: Kyauk Tan Chaung stream, 2.5 km from Daik U (4th and last bridge), 65.5 km on road from Bago [17°18'N 96°31'E] to Toungoo [18°56'N 96°26'E]; K.-E. Witte, 3 April 1996.

Paratypes. ZRC 43430, 5 ex., CMK 12871, 5 ex., NRM 43014, 8 ex., KEW 3375, 2 ex., SMNS 18992, 4 ex., 13.0-15.2 mm SL; same data as holotype. - CAS 60817, 22 ex., 11.0-14.2 mm SL; Myanmar: Pegu [Bago] division: Kha-Yein Chaung, 4 miles north-east of Hlegu on road to Pegu [Bago, 17°18'N 96°31'E] at Wah Knit Kone village; T. R. Roberts, 9 March 1985.

Diagnosis. *Microrasbora nana* is distinguished from all other species of the genus by the presence of a black blotch at the tip of the dorsal fin and a fainter blotch at the tip of the anal fin. It is further distinguished by the combination of the following characters (none being diagnostic alone): 25-26 + 1-2 scales in longitudinal series, 11-13 predorsal scales, 10-11 branched anal-fin rays.

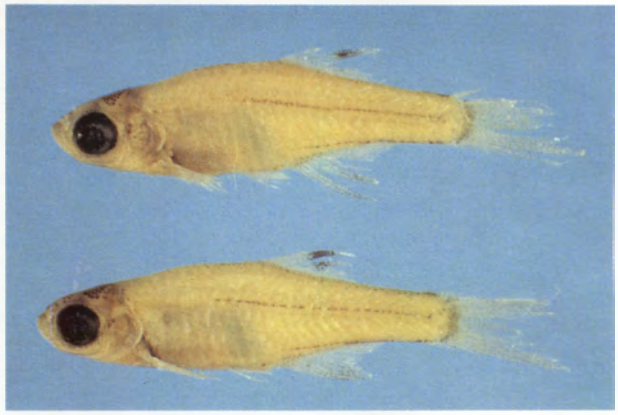

Figure 6. *Microrasbora nana*, paratypes, CAS 60817, 14.2 and 14.0 mm SL; Myanmar: Bago Division.

Figure 7. *Microrasbora nana*, aquarium specimen, about 20 mm SL, not preserved; Myanmar: Sittang basin, collected with holotype (photograph K. Weissenberg).

Description. General appearance is shown in Figures 6-7 and morphometric data of holotype and four paratypes are given in Table 1. Dorsal fin with 3 simple and 7 branched rays, last one split to the base. Pectoral fin slightly falcate, with 10-12 rays; no axillary lobe. Pelvic fin slightly pointed, with 6 rays; two axillary scales distinct in largest specimens. Anal with 3 simple and 10-11 branched rays, last one split to the base. Caudal fin with 10+9 principal rays, 9+8 branched. Caudal peduncle 1.5-2.0 times longer than deep. 25-26 + 1-2 scales in longitudinal series (counted along normal course of lateral line in *Rasbora*). No lateral line pores. 11-13 predorsal scales, ½7½ scales in transverse line in front of pelvic fin origin, ½6½ in transverse line to pelvic fin origin, ½4½ in transverse line on caudal peduncle. No distinct tubercles on lower jaw. Vertebrae 12-13 + 17-18 = 29-31 (n=7).

Coloration. Preserved specimens. The body is pale yellowish with a very thin black interaxial stripe extending from tip of pectoral fin to shortly before caudal fin base. A few black pigments organised in a

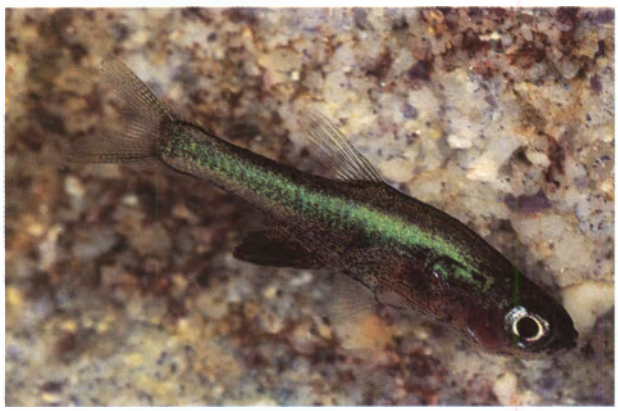

Figure 8. *Sundadanio axelrodi*, CMK 6652, male (above), 17.0 mm SL, and female (below), 15.5 mm SL; Indonesia: Borneo: Kalimantan Barat.

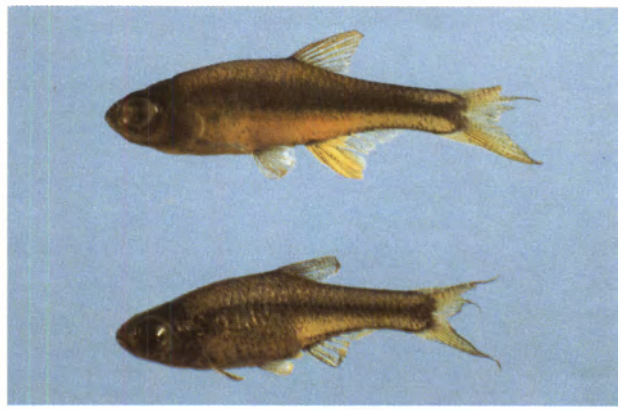

Figure 9. *Sundadanio axelrodi*, aquarium specimen, CMK 9633, male, about 15 mm SL; Indonesia: Bangka (photograph by P. K. L. Ng).

faint vertically elongated greyish blotch at caudal fin base. A thin black stripe from top of head to caudal fin origin along dorsal mid-line. A thin, faint black stripe from anus to caudal fin base along ventral mid-line. A row of black pigments parallel to this last stripe above anal fin base. A black blotch on nape. Fins hyaline with a black blotch at tip of last simple and first two branched dorsal rays, and a fainter blackish blotch at tip of last simple and first 3-4 branched anal rays.

Live specimens. In the field (from turbid waters), slightly yellow with iridescent blue side and silvery eye and belly; fins translucent with blotch in dorsal fin variably developed. Aquarium specimens yellowish (males distinctly yellow) with iridescent bluish side and silvery-golden eye, opercle and belly; a glowing but not well defined golden lateral stripe along centre of body; unpaired fins yellowish with deep black blotch at tip of dorsal (Fig. 7).

Distribution. Presently known only from the lower Sittang and Bago River basins in Myanmar, but the species may have a wider distribution in the Irrawaddy delta.

Etymology. From the Latin nanus, dwarf. An adjective.

Table 1. Morphometric data of selected specimens of *Microrasbora kubotai* and *M. nana*.

	M. kubotai			*M. nana*		
	ZRC 43427	CMK 5339 (n=5)		ZRC 43429	CMK 12871 (n=4)	
	holotype	min	max	holotype	min	max
standard length (mm)	16.4	7.5	10.4	14.6	13.9	15.2
Percentage of standard length						
total length	136.0	129.0	140.3	123.5	-	-
head length	28.0	26.7	28.8	23.5	23.0	23.8
predorsal length	58.5	54.4	58.6	58.8	54.5	58.8
prepelvic length	51.2	47.7	50.0	48.2	47.4	49.1
preanal length	64.6	60.6	63.4	61.8	59.4	61.8
body depth	29.3	30.0	34.6	25.3	25.3	29.6
depth of caudal peduncle	13.4	12.5	14.4	11.8	11.8	14.2
length of caudal peduncle	22.6	20.1	24.4	24.1	21.9	24.8
Percentage of head length						
head depth at nape	78	73	79	90	90	98
snout length	28	21	25	20	18	22
eye diameter	48	42	48	43	39	43
interorbital width	39	42	48	38	33	39

Sundadanio, new genus

Type species. *Rasbora axelrodi* Brittan, 1976 (Figs. 8-9).

Diagnosis. A member of the danioine lineage as diagnosed by the presence of a semicircular indentation on the ventromedian flange of the dentary. *Sundadanio* is the only danioine genus with only 5 branched anal rays (8-17 in the other genera); a unique Weberian apparatus with the 4th centrum extending well below the fused 2nd+3rd centra; conspicuous sexual dichromatism; and the production of repeated croaking sounds when disturbed (e.g. when taken out of the water in a net). Other characters distinguishing the genus (but not unique) are: miniature size (maximum 22.5 mm SL), absence of lateral line pores, and absence of barbels (females and young males are greyish in life, adult males are blue to emerald green dorsally, with a deep red lower part of head, body and caudal peduncle and anal fin [Figs. 7-8]; males reach a larger size and have a deeper body and higher anal fin).

There is no sexual dimorphism in the colour pattern (the pattern of chromatophore distribution), but there is sexual dichromatism: the melanophores are a little stronger in males than in females and the erythrophores and iridiophores are much more developed in males. This is opposed to the situation in *Danio erythromicron* which is the only known danioine species with sexually dimorphic colour pattern.

Etymology. A combination of the words Sunda (the large islands of western Indonesia) and *Danio* (a genus of cyprinid fishes). Gender: masculine.

Remarks. *Sundadanio axelrodi* was originally described as a member of the genus *Rasbora* (Brittan, 1976), probably because of its small size, 5 branched anal rays, absence of barbels and absence of lateral line pores. This placement has been doubted by Roberts (1989) who already commented that the species seems to be a danioine; Kottelat & Vidthayanon (1993) explicitly excluded it from *Rasbora*, but without placing it in any genus.

Sundadanio axelrodi is presently the only known species of the genus. It occurs in Borneo (Sarawak, Kalimantan Barat, Kalimantan Tengah), Bangka and Sumatra (Jambi, Riau). Differences in coloration suggest that more than one species might be confused under that name.

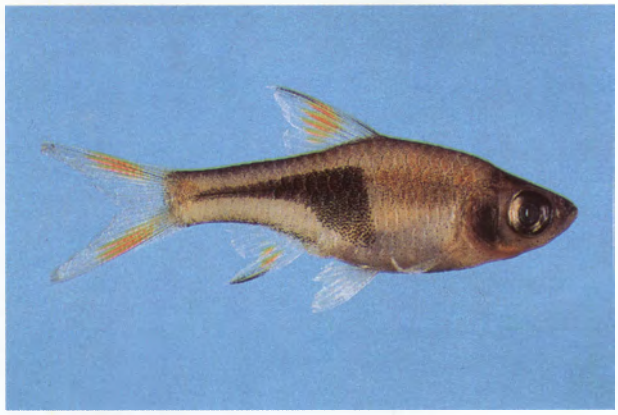

Figure 10. *Trigonostigma heteromorpha*, ZRC 42076, 21.5 mm SL; Thailand: Narathiwat Province.

Trigonostigma, new genus

Type species. *Rasbora heteromorpha* Duncker, 1904 (Fig. 10).

Diagnosis. A 'rasborine' genus distinguished by its unique colour pattern consisting in a reddish, pinkish or orange body (in life) with a conspicuous black stripe from below dorsal-fin origin to middle of caudal-fin base and usually broadened anteriorly so as to have a triangular or hatchet shape (except in *T. somphongsi* in which the stripe is only slightly broader anteriorly), and by its breeding behaviour during which eggs are spawned at the underside of broad leaves and similar structures. Other characters distinguishing the genus (but not unique) are: miniature size (maximum 32 mm SL in nature, aquarium-kept specimens may grow slightly larger), incomplete lateral line reduced to 6-9 pores, absence of barbels, 5 branched anal rays, and deep body (not quantified).

Etymology. From the Greek trigonon, triangle, and stigma, brand; an allusion to the black triangular blotch on the side. Gender: feminine.

Remarks. *Trigonostigma* includes the following named species: *T. heteromorpha* (Duncker, 1904) from the Malay Peninsula (from Narathiwat southwards) and Sumatra (Medan), *T. espei* (Meinken, 1967) from south-eastern Thailand and Cambodia, *T. hengeli* (Meinken, 1956) from Sumatra (Jambi) and Borneo (Kalimantan Barat), and *T. somphongsi* (Meinken, 1958) from Thailand (Meklong basin).

The genus *Rasbora* has long been a catch-all genus for small cyprinids with 5 branched anal rays, a

symphisal knob on lower jaw, no barbels, and a lateral line absent, incomplete or ending in the lower half of the caudal fin base. Many species have been placed in *Rasbora* simply because they do not fit with the definitions of other genera. Some species have recently been recognised as distinct genera (*Horadandia* Deraniyagala, 1943, *Rasboroides* Brittan, 1953 [recognised as valid by Kottelat & Vidthayanon, 1993], *Parluciosoma* Howes, 1980, *Boraras* Kottelat & Vidthayanon, 1993, and *Sundadanio* above). The species of *Trigonostigma* constitute a lineage easily defined by the unique type of colour pattern and spawning behaviour shared by its members.

The spawning behaviour of *Trigonostigma* species has been described many times in the aquarium literature, often documented by series of photographs. Among others, see Korthaus & Zukal (1978) and Wickler (1955) for data on *T. heteromorpha*, Elias (1973) and Richter (1984) for *T. espei* (in both papers misidentified as *T. hengeli*), Meyburg (1959) and Ott (1978) for *T. hengeli*, and Meulengracht-Madsen (1966) for *T. somphongsi*. The eggs are spawned on the lower surface of a large submerged leave or similar structure. In other species usually placed in *Rasbora*, the eggs are spawned in mid-water or among plants, but the eggs are not very adhesive and generally fall on the bottom. *Rasbora dorsiocellata* spawns on the upper surface of submerged leaves close to the water surface (Wickler, 1976).

Trigonostigma somphongsi is distinguished from the other species of the genus in having a more slender body and (somehow related to body depth), a lateral stripe only slightly broader anteriorly, without the conspicuous triangular or hatchet shape, and in missing the dark leading edges of the dorsal and anal fins. As it shares the other characters of the genus, including the unique spawning behaviour, it is placed in *Trigonostigma*. Future research may show that it is the sister species to all its congeners.

Intrarelationships among *Rasbora* sensu lato is still a largely unexplored field, but it is possible that *Trigonostigma* could be related with *Boraras* which shares the reddish background, the black leading edge on the dorsal and anal fins distinct at least in fully adult individuals (except *T. somphongsi*), the reduced size, and the reduced lateral line. They differ by the shape and position of the black marks (spots or a complete stripe in *Boraras*), and vertebrae number (15-16 + 15-16 = 30-31 in *Trigonostigma*, vs. 13-14 + 15-16 = 28-30 in *Boraras*).

Some of the species remaining in *Rasbora* also have an incomplete lateral stripe starting below or slightly in front of dorsal fin origin and ending at anal fin base, but they clearly have no close affinities with *Trigonostigma*. *Rasbora aprotaenia* Hubbs & Brittan, in Brittan, 1953, *R. spilotaenia* Hubbs & Brittan, in Brittan, 1953 and *R. bunguranensis* Brittan, 1951 are related to *R. elegans* Volz, 1903 with which they share the two blotches, one on the side and one at caudal fin base, and the two blotches are joined by a stripe. Some specimens of *R. rutteni* Weber & de Beaufort, 1916 from eastern Borneo have a short stripe in the posterior half of the body only, but the normal condition is to have this stripe continued by a faint stripe extending forward to the gill opening.

Comparison material. *Microrasbora rubescens*: CMK 4059, 16 ex., 9.1-21.5 mm SL; CMK 4060, 84 ex., up to 26.4 mm SL; Myanmar: Inle Lake. *M. gatesi*: CAS-SU 33898, 6 (out of 16) paratypes, 17.7-22.3 mm SL; Myanmar: Rangoon. - CAS-SU 33899, 6 (out of 16) paratypes, 20.4-23.1 mm SL; Myanmar: Hlegu.

Danio erythromicron: CMK 4192, 5 ex., 22.3-27.6 mm SL; Myanmar: Inle Lake.

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