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Five new species of *Puntius* from Myanmar (Teleostei: Cyprinidae)

Sven O. Kullander*

Five small species of *Puntius*, all characterised by a prominent blotch or band on the caudal peduncle, occur syntopic in small streams around Myitkyina and also Lake Indawgyi in northern Myanmar. *Puntius erythromycter*, new species, is characterised by a small size (to 33.1 mm SL), a dark band around the caudal peduncle, an abbreviated lateral line, males with reddish snout beset with tubercles, and absence of barbels. *Puntius nankyweensis*, new species, is diagnosed by a small size (to 32.5 mm SL), presence of minute barbels, a dark band around the caudal peduncle, an abbreviated lateral line, and absence of a scale row above the lateral line. *Puntius thelys*, new species, is a moderate sized species (to 41.8 mm SL), with an abbreviated lateral line, a dark blotch on the caudal peduncle, and absence of humeral marking. *Puntius macrogramma*, new species, is a moderate sized species (to 50.9 mm SL), with complete or almost complete lateral line, a minute humeral spot, and a dark blotch on the caudal peduncle. *Puntius erythromycter*, *P. nankyweensis*, *P. thelys*, and *P. macrogramma* are referred to the *P. conchonius* species group. *Puntius pugio*, new species, reaching 39.3 mm SL, is similar to *P. amphibius*, *P. brevis*, *P. burmanicus*, *P. chola*, *P. leiacanthus*, *P. sophore*, and *P. terio* in the presence of a frontoparietal fontanelle and also characterised by the absence of barbels, a complete lateral line, last unbranched dorsal fin ray without serrae, and a dark band around the caudal peduncle. *Cyprinus puntio* Hamilton, 1822, originally described from India but later only reported from Myanmar, is considered to be a *species inquirenda*. It cannot be identified on the basis of the description and there are no type specimens preserved.

Introduction

Small-sized species of the catch-all southern Asian cyprinid genus *Puntius* comprise over 60 species, ranging in distribution from the Indus drainage in Pakistan west to southern China. Although these species do not form a monophyletic group, several species groups have been recognised (Kortmulder, 1972; Kortmulder & van der Poll, 1981; Kullander & Fang, 2005; Taki et al., 1978). Nineteen species from India and Myanmar conform to the *P. conchonius* species group, recognised first by Taki et al. (1978). So far only a few species of the *P. conchonius* species group have been reported from Myanmar, starting with Day (1870a-b, 1878) who described *P. stoliczkanus* from Pegu (=Bago) and Moulmein (=Mawlamyine), and reported *P. puntio* from Sittoung. Kullander & Fang (2005) described *P. didi* from Myitkyina and Lake Indawgyi, and *P. tiantian* from Putao. Kullander & Fang (2005) suggested that *P. phutunio* reported by Hora & Mukerji (1929) from Myitkyina and Lake Indawgyi was actually *P. didi*. *Puntius phutunio* is not otherwise reported from

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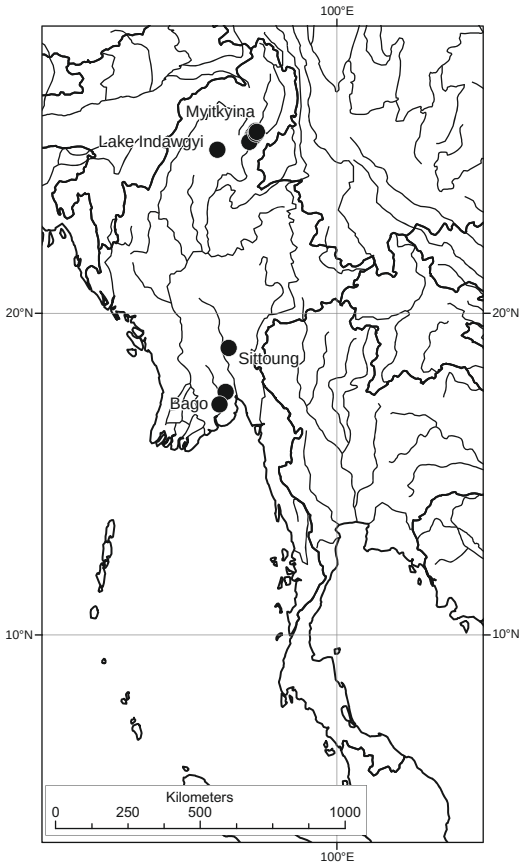

Fig. 1. Map of Myanmar and showing collecting localities for *Puntius pugio* (Sittoung and Bago Rivers; Lake Indawgyi, and Myitkyina area), *P. thelys* and *P. erythromycter* (Lake Indawgyi, Myitkyina area), *P. macrogramma* and *P. nankyweensis* (Myitkyina area).

outside India. Herein I report on another five species of small-sized *Puntius* found in the Myitkyina and Lake Indawgyi region together with *P. didi*. Four of these species are assigned to the *P. conchonius* species group, and one apparently belongs to *Puntius* in the strict sense. Several of the new species share a colour pattern that has been thought to characterise *P. puntio*, viz. a dark band encircling the caudal peduncle (e.g., Jayaram, 1991). I thus also take this opportunity to re-examine information about that nominal species.

Material and methods

Morphometry. Measurements were taken point to point with digital callipers measuring to 0.01 mm, rounded to nearest 0.1 mm. Standard length, head length, and snout length are taken from the tip of the snout to the caudal fin base, posterior opercular margin, and anterior orbital margin, respectively. Predorsal, prepelvic and preanal lengths are taken from the tip of the snout to the anterior base of each fin. Head depth is taken immediately behind the orbit. Body depth is taken at the origin of the dorsal fin. Dorsal, pectoral, pelvic, and anal fin lengths are taken from the base of the first ray to the distal tip of the longest ray. Caudal peduncle length is taken from the base of the last anal fin ray to the middle of the base of the caudal fin. Lateral line scale counts include only scales on the body. Scales in the lateral row equates the lateral line scale count, or, when the lateral line is abbreviated, includes the lateral line scales and posterior scales in the same horizontal row. Prepelvic scales are counted along the ventral midline from the head to the insertions of the pelvic fins, but excluding the 1-2 successively smaller scales between the pelvic fins. Dorsal, anal, and caudal fin counts, and vertebral counts were obtained from radiographs. Fin rays counts are reported as unbranched rays given in lower case Roman numerals, separated by a period from the number of branched rays in European numerals. The last "half ray" in the dorsal and anal fin is not counted as a separate element. Vertebral counts include the Weberian apparatus (individual centra not distinguishable in radiographs, but considered to be four, as known from other cyprinids), and the last half-centrum. Vertebrae anterior to the first interneural dorsal fin pterygiophore are distinguished as predorsal vertebrae, and are included in the count of precaudal vertebrae. The count of vertebrae contained in the caudal peduncle includes all centra on and posterior to a vertical from the base of the last anal fin ray. Homology interpretation of infraorbitals, and the recognition of the lateral fold on the snout follow Taki et al. (1978) and Taki (1974), respectively.

Toponomy. Local toponomy is used in descriptions of collecting sites, but it should be noted that local transliteration of Burmese geographical names is not consistent.

Sampling sites. Almost all specimens reported in this paper come from small streams around Myitkyina, on the right bank of the Ayeyarwaddy River in northern Myanmar, as well as streams and lakeside localities close to Lonton on Lake Indawgyi, which is situated slightly to the southwest of Myitkyina, within the Ayeyarwaddy basin (Fig. 1: Myitkyina, Lake Indawgyi). A few specimens come from the Bago Division, in the Bago and Sittoung river drainages (Fig. 1: Bago, Sittoung). The localities are listed here, by field numbers, to avoid repetitions in the material lists. Collectors for FANG stations were F. Fang and A. Roos, for SOK-94 stations S. O. Kullander and F. Fang, and for SOK-98 stations S. O. Kullander and R. Britz. Locality descriptions and images have been published by Kullander et al. (2000), Kullander & Britz (2002), and Kullander & Fang (2005). Sample compositions are summarised in Table 1.

FANG-97-020: Bago Division: stream crossing bridge about 16 km from Bago on road to Nyaunglaybin, 17°30'18"N 96°31'50"E; 19 Mar 1997.

FANG-97-048: Kachin State: Myitkyina market, 25°23'00"N 97°24'00"E; 30 Mar-3 Apr 1997.

FANG-97-049: Kachin State: Hpa Lap stream ca 3 km N of Yuzana Myaing (8 km to left from Myitkyina-Myitzon road km 11), 25°32'03"N 97°23'22"E; 1 Apr 1997.

FANG-97-050: Kachin State: Hpa Lap Chaung ca 5.6 km N Yuzana Myaing (8 km to left from Myitkyina-Myitzon road km 11), 25°32'08"N 97°23'20"E; 1 Apr 1997.

FANG-97-051: Kachin State: Hpa Lap Chaung just S of Yuzana Myaing village (8 km to left from Myitkyina-Myitzon road km 11), 25°31' 25"N 97°22'19"E; 1 Apr 1997.

FANG-97-053: Kachin State: Nan Kywe Chaung ca 200 m S of Sha Dau village, about 18 km on road Myitkyina-Mogaung, 25°20'03"N 97°16'40"E; 2 Apr 1997.

FANG-97-054: Kachin State: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung, 200 m S of road, 800 m E of Sha Dau village, 25°19'57"N 97°16'47"E; 2 Apr 1997.

FANG-97-056: Kachin State: stream about 24 km on road Myitkyina-Myitzon, 25°33'46"N 97°29' 30"E; 3 Apr 1997.

FANG-97-057: Kachin State: stream about 1.5 km on road Myitzon-Myitkyina, 25°42'57"N 97°29' 45"E; 3 Apr 1997.

SOK-94-012: Bago Division: Begu River where crossed by Highway 1 at 42 miles from Yangon, 17°13'32"N 96°27'22"E; 8 Mar 1994.

SOK-98-015: Kachin State:ditch marginal to fish ponds about 40 km N Myitkyina, on road to Myitzon, 25°29'00"N 97°24'51"E; 24 Mar 1998.

SOK-98-016: Kachin State: Nan Kywe Chaung under bridge on road south to Mogaung, 25°20'20"N 97°16'57"E; 25 Mar 1998.

Table 1. Frequency at each locality of specimens of the *P. conchonius* group and *P. pugio* sampled in Myitkyina and Lake Indawgyi in 1997 and 1998.

sampling event	*P. didi*	*P. macrogramma*	*P. thelys*	*P. erythromycter*	*P. nankyweensis*	*P. pugio*	sum	origin
FANG-97-048		6		2	1		9	market
FANG-97-049	2		1				3	Myitkyina
FANG-97-050	4		8	1			13	Myitkyina
FANG-97-051	20		15	97			132	Myitkyina
FANG-97-053			8	8			16	Myitkyina
FANG-97-054	1	5	1	4	26	22	59	Myitkyina
FANG-97-056	23	2	16	6			47	Myitkyina
FANG-97-057	42		1				43	Myitkyina
SOK-98-015			1	34			35	Myitkyina
SOK-98-016		2	42	101	50		195	Myitkyina
SOK-98-017			10	7			17	Myitkyina
SOK-98-018	2	7	1		1		11	Myitkyina
SOK-98-019			1	86			87	Myitkyina
SOK-98-025	1		1	117			119	Indawgyi
SOK-98-026			1	48		4	53	Indawgyi
SOK-98-027			5			1	6	Indawgyi
Total	95	22	112	511	78	27	845	

SOK-98-017: Kachin State: Nan Kywe Chaung ca 10 km S from Myitkyina and ca 300 m to left from road, 25°20'32"N 97°17'03"E; 25 Mar 1998.

SOK-98-018: Kachin State: Tang Shang Chaung, ca 300 m upstream from bridge at 21 mi on road Myitkyina-Myitzon, 25°33'47"N 97°29' 32"E; 26 Mar 1998. (Kullander & Britz, 2002: fig. 31.)

SOK-98-019: Kachin State: Kyan Khayen Chaung, ca 500 m downstream bridge at Kyan Khayen, 21 mi from Myitkyina, 25°39'2"N 97°30'24"E; 26 Mar 1998.

SOK-98-025: Kachin State: lower 300 m of Nant Yen Khan Chaung, affluent of Lake Indawgyi, little south of Lonton village, 25°06'00"N 96°16'59"E; 31 Mar 1998. (Kullander & Britz, 2002, fig. 27.)

SOK-98-026: Kachin State: Indawgyi Lake margin, pools and swamps close to lake, little north of Lonton village, 25°06'00"N 96°16'59"E; 31 Mar - 1 Apr 1998. (Kullander & Britz, 2002, fig. 38.)

SOK-98-027: Kachin State: Nant Yen Khan Chaung, affluent of Lake Indawgyi, upstream of road, near Lonton village, 25°06'00"N 96°16'59"E; 1 Apr 1998.

Collection codes. NRM Swedish Museum of Natural History, Stockholm; USNM National Museum of Natural History, Smithsonian Institution, Washington, DC.

Puntius erythromycter, new species
(Figs. 2-3)

Holotype. NRM 56987, adult probable male, 30.8 mm SL; Myanmar: Kachin State: Ayeyarwaddy River drainage: Hpa Lap Chaung just S of Yuzana Myaing village (8 km left from Myitkyina-Myitzon road km 11); F. Fang and A. Roos, 1 Apr 1997;

Paratypes. 511 specimens, 11.2-33.1 mm SL. NRM 40026, 2, 23.8-27.8 mm SL; FANG-97-048. – NRM 56762, 1, 26.6 mm SL; FANG-97-050. – NRM 36345, 45, 20.5-31.0 mm SL, NRM 56876, 2, C&S, 28.9 -30.5 mm SL, NRM 43143, 37, 25.0-30.6 mm SL, NRM 43144, 12, 29.2-33.1 mm SL; FANG-97-051. – NRM 36244, 8, 21.9-27.7 mm SL; FANG-97-053. – NRM 56816, 4, 24.5-29 mm SL; FANG-97-054. – NRM 56764, 6, 29.1-31 mm SL; FANG-97-056. – NRM 40728, 34, 14.4-30.9 mm SL; SOK-98-015. – NRM 40675, 101, 17.5-32.1 mm SL; SOK-98-016. – NRM 56761, 7, 23.9-28.5 mm SL; SOK-98-017. – NRM 40909, 86, 14.1-23.4 mm SL; SOK-98-019. – NRM 40975, 117, 16.7-29 mm SL; SOK-98-025. – NRM 56775, 48, 11.2-17.4 mm SL; SOK-98-026. – NRM 26713, 1, 21.6 mm SL, Myitkyina; R. Malaise, 6 Mar 1934.

Diagnosis. A species of the *Puntius conchonius* species group, similar to *P. yuensis*, *P. ornatus*, and *P. nankyweensis* in possession of dark band encircling caudal peduncle well posterior to base of anal fin, absence of humeral mark, and, in *P. nankyweensis*, 10 (rarely 11) circumpeduncular scales. Distinguished from *P. nankyweensis* by absence of barbels (vs. maxillary barbels present), transverse scale count ½4/1/3½ (vs. ½3/1/4½), scales in lateral row 18-20 (vs. 20-23), lateral scale row running curved (vs. straight) from head to caudal fin, caudal peduncle blotch positioned on scales 16-17 or 16-18 (vs. 18-20 or 19-20), and longer anal fin (17.1-22.0 vs. 12.1-16.4 % of SL). Distinguished from *P. yuensis* by smaller size (largest known specimen 33.1 mm SL vs. 55 mm SL), fewer scales in lateral row (18-20 vs. 21-22), and caudal peduncle blotch on scales 16-17 or 16-18 (vs. 19-20). Distinguished from *P. ornatus* by smaller size (largest known specimen 33.1 mm SL vs. 42 mm SL), less scales in lateral row (18-20 vs. 21-22), deeper body (41.2-46.0 % SL vs. 35.9 -38.7 % SL), 10-11 vs. 12 circumpeduncular scales, and caudal peduncle blotch on scales 16-17 or 16-18 (vs. 18-19 or 19-20).

Description. Refer to Table 2 for summary of morphometric data. Relatively deep, slightly elevated, compressed laterally. Predorsal contour ascending, almost straight, nape slightly elevated. Almost straight dorsal contour, slanting from dorsal fin base to caudal fin base. Preventral contour slightly curved or about straight to pelvic fin bases, posteriorly straight to anal fin base, which forms a gently concave outline continuous with straight sloping caudal peduncle outline.

Head short, laterally compressed. More than 50 % of orbit in anterior half of head. Snout rounded. Mouth subterminal, not quite reaching to vertical from anterior margin of orbit. Lips exposed, moderately thick, lips curved; lower lip fold interrupted symphysially. Lateral fold on snout present. Barbels absent. Infraorbital 3+4 broad, anterior end at middle of orbit, anteriorly extending to middle of depth of cheek, posteri-

Fig. 2. *Puntrius erythromycter*, NRM 56987, holotype, probable male, 30.8 mm SL; Myanmar: Hpa Lap Chaung just south of Yuzana Myaing village.

Fig. 3. *Puntrius erythromycter*, NRM 56987, paratype, female, 29.8 mm SL; Myanmar: Hpa Lap Chaung just south of Yuzana Myaing village.

orly extending to preopercle. Breeding tubercles absent in all specimens except very small in dark-coloured males (NRM 56761). Gill rakers 2-3 on epibranchial, one in angle, and 5 (6), 6 (4), 7 (1) on ceratobranchial.

Dorsal fin origin opposite pelvic fin origin; distal margin slightly concave, anterior and posterior corners acute; last ray reaching to vertical from end of anal fin base. Last unbranched dorsal fin ray almost as long as first branched ray; proximal ⅔ compact, thicker than first branched ray, rigid, strongly serrated, with 13-19 pairs of serrae on distal ½; apical ⅓ flexible, segmented, without serrae. D. iii.8 (10), iv.8 (1). Pectoral fin with rounded tip, reaching to vertical from base of pelvic fin. P. i.11 (4), i.12 (7). Pelvic fin tip rounded, attaining vent or anal fin base. V. i.8 (11). Anal fin base posterior to vertical from end of dorsal fin base, distal margin straight or slightly concave, corners acute, last ray reaching middle of caudal peduncle or slightly beyond. A. iii.5 (11). Caudal fin deeply emarginate; lobes making up half of fin length, tips rounded. Principal caudal fin rays 10+9; procurrent rays dorsally 5 (4), 6 (7), ventrally 5 (8), 6 (3).

Lateral line scales 4 (1), 5 (3), 6 (4), 7 (3). Lateral line scale row shifting one scale down from fourth scale, gently curved to ascend to middle of caudal peduncle, comprising 18 (2), 19 (7), 20 (2) scales plus 2 on caudal fin base. Predorsal scales 8 (10), 9 (11), prepelvic scales 9 (2), 10 (8), 11 (1); circumpeduncular scales 10 (9), 11 (2); dorsal midline scale row usually ending before reaching middle of caudal peduncle, and ventral midline scale row not developed. Scales in transverse row 4½/1/3½ (11). Pelvic axillary scale present, length corresponding to ⅓ of pelvic fin length.

Predorsal vertebrae 4+4 (11), abdominal 4 + 12

(11), preanal + caudal 4 + 13 + 13 = 30 (10), 4 + 12 + 14 = 30 (1); vertebral centra within caudal peduncle 6 (9), 7 (2). One specimen dissected, 30.9 mm SL (NRM 43144) with pharyngeal teeth 5, 3, 2.

Coloration in preservative. Ground colour yellowish white. Dorsum light greyish brown, scales with dark margin; sides gradually lighter ventral, below midline scales light with conspicuous brownish margin. Abdomen yellowish white. Chest and anterior side with silvery cast. Cheek, gill cover, and exposed cleithrum silvery with sparse brownish pigment. Snout greyish. Lower parts of head yellowish white. Iris whitish, black dorsally; a dark brown blotch above and below pupil. In strongly pigmented males, dark scale margins widened and intensified.

Dorsal fin in strongly pigmented males (NRM 56817 in particular) smoky with two rows of blackish spots and dark distal margin, inner row of blotches on interradial membranes, and outer row between branches of rays. Dorsal fin lightly pigmented or hyaline in females, spots showing only indistinctly in lightly coloured males. Anal fin distal half smoky, in strongly coloured males blackish (below dark caudal peduncle band). Caudal, pectoral and pelvic fins hyaline; pelvic fin dark grey in strongly pigmented males.

Pseudotympanum present, showing indistinctly beneath third and fourth scale in lateral line. Humeral marking absent. Caudal peduncle blotch posterior to vertical from posterior end of anal fin base, dark brown or black, generally round, contained in a slightly narrower equally intense or slightly less densely pigmented black or brown band encircling caudal peduncle. Side anterior and posterior to caudal peduncle band lighter than rest of side. Blotch covering two or three scales (usually scales 16-17 or 16-18 in lateral line row) and parts of scales above and below, corresponding to scales 2-4 or 3-4 counting from the last scale in the lateral line row. In strongly pigmented males, caudal peduncle blotch and band less conspicuous and light anterior and posterior margins absent; snout dorsally with thickened connective tissue layer, greyish.

Etymology. Named for the red snout in males; erythros (Greek), red, and mykter (Greek), nose. The name is a noun in apposition.

Geographical distribution. Present in most of the smaller water bodies near Myitkyina, and in Lake Indawgyi (Fig. 1; Table 1).

Remarks. Most samples are rather uniform in coloration, with only slight variation in intensity of dark colour, and the dorsal fin pigmentation

Table 2. Standard length (in millimeters) and proportional measurements in percents of standard length of *Puntius erythromycter*. SD, standard deviation. Regression line parameters, a (intercept), b (slope), and r (Pearson's correlation coefficient) are calculated from measurements expressed in millimeters; shown when $p < 0.05$. The holotype is included in calculated values.

	holotype	n	min	max	mean	SD	a	b	r
Standard length (mm)	30.8	11	27.4	32.1	29.6	1.35			
Head length	26.9	11	26.9	29.1	27.9	0.71	0.095	0.276	0.868
Snout length	6.8	11	6.5	7.3	6.9	0.23	0.776	0.043	0.712
Orbit diameter	12.0	11	11.1	12.3	11.6	0.44	1.442	0.068	0.636
Interorbital width	11.7	11	10.7	11.8	11.4	0.34	0.077	0.111	0.840
Head width	15.6	11	14.6	15.6	15.3	0.25	–0.433	0.168	0.957
Head depth	22.1	11	21.1	23.5	22.3	0.78	3.754	0.096	0.649
Body depth	41.2	11	41.2	46.0	44.4	1.36	3.661	0.320	0.759
Predorsal length	54.5	11	53.3	57.2	55.8	1.34	2.055	0.488	0.863
Prepelvic length	51.6	11	51.3	53.6	52.4	0.84	1.445	0.475	0.939
Preanal length	73.4	11	73.0	77.9	75.3	1.69	2.222	0.677	0.884
Caudal peduncle depth	16.2	11	15.0	18.6	16.9	1.05			
Caudal peduncle length	20.8	11	18.9	21.1	20.1	0.67	–0.128	0.206	0.816
Dorsal fin length	31.5	11	28.5	32.6	30.9	1.24	3.772	0.181	0.605
Anal fin length	18.8	11	17.1	22.0	19.9	1.58			
Pectoral fin length	23.1	11	19.6	23.9	22.2	1.16			
Pelvic fin length	23.7	11	20.2	23.9	22.8	1.12			

Fig. 4. *Puntius nankyweensis*, NRM 37262, holotype, 26.8 mm SL; Myanmar: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung.

grades from uniformly hyaline to indistinctly spotted. Only specimens in NRM 56761 show pronounced sexual dichromatism, with four dark males 24.9-29.3 mm SL (one dissected, 29.3 mm SL with testes), and three light females 24.3 -26.0 mm SL (one dissected, 26.0 mm SL, with eggs, 0.6 mm in diameter). Among nine additional specimens dissected, most were sexually quiescent; ripe ova were found only in one specimen 30.7 mm SL (NRM 56764), egg diameter up to 0.6 mm. Sexed females are slightly more deep bodied in overall aspects, than males. It seems possible that the material available of *P. erythromycter* consists almost exclusively of females.

Large tubercles on the snout are not known from other species of the *P. conchonius* group, or in the majority of small species of *Puntius*. Similar sex dimorphism occurs, however, in *P. fasciatus* from southern India, but in that species the tubercles are much more numerous and cover a larger area.

Puntius erythromycter and *P. nankyweensis* are syntopic and similar in overall colour pattern, particularly the dark band around the caudal peduncle, and small size. Differences are manifest particularly in the course of the lateral line scale row (curved in *P. erythromycter*, straight in *nankyweensis*), vertical scale count (4½/1/3½ in *P. erythromycter*, 3½/1/4½ in *P. nankyweensis*), development of barbels (absent in *P. erythromycter*, maxillary barbels present in *P. nankyweensis*), and the dorsal fin coloration (two rows of spots in *P. erythromycter*, immaculate in *P. nankyweensis*). The two species also differ in proportional measurements. *Puntius erythromycter* has a deeper head (21.1-23.5 % of SL, vs. 18.2-21.2), deeper body (41.2-46.0 % of SL, vs. 38.5-41.8), shorter caudal peduncle (18.9-21.1 % of SL, vs. 21.6-23.2), and longer anal fin (17.1-22.0 % of SL, vs. 12.1-16.4) than *P. nankyweensis*.

Puntius erythromycter is apparently the same species as the "Lipstick barb" introduced in the aquarium hobby in 2006. Two aquarium specimens (NRM 56986, female 25.0 mm SL, male 23.7 mm SL) agree in meristics and coloration with wild specimens. In the fresh preserved male, the dorsal portion of the snout is maroon, and beset with several distinct but small pointed tubercles. Living specimens of both sexes had a pale red dorsal fin.

***Puntius nankyweensis*, new species**
(Fig. 4)

Holotype. NRM 37262, 26.8 mm SL; Myanmar: Kachin State: Ayeyarwaddy River drainage: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung, 200 m S of road, 800 m E of Sha Dau village; F. Fang and A. Roos, 2 Apr 1997 (FANG-97-054).

Paratypes. 78 specimens, 19.6-32.5 mm SL. NRM 56818, 1, 27.4 mm SL; FANG-97-048. – NRM 56768, 25, 21.1-28.4 mm SL; FANG-97-054. – NRM 56817, 49, 19.6-32.5 mm SL; NRM 56874, 2, C&S, 25.4 -27.0 mm SL; SOK-98-016. – NRM 56760, 1, 25.9 mm SL; SOK-98-018.

Diagnosis. A species of the *Puntius conchonius* species group, distinguished from other members of that group by lateral line scale row running straight from head to caudal fin base instead of curved, and first branched dorsal fin ray more than twice as long as last branched dorsal fin ray. Similar to syntopic species *P. erythromycter* in possession of dark band encircling caudal peduncle well posterior to base of anal fin, absence of humeral mark, and possession of 10 (rarely 11) circumpeduncular scales. Distinguished from *P. erythromycter* by presence of short maxillary barbels (vs. absence), transverse scale count ½3/1/4½ (vs. ½4/1/3½), scales in lateral row 20-23 (vs. 18-20), lateral scale row running straight (vs. curved) from head to caudal fin, caudal peduncle blotch positioned on scales 18-20 or 19-20 (vs. 16-17, 16-18), last branched dorsal fin ray less than half length of first (vs. more than half length of first), and very short anal fin (12.1-16.4 vs. 17.1-22.0 % of SL). Distinguished from *P. yuensis* and *P. ornatus*, also with dark band around caudal peduncle, by presence of maxillary barbels (vs. absence), transverse scale count ½3/1/4½ (vs. ½4/1/3½), last branched dorsal fin ray less than half length of first (vs. more than half length of first), and lateral scale row running straight horizontal (vs. curved).

Description. Refer to Table 3 for summary of morphometric data. Moderately deep, slightly elevated, compressed laterally. Predorsal contour ascending, almost straight, nape slightly elevated. Almost straight dorsal contour, slanting from dorsal fin base to caudal fin base. Preventral contour slightly curved or about straight to pelvic fin base, posteriorly straight to anal fin base, which forms a gently concave outline continuous with straight sloping caudal peduncle outline.

Head short, laterally compressed. More than 50 % of orbit in anterior half of head. Snout rounded. Mouth subterminal, not quite reaching to vertical from anterior margin of orbit. Lips exposed, moderately thick, lips curved; lower lip fold interrupted symphysially. Lateral fold on snout present. Rostral barbel absent; maxillary barbel present, short (about ½ pupil diameter). Infraorbital 3+4 broad, anterior end at middle of orbit, anteriorly extending to middle of depth of cheek, posteriorly extending to near preopercle. Gill rakers 2-3 on epibranchial, one in angle, and 6 (6), 7 (4) on ceratobranchial.

Dorsal fin origin opposite pelvic fin origin;

Table 3. Standard length (in millimeters) and proportional measurements in percents of standard length of *Puntius nankyweensis*. SD, standard deviation. Regression line parameters, a (intercept), b (slope), and r (Pearson's correlation coefficient) are calculated from measurements expressed in millimeters; shown when $p < 0.05$. The holotype is included in calculated values.

	holotype	n	min	max	mean	SD	a	b	r
Standard length (mm)	26.8	11	25.9	32.5	27.8	1.75			
Head length	28.4	11	27.7	29.6	28.4	0.63	1.086	0.245	0.938
Snout length	6.7	11	6.0	7.2	6.6	0.33	–0.328	0.078	0.837
Orbit diameter	11.6	11	11.1	12.3	11.7	0.34	0.788	0.089	0.886
Interorbital width	10.8	11	10.4	11.2	10.8	0.28	0.484	0.091	0.905
Head width	14.6	11	14.3	15.8	14.8	0.41	0.862	0.117	0.902
Head depth	20.9	11	18.2	21.2	20.2	0.95	1.993	0.131	0.702
Body depth	39.9	11	38.5	41.8	40.5	0.84	–1.051	0.443	0.964
Predorsal length	54.1	11	52.5	55.4	54.1	0.87	0.389	0.527	0.968
Prepelvic length	52.2	11	48.7	52.9	50.8	1.14	1.408	0.457	0.935
Preanal length	74.3	11	70.0	74.8	73.1	1.28	–1.849	0.798	0.975
Caudal peduncle depth	17.5	11	15.1	17.7	16.6	0.73	0.438	0.150	0.795
Caudal peduncle length	21.6	11	21.6	23.2	22.3	0.59	0.172	0.217	0.919
Dorsal fin length	32.5	11	29.7	33.5	31.6	1.24	1.195	0.273	0.818
Anal fin length	16.4	11	12.1	16.4	15.1	1.24	–1.060	0.189	0.703
Pectoral fin length	21.3	11	18.8	23.8	20.8	1.37			
Pelvic fin length	23.9	11	22.7	25.0	23.7	0.67	0.296	0.227	0.911

distal margin slightly concave, anterior and posterior corners acute; last ray reaching to vertical from beginning or middle of anal fin base. Last unbranched dorsal fin ray almost as long as first branched ray, which more than twice as long as last branched ray; proximal ¾ compact, slightly thicker than first branched ray, rigid, strongly serrated, with 15-20 pairs of serrae on distal ⅔; apical ¼ flexible, segmented, without serrae. D. iii.8 (1), iv.8 (10). Pectoral fin with pointed tip, reaching to vertical from base of pelvic fin or slightly shorter. P. i.11 (8), i.12 (3). Pelvic fin tip pointed, attaining vent. V. i.8 (11). Anal fin base well posterior to vertical from end of dorsal fin base, distal margin slightly concave, corners acute, last ray reaching middle of caudal peduncle. A. iii.5 (11). Caudal fin deeply emarginate; lobes making up half of fin length, tips rounded. Principal caudal fin rays 10+9; procurrent rays dorsally 6 (5), 7 (5), ventrally 5 (2), 6 (7).

Lateral line scales 5 (3), 6 (7). Lateral scale row running straight horizontal to caudal peduncle, comprising 20 (1), 21 (6), 22 (1), 23 (3) scales plus 2 on caudal fin base. Predorsal scales 8 (10), 9 (1), prepelvic scales 9 (2), 10 (4), 11 (5); circumpeduncular scales 10 (6), 11 (2), 12 (1); dorsal midline scale row usually ending before reaching middle of caudal peduncle, and ventral midline scale row usually not developed. Scales in transverse row 3½/1/4½ (9) or 4½/1/4½ (2). Pelvic axillary scale present, reaching to ¼ of adpressed pelvic fin.

Predorsal vertebrae 4+4 (11), abdominal 4 +13 (11), preanal+caudal 4+13+13=30 (1), 4+13 +14=31 (3), 4+14+13=31 (6), 4+14+14=32 (1); vertebral centra within caudal peduncle 7 (9), 8 (2). One specimen dissected, 26.5 mm SL (NRM 56817) with pharyngeal teeth 4, 3, 2.

Coloration in preservative. Ground colour yellowish white. Dorsum light brown, scales with dark margin; sides gradually lighter ventral, below midline scales light with brownish blotch at base. Abdomen yellowish white; dark peritoneum may give a swarthy appearance to abdominal sides. Chest and anterior side with silvery cast. Cheek, gill cover, and exposed cleithrum silvery with sparse brownish pigment. Snout greyish. Lower parts of head yellowish white. Iris whitish, black dorsally; a dark brown blotch above pupil.

Dorsal fin in both sexes hyaline, pattern of dark markings absent. Anal fin in both sexes hyaline, distal margin blackish (below dark caudal peduncle band). Caudal, pectoral and pelvic fins hyaline.

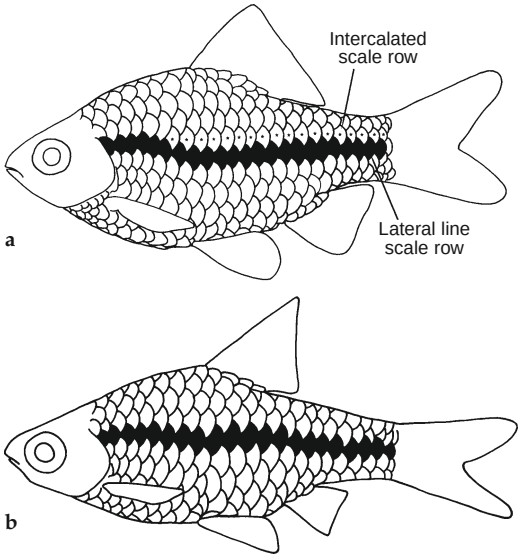

Fig. 5. Scale patterns in *Puntius.* **a,** common pattern with a curved lateral line and an additional horizontal scale row added where downward curve starts; **b,** pattern in *P. nankyweensis*, without curve and intercalated scale row.

Pseudotympanum beneath third and fourth scales in lateral line, evidenced through thin and lightly pigmented scales as two narrow dark vertical shades, and associated aggregation of fat globules. Humeral marking absent. Caudal peduncle blotch posterior to vertical from posterior end of anal fin base, dark brown or black, generally round, contained in a slightly narrower equally intense or slightly less densely pigmented black or brown band encircling caudal peduncle. Side anterior and posterior to caudal peduncle band yellowish white. Blotch covering two or three scales (usually scales 18-20 or 19-20 in lateral line row) and parts of scales above and below, corresponding to scales 2-4, 3-4, or 3-5 counting from the last scale in the lateral line row.

Etymology. Named for the stream in which the type locality is situated, the Nan Kywe Chaung, near Myitkyina.

Geographical distribution. Known only from small streams near Myitkyina (Fig. 1; Table 1).

Remarks. No sexual dimorphism was detected. Specimens dissected from NRM 56817 were one male 24.4 mm SL with slender, white testis, and three females 24.5-26.5 mm SL with blackish ovaries but eggs not developed. A specimen from NRM 56768, 25.5 mm SL, is a female with ripe ovary containing light-coloured eggs up to 0.5 mm in diameter.

Puntius nankyweensis has a straight lateral line scale row, because no additional horizontal scale row is intercalated above it, forcing a ventrad curved course, and the vertical scale count ½3/1/4½ predominates (Fig. 5). In some specimens (including the left side of the holotype), a short scale row may be intercalated close to the predorsal midline, however, producing the count ½4/1/4½, which then is not homologous with the condition in other species with ½/4/1/4½.

Morphometrically, *P. nankyweensis* is characterised by a proportionally short anal fin (length 12.1-16.4 % SL vs. 17.1-22.4), and long caudal peduncle (length 21.6-23.4 % SL vs. 16.2-21.9) compared to *P. didi, P. macrogramma, P. erythromycter, P. thelys,* and *P. tiantian*. The dorsal fin has a more acute triangular shape than in other species of the *P. conchonius* group (Fig. 5), which is a reflection of the gradually much shorter rays posterior to the first branched dorsal fin ray. In *P. nankyweensis* the first ray is much more than twice the length of the last ray. In other species of the *P. conchonius* group, the dorsal fin is broader due to relatively longer posterior dorsal fin rays, the last branched ray more than half the length of the first ray.

Puntius nankyweensis apparently has a slightly narrower infraorbital 3+4 than other species of the *P. conchonius* group, posteriorly with a proportionally slightly greater distance to the preopercle, but it is still proportionally wider than in other *Puntius*. Cleared and stained specimens show no evidence of posterior infraorbitals, present in other species of the *P. conchonius* group.

Puntius thelys, new species
(Figs. 6-8)

Holotype. NRM 56991, adult male, 36.0 mm SL, Myanmar: Kachin State: Ayeyarwaddy River drainage: stream about 24 km on road Myitkyina-Myitzon; F. Fang & A. Roos, 3 Apr 1997 (FANG -97-056).

Paratypes. 12 males, 28.0-36.7 mm SL, 40 females, 26.2-41.8 mm SL, and 61 juveniles, 9.5-22.2 mm SL. NRM 39994, 2, 33.3-39.2 mm SL; FANG-97-048. – NRM 36176, 1, 30.4 mm SL; FANG-97-049. – NRM 36245, 7, 30.3-40.1 mm SL; FANG-97-050. – NRM 37259, 1, 36.2 mm SL; FANG-97-050. – NRM 56763, 13, 27.2-38.1 mm SL, and NRM 56875, 2, C&S, 28.5-31.3 mm SL; FANG-97-051. – NRM 36236, 7, 9.3-17.3 mm SL; FANG-97-053. – NRM 37260, 1, 14.8 mm SL; FANG-97-053. – NRM 37261, 1, 16.1 mm SL; FANG-97-054. – NRM 36228, 2, 8.9-14.9 mm SL; FANG-97-056. – NRM 36342, 12, 30.8-37.1 mm SL; FANG-97-056. – NRM 37258, 1, 35.4 mm SL; FANG-97-056. – NRM 39901, 1, 30.1 mm SL; FANG-97-057. – NRM 56765, 1, 28 mm SL; SOK-98-015. – NRM 40668, 1, 31.7 mm SL; SOK-98-016. – NRM 56766, 1, 30.1 mm SL; SOK-98-016. – NRM 56767, 40, 9.5-15.9 mm SL; SOK-98-016. – NRM 40883, 1, 36.7 mm SL; SOK-98-017. – NRM40885, 9, 12.6-15.7 mm SL; SOK-98-017. – NRM 56859, 1, 32.4 mm SL, SOK -98-018. – NRM 56860, 1, 26.2 mm SL; SOK-98-019. – NRM 56770, 1, 36.4 mm SL; SOK-98-025. – NRM 56774, 1, 22.2 mm SL; SOK-98-026. – NRM 41055, 4, 26.4-41.8 mm SL; SOK-98-027. – NRM 43142, 1, 34 mm SL; SOK-98-027.

Diagnosis. A species of the *P. conchonius* species group distinguished by characters in combination: barbels absent, humeral mark absent; prominent dark blotch present anteriorly on caudal peduncle, chiefly on scales 17-18 or 18-19 in lateral row; dorsal fin in males with two rows of dark blotches and dark margin, blotches anteriorly on fin most prominent; anal and pelvic fins immaculate; lateral line short, on 6-11 scales; scales in lateral row 20-23. Distinguished from similar species *P. macrogramma,* and *P. stoliczkanus* by short (vs. complete or almost complete) lateral line and absence of humeral mark; from *P. conchonius* by larger caudal peduncle blotch and dark colour of dorsal fin in two rows of spots crossing middle of fin (vs. forming a dark marginal blotch).

Description. Refer to Table 4 for summary of morphometric data. Moderately deep, slightly elevated, compressed laterally. Predorsal contour ascending, almost straight, nape slightly elevated. Almost straight dorsal contour, slanting from dorsal fin base to caudal fin base. Prepelvic contour about straight to middle of abdomen where curved, straight horizontal to pelvic fin base, from pelvic fin base slanting to anal fin base, which

Fig. 6. *Puntius thelys*, NRM 56991, holotype, adult male, 36.0 mm SL; Myanmar: stream about 24 km on road Myitkyina-Myitzon.

Fig. 7. *Puntius thelys*, NRM 36342, paratype, adult female, 37.1 mm SL; Myanmar: stream about 24 km on road Myitkyina-Myitzon.

Fig. 8. *Puntius thelys*, NRM 37258, paratype, adult male, 35.4 mm SL; Myanmar: stream about 24 km on road Myitkyina-Myitzon. Photographed immediately after preservation.

forms a gently concave outline continuous with caudal peduncle outline.

Head short, laterally compressed. More than 50 % of orbit in anterior half of head. Snout rounded. Mouth subterminal, reaching to vertical from anterior margin of orbit. Lips exposed, moderately thick, upper lip curved; lower lip interrupted symphysially, straight. Lateral fold on snout present. Barbels absent. Infraorbital 3+4 broad, anterior end at or anterior to middle of orbit, anteriorly extending to middle of depth of cheek, posteriorly extending to preopercle. Breeding tubercles absent in all specimens. Gill rakers 2-3 on epibranchial, one in angle, and 4 (1), 5 (6), 6 (3) on ceratobranchial.

Dorsal fin origin opposite pelvic fin origin; distal margin slightly concave, anterior and posterior corners rounded; last ray not quite reaching to vertical from end of anal fin base. Last unbranched dorsal fin ray almost as long as first branched ray; proximal ¾ to ⅘ compact, much thicker than first branched ray, rigid, strongly serrated, with 11-16 pairs of serrae on distal half; apical ⅕-¼ flexible, segmented, without serrae. D. iii.8 (6), iv.8 (7). Pectoral fin rounded, reaching to vertical from base of pelvic fin. P. i.12 (4), i.13 (5), i.14 (1). Pelvic fin rounded, attaining vent, occasionally unbranched anal fin rays. V. i.7 (2), i.8 (8). Anal fin base posterior to vertical from dorsal fin base, distal margin straight with acute or subacute corners, last ray reaching beyond middle of caudal peduncle. A. iii.5 (13). Caudal fin deeply emarginate; lobes making up slightly less than half of fin length, tips rounded. Principal caudal fin rays 10 + 9 (29); procurrent rays dorsally 5 (1), 6 (12), ventrally 4 (1), 5 (10), 6 (2).

Lateral line abbreviated, lateral line scale row straight horizontal for 4-5 scales, then descending due to intercalation of additional horizontal scale row above, running in a smooth curve ascending to a median position on side of caudal pedunce. Scales in lateral row 20 (2), 21 (6), 22 (5), 23 (1); lateral line scales 6 (1), 7 (2), 8 (3), 9 (2), 10 (4), 11 (1). Predorsal scales 8 (2), 9 (5), 10 (3); prepelvic scales 10 (5), 11 (5); circumpeduncular scales 12 (17). Scales in transverse row ½4/1/3½ (10). Pelvic axillary scale present, reaching to ⅓ of adpressed pelvic fin.

Predorsal vertebrae 4 + 3 (1), 4 + 4 (11) 5 (1), abdominal 12 (5), 13 (8), precaudal+caudal 4 + 13 + 12 = 29 (2), 4 + 13 + 13 = 30 (9), 4 + 14 + 12 = 30 (2). Vertebrae contained in caudal peduncle 5 (1), 6 (12). One specimen dissected, 36.9 mm SL (NRM 41055), with pharyngeal teeth 4, 3, 2.

Coloration in preservative. Ground colour yellowish white. Dorsum light brownish, scale margins narrowly darker; sides gradually lighter

Table 4. Standard length (in millimeters) and proportional measurements in percents of standard length of *Puntius thelys*. SD, standard deviation. Regression line parameters, a (intercept), b (slope), and r (Pearson's correlation coefficient) are calculated from measurements expressed in millimeters; shown when $p < 0.05$. The holotype is included in calculated values.

	holotype	n	min	max	mean	SD	a	b	r
Standard length (mm)	36.0	10	33.0	37.1	34.6	1.37			
Head length	28.1	10	26.7	28.3	27.7	0.57	1.497	0.234	0.867
Snout length	6.9	10	6.2	7.1	6.7	0.27	–0.149	0.072	0.734
Orbit diameter	10.0	10	10.0	11.3	10.7	0.36	1.572	0.062	0.618
Interorbital width	10.8	10	10.3	11.5	11.1	0.38	–0.023	0.111	0.762
Head width	14.4	10	14.4	15.5	14.8	0.39	2.016	0.090	0.754
Head depth	19.7	10	19.2	21.8	20.6	0.88	2.187	0.143	0.560
Body depth	40.3	10	40.3	45.9	43.4	1.47	0.853	0.409	0.733
Predorsal length	54.2	10	54.2	56.6	55.4	0.77	1.388	0.514	0.936
Prepelvic length	48.9	10	48.7	52.2	50.2	1.11	–0.707	0.522	0.884
Preanal length	72.2	10	70.9	76.1	73.1	1.42	–5.069	0.878	0.936
Caudal peduncle depth	15.8	10	15.8	17.4	16.8	0.48	0.76	0.146	0.769
Caudal peduncle length	20.6	10	18.9	21.9	20.5	0.94			
Dorsal fin length	27.5	10	25.8	32.2	29.0	1.86	–3.401	0.388	0.650
Anal fin length	19.4	10	19.4	22.4	20.8	0.97			
Pectoral fin length	22.5	10	22.0	26.1	23.8	1.17	1.253	0.201	0.556
Pelvic fin length	23.1	10	22.6	26.7	24.5	1.36	–2.956	0.330	0.703

ventral, with brownish pigment marking scale outlines. Abdomen yellowish white; dark peritoneum may give a swarthy appearance to abdominal sides. Chest usually with silvery cast. Cheek, gill cover, and exposed cleithrum silvery with sparse brownish pigment. Snout greyish. Lower parts of head yellowish white. Iris whitish, black dorsally.

Dorsal fin in males with black stripe or series of black oval blotches on middle of rays and interradial membranes from first branched fin ray or preceding interradial membrane to third branched ray, continued as blotches proximal to 7th branched ray; more indistinct blackish spots on interradial membrane between major branches of 4th to 7th branched rays; alternatively (Fig. 6) anterior band continuous with outer series of spots; distal margin of fin dusky; a black spot at tip of penultimate unbranched ray. One specimen (NRM 40883) with black spot also laterally on last unbranched dorsal fin ray. Dorsal fin in females slightly pigmented, pattern of spots absent. Anal fin in both sexes lightly pigmented, pattern absent. Caudal fin in both sexes unpigmented except light brownish at basal scales. Pectoral and pelvic fins in both sexes lightly pigmented.

Pseudotympanum beneath fourth scale in lateral line, almost completely masked by thick scale and diffuse pigmentation. Humeral marking absent in all specimens except NRM 40883 in which there is a minute but contrasted black spot at margin of third and base of fourth scale in row below lateral line scales. Caudal peduncle blotch immediately posterior to vertical from posterior end of anal fin base, dark brown to blackish, oval, or roundish with more or less distinct extension to dorsal margin of caudal peduncle, and less distinct extension ventral on side of caudal peduncle. Side anterior and ventral to caudal peduncle blotch much lighter than rest of side. Blotch covering two scales (usually scales 17-18 in lateral row, may also be 18-19) and parts of scales above and below, usually showing through one anterior scale (scale 16 or 17), corresponding to scales 4-5 (4-6) counting from the last scale in the lateral row.

Live colours. Freshly preserved male (Fig. 8) photographed in field, light brownish dorsally, to whitish ventrally, with yellowish tinge to lower sides and anterior and posterior to caudal peduncle blotch. Pelvic fin distally, anal fin anteriorly and margins of caudal fin yellow. Dorsal fin with slight reddish tinge.

Etymology. *Thelys,* Greek adjective meaning feminine, in reference to the female dominance in the samples.

Geographical distribution. Ubiquitous in streams near Myitkyina, and also in Lake Indawgyi (Fig. 1; Table 1).

Remarks. Based on the presence of dorsal fin markings as a male character, we identify 13 males, 28.0-36.7 mm SL, and 40 females, 26.2-41.8 mm SL. Five females, 37.1-41.8 mm, are larger than the largest males, and from each station where both sexes are represented, a female is the largest specimen. It seems likely that females grow larger than males, and may dominate local demes. All eight specimens from FANG-97-050, and all 15 specimens from FANG-97-051 are females; specimens from FANG-97-056, however, include eight males and six females.

Dissected specimens 36.1, 39.0 (NRM 56763), and 38.2 mm SL (NRM 32245) are females with undeveloped ova in single ovary; 34.5 mm SL (NRM 41055) is a male with ripe testes; 36.9 mm SL (NRM 41055) is a ripe female with eggs up to 0.66 mm in diameter.

Puntius thelys is most similar in general aspect to *P. macrogramma,* but readily distinguished by the absence of a humeral blotch, and the short lateral line (6-11 scales vs. 19-23, exceptionally less). The transverse scale count also distinguishes the species (½4/1/3½ in *P. thelys* vs. ½4/1/4½ in *P. macrogramma*).

Puntius macrogramma, new species
(Figs. 9-10)

Holotype. NRM 36198, adult male, 46.9 mm SL; Myanmar: Kachin State: Ayeyarwaddy River drainage: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung, 200 m S of road, 800 m E of Sha Dau village; F. Fang et al., 2 Apr 1997 (FANG-97-054).

Paratypes. 8 males, 37.4-47.5 mm SL, 12 females, 25.5-50.9 mm SL, and 1 juvenile, 19.5 mm SL. NRM 40027, 3, 42.4-46.1 mm SL; FANG-97-048. – NRM 56773, 2, 49.6-50.9 mm SL, and NRM 56872, 1, C&S, 43.4 mm SL; FANG-97-048. – NRM 36615, 3, 44.4-47.6 mm SL; FANG-97-054. – NRM 56769, 1, 19.5 mm SL; FANG-97-054. – NRM 56857, 2, 37.5-39.9 mm SL; FANG-97-056. – NRM 40665, 2,

25.5-26.8 mm SL; SOK-98-016. – NRM 40891, 7, 34.4-40.4 mm SL; SOK-98-018.

Diagnosis. A species of the *P. conchonius* group, distinguished by the combination of absence of barbels, complete or almost complete lateral line, presence of a minute humeral mark on and below lateral line scale 3, and transverse scale count ½4/1/4½ (vs. ½4/1/3½ or ½3/1/4½ in other species of *P. conchonius* group). Similar to *P. stoliczkanus*, but humeral mark much smaller.

Description. Refer to Table 5 for summary of morphometric data. Moderately deep, slightly elevated, compressed laterally. Predorsal contour ascending, almost straight, nape slightly elevated. Almost straight dorsal contour, slanting from dorsal fin base to caudal fin base. Prepelvic contour about straight to below pectoral fin where curved, straight horizontal to pelvic fin bases, from pelvic fin base straight to anal fin base, which forms a gently concave outline continuous with caudal peduncle outline.

Head short, laterally compressed. More than 50 % of orbit in anterior half of head. Snout rounded. Mouth subterminal, reaching to or not quite to vertical from anterior margin of orbit. Lips exposed, moderately thick, upper lip curved; lower lip fold interrupted symphysially, otherwise curved. Lateral fold on snout present. Barbels absent. Infraorbital 3+4 broad, anterior end at middle of orbit, anteriorly extending to middle of depth of cheek, posteriorly extending to preopercle. Breeding tubercles absent in all specimens. Gill rakers 1-2 on epibranchial, one in angle, and 3 (2), 4 (7), 5 (4) on ceratobranchial.

Dorsal fin origin opposite pelvic fin origin; distal margin straight, anterior and posterior corners rounded; last ray reaching to about vertical from end of anal fin base. Last unbranched dorsal fin ray almost as long as first branched ray; proximal ⅔ compact, much thicker than first branched ray, rigid, strongly serrated, with 14-17 pairs of serrae on distal ⅔; apical ⅓ flexible, segmented, without serrae. D. iii.8 (12), iiv.8 (1). Last unbranched dorsal fin ray smooth in specimen 34.7 mm SL. Pectoral fin rounded, reaching to vertical from base of pelvic fin or slightly shorter. P. i.12 (2), i. 13 (11). Pelvic fin tip rounded, attaining vent, occasionally unbranched anal fin rays. V. i.7 (1), i.8 (12). Anal fin base posterior to vertical from dorsal fin base, distal margin straight with rounded corners, last ray reaching beyond middle of caudal peduncle. A. iii.5 (13). Caudal fin deeply emarginate; lobes making up slightly less than half of fin length, tips rounded. Principal caudal fin rays 10+9, procurrent rays dorsally 4 (1), 5 (4), 6 (8), ventrally 4 (1), 5 (10), 6 (2).

Table 5. Standard length (in millimeters) and proportional measurements in percents of standard length of *Puntius macrogramma*. SD, standard deviation. Regression line parameters, a (intercept), b (slope), and r (Pearson's correlation coefficient) are calculated from measurements expressed in millimeters. The holotype is included in calculated values.

	holotype	n	min	max	mean	SD	a	b	r
Standard length (mm)	46.9	13	34.7	47.5	40.4	4.58			
Head length	27.7	13	26.5	28.2	27.3	0.52	0.798	0.253	0.986
Snout length	8.1	13	6.5	8.1	7.4	0.50	–1.179	0.103	0.947
Orbit diameter	10.7	13	10.7	11.5	11.0	0.26	0.552	0.096	0.983
Interorbital width	11.5	13	10.9	12.4	11.5	0.44	–0.525	0.128	0.961
Head width	15.4	13	14.7	16.0	15.4	0.29	0.171	0.149	0.988
Head depth	21.7	13	20.7	22.3	21.7	0.58	–0.271	0.224	0.974
Body depth	44.6	13	41.8	46.7	44.0	1.33	–3.813	0.536	0.989
Predorsal length	55.0	13	54.1	57.9	55.7	0.99	0.252	0.551	0.989
Prepelvic length	51.4	13	50.7	54.1	51.8	1.02	–0.429	0.529	0.986
Preanal length	74.0	13	72.8	75.7	74.4	1.01	–1.005	0.769	0.994
Caudal peduncle depth	15.4	13	15.4	17.9	16.7	0.69	–0.509	0.180	0.939
Caudal peduncle length	20.7	13	17.7	21.1	19.7	0.95	–0.838	0.218	0.939
Dorsal fin length	25.8	13	25.8	29.7	27.7	1.05	2.530	0.214	0.944
Anal fin length	18.3	13	18.0	21.9	19.5	1.04	1.551	0.156	0.883
Pectoral fin length	24.9	13	21.4	25.1	23.2	1.27	–0.553	0.246	0.907
Pelvic fin length	23.7	13	21.9	26.5	23.9	1.21	1.13	0.210	0.899

Fig. 9. *Puntius macrogramma*, NRM 36198, holotype, adult male, 46.9 mm SL; Myanmar: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung.

Fig. 10. *Puntius macrogramma*, NRM 36615, paratype, adult female, 47.5 mm SL; Myanmar: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung.

Lateral line complete (7 of 13) or almost complete with lateral line absent from 1-3 posterior scales (4 of 13), or abbreviated, perforating 10-15 scales (2 of 13). Specimen 34.7 mm on right side with 10 perforated scales followed by regenerated scale, 5 scales without perforation, 4 scales missing, one perforated scale and a perforated caudal fin scale, on left wide with 16 perforated scales followed by 6 scales without perforation and a perforated scale on caudal fin base; specimen 39.9 mm SL with 14 perforated scales on right side, 15 on left side; remaining specimens with 19 (2), 20 (1), 21 (1), 22 (6), 23 (1) lateral line scales. Smallest specimen (19.5 mm SL) with 6-7 perforated scales continued to caudal fin base by complete series of modified scales with median groove precursor to lateral line tube. Scales in lateral row 21 (1), 22 (10), 23 (2), plus 2 or 3 on

caudal fin. Lateral scale row straight horizontal for 3-4 scales, then descending due to intercalation of additional horizontal scale row above, running in a smooth curve ascending to a median position on side of caudal peduncle. Predorsal scales 8 (9), 9 (4); prepelvic scales 10 (3), 11 (8), 12 (1); circumpeduncular scales 12 (13). Scales in transverse row ½4/1/4½ (13). Pelvic axillary scale present, length ⅓ of pelvic fin length.

Predorsal vertebrae 4 + 4 (13), abdominal 4 + 12 (8), 4 + 13 (5), precaudal+caudal 4 + 13 + 13 = 30 (12), 4 + 14 + 13 = 31 (1). Vertebrae contained in caudal peduncle 5 (1), 6 (7), 7 (3). One specimen dissected, 45.7 mm SL (NRM 40027), with pharyngeal teeth 5, 3, 2.

Coloration in preservative. Ground colour yellowish white. Dorsum brown, scales with narrow light submarginal border; sides gradually lighter ventral, below midline scales with brownish blotch at base. Abdomen and chest yellowish white; dark peritoneum may give a swarthy appearance to abdominal sides. Cheek, gill cover, and exposed cleithrum silvery with sparse brownish pigment. Snout greyish. Lower parts of head yellowish white. Iris whitish, black dorsally.

Dorsal fin in males with series of black oval blotches starting on middle of interradial membrane posterior to last unbranched ray, continued on subsequent interradial membranes proximal to near base of interradial membrane between rays 6 and 7; an outer row of smaller blotches is present between major branches of rays 3-8 and on interradial membrane between rays 1 and 2. Penultimate unbranched dorsal fin ray blackish apically. In females, dorsal fin without dark blotches or dark blotches indistinct, much smaller and less numerous than in males. Anal fin in some males with indistinct dark blotches associated with anterior rays; hyaline in females. Caudal fin in both sexes unpigmented except light brownish at basal scales. Pectoral and pelvic fins in both sexes hyaline or lightly pigmented.

Pseudotympanum beneath fourth scale in lateral line, almost completely masked by thick scale and diffuse pigmentation. Humeral marking comprising a dark brown blotch at distal margin of scale 3 in lateral row, and at distal margin of scales 2 and 3 in row below, absent in 19.5, 25.5, and 26.5 mm specimens, often inconspicuous in larger specimens. Caudal peduncle blotch at vertical from posterior end of anal fin base, dark brown to blackish, round or slightly horizontally extended without noticeable dorsal or ventral extensions of pigmentation. Side anterior and ventral to caudal peduncle blotch much lighter than rest of side. Blotch covering two or three scales (usually scales 17-18 or 17-19 in lateral row, may also be 18-19) and parts of scales above and below, corresponding to scales 5-6 (or 4-6, or 5-7) counting from last scale in lateral row.

Etymology. Named with reference to the complete or almost complete lateral line, in contrast to most other members of the *P. conchonius* group, which have an abbreviated, short lateral line. From the Greek makros, long, and gramme, line. A noun in apposition.

Geographical distribution. Recorded only from streams near Myitkyina (Fig. 1; Table 1).

Remarks. *Puntius macrogramma* was first confused with *P. thelys*, which it resembles in overall colour pattern and body shape. *Puntius macrogramma*, however, differs in the rounded or horizontally elongate caudal blotch (vs. rounded or vertically elongate), which is not extended dorsally and ventrally by dark pigment (vs. contained in a dark vertical band on the caudal peduncle), the presence in adults of three minute dark blotches in the humeral region, and the complete or almost complete lateral line (vs. abbreviated). The dark spots in the dorsal fin of males are smaller, not forming a prominent black spot anteriorly as in *P. thelys*, and the dorsal fin margin is hyaline (vs. dark). *Puntius macrogramma* possesses one more scale in the transverse row (½4/1/4½ vs. ½4/1/3½).

The sample of *P. macrogramma* is small, only 22 specimens, with about equal numbers of sexable males (N = 9) and females (N = 12). Two females are slightly larger (49.6-50.9 mm SL) than the largest male (47.5 mm SL). Specimen dissected 49.6 mm SL (NRM 56773) ripe female with eggs in single ovary, egg size up to 0.6 mm in diameter.

Puntius pugio, new species
(Fig. 11)

Holotype. NRM 56992, 33.9 mm SL. Myanmar: Kachin State: Ayeyarwaddy River drainage: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung, 200 m S of road, 800 m E of Sha Dau village; F. Fang et al., 2 Apr 1997 (FANG-97-054).

Paratypes. 34 specimens, not sexed, 20.8-39.3 mm SL. NRM 56858, 1, 34.0 mm SL; SOK-98-027. – NRM 41013, 4, 20.8-35.9 mm SL; SOK-98-026. – NRM 39682, 5, 26-29.5 mm SL; FANG-97-020. – NRM 36354. 20, 31.8-37.8 mm SL and NRM 56873, 1, C&S, 34.0 mm SL; FANG-97-054. – NRM 28445, 1, 39.3 mm SL; SOK-94-012. – USNM 391135, 1, 29.9 mm SL; Bago Division: Sittoung River drainage, Kayin stream near the Sittoung River east of Taungoo, 18°57'27"N 96°28'20"E; R. Britz, 18 Mar 2003.

Diagnosis. Distinguished from all species of *Puntius* except *P. sophore, P. chola*, *P. brevis*, and *P. burmanicus* by presence of frontoparietal fontanel, and from those species by presence of dark band encircling caudal peduncle. Barbels absent, lateral line complete. Last unbranched dorsal fin ray compact except distally, and serrae absent.

Description. Refer to Table 6 for summary of morphometric data. Based on specimens from Myitkyina. Moderately deep, slightly elevated, compressed laterally. Predorsal contour ascending, almost straight, nape slightly elevated. Almost straight dorsal contour, slanting from dorsal fin base to caudal fin base. Preventral contour slanting straight to pelvic fin bases, posteriorly straight to anal fin base, which straight, meeting sloping caudal peduncle outline at slight angle.

Head short, laterally compressed. More than 50 % of orbit in anterior half of head. Snout rounded. Mouth terminal, reaching to or not quite to vertical from anterior margin of orbit. Lips exposed, moderately thick, lips curved; lower lip fold interrupted symphysially. Lateral fold on snout present. Barbel absent. Short, wide frontoparietal fontanel present. Infraorbital 3+4 slender, anterior end at middle of orbit, posteriorly not extending to preopercle. Breeding tubercles absent in all specimens. Gill rakers 6-7 on epibranchial, one in angle, and 13(1), 14(4), 15(4), 16(1) on ceratobranchial.

Dorsal fin origin opposite pelvic fin origin; distal margin slightly concave, anterior and posterior corners rounded; last ray reaching to vertical from end of anal fin base. Last unbranched dorsal fin ray almost as long as first branched ray; proximal ¾ compact, slightly thicker than first branched ray, rigid; apical ¼ flexible, segmented, without serrae, lost in most specimens. D. iii.8(1), iv.8(13). Pectoral fin with rounded tip, reaching to vertical from base of pelvic fin. P. i.12(2), i.13(8). Pelvic fin tip rounded, attaining vent. V. i.8(10). Anal fin base posterior to vertical from end of dorsal fin base, distal margin slightly concave, corners rounded, last ray reaching middle of caudal peduncle. A. iii.5(15). Caudal fin deeply

Table 6. Standard length (in millimeters) and proportional measurements in percents of standard length of *Puntius pugio*. SD, standard deviation. Regression line parameters, a (intercept), b (slope), and r (Pearson's correlation coefficient) are calculated from measurements expressed in millimeters; shown when $p < 0.05$. The holotype is included in calculated values.

	holotype	n	min	max	mean	SD	a	b	r
Standard length (mm)	33.9	10	33.3	37.8	35.0	1.53			
Head length	30.7	10	28.9	30.8	29.7	0.71	1.411	0.257	0.851
Snout length	7.4	10	7.0	8.1	7.5	0.32	–1.004	0.104	0.841
Orbit diameter	12.4	10	11.7	12.9	12.3	0.36	2.212	0.059	0.759
Interorbital width	9.4	10	9.4	10.5	9.9	0.35	–1.172	0.133	0.878
Head width	15.9	10	15.6	16.7	16.1	0.40	–0.777	0.183	0.896
Head depth	22.4	10	20.7	22.4	21.5	0.49	0.979	0.187	0.869
Body depth	41.0	10	39.9	41.6	40.8	0.53	0.221	0.402	0.958
Predorsal length	56.9	10	53.0	56.9	54.8	1.44	–3.505	0.648	0.901
Prepelvic length	54.3	10	49.7	54.3	51.6	1.42	6.281	0.336	0.786
Preanal length	73.5	10	72.5	74.8	73.9	0.67	–0.600	0.756	0.981
Caudal peduncle depth	15.0	10	13.6	15.0	14.3	0.40	0.854	0.118	0.802
Caudal peduncle length	20.4	10	18.4	20.7	19.6	0.62	1.631	0.150	0.750
Dorsal fin length	35.1	10	31.2	37.2	33.8	1.72			
Anal fin length	24.5	10	21.0	24.5	22.5	0.93	0.939	0.198	0.693
Pectoral fin length	23.9	10	20.9	23.9	22.5	1.03			
Pelvic fin length	26.5	10	23.8	26.5	24.7	0.87			

Fig. 11. *Puntius pugio*, NRM 56992, holotype, 33.9 mm SL; Myanmar: Nan Kywe Chaung, 17 km on road Myitkyina-Mogaung.

emarginate; lobes making up half of fin length, tips rounded. Principal caudal fin rays 10+9; procurrent rays dorsally 6 (14), ventrally 5 (14).

Lateral line complete with 21 (2), 22 (12) scales, plus 2-3 scales on caudal fin (1-3 lateral line scales). Lateral line scale row descending after 3rd or 4th scale, making a gentle curve before ascending to median position on caudal peduncle. Predorsal scales 8 (2), 9 (7), 10 (1); prepelvic scales 10 (3), 11 (7); circumpeduncular scales 12 (10). Scales in transverse row ½4/1/3½ (10). Pelvic axillary scale present, length corresponding to ¼ of pelvic fin length.

Predorsal vertebrae 4 + 4 (14), abdominal 4 + 12 (11), 4 + 13 (3), preanal + caudal 4 + 13 + 13 = 30 (13); vertebral centra within caudal peduncle 6 (7), 7 (6). One specimen dissected, 35.6 mm SL (NRM 541013) with 5, 3, 2 pharyngeal teeth.

Coloration in preservative. Ground colour yellowish white. Dorsum light brown, scales with dark margin; sides gradually lighter ventral, below midline scales light with brownish bar at base. Abdomen yellowish white; dark peritoneum may give a swarthy appearance to abdominal sides. Chest and anterior side with silvery cast. Cheek, gill cover, and exposed cleithrum silvery with sparse brownish pigment. Snout greyish. Lower parts of head yellowish white. Iris whitish, black dorsally.

Dorsal fin in both sexes hyaline, with indistinct pattern of sparse black pigment filling up interradial membranes between branched rays 1-2, but more restricted and shifting gradually toward a basal position on succeeding interradial membranes, forming small oval blotch on each interradial membrane. Along distal margin of dorsal fin similar pigmentation contained within branches of rays 2-8, anteriorly on fin confluent with proximal pigmentation. Anal fin with a diffuse wide distal band of black pigment, below dark caudal peduncle band. Caudal fin smoky. Pectoral and pelvic fins hyaline.

Pseudotympanum showing indistinctly through lateral line scales 3-4. Humeral marking absent. Caudal peduncle blotch well posterior to vertical from posterior end of anal fin base, dark brown or black, generally round, contained in a slightly narrower equally intense or slightly less densely pigmented black or brown band encircling caudal peduncle. Side anterior and posterior to caudal peduncle band not conspicuously lighter; posterior to blotch a few scattered brownish dots. Blotch covering two, rarely three scales (usually scales 19-20 or 20-21 in lateral line row) and parts of scales above and below, corresponding to scales 2-4 counting from last scale in lateral line row.

Etymology. Named for the prominent, long, sharp, spine-like last unbranched dorsal fin ray, which in contrast to species with similar colour pattern lacks serrae along the posterior borders. Pugio is Latin for a dagger.

Geographical distribution. Specimens are located from the Lake Indawgyi, the Nan Kywe Chaung in Myitkyina, the lower Bago River and the upper Sittoung River (Fig. 1; Table 1).

Notes. No sexual dimorphism was detected. Dissected specimens in NRM 36354 included a

male 31.8 mm SL with thin testis, and two females, 34.2 and 36.4 mm SL with undeveloped eggs; in NRM 41013 a male 35.6 mm SL with thin testis. *Puntius pugio* differs from all other species described in this paper by the presence of a posterior frontoparietal fontanel, slender infraorbital 3+4, many gill-rakers (13-16), and smooth last unbranched dorsal fin ray, and consequently is not a member of the *P. conchonius* group. The colour pattern of the caudal peduncle is similar to that of *P. erythromycter* and *P. nankyweensis* in particular, including the band encircling the peduncle, but *P. pugio* is undoubtedly a larger species.

Other species of *Puntius* from Myanmar possessing a frontoparietal fontanel are *P. sophore*, *P. chola*, and *P. burmanicus*, sharing also a smooth last unbranched dorsal fin ray. In *P. sophore* barbels are absent and the colour pattern includes one prominent dark blotch in the dorsal fin (absent in *P. pugio*), and another posteriorly on the side of the caudal peduncle, immediately anterior to the caudal fin base (a dark band around the middle of the caudal peduncle in *P. pugio*). The colour pattern of *P. chola* is similar to that of *P. sophore*, but maxillary barbels are present. In *P. burmanicus* maxillary barbels are present. All colour is faded from the NRM specimen of *P. burmanicus*, but according to Day (1878) there is a dull blotch before the base of the caudal fin.

Three samples of *P. pugio* are available from southern Myanmar (NRM 28445-28446 from the Bago River, and USNM 391135 from the Sittoung River). They agree in all respects with specimens from Myitkyina and Lake Indawgyi, except that the small specimen from the Sittoung is considerably more elongate.

Discussion

Species described in this paper all have in common a relatively small size (33.1-47.5 mm SL), and a body colour pattern including a dark band around the caudal peduncle or a dark blotch laterally on the caudal peduncle. Superficially, all species look very similar, and were indeed when first catalogued identified all as *Puntius puntio*.

In northern Myanmar, all five new species described here and *P. didi* were found syntopic in one out of 15 localities, four species in three localities, three species in four localities, two species in seven localities and none alone (Table 1). *Puntius erythromycter* was clearly the most abundant species, but represented by many juveniles. All six species were collected both in 1997 and 1998, although frequencies varied. Only *P. thelys* occurred in every locality even if only by a single specimen, and *P. pugio* was absent only from four localities. *Puntius pugio* and *P. macrogramma* do seem to be somewhat less abundant (Table 1). In the field, no particular observation was made of the very common small species of *Puntius*. We did not notice if they were sampled from different microhabitats or from the same seine haul. Although generally all fish caught were preserved, sampling effort varied between stations. Collecting was made in the low water period, which may be suboptimal for the fishes, and may have forced fish together in streams still carrying water. One can thus not conclude that this fauna of similar marked species of *Puntius* represents an interacting association of, e.g., co-schooling or mimicking species, or whether the association is permanent or seasonal. Nonetheless, the association of similar species is unlikely to be merely coincidental and merits further investigation for its potential ecological and co-evolutionary significance.

One more cyprinid species in Myanmar possesses a dark band around the caudal peduncle, viz. juveniles of *Osteobrama belangeri*, as mentioned by Day (1878: 588), and exemplified by a specimen 41.3 mm SL (NRM 31897). *Osteobrama belangeri* was not found syntopic with any of the species of *Puntius* reported herein.

Prashad & Mukerji (1929) reported nine species of *Barbus* from the Myitkyina district, but all of them medium to large sized species, and several of them now placed in genera other than *Puntius* (*Chagunius chagunio; Barbus sewelli, B. myitkyinae*, and *B. sarana caudimarginatus* considered synonyms of *Systomus sarana*, pending revision; *Neolissochilus hexastichus*, *Puntius chola*, *P. burmanicus*, and *P. sophore*), except *P. phutunio* which was said to occur "in great abundance in the [Indawgyi] lake and in various small muddy and rocky streams in the Myitkyina District". *Puntius phutunio* does not occur in Myanmar, and Kullander & Fang (2005) suggested that the *P. phutunio* reported by Prashad & Mukerji (1929) are actually *P. didi*.

Four of the species described in the present paper, *P. nankyweensis*, *P. erythromycter*, *P. thelys*, and *P. macrogramma* belong to the *P. conchonius* species group as defined by Taki et al. (1978) and

Kullander & Fang (2005). The relationships of *P. pugio* are less certain, but I associate it with *P. chola* and *P. sophore*, and similar species, with which it uniquely shares the frontoparietal fontanelle, as discussed below.

Morphometric and meristic comparisons. A principal component analysis was made on all measurements of the species of the *P. conchonius* group described in this paper, with *P. didi* and *P. tiantian* included. In the complete set, *P. nankyweensis* separates entirely from the rest, reflecting short anal fin and long caudal peduncle (Fig. 12; Table 7). Excluding *P. nankyweensis* from the analysis singles out *P. didi*, with short dorsal and pelvic fins, long prepelvic distance, and somewhat small eyes (Fig. 13; Table 8) reflecting the analysis in Kullander & Fang (2005). Excluding also *P. didi* results in loss of discrete clustering, indicating that most variation in the remaining sample is related to size allometry.

The development of the lateral line is an important character in the systematics of the *P. conchonius* group, and varies among northern Myanmar species. It is complete, i.e., present on every scale along the side to the caudal fin in *P. tiantian*, but present only on the anterior scales in *P. didi* (6-10), *P. erythromycter* (4-7), *P. nankyweensis* (5-6), and *P. thelys* (6-11). Interestingly, in *P. macrogramma*, it may be a short as 14 scales, but commonly stops a few scales before reaching the caudal fin or extending to the caudal fin. The shortest lateral lines are thus found in the smallest species, but in larger species there is a range of variation from short (*P. didi*) to complete (*P. tiantian*).

The transverse scale count is counted differently by different authors, but generally from the dorsal fin to the anal fin or the pelvic fin. Here I follow Kottelat et al. (1993: fig. 9) in counting posteriad and ventrad from the dorsal fin origin to the lateral line row, and anteriad and dorsad from the anal fin origin to the lateral line row. The midline scale at each end is counted as ½, but not really necessary to include. Variation in transverse scale counts was found to be correlated with the course of the lateral line scale row. In most barbine cyprinids (and other groups as well), the lateral line makes a gentle downward curve, posteriorly ascending onto the lower or middle part of the caudal peduncle. In *Puntius* all species so far examined have a curved line, that descends after 3-4 scales, but ascends to terminate in a middle row on the caudal peduncle, when not ending long before. *Puntius nankyweensis* is distinct because the scale row in which the 5-6 lateral line scales run, continues straight to the caudal fin base. This species is unusual in having ½3 instead of ½4 scales between the dorsal fin origin and the lateral line scale row and the low count as well as the straight course of the lateral line scale row is interpreted as lack of intercalation of an additional horizontal scale row dorsal to the lateral line scale row, which does not continue forward to the head (Fig. 5).

Frontoparietal fontanelle. Among ostariophysans a frontoparietal fontanelle is characteristic of characiform fishes, but variable in extension and absent in some families (Vari, 1995; Zanata & Vari, 2005), generally present in siluriforms (Arratia, 2003) and gymnotiforms (Albert, 2001) as two successive frontal fontanelles, variously present or absent in cobitoids and catostomids (Sawada, 1982), and very rarely present in cyprinids (Ramaswami, 1955). Ramaswami (1955) reported and/or illustrated the frontoparietal fontanelle in species of the gobionine genera *Saurogobio*, *Pseudogobio*, and *Abbottina*, and reported and illustrated the posterior parietal fontanel in *Gobiobotia*. The first species of *Puntius* reported to possess a frontoparietal fontanelle was *P. sophore*, the type species of the genus (Mirza, 1973). Shantakumar & Vishwanath (2006) added *P. chola* and *P. terio*. I have found the fontanelle in several geographical samples of *P. sophore*, and also in *P. amphibius*, *P. burmanicus*, *P. chola*, *P. dorsalis*, *P. brevis*, *P. leiacanthus*, and *P. terio*. All these species also possess a smooth last unbranched dorsal fin ray. Barbels are absent in *P. sophore*, but maxillary barbels are present in the remainder.

In characoids the frontoparietal fontanelle commonly extends along the length of the frontals and parietals and the frontals are bridged by a sutured supraorbital (epiphyseal) bar (Weitzman, 1962; Vari, 1995; pers. obs.). In cleared and stained *P. pugio*, the fontanelle is restricted to the area immediately posterior to the transverse frontal lateralis canal, and a narrow median suture of the parietals form the posterior border, approximately as shown by Shantakumar & Vishwanath (2006: fig. 1a; but captions of figs. 1a and 1b have been exchanged), and for *Pseudogobio esocinus* by

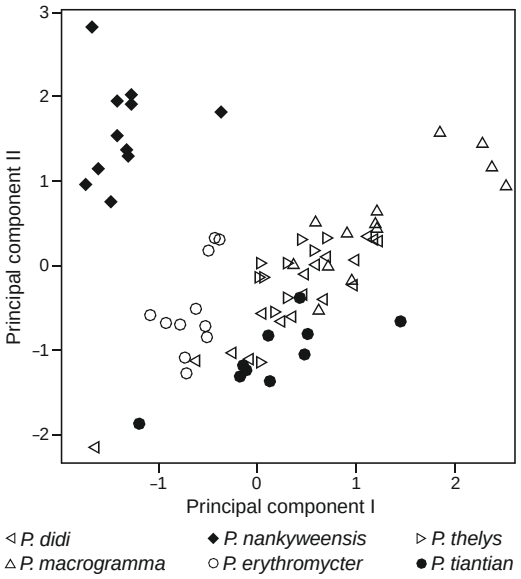

Fig. 12. Plot of scores of Principal Component II against Principal Component II in *P. conchonius* group species from Myanmar, using 16 measurements (Table 7).

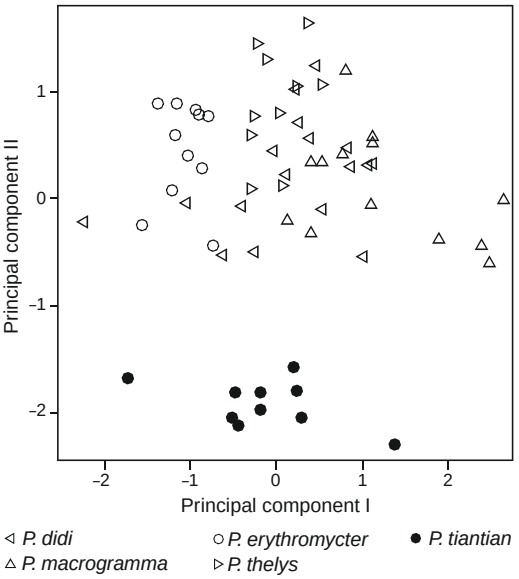

Fig. 13. Plot of scores of Principal Component II against Principal Component II in *P. conchonius* group species from Myanmar, excluding *P. nankyweensis*, using 16 measurements (Table 8).

Table 7. Variable loadings on first three principal components of pooled measurements from *Puntius didi*, *P. macrogramma*, *P. micropterus*, *P. nankyweensis*, *P. thelys*, and *P. tiantian*. Highest loadings for PC II and PC III indicated in boldface.

	I	II	III
Head length	0.132	0.007	0.015
Snout length	0.180	–0.008	**0.048**
Orbit diameter	0.111	0.032	–0.022
Interorbital width	0.161	0.010	–0.002
Head width	0.149	–0.007	0.016
Head depth	0.155	–0.017	0.009
Body depth	0.173	0.009	–0.018
Predorsal length	0.155	0.002	0.013
Prepelvic length	0.146	0.001	0.028
Preanal length	0.153	0.002	0.023
Caudal peduncle depth	0.153	–0.010	0.017
Caudal peduncle length	0.119	**0.047**	0.013
Dorsal fin length	0.106	**0.036**	**–0.035**
Anal fin length	0.204	**–0.072**	**–0.048**
Pectoral fin length	0.176	–0.013	–0.016
Pelvic fin length	0.153	**0.040**	**–0.039**
Eigenvalue	0.378	0.012	0.011
Variance explained	90.4	2.9	2.6

Table 8. Variable loadings on first three principal components of pooled measurements from *Puntius didi*, *P. macrogramma*, *P. nankyweensis*, *P. thelys*, and *P. tiantian*. Highest loadings for PC II and PC III indicated in boldface.

	I	II	III
Head length	0.119	–0.015	–0.004
Snout length	0.154	**–0.050**	0.002
Orbit diameter	0.108	0.032	0.027
Interorbital width	0.141	0.006	0.015
Head width	0.125	–0.020	0.004
Head depth	0.122	–0.012	0.021
Body depth	0.146	0.023	0.024
Predorsal length	0.135	–0.013	–0.001
Prepelvic length	0.127	**–0.031**	0.000
Preanal length	0.133	–0.023	0.002
Caudal peduncle depth	0.130	–0.020	–0.003
Caudal peduncle length	0.129	–0.003	–0.020
Dorsal fin length	0.107	**0.044**	0.019
Anal fin length	0.124	0.030	–0.022
Pectoral fin length	0.144	0.011	–0.032
Pelvic fin length	0.151	**0.050**	–0.021
Eigenvalue	0.277	0.012	0.050
Variance explained	89.6	4.0	1.5

Ramaswami (1955: fig. 4), except that in *P. esocinus* the supraoccipital forms the posterior border. The fontanelle is apparent as a soft quadratic depression in the top of the head in alcohol preserved specimens.

An apparently identical fontanelle to that in *Puntius* is found in species of *Cyclocheilichthys* (*C. apogon*, *C. armatus*, *C. enoplos*, *C. janthochir* examined), *Barbonymus collingwoodii*, *Oreichthys cosuatis*, *Sawbwa resplendens*, and *Scaphognathops bandanensis*. In all those species the fontanelle may vary in length but the lateral margins are parallel. A frontoparietal fontanelle is also present in *Amblyrhynchichthys truncatus*, but in this species it becomes gradually narrower anteriorly.

Rasboroides vaterifloris apparently possesses an elongate mid-dorsal frontoparietal fontanelle, but it is absent in other rasborin and danionin genera screened *(Danio*, *Microrasbora*, *Rasbora)*. In the danionin *Sundadanio*, reported to possess a parietal fontanelle by Fang (2003), the entire skull roof is unossified and collapses in ethanol preserved specimens. The condition in *Sundadanio* resembles the "roofless" skull in *Paedocypris* (Kottelat et al., 2006: fig. 4) and supports close relationship between the two taxa as suggested also by a molecular phylogenetic analysis (Rüber et al., 2007).

Kotalawala (1992) referred to and illustrated a pineal foramen between the frontals in a skull of *Puntius*, species not stated, but it seems to be based on a juvenile with incomplete overlap of frontals. Among cyprinids, the frontoparietal fontanelle is apparently, as far as recorded, restricted to a few cyprinine and gobionine cyprinid genera, and the danionine *Rasboroides*. Numerous genera were screened for external evidence of the frontoparietal fontanelle with negative outcome, but not all cyprinid genera have been available for examination. Although the wide distribution among otophysans suggests a plesiomorphic character at otophysan level, the limited distribution among cyprinids in contrast to other families may indicate phylogenetic signal. Given the overall similarity of all species of *Puntius* possessing a frontoparietal fontanelle, it may be a strong indicator of a monophyletic genus *Puntius* sensu stricto.

The status of *Cyprinus puntio*. *Cyprinus puntio* was described on the basis of specimens from "ponds and ditches of the southern parts of Bengal" (Hamilton, 1822: 318).

Hamilton (1822) described *Cyprinus puntio* as "An almost opaque *Cyprinus* of the *Puntius* kind, with a black ring round the end of the tail, and a black spot at the roots of the dorsal and anal fins." He compared the body shape to that of *Catla catla*. The full colour description is very general and apparently refers to living specimens: "The back and tail are of a greenish-brown colour, almost diaphanous. The abdomen and gill-covers are silvery white. One each side is a diffuse stripe of greenish gold colour. The pectoral, ventral, and tail fins, are glassy; the dorsal and anal are deep yellow. The eyes are silver." The lateral line is referred to as indistinct, and the scales are said to be large. In contrast to adjacent descriptions of other species of the *P. conchonius* group, the first dorsal fin ray is not described as indented (= serrated), but simply referred to as undivided. Hamilton (1822) did not include a drawing of *P. puntio*, and there is evidently no drawing of that species among other drawings made for Hamilton, and which were carefully catalogued by Hora (1929). Although no length is given, it was a small species, brought to Hamilton as the young of *Catla catla*, and the description appears in a section with other small species. The dorsal fin count, with eight branched rays, precludes identity with *Catla catla*, which has 15-16 unbranched dorsal fin rays.

Day (1870b) redescribed *P. puntio* based on five specimens from Sittoung, and referred it to *Barbus*. The colour description refers to "a deep wide black band" that "encircles the free portion of the tail, and includes the tip of the anal", and also to a black-tipped dorsal fin. The third unbranched dorsal fin ray is described as "smooth, weak, and articulated", the lateral line as incomplete, only extending along a few scales.

Day (1878: 582, pl. 145 fig. 6) described *P. puntio* with slightly different information, e.g., transverse scales 5/4 instead of 4/4, last unbranched dorsal fin ray "osseous and entire", lateral line "only extending distinctly for a few scales, but very indistinctly to the base of the caudal fin". The length is given as about "3 inches". The figure shows a species with notably elevated dorsum, and the style of the drawing is similar to that of others showing small species of *Puntius* about 30-40 mm SL, and not of the detail and accuracy presented in drawings of much larger species in the same work.

Hora & Mukerji (1934) illustrated and commented on a specimen 34 mm SL collected from

Nam Me Hsai near Kengtung, in the Mekong river drainage, which they identified as *Barbus puntio*, referring to Day's (1870b) description of *P. puntio* from Sittoung. Hora & Mukerji, however, explicitly considered Day's *P. puntio* as misidentified. They reported that Hamilton's unpublished notes contain the information that the species was obtained by Hamilton at Luckipur and Calcutta. Considering the lack of later reports from Bengal, the 'very meagre and inadequate' description, and absence of illustration, they concluded that *C. puntio* must be regarded as a species inquirenda. Consequently, they reported their own *P. puntio* as sensu Day, and explicitly not as Hamilton's species.

Hora & Mukerji (1934) commented that the specimen that Day (1878) used for illustration is preserved in the collection of the Indian Museum (now Zoological Survey of India, Calcutta), but that it "is greatly damaged and it is not possible, therefore, to elucidate exactly the specific characters of his species". Venkateswarlu & Rama Rao (1986) listed Day's *P. puntio* as a synonym of *P. sophore*.

Later authors have overlooked or ignored those important conclusions and continued to report *P. puntio* as an Indo-Burmese species based on the misidentified Day specimens. Although cited in most general literature about Indian fishes, no specimens have been reported from India. The species is not mentioned in Rahman's (1989) descriptive catalog of the freshwater fishes of Bangladesh. Jayaram (1991: 164) stated "No specimens seen by me. Description after Day, 1878", and depicted and described the lateral line as complete.

The black spot at the base of the dorsal and anal fins suggest that *P. puntio* is similar to *P. gelius*, but *P. gelius* has a serrated last unbranched dorsal fin ray as already presented in Hamilton's descriptions of *P. gelius* and *P. canius*. Hora & Mukerji (1934) compared *P. puntio* with *P. terio*, which, however, does not possess a dark ring around the caudal peduncle.

Day's *P. puntio* from Myanmar, as described, does not possess dark spots at the bases of dorsal and anal fins. The identity of Hora & Mukerji's (1934) specimen remains uncertain, but it differs from the description of *C. puntio* as it has a blotch laterally on the caudal peduncle, rather than a dark ring encircling the caudal pedunce, and the tips rather than the bases of the dorsal and anal fins are black. *Puntius nankyweensis*, *P. erythromycter*, *P. thelys*, and *P. macrogramma* all differ from the description of *Cyprinus puntio* in the presence of a serrated last unbranched dorsal fin ray, and in the absence of dark marks at the bases of dorsal and anal fins. I conclude, like Hora and Mukerji (1934), that *Cyprinus puntio* is a still unidentified species, the identity of which will be addressed in a separate publication.

***Puntius yuensis* and *P. ornatus*.** *Puntius yuensis* Arunkumar & Tombi Singh (2003) and *P. ornatus* Vishwanath & Laisram (2004), both with a dark ring around the caudal peduncle but no other conspicuous body markings, were described from the Yu River drainage, a tributary of the Chindwin River in Manipur, India. *Puntius ornatus* was first reported by Vishwanath (2002) as "*P. ornatus* Vishwanath & Juliana, in press". In the absence of a designated holotype, the description does not make the name available (ICZN Art. 16.4). A formal description of *P. ornatus* appeared in Vishwanath & Laisram (2004), accompanied by a drawing.

These species possibly represent an assemblage of similar species as described herein from Myitkyina, and they are certainly most similar to *P. erythromycter* and *P. nankyweensis*, sharing a serrated unbranched last dorsal fin ray and dark ring around the caudal peduncle. *Puntius yuensis* and *P. ornatus* differ from *P. pugio* in having a serrated instead of smooth last unbranched dorsal fin ray; and from *P. macrogramma* and *P. thelys* because in these species the caudal peduncle band or blotch does not encircle the peduncle.

Unfortunately, specimens have not been available of *P. ornatus* or *P. yuensis*, but information from the original descriptions, supplemented by images and data from the respective holotypes of *P. yuensis* and *P. ornatus* provided by W. Vishwanath (pers. comm.) enable distinction from both *P. erythromycter* and *P. nankyweeensis*, as detailed below.

Specimens in the type series of *P. yuensis* were up to 55 mm SL (Arunkumar & Tombi Singh, 2003), and specimens in the type series of of *P. ornatus* up to 42 mm SL (Vishwanath & Laisram, 2004), which is about 10-20 mm more than the largest specimens of *P. erythromycter* (33.1 mm SL), and *P. nankyweensis* (32.5 mm SL).

Barbels are absent in both *P. ornatus* and *P. yuensis*, and photographs show the lateral line running curved, with ½4/1/3½ scales in a transverse row. This is sufficient to separate them from

P. nankyweensis, in which maxillary barbels are present, the lateral line scale row straight and the transverse scale count ½3/1/4½. The original descriptions of *P. ornatus* and *P. yuensis* give a transverse scale count of ½4/1/2½, but the ventral scales apparently are counted by some other method than used in this paper.

The holotype of *P. ornatus* is said to have 12 circumpeduncular scales, 18 gill rakers, 9 lateral line pores, and lateral line scales 24 (Vishwanath & Laisram, 2004), which are all above the counts obtained from both *P. erythromycter* and *P. nankyweensis*. The circumpeduncular scale count is confirmed by photographs. The figure (Vishwanath & Laisram, 2004: fig. 2) and photos show 8-9 lateral line scales. The photographs show 21-22 scales in the lateral row. Gill rakers were apparently counted by some other method than used here, because *P. cumingii* and *P. phutunio*, which have about 4-5 gill rakers (pers. obs.), are said to have 13 and 9 respectively. The caudal peduncle band is described as crossing scales 18-20 of the lateral line, and shown on photographs as crossing 18-19 or 19-20, which is posterior to the position in *P. erythromycter* (16-17 or 16-18). *Puntius ornatus* is depicted as slender by Vishwanath & Laisram (2004), but more deep-bodied in Vishwanath (2004). The measurements given by Vishwanath & Laisram (2004) suggest a depth of 34.7-39.7 % of SL, which is much below *P. erythromycter* (41.2-46.0 % SL), and confirmed by photographs.

In *P. yuensis* the body depth range is 27.3-36.4 % of SL, which is somewhat slender, as suggested by the illustration, but conflicts with the photograph of the holotype, which shows about 40 % SL, which is only slightly less than in *P. erythromycter* (41.2-46.0 % SL). The lateral line is said to include 6-9 scales (9 in photograph of holotype), and the lateral line scale row 21-22 scales (21 in photograph of holotype), which is more than in *P. erythromycter* (4-7 lateral line scales; 18-20 scales in lateral line scale row). The caudal peduncle blotch is said to be positioned on scales 17-18 of the lateral line row, which is compatible with *P. erythromycter* (16-17, 17-18), but in the photograph of the holotype it is positioned on scales 19-20.

Comparative material. Characidae: *Creagrutus bolivari*, NRM 46781. Cyprinidae: *Amblyrhynchichthys truncatus*, NRM 26693; *Barbonymus collingwoodii*, NRM 27313; *Cyclocheilichthys apogon*, NRM 27309, *C. armatus*, NRM 15354, *C. enoplos* NRM 15008, *C. janthochir*, NRM 52457; *Oreichthys cosuatis*, NRM 50602; *Osteobrama belangeri*, NRM 31897; *Puntius amphibius*, NRM 12058; *P. brevis*, NRM 47881; *P. dorsalis*, NRM 13687; *P. burmanicus*, NRM 33151 ; *P. chola*, NRM 37296; *P. fasciatus*, NRM 12121; *P. liacanthus*, NRM 31404; *P. sophore*, NRM 40609; *P. terio*, NRM 40394; *Rasboroides vaterifloris*, NRM 47845; *Scaphognathops bandanensis*, NRM 15023; *Sawbwa resplendens*, NRM 47437, 52143; *Sundadanio axelrodi*, NRM 47257.

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