

Schistura kampuchensis, a new species of loach from Cambodia (Teleostei: Nemacheilidae)

Jörg Bohlen*, Miloslav Petrůl**, Petra Chaloupková** and Chhouk Borin***

Schistura kampuchensis, new species, is described from several localities in Cambodia. It is distinguished from all other species of *Schistura* by a combination of the following characters: 6–11 more or less regular, continuous black bars on body, reaching ventrally usually to level of pectoral fins; no black midlateral stripe; 8½ branched dorsal-fin rays; 8+8 branched caudal-fin rays; 7 pelvic-fin rays; anus situated 1.7–2.5 eye diameters before anal-fin origin; males without suborbital flap; axillary pelvic lobe present. *Schistura kampuchensis* had earlier been misidentified as *S. pellegrini*.

Introduction

The loach genus *Schistura* includes more than 190 valid species (Kottelat, 2012) distributed throughout South and Southeast Asia and new species are still regularly discovered (e.g. Bohlen & Šlechtová, 2011, 2013a–b, 2014; Bohlen et al., 2014; Chen & Neely, 2012; Freyhof & Serov, 2001; Lalramliana, 2012; Lokeshwor et al., 2012; Lokeshwor & Vishwanath, 2012; Kottelat & Leisher, 2012; Suvarnaraksha, 2012; Zheng et al., 2012). The taxonomic understanding of the genus is far from being complete, and misidentifications occur. One example is the most widespread species of *Schistura* in Cambodia. Kottelat (1985) listed this species under the name *Nemacheilus* sp. B from the Srepok River in northeastern Cambodia and the province Battambang in western Cambodia.

Kottelat (1990) gave a detailed description of the species and assigned it to *S. pellegrini*, a species that was formerly known only from its type locality in Central Vietnam. Kottelat (1990) stated that this identification was tentative since he could not examine the types of *S. pellegrini*. The species appeared under the name *S. pellegrini* again in Rainboth (1996), who gave as distribution area ‘the Tonle San and several tributaries’.

Freyhof & Serov (2001) studied the types of *S. pellegrini* as well as of *S. spiloptera* and found *S. pellegrini* to be a junior synonym of *S. spiloptera*. In their survey of mountain streams of Central Vietnam, Freyhof & Serov (2001) found *S. spiloptera* to be endemic to a small coastal area around the Hai Van pass in Central Vietnam. They provided a detailed description of *S. spiloptera*, based on type specimens of *S. pellegrini* and *S. spiloptera*.

* Institute of Animal Physiology and Genetics, Academy of Sciences of the Czech Republic, Rumburská 89, 277 21 Liběchov, Czech Republic. E-mail: bohlen@iapg.cas.cz (corresponding author).

** Czech University of Life Sciences, Kamýcká 129, 165 21 Prague 6, Czech Republic.

*** Royal University of Agriculture, Chamkar Daung, 12401 Phnom Penh, Cambodia.



Fig. 1. *Schistura kampuchensis*, ZRC 54440, paratype, 37.3 mm SL; Cambodia: Kampot province: stream Ta Da Ou Bey; shortly after capture.

as well as freshly collected material. According to their description, *S. spiloptera* differs from the Cambodian material described by Kottelat (1990) by having 9+8 (vs. 8+8) branched caudal-fin rays, 8 (vs. 7) pelvic-fin rays, a plain (vs. spotted or vermiculated) top of head and 56–100 (vs. 32–70) pores in lateral line. These differences suggest that the Cambodian species is not conspecific with *S. spiloptera*. Since no other name is available for it, we describe it here as *S. kampuchensis*, new species.

Material and methods

The specimens were either fixed in 10 % formaline and later transferred into 70 % ethanol for storage or fixed and stored in 96 % ethanol. All measurements and counts follow Kottelat (1990). Measurements were made point-to-point with dial callipers to the nearest 0.1 mm. Collection abbreviations: CMK, Collection of Maurice Kottelat, Delémont; IAPG, Institute of Animal Physiology and Genetics, Liběchov; NMP, National Museum Prague; ZFMK, Zoologisches Forschungsmuseum Alexander König, Bonn; ZRC, Lee Kong Chian Natural History Museum, National University of Singapore, Singapore.

Schistura kampuchensis, new species

(Figs. 1–2)

Holotype. ZRC 54439, 43.9 mm SL; Cambodia: Kampot province: stream Ta Da Ou Bey (Tek Chhou drainage); 10°41.173' N 104°06.948' E; J. Bohlen, M. Petrtyl et al., 16 March 2013.

Paratypes. ZRC 54440, 28, 17.6–45.7 mm SL; CMK 24724, 10, 22.5–45.9 mm SL; ZFMK 56833–56838, 6, 18.7–41.6 mm SL; NMP P6V 142854–142858, 5, 18.6–43.4 mm SL; IAPG A8339–8341, 3, 25.5–41.6 mm SL; same data as holotype.

Additional material (non-types). ZRC 54441, 9, 20.0–36.3 mm SL; CMK 24725, 4, 22.7–27.8 mm SL; IAPG A8067–8070, 4, 19.2–21.6 mm SL; Cambodia: Kampot province: stream Anlong Kmeng Leng (Mekong drainage); 11°08.597' N 104°08.113' E; J. Bohlen, M. Petrtyl et al., 10 March 2013. – ZRC 54442, 3, 32.1–37.5 mm SL; IAPG A8108, 1, 19.8 mm SL; Cambodia: Kaoh Kong province: stream Thmor Rung (Srae Ambel drainage); 11°11.405' N 103°56.049' E; J. Bohlen, M. Petrtyl et al., 11 March 2013. – ZRC 54443, 3, 31.2–34.3 mm SL; Cambodia: Kaoh Kong province: stream Stung Chral (Srae Ambel drainage); 11°11.102' N 104°01.857' E; J. Bohlen, M. Petrtyl et al., 10 March 2013. – CMK 23887, 2, 37.2–55.9 mm SL; Cambodia: Ratanakiri: tributary of Tonle San in Virachey National Park (Mekong drainage); 14°14'44" N 107°20'59" E; 3 March 2008. – IAPG A7620–7630, 11, 16.5–39.9 mm SL; IAPG A7963–7969, 7, 21.6–31.5 mm SL; Kampot province: stream Ou Bey (Tek Chhou drainage); 10°41.033' N 104°07.260' E; J. Bohlen, M. Petrtyl et al., 8 March 2013. – CMK 5878, 5, 20.9–42.4 mm SL; Cambodia: Ratanakiri: Bounlon (= Krong Ban Lung), tributary of Tonle Srepok? (Mekong drainage); F. d'Aubenton, 25 February 1964.

Diagnosis. *Schistura kampuchensis* is distinguished from all other species of *Schistura* by the combination of the following characters: 8½ branched dorsal-fin rays; 8+8 branched caudal-fin rays; 7 pectoral-fin rays, position of anus 1.7–2.5 eye diameter before anal-fin origin, no sexual dimorphism, 6–11 regular black bars, usually not interrupted, no black midlateral stripe, anterior nostril not reaching margin of eye and axillary pelvic lobe present.



Fig. 2. *Schistura kampucheensis*; Cambodia. a–f, Kampot province: stream Ta Da Ou Bey (a–b, ZRC 54439, holotype, 43.9 mm SL; c–e, ZRC 54440, paratypes [c, 36.2 mm SL; d, 33.5 mm SL; e, 21.4 mm SL]; f, CMK 24724, paratype, 30.2 mm SL); g, ZRC 54442, 37.5 mm SL; Kaoh Kong province: stream Thmor Rung; h, ZRC 54441, 36.3 mm; Kampot province: stream Anlong Kmeng Leng.

Description. See Figures 1-2 for general appearance and Table 1 for morphometric data of holotype and 31 paratypes. A relatively small nemacheilid loach with elongated body (body depth 6.2–7.5 times in SL). Body slightly compressed, caudal peduncle compressed. Maximum body depth at dorsal-fin origin, dorsal outline between nape and dorsal-fin origin nearly straight. Head slightly depressed. Snout round or slightly pointed in lateral view. Depth of caudal peduncle 0.9–1.3 times in its length. Axillary pelvic lobe

present and free. A small adipose crest on dorsal midline of caudal peduncle and on ventral midline along posterior half of caudal peduncle. Largest known size 55.9 mm SL.

Dorsal fin with 4 simple and 8½ branched rays. Distal margin of dorsal fin straight or slightly convex. Anal fin with 3 simple and 5½ branched rays, not reaching caudal-fin base. Caudal fin with 8+8 branched rays, emarginate, lobes round. Pelvic fin with 7 rays; origin before or on vertical through dorsal-fin origin; reaching distinctly



Fig. 3. *Schistura kampuchensis*; ZRC 54439, holotype, 43.9 mm SL; mouth. Scale bar 1 mm.

beyond half of distance to anal-fin origin and beyond anus, which is situated slightly posterior from mid-distance between pelvic-fin base and anal-fin origin. Pectoral fin with 10 rays, exceeding half of distance between bases of pectoral and pelvic fins.

Posterior half of body from dorsal-fin origin covered by small scales except belly; anterior half of body naked. Length of lateral line variable, ranging from ending below dorsal fin to nearly complete. Cephalic lateral line system with 6 supraorbital, 4+9 infraorbital, 9 pre-operculo-mandibular and 3 supratemporal pores. Lips and barbels covered with unculi.

Anterior nostril pierced in front side of a flap-like tube, not reaching margin of eye, with a low anterior rim. Eye moderately large (4.2–6.4 times in lateral head length), eye diameter 1.1–1.8 times in interorbital width. Mouth gape about two times wider than long (Fig. 3). Processus dentiformis wide, very low, broadly rounded. Slight notch in lower jaw. Lips thick; upper lip usually with small median incision and furrows, but median incision absent in about one third of specimens. Lower lip with a broad median interruption, no furrows. Inner rostral barbel reaching corner of mouth, outer one just reaching vertical through posterior rim of eye, maxillary barbel reaching behind vertical through posterior rim of eye.

Sexual dimorphism. None observed. Many species of Nemacheilidae are sexually dimorphic with adult males having a suborbital flap, a suborbital groove, tubercles on the cheeks or fins or specific genital papillae. None of the investigated

specimens of *S. kampuchensis* shows any of such indicators of sexual dimorphism.

Colouration. Ground colour of body and head in preserved specimens light beige, slightly darker dorsally. Body with 6–11, usually 8 or 9, light brown to olive bars, usually continuous across dorsum, rarely bars barely visible on dark background. Bars nearly always (>90 % of specimens) continuous on sides. Bars on body reaching ventrally below midlateral line, usually reaching level of base of pectoral fin; on caudal peduncle bars reaching further ventrally, sometimes fusing ventrally with counterpart of other side. Bars usually regular, only in very few cases irregular, split, narrowing towards ventral part or incomplete; broader in anterior half of body than in posterior half. In two specimens (Fig. 2c,g) whole dorsal half of body darker and bars faint or reduced to blotches along lateral line. No dark midlateral stripe visible as in some other species of *Schistura*. Top of head brown, darker than ground colour of body but lighter than bars on body. A dark grey blotch between eyes, two triangular dark grey blotches stretching from posterior margin of eyes to neck; in a deeper layer than the other pigmentation elements, therefore often not visible without strong light and a dissecting scope. A dark grey stripe in front of each nostril, stretching anteriorly to half distance between nostril and base of inner rostral barbel; a second dark grey stripe in front of eye, stretching anteriorly to half distance between outer rostral barbel and eye. Ventral side of head with scattered melanophores, upper lip, innermost part of lower lip and outer side of second rostral barbel densely covered with melanophores, inner rostral and maxillary barbels without pigments or pigments restricted to base of barbel.

A dark grey bar on base of caudal fin, always much thinner than last body bar, usually broadest at mid-height and narrowing dorsally and ventrally, not reaching dorsal and ventral midline; in most specimens, a little narrowing at base of uppermost branched ray or adjacent unbranched ray, and in about one third of specimens bar interrupted at various places along base of upper caudal-fin lobe.

Base of dorsal fin with a dark brown stripe, interrupted around base of first or second branched ray, height decreasing posteriorly. On first view, all fins with a weak dark band at about half height of fin; at closer inspection, bands not continuous

but each fin ray with a brown dot. Bands on half height of fins faint in pelvic and anal fins, conspicuous in dorsal, caudal and pectoral fins. Caudal fin sometimes with an additional, very faint 'band' in distal half of fin.

In life, ground colour slightly darker beige than in preserved specimens and bars on body dark grey instead of brown. A red dot on base of dorsal fin at base of first or second branched ray (in gap of above mentioned dark brown stripe). In about half of specimens red colour present on proximal half of caudal fin, intensity variable from a faint hue to intensely colour, no direct correlation between intensity of red fin colour and body size, stage of maturity and sex visible.

Specimens from stream Anlong Kmeng Leng (Mekong drainage) (Fig. 2h) differ from remaining samples in having 6-7 body bars (vs. 7-11), narrower than interspaces (vs. wider), dark grey bar on caudal-fin base always interrupted and

black pigment of fin rays nearly invisible in most specimens, giving impression of non-pigmented fins.

Genetic data. The sequence of the complete mitochondrial cytochrome *b* gene of paratype IAPG A8339 has been deposited on Genbank under accession number KU187892.

Habitat. The largest stream in which the species was collected measured about 20 m in width, but the species was most abundant in small streams up to 6 m wide with moderate flow and many stones (Fig. 4). Fishes were hiding between the stones.

Distribution. The investigated material originated from tributaries of the rivers Mekong, Tek Chhou and Srae Ambel in the provinces Kam-pot, Ratanakiri and Kaoh Kong in northern and

Table 1. Morphometric data of holotype and 31 specimens of *Schistura kampuchensis*. Range, mean and SD include holotype. Specimens from all known localities included in measurements.

	holotype	range	mean	SD
Standard length (mm)	43.9	24.2-55.9		
In percentage of standard length				
Total length	122.6	120.4-128.2	123.6	1.7
Dorsal head length	18.5	17.7-23.1	19.9	1.2
Lateral head length	22.3	21.0-26.6	22.9	1.5
Predorsal length	53.1	50.8-58.6	53.9	1.7
Pre-pelvic length	51.0	49.1-56.4	52.5	1.4
Pre-anus length	67.4	65.7-71.7	68.2	1.6
Preanal length	77.7	74.3-80.1	77.2	1.3
Anus-anal distance	10.7	7.3-11.6	9.3	1.0
Head depth at eye	10.7	8.7-12.3	9.9	0.7
Head depth at nape	12.3	11.5-13.4	12.4	0.5
Body depth	15.5	13.3-17.7	14.7	0.9
Depth of caudal peduncle	12.3	10.5-12.8	11.6	0.6
Length of caudal peduncle	12.8	10.4-14.2	12.5	1.0
Snout length	9.8	6.9-10.2	8.8	0.7
Head width at nares	10.9	7.3-11.1	9.1	0.9
Maximum head width	16.6	12.2-16.6	14.8	0.9
Body width at dorsal origin	13.2	10.5-13.7	12.2	0.9
Body width at anal origin	8.4	4.8-8.9	7.3	1.0
Eye diameter	4.6	3.6-5.8	4.7	0.6
Interorbital width	7.1	5.2-8.0	6.9	0.6
Height of dorsal fin	15.5	12.7-20.8	15.7	1.6
Length of upper caudal lobe	21.9	20.3-25.0	22.5	1.3
Length of median caudal ray	19.4	13.4-21.9	18.8	2.0
Length of lower caudal lobe	23.0	20.0-25.2	22.9	1.5
Depth of anal fin	17.5	15.7-19.8	17.4	1.1
Length of pelvic fin	16.9	15.4-19.8	17.4	1.1
Length of pectoral fin	18.2	16.5-21.9	19.2	1.3



Fig. 4. Stream Ta Da Ou Bey in Kampot province, Cambodia. Type locality of *Schistura kampuchensis*. View upstream and to northwest.

southern Cambodia (Fig. 5). Rainboth (1996) listed the species from the Tonle San and tributaries. It seems that *S. kampuchensis* is distributed over a large part of Cambodia, but has up to now not been reported from any other country.

Etymology. From Kampuchea, the Khmer name for Cambodia. The name refers to the fact that the species is widespread in Cambodia, but up to now is not known from outside the country. An adjective.

Remarks

The genus *Schistura* is presently defined by the combination of the following characters: a moderately arched mouth, lower lip with a median interruption, but not forming two lateral triangular pads, colour pattern usually with more or less regular bars and a black bar at base of caudal

fin, dorsal fin with one or two black marks along its base, no acuminate scales on caudal peduncle and caudal fin usually emarginated (Kottelat, 1990). The new species matches this definition of *Schistura* and also bears the most common pigmentation pattern of this genus, which consists of dark bars on the body, a dark grey or black bar on the base of the caudal fin and a dark grey or black dot on the base of the dorsal fin. It is also identical with *S. pellegrini* in Kottelat (1990) and some of the material used by Kottelat (1990) has also been used in this study. As mentioned above, *S. pellegrini* has been demonstrated to be conspecific with *S. spiloptera*, a species restricted to a small area in Central Vietnam (Freyhof & Serov, 2001). The descriptions in Freyhof & Serov (2001) as well as our comparison of *S. kampuchensis* with *S. spiloptera* confirm that *S. kampuchensis* differs from *S. spiloptera* by having 8+8 (vs. 9+8) branched caudal-fin rays, 7 (vs. 8) pelvic-fin rays, a spotted or vermiculated (vs. plain) top of head



Fig. 5. Known populations of *Schistura kampuchensis* in Cambodia (Δ). ★, Type locality.

and a shorter lateral line (32–70 vs. 56–100 pores), and therefore represents a different species.

The most remarkable character of *S. kampuchensis* within the genus *Schistura* is a low number (7, usually 8 in *Schistura*) of rays in the pelvic and the rare count of 8+8 (usually 9+8 or 8+7) branched rays in the caudal fin. A combination of these two characters is found only in five other species of *Schistura* namely *S. balteata* from western Thailand and Myanmar, *S. bairdi* from southern Laos, *S. daubentoni* from northeast Cambodia, *S. fusinotata* from southern Laos and *S. namboensis* from southern Vietnam. It occurs as part of the intraspecific variability in some specimens of *S. malaisei* from northern Myanmar and *S. robertsi* from southern Thailand. *Schistura kampuchensis* differs from *S. balteata* by having 6–11 regular body bars usually continuous across dorsum (vs.

2–3 thin bars below dorsal fin and 3–5 pairs of round spots in front of dorsal fin), 8½ branched dorsal-fin rays (vs. 7½) and presence of a black bar at caudal-fin base (vs. missing). *Schistura kampuchensis* differs from *S. daubentoni* by reaching a larger size (55.9 mm SL vs. 29.0 mm SL), by having usually seven or more bars on body (vs. 6) and the tip of the anterior nostril not reaching the eye (vs. reaching) and from *S. malaisei* by having the anus 1.7–2.5 eye diameters in front of anal-fin origin (vs. about 0.8 eye diameter). *Schistura kampuchensis* is distinguished from *S. bairdi* by having the lateral line reaching vertical through anal-fin origin (vs. dorsal-fin origin), the nostril flap not reaching (vs. reaching) anterior margin of eye and an axillary lobe well-developed (vs. rudimentary). *Schistura kampuchensis* differs from *S. fusinotata* by having 6–11 (vs. 11–16) bars and

not having (vs. having) a broad dark midlateral stripe. *Schistura kampucheensis* can be separated from *S. robertsi* by lateral line reaching vertical through anal-fin origin (vs. pelvic-fin origin), presence (vs. absence) of axillary pelvic lobe and absence (vs. presence) of black marks on lower lip. Freyhof & Serov (2001) described *S. namboensis* from the upper Srepok basin (Mekong drainage) and neighbouring coastal rivers of Vietnam and hypothesised that the material identified by Kottelat (1990) as *S. pellegrini* from northeast Cambodia (including specimens from the lower Srepok) might be *S. namboensis*. Our direct comparison of the Cambodian populations with paratypes and other material of *S. namboensis* revealed that *S. kampucheensis* differs from *S. namboensis* by having continuous bars in more than 90 % of specimens (vs. separated into dorsal saddles and lateral bars in all analysed paratypes and 13 out of 16 analysed specimens from Azun River), by bars nearly reaching ventrally to level of pelvic- and anal-fin bases in more than 90 % of specimens (vs. ending shortly below midlateral line in more than 80 % of specimens) and by not having (vs. usually having) a dark grey midlateral stripe. Additionally, the dorsal outline between nape and dorsal-fin origin is always nearly straight in *S. kampucheensis* (vs. convex in most specimens of *S. namboensis*). From the material that was identified as *S. pellegrini* by Kottelat (1990), CMK 23887 contains two specimens that match the characters of *S. kampucheensis* and therefore are identified as *S. kampucheensis*; the specimens in CMK 5878 are discoloured and therefore important characters that separate *S. kampucheensis* from *S. namboensis* could not be checked.

Other species of *Schistura* with 8+8 branched caudal-fin rays are *S. albirostris* from southern China, *S. kohchangensis* from southeastern Thailand, *S. leukensis*, *S. punctifasciata* and *S. suber* from central Laos, *S. maejotigrina* and *S. pridii* from northern Thailand and *S. obliquofascia* from northern India, but these species differ from *S. kampucheensis* by having 5, 6 or 8 (vs. 7) pelvic-fin rays. Moreover, *S. kampucheensis* differs from *S. leukensis* by having 6–11 (vs. 10–13) bars, from *S. punctifasciata* by lateral line reaching vertical through anal-fin origin (vs. pelvic-fin origin) and absence of black dots on body (vs. black dots superimposed on bars), and from *S. suber* by having 8½ (vs. 7½) branched rays in dorsal fin, an incomplete (vs. complete) lateral line, and nostril tube not reaching (vs. reaching) anterior margin of eye.

Schistura kampucheensis co-occurs with *S. kohchangensis* in the Tek Chhou basin in southern Cambodia. Both species have 8+8 branched caudal-fin rays, but *S. kampucheensis* differs from *S. kohchangensis* by having 7 rays in the pelvic fin (vs. 8), absence of suborbital flap in males (vs. present), first rostral barbel not reaching base of maxillary barbel (vs. reaching beyond base) and the anus 1.7–2.5 eye diameters in front of anal-fin origin (vs. about 1 eye diameter).

Rainboth (1996) listed seven species of *Schistura* as occurring or potentially occurring in Cambodia: *S. daubentoni*, *S. kengtungensis*, *S. kohchangensis*, *S. laterimaculata*, *S. magnifluvis*, *S. nicholsi* and *S. pellegrini*. Additionally, Ou et al. (2011) described *S. diminuta* from the Tonle Kong. The differences between *S. kampucheensis* (= *S. pellegrini* in Rainboth 1996) and *S. daubentoni* and *S. kohchangensis* are discussed above. *Schistura kampucheensis* differs from *S. kengtungensis* by having the origin of the dorsal fin in front of pelvic-fin origin (vs. above), an incomplete (vs. complete) lateral line, 7 (vs. 8) pelvic-fin rays and 8+8 (vs. 9+8) branched caudal-fin rays. It differs from *S. laterimaculata* by having continuous bars on body (vs. blotches along midlateral line), 7 (vs. 8) pelvic-fin rays and 8+8 (vs. 9+8) branched caudal-fin rays and from *S. magnifluvis* and *S. nicholsi* by having the origin of the dorsal fin in front of pelvic-fin origin (vs. above), an incomplete (vs. complete) lateral line and 8+8 (vs. 9+8) branched caudal-fin rays. *Schistura kampucheensis* differs from *S. diminuta* by the presence of an axillary pelvic lobe (vs. absence), depth of caudal peduncle 10.5–12.8 % SL (vs. 8.2–8.9 % SL) and 8+8 (vs. 7+7) branched caudal-fin rays.

The basins of Xekong and Srepok in Laos, Vietnam and Cambodia are rich in fish species and house at least 15 species of *Schistura*, namely *S. bairdi*, *S. bolavenensis*, *S. clatrata*, *S. daubentoni*, *S. diminuta*, *S. fusinotata*, *S. imitator*, *S. kampucheensis*, *S. khamtanhi*, *S. kongphengi*, *S. namboensis*, *S. nicholsi*, *S. nomi*, *S. rikiki* and *S. tizardi* (Freyhof & Serov, 2001, Kottelat, 2001, Rainboth, 1996, Ou et al., 2011). All of these except the above discussed *S. daubentoni*, *S. fusinotata* and *S. namboensis* differ from *S. kampucheensis* by having 8 (vs. 7) rays in pelvic-fin rays and 9+8 (vs. 8+8) branched caudal-fin rays.

Within and across the known localities, *S. kampucheensis* shows a remarkably variability in several characters. Specimens from stream Anlong Kmeng Leng (Mekong drainage) differ from the

remaining samples in having 6–7 body bars (vs. 7–11) and a few details of pigmentation pattern. In 26 out of 27 analysed specimens from the type locality in the Tek Chhou basin the lateral line ends above or behind the anal-fin base, sometimes nearly reaches the caudal-fin base, while in specimens from the Mekong populations the lateral line ends before or above the anal-fin base and in all six analysed specimens from the Srae Ambel basin it ends before the dorsal-fin origin. A small to medium sized incision of the upper lip is present in 70 % of the specimens from the Tek Chhou and in 84 % of the specimens from the Srae Ambel, but only 42 % of the specimens from the Mekong populations have a small incision and medium size incisions do not occur here. However, all of these characters also show a remarkable variability within populations, and therefore the differences between populations can be assigned to founder effect, local selection or genetic drift. Since all populations together share an invariable synapomorphic combination of characters (see diagnosis), we consider them all to be conspecific.

Comparative material. *Schistura balteata*: IAPG A4413–4416, 1, 27.2–58.9 mm SL; Thailand: Kanchanaburi: Huay Ulang.

S. daubentoni: CMK 5877, 3 paratypes, 19.1–28.0 mm SL; Cambodia: Kratie: stream flowing to Mekong.

S. fusinotata: CMK 21456, 2, 22.0–30.2 mm SL; Laos: Attapeu: Xe Kong. – IAPG A5065, 1, 34.2 mm SL; Laos: Xekong: Xe Kong. – IAPG A4817, 1, 28.1 mm SL; Laos: Xekong: Xe Kong.

S. kengtungensis: IAPG A9445–9448, 4, 32.1–44.9 mm SL; Thailand: Petchabun: Mun.

S. kohchangensis: IAPG A7619, A 7671, 2, 35.8–40.6 mm SL; Cambodia: Kampot: Ou Bey. – IAPG A 910–919, 10, 29.5–33.7 mm SL; Thailand: Chanthaburi: Sai Khao.

S. laterimaculata: IAPG A6848–6853, 6, 26.6–43.8 mm; Thailand: Petchabun: Mun.

S. leukensis: CMK 24420, 13, 26.7–59.1 mm SL; Laos: Saysomboune: Nam Mang.

S. namboensis: ZFMK 24095–24104, 10 paratypes, 45.8–54.8 mm SL; Vietnam: Dac Lac: small stream at Ea Nuol. – IAPG 3386–3391, 6, 24.6–36.0 mm SL; Vietnam: Gia Lei: Azun. – IAPG 3266–3279, 14, 20.5–35.5; Vietnam: Gia Lei: Azun.

S. nicholsi: IAPG A9456–9464, 9, 41.6–63.3 mm SL; Thailand: Phetchabun: Mun. – IAPG 7362–7366, 5, 33.2–48.9 mm SL; Thailand: Chiang Mai: Mae Nam Fang. – CMK 24709, 3, 39.7–51.1 mm SL; Laos: Bolikhamsai: Nam Ngiep.

S. pridii: IAPG A2393, 1, 26.8 mm SL; Thailand: Chiang Mai: Huay Mae Tae. – IAPG A928–929, 2, 27.2–

29.1 mm SL; Thailand: Chiang Mai: Doi Chiang Dao.

S. punctifasciata: IAPG A1270–1274, 5, 12.8–28 mm SL; Laos: Khammouan: Xe Bangfai.

S. robertsi: IAPG A7452–7454, 3, 31.4–35.5 mm; Thailand: Phang Nga: unnamed forest stream. – IAPG A7040–7048, 9, 12.6–30.2 mm SL; Thailand: Kapong: Takua Pa. – IAPG A6990–6995, 6, 32.8–39.8 mm SL; Thailand: Nakhon Sri Thammarat: Khao Mhen.

S. suber: CMK 22484, 2, 32.0–37.6 mm SL; Laos: Vientiane: Mam Ngone. – CMK 22643, 3, 28.1–46.9 mm SL; Laos: Xiangkhouang: Nam Ngum. – CMK 22434, 1, 37.8 mm SL; Laos: Vientiane: Nam Ngum.

S. spiloptera: IAPG A3401–3417, 17, 23.7–44.4 mm; Vietnam: Thua Thien-Hue: unnamed mountain stream.

Data for other species from Chen & Neely (2012), Kottelat (1990), Lokeshwor et al. (2012), Suvarnaraksha (2012) and Ou et al. (2011).

Acknowledgements

We wish to thank Soth Vithun and Hok Samphea for their help with the field work. The study was supported by project No. 09/2014/06 of Czech Development Agency, grant 206/08/0637 of the Czech Science Foundation and by the IRP IAPG No. RVO 67985904.

Literature cited

- Bohlen, J. & V. Šlechtová. 2011. A new genus and two new species of loaches (Teleostei: Nemacheilidae) from Myanmar. *Ichthyological Exploration of Freshwaters*, 22: 1–10.
- Bohlen, J. & V. Šlechtová. 2013a. Two new species of *Schistura* (Nemacheilidae) from Myanmar. *Ichthyological Exploration of Freshwaters*, 24: 21–30.
- Bohlen, J. & V. Šlechtová. 2013b. *Schistura puncticeps* (Cobitoidea: Nemacheilidae), a new species of loach from Myanmar. *Ichthyological Exploration of Freshwaters*, 24: 85–92.
- Bohlen, J. & V. Šlechtová. 2014. *Schistura shuensis*, a new species of nemacheilid loach (Cobitoidea: Nemacheilidae) from Myanmar. *Ichthyological Exploration of Freshwaters*, 24: 217–223.
- Bohlen, J., V. Šlechtová & K. Udomritthiruji. 2014. *Schistura hypsiura*, a new species of river loaches (Cobitoidea: Nemacheilidae) from Myanmar. *Raffles Bulletin of Zoology*, 62: 21–27.
- Chen, X.-Y. & D. A. Neely 2012. *Schistura albirostris*, a new nemacheiline loach (Teleostei: Balitoridae) from the Irrawaddy River drainage of Yunnan Province, China. *Zootaxa*, 3586: 222–227.
- Freyhof, J. & D. V. Serov. 2001. Nemacheiline loaches from Central Vietnam with description of a new genus and 14 new species (Cypriniformes: Balitoridae). *Ichthyological Exploration of Freshwaters*, 12: 133–191.

- Kottelat, M. 1985. Freshwater fishes of Kampuchea. A provisory annotated check-list. *Hydrobiologia*, 121: 249–279.
- 1990. Indochinese nemacheilines. A revision of nemacheiline loaches (Pisces: Cypriniformes) of Thailand, Burma, Laos, Cambodia and southern Viet Nam. Pfeil, München, 262 pp.
- 2012. *Conspectus cobitidum*: An inventory of the loaches of the world (Teleostei: Cypriniformes: Cobitoidei). *The Raffles Bulletin of Zoology, Supplement* 26: 1–199.
- Kottelat, M. & C. Leisher. 2012. Fishes from Phuong Hoang cave, northern Vietnam, with description of a new species of loach (Teleostei: Nemacheilidae). *Ichthyological Exploration of Freshwaters*, 23: 237–244.
- Lalramliana. 2012. *Schistura aizawlensis*, a new species of loach from Mizoram, northeastern India (Cypriniformes: Balitoridae). *Ichthyological Exploration of Freshwaters*, 23: 97–104.
- Lokeshwor, Y., A. Barat, J. Sati, A. Darshan, W. Vishwanath & P. C. Mahanta. 2012. *Schistura obliquofascia*, a new loach from Uttarakhand, India (Cypriniformes: Nemacheilidae). *Zootaxa*, 3586: 255–263.
- Lokeshwor, Y. & W. Vishwanath. 2012. *Schistura koldynensis*, a new species of loach from the Koldadyne basin, Mizoram, India (Teleostei: Nemacheilidae). *Ichthyological Exploration of Freshwaters*, 23: 139–145.
- Ou, C., C. G. Montaña, K. O. Winemiller & K. W. Conway. 2011. *Schistura diminuta*, a new miniature loach from the Mekong River drainage of Cambodia (Teleostei: Nemacheilidae). *Ichthyological Exploration of Freshwaters*, 22: 193–200.
- Rainboth, W. J. 1996. *Fishes of the Cambodian Mekong*. FAO, Rome, 265 pp.
- Suvarnaraksha, A. 2012. *Schistura maejotigrina*, a new stream loach (Pisces: Nemacheilidae) from northern Thailand. *Zootaxa*, 3586: 131–137.
- Zheng, L.-P., J.-X. Yang & X.-Y. Chen. 2012. *Schistura prolixifasciata*, a new species of loach (Teleostei: Nemacheilidae) from the Salween basin in Yunnan, China. *Ichthyological Exploration of Freshwaters*, 23: 63–67.

Received 29 December 2014

Revised 30 November 2015

Accepted 28 January 2016