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***Psilorhynchus kaladanensis*, a new species (Teleostei: Psilorhynchidae) from Mizoram, northeastern India**

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Abstract

Psilorhynchus kaladanensis, a new psilorhynchid, is described from the Kaladan basin of Mizoram, India. The new species is diagnosed by having the following combination of characters: caudal fin with small but distinct dark brown triangular spot at mid-base, slightly elongated dark mark near base of lower lobe, indistinct V-shaped vertical bar across center, dark brown oblique bar across fin anterior to center; absence of scales on mid-ventral region between pectoral fins; anteriormost branchiostegal ray greatly reduced in length; 32–33 total vertebrae; 30–32 lateral-line scales; caudal fin with 10+9 principal rays.

Key words: new species, diversity, Indo-Myanmar, Sittwe

Introduction

The genus *Psilorhynchus* McClelland, commonly referred to as torrent minnows, inhabit fast flowing rivers and streams of the Ganges-Brahmaputra drainage, Peninsular India, Ayeyarwaddy drainage of India and Myanmar, Ann Chaung drainage and Ataran River drainage of Myanmar, and Kaladan drainage of northeastern India (Rainboth, 1983; Conway & Kottelat, 2007; Arunachalam & Muralidharan, 2008; Conway & Kottelat, 2010; Lalramliana *et al.*, 2014). *Psilorhynchus* is characterized by an arched dorsum, flattened ventral surface, small and inferior mouth, projecting snout, lack of barbels, uniserial pharyngeal teeth, gill-membranes joined broadly to isthmus with aperture extending ventrally to base of pectoral fin, horizontally inserted paired fins, naked breast and at least 8 scale rows between anus and anal fin (Rainboth, 1983).

Twenty-three species of *Psilorhynchus* are considered valid: *P. sucatio* (Hamilton), *P. balitora* (Hamilton), *P. homaloptera* Hora & Mukerji, *P. rowleyi* (Hora & Misra), *P. pseudecheneis* Menon & Datta, *P. nudithoracicus* Tilak & Husain, *P. microphthalmus* Vishwanath & Manojkumar, *P. arunachalensis* (Nebeshwar, Bagra & Das), *P. amplicephalus* Arunachalam, Muralidharan & Sivakumar, *P. robustus* Conway & Kottelat, *P. tenura* Arunachalam & Muralidharan, *P. breviminor* Conway & Mayden, *P. nepalensis* Conway & Mayden, *P. rahmani* Conway & Mayden, *P. pavimentatus* Conway & Kottelat, *P. melissa* Conway & Kottelat, *P. brachyrhynchus* Conway & Britz, *P. piperatus* Conway & Britz, *P. gokkyi* Conway & Britz, *P. maculatus* Shangningam & Vishwanath, *P. chakpiensis* Shangningam & Vishwanath, *P. hamiltoni* Conway, Dittmer, Jezicek & Ng, and *P. khopai* Lalramliana, Solo, Lalronunga & Lalnuntluanga.

Recent investigation in the Kaladan River and its tributaries in Mizoram, northeastern India, included a species of *Psilorhynchus* that could not be identified. Detailed comparisons of this material with congeners revealed it to belong to an unnamed species. The description of this material as *Psilorhynchus kaladanensis*, new species, forms the basis of this study.



FIGURE 1. *Psilorhynchus kaladanensis*, holotype, PUCMF 14008, 41.7 mm SL, a) dorsal, b) lateral and c) ventral view; (d) paratype, PUCMF 14009, 50.7 mm SL, lateral view.

Materials and methods

Specimens were fixed in 10% formalin and later transferred to 70% ethanol. Counts, measurements and other aspects of the description follow Conway *et al.* (2013). Measurements were made point to point with digital calipers to the nearest 0.1 mm. Measurements of body parts are given as proportions of standard length (SL). Subunits of the head are presented as proportions of head length (HL). For vertebral counts and other osteological studies, specimens were cleared and stained in alizarin. Vertebral counts include the first four vertebrae of the Weberian apparatus. Fin rays were counted using a stereomicroscope and were confirmed through cleared and stained specimens. Numbers in parentheses after a meristic value indicate the frequency of that value. Type specimens were deposited at the Pachhunga University College Museum of Fishes (PUCMF), Mizoram, India, and Mizoram University Biodiversity Museum (MZUBM), Mizoram, India. Other collection codes used herein are: ZSI/ERS for Eastern Regional Station, Zoological Survey of India, Shillong, Meghalaya, India, and ZSI for Zoological Survey of India, Kolkata.

Psilorhynchus kaladanensis, new species (Fig. 1 a–d)

Type material. Holotype: PUCMF 14008, 41.7 mm SL; India: Mizoram: Tuisi River, a tributary of Kaladan River in the vicinity of Khopai village, 22°11'51"N 92°02'16"E; Samuel Lalronunga *et al.*, 7 Mar. 2012.

Paratypes: PUCMF 14009 (14), 37.4–52.2 mm SL; MZUBM/F. 140004–140006 (3), 39.7–50.2 mm SL; PUCMF 14010 (5), 37.6–40.6 mm SL (cleared and stained); same data as holotype.

Diagnosis. *Psilorhynchus kaladanensis* belongs to the *P. balitora* species group, distinguished by having a greatly reduced anteriormost branchiostegal ray and a post-epiphysial fontanelle that is smaller than the pre-epiphysial fontanelle (Conway, 2011). It is distinguished from all other species of the *P. balitora* species group in having the following combination of characters: caudal fin with small but distinct dark brown triangular spot at mid-base, slightly elongated dark mark near base of lower lobe, indistinct V-shaped vertical bar across center, dark brown oblique bar across fin anterior to center; 5–6 unbranched pectoral-fin rays; 10+9 principal caudal-fin rays; 30–32 lateral-line scales; 3 branchiostegal rays; 32–33 total vertebrae; absence of scales on mid-ventral region between pectoral fins; absence of larger scales at pelvic-fin origin.

TABLE 1. Morphometric characters for *Psilorhynchus kaladanensis* (n=23). Ranges include values of holotype.

	holotype	mean	SD	range
Standard length (mm)	41.7			37.4–52.2
% standard length				
Body depth	19.2	19.5	0.8	18.1–20.9
Head length	22.5	22.9	0.8	21.6–24.2
Predorsal length	48.2	49.1	1.2	46.8–50.9
Prepectoral length	21.1	22.0	1.1	20.6–23.9
Prepelvic length	49.2	50.9	1.5	48.6–53.2
Preanal length	78.9	80.9	1.4	78.9–82.7
Distance from snout to anus	59.5	59.5	1.1	57.5–61.7
Distance from anus to anal-fin origin	19.9	20.0	0.9	17.6–21.5
Caudal-peduncle length	11.5	11.3	0.9	9.4–13.3
Caudal-peduncle depth	9.1	8.9	0.4	8.4–9.6
Caudal-peduncle width	4.6	4.8	0.6	3.6–6.2
Pectoral-fin length	24.9	25.3	1.1	22.6–26.9
Pelvic-fin length	21.3	21.7	1.1	19.8–23.4
Length of last unbranched anal ray	18.2	17.8	1.1	16.1–19.6
Length of last unbranched dorsal ray	25.4	23.9	1.2	22.2–26.3
% head length				
Head width	76	73	2.5	69–76
Head depth	61	59	1.8	56–62
Eye diameter	27	28	1.5	26–31
Snout length	48	50	1.9	48–53
Interorbital width	37	36	2.4	33–40
Mouth width	30	32	1.7	29–34

Description. See Table 1 for morphometric characters, and Figure 1 for general appearance. Head depressed; body compressed and elongate. Dorsal profile gently rising from tip of snout to origin of dorsal fin then sloping steeply towards caudal peduncle, body depth greatest at dorsal-fin origin. Ventral surface flattened from lower jaw to caudal-fin base. Head wider than deep. Eye ovoid, moderately large, not visible from ventral view, located slightly posterior on head. Mouth inferior, snout rounded without transverse groove on dorsum, ventral surface bordered by deep longitudinal groove on each side. Tubercles minute, conical with pointed tips over entire surface of snout, rostral cap, skin fold lateral to mouth, lateral and dorsal surfaces of head. Rostral cap and upper lip fused, separated by deep groove. Lower lip soft, not continuous with upper lip around corner of mouth. Lower jaw covered by thick squarish soft tissue, papillated, continuous with skin of isthmus and connected with rostral cap by posterolateral skin fold around corner of mouth (Fig. 2).



FIGURE 2. *Psilorhynchus kaladanensis*, paratype, PUCMF 14009, 50.7 mm SL, ventral view of head.

Pre-epiphysial fontanelle moderate, rod shaped, extending posteriorly to middle of orbit. Post-epiphysial fontanelle small, restricted to posterodorsal surface of neurocranium, positioned between supraoccipital and parietal, without contact to frontal. Five infraorbital bones (IO1-5); IO1-3 platelike; IO1 biggest; IO4-5 reduced in

width. Gill membranes joined to isthmus. Basihyal short, paddle-shaped, greatly expanded at anterior edge. Fifth ceratobranchial with 4 needle-like pharyngeal teeth, arranged in single row. Branchiostegal rays 3, anteriormost ray greatly reduced in length. Swim bladder coated by thick peritoneal membrane. Anterior chamber large, partially enclosed in bony cavity anteriorly by lateral process of 2nd vertebral centrum and laterally by outer arm of os suspensorium; posterior chamber greatly reduced in females.

Dorsal-fin rays iii9 (23); anal-fin rays ii6 (23); principal caudal-fin rays 10+9 (23), dorsal procurrent rays 6, ventral procurrent rays 4. Pelvic-fin rays ii7 (23); pectoral-fin rays v10 (9), v11 (4), vi9 (5) or vi10 (5). Pectoral fin horizontally placed, adpressed fin tip almost reaching pelvic-fin origin. Pelvic-fin origin posterior to dorsal-fin origin, insertion vertical through 2nd branched rays of dorsal fin. Anus between pelvic fins. Caudal fin deeply emarginate, upper lobe slightly longer than lower lobe.

Scales cycloid and large, radii directed posteriorly; 30 (7), 31 (11) or 32 (5) along lateral line, plus 1–2 on base of caudal fin; 3.5/1/2 transverse scale rows from dorsal-fin origin to pelvic-fin origin, 10 around caudal peduncle, 10–11 on predorsal region, 8–9 between anus and anal-fin origin. Scales absent on mid-ventral region between pectoral fins. Total number of vertebrae (abdominal + caudal vertebrae): 22+10 = 32 (3) or 22+11 = 33 (2).

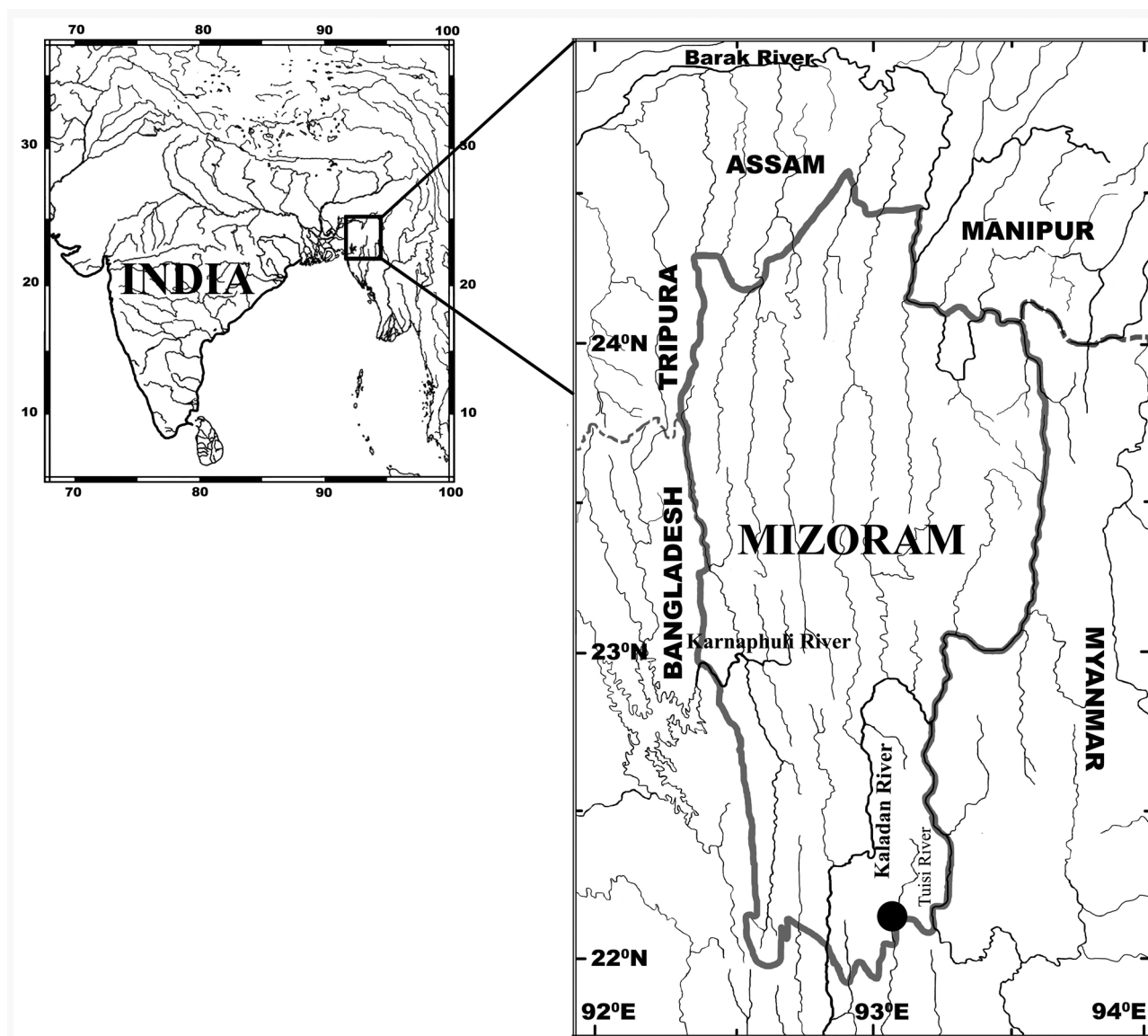


FIGURE 3. Type locality of *Psilorhynchus kaladanensis* (black dot).

Coloration. In 70% ethanol, body background light brown dorsally and laterally, light creamish ventrally. Scales on flank and dorsal surface edged with dark pigment. Flank with 7–9 small round to squarish dark brown blotches in a longitudinal row. Dark pigment between pores of lateral line, forming an indistinct lateral streak. Top of head with distinct dark brown blotch at middle of inter-orbit, and occiput with a heart-shaped dark brown blotch. Two indistinct saddles on dorsal surface between occiput and dorsal-fin origin, first situated closer to occiput than to dorsal-fin origin, extending between 3rd–5th predorsal scales; second saddle at 9th–11th predorsal scales just anterior to dorsal-fin origin. Four distinctive saddles along dorsal surface posterior to dorsal-fin origin. First between insertions of 3–6 branched dorsal-fin rays, second between dorsal- and anal-fin origin, third at vertical through insertions of anal-fin rays and fourth just anterior to caudal-fin base. Saddles extending ventrally on the flank connecting indistinct lateral streak. Scales along L-1 row with a series of small dark brown spot. Base of pectoral fin and scales adjacent to pelvic-fin origin with clusters of small dark brown melanophores, forming distinct pectoral-base and pre-pelvic spots, respectively. Dorsal fin with faint dark brown row of spots crossing centre of fin, this is formed by small aggregations of melanophores at branching point of each branched rays. Caudal fin with small but distinct dark brown triangular spot at mid-base and a slightly elongated dark mark near base of lower lobe, an indistinct V-shaped vertical bar across center of caudal fin and a dark brown oblique bar across the fin anterior to the center, formed by small aggregations of melanophores. Pectoral- and pelvic-fin with dark brown pigments on each ray. Anal fin hyaline. Ventral surface light creamish with melanophores scattered on anterior edge of rostral cap and short line of melanophores posterior to anus running along ventral midline and terminating 5–6 scale rows post anus.

Distribution and habitat. Known only from the type locality, Tuisi River, a tributary of Kaladan River of Mizoram (Fig. 3). It is found in moderate to fast flowing water with sparse vegetation and a substrate of pebbles, sand, gravel and small boulders. The Kaladan River, locally known as the Chhimituipui, originates from the Chin Hills of Myanmar and flows through the southern part of Mizoram, India, and empties into the Bay of Bengal near Sittwe in Myanmar. It is located between the Ganges-Brahmaputra and the Ann Chaung drainage on the western slope of the RakhineYoma Mountain Range, Myanmar.

Etymology. The species is named after the Kaladan River. An adjective.

Discussion

Based on the study of morphology, Conway (2011) grouped *Psilorhynchus* into three species groups, the *P. balitora* species group, the *P. nudithoracicus* species group, and the *P. homaloptera* species group. *Psilorhynchus kaladanensis* belongs to the *P. balitora* species group as it has a greatly reduced anteriormost branchiostegal ray and a small post-epiphysial fontanelle smaller than the pre-epiphysial fontanelle. The greatly reduced anteriormost branchiostegal rays distinguish *P. kaladanensis* from all members of the *P. nudithoracicus* and *P. homaloptera* species groups, which have long and slender anteriormost branchiostegal rays. It further differs from members of the *P. homaloptera* species group in having fewer unbranched pectoral-fin rays (5–6 vs. 7–10) and fewer lateral-line scale rows (31–32 vs. 39–48).

Among the members of *Psilorhynchus balitora* species group, *P. kaladanensis* differs from *P. hamiltoni* and *P. maculatus* in having fewer lateral-line scales (30–32 vs. 34–36) and fewer total vertebrae (32–33 vs. 36). It differs from *P. balitora* in the absence (vs. presence) of scales from its mid-ventral region between the pectoral fins and in having more principal caudal-fin rays (10+9 vs. 8–9+7–8); from *P. nepalensis* in having more principal caudal-fin rays (10+9 vs. 9+8), fewer (1/2 vs. 2/3) dark vertical bars across the caudal fin and absence (vs. presence) of a dark pigment blotch on the distal edge of the dorsal fin; from *P. rahmani* in having (vs. not having) dark vertical bars across the caudal fin, deeper dorsal saddles extending 3 scale rows down from the dorsal surface and contacting the dark blotches in a longitudinal row on the flank (vs. dorsal saddles extending 1–2 scale rows down from the dorsal surface and not contacting the dark blotches in a longitudinal row on the flank), longer head (21.6–24.2% SL vs. 19.4–21.4), longer last unbranched dorsal-fin ray (22.2–26.3% SL vs. 20.4–21.5) and a narrower interorbital (33–40% HL vs. 43.2–47.7); from *P. breviminor* in having (vs. not having) dark vertical bars across the caudal fin, shallower body (18.1–20.9% SL vs. 21.5–24.4), deeper head (56–62 % HL vs. 51.0–55.8) and narrower interorbital (33–40 % HL vs. 40.0–43.7); from *P. brachyrhynchus* in having more branchiostegal rays (3 vs. 2) and fewer vertebrae (32–33 vs. 35); from *P. piperatus* in having more rays in the upper caudal-fin lobe (10 vs. 9), fewer

vertebrae (32–33 vs. 35) and the absence (vs. presence) of a symmetrical pattern of small black blotches on both the upper and lower caudal-fin lobes; from *P. gokkyi* in lacking (vs. having) a deep notch at the level of the ethmoid region and having fewer vertebrae (32–33 vs. 34); from *P. chakpiensis* in having fewer scale rows between the lateral line and pelvic-fin origin (2 vs. 2.5–3), shorter caudal peduncle (9.4–13.3 % SL vs. 17.8–20.5); and from *P. pavimentatus* in having more rays in the upper caudal-fin lobe (10 vs. 9), fewer total vertebrae (32–33 vs. 34), presence (vs. absence) of dark vertical bars across the caudal fin, presence (vs. absence) of dark brown row of spots across the dorsal fin, and absence (vs. presence) of large scale at pelvic fin origin, anterior to pelvic axillary scale. The number of lateral-line scales in *P. amplicephalus* was reported as 35–36 in the original description (Arunachalam *et al.*, 2007). However, Shangningam & Vishwanath (2013b), upon examination of one paratype, reported that it has 32+2 scale along the lateral line, which falls within the range of *P. kaladanensis* (30–32). However, *P. kaladanensis* differs from *P. amplicephalus* in having more principal caudal-fin rays (10+9 vs. 9+8), a shallower body (18.1–20.9 vs. 23.3–25.8 % SL) and a smaller eye (26–31 vs. 31.5–36 % HL).

Four species of *Psilorhynchus* are listed from the Kaladan and Barak drainages of Mizoram (Kar & Sen, 2007; Ng & Lalramliana, 2010; Lalramliana *et al.*, 2014): *P. balitora*, *P. khopai*, *P. nudithoracicus* and *P. sucatio*. *Psilorhynchus kaladanensis* differs from *P. khopai*, *P. nudithoracicus* and *P. sucatio* in having a greatly reduced (vs. long and slender) anteriormost branchiostegal ray, and from *P. balitora*, as already mentioned, in lacking (vs. having) scales on the mid-ventral region between the pectoral fins.

Comparative material and sources

Psilorhynchus balitora: ZSI/ ERS/V/F 2718, 2, 56.8–61.5 mm SL; India: Meghalaya, West Garo hills, Josekgre Chising Nokrek biosphere reserve.

Psilorhynchus homaloptera: ZSI F 11792/1, holotype, 55.1 mm SL and ZSI F11796/1, 4 paratypes, 53.4–58.3 mm SL; India: Nagaland, Keleki stream.

Psilorhynchus khopai: PUCMF 13013, holotype, 63.2 mm SL; India: Mizoram: Tuisi River, a tributary of Kaladan River in the vicinity of Khopai village, Saiha District. PUCMF 13014, 6, paratypes, 57.4–83.7 mm SL; India: Mizoram: Tuisi River, a tributary of Kaladan River in the vicinity of Khopai village, Saiha District.

Psilorhynchus nudithoracicus: PUCMF 2050, 5, 46.2–58.1 mm SL; India: Mizoram, Barak drainage (Brahmaputra basin), Teirei (Tributary of Tlawng River), Saikhawthlir. *Psilorhynchus pseudecheneis*: ZSI F1929/2, 4 paratypes, 76.1–84.4 mm SL; Eastern Nepal: Dudhkosi River, Solokhumbu District.

Psilorhynchus rowleyi: ZSI F 13461/1, 1, 75.5 mm SL; Myanmar: Kora, Vernay-Hopwood Upper Chindwin Expedition, 1935.

Psilorhynchus sucatio: PUCMF 2021, 14, 51.5–62.9 mm SL; India: Mizoram, Barak drainage (Brahmaputra basin), Teirei (Tributary of Tlawng River), Saikhawthlir.

Published information used for comparison: Arunachalam *et al.* (2007) for *Psilorhynchus amplicephalus*, Conway & Kottelat (2007) for *P. robustus*, Conway & Mayden (2008a) for *P. breviminor*, Conway & Mayden (2008b) for *P. nepalensis* & *P. rahmani*, Conway & Britz (2010) for *P. brachyrhynchus*, *P. gokkyi* & *P. piperatus*, Conway & Kottelat (2010) for *P. pavimentatus*, Shangningam & Vishwanath (2013a & b) for *P. maculatus* and *P. chakpiensis*.

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