



GARRA DAMPAENSIS, A NEW RAY-FINNED FISH SPECIES (CYPRINIFORMES: CYPRINIDAE) FROM MIZORAM, NORTHEASTERN INDIA

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Abstract: *Garra dampensis*, a new cyprinid fish species, is described from the Seling River, a tributary of the Khawthlang Tuipui (Karnaphuli River), in Mizoram, India. The species can be distinguished from all other *Garra* species, except *G. abhoyai*, *G. lissorhynchus*, *G. nambulica*, *G. paralissorhynchus* and *G. rupecula* by the presence of a distinct W-shaped black band on the caudal fin. It can be distinguished from the above mentioned five species in having scales on the breast and belly, shorter vent to anal distance, and by having fewer lateral line scales (27–29 vs. more than 29 in all other species). A key to the species of *Garra* in the *Lissorhynchus* complex is provided.

Keywords: Dampa Tiger Reserve, Karnaphuli, Khawthlang Tuipui, new species, Seling.

Abbreviations: HL - Head length; SL - Standard length; MUMF - Manipur University Museum of Fishes, Manipur, India; PUCMF - Pachhunga University College Museum of Fishes, Mizoram, India; ZSI - Zoological Survey of India, Kolkata, India.

Mizo Abstract: *Garra dampensis*, nhalim chungkaw zinga mi, nghazawngkek chi thar chu Seling lui, Khawthlang Tuipui (Karnaphuli), Mizoram, India atanga hmuhchhuah a ni. He sangha chi thar hian a mei ah W ang tak thil dum in rin a nei a, chutiang irin chu nghazawng ek chi dang, heng, *G. abhoyai*, *G. lissorhynchus*, *G. nambulica*, *G. paralissorhynchus* leh *G. rupecula*, te chauhin an nei ve a ni. Heng nghazawngkek chi 5 tarlante nen an danglamna chu, a awm leh dulah te phuhlip a nei bik, a mawngkua leh a mawng pangparh inkar hlat zawng a tawi bik, tin, a taksa dungzui zawng phuhlip intlar thla a tlem bik a ni (27–29 vs. 29 aia tam vek). Nghazawngkek (*Lissorhynchus* complex) ho hriathran theihna tur pek a ni bawk.

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Author Contribution: SLRN - detailed examination of *Garra* species of Mizoram and comparison with specimens in ZSI and in other museums; LNT - supervision in identification of freshwater fish species, interpretation of the result and discusses taxonomic status; LRL - supervision in establishing new species, comparison with available literature, discusses taxonomic status, preparation of drawings and comparison with specimens in MUMF.

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INTRODUCTION

Species of the genus *Garra* Hamilton, 1822 are hill stream bottom dwelling cyprinids currently consisting of more than 85 described species (Chen et al. 2009), usually found in fast flowing rivers and streams adhering to submerged rocks with the help of a sucking disc present on the ventral surface of the head, just behind the mouth. The genus occurs widely from south China, Borneo and south Asia through Burma (now Myanmar), India, the Middle East, Arabian Peninsula and East Africa to West Africa (Menon 1964). During the last decade, several descriptions (Kottelat 2000; Vishwanath & Kosygin 2000; Gopi 2001; Zhang & Chen 2002; Zhang et al. 2002; Kullander & Fang 2004; Vishwanath & Joyshree 2005; Vishwanath & Shanta 2005; Zhang 2005, 2006; Zhou et al. 2005; Li et al. 2008; Vishwanath & Linthoingambi 2008; Chen et al. 2009; Nebeshwar et al. 2009) and revisions (Zhang et al. 2002; Zhou et al. 2005) on *Garra* species have been made from Asia.

The Karnaphuli River, locally known as the Khawthlang Tuipui, in Mizoram, is located between the Ganga-Brahmaputra and the Kolodyne drainages. Originating from the hills of the Mizoram-Tripura border in India, it flows along the Mizoram-Bangladesh border and then southwest through the Chittagong Hill tract and Chittagong and ultimately joins the Bay of Bengal. No previous reports have been made on any *Garra* species from the Karnaphuli drainage of Mizoram. Recent freshwater faunal surveys conducted in the Karnaphuli drainage of Dampa Tiger Reserve, Mizoram, India, resulted in the collection of specimens of *Garra*. Detailed studies and comparison of this material with congeners revealed it to belong to an unnamed species which is herein described as *Garra dampensis* sp. nov.

MATERIAL AND METHODS

The specimens were preserved in 10% formalin and later on transferred to 70% alcohol. Measurements and counts follow Kullander & Fang (2004), and that of ventral to anal fin and vent to anal fin, Menon (1964). Lateral transverse scales rows count and other additional measurements follow Nebeshwar et al. (2009). Measurements were taken point to point with digital calipers rounded to the nearest 0.1mm. Fin rays and numbers of scales were counted under stereo zoom microscope. For vertebral count, three paratype specimens were cleared and stained following Taylor & van Dyke (1985). Abdominal vertebrae count include the

Weberian apparatus (assumed to contain four vertebrae). Numbers in parentheses after a meristic value indicate the frequency of that value. Specimens examined for the study are deposited in Pachhunga University College Museum of Fishes (PUCMF), Mizoram, India.

Garra dampensis sp. nov.

(Image 1 A&B; Image 2 A&B)

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Material examined

Holotype: PUCMF 12001, 22.vii.2011, 45.6mm SL, Seling River, a tributary of Khawthlang Tuipui (Karnaphuli River) in the vicinity of Damparengpui, Mizoram, India, 23°40'51"N & 92°22'35"E, coll. Samuel Lalronunga & Lalnuntluanga.

Paratypes: PUCMF 12002, 10 exs., 40.6–51.9 mm SL, same data as holotype; PUCMF 12003, 2 exs., 42.0–48.9 mm SL, same data as holotype (dissected for gonadal studies); PUCMF 12004, 3 exs., 36.5–41.4 mm SL, same data as holotype (dissected and preserved in glycerin with thymol for bone study).

Diagnosis

A small species of *Garra* with the following combination of characters: no transverse groove and proboscis on the snout; tip of dorsal fin falcate; long axillary scale present at the base of pelvic fin, reaching the base of last pelvic fin ray; 27–29 lateral-line scales, 10–11 regularly arranged predorsal scales; W-shaped black band across the middle of caudal fin and presence of scales on the breast and belly. Additional characters useful for diagnosing this species are outlined in the discussion.

Description

Biometric data are given in Table 1. Head depressed; body small, compressed and elongate. Dorsal profile gently rising from tip of snout to origin of dorsal fin then sloping gently towards caudal peduncle, body depth greatest at dorsal fin base. Ventral surface flattened from head to anal fin base. Eye ovoid, moderately large, not visible from ventral view, located in middle or slightly posterior of head length. Snout rounded without transverse groove, minute tubercles clustered (6–9) at anterior base of rostral barbels and sparsely extending on tip of snout, rostral lobe short. Head wider than deep.

Anterior barbel short, not reaching margin of rostral cap. Rostral cap connected with lower lip at corners of mouth. Upper jaw entirely covered by rostral cap. No



Image 1. Holotype of *Garra dampensis* sp. nov. (PUCMF 11012), 46.5mm SL (A) Lateral and (B) Ventral view.



Image 2. Holotype of *Garra dampensis* sp. nov. (PUCMF 11012), 46.5mm SL Head in (A) Lateral and (B) Ventral view. Scale = 2mm

papilliferous tissue on upper jaw. Antero-lateral fold conspicuous between upper and lower lip at corner of mouth, not extending mediad between exposed lower jaw and lower lip. Lower lip thick and modified into sucking disc. Disc elliptical, wider than long; anterior

margin modified to form a transverse skin fold covered by numerous tiny papillae, anteriorly separated from lower jaw by a deep groove running along lower jaw and posteriorly bordered in a deep groove with a central pad. Central pad wider than long, lateral and posterior margin

Table 1. Biometric data for *Garra dampensis* sp. nov. (n=16). All ratios expressed as percent of SL, HL, or ventral-anal length.

	Holotype PUCMF12001	Mean±Sd Holotype included	RANGE
Standard Length (SL) (in mm)	46.5		36.5–51.9
In % SL			
Body depth	21.7	21.6±0.8	20.1–22.7
Head length	27.3	27.4±0.6	26.6–28.7
Head height at eye	13.2	13.5±0.3	13.1–13.9
Head height at occiput	15.0	15.5±0.3	15.0–16.0
Head width at opercle	21.3	20.9±0.4	20.0–21.4
Head width at nare	17.7	17.3±0.5	16.2–18.1
Body width at dorsal	17.8	17.3±0.5	16.5–18.1
Body width at anal	10.5	9.6±0.6	8.8–10.5
Caudal peduncle length	18.2	16.5±0.9	15.6–18.2
Caudal peduncle height	13.4	13.5±0.4	12.7–14.2
Dorsal fin length	25.3	24.7±0.9	22.8–26.5
Dorsal fin base length	13.0	13.2±0.8	12.3–14.7
Pectoral fin length	26.2	25.3±1.4	22.9–27.1
Pelvic fin length	22.3	21.9±0.8	20.6–23.2
Anal fin length	20.2	19.8±0.8	18.5–21.0
Anal fin base length	8.4	7.8±0.4	7.0–8.4
Upper caudal fin lobe length	23.8	25.8±1.6	22.7–28.3
Lower caudal fin lobe length	24.2	26.3±1.5	24.1–28.5
Median caudal fin rays length	20.0	21.1±1.4	18.1–22.6
Pre-anal length	75.1	77.0±1.4	75.1–79
Pre-anus length	71.9	72.7±1.2	70.6–74.4
Pre-ventral length	52.9	53.5±1.3	51.5–56.0
Pre-dorsal length	53.3	53.2±0.9	51.5–54.7
Pre-pectoral length	22.8	23.4±0.9	21.6–25.2
In % Ventral to anal fin			
Vent to anal fin	17.6	17.9±1.1	15.9–19.6
In % HL			
Snout length	52.8	51.5±1.5	48.7–54.4
Eye diameter	20.0	21.0±1.3	18.5–22.8
Inter-orbital space	47.9	48.6±1.3	45.9–50.3
Disc length	35.9	35.7±0.9	34.2–37.2
Disc width	54.7	53.6±2.3	49.0–57.9
Callous pad length	24.5	23.6±1.3	21.4–26.6
Callous pad width	37.2	34.9±1.9	31.9–37.6

surrounding central pad papillated, posteriormost margin almost reaching vertical to posterior margin of eye.

Dorsal fin with ii, 6(16) rays, falcate with sub-acuminate tip, first branched ray longest; origin closer to snout tip than caudal fin base, origin anterior to pelvic fin origin and over 10th lateral line scales; posterior margin slightly concave. Pectoral fin sub-acuminate with i, 12(16) rays (two to three small unbranched rays posterior to the last branched ray not counted), fourth and fifth branched ray longest, adpressed fin tip reaching beyond half the distance between pectoral fin origin and pelvic fin origin or reached 9th lateral line scale. Pelvic fin subacuminate, with i, 6(16) rays (one small unbranched ray posterior to the last branched ray not counted), second branched ray longest, adpressed fin tip reaching beyond vent but not reaching base of anal fin, axillary scale present at base of pelvic fin, reaching base of last pelvic fin ray. Vent closer to anal fin base than base of last pelvic fin ray. Anal fin sub-acuminate, with ii, 4(16) rays, first branched ray longest, adpressed fin tip almost reaching base of caudal fin. Caudal fin deeply emarginated, lobe tips blunt, principle caudal rays 10+9(16), 10th ray shortest, upper lobe slightly shorter than lower.

Lateral line complete and obvious; scales 27(3), 28(8) or 29(5); transverse scale rows above lateral line 3½(14) or 4½(2); below lateral line from ventral fin origin 3(13) or 4(3); from anal fin origin 3½(10) or 4½(6). Circumpeduncular scale rows 16(16). Predorsal scales 10(10) or 11(6) and arranged regularly. Belly and breast scaled; breast scales in between the pectoral fin base deeply embedded. Gill rakers 12(3).

Vertebrae: 30 (4 + 15 abdominal + 11 caudal) (2) or 31 (4 + 16 abdominal + 11 caudal) (1).

Colouration: In 70% alcohol: dorsum, sides and head dark grey. Ventral side of head, chest, and abdomen whitish. Black spot immediately at the upper angle of gill opening. Each scale formed by blackish spot at center, more conspicuous at the posterior half. Anal, pelvic and pectoral fins whitish, pectoral fin with a black streak on each interradiial membrane. Dorsal fin greyish with submarginal black band. Caudal fin grayish with distinct W-shaped black band.

Notes on biology: A dissected paratype 42.0mm SL is a female with ripe ovulae.

Etymology

The species is named after Dampa Tiger Reserve, Mizoram.

Distribution and habitat

Known only from Seling River, inside Dampa Tiger Reserve, a tributary of Khawthlang Tuipui (Karnaphuli drainage) Mizoram, India (Fig. 1). *Garra dampensis*

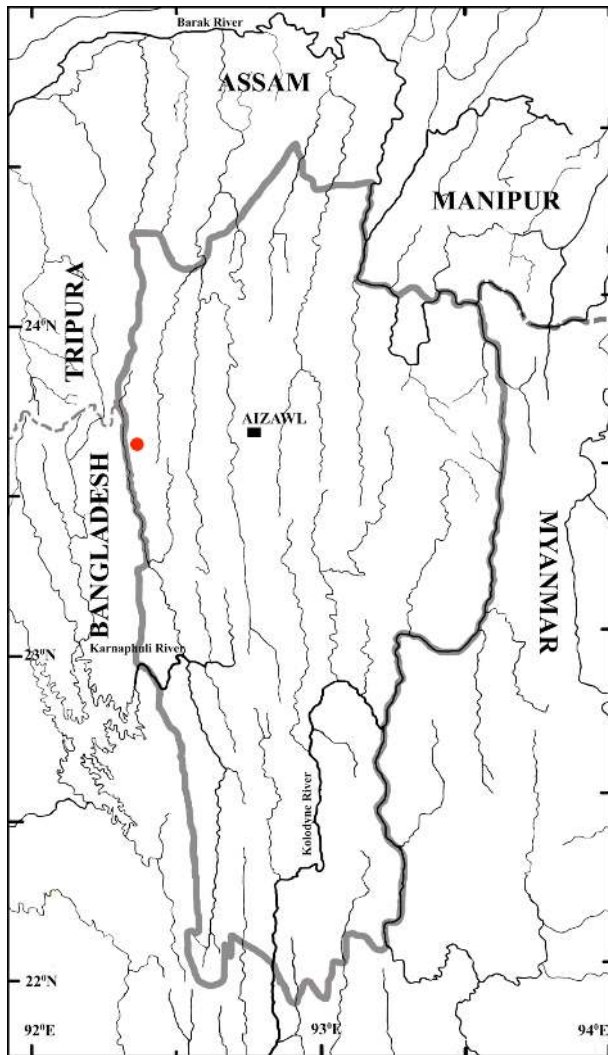


Figure 1. Map of Mizoram, India showing collection localities of (●) *Garra dampensis* sp. nov. A symbol may represent more than one locality.

has been collected from clear, shallow, moderately fast-flowing streams with a predominantly rocky bottom. It is found associated with *Devario aequipinnatus*, *Garra* cf. *annandalei* and *Schistura* spp.

DISCUSSION

Karmakar & Das (2007) and Kar & Sen (2007) reported eight species of *Garra* from Mizoram, namely *Garra annandalei* Hora, *G. gotyla gotyla* Gray, *G. gravelyi* Annandale, *G. kempfi* Hora, *G. lamta* Hamilton, *G. lissorhynchus* McClelland, *G. naganensis* Hora, and *G. notata* Blyth from Barak drainage (Brahmaputra basin), and again *G. annandalei*, *G. gotyla gotyla* along with *G. lamta* and *G. naganensis* to occur in the Mat River (a

tributary of Kolodyne) and Kolodyne River, however, the identity of some of these species needs confirmation.

From Mizoram, the neighboring state of Mizoram, India, the following species has been described, namely *Garra abhoyai* and *G. naganensis* (Hora, 1921), *G. manipurensis* (Vishwanath & Sarojnalini, 1988), *G. litanensis* (Vishwanath, 1993), *G. paralissorhynchus* (Kosygin & Vishwanath, 1998), *G. compressus* (Vishwanath & Shanta, 1998), *G. elongata* (Vishwanath & Kosygin, 2000) and *G. nambulica* (Vishwanath & Joyshree, 2005). Further, the occurrence of *G. lissorhynchus*, *G. rupecula* McClelland, *G. kempfi* Hora, *G. nasuta* McClelland, *G. gravelyi* and *G. gotyla* has been reported from Mizoram (Vishwanath 1993). *Garra abhoyai* has been treated as a junior synonym of *G. rupecula* (Menon, 1964), however, Vishwanath & Linthoingambi (2008) resurrected the species and ruled out the occurrence of *G. rupecula* in the Chindwin basin of Mizoram.

Among the aforementioned species, *Garra gotyla gotyla*, *G. lamta*, *G. litanensis*, *G. elongata*, *G. arupi* and *G. nasuta* are closely related to each other in having a transverse groove and also a weak to well developed proboscis on the snout. *Garra dampensis* clearly differs from any of them in having a snout without a transverse groove.

Garra dampensis shares similar characters with *G. annandalei*, *G. naganensis*, *G. notata*, *G. kempfi*, *G. compressus* and *G. manipurensis* in having a snout without a transverse groove and a proboscis, and in certain body proportions and counts. However, it can be easily distinguished from them by the presence (vs. absence) of a distinct W-shaped black band on the caudal fin.

McClelland (1839) described *Gonorhynchus rupeculus* from the Mishmi Hills, Arunachal Pradesh, India (Brahmaputra basin). The description is very brief and he did not mention the presence or absence of wavy or W-shaped black bar across the caudal fin, but reported 35 scales along the lateral line and nine rows of scales on either side between the dorsal and ventral fins; a snout smooth and broad; a row of open pores extending round the snout between the nostrils, and another row between the eyes, besides other characters. Gunther (1868) and Day (1878), without any comments, considered it as a synonym of *Discognathus lamta* Hamilton (now *Garra lamta*), a species with a deep transverse groove separating the snout tip and no wavy or W-shaped black bar across the caudal fin. Similarly, *Platycaea lissorhynchus* was described by McClelland (1842) from Kasyah Mountains, Assam (Brahmaputra basin) to possess a head, flat below, arched and thick above; a

disc behind the mouth; a snout smooth and rounded; and scales large. The two species were recognized and redescribed as *Garra rupecula* (as *G. rupeculus* by Hora 1921) and *G. lissorhynchus* respectively by Hora (1921) and Menon (1964), mentioning the absence of scales on the ventral side (chest and abdomen), presence of wavy or W-shaped black bar across the caudal fin in both the species and lateral line scales as 32–34 for *G. rupecula* and 32–35 for *G. lissorhynchus*. However, the descriptions on *G. rupecula* by Hora (1921) and Menon (1964) are based on specimens collected from Manipur valley, which belong to Chindwin drainage (Nebeshwar et al. 2009). Since the distribution of *G. rupecula* in the Chindwin basin is already ruled out (Vishwanath & Linthoingambi 2008; Nebeshwar et al. 2009), it can be considered that their examined specimens are totally different species (probably a mixture of small specimens of *Garra nambulica* and *G. paralissorhynchus*, as mentioned by Vishwanath & Linthoingambi 2008). It is thus obvious that the description of *G. rupecula* available is the only brief statement by McClelland (1839), and we therefore consider that a thorough revision is essential to depict the detail characters of the species.

Menon (1964) grouped *Garra* species having a dark streak near the free margin of the dorsal fin, W-shaped band on the caudal fin and naked breast and belly in the *Lissorhynchus* complex. Species which can be put under this group are *G. lissorhynchus*, *G. rupecula*, *G. abhoyai*, *G. paralissorhynchus* and *G. nambulica*. The species under description shares similar characters with them in having a dark streak near the free margin of dorsal fin and distinct W-shaped black band on the caudal fin. However, it can be easily distinguished from them in having scales on breast and belly (vs. absent in all) (see Table 2 for comparison). It further differs from *G. lissorhynchus* in having fewer lateral line scales (27–29 vs. 34–35) and fewer predorsal scales (10–11 vs. 14–15); from *G. rupecula*, as mentioned by McClelland (1839), in having fewer lateral line scales (27–29 vs. 35); from *G. abhoyai* in having deeper body (20.1–22.7 % SL vs. 17.6–18.7), longer head (26.6–28.7% SL vs. 22.0–23.5), longer dorsal fin (22.8–26.5 % SL vs. 11.7–14.8), longer pectoral fin (22.9–27.1 % SL vs. 19.7–22.0), longer pelvic fin (20.6–23.2 % SL vs. 16.5–18.2) and regularly arranged 10–11 predorsal scales (vs. appears to be naked due to thick mucous cover); from *G. paralissorhynchus* in having more gill rakers (12 vs. 6) and shorter vent to anal distance (15.9–19.6% ventral-anal distance vs. 25.0–30.8); and from *G. nambulica* in having fewer lateral line scales (27–29 vs. 34–35), fewer predorsal scales (10–11 vs. 16–29), longer head (26.6–28.7 % SL vs. 20.7–25.1),

longer dorsal fin (22.8–26.5 % SL vs. 17.4–20.4), longer pectoral fin (22.9–27.1 % SL vs. 17.0–20.8), longer pelvic fin (20.6–23.2 % SL vs. 15.2–17.9), longer snout (48.7–54.4 % HL vs. 29.1–33.0) and shorter vent to anal distance (15.9–19.6 % ventral-anal distance vs. 33.6–43.6).

Kullander & Fang (2004) described seven species of *Garra* viz. *G. propulvinus*, *G. vittatula*, *G. rakhinica*, *G. flavatra* and *G. nigricollis* from the western slope of the Rakhine Yoma, while *G. spilota* and *G. poecilura* from the eastern slope of the Irrawaddy drainage. *Garra dampensis* sp. nov. differs from all the species described from Rakhine Yoma and Irrawaddy drainage, except *G. propulvinus* and *G. rakhinica*, in absence (vs. presence) of a narrow band of papilliferous tissue along the upper jaw, and a short pleated papilliferous fold that extends mediad from the corner of the mouth between the exposed lower jaw and the lower lip. Further, *G. dampensis* differs from *G. propulvinus* in having fewer vertebrae (26–27 vs. 28–29), fewer unbranched dorsal fin (2 vs. 3), fewer lateral line scales (27–29 vs. 31), longer head (26.6–28.7 % SL vs. 23.4–25.3), shallower body depth (20.1–22.7 % SL vs. 26.6–28.9), shorter dorsal fin (22.8–26.5 % SL vs. 31.3–34.2) and shorter anal fin (18.5–21.0 % SL vs. 23.3–27.5); from *G. rakhinica* in having fewer unbranched dorsal fin (2 vs. 3), shallower body (20.1–22.7 % SL vs. 27.2–28.8), shorter dorsal fin (22.8–26.5 % SL vs. 28.7–32.3), shorter pectoral fin (22.9–27.1 % SL vs. 28.6–30.8), shorter anal fin (18.5–21.0 % SL vs. 23.3–24.7) and also absence (vs. present) of horizontal black stripes from base of anterior barbel to preopercle.

Rahman (2005) listed *Garra annandalei* and *Garra gotyla gotyla*, both from the Brahmaputra basin in Bangladesh. However, as noted above, both are readily distinguished from the new species.

Comparative material

Garra abhoyai: MUMF 6296–6305, 17.i.2003, 10 exs., 50.6–55.7 mm SL, Iril River, Phungdhar, Manipur, K. Nebeshwar, M. Shantakumar & I. Linthoingambi.

Garra annandalei: MUMF 5088–5090, 20.iii.2000, 3 exs., 52.1–68.2 mm SL, Tuivai River, Churachandpur, Shanta Devi.

Garra compressus: MUMF 2316 (holotype), 17.iii.1998, 69.6mm SL, MUMF 2314–2315, paratype, 2 exs., 80.7–84.2 mm SL, Wanze Stream at Khamson, Ukhrul District, Manipur (Chindwin basin), L. Kosygin.

Garra elongata: MUMF 2311 (holotype), 12.xi.1997, 87.7mm SL; MUMF 2308–2310, paratypes, 3 exs., 74.1–82.8mm SL, a small stream near Tolloi, Ukhrul District, Manipur (Chindwin Basin), L. Kosygin.

Garra gotyla gotyla: ZSI 9955/1, 1 ex., 102.2mm SL, Kangra Hill Stream, Punjab.

Garra gravelyi: MUMF 4173, 17.viii.1999, 1 ex., 74.6mm SL, Leimatak River, Manipur, K. Nebeshwar.

Garra kempfi: Data from Zhang & Chen (2002).

Garra lamta: Data from Menon (1964).

Garra lissorhynchus: MUMF 4163–4166, 02.ix.2000, 4 exs., 69.2–87.5 mm SL, Iyei River at Noney, Tamenglong District (Brahmaputra Basin), K. Nebeshwar.

Garra litanensis: MUMF-68/1 (holotype), 16.iii.1986, 90.1mm SL, Litan Stream, Litan, Manipur, W. Vishwanath.

Garra naganensis: MUMF 4156–4159, 20.xi.1999, 4 exs., 78.2–103.4 mm SL, Barak River, Vanchengphai Village, Tamenglong District, Manipur (Brahmaputra basin); K. Nebeshwar.

G. nambulica: MUMF 8004–8008, 5 exs., 41.5–58.7 mm SL, Conchak lok, stream of Nambul River, Manipur (Chindwin basin).

Garra nasuta: MUMF 4079, 10.xi.1999, 3 exs., 115.2–118.7 mm SL, Barak River at Khunphung, Manipur, K. Nebeshwar.

Garra notata: Data from Menon (1964).

Garra paralissorhynchus: MUMF 5054 (holotype), 25.vii.2000, 64.2mm SL, Khuga River, Churchanpur District, Manipur (Chindwin Basin); L. Shanta Devi. Additional data from Vishwanath & Shanta (2005).

Garra propulvinus, *G. vittatula*, *G. rakhinica*, *G. flavatra*, *G. nigricollis*, *G. spilota*, and *G. poecilura*:

Data from Kullander & Fang (2004).

Garra rupecula: Data from Mc Clelland (1839)

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Table 2. Comparison of *Garra dampensis* sp. nov. with related species.

	Gdam	Gliss	Grupe	Gabho	Gpara	Gnamb
In % SL						
Body depth	20.1–22.7	18.2–20.8	–	17.6–18.7	19.3–25.7	16.4–20.5
Head length	26.6–28.7	23.1–23.6	–	22.0–23.5	20.0–26.8	20.7–25.1
Dorsal fin length	22.8–26.5	18.5–19.4	–	11.7–14.8	19.9	17.4–20.4
Pectoral fin length	22.9–27.1	20.4–22.2	–	19.7–22.0	21.7	17.0–20.8
In % ventral-anal						
Vent- anal distance	15.9–19.6	24.6–26.9	–	37.6–46.0	25.0–30.8	34.0–43.4
In% HL						
Snout length	48.7–54.4	45.8–53.5	–	44.0–48.0	46.8–57.7	29.1–33.0
Meristic count						
Lateral line scales	27–29	34–35	35	30–33	30–31	34–35
Predorsal scales	10–11	14–15	–	–	11–12	16–29
Circumpeduncular scales	16	16	16	16	16	16
Gill rakers	12	12	–	–	6	10
Scales on chest	present	absent	absent	absent	absent	absent

Gdam - *Garra dampensis* sp. nov.; Gliss - *G. lissorhynchus*; Grupe - *G. rupecula*; Gabho - *G. abhoyai*; Gpara - *G. paralissorhynchus*; Gnamb - *G. nambulica*.

Keys to the species of *Garra* in the *Lissorhynchus* complex

1. Breast and belly scaled; Lateral line with 27–29 scales *G. dampensis* sp. nov.
- Breast and belly naked; Lateral line with more than 29 scales 2
2. Lateral line with 30–31 scales; 11–12 predorsal scales *G. paralissorhynchus*
- Lateral line with or more than 30 scales 3
3. Lateral line with 30–33; predorsal region covered by thick mucous, scales irregularly arranged *G. abhoyai*
- Lateral line with 34–35 scales; 16–29 predorsal scales *G. nambulica*
4. Lateral line with 34–35 scales; 14–15 predorsal scales *G. lissorhynchus*
- Row of open pores on inter-orbital, and on inter-narial region *G. rupecula*

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Appendix 1. Morphometric characters of *Garra dampensis* sp. nov.

	Holotype (PUCMF 12001)	Paratypes (PUCMF 12002)										Paratypes (PUCMF 12003)				Paratypes (PUCMF 12004)			
		A	C	D	E	F	G	H	I	K	M	J	N	L	O	P			
Standard length (in mm)	46.5	40.9	41.9	41.6	48.2	42.8	45.2	43.9	51.9	41.7	42	48.9	40.6	36.5	41.4				
In % SL																			
Body depth	21.7	22.1	21.2	21.4	22.1	22.2	21.5	22.7	22.6	21.9	20.9	20.6	20.1	21.7	21.8				
Head length	27.3	27.5	27.3	27	27.8	28.1	27.2	27.1	26.9	27.5	26.8	27.1	28.7	27.6	26.6				
Head height at eye	13.2	13.6	13.3	13.9	13.6	13.5	13.25	13.3	13.1	13.7	13.7	13.3	13.5	13.2	13.9				
Head height at occiput	15	16	15.6	15.9	15.5	15.9	15.3	15.5	15.6	15.7	15.3	15.2	15.5	15.8	15.1				
Head width at opercle	21.3	21	20.6	20.9	21.4	21	20.9	20.5	21.2	20.9	20.2	21.4	21.4	20.4	20.5				
Head width at nare	17.7	16.8	16.9	17.3	17.6	18.1	16.2	17.7	17.4	16.9	17.4	16.6	17.3	17.8	17.3				
Body width at dorsal	17.8	17.7	17.1	16.8	17.7	17.9	16.8	17.4	18.1	16.9	16.9	16.5	17	17.9	17.5				
Body width at anal	10.5	9.6	9	8.7	10.2	10.1	9.4	9.3	10.5	9.3	9.7	8.9	8.9	10.1	9.9				
Caudal peduncle length	18.2	16	16.2	15.6	17.6	15.6	15.6	15.8	18	16.6	16.2	15.9	15.8	16.9	16.6				
Caudal peduncle height	13.4	12.9	13.6	13.4	13.6	13.9	14	13.6	14.2	13.5	13.5	13	13.9	13.7	13.9				
Dorsal fin length	25.3	24.3	22.8	23.9	26.5	24.6	24.5	23.9	26.3	24.8	24.1	24	24.7	24.7	26.2				
Dorsal fin base length	13	13.9	13.7	12.6	14.7	13.1	13.8	12.3	14.2	13	12.7	13.5	12.7	14.1	12.4				
Pectoral fin length	26.2	26.1	25.1	23.7	27.1	24.9	26.2	23.4	26.6	26.8	24.8	26.9	25.3	25.7	23.6				
Pelvic fin length	22.3	22.1	20.9	20.6	22.5	21.8	22.1	20.8	23.2	22.9	22	21.5	21.7	22.9	22.7				
Anal fin length	20.2	20.6	19.5	19	20.7	18.5	20.2	18.6	21	19.8	19.8	20.8	20.3	19.6	19.5				
Anal fin base length	8.4	8.3	7.9	7.5	7.8	7	8.3	7.2	8.3	7.6	7.6	8.1	7.6	8.3	7.5				
Upper caudal fin lobe length	23.8	25.2	25.3	24.3	26.6	27.6	27.3	26.2	28.3	26.4	25.3	26.6	26.9	26.4	23.2				
Lower caudal fin lobe length	24.2	24.9	25.5	25.6	25.5	28	27.4	26.7	28.5	28.4	25.5	24.4	27.5	26.8	28.1				
Median caudal fin rays length	20	21.7	19.7	20.7	21.4	22.6	22.4	21.6	22	22.6	19.4	22.1	21.6	21.5	19.3				
Pre-anal length	75.1	76.5	77.9	77.2	75.7	79	78.5	78.2	75.3	77.4	75.5	75.4	78.7	77.5	78				
Pre-anus length	71.9	72	72.9	72.8	71.1	74.2	73.7	74.4	70.6	72.4	72.1	71.8	74.4	71.9	73.7				
Pre-ventral length	52.9	53.4	54.3	54.3	51.9	54.8	54.3	56	51.5	52.9	53.2	52.7	54.1	53.9	54.7				
Pre-dorsal length	53.3	52.9	53.1	53.2	52.4	53.3	53.8	54.6	52.8	54.7	51.5	52.7	54.3	53.4	53				
Pre-pectoral length	22.8	23.4	25.2	24.4	21.6	22.9	23.9	23.5	22.9	23.4	22.9	22.1	24.9	23.6	24.2				
In % Ventral to anal fin																			
Vent to anal fin	17.6	19	17.8	19	18.9	19.1	17	17.3	19.6	18.4	15.9	16.5	17.3	17.9	18.9				
In % HL																			

	Holotype (PUCMF 12001)	Paratypes (PUCMF 12002)										Paratypes (PUCMF 12003)			Paratypes (PUCMF 12004)		
		A	C	D	E	F	G	H	I	K	M	J	N	L	O	P	
Snout length	52.8	50.7	51.6	51.6	51.7	52.3	48.7	49.7	52.8	51.3	51.8	54.4	49.5	50	53.2	51.5	
Eye diameter	20	18.5	20.9	20.8	22.1	19.6	22.1	20.5	22.5	20.7	22.8	22.8	19.7	19.9	21.6	22.3	
Inter-orbital space	47.9	50.1	49.5	48.8	50.1	47.2	48.1	48.8	47	45.9	49.2	50.2	47.9	48.5	48.6	50.3	
Disc length	35.9	35.5	34.2	36.2	37	34.7	36.4	37.2	36	35.2	35.1	34.9	35.6	36	35.3	36.7	
Disc width	54.7	52.4	50.8	49	54.4	57.9	54.6	55.3	53.8	54.3	53.8	54.2	55.2	50.8	51.1	55.7	
Callous pad length	24.5	23.9	22.2	24.3	23.6	23.8	24.6	26.6	23.1	23.5	22.8	21.4	22.7	23	25.3	23	
Callous pad width	37.2	34.1	32.2	34	34.3	36.5	37.6	36.6	35.2	36.6	33.8	33.2	32.9	31.9	36.8	35.7	

