

A New Species of the Genus *Garra* Hamilton, (Cypriniformes: Cyprinidae) from Nethravathi River, Western Ghats, India

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Publication History

Received: 04 May 2014

Accepted: 28 June 2014

Published: 17 September 2014

Citation

Muthukumarasamy Arunachalam, Subramaniyam Nandagopal. A New Species of the Genus *Garra* Hamilton, (Cypriniformes: Cyprinidae) from Nethravathi River, Western Ghats, India. *Species*, 2014, 10(24), 43-57

ABSTRACT

Garra nethravathiensis sp. nov. a new garrinae cyprinid fish species is described from the upstream of Nethravathi, a west flowing river in Karnataka state of peninsular India. The new species differs from the congeners from Western Ghats mountain ranges by the following combination of characters: snout broadly rounded with deep transverse groove with pointed tubercles arranged irregularly but approximately three rows in each side; lesser lateral-line counts of 30-31 and 16 circumpeduncular scales with thick body and pompous size. It is similar to *Garra mullya* in having weakly developed transverse groove on snout and similar to *G. mclellandi* in having well developed scales on chest and belly. *Garra nethravathiensis* sp. nov. is distinguished from *Garra mullya* by less lateral-line scales (30-31 vs. 32-35); less number of scales between lateral-line to pelvic-fin scales (2.5 vs. 3.5); less number of scales between lateral-line to anal-fin (3.5 vs. 4.5). *Garra nethravathiensis* sp. nov. differs from *Garra mclellandi* by less lateral-line scales (30-31 vs. 35); less number of transverse rows (4.5/2.5/3.5 vs. 4.5/3.5/4.5); less number of anal scale rows (3-4 vs. 7) and more pre anus scales (20-23 vs. 20).

Keywords: Freshwater fish, Karnataka, Indian cyprinid, *Garra nethravathiensis*

1. INTRODUCTION

Genus *Garra* Hamilton (type species: *Cyprinus lamta* Hamilton) is most common in upstreams and middle reaches of rivers from South-east Asia, South Asia, West Asia and East Africa. This genus is represented by 12 species from Western Ghats, India, viz., *Garra mullya* (Sykes), *G. gotyla stenorhynchus* (Jerdon), *G. bicornuta* Rao, *G. maclellandi* (Jerdon), *G. menoni* Rema Devi and Indira, *G. hughi* Silas, *G. kalakadensis* Rema Devi, *G. periyarensis* Gopi, *G. surendranathanii* Shaji, Arun and Easa, *G. emarginata* Kurup and Radhakrishnan, *G. mlapparaensis* Kurup and Radhakrishnan and *G. palaruvica* Arunachalam *et al.* From north and north eastern part of India 27 species were reported such as: *G. lamta* (Hamilton) 1822, *G. gotyla* (Gray) 1832, *G. rupecula* (McClelland) 1839, *G. nasuta* (McClelland) 1838, *G. lissorhynchus* (McClelland) 1842, *G. kempfi* Hora 1921, *G. annandaeli* Hora 1921, *G. naganensis* Hora 1921, *G. abhoyai* Hora 1921, *G. manipurensis* Viswanath 1988, *G. litanensis* Viswanath 1993, *G. compressus* Koshgin and Viswanath 1998, *G. elongata* Viswanath and Kosygin 2000, *G. nambulica* Viswanath and Joyshree 2005, *G. paralissorhynchus* Viswanath and Shanta 2005, *G. arupi* Nebeshwar *et al.*, 2009, *G. kalpangi* Nebeshwar *et al.*, 2012, *G. namyaensis* Shangningam and Vishwanath, 2012, *G. dampensis* Lalronunga *et al.* 2013, *G. magnidiscus* Tamang 2013, *G. arunachalensis* Nebeshwar and Viswanath 2013, *G. birostris* Nebeshwar and Viswanath 2013, *G. quadratirostris* Nebeshwar and Viswanath 2013, *G. minimus* Arunachalam *et al.*, 2013, *G. alticaputus* Arunachalam *et al.*, 2013, *G. nigricauda* Arunachalam *et al.*, 2013, *G. kimini* Arunachalam *et al.*, 2013.

From our earlier collections we examined 10 specimens of the genus *Garra* from Kannikaya village where two rivers, Addahole and Kumaradhara confluence and these two are the tributaries of Nethravathi River basin, Karnataka, South India with a pompous body with hard texture with lateral-line scales 30-31. This prompted us to study in detail all the specimens in that locality and after closer examination it is distinct from other species of *Garra* in comparison with other species reported from peninsular India.

2. MATERIALS AND METHODS

Abbreviations include SL = Standard Length, HL = Head Length, ZSI/SRS = Zoological Survey of India/Southern Regional Station and MSUMNH = Manonmaniam Sundaranar University Museum of Natural History, (MSUMNH) in Alwarkurichi, India and CMA = Collection of M. Arunachalam. Methods for measurements and counts follow those of Hubbs and Lagler (1964). Measurements were taken to the nearest 0.001 mm using digital calipers. Body measurements are expressed as percentage of Standard length (%SL) and head measurements as percentage of head length (%HL). Morphometric characters such as: disc length, disc width, central-pad length, central pad width, post-dorsal length, and body depth are from Kullander and Fang (2004). Additionally distance between pectoral-fin origin to vent and distance between pelvic-fin origin to vent are based on truss network analysis (Rohlf, 1996).

Garra nethravathiensis sp. nov.

Holotype: ZSI/SRS F7542, 1 ex., male. 187.22 mm SL, Kannikaya village where two rivers, Addahole and Kumaradhara confluence and these two are the tributaries of Nethravathi River basin, Karnataka, South India (N 12° 41' 35.3" E 75° 38' 24.1"), collectors: M. Arunachalam, M. Muralidharan, P. Sivakumar 28 March 2002.

Paratypes: MSUMNH 65, 5 ex. 130.03-175.35 mm SL CMA 23, 4 ex, 154.56-173.62 mm SL. All other details are same as holotype.

3. DIAGNOSIS

Garra nethravathiensis sp. nov. can be distinguished from its congeners from Western Ghats mountain ranges of peninsular India by the following characters: pompous size, broad and round central pad of the sucking disc and almost a horse shoe shaped swelling in front and on sides of median pad. Snout broadly rounded with deep transverse groove with pointed tubercles arranged irregularly but approximately three rows in each side. Proboscis absent; lateral-line scales 30-31; circumpeduncular scales 15-16; transverse-scale rows 4.5/2.5/3.5; well developed scales present up to chest region.

4. DESCRIPTION

Counts and measurements are from 10 specimens ranging from 130.0-187.2 mm standard length. (Body characters are in times of standard length and head characters are in times of head length). Body is elongate, sub cylindrical, ventral profile flat, greatest depth at dorsal-fin origin and greatest width at pectoral-fin insertion. Body shape depressed from the tip of snout and gradually becoming cylindrical and then compressed posteriorly (Figure 1). Body depth is 3.8 to 4.5 times in SL. Head stout, tapering gently from occiput towards tip of snout, mouth inferior, moderate and transverse. Head length is 3.9 to 4.1 times in SL. Head depth at nostril is 2.2 to 2.7 times; head depth at

pupil is 1.6 to 1.9 times; head depth at occiput is 1.3 to 1.6 times. Snout obtusely rounded, depressed anteriorly and projecting beyond mouth, without proboscis, but a deep transverse groove and conspicuous tuberculated transverse lobe at tip; its length is 1.7 to 2.0 times. Distance between pectoral-fin to vent is 1.9 to 2.1 times; distance between pelvic-fin to vent is 4.7 to 6.1 times; distance between pectoral-fin insertion to pelvic-fin insertion is 3.2 to 3.8 times; distance between pectoral-fin insertion to anal-fin origin is 1.8 to 2.1 times; distance between pelvic-fin insertion to anal-fin origin is 4.7 to 6.1 times; its length 3.0 to 3.6 times in SL. Pre pelvic-fin distance is 1.9 to 2.3 times in SL. Mental disc is well-developed; disc length is 2.3 to 2.6 times; disc width is 1.6 to 1.8 times; central-pad length is 3.7 to 4.4 times; central-pad width is 2.6 to 3.0 times (Table 1). Tip of snout conical with a blunt edge from ventral aspect. Upper jaw overhung by labial fold which is profusely papillated. Its free end fimbriated, labial fold separated from upper jaw by deep groove and lateral part of snout by a shallow groove. Both grooves and lower labial folds join at corner of mouth by a flap of skin. The posterior labial fold encloses lower jaw but is separated by a deep groove at symphysis. Mental disc well developed, bordered anteriorly by a papillated fold and posteriorly by broad free papillated flap. Gill aperture extends dorsally from anterior base to pectoral-fin. Margins of opercula widely separated. Two pairs of sub-equal barbels, anterior pair smaller than eye diameter, posterior pair rudimentary placed in the labial groove. Eyes are large, upper margin level with the interorbital space. Interorbital space is convex. Pupil of eye is little behind the middle of length of head closer to occiput than tip of snout. Nostrils are closer with curved nostril flap.

FINS

Fins are long, and the counts are: Dorsal fin with 2 unbranched and 8 branched dorsal fin rays, inserted slightly anterior to pelvic-fin insertion, highest point of the body at dorsal-fin origin. The first branched ray of dorsal fin is slightly longer than other branched rays. Dorsal-fin upper edge is concave. Anal-fin with 2 to 3 unbranched and 4 to 5 branched rays; posterior end of anal-fin is reaching to caudal-fin base. Pelvic-fin with 1 unbranched and 8 branched rays; its origin is vertically at base of third branched ray of dorsal-fin, end of pelvic-fin cover the anus, its second branched ray is the longest. The end of the pelvic-fin is not reaching to anal-fin origin. Pectoral-fin with 1 unbranched and 13 to 14 branched rays; its origin is close to gill opening. Fifth branched ray of pectoral fin is longest. Pectoral-fin end is separated from pelvic-fin origin by 3 scales; its end not reaching to pelvic-fin origin. Vent is closer to anal-fin origin by 3-4 scales and 7 scales to the pelvic-fin origin. Caudal-fin forked, upper lobe is longer than lower lobe, bearing 9+8 rays.

SCALE COUNTS

Scales are of moderate-size; lateral-line scales, 30 (5), 31 (5); pre dorsal scales, 8 (3), 9 (6) 10 (1); upper transverse scales, 4.5 (10); scale rows from lateral-line to pelvic-fin insertion, 2.5 (10); lower transverse rows, 3.5 (10); circumpeduncular scales, 15 (6), 16 (4); circumferential scales, 21 (6), 22 (4); scales between vent and anal-fin, 3 (1), 3.5 (4), 4 (5); well developed scales present up to chest region (Figure 2a); pre anus scales 20 (3), 21 (4), 22 (2), 23 (1) (Table 2).

TUBERCLES

Heaviest tubercle accumulation is in transverse protuberance (antero - rostral lobe) at the snout tip. Tubercles are prominent as patches in inter nasal space. Three clusters are in transverse row, one each below nostril and one at centre in the region between transverse lobe and nostril. Transverse lobe and lateral side of the head in front of nostril are covered with horny tubercles. Tubercles are rosette shaped held up by a stalk at the base. There is no sexual dimorphism in the tubercles.

SQUAMATION

Scales on upper caudal peduncle diamond shaped same pattern are evident on entire peduncle posterior to the fin. Chest scale rows are continuous to belly - scale rows until region anterior to pectoral base, from where additional rows are inserted and the pattern becomes irregular. Lateral line scales from anterior region are having pores at centre and main canal pores are as long tubes towards caudal base. Usually there are 3 or 4 scales between vent and anal-fin. Scales on lateral line series are of varied shape anterior hexagonal, towards middle free end hexagonal scales are pronounced a little towards caudal and posterior end with scales are roughly diamond shaped with tapering free end.

COLOURATION

Colour in life, dorsal region gray and becoming pale white below broad lateral band from gill opening to base of caudal-fin, bordered above and below by dark narrow lateral stripes. Posterior part of body with 6 lateral stripes,

receding to margin of caudal-fin, distinct at medial region. A bluish black spot is on the upper angle of the operculum. Scale rows are below lateral line up to base of pelvic-fin, dark centre bordered gray. All fins are uniformly gray with yellow base, in particular melanophores closely associated to fin rays as stripes on the inter-radial membrane from base to distal margin, spreading even over fin rays in dorsal and anal-fins. Pelvic and pectoral fins are yellow at base gray distally. Last few unbranched rays are darkened by presence of melanin. Caudal-fin is gray with darker inter radial membrane denser at medial region, rays beyond which with melanin are oriented towards posterior end. Principal rays are dark.

VERTEBRAE

Vertebrae count 31 (4 + 14 + 13) from one specimen.

ETYMOLOGY

Named after the river where the specimen was collected and *nethravathiensis* is the replacement name for *robustus* (appeared in a project report (M. A.) as a nomen nudem (Rajeev Raghavan *et al.*, 2013).

DISTRIBUTION

As far as this species is now known only from a village called Kannikaya, where the confluence of Addahole and Kumaradhara rivers, all tributaries of Nethravathi River in Karnataka State, India (Figure 5).

5. DISCUSSION

Garra nethravathiensis sp. nov. is distinguished from *Garra mullya* from topotypes from Maharashtra South India (Figure 2b) by less lateral-line scales (30-31 vs. 32-35); less number of scales between lateral-line to pelvic-fin scales (2.5 vs. 3.5); less number of scales between lateral-line to anal-fin scales (3.5 vs. 4.5) and morphometric characters such as: more elongated body (130.03-187.22 SL vs. 36.08-50.59 SL); shorter pre pelvic-fin length (42.47-51.40% SL vs. 52.63-54.35% SL); more anal-fin height (19.94-31.66% SL vs. 10.56-18.37% SL); more peduncle depth (14.72-16.11% SL vs. 9.92-12.86% SL); more dorsal-fin height (27.32-32.75% SL vs. 23.44-26.29% SL); greater distance between dorsal-fin insertion to pelvic-fin insertion (18.43-23.34% SL vs. 12.33-17.33% SL); more distance between dorsal-fin insertion to caudal-fin base (33.77-38.94% SL vs. 31.23-32.04% SL); more snout length (50.96-55.98% HL vs. 40.13-46.24% HL); more pre nasal length (38.28-42.89% HL vs. 29.20-34.35% HL); more head width (77.63-84.57% HL vs. 61.43-73.77% HL); greater disc length (37.20-42.43% HL vs. 18.95-26.48% HL). *Garra nethravathiensis* sp. nov. showed distinction with *Garra gotyla stenorhynchus* by less number of lateral-line scales (30-31 vs. 33-34); less number of scales between lateral-line to pelvic-fin scales (2.5 vs. 3.5); less number of scales between lateral-line to anal-fin scales (3.5 vs. 4.5); proboscis (absent vs. single median proboscis) and following combination of morphometric characters such as; more dorsal-fin height (27.32-32.75% SL vs. 21.27-26.31% SL); greater distance between dorsal-fin insertion to anal-fin insertion (27.69-49.07% SL vs. 24.54-27.90% SL); less distance between pectoral-fin insertion to pelvic-fin insertion (25.70-30.58% SL vs. 31.01-34.40% SL); less pre nasal length (38.28-42.89% HL vs. 44.52-47.50% HL); shorter head depth at nostril (36.46-41.94% HL vs. 42.61-53.54% HL). *Garra nethravathiensis* sp. nov. is distinguished from *Garra bicornuta* by more number of circumpeduncular scales (15-16 vs. 12); more number of circumferential scales (21-22 vs. 18-20); proboscis (absent vs. well developed marked tri-lobed proboscis) and the morphometric characters such as; more pre anal-fin length (73.27-79.86% SL vs. 59.99-71.73% SL); greater pre dorsal-fin length (44.48-47.90% SL vs. 34.82-42.77% SL); more anal-fin height (19.94-31.66% SL vs. 16.38-18.15% SL); greater distance between dorsal-fin origin to anal-fin origin (38.85-42.72% SL vs. 31.93-36.12% SL); more pre nasal length (38.28-42.89% HL vs. 25.69-37.16% HL); more inter nasal width (28.02-36.44% HL vs. 16.49-26.69% HL); longer disc length, disc width and wider central pad of the sucking disc. *Garra nethravathiensis* sp. nov. can be differentiated from *Garra kalakadensis* by less number of caudal-fin rays (9+8 vs. 10+9); less number of lateral-line scales (30-31 vs. 33-34); more number of circumpeduncular scales (15-16 vs. 12-14) and more number of pre anus scales (20-23 vs. 17-20). It shows distinction with *Garra surendranathanii* by more number of pectoral-fin rays (13-14 vs. 12); less number of lateral-line scales (30-31 vs. 36); less number of pre dorsal scales (8-10 vs. 11); less number of anal scale rows (3-4 vs. 5.5-6.5); more number of pre anus scales (20-23 vs. 11-14) and presence of deep transverse groove on snout (vs. absent). *Garra nethravathiensis* sp. nov. is distinguished from *Garra periyarensis* by less lateral-line scales (30-31 vs. 38-39); less number of scales between lateral-line to pelvic-fin scale rows (2.5 vs. 3.5); more circumpeduncular scales (15-16 vs. 12); more circumferential scales (21-22 vs. 18) and presence of scales in chest and belly (vs. absent). *Garra nethravathiensis* sp. nov. showed differences with *Garra menoni* by less number of lateral-line scales (30-31 vs. 32-36); less number of scales between lateral-line to pelvic-fin (2.5 vs. 3.0-3.5); presence of scales in chest and belly (vs. absent). *Garra nethravathiensis* sp. nov. is distinguished from *Garra hughi* by more number of branched dorsal-fin

rays (8 vs. 7); presence of pre dorsal scales (vs. absent); less number of lateral-line scales (30-31 vs. 36-37) and presence of scales in chest and belly (vs. absent). *Garra nethravathiensis* sp. nov. differs from *Garra mccllelandi* (Jerdon) by less lateral-line scales (30-31 vs. 35); less number of transverse rows (4.5/2.5/3.5 vs. 4.5/3.5/4.5); less number of anal scale rows (3-4 vs. 7) and more pre anus scales (20-23 vs. 20). It shows difference with *Garra mlapparaensis* by more unbranched anal-fin rays (2-3 vs. 1); more branched pelvic-fin rays (8 vs. 7); more number of pectoral-fin rays (13-14 vs. 12); less number of caudal-fin rays (9+8 vs. 10+9); less lateral-line scales (30-31 vs. 35); less pre-dorsal scales (8-10 vs. 12); less scales between lateral-line to origin of pelvic-fin (2.5 vs. 3.5) and more number of circumpeduncular scales (15-16 vs. 12). *Garra nethravathiensis* sp. nov. is distinguished from *Garra emarginata* by more unbranched anal-fin rays (2-3 vs. 1); more branched pelvic-fin rays (8 vs. 7); less number of caudal-fin rays (9+8 vs. 10+9); less lateral-line scales (30-31 vs. 35); less pre-dorsal scales (8-10 vs. 11-12); more number of circumpeduncular scales (15-16 vs. 12) and less pre anus scales (20-23 vs. 26). *Garra nethravathiensis* sp. nov. differs from *Garra platycephala* by less unbranched dorsal-fin rays (2 vs. 3); less branched anal-fin rays (4 vs. 5); less branched pectoral-fin rays (13 vs. 14); less lateral-line scales (30-31 vs. 37); less number of scales between lateral-line to origin of pelvic-fin (2.5 vs. 3.5). *Garra nethravathiensis* sp. nov. differs from *Garra jerdoni* by more branched pelvic-fin rays (8 vs. 7); less branched pectoral-fin rays (13 vs. 14); less lateral-line scales (30-31 vs. 36). *G. nethravathiensis* sp. nov. is distinguished from *G. lissorhynchus* by fewer pre dorsal-fin scale rows (8-10 vs. 13), more branched dorsal-fin rays (8 vs. 6), less lateral-line scales (30-31 vs. 34) and absence of W-shaped band on caudal-fin (vs. presence). It is distinguished from *G. nambulica* by less branched pelvic-fin rays (6 vs. 8), more branched dorsal-fin rays (8 vs. 6), fewer pre dorsal-fin scale rows (8-10 vs. 24), less lateral-line scales (30-31 vs. 34) and absence of W-shaped band on caudal-fin (vs. presence). The species is distinguished from *G. annandalei* by less lateral-line scale rows (30-31 vs. 34) and more upper transverse scale rows (4.5 vs. 3.5), presence of transverse groove (vs. absent). *G. nethravathiensis* sp. nov. differs from *G. gotyla gotyla* in having less lateral-line scale rows (30-31 vs. 33) and absence of proboscis (vs. well developed median proboscis). It is distinguished from *G. elongata* in having more branched pectoral-fin rays (13-14 vs. 12), fewer lateral-line scale rows (30-31 vs. 39), less caudal-fin branched rays (9+8 vs. 10+9), less pre dorsal scales (8-10 vs. 13), more circumpeduncular scale rows (16 vs. 12) and from *G. naganensis* in having more branched dorsal-fin rays (8 vs. 7), fewer lateral-line scale rows (30-31 vs. 39), less pre dorsal scales (8-10 vs. 12) and fewer anal scale rows (3-4 vs. 6). From *G. paralissorhynchus* it is distinguished by more branched dorsal-fin rays (8 vs. 6), more branched pectoral-fin rays (13-14 vs. 11) and fewer pre dorsal-fin scale rows (8-10 vs. 12), presence of deep transverse groove on snout (vs. absent) and scales present on chest and belly (vs. naked). It is distinct from *G. kempfi* in having more pectoral-fin rays (13-14 vs. 12), fewer lateral-line scale rows (30-31 vs. 40), less number of anal scale rows (3-4 vs. 7) and fewer pre dorsal-fin scale rows (8-10 vs. 12). From *G. arupi* it is distinguished by more branched pectoral-fin rays (13-14 vs. 10-11), less lateral-line scales (30-31 vs. 35-36), fewer pre dorsal scale rows (8-10 vs. 11-12) and less anal scale rows (3-4 vs. 6-8). It is distinguished from *G. gravelyi* by less lateral-line scale rows (30-31 vs. 32-34); from *Garra nasuta* (McClelland) by less lateral-line scale rows (30-31 vs. 33-34) and absence of proboscis (vs. present). It is distinguished from *G. kalpangi* in having more branched pectoral-fin rays (13-14 vs. 10-12), less lateral-line scale rows (30-31 vs. 32-33) and absence of proboscis (vs. poorly developed proboscis). It is diagnosed from *G. rupecula* in having more branched dorsal-fin rays (8 vs. 6-7), less lateral-line scale rows (30-31 vs. 32-34). It is diagnosable from *G. manipurensis* in having more branched pectoral-fin rays (13-14 vs. 12), fewer lateral-line scale rows (30-31 vs. 34), well developed scales on chest region (vs. naked) and less pre dorsal scales (8-10 vs. 11) and less number of scales between lateral-line to pelvic-fin origin (2.5 vs. 3.5). From *G. compressus* it is distinguished in having more branched pectoral-fin rays (13-14 vs. 12) and fewer lateral-line scale rows (30-31 vs. 39); less anal scale rows (3-4 vs. 5) and fewer upper transverse rows (4.5 vs. 3.5), greater circumpeduncular scales (15-16 vs. 12); from *G. litanensis* in having fewer caudal-fin branched rays (9+8 vs. 10+9), less lateral-line scale rows (30-31 vs. 32); more number of circumpeduncular scales (15-16 vs. 12); from *G. namyensis* in having more branched pectoral-fin rays (13-14 vs. 12), fewer pre dorsal-fin scale rows (8-10 vs. 13), fewer caudal-fin branched rays (9+8 vs. 10+9) and absence of W-shaped band on caudal-fin (vs. presence). It is differentiated from *G. abhoyai* in having more branched pectoral-fin rays (13-14 vs. 11), more branched dorsal-fin rays (8 vs. 6), fewer lateral-line scale rows (30-31 vs. 33) and less pre dorsal-fin scale rows (8-10 vs. 17). It is diagnosable from *G. magnidiscus* in having more branched pectoral-fin rays (13-14 vs. 10-12), less pre dorsal-fin scale rows (8-10 vs. 12-15), fewer caudal-fin branched rays (9+8 vs. 10+9) and less lateral-line scales (30-31 vs. 40-42); from *G. dampansensis* in having more lateral-line scales (30-31 vs. 27-29), more branched dorsal-fin rays (8 vs. 6) and absence of W-shaped band on caudal-fin (vs. presence). *Garra nethravathiensis* sp. nov. can be differentiated from *Garra minimus* by less branched pectoral-fin rays (13 vs. 14-16); less pre dorsal scales (8-10 vs. 10-11); less lateral-line scales (30-31 vs. 35-37); more upper transverse scales (4.5 vs. 3.5); more lower transverse scales (3.5 vs. 2.5-3); more number of circumpeduncular scales (16 vs. 12); less anal scale rows (3.5 vs. 4-6). *Garra nethravathiensis* sp. nov. is distinguished from *Garra alticaputs* by less branched pectoral-fin rays (13 vs. 13-15); less lateral-line scales (30-31 vs. 33); less number of scales between lateral line to origin of pelvic-fin (2.5 vs. 3.5).

Garra nethravathiensis sp. nov. showed distinction with *Garra nigricauda* by less branched pectoral-fin rays (13 vs. 14-16); less lateral-line scales (30-31 vs. 35-36); less number of scales between lateral line to origin of pelvic-fin (2.5 vs. 3-3.5); more number of circumpeduncular scales (16 vs. 12). *Garra nethravathiensis* sp. nov. can be differentiated from *Garra kimini* by less branched pectoral-fin rays (13 vs. 14-15); less lateral-line scales (30-31 vs. 33-34); less number of scales between lateral line to origin of pelvic-fin (2.5 vs. 3.5); more anal scale rows (3.5 vs. 2.5-3); absence of spiny tubercles on pectoral-fin (vs. present). *Garra nethravathiensis* sp. nov. showed differences with *Garra arunachalensis* by less unbranched dorsal-fin rays (2 vs. 3); less unbranched anal-fin rays (2 vs. 3); less branched pectoral-fin rays (13 vs. 14-15); less pre dorsal scales (8-10 vs. 10-12); less lateral-line scales (30-31 vs. 35); less number of scales between lateral line to origin of pelvic-fin (2.5 vs. 3.5); more number of circumpeduncular scales (16 vs. 12); absence of proboscis (vs. prominent quadrate). *Garra nethravathiensis* sp. nov. differs from *Garra birostris* by less unbranched dorsal-fin rays (2 vs. 3); less unbranched anal-fin rays (2 vs. 3); less branched pectoral-fin rays (13 vs. 14-15); less pre dorsal scales (8-10 vs. 10-11); less lateral-line scales (30-31 vs. 33-34); absence of proboscis (vs. prominent bi-lobed). *Garra nethravathiensis* sp. nov. can be differentiated from *Garra quadratiostris* by less unbranched dorsal-fin rays (2 vs. 3); less unbranched anal-fin rays (2 vs. 3); less branched pectoral-fin rays (13 vs. 14-15); less lateral-line scales (30-31 vs. 37); more number of circumpeduncular scales (16 vs. 12). *Garra nethravathiensis* sp. nov. showed distinction with *Garra palaruvica* by less lateral-line scales (30-31 vs. 31-33); more pre dorsal scales (8-10 vs. 11); less number of scales between lateral-line to origin of pelvic-fin (2.5 vs. 3); less lateral transverse scale rows (3.5 vs. 4); more anal scale rows (3.5 vs. 2.5); more pre anus scales (22 vs. 15-17); well developed scales on chest (vs. absence).

We will include the characters distinguishing the genera *Garra* with *Discogobio*, on the mouth structure *Garra nethravathiensis* sp. nov. (Figure 3) showed distinctness in having a rounded median pad, its transverse diameter is equal to or larger than half of the mouth width, and “the rostral cap is curved ventrally and connected with the lower lip at the corners of the mouth. The edge of the rostral cap is fringed or crenulated, and covered with papillae (Wei Zhou, 2005) hence the present species may be included under genus *Garra* because of the horse-shoe shaped swelling is not directly to connected with the jaw and there is some space in it and also papillae are absent on the pad. When Menon (1964) revised the genus *Garra* he mentioned that *G. bicornuta* has one pair of barbel and the subsequent authors Talwar and Jhingran (1991) and; Rema Devi and Indra (1999) followed the same however, in the original description by Rao (1920) it was mentioned that *G. bicornuta* has two pairs of barbels and the topotypes examined have two pairs of barbels (Figure 4). We compared *G. nethravathiensis* sp. nov. with the holotype of *G. menoni* and the other specimens as paratypes in ZSI/SRS are almost in a dried condition and hence measurements and counts from those specimens will lead to errors. Also in the descriptive papers published by Remadevi and Indra (1984) on *Garra menoni* did not provide much information on the meristic counts and morphometric measurements. However, the line drawings of the holotype of *G. menoni* and *G. nethravathiensis* sp. nov. are provided additionally. Among the 12 species so far reported from Western Ghats mountain region in peninsular India, *G. bicornuta*, *G. kalakadensis*, *G. periyarensis*, *G. mlapparensis*, *G. menoni* and *G. emarginata* are in the group of species having 12 circumpeduncular scales while *G. mullya*, *G. gotyla stenorhynchus*, *G. surendranathanii*, *G. hughi*, *G. palaruvica* and *G. mccllellandi* are in the group having 16 circumpeduncular scales. Among the 12 species *G. hughi* is the only species from Western Ghats with naked pre dorsal scales.

6. COMPARATIVE MATERIALS EXAMINED

Garra mullya (Sykes): MSUMNH - C2 Alwarkurichi, 4ex. 36.08-50.59mm SL; (Location: Beema river, Krishna basin, Maharashtra, India, putative topotypes). Collected by: Dr. M. Arunachalam and Team. Date of collection: 26.11.1998.

Garra gotyla stenorhynchus (Jerdon): MSUMNH - C3 Alwarkurichi, 15ex. 87.23-126.16 mm SL; (Location: Nellithurai, Bhavani River, Tamil Nadu, India, topotypes). Collected by: Dr. M. Arunachalam and Team. Date of collection: 02.02.2001.

Garra bicornuta Rao: MSUMNH - C4 Alwarkurichi, 19ex. 59.6-138.5 mm SL; (Location: Thunga river at Thirthahalli, Karnataka, India, topotypes). Collected by: Dr. M. Arunachalam and Team. Date of collection: 19.01.2004.

Garra kalakadensis Rema Devi: MSUMNH - C5 Alwarkurichi, 10ex. 54.4-74.0 mm SL; (Location: Kalakad, Tamiraparani River Basin, Tamil Nadu, India). Collected by: Dr. M. Arunachalam and Team. Date of collection: 10.02.2001.

Garra hughi Silas: MSUMNH - C6 Alwarkurichi, 10ex. 47.0-62.6mm SL; (Location: Perumalmalai Stream, Kodaikanal, Tamil Nadu, India, topotypes). Collected by: Dr. M. Arunachalam and Team. Date of collection: 07.05.1996.

Garra menoni Rema Devi and T.J. Indra: Holotype: ZSI/SRS, Chennai, F 553, 69.00 mm SL; (Location: Kunthi River, Silent valley, Kerala, India). Collected by: R.S. Pillai. Date of collection: 19.01.1979.

Garra mccllellandi (Jerdon): MSUMNH - C7 Alwarkurichi, 1ex. 157.57mm SL; (Location: Noolpuzha, Wayanad Wildlife Sanctuary, Kabini Drainage, Tirunelli, Kerala, India, topotypes). Collected by: Dr. M. Arunachalam and Team. Date of collection: 13.09.2008.

Garra periyarensis K.C. Gopi: Holotype: ZSI, CLT, No V/F 9426, 156.00mm SL; Periyar River, Thanikkudy, Periyar Tiger Reserve, Kerala, India. Collected by: P.M. Sureshan. Date of collection: 07.11.1996. MSUMNH - C8, Alwarkurichi, 4ex. 142.5-160.1mm SL; (Location: Thuraiyar, Peachiparai range, Parambikulam Periyar Tiger Reserve, Kerala, India, topotypes). Collected by:

Dr. M. Arunachalam and Team. Date of collection: 29.06.2009. *Garra surendranathanii* Shaji, Arun and Easa: Holotype: ZSI/WGRS/9390, 147.00mm SL; Orukomban, tributary of Chalakkudy River, Kerala, India. Collected by: Shaji, Arun and Easa. Date of collection: 12.03.1996. MSUMNH - C9 Alwarkurichi, 3ex. 111.35-122.09mm SL; (Location: Orukomban, Kerala, India, topotypes). Collected by: Dr. M. Arunachalam and Team. Date of collection: 20.12.2003. *Garra emarginata* Madhusoodana Kurup and Radhakrishnan: Holotype: ZSI/WGRC/F2472, 85.72 mm SL; Pooyemkutti, Periyar River, Kerala, India. Collected by: K.V. Radhakrishnan. Date of collection: 11.06.2003. *Garra mlapparaensis* Madhusoodana Kurup and Radhakrishnan: Holotype: ZSI/WGRC/F2473, 74.53 mm SL; Mlappara, Periyar River, Kerala, India. Collected by: K.V. Radhakrishnan. Date of collection: 12.04.2002. *Garra jerdoni* Day ZSI, Calcutta, F 1507, 160.56 mm SL; (Location: Bhavani River, Nilgiris, Tamil Nadu, India). Type Specimen purchased from Dr. Francis Day. (As per label in ZSI). *Garra platycephala* Rao ZSI, Calcutta, F 9816/1, 104.29 mm SL; (Location: Cauvery River, Srirangapatnam, Mysore, Karnataka, India). *Garra palaruvica* Arunachalam *et al*: MSUMNH - 67 Alwarkurichi, 5ex. 28.24-36.29mm SL; (Location: Palaruvi, near Thenmala, Kallada River basin, Kollam (District), Kerala, India). *Garra lissorhynchus* Topotype: ZSI Calcutta, FF 8098 / 1; 73.05 mm SL; Collected by: L. Kosygin. *Garra nambulica* Paratype: ZSI Calcutta, 4139; 50.41 mm SL; Irengloic Stream flowing to Nambul River, Shingala Village, Imphal West District, Manipur, India. 03rd Feb. 2004. MUMF 8002; Type series examined from Manipur University Museum of Fishes. *Garra annandalei* Holotype: ZSI Calcutta, F 6082 / 2-1; 60.17 mm SL; Kokha nallah, Koshi river, District: Barabakshetra. India. 30th Jan.1946. *Garra gotyla gotyla* ZSI Calcutta, F 198/2; 121.92 mm SL; Kumaon Hills survey, Kosi River Kosi village, Almorah, 07th June1948. *Garra elongata* ZSI Calcutta, FF 4157; 81.28 mm SL; Hill stream near Tollai, Ukhrul district, Manipur, India, 12th Nov. 1997. *Garra naganensis* ZSI Calcutta, F 9970 / 1; 89.93 mm SL; Senapathi Stream, Naga hills, Assam, India). Collector L. Kosygin; Type series examined from MUMF. *Garra paralissorhynchus* Paratype: ZSI Calcutta, 4158; 52.35 mm SL; Location: Khuga River, Churachandrapur district, Manipur, India. 25th July 2000. *Garra kempfi* Holotype: ZSI Calcutta, F 7716 / 1; 88.51 mm SL; Sharjon River, below Damda, the Abor hills, India. 25th July 2000. *Garra abhoyai* Type series examined from MUMF. *Garra manipurensis* Type series examined from MUMF. *Garra compressus* Type series examined from MUMF. *Garra litanensis* Type series examined from MUMF. *Garra namyaensis* Type series examined from MUMF. *Garra arupi* data from Nebeshwar *et al.*, (2009). *Garra kalpangi* data from Nebeshwar, Bagra and Das (2011). *Garra nasuta* data from Monograph (Menon, 1964) of the Cyprinid fishes of the genus *Garra* Hamilton. *Garra rupecula* data from Talwar and Jhingran (1991). *Garra dampensis* data from Lalronunga *et al.* (2013). *Garra magnidiscus* data from Tamang (2013). *Garra arunachalensis*, *Garra birostris*, *Garra quadratirostris* data from Nebeshwar and Vishwanath (2013). *Garra minimus* Arunachalam *et al*: MSUMNH 59, 5 ex. 39.8-52.9 mm SL; tributary of Ranga River, Lower Subanshri District, Arunachal Pradesh, India. *Garra alticaputus* Arunachalam *et al*: MSUMNH 60, 3 ex. 57.6-61.6 mm SL; Dikrong River at Boorum Village (tributary of Ranga River), Lower Subanshri District, Arunachal Pradesh, India. *Garra nigricauda* Arunachalam *et al*: Siang River, near Pasighat, Arunachal Pradesh, India. *Garra kimini* Arunachalam *et al*: tributary of Ranga River, 7 km from Hola camp, Lower Subanshri District, Arunachal Pradesh, India.

SUMMARY OF RESEARCH

1. The genus *Garra* is the most the enigmatic one and species is described by earlier authors consisted of a complex of species.
2. *Garra mullya* Sykes is common and abundant in hill streams of Western Ghats and due to its poor description, most of the closely species are included in this taxon. The newly described species is an example.
3. There should be some coordination in diagnosing characters among the taxonomist.

FUTURE ISSUES

1. More exploratory efforts are needed to study the fishes in the Western Ghats part of India.

ACKNOWLEDGMENTS

This research was supported National Agriculture Technology Project and DST-Government of India (S/FST/ESI-101/2010) to the senior author. We acknowledge the help of Mr. S. S. Mariappan, Drawing Master, Panchayat Union Middle School, Pothukudi, Tamil Nadu, India for line drawings. Special thanks to Dr. K. Venkataraman, Director, ZSI Kolkatta; Shri. K.C Gopi, Scientist E, ZSI Kolkatta; Dr. B.H.C Murthy, Scientist B, ZSI Kolkatta; Dr. K. Illango, Scientist D, Officer in Charge, ZSI/SRS [now it is ZSI SRC, (Southern Regional Centre)], Chennai; Dr. Jayasree Thilak, Scientist C, ZSI/SRS/SRC Chennai; Dr. P. M. Sureshan, Scientist-'C', Officer-in-Charge, ZSI/WGRC, Calicut, Kerala for access to the collection of fishes and examination of species of *Garra* for comparative purposes. We also thank Dr. W. Viswanath, Professor, Department of Life Sciences, Manipur University Museum Fishes (MUMF), Manipur for the loan of specimens for comparative purposes.

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Table 1

Morphometric characteristics of *Garra nethravathiensis* sp. nov. from Kannikaya, Confluence of Addahole with Kumaradhara, Nethravathi River, Karnataka, India

S. No	Morphometric Characters	<i>Garra nethravathiensis</i> (N = 10, including Holotype)			
		Min	Max	Average	SD
1	Standard length	130.0	187.2	159.2	18.0
2	Snout to urocentrum	93.7	96.0	94.8	0.7
3	Pre anal length	73.3	79.9	75.5	2.0
4	Pre dorsal length	44.5	47.9	46.2	1.1
5	Pre pelvic length	42.5	51.4	49.1	2.6
6	Pre pectoral length	21.0	22.9	22.0	0.7
7	Pre occipital length	81.3	90.2	86.5	3.3
8	Snout to opercle	90.4	94.1	93.0	1.1
9	Upper jaw length	39.6	46.1	42.6	2.3
10	Snout length	51.0	56.0	54.2	1.6
11	Pre nasal length	38.3	42.9	41.0	1.8
12	Orbit width	19.2	23.8	21.7	1.3
13	Inter orbital width	42.4	44.5	43.5	0.8
14	Inter nasal width	28.0	36.4	31.5	2.6
15	Head width	77.6	84.6	81.7	2.1
16	Peduncle length	10.8	15.3	12.8	1.7
17	Dorsal-fin origin to pelvic-fin insertion	24.2	27.6	26.2	1.2
18	Anal-fin height	19.9	31.7	22.7	3.3
19	Head depth at nostril	36.5	43.9	40.4	2.3
20	Head depth at pupil	52.8	60.4	57.1	2.2
21	Head depth at occiput	67.4	75.7	71.3	2.8
22	Peduncle depth	14.7	16.1	15.3	0.4
23	Caudal-fin length	23.4	29.6	27.1	2.2
24	Dorsal-fin height	27.3	32.7	30.2	1.8
25	Pectoral-fin length	22.0	25.2	24.2	0.9
26	Pelvic-fin length	21.0	23.5	22.5	0.8
27	Maxillary barbel length	3.6	5.6	4.4	0.6
28	Rostral barbel length	9.5	12.8	11.3	1.0
29	Occiput to dorsal-fin origin	22.3	27.3	25.1	1.4
30	Occiput to pectoral-fin insertion	19.2	21.2	20.2	0.7
31	Occiput to pelvic-fin insertion	40.0	42.2	40.9	0.7
32	Dorsal-fin insertion to pelvic-fin insertion	18.4	23.3	21.5	1.6
33	Dorsal-fin origin to pectoral-fin insertion	26.1	30.1	27.7	1.5
34	Dorsal-fin origin to anal-fin origin	38.9	42.7	40.5	1.1
35	Dorsal-fin insertion to caudal-fin base	33.8	38.9	35.5	1.8
36	Dorsal-fin insertion to anal-fin origin	22.6	27.7	26.1	1.5
37	Dorsal-fin insertion to anal-fin insertion	27.7	31.7	29.8	1.2
38	Dorsal-fin base length	14.8	18.7	16.4	1.1
39	Anal-fin base length	6.8	10.7	7.8	1.1
40	Pectoral-fin insertion to pelvic-fin insertion	25.7	30.6	28.0	1.5
41	Pectoral-fin insertion to anal-fin origin	45.9	53.6	49.1	2.4
42	Pelvic-fin insertion to anal-fin origin	18.7	22.3	20.6	1.1
43	Head length	31.2	47.4	39.3	5.0
44	Post-dorsal length	49.1	58.0	53.1	2.9
45	Body depth	21.8	26.0	24.7	1.2
46	Distance b/w pectoral-fin origin to vent	45.7	52.5	48.3	2.2
47	Distance b/w pelvic-fin origin to vent	16.4	21.2	18.9	1.4
48	Disc length	37.2	42.4	39.5	1.6
49	Disc width	53.4	61.3	56.5	2.8

50	Central pad length	22.4	26.9	24.6	1.6
51	Central pad width	32.7	38.3	35.5	2.0

Table 2

Meristic characteristics of *Garra nethravathiensis* sp. nov. from Kannikaya, Confluence of Addahole with Kumaradhara, Nethravathi River, Karnataka, India

S. No	Meristic counts	Min	Max	Average
1	Unbranched dorsal fin rays	2	2	2.1
2	Branched dorsal fin rays	8	8	8
3	Unbranched anal fin rays	2	3	2.1
4	Branched anal fin rays	4	5	4.9
5	Unbranched pelvic fin rays	1	1	1
6	Branched pelvic fin rays	8	8	8
7	Unbranched pectoral fin rays	1	1	1
8	Branched pectoral fin rays	13	14	13.9
9	Caudal fin upper lobe	9	9	9
10	Caudal fin lower lobe	8	8	8
11	Lateral line scales	30	31	30.6
12	Pre dorsal scales	8	10	8.6
13	Upper transverse rows	4.5	4.5	4.5
14	Lateral line to pelvic scale rows	2.5	2.5	2.7
15	Lower transverse rows (anus)	3.5	3.5	3.8
16	Circumpeduncular scales	15	16	15.6
17	Circumferential scales	21	22	21.7
18	Transverse chest row scales	7	8	7.3
19	Anal scale rows	3	4	3.7
20	Pre anus scales	20	23	21.1

Fig. 1. *Garra nethravathiensis* sp. nov. F7542, 187.22 mm SL, from Kannikaya, Confluence of Addahole River with Kumaradhara River of Nethravathi River basin, Karanataka, India.

1a - Lateral view of *Garra nethravathiensis* sp. nov.



1b - Ventral view of *Garra nethravathiensis* sp. nov.



1c - Oral view of *Garra nethravathiensis* sp. nov. in caudoventral aspect to show papillose upper lip

Figure 1

Garra nethravathiensis sp. nov. F7542, 187.22 mm SL, from Kannikaya, Confluence of Addahole River with Kumaradhara River of Nethravathi River basin, Karanataka, India

Fig. 2. Line drawings of ventral views of (a) *Garra nethravathiensis* sp. nov. collected from Kannikaya, Confluence of Addahole River with Kumaradhara River of Nethravathi River basin, Karnataka, India. (b) *Garra mulya* (Sykes) collected from Savitri, Krishna basin, Maharashtra, India.

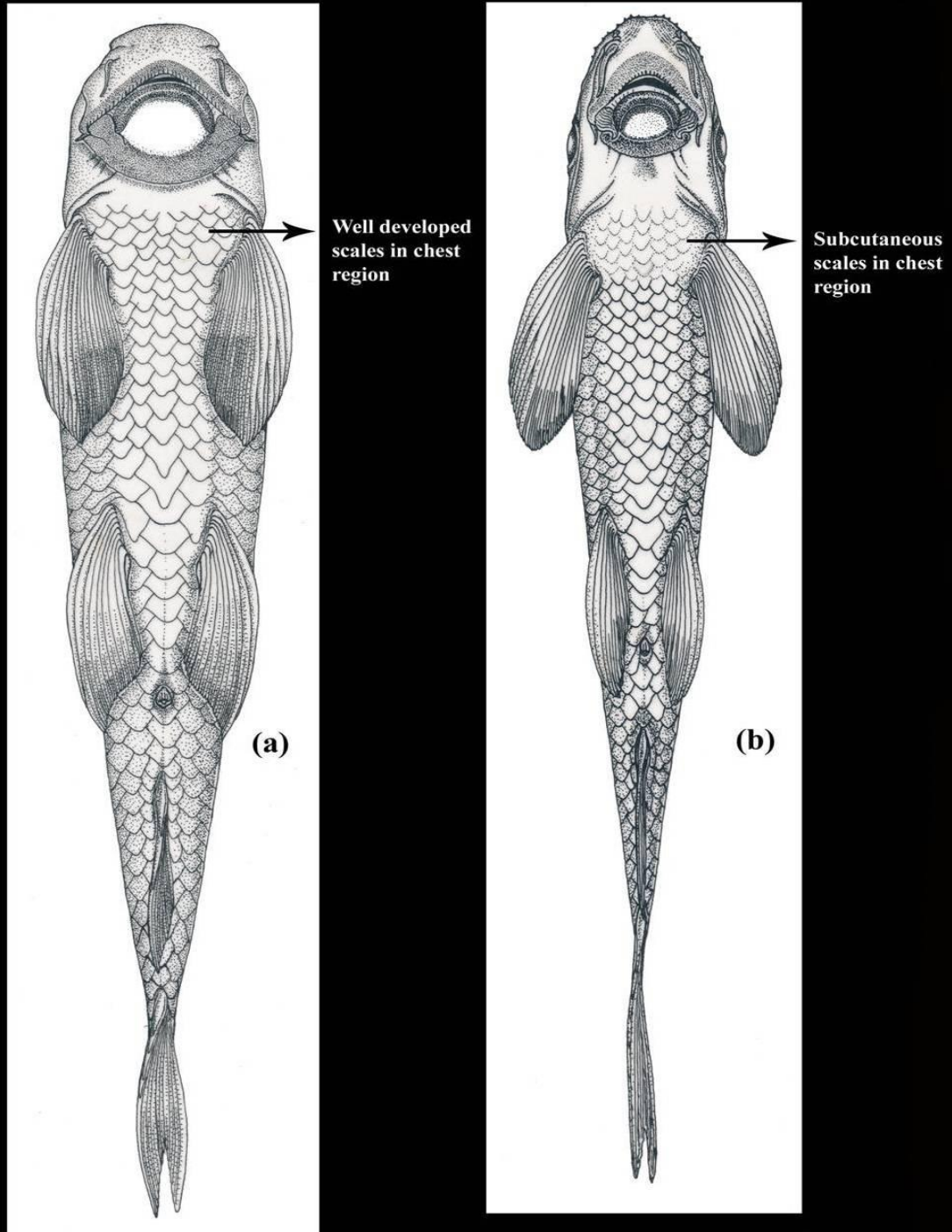
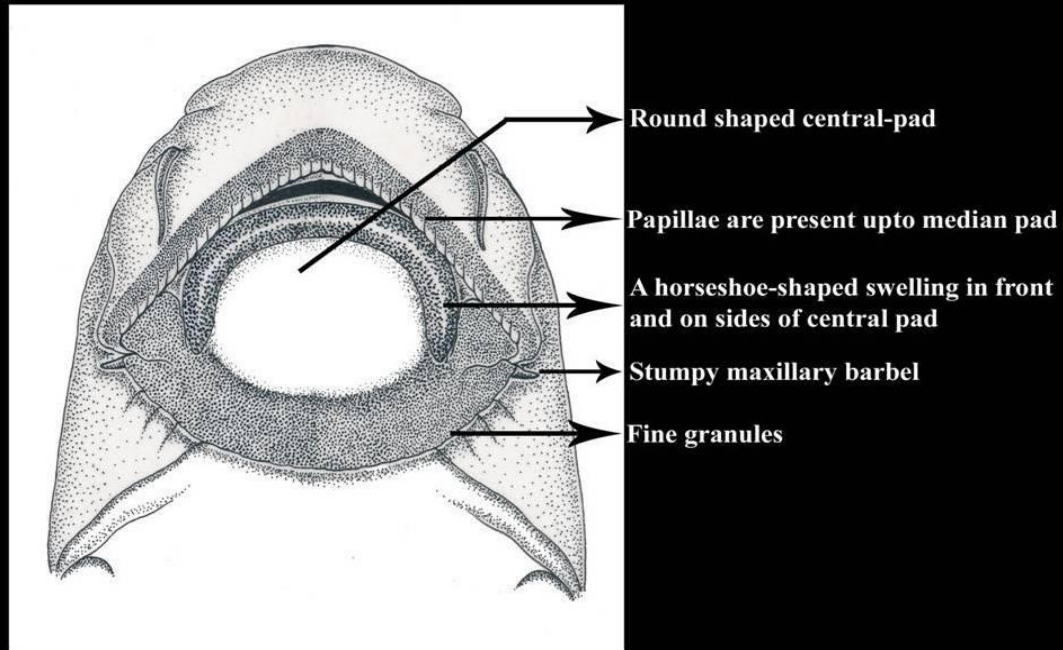


Figure 2

Line drawings of ventral views of (a) *Garra nethravathiensis* sp. nov. collected from Kannikaya, Confluence of Addahole River with Kumaradhara River of Nethravathi River basin, Karnataka, India. (b) *Garra mulya* (Sykes) collected from Savitri, Krishna basin, Maharashtra, India.

Fig. 3. Line drawings of ventral view of mouth

(a) *Garra nethravathiensis* sp. nov. collected from Kannikaya, Confluence of Addahole River with Kumaradhara River of Nethravathi River basin, Karanataka, India.



(b) *Garra mullya* (Sykes) collected from Savitri River, Krishna River basin, Maharastra, India.

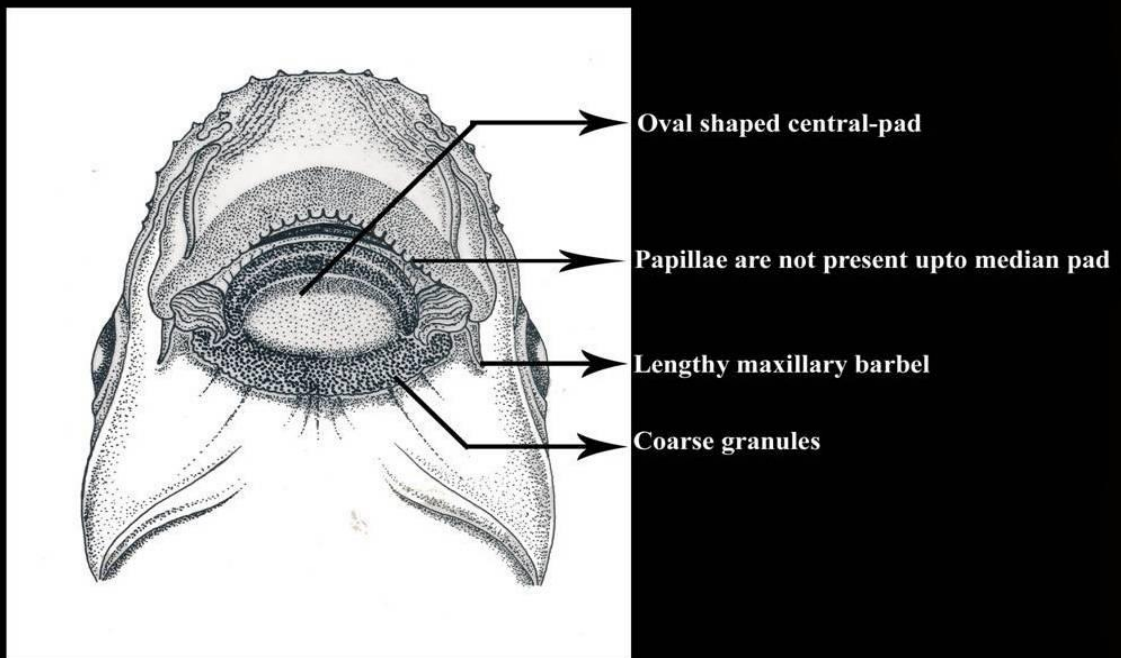


Figure 3

Line drawings of ventral views of Mouth (a) *Garra nethravathiensis* sp. nov. collected from Kannikaya, Confluence of Addahole River with Kumaradhara River of Nethravathi River basin, Karanataka, India. (b) *Garra mullya* (Sykes) collected from Savitri river, Krishna basin, Maharastra, India

Fig. 4. *Garra bicornuta* (Rao) - Thunga River at Thirthahalli, Karnataka, India.

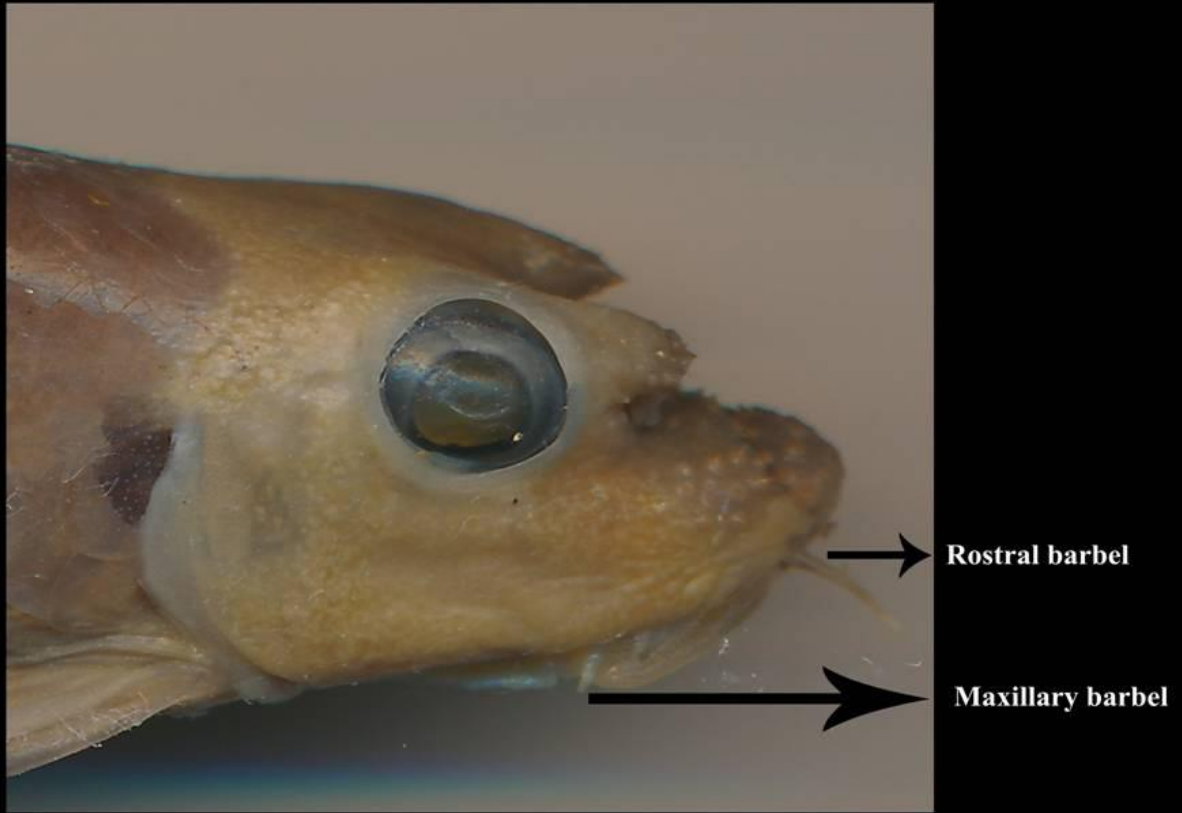


Figure 4

Garra bicornuta (Rao) - Thunga River at Thirthahalli, Karnataka, India



Figure 5

Map showing collection site of *Garra nethravathiensis* sp. nov.