FISHES OF THE GENUS *GLYPTOTHORAX* BLYTH (TELEOSTEI: SISORIDAE) FROM MANIPUR, INDIA, WITH DESCRIPTION OF THREE NEW SPECIES

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ABSTRACT

Sisorid catfishes of the genus *Glyptothorax* of Manipur, India is revised. *Glyptothorax ngapang* sp. nov., *G. granulus* sp. nov. and *G. chindwinica* sp. nov. are described from Chindwin basin of the state. Characteristic differences in the new species include: *G. ngapang* sp. nov. in its well tuberculated skin and slender caudal peduncle; *G. granulus* sp. nov. in having granulated skin and thoracic adhesive apparatus width 78.9-85.0% its length; and *G. chindwinica* sp. nov. in having large head, depth at nape 55.8-56.7% HL, teeth on upper jaw as broad patch, lateral extent of lower jaw tooth band more than that of upper, and thoracic adhesive apparatus with a shallow pit in the centre. *G. manipurensis* is differentiated from *G. striatus* and its status and synonymy with *G. sinense* is discussed. A key to identification of species of the genus of the state is given.

KEYWORDS

Fishes, *Glyptothorax*, Manipur, new species, overview

ABBREVIATIONS

NATP - National Agricultural Technology Project; MUMF - Manipur University Museum of Fishes; ZSI - Zoological Survey of India, Kolkata

Members of the sisorid catfish genus *Glyptothorax* Blyth, are distributed in all mountain waters of India, both in the Himalaya and in the chains, Tibet and the Sunda Islands (Vinciguerra, 1890). Kullander *et al.* (1999) revised its distribution as widespread in South Asia from Tigris-Euphrates basin eastward to Vietnam and eastern China. They belong to the family Sisoridae which is a composite assemblage of divergent forms (Jayaram, 1979) and the subfamily Glyptosterninae, a group distributed from the Caucasus to China (Roberts, 1989). Jayaram distinguished the genus from other members of the subfamily by the presence of greatly depressed head, thick and papillated lips and ventral surface of thorax with an adhesive apparatus with or without a central pit. Roberts described the apparatus to consist of unculiferous laminae arranged in a whorl and confined to abdomen immediately behind isthmus and between pectoral fins. dePinna (1996) diagnosed the genus by the following combination of characters: thoracic adhesive apparatus comprising an elliptical field of folded longitudinal pleats of skin, a detached distal portion of the premaxilla, and long and thin lateral arms of the vomer that extend under the entire length of the articular process of the lateral ethmoid.

Hora (1921) described *Glyptothorax minutus* from Imphal stream and reported *G. dorsalis* Vinciguerra from the state. Menon (1954a) described *G. manipurensis* from Barak river, Karong and reported the occurrence of *G. trilineatus* Blyth and *G. platypogonoides* Bleeker in the state. Menon (1954b) also reported *G. platypogonoides* from the state. Vishwanath (2000) included *G. platypogonoides*, *G. trilineatus*, *G. manipurensis*, *G. cavia*, and *G. sinense* in his list of fishes of the state. *G. platypogonoides* is now spelled *G. platypogonides* (Roberts, 1989; Tan & Ng, 2000). Subsequent reports of Hora & Mukerji (1935), Hora (1936), and Menon (1953) from the state did not include any representative of the genus.

Examination of several collections from different parts of Manipur included six species of *Glyptothorax* of which three from Chindwin basin are undescribed. They are described here as new species, *viz.*, *Glyptothorax granulus* sp. nov., *Glyptothorax ngapang* sp. nov. *and Glyptothorax chindwinica* sp. nov. Descriptions of *G. manipurensis* Menon, *G. cavia* (Hamilton) and diagnosis of *G. ventrolineatus* Vishwanath and Linthoingambi are provided. A key to identification of the species of *Glyptothorax* of Manipur is also given.

MATERIAL AND METHODS

Measurements were made with a dial caliper to the nearest 0.1 mm. Counts and measurements were made on the left side of specimens wherever possible using a PC based binocular stereo zoom microscope (Olympus model SZ40) with transmitted light. Counts and measurements followed Ng & Lim (1995) except body depth which was measured as a straight vertical distance measured from the belly to the dorsal fin origin. Antero-posterior extent (A-P extent) of teeth band was measured as the straight distance from anterior to posterior end of the widest part of the band and lateral extent, the greatest transverse distance. Teeth bands in ZSI specimens were not dissected. Length of adhesive apparatus was measured as the longest longitudinal distance of skin folds from behind isthmus to the posterior most region where the folds end; the width, greatest transverse distance. Length of occipital process was measured as the greatest distance from its base to the tip and its width, the greatest transverse distance at base. Nature of skin was observed under the microscope after scrapping out mucous cover. Clearing and staining of specimens for osteology followed Hollister (1934). Vertebral counts followed Roberts (1989). Bones were observed in Alizarin stained transparent specimens. Subunits of head and fin lengths are presented as proportions of head length (HL). HL and measurements of body parts are given as proportions of standard length (SL). Numbers in parentheses indicate number of specimens examined. Type specimens are deposited in the Manipur University Museum of Fishes (MUMF).

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Glyptothorax cavia (Hamilton)
(Images 1a[W], 1b[W] & Fig. 1a)

Pimelodus cavia Hamilton, 1822: 188, 378 (type locality: northern rivers of Bengal).
Glyptothorax cavia Hora and Menon, 1948: 49, 60

Material examined
18.iii.1999, 5 ex., Barak River, Vanchengphai, Tameng-long District, Manipur, India, 98.2-123.4mm SL, coll. K. Nebeshwar (MUMF 4019); 2.iv.2000, 10 ex., same data, 148.3-150.8mm SL (uncat.).

Diagnosis
G. cavia is distinct in having the following combination of characters: body depth at dorsal fin origin 25.7-26.0% SL; head high, its depth at nape 68.3-69.5 and at eye 51.8-54.3% HL; upper jaw tooth band: A-P extent 20.4-21.6 and lateral extent 43.5-44.5% HL, A-P extent 47.3-48.6% its lateral extent, its lateral extent equal to that of lower band; teeth band on lower jaw: divided only by narrow partition that is not projecting, its A-P extent 9.5-10.2 and lateral extent 43.2-44.5% HL; thoracic adhesive apparatus with a deep pit, its length 47.1-48.5% HL; caudal fin forked; skin sparsely granulated, with dark brown spots.

Description
General appearance of the fish as in Fig. 1a and its morphometric data and comparison with *G. chindwinica*, in Table 1. Body spindle shaped, ventral profile flat and dorsal profile slightly arched; head depressed, with bluntly pointed snout tip and subterminal mouth and broad fleshy lips; upper jaw longer than lower jaw, teeth band on upper jaw in an almost rectangular patch, those on lower jaw interrupted by a spindle shaped skin fold, lateral extent of upper same as that of lower (Fig. 1a); eye small; distance between occipital process and basal bone of dorsal twice of eye diameter; thorax and anterior portion of abdomen flattened ventrally with a conspicuous heart shaped thoracic adhesive apparatus with a deep pit, the longitudinal skin folds extend anteriorly to isthmus so that the apex is pointed rostrally (Image 1b[W]).

Barbels: Four pairs, nasal more or less equal to inner mandibular and reaching only slightly more than half the distance from naris to eye; maxillary extending to middle of pectoral fin base, outer mandibular longer than inner not reaching the posterior margin of the gill opening.

Fins: Dorsal situated close to the snout tip than to caudal fin, its posterior margin slightly curved, its height more than body depth, bearing I, six rays, the spine smooth with no serrations; pectoral extending to vertical of half of dorsal base, bearing I, nine rays, last divided to base, the spine strong and broad with 7-11 posterior antrose serrae; pelvic origin at level of behind posterior end of dorsal base and extending upto anus, bearing i, five rays; anterior margin of adipose dorsal gently sloping and its origin at same vertical level with that of anal; anal with i or iii, 10 rays; caudal forked, with seven branched rays in the upper and eight in the lower lobes.

Skin: appears smooth to touch but careful observations under microscope shows sparse distribution of granulations on predorsal region, dorsal surface of head, dorsal fin base but very sparsely distributed on body.

***Figure 1a. Teeth bands of* Glyptothorax cavia**

Colour. Body brown with variously distributed dark brown spots. Dorsal and anal fins with two black stripes: one at base, one submarginal separated by a white one in middle, fin edges white. Adipose dorsal fin brown with white edges. Pectoral and pelvic fins brown with white edge. Caudal fin with a black submarginal band which becomes marginal on the middle rays.

Glyptothorax manipurensis Menon
(Image 2a[w], 2b[w], Image 8[w] & Fig. 1b)

Glyptothorax manipurensis Menon 1954: 23 (type locality: Barak River, Karong, Manipur).

Material examined
ii.1953, 1 ex., (holotype) Barak river, Karong, Naga Hills, Manipur, India, 73.4mm SL, coll. A.G.K. Menon (F738/2); 3 ex., (paratypes) same data as of holotype, (F 739/2), 52.4-64.5mm SL; 10.xii.1998, 10 ex. Barak river, Vanchengphai, Manipur, India, 69.0-104.0mm SL, coll. K. Nebeshwar (MUMF 4029-4032).

Diagnosis
A species of *Glyptothorax* with following combination of characters: head pointed and large, its depth at occiput 66.0-72.3% its length, maximum width 79.0-84.3% HL; interorbital space 28.0-33.1% HL; A-P extent of lower jaw tooth band 20.0-20.4% its lateral extent; occipital process length three

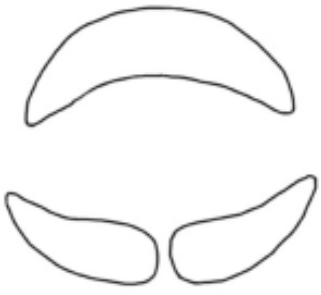

***Figure 1b. Teeth bands of* Glyptothorax manipurensis**

times its width; adhesive apparatus with a caudally open central depression (Image 2b[w]), the apparatus width 73.7-78.9% its length; no ridges or bumps in front of adipose fin; dorsal spine serrated with five antrose serrae; pectoral spine with 9-11 serrae; pelvic fin extending up to anus; anal fin short, extending upto vertically through posterior extremity of adipose fin; caudal fin lobes equal; caudal peduncle height 45.4-48.0% its length; a white longitudinal line overlapping lateral line; black spot at dorsal, adipose and caudal fin bases present; smooth skin.

Description

General appearance of the fish as in Image 2a[w] and its morphometric data in Table 2, comparison with *G. granulus* and *G. sinense*, in Table 3. Body short, ventral surface curved; head pointed at tip; mouth inferior; lips papillated; teeth on upper jaw as one continuous lunate shaped band, those on lower jaw in two patches separated by a narrow partition (Fig. 1b); snout length more than gape width; eyes small and rounded, located on dorsal surface of head; adhesive apparatus with a depression in the centre which is open caudally; caudal peduncle deep.

Barbels: Four pairs, nasal reaches anterior margin of orbit; maxillary with broad bases, when straightened extend beyond posterior end of pectoral fin base; outer mandibular reach middle of pectoral fin base; inner mandibular half the length of outer mandibular.

Fins: Dorsal located at midlength through distance between snout tip and adipose dorsal origin, bearing I, six rays, the spine serrated posteriorly on the distal part with five antrose serrae, the serrae may be less distinct in specimens less than about 70 mm SL; pectoral with I, nine rays, the spine with well developed 9-11 serrae, bearing no adhesive apparatus; pelvic with i, five rays, situated through posterior end of dorsal base, reaching up to anus only; anal short, bearing ii, 10 rays of which last is undivided, located vertically through anterior base of adipose fin; adipose dorsal well developed and situated closer to rayed dorsal fin than to caudal fin base; caudal forked, lower little longer with seven branched rays in the upper and eight in the lower lobes.

Skin: Skin on head and body smooth.

Colour**:** Body grey. Dorsal fin base black, a black band covering on its spine, 1st and 2nd rays only at one-fourth of the fin height, but edges white. Adipose fin black patch at base and white edges. Caudal fin base black. Pectoral, ventral and caudal fins dusky.

Distribution**:** India: Manipur: Barak River (Brahmaputra drainage).

GLYPTOTHORAX VENTROLINEATUS VISHWANATH AND LINTHOINGAMBI

(Image 3a[w], 3b[w] & Fig. 1c)

Glyptothorax ventrolineatus Vishwananth and Linthoingambi, 2005: 201 (type locality: Iril river, Manipur, India).

Material Examined: 15.i.2003, 6 exs., Iril river, Ukhrul district, Manipur, India, 85.8mm SL (holotype) and 85.1-94.5mm SL (paratypes), coll. I. Linthoingambi (MUMF L0221-26); 10.iv.2003, 4 exs., Lokchao river, Moreh (Indo-Myanmar border), Chandel district, Manipur, India, 67.2-83.2mm SL, coll. K. Nebeshwar and party (MUMF 4300-4303); 8.ix.2005, 10 exs., Lokchao River, Moreh (Indo-Myanmar border), Chandel district, Manipur, India, 75.8-91.2mm SL, coll. L. Sakuntala (uncat); Namya River, Kongan Thana, 61.4 and 71.3mm SL, coll. S.G. Duncan (ZSI 12460/1 & 2).

***Figure 1c. Teech bands of* Glyptothorax ventrolineatus**

Diagnosis

G. ventrolineatus is distinguished in having the following combination of characters: supra-occipital process not in contact with first dorsal fin pterygiophore; its width 38.3-44.7% its length; nasal barbel length twice of internasal distance; lateral extent of lower jaw teeth band greater than that of upper jaw; thoracic adhesive apparatus longer than broad, open caudally, without a central pit; dorsal fin spine finely serrated at tip on lateral side; adipose dorsal fin base length equals rayed dorsal fin base length; caudal fin longer than head length; skin on head, body and adipose dorsal fin granulated; body dark brown or greyish, abdomen and underside of head creamish; dorsal fin base dark brown, a hazy black band in the middle of fin, white margin; three creamish longitudinal light bands: one each along mid-dorsal line, lateral lines and mid-ventral line of the body.

GLYPTOTHORAX NGAPANG SP. NOV.

(Images 4a[w], 4b[w] & Figs. 1d, 2)

Holotype: 6.vii.2001, Iril river, Bamonkampu, Manipur, India, 82.7mm SL, coll. I. Linthoingambi (MUMF 6131).

Paratypes: 9 exs., same data as holotype, 61.7-99.5mm SL, (MUMF 6132); 10.iv.2003, 10 exs., Lokchao river, Moreh (Indo-Myanmar border), 65.0-98.5mm SL, coll. W. Vishwanath (MUMF 6141); 31.xii.1961, 2 exs., Imphal stream, Sekmaijing Khanang, Manipur, India, 76.5 & 100.2mm SL, coll. C.B. Srivastava (ZSI F2889/2).

Distribution

India: Manipur: Iril and Lokchao rivers (Chindwin basin).

Etymology

Named after its local name 'ngapang' in Manipuri.

Diagnosis

A *Glyptothorax* species with the following combination of characters: head depth at occiput 61.3-65.6% HL, maximum width 71.2-78.4% HL; its length 22.2-25.0% SL; gape width 31.2-35.1% HL; interorbital space 22.1-27.5% HL; teeth on lower jaw: lateral extent of 32.0-33.0% HL, A-P extent 21.2-22.0% lateral extent; adhesive apparatus width 58.4-63.0% its length, its length 61.5-68.8% HL; adipose dorsal fin long, its base length 49.1-65.0% interdorsal length; caudal peduncle slender, its height 28.0-34.8% its length; skin tuberculated, tubercles oval with cornified longitudinal ridges; dorsal spine serrated only on distal part, with 2-3 serrae.

Description

General appearance of the fish is in Image 4a[w]; its morphometric data in Table 2 and its differentiating characters from *G. dorsalis* sensu Vinciguerrae (1890) in Table 4. Body moderate, slender and elongated, its depth more than dorsal spine-length; head small, its dorsal surface rough with tubercles; mouth gape small; teeth on upper jaw in a single patch, those on lower jaw interrupted by a narrow space which widens posteriorly (Fig. 9d); eyes small; gill openings united at narrow isthmus; adhesive apparatus on thorax small, V-shaped, open type with elongated depression in the center, longer than broad (Image 4b[w]); caudal peduncle slender.

Barbels: Four pairs, nasal reach halfway the distance between the posterior nare and the anterior margin of orbit; maxillary when straightened extend upto middle or posterior end of pectoral fin base; outer mandibular reach anterior pectoral fin base; inner mandibular reaches the anterior portion of thoracic adhesive apparatus.

Fins: Dorsal situated close to snout tip than to caudal, bearing I, 6 rays, the spine strong, smooth anteriorly and with 2-3 serrae posteriorly and distally; pectoral with I, 10 rays, the spine strong with 10-12 serrae on the internal side, extending upto the region vertically through middle or posterior end of dorsal base; pelvic with i, 5 rays, its origin vertically through posterior end of dorsal base, extending nearly or up to (in smaller specimens) anal origin; anal long and high, with ii, 11 rays, its origin vertically in advance of adipose fin; adipose dorsal well developed and long; caudal deeply forked.

Skin: Tuberculated, tubercles oval shaped and unevenly distributed on sides and on dorsal side. The tubercles may be present as markings to well developed ones with longitudinal cornified ridges (Fig. 2). In smaller specimens tubercles are more prominent. In some specimen there are only markings of the tubercles making the skin smooth to touch, probably due to the shedding of tubercles or to poor preservation.

Bones: Neural spine expanded distally, no ridges or bumps in the area in front of the adipose fin. Number of total vertebrae 17+20 or 18+19. Occipital process pointed, longer than broad at base, not reaching basal bone of dorsal fin.

Colour: Body yellowish brown, marked with black spots. Pectoral, ventral and anal fins spotted brown. Dorsal fin two dark brown bands, one at base and another distally with an interspace of equal width, outer edge white. Adipose dorsal fin black with white edge.

Figure 1d. Teeth bands of* Glyptothorax ngapang *sp. nov.

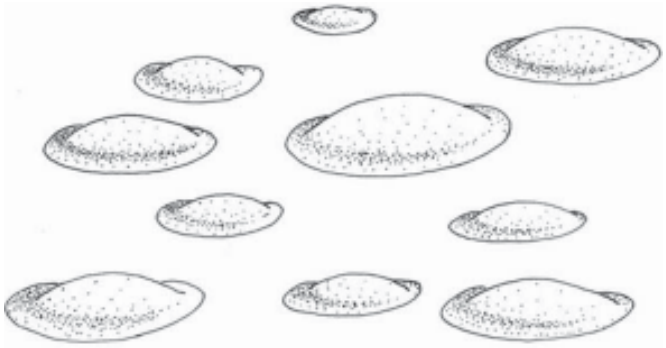

Figure 2. Tubercles on skin of* Glyptothorax ngapang *sp. nov.

***GLYPTOTHORAX GRANULUS* SP. NOV.**

(Images 5a[w], 5b[w] & Fig. 1e)

Holotype: 10.i.2004, Iril river, Phungdhar, Ukhrul district, Manipur, India, 76.6mm SL, coll. I. Linthoingambi (MUMF 6151).

Paratypes: 6.vii.2003, 10 exs., same data as holotype, 61.7-76.6mm SL (MUMF 6152); 7.iii.2004, 7 exs., same data as holotype, 63.6-74.0mm SL (MUMF 6153-6155); 3.iv.2004, 10 exs., Lokchao river, Moreh (Indo-Myanmar border), 80.5-89.8mm SL, coll. W. Vishwanath (MUMF 6156).

Distribution

India: Manipur: Iril and Lokchao rivers (Chindwin basin).

Etymology

Named after the nature of skin with granules.

Diagnosis

A *Glyptothorax* species with the following combination of characters: body plain with no longitudinal lines, head rounded, depressed, its depth at occiput 60.2-61% HL; occipital process separated from the dorsal pterigiophore by a considerable distance, its length 2 times its width; thoracic adhesive apparatus well developed, with a depression in the center which is open caudally, the apparatus width 78.9-85.0% its length; dorsal spine serrated posteriorly on the distal part with 6 antrose serrae; adipose dorsal fin well developed and there are no series of ridges or bumps in front of it; skin granulated; total vertebrae

***Figure 1e. Teeth bands of* Glyptothorax granulus**

count 35-36; caudal peduncle height 48.3-56.0% its length.

Description

General appearance of the fish is as shown in Image 5a[w], morphometric data in Table 2 and differentiating characters from nearest congeners in Table 3. Body slightly elongated, its depth increasing curvilinearly from snout tip to origin of dorsal fin and decreases posteriorly, ventral surface flat, its width greatest at insertion of pectoral fins, narrowest at end of caudal peduncle; head depressed, its depth 61.8-72.3% HL; mouth inferior; lips papillated; teeth on upper jaw as a single continuous band, those on lower jaw in two distinct patches separated by a narrow partition which widens on the anterior side (Fig 1e); snout length more than gape width; eye small and rounded, located on dorsal surface of head; adhesive apparatus almost oval and with a depression in the center which is open caudally (Image 5b[w]); caudal peduncle deep.

Barbels: Four pairs, nasal almost reach anterior margin of orbit; maxillary with broad bases, when straightened extend upto middle of pectoral fin base; outer mandibular reach anterior pectoral fin base; inner mandibular reach anterior portion of thoracic adhesive apparatus.

Fins: Dorsal located at midlength through distance between snout tip and adipose dorsal origin, with I, 6 rays, the spine serrated posteriorly on the distal part with 6 antrose serrae; pectoral with I, 9 rays, the spine with well developed 11-12 serrae, fin with no adhesive apparatus; pelvic with i, 5 rays, situated through posterior end of dorsal base, may or may not reach anal fin base; anal fin short, bearing ii, 9 rays, located vertically through in front of adipose fin; adipose dorsal well developed and situated closer to rayed dorsal fin than to caudal base; caudal forked, lower little longer with 7 branched rays in the upper lobe and 8 in the lower lobe.

Skin: Granulated evenly all over body but head plain.

Bones: Neural spines expanded distally, no ridges or bumps in front of the adipose fin. Number of total vertebrae 35-36 caudal vertebra 17(2) or 18(2), precaudal vertebra 18(4). Occipital process blunt and separated from the pterigiophore by a considerable distance, its length twice the width.

Colour: Body brown. Dorsal, adipose and caudal fin bases black. A submarginal dusky stripe on proximal half of the distal half of dorsal and anal fins. Adipose fin edge white. Pectoral, ventral and caudal fins dusky.

***Table 1. Morphometric data of* Glyptothorax ngapang *sp. nov.,* Glyptothorax granulus sp. nov. *and* Glyptothorax manipurensis**

Characters	*G. ngapang* sp. nov.	*G. granulus* sp. nov.	*G. manipurensis* (MUMF)	*G. manipurensis* (Types in ZSI)
Standard length	61.7-99.5	61.7-99.5		52.3-73.4
Percentages Standard length				
Head length	22.2-25.0	26.0-26.7	23.6-25.2	24.0-25.5,
Body depth at dorsal fin base	16.2-19.1	18.6-19.7	18.9-23.7	18.9-20.5
Caudal peduncle length	19.8-20.7	17.2-20.0	19.2-21.4	18.0-20.2
Adhesive apparatus length	14.0-15.7	13.3-15.7	13.2-15.3	14.1-16.2
Prepelvic length	46.5-50.7	47.4-50.4	48.2-49.8	50.0-51.0
Preanal length	62.7-67.5	64.6-66.0	66.0-67.8	69.6-70.0
Dorsal fin length	11.9-12.9	13.0-14.3	12.8-15.6	14.3-16.0
Interdorsal distance	21.5-24.6	19.7-22.8	22.2-23.6	22.0-23.4
Adipose fin length	11.2-14.0	13.8-14.6	13.1-14.5	12.3-13.0
Pectoral fin length	20.7-21.0	23.8-24.9	21.9-23.5	22.3-24.5
Ventral fin length	14.5-14.8	16.5-17.7	15.6-16.6	16.3-17.4
Anal fin length	15.5-16.3	13.5-14.5	13.3-15.5	12.5-14.2
Caudal peduncle height % its length	28.0-34.8	48.3-56.0	45.4-48.0	47.3-48.7
Percentages head length				
Head depth at occiput	61.3-65.6	60.2-61.0	66.0-72.3	62.3-65.4
Head width (max)	71.2-78.4	84.0-87.3	79.0-84.3	85.3-90.0
Eye diameter	09.8-12.9	10.9-13.4	13.0-14.0	14.5-15.0
Snout length	48.8-51.8	47.0-50.0	45.6-49.0	48.3-50.2
Interorbital space	22.1-27.5	26.2-29.9	28.0-33.1	32.2-34.0
Gape width	31.2-35.1	36.6-38.3	39.0-41.5	40.0-42.2
Internarial space	14.1-16.2	13.7-17.0	16.0-19.5	–
Adhesive apparatus length	61.5-68.9	50.0-59.0	56.0-63.5	59.3-63.6
Upper jaw tooth band A-P extent	09.0-09.2	08.1-09.5	05.4-08.7	Not examined
Upper jaw tooth band lateral extent	28.0-31.2	29.5-31.4	27.8-31.0	–
Lower jaw tooth band A-P extent	07.0-07.1	08.1-09.1	07.3-07.4	Not examined
Lower jaw tooth band lateral extent	32.0-33.0	35.0-35.2	36.0-37.3	–
Lower jaw tooth band A-P extent % its lateral extent	21.2-22.0	23.0-26.0	20.0-20.4	–
Adhesive apparatus width% head width (max)	41.9-59.5	48.1-54.3	47.2-53.7	48.1-51.5
Adhesive apparatus width % its length	58.4-63.0	78.9-85.0	73.7-78.9	71.0-77.0

GLYPTOTHORAX CHINDWINICA SP. NOV.

(Images 6a[w], 6b[w] & Fig. 1f)

Holotype: 26.viii.2002, Iril River, Urup, Manipur state, India, 145.4mm SL, coll. I. Linthoingambi (MUMF 6366).
Paratypes: 3.iv.2004, 4 exs., Lokchao river, Moreh (Indo-Myanmar border), Chandel district, Manipur, India, 115.6-145.5mm SL, coll. W. Vishwanath (MUMF 6368); 15.i.2004, 5 exs., Thoubal river, Nongpok Keithelmanbi, Thoubal district, Manipur, India, 100.2-123.6mm SL, coll. I. Linthoingambi (MUMF 6369); 2.iii.2000, 10exs., Imphal river, Ithai, Bishenpur, Manipur, India, 165.0-170.0mm SL, coll. L. Juliana (uncat).

Distribution

India: Manipur: Iril, Thoubal, Ithai and Lokchao rivers (Chindwin basin).

Etymology

Named after its type locality.

Diagnosis

G. chindwinica sp. nov. is distinct in having the following combination of characters: head depth at nape 55.8-56.7 and at eye 42.0-44.9% HL; upper jaw tooth band: A-P extent 67.6-69.0% its lateral extent, its lateral extent 86.0-87.6% lateral extent of lower teeth band; it's A-P extent 29.1-30.6 and lateral extent 43.0-44.6% HL; lower jaw tooth band: A-P extent 11.6-13.2 and lateral extent 50.0-51.6% HL; a heart shaped thoracic adhesive apparatus with a shallow pit in the centre, its length 39.2-41.6% HL; caudal fin with a submarginal black band forming a V-shaped band by extending to the base of middle rays; skin smooth, body with black patches.

Description

General appearance of the fish is as shown in Image 6a[w], morphometric data and comparison with *G. cavia* in Table 1. Body slender, compressed on caudal peduncle; head depressed, with pointed snout tip and subterminal mouth and broad fleshy lips; upper lip continuing into maxillary barbells; upper jaw longer than lower jaw, teeth on upper jaw in a broad patch, those on lower jaw in two distinct patches interrupted by a prominent, spindle shaped skin fold which bulges on the sides, the interruption very narrow on the anterior front almost making a false appearance of a continuous band, lateral extent of lower more than that of upper (Fig. 1f); eye small; distance

***Table 2. Morphometric data of* Glyptothorax chindwinica *sp. nov. and* Glyptothorax cavia**

Characters	*Glyptothorax chindwinica*	*Glyptothorax cavia* (MUMF specimens)	*Glyptothorax cavia* (ZSI specimens)
Percentage Standard Length			
Body depth (dorsal origin)	20.8-20.9	25.7-26.0	19.4-21.4
Body depth (anal origin)	14.3-15.6	16.3-17.2	-
Head length	28.3-29.0	27.5-28.1	29.6-31.5
Caudal peduncle length	16.0-17.2	15.2-16.8	13.8-16.4
Dorsal fin length	11.5-11.9	12.7-13.5	11.4-13.2
Adipose fin length	12.7-14.5	13.5-15.2	12.5-15.8
Pectoral fin length	20.9-21.0	21.0-22.3	20.5-22.5
Pelvic fin length	14.5-14.7	12.3-13.6	13.9-16.3
Anal fin length	11.9-12.6	13.7-13.5	12.3-14.6
Predorsal length	38.3-39.1	36.8-38.2	40.1-41.3
Interdorsal distance	23.4-26.4	25.1-27.3	20.8- 21.9
Caudal peduncle height % its length	02.0-02.1	01.7-02.0	02.0-02.4
Percentage Head length			
Adhesive apparatus length	39.2-41.6	47.1-48.5	41.7-49.1
Upper jaw tooth band A-P extent	29.1-30.6	20.4-21.6	Not examined
Upper jaw tooth band lateral extent	43.0-44.6	43.5-44.5	–
Lower jaw tooth band A-P extent	11.6-13.2	9.5-10.2	Not examined
Lower jaw tooth band lateral extent	50.0-51.6	43.2-44.5	–
Upper jaw tooth band A-P extent % its lateral extent	67.6-69.0	47.3-48.6	–
Upper jaw tooth band lateral extent % lower jaw tooth band lateral extent	86.0-87.6	100.0-100.3	–
Head depth (nape)	55.8-56.7	68.3-69.5	50.1-57.0
Head depth (eye)	42.0-44.9	51.8-54.3	40.2-41.7
Head width (max)	76.6-83.9	81.3-83.4	73.2-75.6
Snout length	49.6-49.8	50.9-52.4	49.1-50.6
Eye diameter	08.9-09.5	08.9-9.0	08.7-09.2
Percentage Head width			
Adhesive apparatus width	43.0-48.8	48.3-50.8	45.4-55.0
Upper jaw tooth band lateral extent	32.3-33.2	47.5-48.0	–
Lower jaw tooth band lateral extent	47.8-49.0	27.5-29.6	–
Interorbital space	29.5-33.2	30.5-32.0	33.0-33.7
Colouration			
Nature of skin	smooth, with black patches	sparsely granulated, with dark brown spots	sparsely granulated, with dark brown spots
Band on caudal fin	v- shaped, extending to fin base	sub marginal on outer and marginal on middle rays	sub marginal on outer and marginal on middle rays

between occipital process and basal bone of dorsal twice of eye diameter; thorax and anterior portion of abdomen flattened ventrally with a conspicuous heart shaped adhesive apparatus on the thorax, a shallow pit on the apparatus, the longitudinal skin folds extend anteriorly to isthmus so that the apex is pointed rostrally (Image 6b[w]).

Barbels: Four pairs, nasal arising from the internarial septum reaching only slightly more than half the distance from naris to eye; maxillary extending to middle of pectoral base; outer mandibular slightly longer than inner and reaching the gill opening.

Fins: Dorsal closely placed to the snout than to caudal, its posterior margin straight, bearing I, 6 rays, its spine smooth bearing no serrations; pectoral fin with I, 10 rays, the spine strong and broad with 10 posterior antrose serrae, fin extending up to posterior end of dorsal base, fleshy extension of its spine longest; pelvic with i, 5 rays, its origin behind vertical level of dorsal fin end; adipose dorsal well developed, its origin at same vertical level with that of anal, its anterior margin gently sloping; anal with ii, 9 rays, first two rays the longest extending beyond vertical level of adipose fin end; caudal forked, with lower lobe very slightly longer, bearing 8 branched rays in the upper and in the lower lobes.

Skin. Nature of skin on body and head smooth with no tubercles or granulations.

Colour. Body grey, with black patches all over it. Dorsal and pectoral fin edge white, a submarginal black stripe and yellow at base. Pelvic and anal fins with four bands: one black band at base and one submarginal, between the two black bands a yellow band of twice width of submarginal band, white band on the edges. Adipose fin anterior half of base yellow, a broad black band in middle and edge white. Caudal fin base black, submarginal black band forming a V shaped by extending to the base of middle rays.

Figure 1f. Teeth bands of* Glyptothorax chindwinica *sp. nov.

Discussion

Fishes of the genus *Glyptothorax* are torrential hill stream forms. Distribution of a species of the genus is restricted to a particular river basin and not to another basin which has no water connections. The six species of the genus from Manipur dealt in this work are discussed below.

***G. cavia*:** Hamilton described *Glyptothorax cavia* from the Gangetic basin in North Bengal, India. The species has unique thoracic adhesive apparatus with a deep central pit, broad teeth band, skin sparsely granulated. In the present study, specimen of *G. cavia* in ZSI, Kolkata from Kosi River and in MUMF from Barak River in Manipur have been compared. Their characters fit into each other. Prashad and Mukerji (1929) described *Glyptothorax burmanicus* from Sankha, a large hill-stream, midway between Kamaing and Mogaung, Myitkyina district, Upper Burma, a stream connected to the Chindwin-Irrawaddy drainage. Hora and Menon (1948) treated *G. burmanicus*, a synonym of *G. cavia*. They did not provide proper justification for the synonymy. Menon (1954a), Talwar and Jhingran (1991), Chu (1999), Menon (1999) also followed the same.

Glyptothorax burmanicus is a Chindwin-Irrawady form and *G. cavia*, a Ganga-Brahmaputra form. Occurrence of the later in Chindwin drainage is less likely. Prashad and Mukerji (1929) diagnosed *G. burmanicus* in having teeth on lower jaw divided in the middle by a narrow fleshy projection of the skin, caudal fin deeply emarginated, short pectoral fin. They also reported the fish to be not belonging to two groups of the genus as described by Hora (1923). *G. cavia* on the other hand has teeth on lower jaw divided in the middle by narrow partition that is not projecting; skin sparsely granulated and caudal fin forked. Thus *G. burmanicus* is treated here distinct and resurrected from synonymy with *G. cavia*.

***G. manipurensis*:** Menon (1954a) described *G. manipurensis* from Barak river in Manipur (Brahmaputra basin), India. Misra (1976) and Talwar and Jhingran (1991), without any justification, treated the fish a junior synonym of *G. sinense*, a species Regan (1908) described from Tungting (= Dongtin) lake in China, which has a water connection with the Yangze river. Menon (1974); Jayaram (1979); Vishwanath & Tombi (1985, 1987); Selim & Vishwanath (1999), treated the fish as a subspecies of *G. sinense*. Vishwanath (2000, 2002), reported *G. sinense* from Chindwin basins of Manipur. Kosygin & Vishwanath (2005) redescribed *G. manipurensis* after examining the holotype and specimens from Brahmaputra basin and also from Chindwin basin (a different basin). The redescription can not be treated valid. They also described the species to have granulations on the body. Present study reveals that the holotype in ZSI has smooth skin. Chinese specimen of *G. sinense* in ZSI Kolkata (Image 8[w]) has tuberculated skin which in agreement with Chu and Mo (1999). Examination of more and fresh specimens of *G. sinense* will reveal further distinguishing characters between the species and *G. manipurensis*.

Gunther (1868) and Day (1878) reported of transverse striations on the undersurface of the outer rays of paired fins of *Glyptothorax striatus* McClelland. Hora (1923) also observed similar structures in the species collected from Khasi & Garo Hills, Meghalaya, India, and described them as adhesive apparatuses. *G. manipurensis* is distinguished from *G. striatus* in having adhesive apparatus only on the thorax vs. on under surface of paired fins and on thorax (Image 8[w]); skin smooth vs. granulated; dorsal, adipose and caudal fin bases black vs. plain; caudal peduncle deep vs. long and narrow posterior margin of pectoral fin concave vs. convex; anterior end of thoracic adhesive apparatus pointed vs. blunt. Thus *G. manipurensis* is treated valid and redescribed.

***G. ventrolineatus*:** Two ZSI specimens from Namya River, Kongan Thana (F 12460/1 & 2) have been identified as

Glyptothorax ventrolineatus. Hitherto reports of *G. trilineatus* from India are due to misidentifications. *G. ventrolineatus* differs from *G. trilineatus* in having a longitudinal light band on the midventral line of the body vs. no band; nasal barbel length twice internasal length vs. equal; width of occipital process 38.3-44.7 vs. 25.0-33.3% of its length; dorsal spine smooth on posterior side, but finely serrated at tip on lateral side vs. finely serrated on distal part, posteriorly, lateral side smooth.

***G. chindwinica* sp. nov.:** *Glyptothorax chindwinica* sp. nov. is much similar to *G. cavia* in general appearance, but can be easily distinguished in the nature of tooth band, length of thoracic adhesive apparatus, head size, nature of skin and type of band on the caudal fin (Table 4). It is also different from *G. burmanicus* in having body plain vs. spotted; skin smooth vs. granulated; pectoral fin long, extending upto posterior end of dorsal fin base vs. short, extending upto vertical level of dorsal fin origin; adipose fin base shorter than anal fin vs. longer; caudal fin deeply forked vs. deeply emarginated.

***G. ngapang* sp. nov.:** Bleeker (1855) described *G. platypogonides* from Lahat, Sumatra, which belongs to Sundaland zoogeographical region. The exact identity of *G. platypogonides* has often been unclear (Tan & Ng, 2000) and the problems encountered in the identification of the syntypes have been outlined by Roberts (1989). Menon (1954a) gave a description of the species based on specimens from Manipur, Myanmar and Thailand. Menon (1954b) listed the species from Manipur without giving description. Misra (1976) also provided description of the species and reported it to be distributed in Manipur and Assam in India, Myanmar, Thailand and Sumatra. Day (1878) did not include the species in the Indian region. Roberts (1989) referred to the reports of *G. platypogonides* from India, Myanmar, Thailand and Malay Peninsula as misidentifications. Subsequent reports of the species (Vishwanath, 2000, 2002; Selim & Vishwanath, 1999) are all due to misidentifications.

Vinciguerra (1890) described *G. dorsalis* from Meetan, upper Burma. Hora (1921), reported the species from Manipur while describing *G. minutus* from Imphal stream. Menon (1954b), Menon (1974) and Misra (1976) considered *G. dorsalis* and *G. minutus* junior synonyms of *G. platypogonides* without justification. Vinciguerra (1890) did not make any mention of serrae on pectoral spine. Hora's (1921) description of *G. dorsalis* from Manipur differs from the original description in having an upper surface of head tuberculated vs. smooth. He also reported the species to have a smooth dorsal spine and to have 11 serrae on pectoral spine. Later Hora (1923) added dorsal spine of the species to be finely serrated along its posterior border but smooth anteriorly. As there is difference with the original description, Hora's (1921 & 1923) *G. dorsalis* from Manipur may be a misidentification. Hora's species may well be the new species, *G. ngapang* sp. nov. under description as they share a few characters, particularly the fine serrations on

Table 3. Showing differentiating characters between Glyptothorax granulus* sp. nov., *Glyptothorax manipurensis* and *Glyptothorax sinense

	***Glyptothorax granulus* sp. nov.**	***Glyptothorax manipurensis***	***Glyptothorax sinense***
Head shape	rounded, depressed its depth 60.2-61.0% HL	pointed, depth, 66.0-72.3% HL	bluntly pointed
Thoracic adhesive apparatus	oval, caudally open depression	central depression caudally open	rhomboidal, no central depression
Skin	granulated	smooth	weakly tuberculated
Ridges in front of adipose fin	absent	absent	present 5 in number
Dorsal spine	serrated with 6 antrose serrae	serrated with 5 serrae	smooth
Pectoral spine	serrated with 11-12 serrae	serrated with 9-11 serrae	serrated with 7 serrae
Anal fin	short, extending beyond vertically through to posterior extremity of adipose fin	short, extending upto vertically through posterior extremity of adipose fin	long, extending beyond vertically thro post. extremity of adipose fin
Pelvic fin extention	beyond anus	upto anus only	beyond anus not reaching anal fin
Caudal fin lobes	lower slightly longer	equal	fins damaged
Occipital process	2 times its width	3 times its width	–
Caudal peduncle height % its length	48.3-56.0	45.4-48.0	44.8
Lines on body	none	a white line overlapping lateral line	not seen any

Table 4. Differentiating characters between Glyptothorax ngapang* sp. nov. and *Glyptothorax dorsalis

Characters	***Glyptothorax ngapang* sp. nov.**	***Glyptothorax dorsalis* (from original description)**
Body depth (BD) & dorsal spine height (DSH)	equal	DSH higher than BD
Adhesive apparatus	well developed; V-shaped; length 59.8-68.9% HL	barely visible
HL % SL	22.2-25.0; dorsal side tuberculated	dorsal side smooth
Interorbital space % HL	22.1-27.5	28.5
Dorsal spine, its length % HL	Serrated, 62.9-72.5	Smooth, 82.1
Pectoral and anal fins	spotted brown	2 black stripes, one at base, another in the middle
Pelvic fin	spotted brown	one black stripe in the middle
Adipose fin	well developed	not well developed

Key to species of *Glyptothorax* of Manipur

1. Thoracic adhesive apparatus with a central pit 2
   Thoracic adhesive apparatus with no central pit 3
2. Skin smooth, with black patches; upper jaw tooth lateral extent 86.0-87.6 % that of lower ..... ***G. chindwinica* sp. nov.**
   Skin sparsely granulated with dark brown spots; Lateral extent of upper jaw tooth band equals that of lower jaw ..... *G. cavia*
3. Skin tuberculated; caudal peduncle slender, its height 28.0-34.8 % its length ..... ***G. ngapang* sp. nov.**
   Skin smooth or granulated; caudal peduncle deep, its height more than 45 % its length 4
4. Skin granulated; dorsal, adipose dorsal and caudal fin bases plain or black 5
   Skin smooth; dorsal, adipose dorsal and caudal fin bases black ..... *G. manipurensis*
5. Body with no longitudinal creamish white lines; dorsal, adipose and caudal fin bases black; dorsal spine serrated posteriorly ..... ***G. granulus* sp. nov.**
   Body with longitudinal creamish yellow band on midventral line; dorsal, adipose and caudal fin bases plain; dorsal spine smooth posteriorly ..... *G. ventrolineatus*

pectoral and dorsal spines.

Differentiating characters between *G. ngapang* and *G. dorsalis* sensu stricto are shown in Table 2. *G. ngapang* sp. nov. can be diffenrentiated from *G. minutus* sensu Hora in having thoracic adhesive apparatus V-shaped vs. U-shaped; dorsal spine serrated vs. smooth; pectoral and pelvic fins spotted brown vs. plain; anal fin with ii, 11 vs. iii, 9 rays; pectoral spine with 10-12 vs. 6 serrae.

Glyptothorax ngapang sp. nov. can be differentiated from *G. minimaculatus* Li, a species from Tengchong Xian, Yunnan, China (Salween) in having skin tuberculated vs. granulated; plaques on body absent vs. present.

***G. granulus* sp. nov.:** *Glyptothorax granulus* sp. nov., *G. sinense* and *G. manipurensis* are similar in continuous teeth band on upper jaw, two bands in lower jaw; occipital process not reaching pterygiophore; adhesive apparatus present only on chest; dark patches below adipose and caudal fin bases and slender nuchal plate on pterygiophore. *G. granulus* sp. nov. and *G. manipurensis* are similar in addition to the aforesaid characters in having a thoracic adhesive apparatus with a caudally open central depression; dorsal spine serrated with antrose serrae; pectoral spine with equal number of serrae; no ridges or bumps in front of adipose fin. Differentiating characters between the three species are presented in Table 3. *Glyptothorax granulus* sp. nov. can be differentiated from *G. zanaensis* Wu, He & Chu from Qinghai-Xizang plateau region, China in having dorsal, adipose and caudal fin bases black vs. plain.

Most species in the family Sisoridae either are monotypic or include few species, and they are usually relatively well circumscribed by one or more putatively synamorphic traits. The most striking exception is the genus *Glyptothorax* with about 40 species (Li, 1986), which has served as a taxonomic wastebasket for species lacking the evident diagnostic characters of other genera (dePinna, 1996). Hora (1923) referred to the genus to be still in process of adaptation to life in hill streams and the specific characters in them are not yet properly fixed. The statements need reconsideration because descriptions of most of the species are based on few samples. Development of special adaptive structures in hill stream forms varies in the ontogenic development. Larger sampling and examination of specimens of different stages of life might solve the problem.

Hora (1923) divided the genus *Glyptothorax* into two groups, first: adhesive apparatus only present on the chest and second: the apparatus equally well developed on the outer rays of the paired fins. The first group, herein referred to as "*G. manipurensis* group" has well developed adhesive apparatus only on the chest which is longer than broad; head and body not greatly depressed; spines of dorsal and pectoral fins strong and osseous. The second, herein referred to as "*G. pectinopterus* group" has equally well developed adhesive organ on the outer rays of the paired fins; head and body greatly flattened; dorsal spine weaker and pectoral spine showing indentations along outer border; adhesive apparatus on the thorax considerably reduced and broader than long. All the known species from the state have adhesive apparatus only on the chest, which are longer than broad and smooth undersurface of outer rays of paired fins. They are considered representatives of "*G. manipurensis* group".

It is clear that *Glyptothorax cavia* and *G. manipurensis* are Ganga-Brahmaputra forms, *G. burmanicus*, *G. chindwinica* sp. nov., *G. dorsalis*, *Glyptothorax granulus* sp. nov. and *G. ngapang* sp. nov., are Chindwin-Irrawady forms, *G. sinense*, is a Yangze form and *G. platypogonides*, is a Sundaland form.

Earlier fish taxonomy was often based on a limited sample sizes and poorly preserved specimens. Failing to interpret the reason for observed variability: ontogenic, geographic, intra- or interspecific; taxonomists conservatively concluded for intraspecific variability (Ng & Kottelat, 2000). The present concept is that fresh water fishes are distributed in a particular river basin. Their congeners in an entirely separated different basin are proved to be different species. Various revisional studies of 'such highly variable' and widely distributed forms of earlier days have now shown to be aggregates of distinct, often not even closely related species (Roberts & Ferraris, 1998; Ferraris & Runge, 1999; Ng, 2003; Chakrabarty & Ng, 2005; Ng & Kottelat, 2000; Kottelat 1996; Kottelat & Lim 1993).

Comparative Materials

1. Glyptothorax cavia, left Bank of Kosi river, two furlongs down the confluence with the Arun river at Tribeni, Nepal, Kosi survey, F218/2, 2; 86.4 and 98.0 mm SL. Same data, F219/2, 2; 82.8 and 80.3 mm SL.

2. G. trilineatus, Tenasserim, Burma, coll. Major Berdmore, ZSI F10380/1, 79.0 mm SL (Holotype).
3. G. trilineatus ? ZSI 12460/1 & 2 (61.4 and 71.3 mm SL), Namya River, Kongan Thana, coll. S. G. Duncan.
4. Glyptothorax striatus, Uncat., 2 (79.7 and 83.0 mm SL), ICAR Complex for NE region, Barapani, Meghalaya, India, coll. B. K. Mahapatra.
5. G. sinense, ZSI F12209/1 (60.7 mm SL), Donated by Fan Memorial Institute of Biology, Peiping, China.
6. G. platypogonides, ZSI F2889/2 (76.5 and 100.2 mm SL), Imphal stream, at Sekmaijin khanang, Manipur, C. B. Srivastava.

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