FISH OF THE NAGA HILLS, ASSAM.

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(Plate VII)

INTRODUCTION.

In 1921, one[1] of us published an account of the " Fish and Fisheries of Manipur with some observations on those of Naga Hills " and recorded 17 species from streams with rocky beds in the northern watershed (Brahmaputra drainage) and 18 species from similar streams in the southern watershed (Chindwin drainage) of the Naga Hills. The lists included the 3 species mentioned by Day in the *Fauna of British India* from the Naga Hills and the two species described by Chaudhuri[2] from this area. Only 3 species, *viz.*, *Barbus hexastichus*, *Barilius barila* and *Danio aequipinnatus*, were known to be common to both the watersheds; this reduces the total of the species known from the Naga Hills to 32[3]. It may be noted here that under the name Naga Hills is included all the country inhabited by the Naga tribes and not merely the district to which the name is officially applied.

The interest of the fish fauna of the Naga Hills lies in the fact that it contains representatives of the Assamese and the Burmese elements in almost equal proportions. To study this point in detail one of us requested Dr. J. H. Hutton, Deputy Commissioner of the Naga Hills, in 1927 to make a collection of fish during the course of one of his tours to an unfrequented part of the hills. Dr. Hutton agreed to this suggestion and procured a valuable collection for the Zoological Survey of India. Early this year Dr. B. Prashad and Dr. B. Chopra visited the Naga Hills to study certain zoogeographical problems and in the course of their investigations made an extensive collection of fishes.

The present paper deals mainly with these two collections.

Dr. Hutton made collections at the following places :—

Zhokami Tekhubami Mekruchu Mohumi	Brahmaputra drainage (Dayang Valley).
Purobami Sahunyu Melori Lepori Yisisu Laruri	Chindwin drainage (Tizu Valley).

[1] Hora, *Rec. Ind. Mus.* XXII, pp. 165-214, pls. ix-xii (1921).

[2] Chaudhuri, *Rec. Ind. Mus.* VII, p. 443, pl. xl, figs. 4, 4*a*, 4*b* and pl. xli, figs. 1, 1*a*, 1*b*; p. 441, pl. xl, figs. 1, 1*a*, 1*b* (1912).

[3] In 1921, Dr. Murray Stuart of the Geological Survey of India made a small collection of fish, comprising 11 species (Hora, *Rec. Ind. Mus.* XXII, p. 743, 1921) from the North-eastern border of Burma and the Naga Hills. As the exact localities of the species are not known, we have not included these forms in our treatment of the fish fauna of the Naga Hills. It may be remarked that 4 out of the 11 species, *viz.*, *Garra gotyla*, *Barbus chrysopterus*, *Barilius vagra* and *Ambassis nama*, are not represented in other collections from the Naga Hills.

Drs. Prashad and Chopra made collections at the following places :—

Kohima	Brahmaputra drainage.
Mao	
Chakabama	
Kekrima	
Emilomi	
Khezhabama	Chindwin drainage.
Phekrokejima	
Chepoketami	
Sakhai	
Sakhalu	

There are altogether 23 species in the two collections and of these 11, *i.e.*, *Amblyceps mangois*, *Exostoma labiatum*, *Barbus ticto*[1], *Crossochilus latius*, *Garra lissorhynchus*, *Garra kempi*, *Oreinus molesworthi*, *Psilorhynchus homaloptera*, sp. nov., *Nemachilus rupecola*, *N. subfusca*, and *Ophicephalus gachua*, are recorded from the Naga Hills for the first time. Though only one new species has been discovered in the collections under report, it has been possible to elucidate the precise specific limits of *Barbus hexagonolepis*, *Nemachilus manipurensis* and *N. subfusca*, while the geographical distribution of a number of species has been more precisely determined. For instance, *Exostoma labiatum*, *Barbus clavatus*, *B. hexagonolepis*, *Garra lissorhynchus*, *G. kempi*, *G. naganensis* and *Oreinus molesworthi*, which were hitherto known from the Brahmaputra drainage system, are now recorded from the Chindwin drainage system also. Species like *Brachydanio acuticephala* and *Nemachilus manipurensis*, which were known only from the Chindwin drainage system, have now been discovered in the Brahmaputra basin also.

44 species are now known from the Naga Hills. These species, together with their distribution as now known, are listed below :—

Serial Number.	Specific Name.	Brahmaputra Drainage System.	Chindwin Drainage System.	Widely distributed.
	BAGRIDAE.			
1	*Mystus bleekeri* (Day)	..	..	×
	SILURIDAE.			
2	*Ompok bimaculatus* (Bloch)	..	..	×
	AMBLYCEPIDAE.			
3	*Amblyceps mangois* (Hamilton)	..	..	×
	SISORIDAE.			
4	*Erethistes hara* (Hamilton)	..	..	×
5	*Erethistes elongata* Day	×	..	..
6	*Exostoma labiatum* (McClell.)	×	×	..

[1] *Barbus ticto* was obtained by one of us from the sluggish waters of the Manipur Valley, but it is recorded here from the Naga Hills.

Serial Number.	Specific Name.	Brahmaputra Drainage System.	Chindwin Drainage System.	Widely distributed.
	CYPRINIDAE.			
7	*Danio* (*Danio*) *dangila* (Hamilton)	..	..	×
8	*Danio* (*Danio*) *aequipinnatus* (McClell.)	..	..	×
9	*Danio* (*Danio*) *naganensis* Chaudhuri	..	×	..
10	*Danio* (*Brachydanio*) *acuticéphala* Hora	×	×	..
11	*Rasbora rasbora* (Hamilton)	..	..	×
12	*Barilius barila* (Hamilton)	..	..	×
13	*Barilius dogarsinghi* Hora	..	×	..
14	*Barilius bendelesis* var. *chedra* (Hamilton).	×†	..	..
15	*Barbus clavatus* McClell.	×	×	..
16	*Barbus tor* (Hamilton)	..	..	×
17	*Barbus hexagonolepis* McClell.	×	×	..
18	*Barbus conchonius* (Hamilton)	..	..	×
19	*Barbus oatesii* Boulenger	..	×	..
20	*Barbus ticto* (Hamilton)	..	..	×
21	*Crossochilus latius* (Hamilton)	..	..	×
22	*Garra rupeculus* (McClell.)	×	×	..
23	*Garra abhoyai* Hora	..	×	..
24	*Garra naganensis* Hora	×	×	..
25	*Garra kempi* Hora	×	×	..
26	*Garra lissorhynchus* (McClell.)	×	×	..
27	*Oreinus molesworthi* Chaudhuri	×	×	..
	PSILORHYNCHIDAE.			
28	*Psilorhynchus* sp. Hora	×	..	..
29	*Psilorhynchus homaloptera*, sp. nov.	×	..	..
	COBITIDAE.			
30	*Lepidocephalichthys berdmorei* (Blyth)	..	×*	..
31	*Lepidocephalichthys guntea* (Hamilton)	×†	..	..
32	*Acanthophthalmus pangia* (Hamilton)	×	×*	..
33	*Nemachilus manipurensis* Chaudhuri	×	×	..

* denotes that the species is found in Burma also.
† denotes that the species is found in other parts of India also.

Serial Number.	Specific Name.	Brahmaputra Drainage System.	Chindwin Drainage System.	Widely distributed.
	COBITIDAE—*contd.*			
34	*Nemachilus zonalternans* (Blyth)	..	×*	..
35	*Nemachilus sik maiensis* Hora	..	×	..
36	*Nemachilus kangjupkhulensis* Hora	..	×*	..
37	*Nemachilus prashadi* Hora.	..	×	..
38	*Nemachilus botia* (Hamilton)	..	..	×
39	*Nemachilus rupecola* (McClell.)	×†	..	..
40	*Nemachilus subfusca* (McClell.)	×	..	..
	MASTACEMBELIDAE.			
41	*Rhynchobdella dhanasorii* Hora	×	..	..
	NANDIDAE.			
42	*Badis badis* (Hamilton)	..	..	×
	OPHICEPHALIDAE.			
43	*Ophicephalus gachua* Hamilton	..	..	×
44	*Ophicephalus punctatus* Bloch.	..	..	×

* denotes that the species is found in Burma also.
† denotes that the species is found in other parts of India also.

Of the 44 species listed above, 16 are widely distributed in India and Burma; 11 are common to the Brahmaputra and the Chindwin drainage basins, though *Acanthophthalmus pangia* is found in Burma also; 8 species are found only in the Brahmaputra drainage of the Naga Hills, but of these *Nemachilus rupecola*, *Lepidocephalichthys guntea* and *Barilius bendelesis* are also found in other parts of India. Similarly, of the 9 species found only in the Chindwin drainage of the Naga Hills, *Nemachilus zonalternans*, *N. kangjupkhulensis*, *Lepidocephalichthys berdmorei* and *Barbus oatesii* are found in Burmese waters also.

Another point of zoogeographical interest is the similarity between the fish fauna of the Garo Hills, the Mishmi Hills, the Khasi Hills and the Naga Hills *inter se* and of these hills with that of the Eastern Himalayas. This is particularly true of the forms adapted to live in torrential streams, such as *Exostoma labiatum*, *Erethistes elongata*, *Garra kempi*, *G. lissorhynchus*, *Oreinus molesworthi*, *Nemachilus rupecola*, *N. subfusca*, etc. From a study of the Batrachian fauna of the Abor Hills, Annandale[1] concluded that "All the evidence at present available, therefore, supports the view that the fauna of the extreme eastern part of the

[1] Annandale, *Rec. Ind. Mus.* VIII, p. 36 (1912).

Himalayan foot-hills is not, at any rate so far as the frogs and toads are concerned, Himalayan in the sense in which the term has hitherto been understood, but allied rather to the fauna of Assam south of the Brahmaputra or even to that of Burma." Our studies on the distribution of fishes from these regions also lead us to similar conclusions.

The above list of species also shows that the fish fauna of the Naga Hills contains a great preponderance of the Ostariophysi, 40 out of a total of 44 species. Of these 40 species, 6 belong to the Siluroidea (1 Bagridae, 1 Siluridae, 1 Amblycepidae and 3 Sisoridae) and the remaining to the Cyprinoidea (21 Cyprinidae, 2 Psilorhynchidae and 11 Cobitidae). The remaining 4 species are distributed among the families Mastacembelidae, Nandidae and Ophicephalidae.

The 44 species known from the Naga Hills belong to 19 genera, all of which, with the possible exception of *Psilorhynchus*, are fairly widely distributed in India and Burma. It is thus seen that the Naga Hills—the watershed of the principal Burmese (Irrawaddy) and Assamese (Brahmaputra) drainage systems—have no endemic element so far as the genera of fishes are concerned. Among the species, however, there are 5, *viz.*, *Danio naganensis*, *Barilius dogarsinghi*, *Garra abhoyai*, *Nemachilus sikmaiensis* and *N. prashadi*, which are so far konwn only from the Chindwin drainage of the Naga Hills and 3, *Psilorhynchus* sp., *P. homaloptera* and *Rhynchobdella dhanasorii*, from the Brahmaputra drainage. *Danio* (*Brachydanio*) *acuticephala*, *Garra nanagensis* and *Nemachilus manipurensis* are also endemic in the Naga Hills, though they are found equally abundantly in both the watersheds. Thus 25 per cent. of the fish are endemic in the Naga Hills.

We have to thank Dr. J. H. Hutton for the very careful way in which his collection was preserved and labelled. To Drs. B. Prashad and B. Chopra we are grateful for devoting a considerable part of their time in the Naga Hills to the collection of fishes. Babu R. C. Bagchi has executed the drawings with his usual skill and care, and for this we are thankful to him.

Systematic description.

BAGRIDAE.

Mystus bleekeri (Day).

1921. *Macrones bleekeri*, Hora, *Rec. Ind. Mus.* XXII, p. 179.

1 specimen. Melori, Tizu River. J. H. Hutton, March 1927.

Mystus bleekeri is represented in Dr. Hutton's collection by a young specimen about 90 mm. in total length.

SILURIDAE.

Ompok bimaculatus (Bloch).

1921. *Callichrous bimaculatus*, Hora, *Rec. Ind. Mus.* XXII, p. 178.

1 specimen. Melori, Tizu River. J. H. Huttom, March 1927.

The only specimen of *Ompok bimaculatus* in Dr. Hutton's collection is about 142 mm. in total length.

AMBLYCEPIDAE.

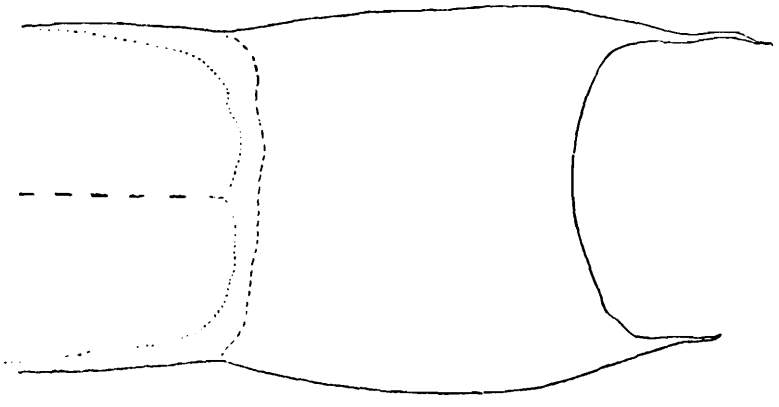
Amblyceps mangois (Hamilton).

1933. *Amblyceps mangois*, Hora, *Rec. Ind. Mus.* XXXV, p. 617.

1 specimen. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

17 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

One of us (Hora, *op. cit.*, pp. 607-621) has recently discussed the taxonomy and bionomics of the loach-like fishes of the genus *Amblyceps*. In most of the specimens under report the caudal fin is almost truncate



TEXT-FIG. 1.—Outline sketch of caudal fin of a specimen of *Amblyceps mangois* (Hamilton) from Lizho stream near Sakhai showing prolonged outer rays. × 3.

or slightly emarginate. In the example from the Lizho stream, however, the end rays of the caudal fin are produced into thread-like processes although the fin is not deeply emarginate as is usually the case with the Siamese examples.

The largest specimen is about 120 mm. in total length.

SISORIDAE.

Exostoma[1] **labiatum** (McClelland).

1923. *Glyptosternum labiatum*, Hora, *Rec. Ind. Mus.* XXV, p. 42, pl. i, fig. 2.

4 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

4 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

2 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

15 specimens. Sakhalu, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

Exostoma labiatum has hitherto been known from the Mishmi and the Abor Hills in the Brahmaputra drainage basin. It is of interest to note that all the specimens recorded here were obtained from the Chindwin drainage basin.

The largest specimen is about 87 mm. in total length.

[1] One of us (Hora, *Rec. Ind. Mus.* XXV, p. 8, 1923) considered *Exostoma* Blyth to be a synonym of *Glyptothorax* Blyth as the type-species of the former—*E. berdmorei* Blyth—is indistinguishable from species included under *Glyptothorax*. The name is, however, used here in a loose but hitherto accepted sense, for the sake of convenience.

CYPRINIDAE.

Danio (Danio) aequipinnatus (McClelland).

1934. *Danio (Danio) aequipinnatus*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, p. 131.

1 specimen. Mohumi village, sources of the Rengma River. J. H. Hutton, March 1927.

3 specimens. Chakhabama, Sidzu River. B. Prashad & B. Chopra, 17th February 1935.

Several specimens. Emilomi, Kéieki stream. B. Prashad & B. Chopra, 26th February 1935.

Danio aequipinnatus is a widely distributed species, though in the collections before us it is represented from 3 localities in the Brahmaputra basin.

The largest specimen is about 102 mm. in total length.

Danio (Danio) naganensis Chaudhuri.

1912. *Danio naganensis*, Chaudhuri, *Rec. Ind. Mus.* VII, p. 441, pl. xl, figs. 1, 1*a*, 1*b*.

1 specimen. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

12 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of Tizu; Yisisu, Yazhiluwu River; a tributary of Tizu. J. H. Hutton, March 1927.

2 specimens. Laruri, Zhuzeti stream, a tributary of Titlo or Namtaleik. J. H. Hutton, March 1927.

4 specimens. Khezhabama (Chizami), Chiteri stream. B. Prashad & B. Chopra, 20th February 1935.

Numerous specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

Numerous specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

Danio naganensis was described by Chaudhuri from the Lungting River, Naga Hills, Manipur. The collections under report show that the species is very common and widely distributed in the Chindwin drainage of the Naga Hills. In most of the characters it is similar to *D. aequipinnatus*, but can be distinguished from it by its less deep body, one broad lateral band and eight divided rays in the dorsal fin. Moreover the eggs of *D. naganensis* are relatively much larger than those of *D. aequipinnatus*. From the distribution of the two species, as judged by the collections under report, it seems probable that *naganensis* replaces *aequipinnatus* in the Chindwin drainage of the Naga Hills.

The largest specimen is about 88 mm. in total length.

Danio (Brachydanio) acuticephala Hora.

1921. *Danio (Brachydanio) acuticephala*, Hora, *Rec. Ind. Mus.* XXII, p. 193.

8 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

3 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

Brachydanio acuticephala was described from a very large number of specimens collected from the small streams and ponds of the Manipur Valley. Dr. J. H. Hutton obtained specimens from springs forming

the sources of the Dayang (Brahmaputra basin) and Tizu (Chindwin basin) Rivers.

In our[1] recent key to the species of the subgenus *Brachydanio, acuticephala* was included among the forms characterised by "Lateral line short, not extending beyond pectoral fin." We find, however, that the lateral line is totally absent in this species. The absence of barbels distinguishes it from the other species in which the lateral line is totally absent.

The largest specimen in Dr. Hutton's collection is about 35 mm. in total length.

Barilius barila (Hamilton).

1921. *Barilius barila*, Hora, *Rec. Ind. Mus.* XXII, p. 190.

2 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

1 specimen. Chakabama, Sidzu River. B. Prashad & B. Chopra, 16th February 1935.

4 specimens. Sakhai, Lizho stream B. Prashad & B. Chopra, 23rd February 1935.

6 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 24th February 1935.

The specimens of *Barilius barila* in the collections under report show the morphological characteristics referred to by one of us (Hora, *op. cit.*) as adaptations to life in hill streams.

The largest specimen is about 148 mm. in total length.

Barbus clavatus McClelland.

1921. *Barbus clavatus*, Hora, *Rec. Ind. Mus.* XXII, p. 185, pl. ix, fig. 1.

4 specimens. Chipoketami, Tese-rü River. B. Prashad & B. Chopra, 22nd February 1935.

12 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd September 1935.

7 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd September 1935.

One of us discussed the systematic position of *Barbus clavatus* in 1921 and re-described the species from specimens collected in the Senapati stream (Barak River) at Kairong. The species had hitherto been found only in the Brahmaputra drainage system, but all the specimens under report were collected from the Tizu River or its tributary streams which ultimately drain into the Chindwin River. The specimens are well preserved and agree with the examples described from Kairong.

B. clavatus is readily distinguished by its large armed dorsal spine and by the black markings on the membranes in between the dorsal fin rays.

Attention may here be directed to the fact that one of us[2] described a variety of this species from the Myitkyina District, Upper Burma. The Burmese form is distinguished by its longer snout, shorter dorsal spine, lepidosis and colouration.

The largest specimen is about 200 mm. in total length.

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[1] Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, pp. 130, 131 (1934).

[2] Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVII, pp. 64-67, text-figs. 10, 11; pl. iii, fig. 1 (1934).

Barbus hexagonolepis McClelland.

1839. *Barbus hexagonolepis*, McClelland, *As. Res.* (Ind. Cyprinidae) XIX pp. 270, 336, pl. xli, fig. 3.
1878. *Barbus hexagonolepis*, Day, *Fish. Ind.*, p. 564, pl. cxxxvii, fig. 4.
1921. *Barbus hexastichus*, Hora (*nec* McClleland), *Rec. Ind. Mus.* XXII, p. 186.
1924. *Barbus hexastichus*, Hora (*nec* McClelland), *Rec. Ind. Mus.* XXVI, p. 27.

Several specimens (fry). Melori, Tizu River; Leori, Phodung River, a tributary of Tizu; Yisisu, Yazhiluwu River; a tributary of Tizu. J. H. Hutton, March 1927.

Several specimens (fry). Khazhabama (Chizami), Chiteri stream. B. Prashad & B. Chopra, 20th February 1935.

5 specimens. Chipoketami, Tese-rü River. B. Prashad & B. Chopra, 22nd February 1935.

7 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 24th February 1935.

Several specimens (fry). Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Barbus hexagonolepis appears to be the commonest species in the hills of Assam. According to Day "The character of the interrupted groove behind the lower lip at once distinguishes this species from B. *hexastichus*." It seems probable that the fry of both the species have black spots on either side before the base of the caudal fin. This juvenile character of the fry led one of us to refer specimens of *B. hexagonolepis* from the Naga Hills and the Garo Hills to *B. hexastichus*. A thorough examination of the specimens has shown that *B. hexagonolepsis* has a more slender body form, 28-30 scales along the lateral line and an interrupted groove behind the lower lip.

Barbus hexastichus is very closely related to *B. tor* (Hamilton). The races and varieties of the latter are not yet properly understood. It is difficult, therefore, to define the precise systematic position of *B. hexastichus*.

The largest specimen is about 300 mm. in total length.

Barbus ticto (Hamilton).

1921. *Barbus ticto*, Hora, *Rec. Ind. Mus.* XXII, p. 187.

1 specimen. Mohumi, sources of the Rengma River. J. H. Hutton, March 1927.

The only specimen of *Barbus ticto* in Dr. Hutton's collection is about 67 mm. in total length. Besides the usual spots on the sides of the tail, the distal half of the dorsal fin is grayish in colour.

Crossochilus latius (Hamilton).

1934. *Crossochilus latius*, Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 49, fig. 6.

1 specimen. Melori, Tizu River. J. H. Hutton, March 1927.

The specimen of *Crossochilus latius* conforms to the Siamese and Burmese form of the species as recently defined by one of us (Mukerji, *op. cit.*). This race differs from the *forma typica* from Northern Bengal in having 8 scales in a transverse series and 15 to 16 round the caudal peduncle. The form is depressed and slender and the head is relatively longer (4·3 to 4·8 times in the length of the body without the caudal as against 5 to 5·2 times in the typical form).

The specimen is about 120 mm. in total length.

Garra lissorhynchus (McClelland).

1921. *Garra lissorhynchus*, Hora, *Rec. Ind. Mus.* XXII, p. 662, pl. xxvi, figs. 2, 2*a*.

1 specimen. Zhokami and Tekhubami, source of the Dayang River. J. H. Hutton, March 1927.

2 specimens. Sakhai, Lizho stream B. Prashad & B. Chopra, 23rd February 1935.

5 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

In all the 8 specimens the dorsal and the caudal fins bear the characteristic markings of the female as described by one of us (Hora, *op. cit.*). In 5 examples the body cavity is full of ova in various stages of development, while in the remaining three there are only empty sac-like structures.

G. lissorhynchus has so far been known from the Khasi and Jaintia Hills which are situated in the Brahmaputra basin. The species is here recorded from the Chindwin basin for the first time.

In colour markings the female specimens of *G. lissorhynchus* resemble *G. abhoyai* Hora, but the two species differ in general facies and lepidosis.

The largest specimen is about 75 mm. in total length.

Garra kempi Hora.

1921. *Garra kempi*, Hora, *Rec. Ind. Mus.* XXII, p. 665, pl. xxvi, figs. 3, 3*a*.

8 specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

15 specimens. Melori, Tizu River; Leori, Phodung R., tributary of Tizu; Yisisu, Yazhiluwu R., tributary of Tizu. J. H. Hutton, March 1927.

3 specimens. Laruri, Zhuzeti stream, a tributary of the Titlo or Namtaleik. J. H. Hutton, March 1927.

Numerous specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

Garra kempi was originally described from a single specimen procured by Dr. S. W. Kemp from the Siyom River, below Damda in the Abor Hills. The waters from these hills drain into the Brahmaputra. The large number of specimens under report come from several small streams which join the Tizu River, a tributary of the Chindwin River.

The species is readily distinguished by the large size of its mental disc and by the fact that the anal opening is situated very far forwards, *i.e.*, almost midway between the commencement of the anal and that of the ventral fins.

The largest example is about 110 mm. in total length.

Garra naganensis Hora.

1921. *Garra naganensis*, Hora, *Rec. Ind. Mus.* XXII, p. 667, pl. xxv, figs. 2, 2*a*.

5 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

1 specimen. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

7 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of the Tizu; Yisisu, Yazhiluwu River, tributary of Tizu. J. H. Hutton, March 1927.

1 specimen. Laruri, Zhuzet stream, a tributary of the Titlo or Namtaleik. J. H. Hutton, March 1927.

2 specimens. Stream at Mao. B. Prashad & B. Chopra, 14th February 1935.

17 specimens, Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

Numerous specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Garra naganensis was described from a single specimen collected at Kairong in the Senapati stream (Barak River) which drains into the Brahmaputra. The collections under report contain a large number of specimens of all sizes both from the Brahmaputra and the Chindwin drainage systems.

The species is distinguished from the preceding form by its small transversely oval mental disc and by the fact that the anal opening is situated much nearer the commencement of the anal fin than that of the ventral fins.

The largest specimen is about 130 mm. in total length.

Oreinus molesworthi Chaudhuri.

1913. *Oreinus molesworthi*, Chaudhuri, *Rec. Ind. Mus.* VIII, p. 247, pl. vii, fig. 2, 2*a*, 2*b*.

7 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

2 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 24th February 1935.

1 specimen. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Oreinus molesworthi was described from a single specimen obtained at Yembung in the Abor Hills. Since then it has been found in the Eastern Himalayas below Darjeeling[1]. The range of the species is here extended to the Chindwin drainage system for the first time.

The largest specimen is about 235 mm. in total length.

PSILORHYNCHIDAE.

Psilorhynchus homaloptera, sp. nov.

(Plate VII, figs. 1-6).

17 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February, 1935.

D. 2/7 ; A. 2/5 ; P. 7-8/9 ; V 2/7 ; C. 18 : L. l. 42-44 ; L. tr. 6-7 (3+3 or $3\frac{1}{2}+3\frac{1}{2}$).

In its depressed and flattened body, general facies and build *Psilorhynchus homaloptera* superficially resembles some of the highly specialised Homalopterid fishes. The dorsal profile is evenly arched ; it rises gently from the tip of the snout to the insertion of the dorsal fin, beyond which it slopes down gradually to the root of the caudal fin. The ventral profile is more or less horizontal or very slightly arched. The ventral surface of the head and the chest are flat and horizontal. The maximum depth of the body lies in front and below the dorsal fin. The caudal peduncle is short and fairly compressed ; its least height is contained from 1·4 to 1·7 times in its length.

[1] Hora, *Rec. Ind. Mus.* XXII, p. 734 (1921).

The head is greatly depressed, small and sub-triangular. The length of the head is contained from 5·1 to 5·6 times in the length of the body excluding the caudal fin. The height of the head at the occiput is equal to its length behind the nostrils. The snout is spatulate, smooth, obtusely pointed and has trenchant margins; it is considerably longer than the post-orbital part of the head, its length being contained about 2 times in the length of the head. The eyes are rather small, globular and dorso-lateral; they are situated almost entirely in the posterior half of the head. They are provided with free orbital margin and are not visible from the ventral surface. The diameter of the eye is contained from 3·6 to 4 times in the length of the head. The interorbital space is flat and much wider than the orbit. The gill openings are narrow; they extend from the lateral line as far down as the termination of the base of the pectoral fins. The nostrils are fairly large and situated much nearer the anterior margins of the eyes than the tip of the snout; they are separated by a conspicuous membranous flap. The internarial distance is almost equal to the length of the head behind the middle of the eyes.

The mouth is ventral and its opening is slightly arched; the width of the gape is equal to the length of the head behind the middle of the eyes. The upper jaw overhangs the vestibulum of the mouth. Both the upper and the lower jaws are provided with sharp rasping horny edges, bordered by thick, fleshy lips which are entire. The lips are not continuous at the angles of the mouth. The upper lip is narrow, somewhat tough and partly covered with the rostral fold. The lower lip, with its posterior superficial part, is in the form of a broad, thick flap which is free from the jaw. A fairly deep, distinct lateral furrow passes on either side from the post-labial groove to the sides of the snout, and marks off the mouth parts and the thick rostral fold. The rostral fold and the under surfaces of the chins are sparsely studded with minute tubercles, while the skin behind the lower lip is somewhat papillated.

The dorsal fin is in advance of the ventrals and its commencement is much nearer the tip of the snout than the root of the caudal; it is almost equidistant between the anterior margin of the eye and the commencement of the anal. The height of the fin is somewhat variable; it may be equal to or a little higher than the depth of the body below it. Its free margin is straight and oblique. The pectoral fins are pedunculate, broad, expanded and fan-shaped with a rounded free margin. They are horizontally placed, considerably longer than the head and are separated from the ventrals by a distance equal to one-third of their own length. The ventral fins are like the pectorals; they are somewhat shorter and have an oblique base, so that the fins on the two sides converge when folded back. They have a more or less truncate free margin, and they extend considerably beyond the anal opening which is situated nearer the tip of the ventrals than their origin. The anal fin is short and, like the dorsal, has a straight and oblique outer margin. It is about twice as long as its base and about one and half times longer than the height of the body above it. The caudal fin is lunate with unequal and angulate lobes, the lower lobe being slightly longer than the upper. It is considerably longer than the head and its own height.

The lateral line is feebly arched and runs along the middle of the body to that of the root of the caudal fin. The scales are fairly large, thin, and firmly adherent; they are arranged more or less regularly on the body. There are from 14 to 15 scales before the dorsal fin and 12 round the caudal peduncle. The number of perforated scales along the lateral line varies from 42 to 44. The number of scales in a transverse series between the bases of the dorsal and the ventral fins is also somewhat variable. Usually there are 7 rows, $3\frac{1}{2}$ rows being arranged between the base of the dorsal and the lateral line and $3\frac{1}{2}$ rows between the lateral line and the bases of the ventrals. In some specimens, there are only 6 rows, 3 rows above and 3 rows below the lateral line. The under surface of the body from the chest to the origin of the ventrals is perfectly smooth and devoid of scales.

The air bladder though still of the normal Cyprinid type has undergone considerable degeneration. In all essential features it is like that of *P. balitora* and *P. sucatio*, but is very much reduced. The anterior chamber is pea-shaped and somewhat flattened dorso-ventrally. The posterior chamber is very much smaller than the anterior chamber, but is more or less similar in shape. It has shifted from its original or normal position and is superimposed medially on the posterior part of the anterior chamber where it is partly tucked in a shallow invagination. The walls of both the chambers are thick and fibrous. The transverse processes of the second vertebra, on which the air-bladder rests, are considerably modified (pl. vii, fig. 5) so as to provide a bony covering for the anterior end of the bladder.

The basipterygium, like that of *P. balitora*, described and figured by one of us[1], has undergone complete ossification so as to form a shield-like structure, similar to that found in most Homalopterid fishes. It is slightly longer than broad, broadest at the zone of the ventral fin rays, and is destitute of well differentiated antero-medial or lateral horns. Anteriorly the basipterygum is broadly rounded. A fairly elevated, oblique and narrow ridge passes on either side on the dorsal surface of the basipterygium, almost parallel to the antero-lateral border. It extends as far as the anterior margin of the zone of the ventral fin rays and externally cuts off a fairly wide, elongated strip which is concave throughout, while internally these two longitudinal ridges, together with the postero-medial ridges meeting in the centre, enclose an obtusely triangular, broad space. This triangular enclosed area has a heart-shaped central, convex surface. The latero-posterior border of the basipterygium, *i.e.*, the zone of the ventral fin rays, is more or less flat and is provided with an antero-lateral and a postero-lateral angle. Near each antero-lateral angle are present two lateral foramina for connecting the basipterygium with the modified rib. This state of affair is very characteristic of *P. homaloptera*. In *P. balitora* and *P. sucatio* lateral foramina are altogether absent, while in Homalopterid fishes, when present, there is only a single foramen. The postero-medial horns are fairly developed and are widely separated by flat transverse processes. Above the base of each postero-lateral horn there is a short and angular sub-vertical process (pl. vii, fig. 4).

[1] Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVI, p. 826, fig. 2 (1933).

The structures of the pharyngeal bone and teeth (pl. vii, fig. 6) correspond almost entirely to those of *P. sucatio* described and figured by one of us[1]. The pharyngeal bones are roughly triangular in outline, and in a specimen, 80 mm. long, the length of their base is about 2 mm. The teeth are set close together on a broad apex; they are slender, almost of uniform length and thickness, hooked at the tip and arranged in a single row. Their approximate length is 0·6 mm.

The colouration in alcohol is uniformly pale olivaceous green, except for the ventral surface which is somewhat lighter. The head and the body are spattered all over with fine black dots. A fairly broad dusky lateral band passes, along the lateral line, from the angle of the operculum to the root of the caudal fin. In certain specimens a similar band passes dorsally from the occiput to the tail, while in others this band may break up, partly or entirely, into small irregular blotches. All the fins are more or less dusky.

Type-specimen.—F. 11792/1, in the collection of the *Zoological Survey of India* (*Ind. Mus.*), *Calcutta.*

Measurements in millimetres.

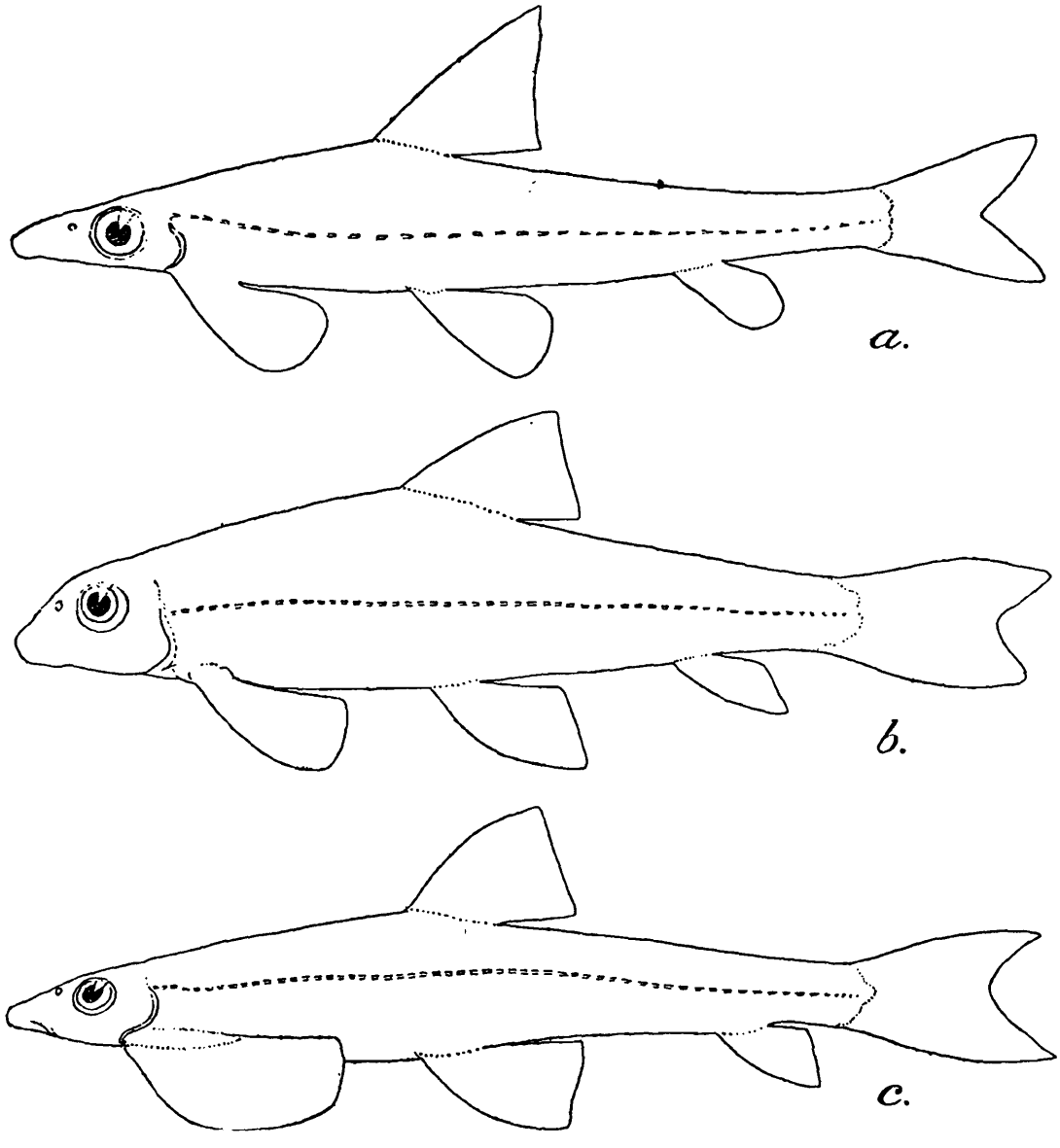
	Type.			
Length of body without caudal	64·0	59·0	57·0	56·0
Height of body	12·0	11·0	9·5	9·0
Length of head	12·0	11·0	11·0	10·0
Breadth of head	10·0	10·0	10·0	10·0
Height of head at occiput	7·5	7·0	7·0	6·5
Length of snout	6·0	5·5	5·5	5·0
Diameter of eye	3·0	3·0	3·0	2·5
Interorbital width	5·0	5·0	5·0	4·5
Height of dorsal fin	12·5	11·0	10·0	10·5
Length of pectoral fin	16·5	15·0	13·5	13·0
Height of anal fin	9·0	8·5	8·0	8·0
Length of caudal fin	14·0	13·0	12·5	12·5
Length of caudal peduncle	8·0	9·0	8·0	8·0
Least height of caudal peduncle	5·5	5·5	5·0	4·5

Remarks.—The systematic position of the genus *Psilorhynchus* has been elucidated only in recent years [2] and from a study of the abundant material of *P. sucatio* and *P. balitora* it has been shown that these fishes are sufficiently remarkable to constitute a separate family. They are distinguished by a peculiar type of mouth and lips; absence of barbels; single row of pharyngeal teeth; free, though greatly reduced air-bladder in the abdominal cavity; completely ossified, broad, plate-like basipterygium; and the presence of a number of unbranched rays in the pair fins. Though the new species described here has assumed the form of the most highly specialised Homalopterid fishes, it exhibits all the above characters in a marked degree. *P. homaloptera*, sp. nov. is not only abundantly distinct in general facies and build, but can also be distinguished by its small, dorso-lateral eyes and the larger number of

[1] Mukerji, *Journ. Bombay Hat. Hist. Soc.* XXXVI, p. 828, pl. i, fig. 5 (1933).

[2] Hora, *Rec. Ind. Mus.*, XXVII, pp. 457-460, text-fig. 3 (1925); Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVI, pp. 823-828 (1933).

undivided rays in the pectoral fins. The absence of scales along the entire ventral surface in front of the anal fin is another distinguishing feature of the species.



Text-fig. 2.—Lateral views of three Indian species of *Psilorhynchus* McClelland.

a. Psilorhynchus sucatio (Hamilton). × 1½.
b. Psilorhynchus balitora (Hamilton). × *ca.* 1⅘.
c. Psilorhynchus homaloptera, sp. nov. × 1½.

Our field-notes concerning the ecology of the Indian species of *Psilorhynchus* show that the differences in their form and structure can be correlated with differences in their habitats. *P. sucatio* has a shovel-like head, large lateral eyes, fairly complete lepidosis on the ventral surface behind the bases of the pectorals, a fewer number (4) of unbranched rays in the pectoral fins, and a spindle-shaped form. The species was found by us in larger streams at Siliguri where the bed was either muddy or where a large pool had formed. Specimens were also collected from pebbly beds, but they were not so common in such situations. *P. balitora* has a *Garra*-like appearance, somewhat smaller, dorso-lateral eyes which are not visible from the ventral surface, irregular lepidosis on the ventral surface behind the bases of the pectorals, larger

number (6) of unbranched rays in the pectoral fins and moderately elevated body. It lives in pebbly beds of small rapid-running streams at the base of hills. We collected a very large number of specimens from the Sevoke stream and the Mahanaddi river at the base of the Darjeeling Himalayas. The young specimens reported by one of us (Hora, *Rec. Ind. Mus.*, XIX, p. 211, 1920; *ibid.*, XXII, p. 182, pl. ix, figs. 6, 6*a*, 1921) from the Naga Hills were collected from a pool in the course of a torrential stream at Piphima and as they had not developed all the characters of the adult yet, they cannot throw much light on the adaptations undergone by the species [1]. *P. homaloptera* has a greatly depressed and flattened body, much smaller eyes, naked ventral surface, greatly reduced bladder and large number (8) of undivided rays in the pectoral fins, which are pedunculate. It was collected from the Keleki stream at Emilomi, but unfortunately we have no particulars of its precise habitat, though from an analogy with other torrential fishes, it can be safely assumed that the specimens must have been collected from rapids in the course of the stream.

From a close study of the build and habitat of *P. sucatio* it seems probable that the fish digs in sand or mud where it lives in burrows, though it is also capable of adhering to rocks as was observed by one of us by keeping the specimens in an aquarium. The modifications for digging purposes are (i) greatly flattened, elongated, shovel-like head and trenchant snout, (ii) small, ventral mouth, (iii) absence of barbels, (iv) lateral eyes, (v) a number of undivided rays in paired fins, (vi) position of the paired fins on the ventral surface, (vii) silvery peritoneal lining, and (viii) spindle-shaped body. The position of the paired fins on the ventral surface is rather significant. In all hill-stream fishes the paired fins are horizontal and spread outwards so as to enable the fish to have a greater surface for adhesion; their position on the ventral surface in *P. sucatio*, therefore, suggests that they are not normally used for adhesion in this species. If the fins were to project out at the sides, they will be a great hindrance at the time of burrowing. The lateral eyes are useful because no mud or sand can adhere to them. The undivided rays in the paired fins impart strength to the structures which are presumably used for burrowing. The shape of the head and body, the form and position of the mouth and the absence of barbels are all useful characters for a burrowing fish. The silvery or white peritoneal lining also suggests that the fish does not live in situations where it may be exposed to much light.

P. balitora shows modifications for life in rapid-running waters, though as its name indicates it may also be a sand-digger (*balitora* in Bengal means a sand-digger). Its form is more elevated, the snout is not so elongated and depressed, the eyes are dorso-lateral, the paired fins are horizontal and project beyond the contour of the body at the sides; the number of the undivided rays is increased from 4 to 6 and the peritoneal lining is grayish. In *P. homaloptera* the body is flattened and greatly depressed, the paired fins are pedunculate and spread

[1] It is likely that the young specimens from Piphima belong to our new species from Emilomi, but we leave this question open till specimens of intermediate sizes are discovered. The Piphima specimens are too young to warrant any conclusions.

outwards and the peritoneal lining is black showing that the fish lives on surfaces of rocks almost in direct sunlight. The eyes are small and dorsolateral.

The modifications undergone by these three species are of a progressive nature and it is remarkable to note that though the original modifications may have been induced by a burrowing habit, they have become accentuated when the same fishes took to life in swift currents. Attention may also be directed to the fact that similar modifications sometimes result in apparently different adaptations, but when the nature of modifications is analysed against the functions of the structures, then the real value of adaptations becomes evident. For instance, a strong pectoral fin is as useful for digging as for adhering to rocks and in both cases the result is achieved by the formation of a number of undivided rays. Bottom life is as natural for a burrowing species as for a species that adheres to rocks in a torrential stream, and the result is that in both cases the air-bladder is greatly reduced. One of us [1] has already directed attention to such cases of adaptations and explained their significance.

So far as can be ascertained, *Psilorhynchus* is restricted to India and Burma. The two species from China, *Psilorhynchus sinensis* Sauvage & Dabry de Thiersant (=*Hemimyzon sinensis*) and *P. fasciatus* Sauvage (=*Pseudogastromyzon fasciatus*), have been shown to be Homalopterid fishes [2]. The only other species described under this generic denomination is *Psilorhynchus aymonieri* Tirant [3] which has not yet been properly studied. The descriptions and figures of the species recently reprinted by Chevey [4] do not show its *Psilorhynchus* affinities, but it is difficult to assign any systematic position to it without examining the specimens.

COBITIDAE.

Nemachilus botia (Hamilton).

1921. *Nemachilus botia*, Hora, *Rec. Ind. Mus.*, XXII, p. 199.

1 specimen. Mekruchu stream, Dayang valley. J. H. Hutton, March 1927.

Nemachilus botia is represented by a single male specimen about 80 mm. in total length.

Nemachilus kangjupkhulensis Hora.

1921. *Nemachilus kangjupkhulensis*, Hora, *Rec. Ind. Mus.*, XXII, p. 202, pl. x, figs. 4, 4*a*.
1934. *Nemachilus kangjupkhulensis*, Mukerji, *Journ. Bombay Nat. Hist. Soc.*, XXXVII, p. 48.

1 specimen. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

15 specimens. Melori, Tizu River; Leori, Phodung River a tributary of Tizu; Yisisu, Yazhiluwu River, a tributary of Tizu. J. H. Hutton, March 1935.

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[1] Hora, *Phil. Trans. Roy. Soc. London* (B) CCXVIII, p. 264 (1930).
[2] Hora, *Mem. Ind. Mus.* XII, pp. 299, 314 (1932).
[3] Tirant, *Bull. Soc. Etudes Indochinoises* (1883).
[4] Chevey, *Oeuvre Ichtyologique de G. Tirant*, p. 35 (Saigon : 1929-1934).

16 specimens. Laruri, Zhuzeti stream, a tributary of Titlo or Namtaleik. J. H. Hutton, March 1927.

17 specimens. Sakhai, Lizho stream. B. Prashad & B. Chopra, 23rd February 1935.

3 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 24th February 1935.

Nemachilus kangjupkhulensis was found to be widely distributed in the hill-streams of the Manipur Valley whence the waters drain into the Chindwin River. Mukerji recorded it from Burma and in the collections under report the species was collected from several streams of the Chindwin drainage only.

The largest specimen is about 72 mm. in total length.

Nemachilus manipurensis, Chaudhuri.

1912. *Nemachilus manipurensis*, Chaudhuri, *Rec. Ind. Mus.* VII, p. 443, pl. xl, figs. 4, 4*a*, 4*b* & pl. xli, figs. 1, 1*a*, 1*b*.

1921. *Nemachilus manipurensis*, Hora, *Rec. Ind. Mus.* XII, p. 199.

33 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

Numerous specimens. Purobami and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

3 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of Tizu; Yisisu, Yazhiluwu River, a tributary of Tizu. J. H. Hutton, March 1927.

1 specimen. Stream at Kohima. B. Prashad & B. Chopra, 14th February 1935.

4 specimens. Chakabama, Sidzu River. B. Prashad & B. Chopra, 16th February 1935.

Numerous specimens. Paddy fields and irrigation channels, Kekrima. B. Prashad & B. Chopra, 18th February 1935.

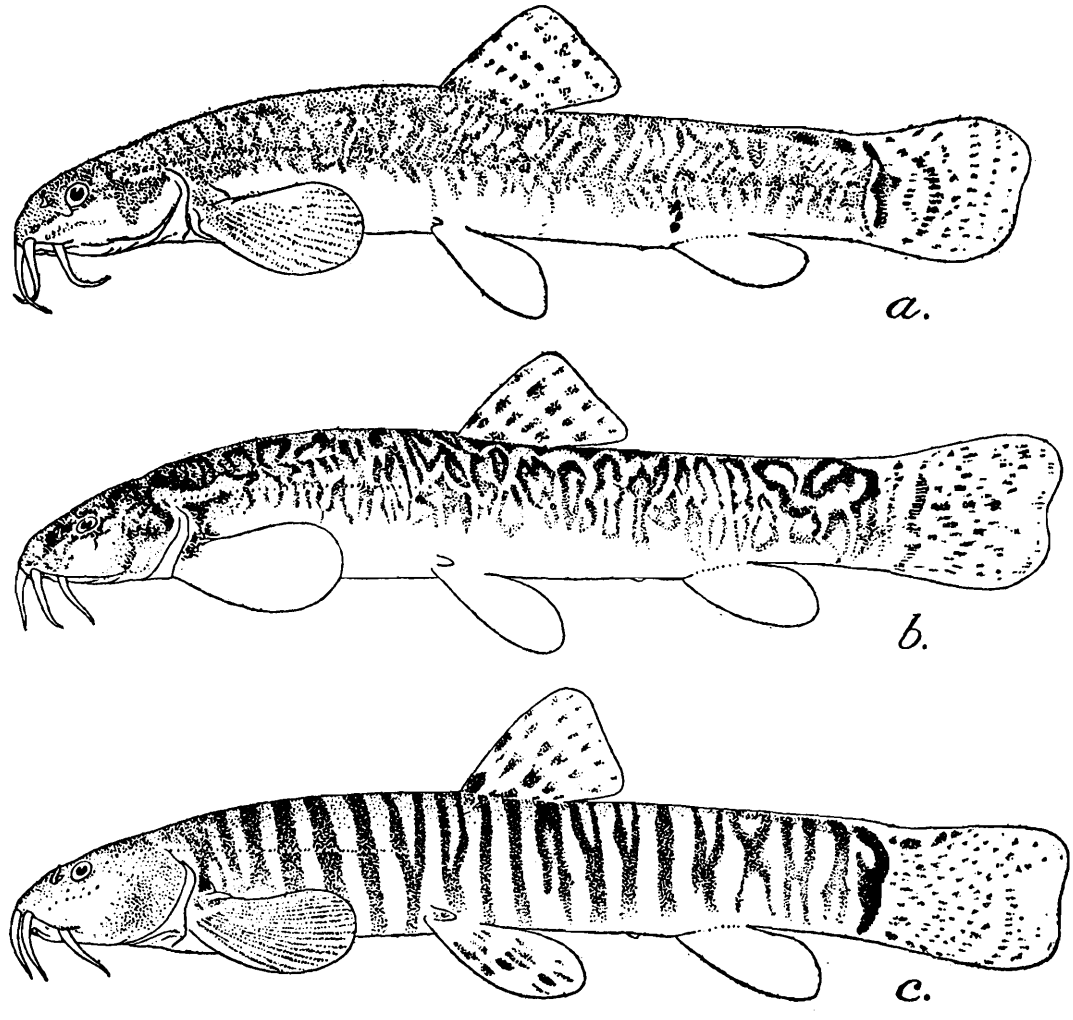
23 specimens. Sakhai, Lizho Stream. B. Prashad & B. Chopra, 23rd February 1935.

2 specimens. Sakhai, Tizu River. B. Prashad & B. Chopra, 23rd February 1935.

6 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Nemachilus manipurensis was described by Chaudhuri from three specimens collected in Manipur but later one of us reported on a large number of specimens from the Manipur Valley and remarked that "Except for slight variation in the colour of some specimens, they agree with Chaudhuri's description of the species" The collections now before us show that according to the colour variation the individuals of this species can be divided into two groups, *i.e.* (i) banded forms and (ii) mottled or plain forms. These differences refer to the colour of the body only, for in all specimens the dorsal and the caudal fins are marked with a large number of short, wavy bands. Correlated with the colour differences, there are certain morphological differences which are equally well marked. In the banded specimens the head and body are not greatly depressed and the ventral surface is only moderately flattened, whereas in the mottled specimens the head and body are greatly depressed and the ventral surface is flat and horizontal. When these characters are analysed against localities, it is seen that the banded and flattened specimens were invariably collected from rapids with pebbly beds, whereas the mottled specimens were collected in ponds, tanks or other stationary or sluggish pieces of water. It is significant that, with a few exceptions, the specimens collected in the Manipur Valley, where the

streams are rather sluggish, are of the mottled or plain type whereas those from the Naga Hills, where the streams are torrential, are mostly



Text-fig. 3.—Three colour variations of *Nemachilus manipurensis* Chaudhuri.

a. A specimen from Sakhai, Naga Hills. × 2.
b. A specimen from Purobami and Sahunyu, Naga Hills. × *ca*. 1½.
c. A specimen from Kekrima, Naga Hills. × *ca*. 1½.

Specimens with no markings on body from the Manipur Valley have already been figured by Chaudhuri (*Rec. Ind. Mus.* VII, pl. xl, fig. 4 and pl. xli, fig. 1, 1912).

banded. As the species is distributed over a considerable area and is found in different types of habitat conditions, it has undergone remarkable adaptative modifications.

Nemachilus manipurensis is similar to *N. multifasciatus* Day [1] in several respects, such as incomplete lateral line, barred dorsal and caudal fins and a large number of bands on the body, but differs in the form of the caudal fin (deeply emarginate in *multifasciatus* and truncate or slightly lobed in *manipurensis*) and colour pattern on the body (*manipurensis*, when banded, has uniformly narrow bands throughout whereas *multifasciatus* possesses few broad bands behind the dorsal and anteriorly the bands break up into narrower bands). These differences do not appear to be specific but until fresh material of Day's species becomes available it is desirable to treat these species as distinct.

The largest specimen is about 80 mm. in total length.

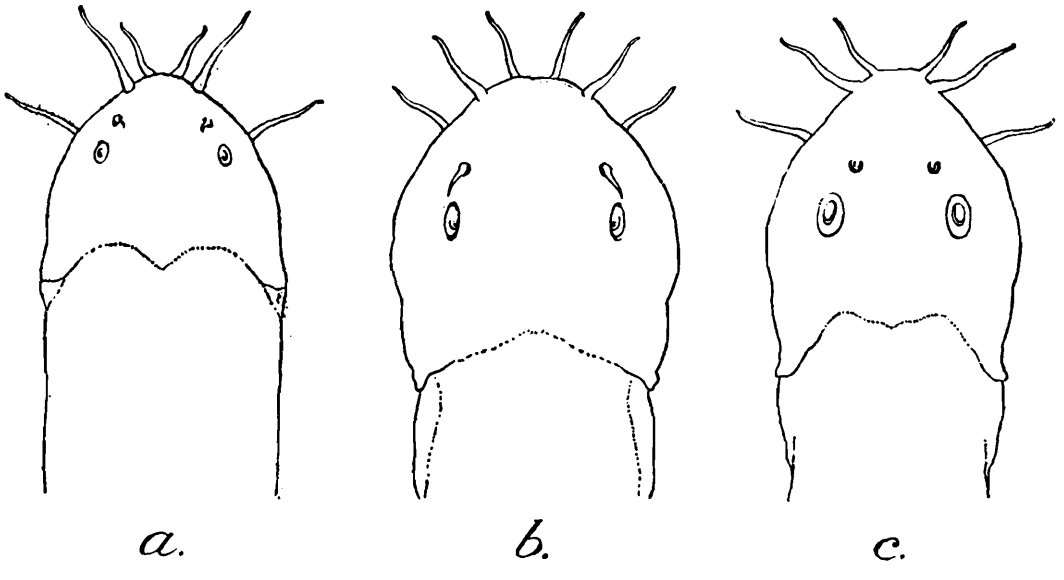
[1] Hora, *Rec. Ind. Mus.* XXXVII, p. 61 (1935).

Nemachilus rupecola (McClelland).

1839. *Schistura rupecula*, McClelland *Asiat. Res.* XIX (2) pp. 309, 441, pl. lvii, fig. 3.

21 specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

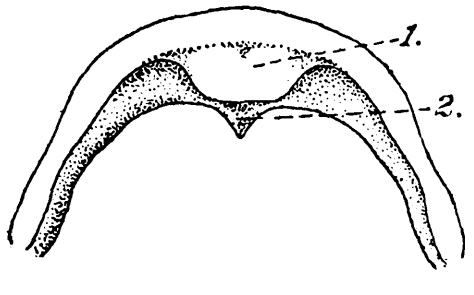
In their general build the specimens of *Nemachilus rupecola* from the Naga Hills agree with the form, *N. rupecola* var. *inglisi*, recently described by one of us [1] from the Eastern Himalayas, but differ from it in the absence of well-marked nasal appendages. It is probably an Assamese race of the Himalayan species but as the material before us is not in a good condition we refrain from giving it a separate name. In the typical



TEXT-FIG. 4.—Outline sketches of head of three geographical races of *Nemachilus rupecola* (McClelland).

a. A specimen from Simla Hills. × *ca.* 2.
b. A specimen from Darjeeling Himalayas. × *ca.* 2.
c. A specimen from Naga Hills. × *ca.* 2.

form from the Western Himalayas the head, especially in the region of the eyes, is not so broad as in the Darjeeling or Assamese forms. Moreover, the scales in the posterior region of the body in the typical form are well marked. The broadening of the head and the reduction of the scales in the case of the Darjeeling and Assamese forms show that the fish is better adapted to withstand the rush of torrents.



TEXT-FIG. 5.—Front view of jaws of a specimen of *Nemachilus rupecola* McClelland from Naga Hills. × 7½.

1 = beak-like process of upper jaw;
2 = emergination of lower jaw.

The jaws of *N. rupecola* are very characteristic. The upper jaw is produced into a beak-like process with a broad, truncate apex, while the lower jaw is deeply incised to receive this process. This condition is present in certain other species of the genus also but the characters are not well defined.

The largest specimen is about 102 mm. in total length.

[1] Hora, *Rec. Ind. Mus.* XXXVII, p. 58 (1935).

Nemachilus subfusca (McClelland).

1839. *Schistura subfusca*, McClelland, *As. Res.* (Ind. Cyprinidae) XIX, pp. 308, 443, pl. liii, fig. 5.

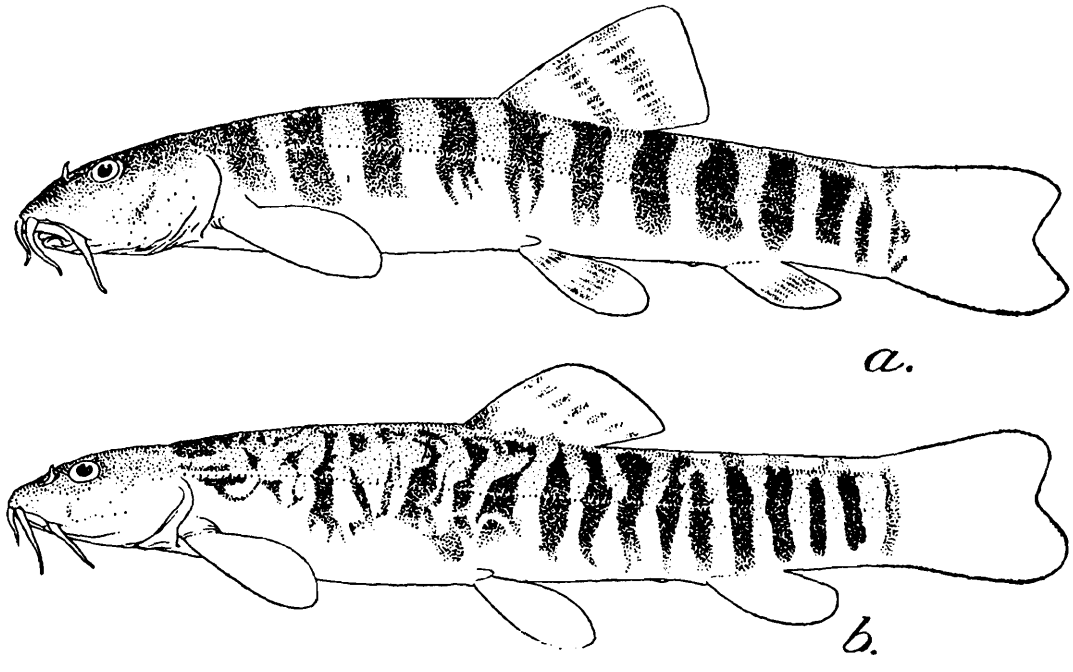
Several specimens. Mekruchu stream, etc., Dayang Valley. J. H. Hutton, March 1927.

Several specimens. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Nemachilus subfusca was described by McClelland from " Upper Assam " and characterised as " Without spines; four cirri in front of the mouth, various regular zones encircling the body; eyes approximating to each other on either side of a narrow trenchant ridge like that of *Cobitis phoxocheila*; snout hard. Fin rays are,

D. 11 : P. 11 : V 7 : A. 7 : C. 17."

The above description is too meagre to establish the specific identity of *N. subfusca* and for this reason its specific limits have remained undetermined so far. One of us[1], from a study of the Eastern Himalayan species of the genus, regarded it as a synonym of *N. scaturigina* (McClell.) but the abundant material now before us shows that the Assamese form has to be regarded as a separate species. In *N. subfusca* the lateral line is complete or incomplete but it is fairly extensive (complete in *N. scaturigina*). The scales are feebly developed and in the anterior region of the body they are totally absent (scales well marked all over the body



Text-fig. 6.—Two colour variations of *Nemachilus subfusca* (McClelland) from Naga Hills.

a. A young specimen. × *ca.* 2. *b.* A mature specimen. × *ca.* 1½.

in *N. scaturigina*). In young specimens the colour-bands are more or less similar to those figured by McClelland whereas in older specimens

[1] Hora, *Rec. Ind. Mus.* XXXVII, p. 64 (1935).

the bands are broader and more numerous (incomplete bands in *N. scaturigina*). Specimens similar to those before us are present in an undetermined lot from the Khasi Hills and though McClelland has not mentioned any definite locality for his species, it is known that the originals of several of his Assamese species came from the Mishmi and the Khasi Hills. It is likely, therefore, that the specimens now before us represent McClelland's species.

Nemachilus subfusca may now be characterised as follows :—

D. 2/8 ; A. 2/5 ; P. 1/10 ; V. 1/6 ; C. 18.

Nemachilus subfusca is a gracefully built and moderately elongated species in which the upper profile is evenly arched up to the origin of the dorsal fin, beyond which it is almost straight or slopes slightly to the root of the caudal. The ventral profile is more or less horizontal in front of the ventral fins. The head is long, narrow and somewhat pointed anteriorly ; its length is contained from 4·2 to 5 times in the total length excluding the caudal and from 5 to 5·8 times including the caudal. The head is slightly wider than deep ; its width is contained from 1·2 to 1·4 times and the height at occiput from 1·5 to 1·8 times in its length. The snout is a little longer than the post-orbital part of the head. The eyes are dorso-lateral in position and are situated almost midway between the free margin of the operculum and the tip of the snout. They are not visible from the ventral surface. The diameter of the eye is contained from 4·5 to 6 times in the length of the head and from 1·5 to 2·7 times in the length of the snout. The interorbital space is moderately convex and slightly wider than the diameter of the eye. The mouth is small and semicircular ; its gape is equal to the length of the snout in front of the nostrils. The lips are fleshy and plain ; in preserved specimens they appear to be feebly corrugated. The lower lip is interrupted in the middle and deflected at the sides. The jaws are unequal, the lower one being considerably overhung by the upper. The lower jaw is sharp and shovel-like, being in some cases faintly incised in the middle. The upper jaw is produced into a short vertical, beak-like structure. The barbels are well-developed, all the three pairs are longer than the orbital width, the outer rostrals being the longest.

The body is sub-cylindrical in shape and somewhat elongated ; its depth is contained from 5·5 to 6·9 times in the total length without the caudal. The scales are feebly developed and are present only in the tail region. They appear to be totally absent in the anterior part and on the ventral surface of the body. Usually the lateral line is complete running along the middle of the body ; when incomplete, it is fairly extensive and extends as far as the anal fin. The caudal peduncle is considerably compressed, short and squarish ; it is slightly longer than high.

The dorsal fin commences in advance of the ventrals and its insertion is somewhat nearer to the root of the caudal fin than to the tip of the snout ; its posterior margin is obliquely truncate. The longest ray of the dorsal is in most specimens equal to or slightly shorter than the

depth of the body below it ; only rarely it is longer. The paired fins are short and horizontally placed ; they have rounded margin. The pectorals are nearly as long as the head behind the nostrils ; they are separated from the origin of the ventrals by a distance almost equal to their own length. The ventrals are shorter than the pectorals and do not extend as far as the anal opening, which is situated midway between the tip of the ventrals and the commencement of the anal, or a little nearer the latter. The anal fin is almost as high as the body above it ; it has, like the dorsal, a truncate outer margin. The caudal fin is shorter than the head ; it is emarginate with the lower lobe slightly more developed.

In spirit specimens the head and body are grayish to dusky above and pale olivaceous below. In adult specimens there are from 12 to 18 broad, dark, vertical bands which descend from the dorsal surface and extend almost to the ventral surface. These bands are very variable in regard to shape, size and position. They may be broader or narrower than or equal to the alternating bands of the ground colour. They may be straight, oblique or crescentic. Usually, these bands are more regular and prominent in the posterior half of the body, while anteriorly they may either break up into series of irregularly distributed blotches, or they may be obliterated altogether. In certain specimens, some of the bands are split into secondary bands. In the young and half grown specimens, the bands are less variable, narrower and fewer in number ; they are more regularly arranged and seldom exceed 14 in number. In all specimens the band at the root of the caudal fin is much darker than the others. There is a prominent black spot at the base of the anterior rays of the dorsal fin ; all the fin rays of the dorsal are dusky. The rest of the fins are diaphanous.

Measurements in millimetres.

Total length including caudal	82·0	70·0	64·0	51·0	45·0
Length of caudal	12·0	9·0	9·0	9·0	7·0
Length of head	14·0	12·0	12·0	10·0	9·0
Width of head	10·0	9·5	9·0	7·0	6·5
Height of head at occiput	9·0	8·0	7·0	5·5	5·5
Greatest depth of body	12·0	9·0	10·0	7·5	5·5
Length of snout.	6·5	6·0	5·0	4·5	3·0
Diameter of eye.	2·5	2·2	2·0	2·0	2·0
Interorbital distance	3·0	3·0	3·0	2·2	2·0
Length of caudal peduncle	9·5	9·0	8·0	5·0	5·0
Least height of caudal peduncle	8·2	8·0	7·0	4·5	4·0
Longest ray of dorsal	10·2	10·2	9·5	8·0	7·0
Length of pectoral	11·0	9·5	9·5	7·0	7·0
Length of ventral	9·5	9·0	8·5	7·0	6·0
Longest ray of anal	9·0	9·0	8·0	6·5	6·0
Distance between tip of snout and commencement of dorsal	36·0	31·0	29·0	24·0	19·5
Distance between commencement of pectoral and that of ventral	24·5	18·0	16·5	14·0	11·0
Distance between tip of snout and anal opening	52·0	45·0	40·0	31·5	27·0

OPHICEPHALIDAE.

Ophicephalus gachua Hamilton.

1934. *Ophicephalus gachua*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVI, p. 135.

8 specimens. Zhokami and Tekhubami, sources of the Dayang River. J. H. Hutton, March 1927.

6 specimens. Purobani and Sahunyu, sources of the Tizu River. J. H. Hutton, March 1927.

7 specimens. Melori, Tizu River; Leori, Phodung River, a tributary of Tizu River; Yisusu, Yazhiluwu River, a tributary of Tizu River. J. H. Hutton, March 1927.

6 specimens. Kekrima. B. Prashad & B. Chopra, 17th February 1935.

4 specimens. Khazabama (Chizami), Chiteri stream. B. Prashad & B. Chopra, 20th February 1935.

16 specimens. Phikrokezema. B. Prashad & B. Chopra, 21st February 1935.

1 specimen. Emilomi, Keleki stream. B. Prashad & B. Chopra, 26th February 1935.

Ophicephalus gachua is a widely distributed species of the genus and is represented in the collection from both the drainage basins of the Naga Hills. One of us[1] had referred specimens of this species collected in the Manipur Valley to *Ophicephalus harcourt-butleri* but we (*op. cit.*) have recently shown that the two species are synonymous.

The largest specimen under report is about 150 mm. in total length.

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[1] Hora, *Rec. Ind. Mus.* XXII, p. 208 (1921).

MGIPC—M—III-8-11—20-9-35—510.