XXIX. INDIAN CYPRINOID FISHES BELONGING TO THE GENUS *GARRA*, WITH NOTES ON RELATED SPECIES FROM OTHER COUNTRIES.

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(Plates XXIV—XXVI).

CONTENTS.

INTRODUCTION.

Among the Indian fresh-water fishes few have greater interest in the study of evolution than those belonging to the genus *Garra*. Great confusion has prevailed in the taxonomy of this genus, partly because many of the species exhibit considerable individual variability, and partly because ichthyologists have attempted to apply to them specific standards unsuitable for forms apparently still in the process of adaptation to their environment. Scale-counts, number of fin-rays and proportions are all important diagnostic characters in most Cyprinid genera; but in *Garra*, at any rate, they have much less significance than the structure of certain organs and appliances modified or produced in correlation with the peculiar mode of life adopted, apparently not very long ago, by the members of the genus. Before expressing an opinion as to how this has come about it is necessary that the genus should be investigated as completely as possible on anatomical and taxonomic lines. This Annandale attempted to do, so far as the taxonomy of the Indian species is concerned, in two recent papers (1919*a*, *b*), while Narayan Rao (1920) has still more recently published a third paper on the same subject and Annandale and I have discussed the generic position of the fish in a fourth (1920).

The great difficulty under which we have laboured hitherto has been that the type-specimens of older species were not available and that the figures and descriptions previously published were inadequate. This difficulty has now been overcome to a great extent, firstly because the old collection of the Indian Museum, including types of the species described by Day, which was sent to Dr. V Pietschmann before the beginning of war, has been returned to Calcutta, and secondly because I have been able to visit and obtain specimens from the same localities in which Hamilton Buchanan found his specimens of *Cyprinus* (*Garra*) *lamta*, the genotype of *Garra*. The collection of the Zoological Survey of India has also been very largely augmented by the addition of specimens from many parts of the Indian Empire, and we have in particular received from Mr. Narayan Rao and Mr. G. E. Shaw, to whom our best thanks are due, valuable series from Coorg and the Darjiling Himalayas respectively. The Bombay Natural History Society has also lent us some interesting forms, and practically all the Indian districts whence specimens of the genus have been described are now well represented in our collection.

My sincere thanks are due to Dr. N. Annandale for placing the valuable material in my hands for investigation and description and for allowing me to visit some hill-streams to study these fishes in nature. I am indebted to Dr. S. W Kemp for going through the manuscript with me and also for some valuable suggestions. I have also to express my obligations to Mr. Tate Regan for the courtesy he has shown me in sending at my request a copy of Heckel's original description of the genus *Discognathus*.

HISTORY

Hamilton Buchanan, in his classical work entitled "*An account of the Fishes of the Ganges*," published in 1822, was the first to describe a species—*Cyprinus lamta*—with a disc behind the lower jaw, which he "found in rivulets, with rocky bottoms, in the province of Behar, and in the Rapti River of the Gorakhpur District." This characteristic form he referred to his ninth division of *Cyprinus* which he termed *Garra*. A decade after this Gray (1832) figured a similar species, *Cyprinus gotyla*, also with a disc on the lower jaw, from "Mountain Stream, India"; while McClelland (1838, 1839, 1842) recorded a number of species with the same character from streams in the Eastern Himalayas. The latter, however, described his specimens under two genera, *Gonorhynchus* and *Platycara*, and seems to have attached no importance to the character of the disc. Sykes (1841) also paid little attention to this well-marked structure in *Chondrostoma mullya* from South India and it was left to Heckel to recognise its value as a generic distinction when he referred his Syrian specimens (1843) to the new genus *Discognathus*. Heckel refers to Gray's species and also to those described by McClelland, but seems to have been unaware of the existence of *Cyprinus lamta* and *Chondrostoma*

mullya. In 1844 he described *Discognathus fusiformis* from Bombay and two years later he recorded similar forms from Abyssinia. Jerdon (1849) recorded *Gonorhynchus gotyla* and described two new species in the same genus from South India; while Blyth (1860) adopted *Platycara* of McClelland in describing a new species from Burma. Bleeker (1863*a*) recognised Buchanan's *Garra* as a distinct genus and gave the name of *Garra ceylonensis* to a new species from Ceylon. In the *Atlas Ichthyologique*, III, p. 24, 1863, Bleeker described two subgenera of *Garra*, Ham. Buch., *Garra* and *Discognathus*, distinguishing them merely by the number of barbels, which are four in the former and two in the latter. Day (1865, 1867) in a series of papers on the Fishes of South India gave an account of some new species of *Garra*, and in 1869 erected a new genus *Mayoa* for two specimens he found in the Calcutta Museum which probably came from Northern India. After the publication of Günther's catalogue (1868) Day, when writing a "Monograph of Indian Cyprinidae" (1871), evidently recognised only one Indian species of *Discognathus*, for he places all the then known species, with the exception of *D. variabilis*, under the synonymy of *D. lamta*; at the same time he allowed his new genus, *Mayoa*, to stand with a single species, *M. modesta*. Next year he recorded a peculiar specimen from the Salt Range, Punjab, which he referred to *D. lamta*. In his later works Day (1878, 1889) abolished his new genus and recognised three species, viz. *D. lamta*, *D. jerdoni* and *D. modestus*. Steindachner (1867) recorded *Garra gotyla* from Simla and added a few notes on the characters of *G. lamta*. Günther (1868) recognised *Discognathus variabilis* and *D. nasutus* and described *D. macrochir* as a new species; all the remaining known forms he regarded as synonymous with *D. lamta*. In 1889 he also referred specimens collected in Afghanistan to *D. lamta*, while Playfair (1870) and Blanford (1870) gave on his authority the same name to their Arabian and Abyssinian specimens. Sauvage (1874) obtained a new species, *D. prochilus*, in China, while Lortet (1883) and Tristram (1884) referred their Palestine examples to *D. lamta*, the latter author pointing out, however, that they might represent the species—*D. rufus*—which Günther had considered to be a synonym of the former. Vinciguerra (1883) recorded *D. lamta* from Africa and described a new species, *D. chiarinii*, from the same continent. Later on, in 1889, while writing an account of the fishes of Burma, he named another new species *D. imberbis* and recorded *D. lamta*. Nikolsky (1897, 1899) recorded *D. variabilis* and *D. lamta* from Persia and its vicinity, but later on (1900) described the specimens which he had previously referred to *D. variabilis* as a new species, *D. rossicus*, while those referred to *D. lamta* were made the type of another new species, *Garra persica*, by Berg (1913). Boulenger in a series of papers (1901, 1903, 1905) and in his two works (1907, 1909) on the fishes of Africa stimulated research in this genus and himself described and figured as many as seven species of *Discognathus*, while quite recently another species has

been described from the same continent by Nichols and Griscom (1917). Vaillant (1902) described a new species, *D. borneensis*, from Borneo; this was referred to the genus *Garra* by Fowler (1905) and again placed in the genus *Discognathus* by Weber and Beaufort (1916). Pellegrin in 1905 gave the name of *D. rothschildi* to a species from Abyssinia; this Boulenger in 1909 regarded as doubtfully synonymous with *D. dembeensis*. Regan in 1909 and 1914 described two new species, one from Yunnan and the other from Waziristan respectively. Jenkins (1909), after having examined the specimens in the Indian Museum, preferred to call all of them *D. lamta* and in 1910 he also referred a fish from Baluchistan to the same species. In 1912 Garman described a new species, *G. imberba*, from Western Syechuan, China. He referred it to a new subgenus of *Garra*, which he termed *Ageneiogarra*. This subgenus he distinguished from the two others recognised by Bleeker (1863) by the absence of barbels. Zugmayer (1913) hesitatingly referred his examples from Pishin in Baluchistan to two species, *D. lamta* and *D. variabilis*; while Chaudhuri in the same year recorded *D. lamta* from the Abor Hills. Annandale (1913), when writing notes on the fishes of the Lake of Tiberias, recognised at least four races of *D. lamta* and in Chaudhuri's paper he pointed out that the Abor examples might represent the Assamese race *nasutus* of McClelland; in two more recent papers (1919) he recognised many Indian forms to be specifically distinct. Jordan and Evermann (1917), when urging the revival of old names, pointed out that *Garra* is a valid genus, and Rao (1920) has quite recently described certain fishes from Mysore under this generic name. Still more recently Annandale and myself (1920) discussed the advisability of recognising both *Garra* and *Discognathus* on certain anatomical grounds. Prashad (1919) described a new species from the Kangra Valley, Punjab, and in 1920 I outlined the evolution of *Garra* from the allied Cyprinid genera.

The chequered history of the genus *Garra*, characterised by the presence of a mental disc behind the lower jaw, has resulted from various causes. The greatest confusion has, however, centred round *Garra lamta* of which a short and inadequate description without a figure was given in *An account of the Fishes of the Ganges* by Hamilton Buchanan. An illustration of a species with the disc-character well marked occurs among the manuscript drawings of this author, now preserved in the library of the Asiatic Society of Bengal; it is labelled *Cyprinus godyari*. Both *godyari* and *lamta* are local names of the same fish in the Bhagalpur and Gorakhpur districts respectively, and it is clear from a remark on page 103 of Day's volume on the fisheries and botany of Bengal (in Hunter's *Statistical Account of Bengal*, 1877) that the two names refer to the same species. Day, who is quoting from a manuscript of Hamilton Buchanan, says, "The Godiyari of the Bhagalpur list is here called lamta."

There has also been some confusion as to the exact localities

whence Buchanan obtained his specimens of *godyari* and *lamta*. On page 81 of the volume cited above the habitat of the *godyari*, cited under the name *sahari*, is given as, "small streams among rocks south of Monghir"; the *lamta* has been stated to occur "in the Rapti River of the Gorakhpur District." Nowadays Monghyr is not included in the Bhagalpur District but is in a district of its own; the hills towards its south, to which Buchanan referred, are the well-known Kharagpur Hills. While gathering information for a tour in these hills my attention was drawn to a significant passage in the *District Gazetteer of Monghyr* (1909) where the author, dealing with the fishes of the Man River, observes that, "The pools below the waterfalls along the latter river are tenanted by a little fish which the woodmen declare to be the young *tengra*. When flood comes this little fish finds it very difficult to hold its own against the stream; but nature has provided it with a sucker, which enables it to fasten itself to the rocks and wait securely until the flood has passed." This passage proved of great assistance in determining the habitat of *Garra lamta* recorded by Hamilton Buchanan from the then known Bhagalpur District and in October 1920 a series of specimens was obtained in the Man River. The fish were fairly abundant in small pools below the *Katin* waterfall, but it was very difficult to net them as on the slightest provocation they would hide themselves underneath stones. By bailing the water from an isolated pool in the course of the *Katin nallah* eight specimens were obtained, one was found in the Bhaura Stream, a tributary of the Man River, and another near the *Uttar band*, the canal outlet on the eastern side. From the passage quoted from the *Gazetteer*, it would be inferred that the local name of *Garra lamta* is "*tengra*" in these parts. I have not been able to verify this, but found two local names instead current among the fishermen, *Gudar* [1] and *Patharchat*; in the former reference is made to the rounded subcylindrical form of the fish and in the latter to its habit of adhering to stones. The fish was said to be very common during the rains and it is stated that at this season a large number climb up the artificial waterfall known as *Katin*. After having made collections at Kharagpur, I went to Gorakhpur to see the fishes of the Rapti River, but failed to find a single specimen of *Garra*. Moreover the name *lamta* was strange in the town of Gorakhpur and its vicinity. Even enquiries from old fishermen elicited no information as to the occurrence of a fish with this name in the district, nor did they recognise as local fish some specimens of *Garra* which I had brought with me. It may here be remarked that the Rapti River near Gorakhpur is a muddy channel and its bed is nowhere rocky within a few miles of the town.

In giving a synopsis of the species of a genus of fish a good

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[1] *Gudar* is also the vernacular name given to all species of *Nemachilus* in the Kumaon Hills.

deal of importance is generally attached to the number of fin-rays and scales, but in *Garra* these characters are variable and it is impossible to use them in separating one species from another. Jenkins (1909) relied on these very characters and came to the conclusion that, "there are no specimens of *Discognathus* in the Indian Museum which justify me in considering that there is more than one Indian species of this genus." In both the Indian and African species the general rule is that there are seven to eight branched and two to three unbranched rays in the dorsal, while in the anal there are five branched besides one or two that are unbranched. The number of scales along the lateral line varies from 33 to 44. Marked deviations from these numbers occur only as abnormalities and minor differences are always bridged over when a large series of specimens are examined from the same locality.

In the absence of any well-marked characters, in the number of scales and fin-rays, Günther (1868) attributed to *G. lamta* a very wide range extending from "Syria to Assam," and ever since this statement was made, authors in general have attributed any species of this genus from any part of this region to *G. lamta*. In particular Day, who had previously recognised several species from South India, subsequently (1871) referred them all to *G. lamta*, but later on (1878) insisted on the specific validity of *G. jerdoni*.

No less confusion has been caused by a black spot that is present in many species behind the angle of the operculum. Also there is often a series of black spots at the base of the fin-rays of the dorsal fin.

In certain species of *Garra* a proboscis is present on the snout and this has been regarded as a secondary sexual character restricted to males, in *G. stenorhynchus* and *G. bicornuta*, however, the proboscis is known to be common to both sexes. Very little is known about the variation of the proboscis or the conditions which influence its formation. I have found after examination and dissection of a large series of specimens from all parts of India that wherever a well-developed proboscis is present it is always common to both sexes except in the classical species *G. lamta*, in which a peculiar proboscis is present in the male sex only.

The credit of stimulating research in this genus belongs to Boulenger, who recognised many species of *Garra* from Oriental Africa and pointed out in 1907 that the Asiatic species of the genus were much in need of revision. Annandale (1913, 1919) attempted to revise the Indian species in a series of valuable papers, but unfortunately the old collection of the Indian Museum containing Day's types was at that time interned in Austria, having been sent to Dr. V Pietschmann before the outbreak of war.

PROBABLE EVOLUTION OF THE DISC IN *GARRA*, AS REPRESENTED BY A SERIES OF SPECIMENS COLLECTED IN MANIPUR, ASSAM.

The young specimens on which the following observations were made, were collected in various hill-streams that flow into the Manipur Valley from the surrounding Naga Hills. I have figured eight stages in the text, seven of which are drawn from the Manipur specimens while stage 2 is a copy of the illustration previously published by Annandale and myself (1920). The original of the figure was then referred to *Garra nasutus*, but I am unable to assign it to any species now on account of the immaturity of the specimen, which is only 7·4 mm. in length. The Manipur examples are, however, much larger and I have been able to identify them as *Garra rupeculus*. This is one of the smallest known species of the genus and is extremely well-adapted for life in rapid running streams. The following are the localities and measurements of these examples :—

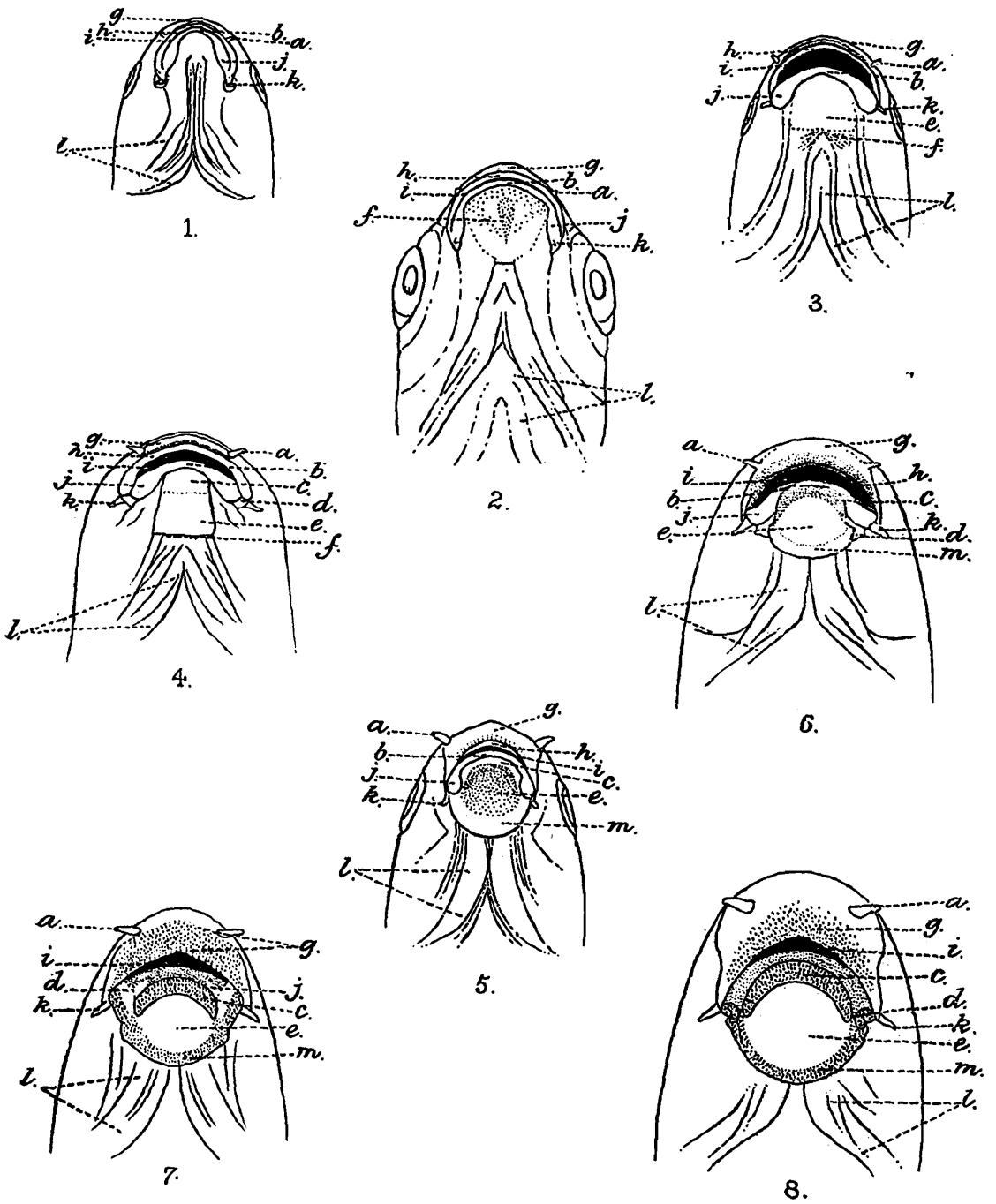
Stage No.	Locality.	Length without caudal.
		mm.
1	Small stream, 3 miles N.W. of Potsengbaum	13·4
3	Small stream near Kangpokpi	18·5
4	Thaubal stream near Yaribuk	20·0
5	Sikmai stream near Palel	18·5
6	Thaubal stream near Yaribuk	21·0
7	,, ,, ,, ,, ...	19·0
8	,, ,, ,, ,, ...	25·0

It is unfortunate that very little attention was paid to the preservation of these specimens in the field; I was not aware at the time that these young examples would yield such interesting results. The region of the head, however, is well preserved in all the specimens, but the opening of the mouth, which in some examples gapes widely, while in others it is completely closed, considerably alters the ventral aspect, especially the extent of the labial folds and the lips. It is clear from the measurements given above that the stages in the development of the disc are not necessarily correlated with size, but that they may depend upon the age of the fish. We are as yet ignorant of the stimuli that hasten or retard the development of this interesting organ in a particular environment.

The figures are semi-diagrammatic and are drawn with the help of a camera lucida.

Great difficulty has been experienced in the terminology of the disc and its associated structures. The mouth in this genus is situated on the under surface and hence the so-called upper and lower lips are really anterior and posterior in relation to the mouth. Moreover the true lips are only visible either in the less advanced species or in the younger stages of the more advanced forms; with

the growth of the fish they are in the latter case covered by secondary folds. These, the anterior and the posterior labial folds, have hitherto been termed the upper and the lower lips.



TEXT-FIG. 1.—Development of mental disc in *Garra.*

1—8 represent successive developmental stages of the disc in *Garra.* *a* = rostral barbel; *b* = median portion of posterior lip; *c* = posterior labial fold; *d* = connective; *e* = callous portion of disc; *f* = papillate disc rudiment; *g* = anterior labial fold; *h* = anterior lip; *i* = mouth; *j* = lateral swollen portions of posterior lip; *k* = maxillary barbels; *l* = branchiostegal rays; *m* = posterior free margin of disc.

Although the development is gradual I have thought it convenient to select a number of representative stages and to describe each in detail.

In stage 1 the mouth is situated slightly behind the tip of the snout and is bordered by the true lips. In front of the ante-

rior lip (*h*) is a narrow groove which separates it from the fold (*g*) covering the tip of the snout. Both the lips are continuous near the angle of the mouth. The anterior lip is of almost uniform thickness throughout and is partially covered by a flap of the posterior lip (*j*) near the angle of the mouth. The posterior lip can be divided for description into three parts, the median narrow part (*b*) and the two swollen bulb-like lateral portions (*j*). The bony elements of the jaws are not visible. There are two pairs of short barbels and the eyes are distinctly visible from below. There is as yet no indication of the disc and the branchiostegal membranes which meet at an acute angle are continued forwards for a considerable distance.

A slightly more advanced stage is shown in figure 2, the only noteworthy feature being the presence of an almost circular area (represented by dotting in fig. 2) immediately behind the posterior lip. This area I consider to be the rudiment of the disc organ.

In stage 3 the disc rudiment (*f*) is restricted and is represented by a few papillate concentric lines, the squarish area between these and the posterior lip may now be called the disc proper (*e*). At this stage the branchiostegal membranes are slightly separated and the branchial isthmus has become wide.

A marked change is shown in stage 4. The disc rudiment is now represented by a transverse line of papillae (*f*) just behind the disc proper (*e*); the anterior portion of the latter is indistinctly demarcated as a somewhat prominent lobe which ultimately develops into the posterior labial fold (*c*). Changes have also taken place in the lateral bulb-like portions of the posterior lip (*j*). A small area on each side is separated off just at the angle of the mouth and is represented in the figure as a connective (*d*) between the anterior and the posterior lips. The branchial isthmus is still further widened and the branchiostegal rays are slightly reduced with their membranes somewhat separated. By a careful comparison of the four stages it can readily be seen that the mouth has shifted backwards and that the anterior labial fold is coming into prominence.

Between the fourth and the fifth stage there is a lack of continuity. The disc rudiment is entirely absent and the anterior labial fold is more extensive; it has almost covered the anterior lip (*h*), of which only the median portion is visible. The mouth opening has shifted still further backwards and the disc is well marked with lunate anterior (*c*) and semicircular posterior (*m*) borders. In the development of the branchial isthmus, the branchiostegal membranes and rays and the posterior lip, the specimen from which this stage is described is less advanced than that shown in stage 4. The connectives have not yet been separated, though near the angle of the mouth the lip is greatly swollen.

In stage 6 the features of the disc and the anterior labial fold (*c*) are well pronounced, and the connective (*d*) is a distinct structure. Changes have also taken place in the posterior lip and

the branchial region. The antero-median portion of the posterior lip (*h*) has become very thin and in its place the anterior border of the disc is coming into prominence. In the branchial region the isthmus is wider, and the rays much reduced.

In stage 7 we are approaching the definitive form. The anterior lip is entirely hidden underneath the labial fold which is now distinctly fringed and tuberculate, and the median portion of the posterior lip is represented by small prominences in front of its posterior swollen region. The connective is well-marked and forms an anterior continuation of the posterior border of the disc on either side. The posterior jaw is now visible in the middle. The branchiostegal membranes no longer meet behind the disc and their rays are greatly reduced.

In the final stage all traces of the posterior lip are gone except for the connective (*d*) near the angle of the mouth ; the mouth is now surrounded by secondary folds both anteriorly and posteriorly. The isthmus is much wider and the rays in the branchiostegal membranes greatly reduced. From this stage it is but a small step to reach the condition found in the adults of the most advanced species. The only change is that the isthmus is still wider and the rays further reduced.

It will be advantageous at this point to enumerate the lines along which the development of the under surface of head has taken place in *Garra* :—

(i) The anterior labial fold develops considerably and ultimately covers the anterior lip.

(ii) The anterior lip, though prominent in the younger stages, is much reduced in the older and is covered by the anterior labial fold.

(iii) The mouth, which at first occupies a position near the tip of the snout, becomes shifted backwards and in all the older stages is clearly ventral in position.

(iv) The posterior lip in younger stages is narrow in the middle, but greatly thickened near the angle of the mouth. During the development of the fish the median part is replaced by a posterior labial fold ; but the thickened portions near the angles separate off and form definite connectives on either side between the upper labial fold and the posterior border of the disc.

(v) The disc begins as a finely papillate squarish area just behind the posterior lip. Its anterior portion is early marked off into the disc proper and the papillae (which are probably the disc rudiments) are pushed backwards. They ultimately vanish and their place is taken by the posterior border of the disc. The anterior border of the disc is marked off as a posterior labial fold having a callous circular portion in the middle.

(vi) The branchial membranes containing the branchiostegal rays meet for a considerable distance in young individuals, but with the growth of the fish they are widely separated and the rays in them greatly reduced.

(vii) The eyes in the adult are usually invisible from below though visible in the first few stages on the under surface.

It seems quite probable that the various changes enumerated above have been brought about by the rolling of the skin covering the snout towards the under surface and that the mouth changes its position and is being gradually shifted backwards. By this process the anterior labial fold is formed and the divergence and reduction of the branchiostegal membranes and the rays brought about. How the true lips are replaced by secondary folds is a matter of detail. The disc develops from the papillate disc rudiment.

In adults of certain less specialised species of the genus, the structure of the disc and the associated organs resembles a stage in the development of typical species of the genus. Thus *G. chaudhurii* and *G. quadrimaculatus* are similar to stage 4, while *G. vinciguerrae* shows a considerable resemblance to stage 5. In almost all the species that occur in Persia, Syria and Africa the mental disc is less specialised and the true lips are usually present. The new species from Darjiling is represented by three specimens, two of which are mature males and the other a ripe female. The mental disc in the three specimens shows progressive specialisation beginning with stage 4 of the developmental series described above. It is not uncommon to find one or two specimens in a big collection of typical *Garra* in which the branchiostegal rays meet at an acute angle behind the disc and the branchial isthmus is narrow. It is still more common to meet with examples in which the posterior and the anterior borders of the disc are poorly developed, but it is always possible, after examining a large number of individuals from the same locality, to refer them along with normal specimens to their proper species.

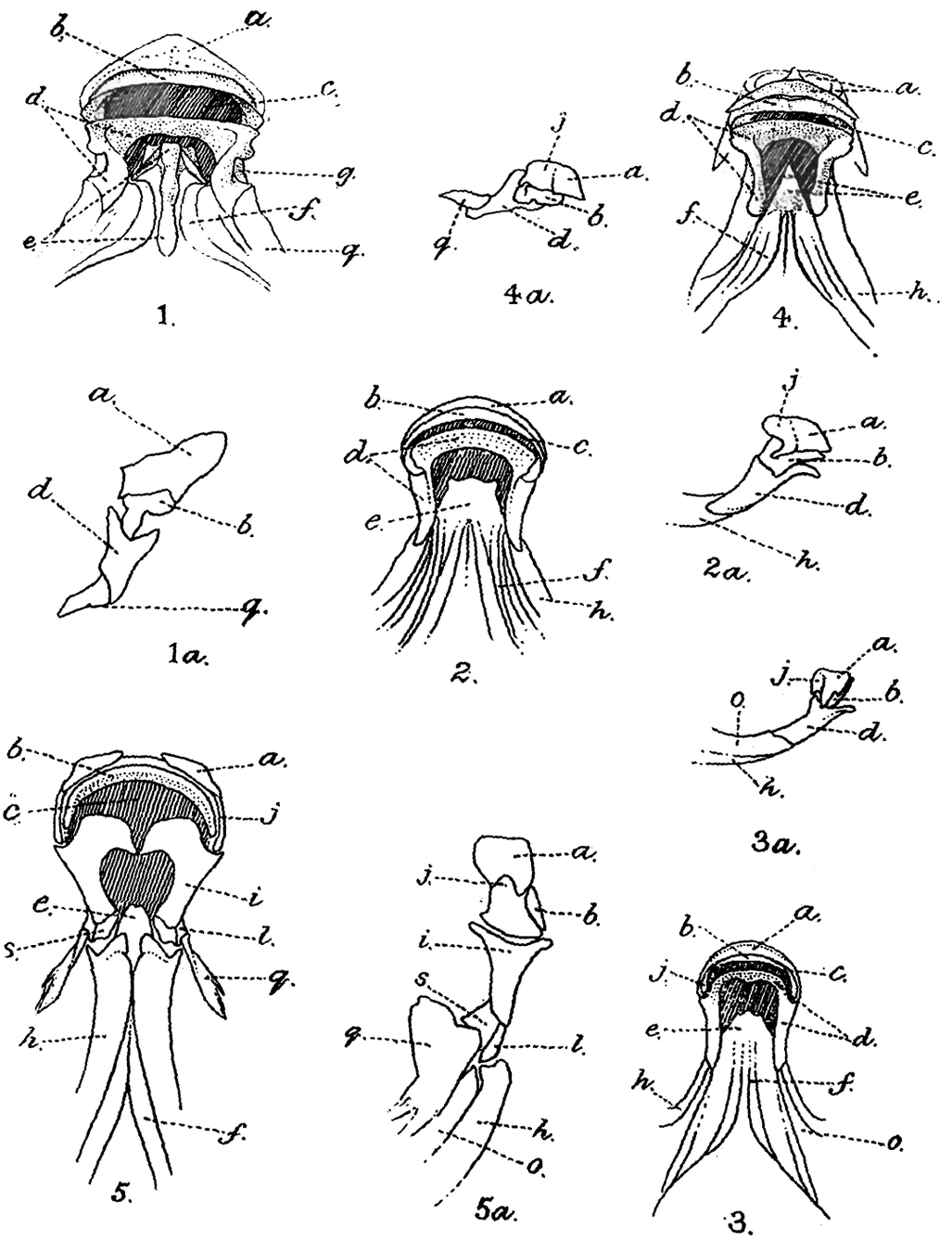
In the collection of the Zoological Survey of India there is a series of young specimens from Madras collected by Major Sewell. Of these I have been able to determine only four stages which are separated from each other by fairly wide gaps.

SKELETON OF THE MOUTH-PARTS.

Boulenger (1907), when defining the genus *Discognathus*, gave the following short account of its skeleton:—"The skeleton is very similar to that of *Labeo*, but the premaxillaries emit short ascending processes, the posterior edge of the mandible is raised into a process at the symphysis, and the clavicles do not form a diaphragm." So far as the skeleton of the mouth-parts is concerned, I find great dissimilarity between that of *Labeo* and that of *Garra*. The nearest approach to *Garra* is made by *Cirrhina* and *Crossochilus*. The following are some of the salient points in which the mouth-parts of *Labeo* (fig. 2, 5, 5*a*) differ from those of the other genera enumerated above:—

(i) The bones are distinct and separate and have not coalesced to form a rigid structure.

(ii) The maxillae of the two sides are widely separated in the middle.



TEXT-FIG. 2.—Skeleton of mouth-parts of *Garra* and allied genera.

1. *Garra mullya* (Sykes), ventral view.
1*a*. Same, lateral view of upper and lower jaws.
2. *Garra rossicus* (Nikolsky), ventral view.
2*a*. Same, lateral view of upper and lower jaws.
3. *Cirrihina mrigala* (Ham. Buch.), ventral view.
3*a*. Same, lateral view of upper and lower jaws.
4. *Crossochilus latia* (Ham. Buch.), ventral view.
4*a*. Same, lateral view of upper and lower jaws.
5. *Labeo rohita* (Ham. Buch.), ventral view.
5*a*. Same, lateral view of upper and lower jaws.

a=maxilla; *b*= premaxilla; *c* = mouth cavity; *d* = lower jaw; *e* = urohyal; *f* = branchiostegal rays; *g* = portion of skull; *h* = preoperculum; *i* = dentary *j* = jugal; *l* = splenial; *o* = interoperculum; *q* = quadrate; *s* = articular.

(iii) The articular and dentary bones on each side have fused to form a single piece, but those of the two sides are distinctly separate.

(iv) The preopercular bones meet or slightly overlap just behind the lower jaw, presenting an articular surface anteriorly.

(v) The branchiostegeal rays are concealed under the opercular borders anteriorly and are not visible for a considerable distance behind the mouth.

(vi) The mouth points anteriorly and is considerably nearer to the dorsal than to the ventral profile of the fish.

From the points enumerated above it is clear that *Labeo* represents a skeletal structure of the mouth parts, which is at a low stage of organisation ; but at the same time we must remember that in *Labeo* the mouth is suctorial and this probably accounts for the mobility of its component parts.

Now let us examine more closely the condition found in a specialised member of the genus *Garra* (fig. 2, 1, 1*a*). The sutures between the various bones are absent and the skeleton presents a solid structure. The mouth having been shifted backwards, the maxillae and the premaxillae are well developed and are fairly broad. The backwardly directed process of the posterior jaw (corresponding to the articular bone, etc., of other bony fishes) is short and curved instead of being straight as in *Labeo* ; those of the two sides are widely separated and articulate with the quadrate of each side respectively. The basihyal is very prominent in the middle behind the lower jaw and is distinctly separate from other structures throughout its length posteriorly. Anteriorly it is flattened out laterally on the dorsal surface and to this are attached the anterior ends of the branchiostegal rays which are greatly reduced and are represented by two or three short bony elements. The rays of the two sides are widely separated in the middle. On account of the position of the mouth, both the jaws have to be accommodated in a short space.

In a less specialised form of the same genus (fig. 2, 2, 2*a*) the fusion of the bony elements is not complete and the position of the mouth near the tip of the snout considerably alters the whole arrangement. The jugal is visible as a separate bone and a faint line of demarcation can be made out between the dentary and the articular bones. The articular is almost straight and meets the opercular border behind ; it is visible on the ventral surface. The basihyal is seen as a rounded process behind the posterior jaw, but is covered for a greater part of its length by the branchiostegal rays, which are but slightly reduced. The rays of the two sides meet for a considerable distance on the ventral surface.

The structure met with in *Cirrhina* (fig. 2, 3, 3*a*) is not very different from that described above, the only difference being that more of the opercular elements are visible on the under surface, the visible portion of the basihyal is further reduced and the branchiostegal rays and the articular bones have become more marked.

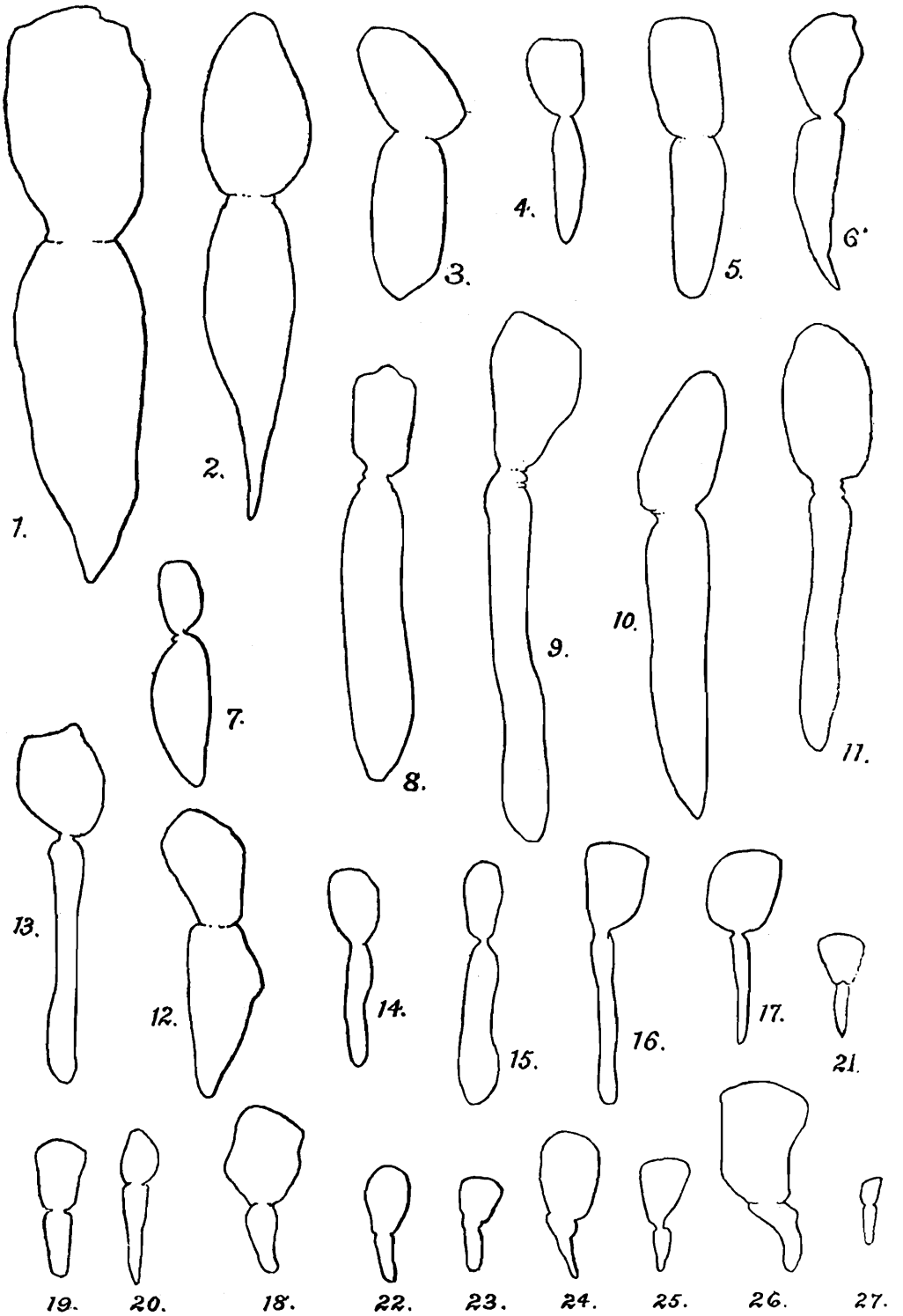
In *Crossochilus* (fig. 2, 4, 4*a*) the mouth is situated considerably behind the tip of the snout and consequently the structure of the mouth-parts is different from that found in *Cirrhina*, and in certain respects resembles that of a specialised form of *Garra*. It may also be pointed out that, like *Garra*, a fringed, tuberculated, well-developed anterior labial fold is present in *Crossochilus*. The articular bone is fairly extensive and only a small portion of the basihyal is visible from below. The branchiostegal rays meet for a short distance behind the tip of the basihyal and then suddenly diverge outwards. The rays are reduced.

AIR-BLADDER AND ASSOCIATED SKELETAL STRUCTURES.

The air-bladder has long been considered to be an organ of the greatest importance in the taxonomy of the bony fishes and especially in distinguishing the families of Cyprinoidea. I have carefully examined this organ in the various species of *Garra* and also in *Labeo rohita*, *Cirrhina mrigala* and *Crossochilus latia*. The comparison is instructive. The normal type of bladder is present in *Cirrhina* (fig. 3, 2) and *Labeo* (fig. 3, 1) and its length is contained about 3·3 times in the length of the fish including the caudal fin. The anterior chamber is smaller than the posterior and is in the form of a short massive cylinder. The posterior chamber is almost as broad as the anterior a short distance behind its commencement, but thence it gradually tapers to the end. In all the less modified species of *Garra* that I have examined, viz. *G. adiscus*, *G. rossicus*, *G. blanfordi* and *G. rufus*, the bladder agrees with this type in form and extent, whereas in all specialised species of the genus and in *Crossochilus latia* it is somewhat modified. The modifications chiefly consist in the form and extent of the posterior chamber, which, instead of being swollen in the middle, may be of uniform thickness throughout, with its walls somewhat thickened. This condition is found in *Garra gravelyi*, *G. jenkinsonianum* and *G. mullya*. In the remaining species the whole of the bladder is greatly reduced and its length is never contained less than 5 times in the length of the fish. The extreme phase of reduction within the genus is reached in *Garra stenorhynchus*, *G. arabica*, *G. gotyla* and *G. nasutus*, in which the bladder is contained about 15 times in the length of the fish without the caudal. In *G. gotyla*, *G. nasutus* and *G. lissorhynchus*, the bladder is covered by a thick, fibrous coat and is firmly fixed to the body-wall. In some species the posterior chamber is greatly reduced and its cavity almost obliterated.

In *Crossochilus* (fig. 3, 11) the bladder resembles that of certain species of *Garra*; its length is contained 5·3 times in the total length of the fish. The posterior chamber is long but of uniform thickness throughout.

Having found so much variation in the species of *Garra* as regards this interesting organ I was almost tempted to regard it



TEXT-FIG. 3.—Air-bladder of *Garra* and allied genera.

1. *Labeo rohita* (Ham. Buch.).
2. *Cirrhina mrigala* (Ham. Buch.).
3. *Garra rufus* (Heckel).
4. *Garra blanfordi* (Boulenger).
5. *Garra rossicus* (Nikolsky).
6. *Garra adiscus* (Annandale).
7. *Garra lamta*, Ham. Buch.
8. *Garra jenkinsonianum*, sp. nov.
9. *Garra gravelyi* (Annandale).
10. *Garra mullya* (Sykes).
11. *Crossochilus latia* (Ham. Buch.).
12. *Garra bicornuta*, Rao.
13. *Garra mullya* (Sykes), hill-stream form.
14. *Garra notata* (Blyth).
15. *Garra* sp. (from Persia).
16. *Garra naganensis*, sp. nov.
17. *Garra prashadi*, sp. nov.
18. *Garra jerdoni*, Day.
19. *Garra kempi*, sp. nov.
20. *Garra abhoyai*, sp. nov.
21. *Garra lissorhynchus* (McClelland).
22. *Garra gotyla* (Gray).
23. *Garra nasutus* (McClelland).
24. *Garra stenorhynchus* (Jerdon).
25. *Garra arabica*, sp. nov.
26. *Garra stenorhynchus* (Jerdon).
27. *Garra rupeculus* (McClelland).

as a specific character; but further examination showed that it is not only variable in the different species of the genus, but differs in individuals of the same species as well. Moreover, in the young individuals it is in all species very much like the normal form. As I have already remarked, it is not surprising to find considerable variation in an organ which shows retrogressive degeneration. I hope to deal with this aspect of the matter shortly in a separate paper dealing with the adaptations of the hill-stream fishes.

I have examined the weberian ossicles in these genera and do not find any great departure in any of them from the normal form. The platform formed by the transverse processes of the third vertebra shows certain modifications, but their discussion is beyond the scope of the present enquiry.

GARRA AND *DISCOGNATHUS*.

Quite recently Annandale and myself (1920) recognised *Discognathus* as a separate genus from *Garra*, basing our distinction mainly on the position of the mouth, which in the former is situated near the tip of the snout, on the presence of vestigial lips and disc in *Discognathus* and lastly on the fact that in the genus *Discognathus* the "opercular and preopercular borders" meet "at an acute angle on the ventral surface some distance behind the adhesive disc." In view of the developmental series described above and also in view of the occurrence in the Darjiling Himalayas of a form very similar to *G. quadrimaculatus* from Oriental Africa, I am unable to retain the view recently expressed by Annandale and myself. If two genera are adopted the systematic position of certain stages in the development of some advanced members of *Garra* becomes obscure and certain abnormalities due to restricted development cannot easily be referred to their proper genera.

Garman (1912) divided the species of the genus *Garra* into three groups which he considered as distinct subgenera. He based his distinction on the number of barbels and recognised Bleeker's (1863) two subgenera, *Garra* and *Discognathus*, as valid. He at the same time proposed a new subgenus, *Ageneiogarra* (to accommodate his species *G. imberba* from China), characterised by the absence of barbels. The specific name he employed for his new species is preoccupied, as Vinciguerra (1889) has described a fish from Burma as *Discognathus imberbis*. The barbels are so minute throughout the genus that I do not regard their occasional absence as a character of subgeneric importance.

As regards the relationship of *Garra* with other Cyprinid genera, it is better to postpone a full discussion until the Malay forms assigned to *Crossochilus* are available for examination. It may, however, be pointed out that great similarity exists between the mouth-parts of *Cirrhina*, *Crossochilus* and *Garra* and that *Cirrhina* holds the same relation to *Crossochilus* which the less specialised members of *Garra* hold to the more specialised forms in the genus.

SYNOPSIS OF THE INDIAN AND SOME OF THE EXTRA-INDIAN SPECIES OF *GARRA*.

In the synopsis I have included 21 Indian and 5 extra-Indian species of *Garra*. With the exception of *G. imberbis*, which can be easily recognised by the total absence of its barbels, I have examined specimens of all Indian species. I have not included *G. wanae* from Waziristan because in Regan's description of the species I could not find those characters which I have employed in building up the synoptic table.

The table does not apply to young individuals. The names of extra-Indian species are placed in square brackets.

a. Barbels absent ... ... *G. imberbis* (Vinciguerra).

a'. Barbels present.
  b. Pupil of eye wholly in posterior half of head.
    c. Proboscis present.
      d. Proboscis trilobed.
        e. Lateral lobes of proboscis short and in front of nostrils .... [*G. arabica*, sp. nov.]
        e'. Lateral lobes of proboscis almost as long as central lobe, covering nostrils .. ... *G. bicornuta*, Rao.
      d'. Proboscis a single projection without lateral lobes.
        e. Proboscis well-developed with well defined lateral tubercular areas.
          f. Snout as seen from below trenchant and bearing a well-defined almost semi-circular lobe; space between gill-openings on under surface less than post-orbital length of head. *G. monti-salsi*, sp. nov.
          f'. Snout from below evenly rounded and convex; space between gill-openings on under surface greater than post-orbital length of head.
            g. Eyes small, contained 5 to 6 times in length of head; distance between anus and origin of anal fin less than 1/3 the distance between origins of anal and ventral fins ... ... *G. gotyla* (Gray).
            g'. Eyes moderately large, contained 3·7 to 4·3 times in length of head; distance between anus and origin of anal fin greater than 1/3 the distance between origins of anal and ventral fins ... ... *G. stenorhynchus* (Jerdon).
        e'. Proboscis not well developed, represented by a prominent squarish area in front of nostrils; lateral tubercular areas poorly developed.
          f. Dorsal fin considerably higher than length of head; lobes of caudal fin equal ... *G. gravelyi* ♂ (Annandale).
          f'. Dorsal fin almost equal to or less high than length of head; lobes of caudal fin not equal ... ... *G. nasutus* (McClell.).
    c'. Proboscis absent.
      d. Tubercular areas on snout present ... *G. jerdoni*, Day.
      d'. Tubercular areas on snout absent ... *G. annandalei*, Hora.
  b'. Pupil of eye not wholly in posterior half of head.
    c. Pupil of eye nearer posterior margin of operculum than tip of snout.

d. Proboscis present on snout forming a distinct median knob; no groove marking off tip of snout — *G. lamta* ♂ Ham. Buch.

d'. Proboscis absent or represented by a raised area between the nostrils.

e. Tubercles on snout usually present; two short lateral grooves marking off tip of snout ... — *G. mullya* (Sykes).

e'. Tubercles if present few; no grooves on snout (snout smooth).

f. Anterior origin of dorsal equidistant from tip of snout and base of caudal.

g. Scales present in post-pelvic region and on dorsal surface in front of dorsal ... — *G. lissorhynchus* (McClell.).

g'. Scales absent in post-pelvic region and on dorsal surface in front of dorsal ... — *G. abhoyai*, sp. nov.

f'. Anterior origin of dorsal not equidistant from tip of snout and base of caudal.

g. Ventrals distinctly reaching beyond anal opening.

h. Anus situated almost midway between anterior origins of anal and ventral fins — *G. kempi*, sp. nov.

h'. Anus not situated midway between anterior origins of anal and ventral fins.

j. Distance between anus and anterior origin of anal fin greater than 1/3 distance between anterior origins of anal and ventral fins ... ... — *G. naganensis*, sp. nov.

j'. Distance between anus and anterior origin of anal fin less than 1/3 distance between anterior origins of anal and ventral fins ... ... — *G. prashadi*, sp. nov.

g'. Ventrals almost reaching or not reaching the anal opening ... ... — *G. gravelyi*, ♀ (Annandale).

c'. Pupil of eye almost in middle of head or nearer tip of snout than posterior border of operculum.

d. Belly and dorsal surface in front of dorsal fin naked ... ... — *G. rossicus* (Nikolski).

d'. Belly and dorsal surface in front of dorsal fin not naked.

e. Anterior origin of dorsal almost equidistant from tip of snout and base of caudal.

f. Maxillary barbels shorter than diameter of eye.

g. Diameter of eye contained 3·9 times in length of head .. .. — [*G.* sp.]

g'. Diameter of eye contained 4·4 times in length of head ... ... — *G. notata* (Blyth).

f'. Maxillary barbels longer than diameter of eye ... ... — *G. chaudhurii*, sp. nov.

e' Anterior origin of dorsal not equidistant from tip of snout and base of caudal.

f. Anterior origin of dorsal nearer tip of snout than base of caudal.

g. Mental disc absent or rudimentary ... — [*G. adiscus* (Annandale).]

g'. Mental disc present.

h. Anterior origin of ventrals distinctly nearer base of caudal than tip of snout.

j. Anterior origin of anal nearer base of caudal than anterior origin of ventrals ... ... — *G. lamta*. ♀ Ham. Buch.

j'. Anterior origin of anal nearer anterior origin of ventrals than base of caudal ... ... [*G. rufus* (Heckel).]

h'. Anterior origin of ventrals almost equidistant from base of caudal and tip of snout ... ... *G. jenkinsonianum*, sp. nov.

f'. Anterior origin of dorsal nearer base of caudal than tip of snout.

g. Ventrals extending beyond anal opening; anus considerably removed from base of anal fin ... ... *G. rupeculus* (McClell.).

g'. Ventrals just reaching anal opening; anus close to base of anal fin ... [*G. blanfordi* (Boulenger).]

PART I. INDIAN SPECIES OF *GARRA*

Garra bicornuta, Rao.

1920. *Garra bicornuta*, Rao, *Ann. Mag. Nat. Hist.* (9), VI, p. 57, pl. i, figs. 3, 3*a*, 3*b*.

Of this species I have examined six specimens; three are females and in the remaining three I have not been able to determine the sex.

There is a well-marked trilobed proboscis on the snout. The lateral lobes are free and tapering while the median lobe is represented by an immoveable rectangular prominence. The nostrils are situated near the bases of the former and are covered over by them.

The air-bladder is reduced, but its form is of the normal Cyprinid type. The following are the dimensions of the air-bladder in a specimen 9·7 cm. in length:—

Length of anterior chamber	... 6·5 mm.
,, ,, posterior ,, ...	... 11·0 ,,
Greatest diameter of anterior chamber ...	... 4·6 ,,
,, ,, ,, posterior ,, ...	... 3·6 ,,

In another mature female specimen 12·5 cm. in length, the air-bladder is contained almost 9 times in the total length of the fish

Tunga R., Mysore ... Narayan Rao ... 3 syntypes and 3 other specimens.

Garra monti-salsi, sp. nov.

1872. *Discognathus lamta*, Day, *Journ. As. Soc. Bengal* XLI (2), p. 318.

1878. *Discognathus lamta*, Day (in part), *Fish. India* II, p. 527, pl. cxxiii, fig. 1.

1889. *Discognathus lamta*, Day (in part), *Faun. Brit. Ind. Fish.* I, p. 346.

In this characteristic species the dorsal profile is slightly arched, the ventral is straight and horizontal anteriorly but rises to the base of the caudal fin posteriorly. The head is much depressed and is almost rectangular; its length is contained 3·9 times in the length of the fish without the caudal; it is 1·4 times as long as broad. The eyes are situated in the posterior half of

the head and their superior margin is coterminous with the dorsal profile; the diameter is contained 5 times in the length of the head. The interorbital space is somewhat concave and is 2·2 times as broad as the diameter of the eye. The snout is thrice the diameter of the eye and bears a well-developed median proboscis, which extends almost to the anterior end of the snout. The dorsal profile of the proboscis is convex and the ventral concave; it is constricted in the middle and is tuberculated near the anterior swollen end. The snout is marked by a deep transverse cleft near its anterior end and bears two prominent tubercular areas, when seen from below the snout appears to be trenchant and shows a well-defined almost semicircular lobe near its tip. The nostrils are situated externally at the base of the proboscis a short distance in front of the eye. The posterior nostril of each side is completely covered by a rectangular lid. The slit of the mouth is arched and the mental disc is well developed. There are two pairs of barbels shorter than the diameter of the eye. The gill-openings extend for a considerable distance on the under surface and are separated from each other by a distance slightly greater than the diameter of the eye; the opercular bones are not followed by a fleshy flap posteriorly. The lateral line is almost straight and is in the middle of the body; there are 32 scales along its length and 7 longitudinal rows between the bases of the dorsal and the ventral fins. The dorsal fin is situated nearer to the tip of the snout than to the base of the caudal fin; its base is equal to the length of the head in front of the posterior margin of the orbit; the first branched ray is the longest and is much higher than the body; the free margin of the fin is concave. There are eight branched rays in the dorsal besides three that are not branched. The ventrals are situated below the middle of the dorsal and their origin is slightly nearer the base of the caudal than the end of the snout; they extend to the anus and are somewhat shorter than the pectorals which are considerably shorter than the length of the head. The anal almost extends to the base of the caudal fin.

The air-bladder is small and the scales on the chest and on the middle of abdomen are poorly developed.

The unique specimen of the species had been opened out and the viscera removed, but still I have been able to find a few minute eggs in the oviduct. It is a female 109 mm. in length without the caudal fin.

Type-specimen.—F 9953/1, *Zoological Survey of India* (*Ind. Mus.*).

Locality.—The specimen was purchased from Day and is the original of the figure referred to above. It was collected for him "by Dr. Waagen from the Nilwan ravine near the Shapur salt ranges," Punjab.

Since the above description was written, I have found several specimens of the species in the unnamed collection of the Indian Museum from the Khewrah gorge (alt. 2000 ft.) in the Jhelum

District, Punjab. The adults agree with the type-specimen very closely. In the young individuals the proboscis is short and the snout when seen from below is not trenchant but is evenly rounded; the first few rays of the dorsal fin are greatly elongated and the gill-openings are somewhat wider.

Garra gotyla (Gray).

1832. *Cyprinus gotyla*, Gray, *Ill. Ind. Zool.*, pl. 88, figs. 3, 3*a*.
1867. *Garra gotyla*, Steindachner, *Sitz. Ak. Wiss. Wien* LVI (1), p. 360, pl. 2. figs.
1919. *Discognathus kangrae*, Prashad, *Rec. Ind. Mus.* XVI, pp. 163—165, figs. 1 and 1*a*.
1919. *Discognathus jerdoni* var. *kangrae*, Annandale, *Rec. Ind. Mus.* XVIII, p. 74.

It is after long hesitation and not without reserve that I recognise this species as valid. Gray has not given any description of his species, but as most of his figures are made from specimens collected in Northern India, I have referred the North Indian specimens with a well-developed proboscis to this form. The specimens from the Eastern Himalayas differ, as regards the shape and proportions of the head, from those found in the Western Himalayas. The eyes in both sets of specimens, are, however, in the posterior half of the head and are comparatively smaller than in allied species of the genus.

The air-bladder in a specimen from Kangra, Punjab, is minute; its anterior chamber possesses a thick fibrous coat which firmly attaches it to the dorsal body-wall. The walls of the posterior chamber are somewhat thickened. The following are the measurements of the bladder in a specimen 14 cm. in length :—

Length of anterior chamber	4·5 mm.
,, ,, posterior ,, ...	3·5 mm.
Greatest diameter of anterior chamber	3·0 mm.
,, ,, ,, posterior ,, ...	1·5 mm.

Garra gotyla has a fairly extensive but restricted range as it occurs along the base of the Himalayas throughout their length.

Jaugal Khad, Kangra, Panjab ...	N. Annandale	...	4.
Kangra Valley, hill-streams ...	Punjab Fisheries	...	12.
Ravi R., near Madhopur, Punjab	,, ,,	...	Several young.
Simla	Purchased from Day	...	1.
Chumba	,, ,,	...	1.
Dhikla, Gharwal Dist., U.P. ...	R. Hodgart	...	1.
Mahanadi R., Darjiling Dist. ...	G. E. Shaw	...	Several.

Garra stenorhynchus (Jerdon).

1849. *Gonorhynchus stenorhynchus*, Jerdon, *Madras Journ. Lit. Sci.* XV, p. 310.
1849. *Gonorhynchus gotyla*, Jerdon (*nec* Gray), *ibid.*, p. 309.
1867. *Garra gotyla*, Day (*nec* Gray), *Proc. Zool. Soc. London*, p. 288.
1919. *Discognathus jerdoni*, Annandale (*nec* Day) in part, *Rec. Ind. Mus.* XVI, p. 132.
1919. *Discognathus jerdoni*, Annandale (*nec* Day) in part, *Rec. Ind. Mus.* XVIII, p. 73, pl. ix, fig. 1 and pl. xi, fig. 3.

1919. *Discognathus stenorhynchus*, *id.*, *ibid.*, p. 74, pl. ix, fig. 3; pl. xi, fig. 4.
1919. *Discognathus gotyla*, *id.*, *ibid.*, p. 75, pl. x, fig. i; pl. xi, fig. 6.
1920. *Garra jerdonia*, Rao (*nec* Gray) in part, *Ann. Mag. Nat. Hist.* (9) VI, p. 53.
1920. *Garra stenorhynchus*, *id.*, *ibid.*, p. 53.

The proboscis on the snout exhibits considerable variation and it is on this account that so many different species have been recorded or described from South India. Having examined numerous specimens of this form, I am convinced that all these should be referred to *G. stenorhynchus*. The extent of the snout does not depend upon the age or the sexual maturity of the specimen as is shown by the collection before me. The specimens with a comparatively small proboscis have been referred to *B. jerdoni* (*nec* Day) both by Annandale and Rao; but on dissection some of them have been found to be full of eggs.

The air-bladder is rather characteristic and provides a good specific distinction. In a ripe female specimen 12 cm. in length, the following are the measurements of the bladder :—

Length of anterior chamber	5·0 mm.
,, ,, posteror ,, ...	3·5 mm.
Greatest diameter of anterior chamber	3·8 mm.
,, ,, ,, posterior ,, ...	2·0 mm.

The bladder is provided with a thicker coat; its posterior chamber is swollen anteriorly and drawn out into a fine process posteriorly, the walls of which are thickened.

Nierolay Stream, Bhavani R., Base of Nilgiris.	N. Annandale	11.
Hill-streams, Coorg, Mysore ...	C. R. Narayan Rao ...	18.
Mettupalaiyam, Dist. Coimbatore.	N. Annandale	7.
Nilgiris, Madras ...	F. Day	2.
Madras	,, ...	1.
?	A.S.B.	1.

Garra gravelyi (Annandale).

1918. *Discognathus lamta*, Annandale, *Rec. Ind. Mus.* XIV, p. 45.
1919. *Discognathus gravelyi*, Annandale, *ibid.*, XVI, p. 133, pl. ii, figs. 3, 3*a*.

Of the five specimens procured by Dr. N. Annandale from the Inlé Lake and the He-Ho stream, two are ripe females, one ripe male and two immature males. The type specimen of *G. gravelyi* is the mature male and differs considerably from the female specimens, but the presence of two young males serves to a certain extent as a connective link between the two forms. In the male the mental disc is better developed, the mouth is considerably behind the tip of the snout and consequently the labial fold is more extensive, the pectoral fins are longer than the head, the snout possesses an indistinct proboscis and the head and body are somewhat depressed with the chest almost naked, while the female lacks all these characters.

The air-bladder is quite normal and is not much reduced. In a specimen 9·7 cm. in length, the following are the measurements of the bladder:—

Length of anterior chamber	...	...	11 mm.
,, ,, posterior ,,	...	...	22 mm.

Specimens of this species were examined from the following localities:—

He-Ho stream, S. Shan States	N. Annandale ...	... 3.
Fort Stedman, Inlé Lake, S. Shan States.	,, ...	... 2.

Garra nasutus (McClelland).

Plate XXIV, fig. 4.

1838. *Platycara nasuta*, McClelland, *Journ. As. Soc. Bengal* VII (2), p. 947, pl. lv, figs. 2, 2*a* and 2*b*.
1839. *Platycara nasuta*, McClelland, *Asiatic Res.* XIX, p. 300, pl. lxvii, figs. 2.
1839. *Gonorhynchus caudatus*, McClelland, *ibid.*, p. 375.
1868. *Discognathus nasutus*, Günther, *Cat. Brit. Mus. Fish.* VII, p. 70.
1913. *Discognathus lamta*, Chaudhuri, *Rec. Ind. Mus.* VIII, p. 247.

This species is known to me from one adult specimen from the Abor Hills and from numerous young and half-grown specimens from Manipur, Assam and Manjhitar, Sikkim. As McClelland's description of the species is brief and his figures totally inaccurate, I take this opportunity to redescribe the species from the adult specimen with notes from the young examples.

D. 2/8—9. A. 2/5. P. 14. V. 8.

In *Garra nasutus* the head and body are greatly depressed and the fish comes to resemble the species of the Homalopterid genus *Balitora* in form. The dorsal profile is slightly arched; the ventral is straight and horizontal throughout. The head is almost as broad as long; the length is contained 5·7 times in the total length of the fish. The length of the caudal fin is contained 5·4 times and the depth of the body near the origin of the dorsal fin 6·2 times in the length of the fish. The eyes are dorso-lateral in position and are invisible from below; they are situated in the second half of the head and their diameter is contained 4·2 times in the length of the head, 2.6 times in the length of the snout and twice in the interorbital distance. There is a short, broad and indistinct proboscis on the snout, the tip of the snout is marked off into a rounded lobe. There are two pairs of short barbels, shorter than the diameter of the eye. The mental disc is almost circular and coextensive with the width of the head. The lateral line is straight; it is somewhat nearer to the ventral than to the dorsal surface. The scales are rather thin and almost indistinguishable; there are 34 scales along the lateral line and 8 longitudinal series of scales between the bases of the dorsal and the ventral fins. The dorsal fin is higher than the body and is almost as long as the head; its origin is nearer to the tip of the snout

than to the base of caudal fin. There are nine branched and two unbranched rays in it and the first branched ray is the longest. The ventrals originate before the fourth branched dorsal ray and extend to beyond the anal opening. The caudal fin is deeply emarginate, the lower lobe is much the longer. The colour of the body and head in spirit is uniformly dark brown with the exception of the ventral surface which is dirty-white. The colour of the upper and the lower surfaces of the paired fins corresponds to the colour of the dorsal and the ventral surfaces of the body respectively. There are black spots at the bases of the dorsal fin rays and the membrane between the rays is also blackened.

Extreme modification of the air-bladder occurs in this species. Both the chambers are minute and possess thick walls. There is a thick fibrous coat covering the bladder and fixing it firmly to the body-wall. The following are the measurements of the bladder in the adult specimen :—

Length of anterior chamber	2·5 mm.
,, ,, posterior ,, ...	3·5 mm.
Greatest diameter of anterior chamber	2·5 mm.
,, ,, ,, posterior ,, ...	1·5 mm.

In the young specimens, the head and body is not greatly depressed and the air-bladder is comparatively larger. The two lobes of the caudal fin are unequal and an indistinct proboscis is present on the snout. The head is fairly long and bluntly pointed, and the eye in some examples is not wholly in the posterior half of the head. The upper surface is dark and the under surface of the head and belly is white. The fins are white and at the base of the dorsal fin there are small black spots; sometimes a big black blotch is present before the base of the caudal fin. In an example from Manipur one of the rostral barbels is furcate.

Annandale (see Chaudhuri, 1913) identified the Abor specimen from Siyom River as *Discognathus lamta* subsp. *nasutus* (McClelland).

Distribution.—McClelland recorded it from the Khasi and the Mishmi Hill tracts. Specimens of this species have now been obtained in the Abor Hills and in the Manipur Valley, Assam. I refer numerous young specimens from Sikkim to this species with some doubt.

Siyom R., below Damda, Abor Hills.	S. W. Kemp	1.
Assam	Purchased from Day ...	?
Manjhitar, Sikkim ...	B. L. Chaudhuri	Several.
Streams in the Manipur Valley	S. L. Hora	20.

Measurements in millimetres.

Total length, including length of caudal	136·0
Length of caudal	25·0
Depth of body near origin of dorsal...	20·0
Length of head	23·5
Width of head	22·0
Diameter of eye	5·5
Length of snout	14·5

Interorbital width	11·0
Length of caudal peduncle	19·0
Height of caudal peduncle	12·5
Longest ray of dorsal	23·0
,, ,, ,, anal	19·0
Length of pectoral	24·0
,, ,, ventral	23·0

Garra jerdoni, Day.

1867. *Garra jerdoni*, Day, *Proc. Zool. Soc. London*, p. 288.
1878. *Discognathus jerdoni*, Day, *Fish India.* II, p. 528, pl. cxxii, fig. 6.
1889. *Discognathus jerdoni*, Day, *Faun. Brit. Ind. Fish.* I, p. 247.
1919. *Discognathus elegans*, Annandale, *Rec. Ind. Mus.* XVIII, p. 76, pl. ix, fig. 4; pl. xi, fig. 5.
1920. *Garra platycephala*, Rao, *Ann. Mag. Nat. Hist.* (9) VI, p. 56, pl. i, figs. 2, 2*a*, 2*b*.

This species is readily recognised by its flat or slightly concave head and by the presence of a large number of prominent tubercular areas on the otherwise smooth snout.

Rao described *Garra platycephala* from young specimens in which the tubercular areas are not raised and the snout, though marked by a large number of mucous pores, is uniformly flattened.

The air-bladder is much reduced; the following are its measurements in a female example 13·9 cm. in length:—

Length of anterior chamber	6·5 mm.
,, ,, posterior ,, ...	5·0 mm.
Greatest diameter of anterior chamber	4·3 mm.
,, ,, ,, posterior ,, ...	2·5 mm.

Specimens of this species were examined from the following localities:—

Bhavani R., Nilgiris, Madras ...	Purchased from Day ...	1.
Nierolay Stream, base of Nilgiris ...	N. Annandale	2.
Cavery R., Seringapatam, Mysore ...	C. R. Narayan Rao ...	1.

Garra annandalei, sp. nov.

1878. *Discognathus lamta*, Day (in part), *Fish. India* II, p. 527, pl. cxxii, fig. 4.
1889. *Discognathus lamta*, Day (in part), *Faun. Brit. Ind. Fish.* I, p. 246, fig. 87.

The fish is almost subcylindrical with the head and body slightly depressed. The dorsal profile rises considerably from the tip of the snout to the base of the dorsal fin beyond which it gradually slopes to the base of the caudal fin. The ventral profile is straight throughout. The length of the head is contained 4·5 times and the depth of the body 4·5 to 5 times in the length of the fish without the caudal fin. The head is 1·2 times as long as wide. The eyes are laterally placed, slightly below the dorsal profile of the head, and are invisible from below; the diameter is contained 5·2 times in the length of the head and about 2·5 times in the length of the snout and in the interorbital width. The mouth

is small and is situated considerably behind the anterior end of the snout; the mental disc is well developed. There are two pairs of short barbels, shorter in length than the diameter of the eye; a distinct deep groove runs from the base of the rostral barbels to the angle of the mouth. The dorsal fin commences in advance of the ventrals and is distinctly nearer the tip of the snout than the base of the caudal fin, its longest ray is shorter than the depth of the body below it. The pectorals are shorter than the head and are separated from the ventrals by half of their own length. The ventrals extend beyond the anus but do not reach the base of the anal fin. The caudal fin is deeply emarginate; the caudal peduncle is 1·2 times as long as high. The lateral line is straight and runs almost in the middle of the body. There are 34 to 38 scales along the lateral line and 8 series of longitudinal rows of scales between the bases of the dorsal and ventral fins. There is a scaly sheath to the base of the dorsal and a scaly appendage to that of the ventrals. The scales are large but inconspicuous on the chest while they are fairly well marked on the belly.

The sides and the upper surface of the head and body, in spirit, are dark; the under surface is dirty white. The pectoral, dorsal and the caudal fins are dusky; the ventrals and the anal whitish. Some of the scales along the lateral line show a pinkish tinge in the centre.

Type-specimen.—F 10071/1, *Zoological Survey of India* (*Ind. Mus.*).

There is a mature female purchased from Day which is labelled as having come from Assam. Several other specimens have recently been sent to us by Mr. G. E. Shaw from various streams at the base of the Darjiling Himalayas.

Measurements in millimetres.

	A.	B.
Length of fish without caudal	118	105·5
,, ,, head	26	23
Width of head	21	18
Depth of body near origin of dorsal	23·5	23
Diameter of eye	5	4·5
Length of snout	13·2	11·7
Interorbital width	12·5	10·7
Length of caudal peduncle	18	17·5
Height of caudal peduncle	16	14
Longest ray of dorsal	20·5	21·5
,, ,, ,, anal	17	17
Length of pectoral	23	19·6
,, ,, ventral	19·5	19

Garra mullya (Sykes).

1841. *Chondrostoma mullya*, Sykes, *Trans. Zool. Soc.* London II, p. 359, pl. lxii, fig. 3.
1844. *Discognathus fusiformis*, Heckel, in Hügel's *Kaschmir*, p. 387, figs.
1865. *Garra malabarica*, Day, *Proc. Zool. Soc. London*, p. 297.
1865. *Garra malabarica*, Day, *Fish. Malabar*, p. 205, pl. xv, fig 1.
1867. *Garra alta*, Day, *Proc. Zool. Soc. London*, p. 349.

1868. *Discognathus lamta*, Günther (in part), *Cat. Brit. Mus. Fish.* VII, p. 69.
1878. *Discognathus lamta*, Day (in part), *Fish. India*, II, p. 527.
1889. *Discognathus lamta*, Day (in part), *Faun. Brit. Ind. Fish.*, I, p. 247.
1919. *Discognathus lamta*, Annandale, *Rec. Ind. Mus.*, XVI, p. 131, text-fig. 1, pl. ii, figs. 1, 1*a*.
1919. *Discognathus jerdoni*, Annandale (*nec* Day) in part, *ibid.*, p. 132.
1919. *Discognathus nasutus*, Annandale, (*nec* McClelland), *ibid.*, p. 132, pl. ii, figs. 2, 2*a*.
1919. *Discognathus lamta*, Annandale, *Rec. Ind. Mus.* XVIII, p. 72.
1919. *Discognathus jerdoni*, Annandale (*nec* Day) in part, *ibid.*, p. 73, pl. ix, fig. 2.
1920. *Garra lamta*, Rao, *Ann. Mag. Nat. Hist.* (9) VI, p. 49.
1920. *Garra jerdonia*, Rao, (*nec* Day) in part, *ibid.*, p. 53.
1920. *Garra jerdonia* var. *brevimentalia*, *id.*, *ibid.*, pp. 54–56, pl. 1, figs. 1*a*, 1*b*.

Garra mullya is the most widely distributed species of the genus in India: its range extends from Kathiawar, through the greater part of the Central Provinces, to the whole of Peninsular India. Consequent upon a wide range it shows a certain amount of variation. In some examples the disc is greatly reduced and its free borders represented by a short fringe. In one example from Bombay, the paired fins are extremely small and show a stunted growth. The form is fusiform and the snout is almost smooth.

Specimens of this species occurring in hill-streams are somewhat flattened and different looking. The air-bladder exhibits considerable variation and in the hill-stream forms it is usually reduced. The species seem to be still in process of adaptation to hill-stream life.

The following are the measurements of the bladder in a specimen from Malabar which is 10 cm. in length without the caudal fin:—

Length of anterior chamber	8·2 mm.
,, ,, posterior ,, ...	17·5 mm.

Streams in Coorg, Mysore ...	C. R. Narayan Rao ...	Several.
Kavery Sangam, Mysore ...	B. L. Chaudhuri ...	8.
Malabar	Purchased from Day ...	1.
Tenmalai, Madras	N. Annandale ...	1.
Mettupalaiyam, Dist. Coimbatore, Madras.	,, ...	2.
Nierolay Stream, base of Nilgiris, Madras.	,, ...	1.
Cochin Forests, Madras ...	J. R. Henderson ...	12.
Yenna Valley, Satara Dist., Bombay.	N. Annandale and F. H. Gravely.	14.
Koyna Valley, Satara Dist., Bombay.	F. H. Gravely	1.
Medha, Satara Dist., Bombay ...	S. P. Agharkar... ...	11.
Dhoni, near Wai, Krishna R., Bombay.	,, ...	11.
Vashishti Valley, Ratnagiri Dist., Bombay.	F. H. Gravely	12.
Borivli, Thana Dist., Bombay ...	Bacteriological Laboratory, Bombay.	2.
Poona	Purchased from Day ...	1.
Khodmal Hills, Orissa ...	J. Taylor	6.
Chanda, C.P.	Mus. Coll.	1.
Birbhum	,, ...	3.

Base of hills, Chakardharpur Singbhoom Dist., Chota Nagpur.	F. H. Gravely ...	... 2.
Pachmarhi, C.P.	A. Buchanan, W. H. Kenrick and F. H. Gravely.	Several.
Near Sasan, Gir Forests, Kathiawar.	S. P. Agharkar...	... 2.
Streams in Girnar Mt., near Junagadh, Kathiawar.	,, ...	... Several.
?	A.S.B. ...	... 1,

Garra lamta, Ham. Buch.

Plate XXIV, figs. 2, 2*a*.

1822. *Cyprinus* (*Garra*) *lamta*, Hamilton Buchanan, *Fish. Ganges*, pp. 343, 393.

D. 2/8. A. 2/5.

As has already been pointed out considerable confusion has centred round this historic species. Having now collected specimens from the type-locality I take this opportunity to define the species precisely. I have compared my specimens with Buchanan's manuscript drawing and find no difference between the two.

Garra lamta is a beautiful little Cyprinid fish with a fusiform body, highest near the origin of the dorsal and tapering towards both ends. The head and body is depressed but not greatly so. The length of the head is contained 4·7 times, of the caudal fin 5 times and the depth of the body 5·2 times in the length of the fish including the caudal fin. The head is 1·2 times as long as broad. The eyes are lateral and are situated slightly below the dorsal profile of the head, they are almost invisible from below. Their diameter is contained four times in the length of the head, twice in the interorbital width and 1·7 times in the length of the snout. In the female the eye is almost in the middle of the head, in the male, however, it is somewhat in the posterior half. The snout is smooth in the female while in the male it is provided with a short knob-like median proboscis in front of the nostrils; the tip of the snout is also marked off by a groove into a transverse lobe which is covered by spiny tubercles. Tubercles are also present on the sides of the snout in front of the nostrils. The mouth in both sexes is a small, slightly arched transverse opening on the under surface considerably behind the anterior end of the snout. In the male the mental disc is better developed. There are two pairs of short thread-like barbels. In the male the barbels are comparatively much longer than in the female; the rostral pair being longer than the diameter of the eye. The origin of the dorsal fin is nearer to the tip of the snout than to the base of the caudal; it is not so high as the depth of the body below it; the last undivided ray is the longest. In the female its free margin is truncate whereas in the male it is slightly concave. The ventrals are situated almost below the middle of the dorsal and their origin is equidistant from the tip of the snout and the base of the caudal fin in the male, while in the female it is much nearer to the

base of the caudal fin than to the anterior end of the snout. The pectorals are shorter than the head and are sharp in the middle. They are separated from the ventrals by a distance less than $\frac{1}{3}$ of their own length; the ventrals extend to the anal opening. The anal fin is short and almost reaches the base of the caudal, which is deeply emarginate. There are 30 to 31 scales along the lateral line and 8 longitudinal series of scales between the bases of the dorsal and ventral fins; a scaly appendage is only present near the base of the ventral fin in the female. The scales on the chest and the belly in the male are much reduced and, indeed, to the naked eye they appear almost absent; in the female conspicuous scales are present on the belly, but on the chest they are somewhat reduced.

The air-bladder, in the young specimens that I have examined, is quite normal; its length is contained about 3 times in the total length of the fish. The following are the measurements of the bladder in an immature male specimen 54·5 mm. in length :—

Length of anterior chamber	... 5 mm.
,, ,, posterior ,, ...	... 9·5 mm.
Greatest diameter of anterior chamber ...	... 3·3 mm.
,, ,, ,, posterior ,, ...	... 3·0 mm.

The following changes in the colour of the fish were noticed by keeping it living in water in a small dish :—" immediately after it was removed from the stream the fish was almost transparent, but shortly afterwards a black longitudinal streak was observed along the lateral line and above it was a whitish band running from behind the eye to the base of the caudal fin. An indistinct black blotch was also to be seen on the sides of the tail near the base of the caudal fin." On transferring the fish to weak alcohol, the upper surface was noticed to be greenish and the belly yellowish-white, the fins immaculate except for the few rays in the dorsal and the caudal fins which were streaked with black along their length. These observations were made on a female specimen in the field in October; but since then the specimens have changed considerably in spirit and there are marked differences in the colouration of the male and the female examples. In a female specimen the whole of the upper surface of the head and body is dusky and the ventral dirty white. There is also a longitudinal streak on the sides which begins in a prominent black spot near the upper margin of the gill-opening and ends in a rounded black blotch near the base of the caudal fin which is lightly streaked in the middle. In the male the general colouration is very much the same, but instead of a longitudinal black stripe there are 5 or 6 longitudinal wavy black lines, most conspicuous in the tail region, and the black blotch near the base of the caudal fin is replaced by a short vertical bar. There are minute black spots near the bases of the dorsal fin-rays and the membrane between these is also blackened in certain regions.

This species instead of having a very wide range, as stated by a number of authors, is restricted to the eastern part of the

Vindhya Range and the Nepal Terai. Buchanan procured some specimens from the Gorakhpur District, probably from the hill-streams.

Measurements in millimetres of a female specimen.

Total length including caudal	47·0 mm
Length of caudal	9·5 ,,
,, ,, head	10·5 ,,
Width of head	8·0 ,,
Depth of body near origin of dorsal fin	9·0 ,,
Diameter of eye	2·6 ,,
Length of snout	4·4 ,,
Interorbital width	5·5 ,,
Length of longest ray of dorsal	8·0 ,,
,, ,, ,, ,, ,, anal	7·5 ,,
,, ,, pectoral	9·5 ,,
,, ,, ventral	7·8 ,,
,, ,, caudal peduncle	5·7 ,,
Height of ,, ,, ...	5·2 ,,

I have examined specimens of this species from the following localities :—

Bhaura Stream, Kharagpur Hills, South of Monghyr.	S. L. Hora	1.
Uttar Band, Man R., Kharagpur Hills, South of Monghyr.	,, ...	1.
Katin Nallah, Kharagpur Hills, South of Monghyr.	,, ...	6.
Maldhun, Nainital Dist., U.P. ...	Mus. Coll.	1.
Narsingpur, C.P.	Maj. W H. Kenrick ...	1.
Chandli Deoli, C.P.	Col. Biddulph ...	5.

Garra lissorhynchus (McClelland).

Plate XXVI, figs. 2, 2*a*.

1842. *Platycara lissorhynchus*, McClelland, *Calcutta Journ. Nat. Hist.* II, p. 587, pl. lxviii, fig.
1868. *Discognathus macrochir*, Günther, *Cat. Brit. Mus. Fish.* VII, p. 70.
1869. *Mayoa modesta*, Day, *Proc. Zool. Soc. London*, p. 553.
1871. *Mayoa modesta*, Day, *Journ. As. Soc. Bengal* XL (2) p. 108, pl, ix, fig. 2.
1878. *Discognathus modestus*, Day, *Fish. India* II, p. 528, pl. cxxii, fig. 5.
1889. *Discognathus modestus*, Day, *Faun. Brit. Ind. Fish.* I, p. 247.

Günther seems to have been unaware of McClelland's *Platycara lissorhynchus*, as no reference is made to this species in his catalogue. McClelland described his species from specimens obtained in the Khasi Hills by Mr. Griffith and from page 574 of the volume cited above, it is clear that he forwarded one specimen " to the Museum at the India House." Günther's form was known to him from two examples, one from the collection of the East India Company and the other from Mr. Griffith's collection. The former example is probably that which was despatched to the India House by McClelland. Having examined numerous specimens from the Khasi Hills and after having carefully compared them with

the figures of McClelland and the description of Günther I find no difference between the various forms. I have also examined the type of Day's *D. modestus* from Northern India, and cannot separate it from other specimens from the Khasi Hills.

The head and body are greatly depressed in this species and the form resembles that of the species of the Homalopterid genus *Balitora;* it was probably the shape which led McClelland to regard it as a species of his genus *Platycara.* The species is also distinguished from other species of *Garra* by the fact that the chest and the middle of the abdomen are naked while big scales are present on the post-pelvic region. The pectoral fin is greatly expanded and is considerably longer than the head.

There is a marked difference in the colour of male and female specimens. In a female example the colour in spirit of the dorsal and lateral surfaces is dark livid grey, obscurely marbled with yellowish brown; the ventral surface is dull-yellowish. There is a dark streak near the free margin of the dorsal and a broad, black, **W**-shaped band on the anterior half of the caudal fin; an indistinct black blotch is present near the base of the caudal and a small black spot just behind the angle of the operculum. In the male the colour of the body is much lighter and the characteristic markings on the dorsal and the caudal fins are absent. The specimens from which the early descriptions were taken were in all probability males as no reference to the characteristic colouration of the female is made therein.

The air-bladder in this species has deviated considerably from the normal form. Not only is it much reduced but the posterior chamber has become thread-like and its walls are greatly thickened; the lumen of the chamber is almost obliterated. The anterior chamber is firmly fixed to the body-wall by a fibrous coat which covers it. In a mature female 56 mm. in length, the following are the measurements of the bladder :—

Length of anterior chamber	3·2 mm.
,, ,, posterior ,, ...	3·0 mm.
Greatest diameter of anterior chamber	2·7 mm.
,, ,, ,, posterior ,, ...	1·0 mm.

In Day's type of *modestus*, however, the bladder is better developed and corresponds more closely to the normal form. The following are its measurements :—

Length of specimen excluding caudal	70 mm.
,, ,, anterior chamber	3·7 mm.
,, ,, posterior ,, ...	5·0 mm.
Greatest diameter of anterior chamber	3·0 mm.
,, ,, ,, posterior ,, ...	2·0 mm.

I have examined specimens of this species from the following localities :—

Nong-priang Stream, Cherrapunji ...	B. Warren	8.
Northern India (?)	Purchased from Day ...	1.
Assam	Mus. Coll.	1.
Jaintia Hills, Assam	Col. Godwin Austen ...	3.

Measurements in millimetres.

Total length including caudal	...	...	...	90	mm.
Length of caudal	...	...	...	18·5	,,
,, ,, head	...	...	...	16·2	,,
Width of head	...	...	...	15·5	,,
Depth of body near base of dorsal	...	...	...	14·5	,
Diameter of eye	...	...	...	3·7	,,
Length of snout	...	...	...	8·5	,,
Interorbital width	...	...	...	8·0	,,
Length of caudal peduncle	...	...	...	12·0	,,
Height of caudal peduncle	...	...	...	9·5	,,
Longest ray of dorsal	...	...	...	14·0	,,
,, ,, ,, anal	...	...	...	17·5	,,
Length of pectoral	...	...	...	14·5	,,
,, ,, ventral	...	...	...	11·5	,,

Garra abhoyai, sp. nov.

Plate XXVI, figs. 1, 1*a*, 1*b*.

D. 2/6—7. P. 15—16. V 9. A. 1/5.

The fish has a characteristic fusiform body; the dorsal profile rises considerably from the tip of the snout to the origin of the dorsal fin, beyond which it slopes down to the base of the caudal; the ventral is almost straight and horizontal in front of the anal fin, beyond which it slightly rises to the base of the caudal. The under surface of the head and body is flat, but the fish as a whole is not greatly depressed. The length of the head is almost equal to the depth of the body in front of the base of the dorsal and is contained 4·3–4·6 times in the length of the fish. The eyes are almost lateral in position and are situated slightly below the dorsal profile of the head; they are placed somewhat in the posterior half of the head and are invisible from below. The diameter of the eye is contained 4·6 times in the length of the head, 3·3 times in the length of the snout and 3·3–3·6 times in the interorbital width. The snout is smooth and the nostrils are placed considerably nearer to the eye than to the tip of the snout. The mouth is a slightly arched, transverse opening on the under surface and is provided with a well-marked almost circular disc. There are two pairs of short barbels; they are shorter than the diameter of the eye. The lateral line is straight and runs along the middle of the body; there are 33 to 35 scales along the lateral line. On the sides and on the dorsal surface behind the dorsal fin, the scales are well-marked and their boundaries easily distinguishable, while in front of the dorsal fin they are much reduced and, indeed, to the naked eye the surface appears to be absolutely devoid of any scales. The under surface in front of the ventrals is naked but ill-defined scales are present between the bases of the ventral and anal fins. The dorsal fin commences almost in the middle of the distance between the tip of the snout and the base of the caudal fin; the second branched ray is the longest; it is not as high as the depth of the body below it; its free margin is almost truncate. The ventrals commence below the 4th ray of the dorsal. The pectorals

are shorter than the head and are separated from the ventrals by a distance equal to the base of the dorsal fin. Both the paired fins are horizontally placed and are provided with muscles on the ventral aspect of some of the outer rays. The anal fin is considerably removed from the anal opening and its longest ray is twice as high as the shortest. The caudal fin is evenly lobed and deeply emarginate.

The air-blader is reduced; it is not greatly modified in form. The following are its measurements in a mature female specimen 65 mm. in length without the caudal fin:—

Length of anterior chamber	...	... 3·5 mm.
,, ,, posterior ,,	...	... 5·0 ,,
Greatest diameter of anterior chamber	...	... 2·8 ,,
,, ,, ,, posterior ,,	...	... 1·5 ,,

The fish has a characteristic colouration. The upper surface of the head and body are dusky, while the ventral surface and the fins are dirty white. There is a light black bar across the dorsal and a **W**-shaped black marking on the caudal fin.

Locality.—Three specimens were sent to the Indian Museum by Mr. Pettigrew from Manipur, Assam; Dr. N. Annandale informs me that Pettigrew made his collection in the neighbourhood of Ukhral, which is situated at an altitude of 6000 ft. among the Naga Hills.

Type-specimen.—F 5307/1, *Zoological Survey of India* (*Ind. Mus.*).

Annandale (1913, p. 37) recognised this species to be an undescribed form, but he then considered it a race of *lamta* and did not attempt to describe it. He pointed out, however, that the Manipur race "has the whole of the ventral surface devoid of scales and exhibits marked peculiarities in colouration."

Measurements in millimetres.

	A.	B.	C.
Total length excluding caudal	65	61	64·5
Length of head	14	14	14
Depth of body near base of dorsal	14·5	13·5	13
Diameter of eye	3	3	3·3
Length of snout	7	7	7
Interorbital width	8	7·3	7·5
Length of caudal peduncle	12·5	11·5	9·5
Height ,, ,, ,, ...	8·2	7	7·5
Longest ray of dorsal	11	11·6	11·7
,, ,, ,, anal	10·5	10	10·7
Length of pectoral	13·5	11·5	12·5
,, ,, ventral	12	10·6	11·5

Specimens A and C are females full of eggs; I have not opened B and, therefore, cannot give its sex.

Garra kempi, sp. nov.

Plate XXVI, figs. 3, 3*a*.

1913. *Discognathus lamta*, Chaudhuri, *Rec. Ind. Mus.* VIII, p. 247.

D. 2/8. A. 2/5. P. 13. V 8.

In this fish the head and body are greatly depressed and flattened so that the dorsal and ventral profiles are slightly arched in front of the ventrals, beyond which they gradually slope to the base of the caudal fin. The tail is thick and narrow and almost whip-like. The head is almost squarish, its breadth being contained 1·2 times and its height 1·6 times in the length. The depth of the body is contained 5·6 times and the length of the head 4·5 times in the length of the fish without the caudal fin. The eyes are small, occupy a dorso-lateral position, and are invisible from below. They are situated somewhat in the posterior half of the head; their diameter is contained 5 times in the length of the head, 2 times in the length of the snout and 2·4 times in the interorbital width, their superior margin is in line with the dorsal profile of the head. The snout is broad and semicircular; the nostrils are situated in its posterior half. Slightly in front of the nostrils on both sides is a whitish bony area which is somewhat raised from the general surface. There are two pairs of short thick barbels, the rostral being slightly longer than the diameter of the eye. The mouth-opening is greatly arched and is as wide as the breadth of the head. The mental disc is well-developed and is 1·5 times as broad as long. The tubercles on the labial fold and on the free border of the mental disc are minute. The gill-openings extend on the under surface for a short distance and the branchiostegal rays are not visible.

The origin of the dorsal fin is nearer to the tip of the snout than to the base of the caudal fin. Its first divided ray is the longest and is higher than the depth of the body below it. The ventrals originate slightly behind the dorsal and their origin is also slightly nearer to the anterior end of the snout than to the base of the caudal fin. The paired fins are broad and horizontally situated. The pectorals are as long as the head and are provided with thick pads of muscles on the ventral surface of some of the outer rays; they are separated from the ventrals by a considerable distance. The ventrals extend beyond the anus, but do not reach the base of the anal fin which in its turn does not reach the base of the caudal fin. The anus is raised on a papilla and is situated almost midway between the origin of the ventral and anal fins. The lateral line is almost in the middle of the body and runs straight from the angle of the operculum to the middle of the base of the caudal fin. The scales are rather small; there are 39 scales along the lateral line and 8 longitudinal series of scales between the bases of the dorsal and the ventral fins. The scales are absent on the chest and are much reduced on the belly along the middle line. The caudal peduncle is 1·8 times as long as high.

The air-bladder, though greatly reduced, does not show any special modification in the form of a thick coating, etc. The following are the measurements of the bladder in the type-specimen which is about 9 cm. in length including the caudal :—

Length of anterior chamber	...	...	4·5 mm.
,, ,, posterior ,,	...	...	4·0 ,,
Greatest diameter of anterior chamber	...	...	3·0 ,,
,, ,, ,, posterior ,,	...	..	1·3 ,,

The colour of the upper surface of the body and head is blackish, as is also that of the dorsal, caudal and upper surface of the paired fins. On the under surface it is dirty white. The scales are distinctly edged with black.

Type specimen.—F 7716/1, *Zoological Survey of India* (*Ind. Mus.*).

Locality.—Only one specimen has been examined, procured by Dr. S. W Kemp in Siyom R., below Damda at an altitude of 1300 ft., among the Abor Hills.

Measurements in millimetres of the type-specimen.

Length of fish including length of caudal	...	...	...	89·5
,, ,, head	...	...	...	20·0
Width of ,,	...	...	...	17·0
Depth of body near origin of dorsal	...	...	...	16·0
Diameter of eye	...	...	...	4·0
Length of snout	...	...	...	8·0
Interorbital width	...	...	...	9·8
Length of mouth-opening	..	...	...	12·0
Length of callous portion of disc	...	...	...	6·5
Width ,, ,, ,, ,, ,,	...	...	...	9·5
Distance of anus from anterior end of snout	...	...	...	54·0
Length of caudal peduncle...	...	...	...	18·5
Height of caudal ,, ...	...	...	...	10·0
Length of pectoral fin ...	...	...	...	19·7
,, ,, ventral ,, ...	...	...	...	17·5

Garra naganensis, sp. nov

Plate XXV, figs. 2, 2a.

D. 2/7. A. 1/5. P. 14. V 8.

The dorsal profile in this fish rises from the tip of the snout to the base of the dorsal fin beyond which it runs straight to the base of the caudal fin; the ventral is somewhat convex. The head is flattened on the under surface and is 1·2 times as long as broad; its length is contained 4·9 times in the length of the fish without the caudal. The depth of the body near the origin of the dorsal fin is equal to the length of the head. The eyes are almost in the posterior half of the head and look outwards and upwards; their diameter is contained 4 times in the length of the head, 2·1 times in the length of the snout and 2 times in the interorbital width. The snout is broad and semicircular and the nostrils are situated in its posterior third. There are two pairs of short barbels, shorter than the diameter of the eye in length. The mouth is on the under surface considerably behind the anterior end of the snout and is provided with well-developed upper and lower labial folds. The mental disc is oval, its longitudinal diameter being half the transverse diameter. The origin of the dorsal fin is

much nearer the end of the snout than the base of the caudal fin; it is not so high as the depth of the body below it. The ventrals commence below the middle of the dorsal fin and their origin is equidistant from the base of the caudal fin and the tip of the snout. The pectorals are as long as the head and are sharp in the middle; they are separated from the ventrals by a distance which is more than half of their own length. The third ray of the ventral fin is the longest; the fin extends beyond the anal opening, which is situated nearer to the origin of the anal than to that of the ventral. The anal fin is short and does not reach the base of the caudal fin. The caudal fin is evenly lobed and deeply emarginate. The lateral line is straight and runs almost in the middle of the body; there are 39 scales along its length and 8 series of longitudinal scales between the bases of the dorsal and anal fins. The scales are absent near the bases of the pectoral fins and are greatly reduced on the chest and in the middle of the abdomen; large scales are present in the post-pelvic region.

The air-bladder is greatly reduced and the posterior chamber is narrow and long. In a specimen 98 mm in length, the following are the measurements of the bladder:—

Length of anterior chamber ...	... 5·3 mm.
,, ,, posterior ,, ...	... 10·5 ,,
Greatest diameter of anterior chamber ...	... 3·8 ,,
,, ,, ,, posterior ,, ...	... 1·3 ,,

The colour on the upper surface and the sides is black, on the under surface whitish. The dorsal and the caudal fins are dusky as is also the dorsal surface of the paired fins. The anal and the under surface of the paired fins are whitish. There is a minute black spot behind the angle of the operculum.

Type-specimen.—F 9970/1, *Zoological Survey of India* (*Ind. Mus*).

Locality.—A single specimen was obtained by myself in the Senapati Stream near Kairong, among the Naga Hills, Assam, in February, 1920.

Measurements in millimetres.

Total length without the caudal	98
Length of head	20
Depth of body near origin of dorsal	20
Width of head	16·5
Diameter of eye	5·0
Length of snout	10·5
Interorbital width	10·0
Length of caudal peduncle	20·0
Height of caudal peduncle	12·5
Distance of vent from anterior end of snout	62·5
Length of callous portion of disc	4·0
Width ,, ,, ,, ,, ,, ...	7·5
Longest ray of dorsal fin	16·0
,, ,, ,, anal ,, ...	17·0
Length of pectoral fin	20·0
,, ,, ventral ,, ...	18·0

Garra prashadi, sp. nov.

Plate XXIV, fig. 3.

D. 3/7—8. A. 2/5. V 8—9. P. 13.

The fish is subcylindrical with the head and body somewhat flattened on the under surface. The dorsal profile rises considerably from the tip of the snout to the origin of the dorsal fin, beyond which it gradually slopes to the base of the caudal; the ventral profile is straight and horizontal in front of the anal fin, beyond which it rises to the base of the caudal. The head is short and bluntly pointed; its length is contained 4·5 to 5 times in the length of the fish without the caudal fin; the head is almost 1·1 times as long as broad. The depth of the body near the origin of the dorsal fin is slightly greater than the length of the head. The eyes are lateral and are in the upper half of the head; their diameter is contained 4·3 times in the length of the head and 2 to 2·1 times in the length of the snout and in the interorbital width. The eyes are situated slightly in the posterior half of the head. The mouth is on the under surface, somewhat behind the tip of the snout; its gape is half as broad as the width of the head. The mental disc is comparatively small but is well developed. There are two pairs of short barbels, shorter than the diameter of the eye. The dorsal fin commences nearer the tip of the snout than the base of the caudal fin; it is almost as high as the depth of the body below it. The ventrals are situated below the middle of the dorsal and their commencement is midway between the tip of the snout and the base of the caudal fin. The pectorals are longer than the head and are horizontally placed; they are sharp in the middle and are separated from the ventrals by half their own length. The ventrals extend to the anus and are provided with scaly appendages near their bases. The anal is considerably removed from the ventrals and does not extend to the base of the caudal fin. The caudal fin is deeply emarginate; the caudal peduncle is 1·2 times as long as high.

The air-bladder is minute but of the normal Cyprinid type. In a male specimen 82 mm. in length the following are its measurements:—

Length of anterior chamber	...	...	...	5·5 mm.
,, ,, posterior ,,	...	...	...	6·5 ,,
Greatest diameter of anterior chamber			...	4·0 ,,
,, ,, ,, posterior ,,		...	...	1·2 ,,

The scales in *Garra prashadi*, though well developed, are rather obscure. I have been able to make out 32 along the lateral line and $6\frac{1}{2}$ longitudinal series of scales between the bases of the dorsal and the ventral fins. The scales are poorly developed on the abdomen and are absent on the chest.

The colour is rather characteristic, the dorsal surface of the head is dusky; it is dirty white on the under surface. The upper surface of the body and its sides above the lateral line are

dark, the rest of it and the paired and the anal fins whitish. The dorsal and the caudal fins are dusky, the latter with an oblique black longitudinal bar on its lower lobe. There is a black spot behind the angle of the operculum and a short obscure black bar near the base of the caudal. On the sides of the tail are a number of black, wavy longitudinal lines.

Type specimen.—F 9971/1, *Zoological Survey of India (Ind. Mus.)*.

Locality.—Only three specimens of this interesting species have been examined; they were obtained in Malwa Tal, U.P., in May, 1920, by Dr. Baini Prashad and myself.

Measurements in millimetres.

	A.	B.
Length of fish without caudal	82	71
,, ,, head	16·5	15·7
Width ,, ,, ...	14	13·3
Depth of body near origin of dorsal	17·5	16
Diameter of eye	3·8	3·6
Length of snout	7·5	8
Interorbital width	8	6·9
Length of caudal peduncle	13	11·5
Height of ,, ,, ...	10·6	9·4
Longest ray of dorsal	17·5	15
,, ,, ,, anal	15·5	13·5
Length of pectoral	19·5	16·5
,, ,, ventral	17	14

Garra notata (Blyth).

1860. *Platycara notata*, Blyth, *Journ. As. Soc. Bengal*, XXIX, p. 161.

To this species I refer three young specimens collected by Major Berdmore in Tenasserim, Burma. Blyth's description of the species is inadequate and I therefore take this opportunity to add a few notes to it.

D. 2/7—8. A. 2/5. P. 14—15. V 9.

In *Garra notata* the under surface of the head and body are greatly flattened and the ventral profile is straight and horizontal throughout. The dorsal profile is arched, it rises from the tip of the snout to the base of the dorsal fin, beyond which it slopes down to the base of the caudal. The head is almost one and a half times as long as broad; its length is contained 4·1 times in the length of the fish without the caudal fin and is slightly greater than the depth of the body near the origin of the dorsal fin. The eyes are almost lateral but invisible from below; their diameter is contained about 3·3 times in the length of the head, 1·3–1·9 times in the length of the snout and 1·8 times in the interorbital width. There are two pairs of thread-like barbels, the rostrals are longer than the diameter of the eye; the maxillary are very small and liable to be overlooked. The eye is situated almost in the middle of the head or slightly nearer to its posterior margin.

The origin of the dorsal is almost equidistant from the tip of the snout and the base of the caudal fin or it is somewhat nearer to the former. The scales in front of the ventrals on the under surface are greatly reduced and, indeed, to a superficial observer may appear to be almost absent. There are 33–34 scales along the lateral line and 8 series of longitudinal rows of scales between the bases of the dorsal and ventral fins.

The colour has undergone considerable change as the specimens have been preserved in spirit for a long time. Except for the under surface in front of the ventrals and the cheeks, which are whitish, the fish is dark brown. There is a black spot near the angle of the operculum and a series of black markings at the base of the dorsal fin-rays.

Blyth describes the colouration of the fish as follows:— "Colour dusky olive-green above and on the sides, beneath buffy-albescent. Base of the dorsal fin whitish, setting off a series of black spots, larger anteriorly and the hindmost generally obsolete: rest of the fin a little nigrescent. One or more spots also at base of the anal fin. Pectorals somewhat yellowish at base, then blackish; a dusky line along each longitudinal row of scales becoming gradually visible towards the tail." The colouration was noted from a specimen about 6 in. in length.

Measurements in millimetres.

Length of fish without caudal	54	54·5
,, ,, head	13	13·5
Width of head	9	9·6
Depth of body	12·5	13·5
Diameter of eye	3	3·2
Length of snout	5·7	5·3
Interorbital width	5·5	6
Length of caudal peduncle	9·5	9·2
Height ,, ,, ,, ...	6	6·7
Longest ray of dorsal	11	10·7
,, ,, ,, anal	8	9·7
Length of pectoral	11·7	12·5
,, ,, ventral	8·2	10

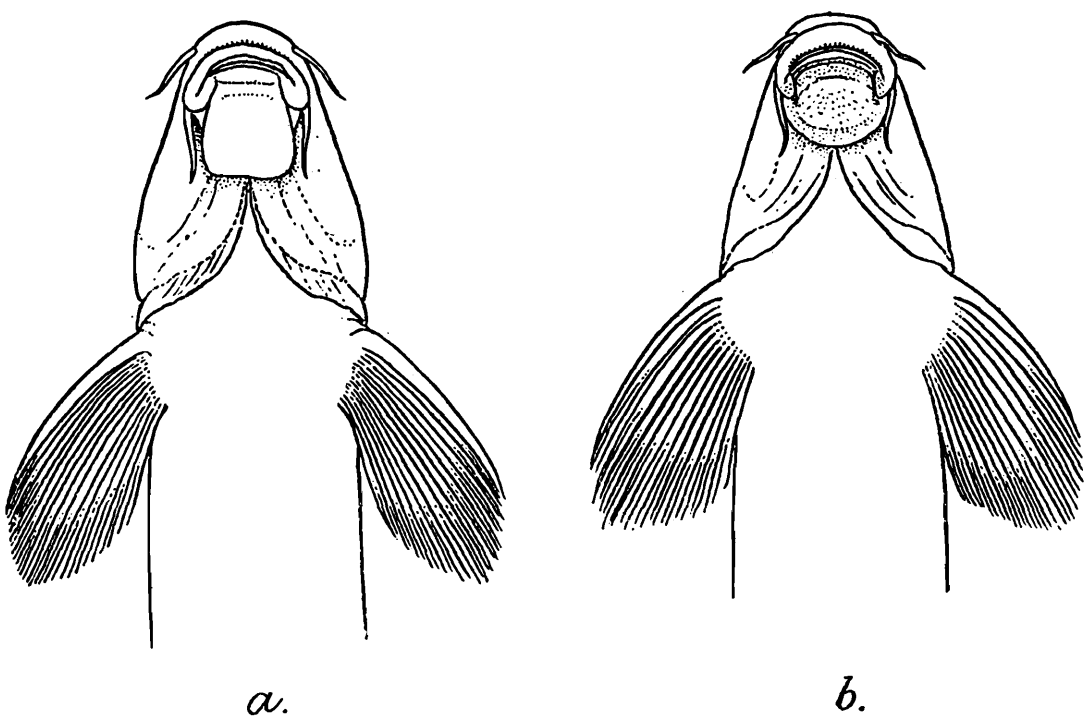
Garra chaudhurii, sp. nov.

Plate XXV, fig. 3.

D. 2/7—8. A. 2/5. P. 13—15. V 8.

This species is represented by small individuals from the Darjiling District of Northern Bengal. The head and body are depressed and the ventral profile is almost straight; the dorsal profile is arched and slopes considerably on both sides from the origin of the dorsal fin. The head is conical and is 1·3 times as long as broad; its length is contained from 4·1 to 4·9 times in the length of the fish without the caudal. The depth of the body is as much greater than the width of the head as it is less than its length. The eyes are almost lateral and are invisible from be-

low. They are situated nearer to the tip of the snout than to the posterior margin of the operculum; their diameter is contained from 4·6 to 5·7 times in the length of the head, 2–2·1 times in the length of the snout and 2·1–2·6 times in the interorbital width. There are two pairs of barbels, longer than the diameter of the eye. The snout is smooth and the nostrils are situated nearer the margin of the orbit than to the tip of the snout. The mouth-opening is somewhat arched and is situated slightly behind the tip of the snout. The mental disc exhibits considerable variation in the three adult specimens examined. In the ripe female it corresponds to developmental stage 4 and consists of a rectangular pad behind the mouth which is separated by a faint line of demarcation into an anterior portion, the posterior labial fold, and



TEXT-FIG. 4.—Form of mental disc in two ripe specimens of *Garra chaudhuri*, sp. nov.

the posterior portion, the disc proper. In the other two male specimens it is more marked, but the true lips are still visible and the various components of the disc are not well differentiated. The origin of the dorsal fin is slightly nearer to the tip of the snout than to the base of the caudal fin and its longest ray is as high as the depth of the body below it. The pectorals are shorter than the length of the head and are separated from the ventrals by a considerable distance.

In spirit the specimens have lost their natural colouration. They are dusky on the body above the lateral line and on the upper surface of the head. The rest is dirty white and the cheeks are whitish.

The air-bladder is of the normal Cyprinid type; its length is contained 2·8 times in the length of the fish without the caudal fin.

The scales are poorly developed on the under surface and are

greatly reduced anteriorly. There are 32–33 scales along the lateral line and 8 series of longitudinal rows of scales between the bases of the dorsal and ventral fins.

Type-specimen.—F 8146/1, *Zoological Survey of India* (*Ind. Mus.*).

Locality.—There are three specimens of this species from the Darjiling District, presented to the Indian Museum by Dr. Walker.

Measurements in millimetres.

Length of fish without caudal	53·2	56·2
,, ,, head	13	11·4
Width ,, ,,	9·6	8·2
Depth of body	11·5	9·9
Diameter of eye	2·8	2
Length of snout	5·6	4·2
Interorbital width	6	5·3
Length of caudal peduncle	9·6	8·0
Height ,, ,, ,,	7	6·7
Longest ray of dorsal	11·7	9·6
,, ,, ,, anal	10·2	7
Length of pectoral	11·7	10
,, ,, ventral	10	8

Garra jenkinsonianum, sp. nov.

Plate XXV, fig. 1.

1910. *Discognathus lamta*, Jenkins, *Rec. Ind. Mus.* V, p. 128.

D. 2/8. A. 1/5. P. 12—14. V. 8—9.

In *Garra jenkinsonianum* the dorsal profile is greatly arched; it rises from the tip of the snout to the base of the dorsal fin, beyond which it slopes gradually to the base of the caudal. The ventral profile is straight and horizontal throughout. The head is somewhat flattened on the under surface and is short and bluntly pointed; its length is contained 4·3 times in the length of the fish without the caudal and it is 1·2 times as long as broad. The body is slightly flattened; its depth near the origin of the dorsal fin is almost equal to the length of the head. The eyes are situated almost in the middle of the head and are lateral in position; they are slightly visible from above and almost invisible from below. The diameter of the eye is contained 4·3 times in the length of the head, 1·8 times in the length of the snout and 2·1 times in the interorbital width. The mouth is small and slightly arched; it is not situated far behind the tip of the snout. The mental disc is small but its various parts are well-marked. There are two pairs of short barbels; their length is shorter than the diameter of the eye. The snout is smooth and rounded, but near the tip it is marked off into a small lobe by two short transverse grooves. The origin of the dorsal is nearer the tip of the snout than the base of the caudal fin; it is considerably in advance of the ventral; its longest ray is shorter than the depth of the body below it and its free margin is almost straight. The pectorals are

shorter than the head and are separated from the ventrals by a distance less than $\frac{1}{3}$ of their length. The ventrals are situated at an equal distance from the base of the caudal fin and the tip of the snout; they extend to beyond the anal opening. The anal does not reach the base of the caudal fin, which is slightly emarginate. The lateral line is straight and runs along the side of the fish somewhat nearer to the dorsal than to the ventral surface, there are 33–34 scales along its length and $7\frac{1}{2}$ series of longitudinal rows of scales between the bases of the dorsal and the ventral fins. The scales are absent on the chest but are quite normal on the belly. The anus is situated in the beginning of the last third of the distance between the origin of the ventral and the anal fins.

The air-bladder in this species is of the normal Cyprinid type, its length is contained 2·7 times in the length of the fish without the caudal.

The sides and the upper surface of the head and body are darkish with an indistinct greyish band along the lateral line on each side. The under surface is dull white. There is a distinct black spot just behind the angle of the operculum.

Type specimen.—F 5736/1, *Zoological Survey of India* (*Ind. Mus.*).

Locality.—Numerous specimens were obtained by Dr. Jenkins and Dr. Annandale in Sita Nullah, Paresnath Hills, Bengal.

Measurements in millimetres.

	A.	B.
Length of fish without caudal	63	60
,, ,, head	15	14
Width ,, ,, ...	11·5	11
Depth of body	15·3	14·6
Diameter of eye	3·5	3·2
Length of snout	6·4	5·3
Interorbital width	7·5	7
Length of caudal peduncle	10	12
Height of ,, ,, ...	8	8·4
Longest ray of dorsal	11·8	11·5
,, ,, ,, anal	10·5	10·5
Length of pectoral	14	14·5
,, ,, ventral	11·6	11·5

Sita Nullah, Paresnath Hills... Dr. Jenkins and Dr. Annandale... 14.
,, ,, ... Dr. Jenkins ... ... 2.

Garra rupeculus [1] (McClelland).

Plate XXIV, fig: 1.

1839. *Gonorhynchus rupeculus*, McClelland, *Asiatic Res.* XIX, pp. 281, 343, pl. xliii, figs. 4, 5.
1839. *Gonorhynchus brachypterus*, McClelland, *ibid.*, pp. 283, 374.

McClelland described both the species from the "Mishmee Mountains" where they were obtained by Mr. Griffith. McClelland

[1] When giving a synopsis of the species on page 281 and 283 McClelland spells the name of this species as *rupiculus*, while in the description on page 343 he spells it *rupeculus*.

himself doubted whether the two forms were specifically distinct as on p. 283 (footnote) of the work cited above he remarks of *G. brachypterus*,—"It also agrees with that species (*G. rupeculus*) in the form of its fins; the presence of two very minute cirri being my chief reason for separating them, I have not thought it necessary to give a figure." Having collected a large number of examples of this species, I do not find myself justified in accepting the two forms as distinct species. The barbels are, undoubtedly, very minute and are apt to be overlooked. As a matter of fact there are four short barbels, of which McClelland could see only two in certain individuals. Since the publication of Günther's Catalogue (1868) both these species have been placed under the synonymy of *G. lamta* by several ichthyologists without comment. Some of my specimens, though none of them is more than 2 inches in length, are ripe females as they have been found on dissection to contain eggs. This species is a characteristic hill-stream form.

The species is readily distinguished by its small size, depressed body and head and almost straight profile. The length of the head is contained 4·5–5 times, the depth of the body near the origin of the dorsal fin 5·3–6·9 times in the length of the fish including the caudal fin. The head is 1·2 times as long as broad. The eyes are dorso-lateral and are situated in the middle of the head; their upper margin is in line with the dorsal profile of the head. There are two pairs of minute barbels. The mouth is provided with well-developed labial folds and the mental disc is well-marked. There are rows of open pores on the snout, one extending from the antero-inferior margin of the eye to its tip and another from behind the disc on the under surface, coming upwards and backwards and ultimately continued along the lateral line. The origin of the dorsal fin is slightly nearer to the base of the caudal than to the tip of the snout; it contains six branched rays besides one or two that are not branched. The pectorals are horizontal and rounded, they are shorter than the length of the head and are widely separated from the ventrals. Both the paired fins are horizontally placed and are provided with muscles on the under surface of some of their outer rays. The ventrals extend considerably beyond the anus. The lateral line is straight and runs nearer to the dorsal than to the ventral surface. There are 32–34 scales along the lateral line and 9 longitudinal series of scales between the bases of the dorsal and ventral fins. The ventral surface is naked.

The air-bladder is normal in form. In a specimen 30 mm. long, the following are the measurements of the bladder.

Length of anterior chamber	...	...	...	2·2 mm
" " posterior "	..	...	...	3·0 "
Greatest diameter of anterior chamber		...	...	2·5 "
" " " posterior "		...	...	1·2 "

The colour is variable; generally it is black on the upper surface and sides of the body and white below. The fins are all

white, except for a light black streak near the free margin of the dorsal and a wavy band in the middle of the caudal fin. There is a deep black bar across the base of the dorsal and this in some specimens is preceded by a narrow white streak. In certain examples the colour below the lateral line is very light while in others a deep black longitudinal band is present along the lateral line and both the surfaces above and below it are light in colour.

Locality.—My specimens were collected in the hill-streams of the Manipur Valley, Assam. It is also known from the adjacent Mishmi Hills.

Measurements in millimetres.

	A.	B.	C.	D.	E.	F.
Length of fish including caudal fin ...	29·8	30	30·2	34·4	30·7	29.7
Greatest depth of body ...	4·3	4.4	4·6	6·4	4·4	5·2
Length of head	6·2	5·8	6·1	7·2	6·3	6·2
Width of head	4·8	4·8	4·8	5·4	4·8	4·4

Garra sp.

I am indebted to my friend Mr. Prashar Bhatia for a young specimen of *Garra* from the neighbourhood of Bannu City, which is situated very near Waziristan. The specimen is only 37 mm. in length and differs from *G. wanae* in the following respects :—

(i) The eyes are partly visible from below.

(ii) The origin of the dorsal fin is slightly nearer to the tip of the snout than to the base of the caudal fin.

(iii) There is a well-developed free tubercular border to the disc with the posterior and lateral edges free.

(iv) There is a round black spot on either side of the tail near the base of the caudal fin.

I have not thought it proper to describe a new species on the basis of a single, probably immature, individual.

Part 2. On some extra-Indian species of *Garra*.

While revising the Indian species of *Garra* I have also examined some specimens of this genus from outside India proper in the collection of the Indian Museum. The specimens dealt with in this part are from the following localities :—

(i) Five specimens (F 8120—24/1) from Lahej near Aden.

(ii) One specimen (No. 9405) from Baluchistan.

(iii) Nine specimens (F 8125—33/1) from the Lake of Tiberias, Palestine.

(iv) Numerous specimens (F 8174—95/1) from the Kushk River, Afghanistan.

(v) Topotypes of *G. blanfordi* (F 8108—8119/1) from Abyssinia.

(vi) Type-series of *G. adiscus* from Seistan.

Except *G adiscus* (Annandale), all have been referred by

various authors to *Garra lamta*. Blanford [1] referred those from Lahej near Aden to the latter species on the authority of Günther Annandale,[2] while recognising that the Palestine species was distinct from the Indian one, considered it merely a local race of *G. lamta* which he called *rufus* (Heck.). Both Lortet [3] and Tristram [4] also described and figured their examples from Palestine as *G. lamta*,[5] while Jenkins [6] referred the Baluchistan specimen to the same species without comment. The Abyssinian form previously referred to *G. lamta* by Blanford (*op. cit.*, p. 460) and Vinciguerra [7] has been separated by Boulenger [8] under the name *G. blanfordi*. Numerous examples collected between the Helmand and the Kushk Rivers in Afghanistan were recorded by Günther [9] himself as *G. lamta*, but Boulenger in the paper cited above has referred the same specimens to *G. variabilis*, Heck., of which he regards Nikolski's[10] *G. rossicus* as a synonym.

In my opinion the Arabian form must be described as a new species. I agree with Boulenger and Annandale as regards those from Abyssinia and Seistan, while *G. rufus* seems to me to be specifically distinct. The single specimen from Persian Baluchistan probably represents an undescribed species, but I prefer not to name it on the basis of a single individual. Boulenger in the paper cited above gives a very wide interpretation to the species *G. variabilis* (Heck.), in which Tate Regan [11] also included the form recently described by Annandale [12] as *G. phryne*. Mr. Tate Regan has, however, recently informed us that there are no specimens in the British Museum that he can refer to *G. variabilis*, and it is clear that several allied forms are capable of specific separation.

Garra arabica, sp. nov.

1870. *Discognathus lamta*, Blanford (in part), *Geol. Zool. Abyssinia*, p. 461.

D. 3/8. A. 2/5. V. 9. P. 14—15.

Garra arabica is a fairly stout fish with the dorsal profile arched and the ventral almost horizontal and straight in front of the anal fin, beyond which it rises to the base of the caudal fin. The head and body are somewhat depressed. The length of the head is contained 4 to 4·3 times and the depth of the body 3·6 to 4

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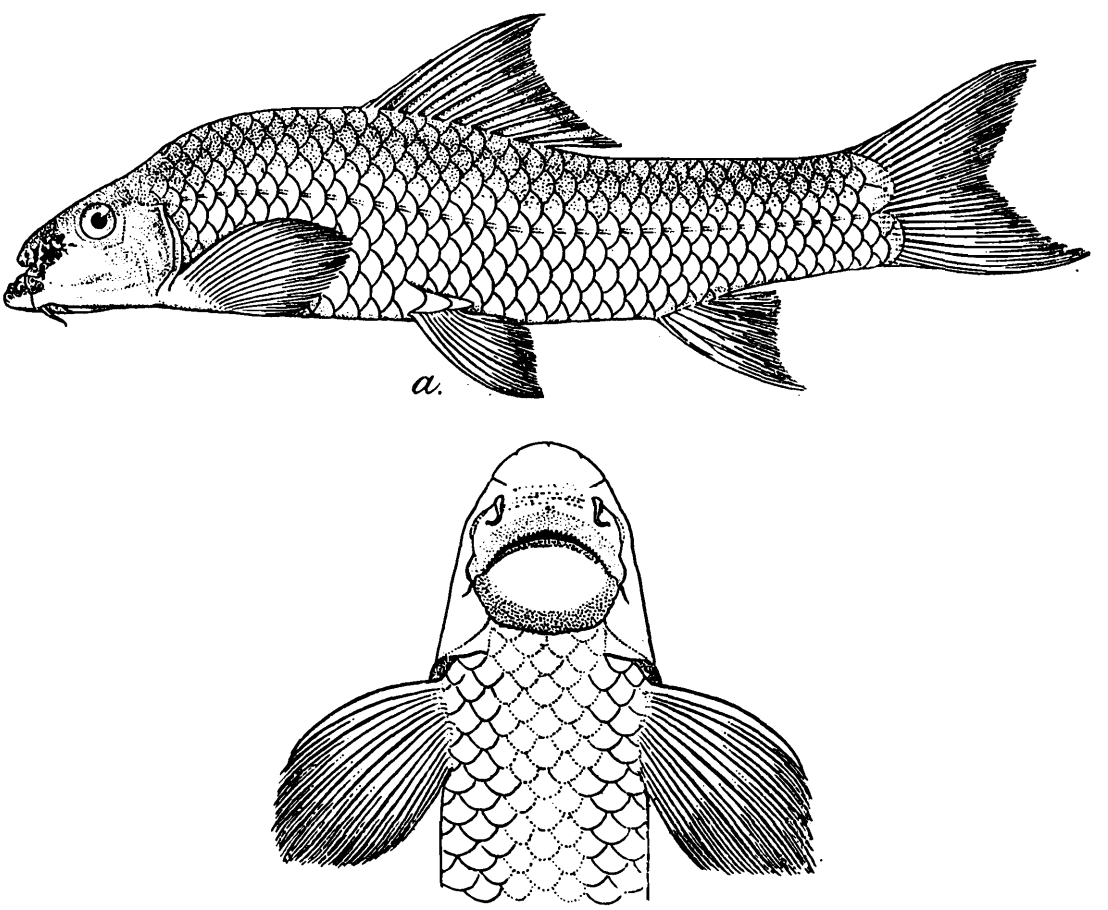
1 *Geol. Zool. Abyssinia*, p. 461 (1870).
2 *Journ. As. Soc. Bengal* (n.s.) IX, p. 37, fig. 2 (1913).
3 *Arch. Mus. d'Hist. Nat. Lyon* III, p. 153, pl. xvi, figs. 4,5 (1883).
4 *Faun. Flor. Palest.*, p. 172, xix, fig. 3 (1884).
5 The specimen figured by Lortet is quite distinct from Annandale's Palestine specimens.
6 *Rec. Ind. Mus.* V, p. 124 (1910).
7 *Ann. Mus. Genova* XVIII, p. 695 (1883).
8 *Proc. Zool. Soc. London* II, p. 160 (1901).
9 *Trans. Linn. Soc.* (2) V, p. 170 (1889).
10 *Ann. Mus. Zool. Acad. Petersbourg* V, p. 239 (1900).
11 *Journ. As. Soc. Bengal* II, p. 8 (1906).
12 *Rec. Ind. Mus.* XVIII, p. 70, pl. x, fig. 3 pl. xi, fig. 2.

times in the length of the fish without the caudal fin. The head is 1·3 times as long as broad. The eye is in the posterior half of the head and is contained 4·5 to 5 times in the length of the head, 2·4 to 2·8 times in the length of the snout and 1·7 to 2 times in the interorbital width. The eyes are dorso-lateral in position and are invisible from below. The snout projects considerably beyond the mouth and the mental disc is well developed. The tubercles on the labial fold and also on the free borders of the disc are comparatively minute. The upper labial fold is fringed. The gape of the mouth is slightly less than half the length of the head. There are two pairs of barbels; those at the angle of the mouth are very



Text-fig. 5.—Lateral view and under surface of head of *Garra arabica*, sp. nov.
a. Lateral view of type-specimen.
b. Under surface of head of same.

small. The length of the rostral barbels is less than the diameter of the eye. There are 33 to 34 scales along the lateral line and 9 longitudinal rows between the bases of the dorsal and the ventral fins. There are three and a half rows of scales between the lateral line and the root of the ventral. The scales are feebly developed in the region of the chest and also form appendages to the bases of the ventrals. The dorsal fin is situated slightly in advance of the ventrals; its first divided ray is the longest and its free margin is concave. Its origin is much nearer to the tip of the snout than to the base of the caudal. The pectoral fin is sharp in the middle and is as long as the head. It is separated from the ventrals by

half its own length. The ventrals extend beyond the anus but the anal does not reach the base of the caudal fin.

In adult specimens there is always a well-developed proboscis, studded with hollow tubercles projecting in front of the nares on the snout. Similar hollow tubercles are also present on other parts of the snout.

The air-bladder is much reduced and the two chambers are separated by a comparatively long and narrow neck. The following are the dimensions of the air-bladder in a specimen 102 mm. long without the caudal:—

Length of anterior chamber	4·5 mm.
,, ,, posterior ,, ...	3·2 ,,
Greatest diameter of anterior chamber	3·3 ,,
,, ,, ,, posterior ,, ...	1·3 ,,

The colour has faded in spirit, but even now indistinct longitudinal black bands can be seen on the body and an indistinct black dot on the operculum near its angle.

Type-specimen.—F 8123/1, *Zoological Survey of India* (*Ind. Mus.*).

Locality.—From Lahej near Aden, where it is said to be very common. The specimens were presented to the Indian Museum by Dr. W. T. Blanford.

Measurements in millimetres.

	A.	B.	C.
Total length excluding caudal	121	121	98
Length of head	29	28	24·5
Width ,, ,, ...	21	21·5	18
Depth of body	33·5	32	24
Length of snout	17	16	13
Diameter of eye	6	5·5	5·5
Interorbital width	11	11·5	9·5
Heigth of dorsal fin	27	27·5	22·6
Length of anal ,, ...	23	22·5	20
,, ,, pectoral ,, ...	28	28	24
,, ,, ventral ,, ...	26	26	21
Length of caudal peduncle	24	19	17
Depth ,, ,, ,, ...	16	16.5	14·5
Length of rostral barbels	5	4	4·3
Gape of mouth	12	13·5	10

Playfair[1] in 1870, recorded from Lahej some fish, which he referred to *G. lamta*, on the authority of Günther. He also gave a short description of his specimens. My examples do not agree with his account of these fishes and, therefore, I suppose that in Arabia as in other countries where this genus is found there is probably more than one species. Our Arabian specimens certainly do not belong to *G. lamta*, to which they were originally referred. The new species differs from Playfair's description in the following characters:—

(i) The number of the longitudinal series of scales between

[1] *Proc. Zool. Soc. London*, pp. 85, 86 (1870).

the lateral line and the ventrals is three and a half in *G. arabica*, while it is four and a half in Playfair's form.

(ii) In *G. arabica* the pectoral terminates about a half of its own length from the root of the ventral, while in Playfair's examples it terminates "at about its own length before root of ventral."

(iii) The proportions in the two species do not agree. *G. arabica* closely resembles *G. stenorhynchus* and *G. gotyla* from India in the character of the snout, which in these three species possesses a proboscis; but whereas in the two Indian species the proboscis is single, in the Arabian species it is provided with two short processes near its base, one on each side. The three species also differ in proportions and number of fin-rays.

Garra sp.

? 1897. *Discognathus* sp.? Nikolsky, *Ann. Mus. Zool. Acad. Petersbourg* II, p. 348.
1910. *Discognathus lamta*, Jenkins, *Rec. Ind. Mus.* V, p. 124.

In this fish the dorsal profile rises from the anterior end of the snout to the origin of the dorsal fin, beyond which it slopes down to the base of the caudal fin. The ventral profile in front of the ventrals is straight and horizontal. The head and body are depressed and the scales on the chest and the middle of the abdomen are poorly developed. To the naked eye, indeed, the surface appears to be absolutely devoid of scales. The length of the head is contained 3·6 in the length of the fish without the caudal fin. The head is almost 1·4 times as long as broad. The eye is almost in the middle of the head or somewhat in the posterior half, its diameter is contained 5 times in the length of the head. It is dorso-lateral in position and is invisible from below. The interorbital space is slightly less than the length of the snout and almost equals the gape of the mouth; it is twice the diameter of the eye. The snout projects considerably beyond the mouth which is provided with a fringed labial fold. The mental disc is well developed. There are eight branched rays in the dorsal and five in the anal. The origin of the dorsal is equidistant from the end of the snout and the base of the caudal fin and is also considerably in advance of that of the ventral. There are two pairs of short barbels. The maxillary barbels are shorter than the diameter of the eye, while the rostral barbels are longer. There are 33 scales along the lateral line and 8 rows between the bases of the dorsal and the ventral fins.

The air-bladder is slightly reduced, otherwise it is of the normal Cyprinid type. The following are its dimensions in a specimen 51·5 mm. in length without the caudal:—

Length of posterior chamber	9·5 mm.
,, ,, anterior ,, ...	5·2 ,,
Greatest diameter of posterior chamber	2·0 ,,
,, ,, ,, anterior ,, ...	3·5 ,,

In spirit the upper surface of the head and body is dusky and the belly is white.

Locality.—Only one specimen from Persian Baluchistan (W. T. Blanford's Persian collection) has been examined. It is immature and the sex cannot be determined.

The species differs from *G. persica*, Berg (1913) in having the upper lip fringed, in having no scales on the belly and in proportions and colouration. In it the eye is situated almost in the centre of the head, while in *G. persica* it is in the posterior half.

Garra rufus (Heckel).

1843. *Discognathus rufus*, Heckel, *Russegger's Reis.* I, p. 1071, pl. 8, fig. 2.
1884. *Discognathus lamta*, Tristram, *Faun. Flor. Palest.*, p. 172, pl. xix, fig. 3.
1913. *Discognathus lamta* var. *rufus*, Annandale, *Journ. As. Soc. Bengal* (n.s.) IX, pp. 36—38, fig. 2.

Through the kindness of Mr. Tate Regan, to whom our best thanks are due, we are now in possession of the original description of Heckel's species. After a careful comparison of Dr. Annandale's Palestine specimens with the description of Heckel's *G. rufus* from Syria, I have not been able to find any specific differences.

In *G. rufus* the air-bladder is well-developed and its length is contained 2·7 times in the total length of the fish without the caudal fin.

Garra blanfordi (Boulenger).

1900. *Discognathus blanfordi*, Boulenger, *Cat. Fresh-w. Fish. Africa* I, p. 249, fig. 263.

While discussing the distribution and relationship of the genus *Discognathus*, Annandale[1] pointed out the possibility that the African species "may be degenerate rather than primitive." He had then no African specimens for examination. I have now dissected a specimen of *G. blanfordi* from Abyssinia in order to see the air-bladder and the weberian ossicles and find the structure of both to be of normal Cyprinid type. The air-bladder is fairly extensive and is not covered by any fibrous coat. The weberian ossicles and the bladder are of the normal Cyprinid type. It is clear, therefore, that *D. blanfordi* is not degenerate in so far as the air-bladder is concerned. The following are the measurements of a specimen 35 mm. in length without the caudal :—

Length of anterior chamber	... ...	5·2 mm.
,, ,, posterior ,,	... ...	7·5 ,,
Greatest diameter of anterior chamber	... ..	3·6 ,,
,, ,, ,, posterior ,,	.. ...	2·3 ,,

Garra adiscus (Annandale).

1919. *Discognathus adiscus*, Annandale, *Rec. Ind. Mus.* XVIII, p. 68 pl. x, fig. 2 ; pl. xi, fig. 1.
1920. *Discognathus adiscus*, Annandale and Hora, *ibid.*, p. 165.

[1] *Rec. Ind. Mus.* XVIII, p. 69 (1919)

Annandale pointed out in the description of the species that it " must be accepted as an extremely primitive representative of *Discognathus*." In another paper in the same volume (p. 165) I concurred in the same view. I have now examined the skeleton and the air-bladder more closely and find some corroborative evidence, but as has already been pointed out it is impossible to express any final opinion on the subject until the Malayan species assigned to *Crossochilus* are examined anatomically.

I have prepared skeletons of the jaws in *Crossochilus latia*, *Cirrhina mrigala* and *Garra adiscus* for comparison and find great similarity as regards their bony structure in *G. adiscus* and *C. mrigala*. Both these differ from *C. latia* in having a longer articular bone and better developed branchiostegal rays. They also differ in the character of the basibranchiostegal bone or urohyal. Correlated with these differences there are others in the air-bladder. Whereas the bladder of *C. mrigala* and *G. adiscus* are of the normal type, in *C. latia* it is somewhat reduced and differs considerably from the normal form, more closely resembling that of some advanced species of *Garra*. The posterior chamber has become cylindrical with an almost uniform thickness throughout, and its walls are also thickened. It is clear, therefore, that *G. adiscus* is more closely allied to *Cirrhina* than it is to *Crossochilus*. In this respect *G. adiscus* agrees with other less modified species of *Garra* I have examined.

The following are the measurements of the bladder in a specimen 58 mm. in length :—

Length of anterior chamber	...	...	6·8 mm.
,, ,, posterior ,,	...	...	11 ,,
Greatest diameter of anterior chamber	...	...	4·5 ,,
,, ,, ,, posterior ,,	...	...	3·2 ,,

The systematic position of this species is rather doubtful. I provisionally include it in the genus *Garra*.

Garra rossicus (Nikolsky).

1889. *Discognathus lamta*, Günther, *Trans. Linn. Soc. London* V (2), p. 107.
?1897. *Discognathus variabilis*, Nikolsky, *Ann. Mus. Zool. Ac. Sci. St. Petersburgh* II, p. 347.
1899. *Discognathus variabilis*, Nikolsky, *ibid.*, IV, p. 412.
1900. *Discognathus rossicus*, Nikolsky, *ibid.*, V, p. 239.
1905. *Discognathus rossicus*. Berg, *Izv. Vost.-sibir.* IV, Vuip. 6, p. 261, pl. iv.
1906. *Discognathus variabilis*, Regan, *Journ. As. Soc. Bengal* II p. 8.
1919. *Discognathus phryne*, Annandale, *Rec. Ind. Mus.* XVIII, p. 70, pl. x, fig. 3 ; pl. xi, fig. 2.
1920. *Discognathus phryne*, Annandale and Hora, *ibid.*, p. 166.

This species is closely allied to *G. variabilis*, Heck., from which it differs in the following characters :—

(i) The origin of the dorsal fin is considerably nearer the base of the caudal fin than the tip of the snout.

(ii) The minimum height of the dorsal fin is contained more than twice in its maximum height.

(iii) The caudal fin is deeply emarginate.

(iv) The chest and back are naked.

(v) The proportions are different in the two species.

Nikolsky described *G. rossicus* from the specimen which he had previously referred to *G. variabilis*. Annandale and myself in 1920 regarded Nikolsky's *G. variabilis* as a synonym of *G. phryne* but overlooked his later paper (1900) in which the specific name *rossicus* is proposed. I have now carefully compared the descriptions of *D. phryne* and *D. rossicus* and do not think that there is any difference between the two forms. In his Latin description Nikolsky makes no mention of the scales on the chest or on the back; but considering that his specimens were obtained from the same locality whence Annandale described his *G. phryne*, I have no doubt that the two species are identical.

I refer to this species the specimens collected by Aitchison when he was attached to the Afghan Delimitation Commission. These examples are not in good condition for detailed examination; but so far as I have been able to make out the only difference between them and the *G. phryne* from Seistan lies in the structure of the mental disc. In the Afghanistan examples the free borders of the disc are well developed.

I also refer to this species Col. MacMahon's specimens from Seistan and several examples collected by Col. Alcock in the Shila and Lora Rivers, Afghanistan.

This species is fairly common in the hilly country of Baluchistan but is rare in Seistan and Oriental Persia.

The air-bladder, like the other less modified species of *Garra*, is fairly extensive and is of the normal form. In a mature female 55 mm. in total length, the measurements are as follows:—

Length of anterior chamber	6·0	mm.
,, ,, posterior ,, ...	11·0	,,
Greatest diameter of anterior chamber	5·0	,,
,, ,, ,, posterior ,, ...	3·5	,,

BIBLIOGRAPHY OF THE GENUS *GARRA*.

An asterisk (*) preceding the name of an author indicates that the book has not been seen by the writer.

Annandale, N., 1913. Notes on Fishes, Batrachia and Reptiles of the lake of Tiberias.—*Journ. Proc. As. Soc. Bengal*, (n.s.) IX, pp. 36—38, text-figs. 1, 2.

,, 1918. Fish and Fisheries of the Inlé Lake.—*Rec. Ind. Mus.*, XIV, p. 45.

,, 1919 (*a*). Notes on Freshwater Fish mostly from the Satara and Poona Districts.—*Rec. Ind. Mus.*, XVI, pp. 129—134, pl. ii.

,, 1919 (*b*). Notes on fish of the genus *Discognathus* from India and Persia.—*Rec. Ind. Mus.*, XVIII, pp 65—78, pls. ix—xi.

Annandale, N., and
Hora, S. L., 1920. The fish of Seistan.—*Rec. Ind. Mus.*, XV pp. 161—168, text-figs. 3, 4.
* Berg, L. S., 1905. Die Fische von Turkestan. [Text in Russi *Mitth. Turkestan. Abh. K. Russ. Geogr. Ge* IV, p. 261, pl. iv.
,, 1913. Description of a new species of *Garra*(=*Discognathus*) from Eastern Persia.— *Ann Mus. Zool. St. Pétersbourg*, XVIII, pl. lxi.
Blanford, W T., 1870. *Observations on the Geology and Zoology of Abyssinia* (London).
Bleeker, P., 1853. *Nalezingen op de Ichthyologie Fauna van Bengalen en Hindostan* (Batavia).
,, 1863 (*a*). Description de quelques espèces nouvelles de Cyprinoïdes du Ceylan.—*Versl. en Meded., Afd. Natuurk.* XV, pp. 239—242.
,, 1863 (*b*). *Atlas Ichthyologique*, III, p. 24 (Amsterdam).
* ,, 1864. Description de quelques espèces de Cobitioïdes et de Cyprinoïdes de Ceylon.—*Nat. Verh Holl. Matsch. Wetensch.* (2) XX, pp 1—23.
Blyth, E., 1860. Report on some Fishes received chiefly from the Sitang River and its Tributary Streams, Tenasserim Provinces.—*Journ. As. Soc. Bengal*, XXIX, pp. 160—161.
Boulenger, G. A., 1901. On a small collection of Fishes from Lake Victoria made by order of Sir H. H. Johnston, K.C.B.—*Proc. Zool. Soc. London*, II, pp. 159—160.
,, 1903. Report on the Fishes collected by Mr. Oscar Neumann and Baron Carlo von Erlanger in Gallaland and Southern Ethiopia.—*Proc. Zool. Soc. London* II, pp. 330—331.
,, 1905. On a second collection of Fishes made by Mr. S. L. Hinde in the Kenya District, East Africa.—*Proc. Zool. Soc. London*, I, p. 62, pl. vii, fig. 1.
,, 1907. *The Fishes of the Nile*, pp. 180—189, pls. (London).
,, 1909. *Catalogue of the Fresh-water Fishes of Africa*, I, pp. 343—352, text-figs. (London).
Chaudhuri B. L., 1913. Zoological Results of the Abor Expedition, 1911—12, Fish.—*Rec. Ind. Mus.*, VIII, p. 247.
Day, F., 1865 (*a*). On the Fishes of Cochin, on the Malabar Coast of India.—*Proc. Zool. Soc. London*, p. 349.
,, 1865 (*b*). *The Fishes of Malabar*, p. 205, pl. xv, fig. 1 (London).
,, 1867 (*a*). On the Fishes of the Neilgherry Hills and Rivers around their Bases.—*Proc. Zool. Soc. London*, p. 288.

Day, F., 1867 (*b*). On some Fishes from the Wynaad.—*Proc. Zool. Soc. London*, p. 349.

,, 1869. Remarks on some of the Fishes in the Calcutta Museum. Part ii.—*Proc. Zool. Soc. London*, p. 553.

,, 1871. Monograph on Indian Cyprinidae, (Part I).—*Journ. As. Soc. Bengal*, (2) XL, pp. 108—111, pl. ix, figs. 2, 3.

,, 1872. Monograph of Indian Cyprinidae, (Part vi).—*Journ. As. Soc. Bengal*, (2) XLI, p. 318.

,, 1877. On Fisheries and Botany of Bengal, in Hunter's *Statistical Account of Bengal* (London).

,, 1878. *The Fishes of India* II, pp. 527—529, pl. cxxii, figs. 4, 5, 6, and pl. cxxiii, fig. 1 (London).

,, 1889. *The Fauna of British India. Fish*, I, pp. 245—247, fig. 87 (London).

Fowler, H. W., 1905. Some Fishes from Borneo.—*Proc. Acad. Nat. Sci. Philadelphila* LVII, p. 482.

Garman, S., 1912. Some Chinese Vertebrates. Pisces.—*Mem. Mus. Comp. Zool. Harvard* XL, p. 114.

Gray, J. E., 1832. *Illustrations of Indian Zoology* I, pl. 88, fig. 3 (London).

Günther, A., 1868. *Catalogue of the Fishes in the British Museum* VII, pp. 68—71 (London).

,, 1889. The Zoology of the Afghan Delimitation Commission. Fishes.—*Trans. Linn. Soc. London* (2), V, p. 107.

Hamilton, F. B., 1822. *An Account of the Fishes of the Ganges*, pp. 343, 393 (Edinburgh).

Heckel, J. J., 1841—8. *Ichthyologie.* In Russegger's *Reisen in Europa, Asien und Africa* I, pp. 1027, 1049, 1071, 1072, pl. 8, figs. 1, 3 and II, 3, pp. 262, 284.

,, 1844. *Fische Kaschmir's nebst einen Anhang von drei neuen Arten aus indien, gesammelt von Freiherrn Carl v. Hügel*, p. 387.

Hora, S. L., 1920. Revision of the Indian Homalopteridae and of the genus *Psilorhyunchus* (Cyprinidae).—*Rec. Ind. Mus.* XIX, p. 213.

Jenkins, J T., 1909. The Indian species of the genus *Discognathus.*—*Rec. Ind. Mus.* III, pp. 290—293.

,, 1910. On a collection of Fishes made by W. T. Blanford in 1872 in Persia and Baluchistan.—*Rec. Ind. Mus.* V, p. 124.

Jerdon, T. C., 1849. On the Fresh Water Fishes of Southern India.—*Madras Journ. Lit. and Sci.*, XV, p. 309—310.

Jordan, D. S., and Evermann, B. W., 1917. *The Genera of Fishes*, p. 115 (California).

Lortet, L., 1883. Poissons et Reptiles du lac de Tiberiade.—

Arch. Mus. Hist. Nat. Lyon III, p. 153, pl. xvi, figs. 4, 5.

McClelland, J , 1838. Observations on six new species of Cyprinidae, with an outline of a new classification of the family.—*Journ. As. Soc. Bengal* (2) VII, p. 947, pl. lv, figs. 2, 2*a*, 2*b*.

,, 1839. Indian Cyprinidae.—*Asiatic Researches* XIX, pp. 281—283 ; 373—375 , 300 and 328, pl. xlii, figs. 2, 2*b*, 4, 5, and pl. lvii, figs. 2, 2*a*, 2*b*.

,, 1842. On the fresh-water Fishes collected by William Griffith, Esq., F.L.S., Madras Medical Service, during his travels under the orders of the Supreme Government of India, from 1835—1842.—*Calcutta Journ. Nat. Hist.* II, p. 587, pl. lxviii, fig.

Nichols, J T., and Griscom, L., 1917. Fresh-water Fishes of the Congo Basin obtained by the American Museum, Congo Expedition, 1909—1915.—*Bull. Amer. Mus. Nat. Hist.*, XXXVII, p. 696, text-fig. 11.

Nikolsky, A. M., 1897. Voyage de Zaroudny etc., Reptiles, Amphibies et Poissons.—*Ann. Mus. Zool. Ac. Sci. St. Petersburgh* II. pp. 347—348.

,, 1899. *Ann. Mus. Zool. Ac. Sci. St. Pétersburg*, IV, pp. 411—412 (Title in Russian).

,, 1900. *Ann. Mus. Zool. Ac. Sci. St. Pétersburg* V, pp. 239—241 (Title in Russian).

O'Malley, L. S. S., 1909. *Bengal District Gazetteers*, Monghyr, p. 25 (Calcutta).

Pellegrin, J., 1905. Poissons d'Abyssinie et du Lac Rodolphe (Collection Maurice de Rothschild).—*Bull. Mus. Paris*, p. 291.

Playfair, Lieut.-Col., 1870. Note on a Fresh-water Fish from the Neighbourhood of Aden.—*Proc. Zool. Soc. London*, p. 85.

Prashad, B., 1919. On a new species of *Discognathus* from the Kangra Valley.—*Rec. Ind. Mus.* XVI, p. 163, text-figs.

Rao, C. R. N., 1920. Some new species of Cyprinoid Fish from Mysore.—*Ann. Mag. Nat. Hist.* (9) VI, pp. 45—59, pl. 1, figs. 1, 2, 3.

Regan, C. T., 1907. Description of three new Fishes from Yunnan, collected by Mr. J Graham.—*Ann. Mag. Nat. Hist.* (7) XIX, p. 63.

,, 1914. Two new Cyprinid Fishes from Waziristan, collected by Major G. E. Bruce.—*Ann. Mag. Nat. Hist.* (8) XIII, p. 263, fig. A.

Sauvage, H. E., and Thiersant, D. de, 1874. Notes sur les Poissons des Eaux Douces

de Chine.—*Ann. Sci. Nat. Paris* (6) I, No. 5, p. 8.

Steindachner, F., 1867. Über einige Cyprinoiden aus Ostindien.—*Sitzungsb. Akad. Wiss. Wien* LVI, i, p. 360, pl. iii.

Sykes, W. H., 1841. On the Fishes of the Dukhun.—*Trans. Zool. Soc. London* II, p. 359, pl. lxii, fig. 3.

Tristram, H. B., 1884. *The Fauna and Flora of Palestine*, p. 172, pl. xix, fig. 3 (London).

Vaillant, M. L., 1902. Résultats Zoologiques de l' Expédition Scientifique Néerlandaise au Bornéo Central.—*Notes Leyden Mus.* XXIV, p. 91.

Vinciguerra, D., 1883. Spedizione Italiana nell' Africa Equatoriale; Resultati Zoologici; Pesci d'acqua dolce.—*Ann. Mus. Stor. Nat. Genova* XVIII, pp. 695—699, text-figs.

„ 1889. Viaggio di Leonardo Fea in Birmania e Regioni Vicine, Pesci.—*Ann. Mus. Stor. Nat. Genova* XXIX, pp. 275—280, text-fig. 275, pl. ix, fig. 7.

Weber, M., and Beaufort, L. F., 1916. *The Fishes of the Indo-Australian Archipelago* III, p. 228, fig. 29 (Leiden).

Zugmayer, E., 1913. Die Fische von Baluchistan.—*Abh. Bayerischen Ak. Wiss.* (*Math.-phys. Klasse*) XXVI, p. 24.