SILUROID FISHES OF INDIA, BURMA AND CEYLON.

By SUNDER LAL HORA, *D.Sc., F.R.S.E, F.N.I., Assistant Superintendent, Zoological Survey of India,* and NIRMAL CHANDRA LAW, *M.Sc.*

(Plates I and II.)

IX. FISHES OF THE GENERA *Gagata* BLEEKER AND *Nangra* DAY.

Recently while working out collections of freshwater fishes from Assam and Travancore, considerable difficulty was experienced in separating Indian species hitherto referred to the genera *Gagata* Bleeker, *Batasio* Blyth and *Nangra* Day. This led us to examine the entire material of these genera in the extensive collections of the Indian Museum with very interesting results. In this article we propose to deal with the fishes of the genus *Gagata*, of which *Nangra* is regarded as a synonym, while the genus *Batasio* is treated in detail in the next article of this series.

Gagata Bleeker.

1858. *Gagata*, Bleeker, *Ichthyol, Archipel, Ind. Prodromus*, I, p. 204 (orthotype *G. typus* Blkr. = *Pimelodus gagata* Ham.).
1860. *Gagata*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 152.
1863. *Gagata*, Bleeker, *Ned. Tijdschr. Dierk.* I, p. 90.
1864. *Callomystax*, Günther, *Cat. Fish. Brit. Mus.* V, p. 218.
1877. *Gagata*, Day, *Fish, India*, p. 492.
1877. *Nangra*, Day, *ibid.*, p. 493.
1911. *Gagata*, Regan, *Ann. Mag. Nat. Hist.* (8) VIII, p. 564.
1911. *Nangra*, Regan, *ibid.* (8) VIII, p. 564.
1913. *Gagata*, Weber & de Beaufort, *Fish. Indo-Austral. Archipel.* II, p. 268.

In 1858, Bleeker provisionally proposed the generic name *Gagata* and included a number of heterogenous forms in it. It was not until 1863, however, that its definition was given and *Pimelodus gagata* Hamilton, rechristened as *Gagata typus* Bleeker, definitely assigned to it. As Bleeker had not seen any specimen of Hamilton's species, his characterisation of the genus was imperfect and the systematic position he assigned to it was faulty. However, Blyth recognised *Gagata* as a valid genus, but remarked : " This, as it now stands, is a heterogeneous assemblage of species, and I know of none that can properly range with the type of it, which is *Pimelodus gagata*, B. H. : a species with the maxillary cirri bony towards the base, as in *Bagarius* to a much greater extent. The *Menoda* dubiously referred to this type by Dr. Bleeker is identical with *Bagrus corsula*, Val., which therefore must stand as *B. menoda* (B. H.) ; the *Mangois* appertaining to my genus *Amblyceps ;* and another type may be here indicated as—*Hara*, nobis, n.g." Günther redescribed the species *gagata* from 5 examples, which he regarded as " Types of the species. Presented by G. R. Waterhouse, Esqr.," and erected for it a new genus *Callomystax*. He was aware of Bleeker's *Gagata* but did not consider it a valid genus and remarked :

> " Dr. V. Bleeker does not appear to have been acquainted with this fish, so that not only the characters of the genus which he proposed for it are incorrect, but it is also improperly referred to the ' phalanx ' of *Arii*, and to the ' Stirps ' of *Bagrini*."

Later workers, however, regarded *Gagata* Bleeker as a valid genus and considered Günther's *Callomystax* as its synonym. Günther had assigned only one species to this genus, but Day included 4 species in it—*G. cenia* (Ham.) with *G. gagata* (Ham.) as a synonym, *G. itchkeea* (Sykes), *G. batasio* (Ham.) and *G. tengana* (Ham.). According to Day, the range of the genus extends from the " Rivers of Sind, India (except Madras) and Burma." One more species—*G. schmidti*—has since been described by Volz[1] from Sumatra.

Day established another genus *Nangra* to accommodate *Pimelodus nangra* Hamilton, *P. viridescens* Hamilton and a new species from the Sone River (*Nangra punctata*) and remarked :—

> " This genus differs from *Gagata* in its barbels not being placed in a transverse line behind the chin : and in its gill-membranes not being confluent with a broad isthmus but rather deeply notched. It is allied in some respects to *Macrones*, but has no teeth on the palate, whilst its air-vessel is enclosed in bone. "

Our studies have shown that the characters distinguishing the two genera intergrade into each other and can at best be used for separating species in the same genus.

In order to discuss the systematic position of the above-mentioned species, it is necessary to know, in the first instance, the precise limits of the genus *Gagata* Hamilton. Though quite a number of Hamilton's species are inadequately characterised, there is no difficulty in recognising *P. gagata*, as its detailed description and figure leave no doubt about its identity. Reference may here be made to a few of its most salient features as given by Hamilton.

i. There are eight barbles ; the two nasal and the four mandibulary barbels are shorter than the head, while the maxillary barbels are rather longer, and have a membrane extending half way along their hinder edge.
ii. The anal fin is provided with 17 rays.
iii. The fins are edged with black.
iv. The bones of the head are roughened with variously intersecting ridges.
v. The jaws are crowded with minute teeth, while the tongue and the palate are smooth.
vi. Both apertures of each nostril are circular and are separated only by the nasal barbel.

Bleeker (1863, p. 90) based his genus *Gagata* on the following characters :—

> " Cirri 8, nasales 2, supramaxillares 2, inframaxillares 4. Palatum edentulum. Dentes maxillis pluriseriati parvi. Scutum capitis granosum, fonticulis lateralibus. Cirri supramaxillares basi membrana muniti. Spina dorsi edentula. B. 5."

Günther gave a good definition of the genus under *Callomystax* and included the following additional important diagnostic characters in it :—

i. The two pairs of mandibulary barbels are inserted in a transverse series immediately behind the margin of the lower lip. The maxillary barbels are osseous to some extent.
ii. The eyes are without free orbital margins.

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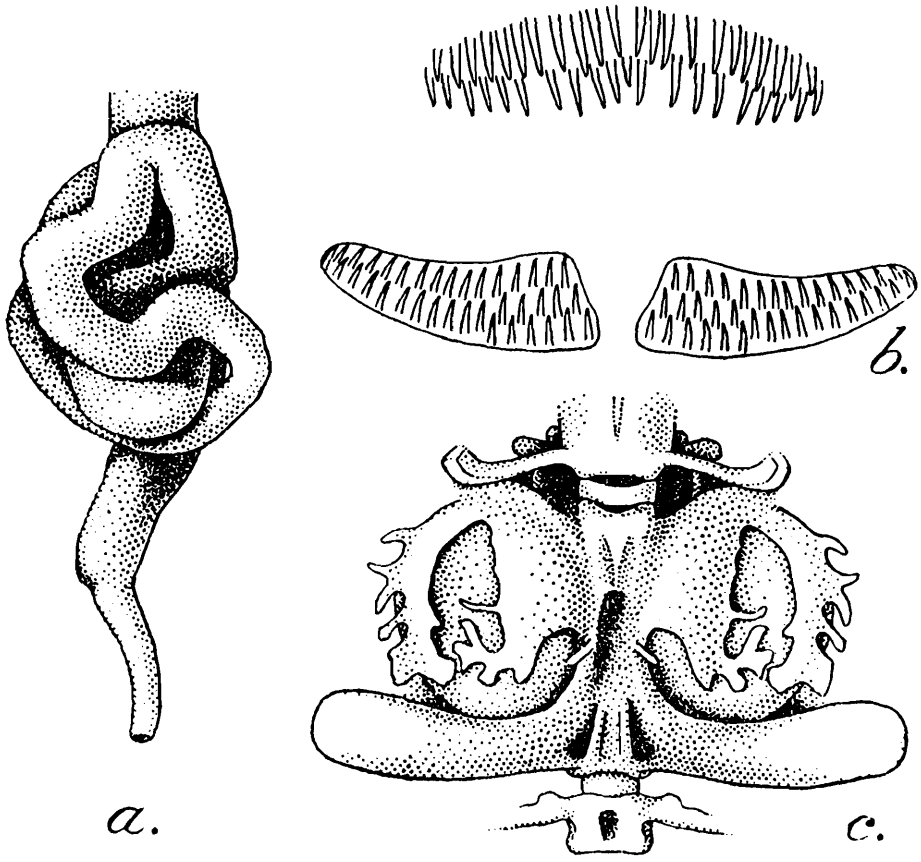
[1] Volz, W., *Revue Suisse de Zool.* XII, p. 470 (1904).

iii. The gill-openings are of moderate width, the gill-membranes being confluent with the skin of the isthmus.

Day added to the generic definition the character of the air-bladder which he found to consist of " two rounded portions, each of which is enclosed in an osseous cup." Regan in his synopsis of the genera of the Sisoridae defined the main skeletal features of *Gagata* and *Nangra*.



Text-fig. 1.—Alimentary canal, dentition and air-bladder of *Gagata gagata* (Hamilton).

a. Alimentary canal. ×2⅖; *b*. Dentition. ×8; *c*. Air-bladder. ×3⅗.

In view of what is stated above, the genus *Gagata* may be defined as follows :—

Gagata comprises a group of Sisorid fishes in which the body is compressed and the snub-nosed head, though globular, is somewhat elevated, only rarely depressed. The upper surface of the head is provided with sharp, longitudinal ridges ; it is covered with thin, smooth skin, but some of the bones on the dorsal surface are variously roughened. The median fontanel is very conspicuous. The mouth is small, transverse and ventral. The lips are thick, continuous and somewhat fimbriated ; the post-labial grooves are restricted round the corners of the mouth. The jaws are provided with small, villiform teeth ; the palate is edentulous. There are eight barbels ; the nasal barbels are small and thin and are prolongations of the broad flaps separating the two nostrils on each side ; these flaps, when present, cover a part of the posterior nostrils on each side ; the maxillary barbels are osseous proximally, and are provided with membraneous flaps along the inner surface ; the two pairs of mandibular barbels are shorter and may or may not be situated in a more or less transverse series behind the posterior lip.

The skin in the thoracic region is smooth. The nostrils are close together. The eyes are subcutaneous. The gill-openings are fairly wide; the gill-membranes may be confluent with the skin of the isthmus, or deeply notched. The rayed dorsal fin is provided with a strong spine. The adipose dorsal is short but prominent. The pectorals are provided with strong spines which are denticulated internally. The pelvics are horizontal and 6-rayed; they are situated behind the dorsal. The anal fin is short. The caudal fin is deeply forked. The air-bladder is divided into two rounded portions which are partially enclosed in bone and come in direct contact with the skin above the pectorals. There are 5 to 7 branchiostegal rays.

Regan distinguished *Gagata* from the other genera of the Sisoridae by the following combination of characters :—

> " Praecaudal vertebrae normal, with the ribs attached to the simple parapophysis and the neural arches without the lateral processes; end of transverse process of fifth vertebra appearing as a rugose plate behind the lateral cutaneous area.
>
> " Head somewhat compressed and elevated; tail and caudal vertebrae normal.
> " Mesopterygoid smaller than metapterygoid, pelvis behind the dorsal.
> " Gill-membranes attached to isthmus."

Further, he distinguished *Nangra* from *Gagata* by the fact that in the former the gill-membranes are free from the isthmus.

Having defined the generic limits of *Gagata* and *Nangra* we may now consider the systematic position of the various species assigned to these genera. Hamilton's *Pimelodus cenia* is undoubtedly congeneric with his *P. gagata.* In the former the author seems to have overlooked the minute nasal barbels. Günther appears to have overlooked this species entirely, for there is no mention of it in his *Catalogue.* Though in 1869, Day[1] recognised it as a distinct species, in his *Fishes of India* and the *Fauna* he considered it as a young form of *Gagata gagata.* We have examined a large series of specimens of both the species in the collection of the Indian Museum and are definitely of the opinion that they are quite distinct and represent two valid species of the genus *Gagata.*

Day (*loc. cit.*, 1877, p. 493) included Hamilton's *Pimelodus batasio*[2] in the genus *Gagata,* and as he had no specimen for study he seems to have been greatly influenced by Hamilton's statement to the effect that " There is no *slit* under the throat. . " Cuvier and Valenciennes[3] included this species under *Bagrus,* Blyth[4] under *Batasio* and Günther[5] under *Macrones.* We have examined several specimens of the species from the type-locality and find that Hamilton's statement with regard to a slit under the throat is not correct. In Hamilton's original drawing[6] of the species the two nostrils of each side are shown as situated wide apart, which precludes its being a member of the Sisoridae. This species has been rightly assigned by Shaw and Sheb-

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[1] Day, F., *Proc. Zool. Soc. London,* p. 309 (1869).
[2] Hamilton, F., *Fish. Ganges,* p. 179 (Edinburgh: 1822).
[3] Cuvier, G. and Valenciennes, A., *Hist. Nat. Poisson* XIV, p. 425 (1839).
[4] Blyth, E., *Journ., As. Soc. Bengal* XXIX, p. 150 (1860).
[5] Günther, A., *Cat. Fish. Brit. Mus.* V, p. 83 (1864).
[6] Day, F., *Fish. India,* pl. xcix, fig. 5 (1877); Hora, S. L., *Mem. Ind. Mus.* IX, pl. xxii, fig. 3 (1929).

beare[1] to the genus *Batasio* Blyth, which is dealt with in the next article of this series.

As regards the true systematic position of *Pimelodus tengana* Hamilton there is some difficulty. It has been included under the genus *Bagrus* by Cuvier and Valenciennes, *Batasio* by Blyth, *Macrones* by Günther and *Gagata* by Day. This species was collected by Hamilton in the Brahmaputra and in his original notes the description is dated "Gualpara, 29th July, 1808." To elucidate its systematic position attention may be directed to the following salient features as noted by Hamilton:—

1. There are eight barbels shorter than the head.
2. The anal fin possesses fourteen rays.
3. It is a small fish of about 3 inches in length.
4. The back is marked with many black dots, which are collected into a spot above each pectoral fin, and also on the crown of the head. The fins of the back and tail are also dotted, so that the edge of the last is black, and several spots are formed on the first.
5. Both openings of each nostril are circular, with a tendril between them.
6. Under the lower jaw there is no slit.

Though it is stated by Hamilton that the two openings of each nostril have a barbel between them, his figure shows that these openings are situated widely apart and that the posterior one is provided with a barbel at the anterior end. It would thus appear that the species cannot be referred to the Sisoridae, but belongs to the Bagridae. It seems to belong to the genus *Batasio* and is conspecific with Blyth's *B. affinis*. We shall elucidate further the systematic position of this species in our account of the fishes of the genus *Batasio*.

Hamilton's *P. nangra*, the type of Day's genus *Nangra*, differs from *Gagata gagata* and *G. cenia* in having longer barbels and deeply notched gill-membranes, though Hamilton in the description of this species also states "There is no *slit* under the throat." The bases of the mandibular barbels are not situated in a straight line. As indicated above, we do not regard these differences of generic value, especially as *Gagata itchkeea* (Sykes) is a form intermediate in characters between *Gagata* and *Nangra*.

In *Pimelodus viridescens*, Hamilton mentioned only six barbels; evidently he overlooked the minute nasal barbels. The most significant feature of this species is its greatly depressed head and anterior part of body. It is stated to possess a slit under the throat. From a careful study of Day's descriptions of *Nangra punctata* and *Nangra viridescens* and also from an examination of his drawings of the two species it seems probable that the two are identical, the latter being the juvenile form of the former. Two fresh specimens in our collection also confirm this view. In the nature of its gill-openings, *G. viridescens* agrees with *G. nangra*. Day recorded this species from Poona and one of us[2] also recorded it from the Deccan. Re-examination of the

[1] Shaw, G. E. and Shebbeare, E. O., *Journ. Roy. As. Soc. Bengal, Science* III, p. 97, fig. 98 (1938).

[2] Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 19 (1937).

material has shown that the Deccan specimens are referrable to *G. itchkeea* in which the isthmus is very narrow and the mandibular barbels are not situated in an absolute straight line.

The only extra-Indian species of *Gagata* is *G. schmidti* Volz from Sumatra. Its salient features are the depressed head, 1½ times broader than high; the small eyes, longitudinal diameter being contained 13 times in length of head; the absence of fontanels; the dorsal spine being dentated along the front and hind borders; the very narrow isthmus, and its almost uniform gray brown colour.

The Indian species of the genus *Gagata* may be distinguished by the following key :—

Key to the Indian species of the genus Gagata *Bleeker.*

I. Nasal barbels small or rudimentary, being almost as long as or considerably shorter than longitudinal diameter of eye.

A. Dorsal fin considerably longer than head; both dorsals, anal, pectoral and pelvic fins black distally.
[Gill-membranes united with a fairly broad isthmus; maxillary barbels slightly and mandibular barbels considerably shorter than head; bases of mandibular barbels close together and in a transverse row; median groove on head extending to end of occipital process] — *G. gagata.*

B. Dorsal fin considerably shorter than head; distal portions of fins not coloured black.

1. Maxillary barbels longer than head.
[Gill-membranes united with a very narrow isthmus; mandibular barbels somewhat shorter than head; bases of inner mandibular barbels somewhat in advance of those of the outer; median groove on head extending as far as posterior border of orbit and followed by a small, median, oval fontanel] .. — *G. itchkeea.*

2. Maxillary barbels considerably shorter than head.

a. Bases of mandibular barbels close together and in a transverse row. [Gill-membranes united with a narrow isthmus; width of head considerably less than its length in front of pectorals; median groove on head extending to base of occipital process] .. — *G. cenia.*

b. Bases of mandibular barbels set widely apart, and at different levels. [Gill-membranes united with each other and the isthmus; head almost as broad as its length in front of pectorals; median groove on head extending to base of occipital process] — *G. viridescens.*

II. Nasal barbels almost as long or longer than head. [Bases of mandibular barbels set widely apart, and at different levels; gill-membranes united with each other across the isthmus; maxillary and outer mandibular barbels much longer than head; median groove on head extending to base of occipital process] .. .. *G. nangra.*

Gagata gagata (Hamilton).

Plate I, figs. 1, 2.

1822. *Pimelodus gagata*, Hamilton, *Fish. Ganges*, pp. 197, 379, pl. xxxix, fig. 65.
1854. *Pimelodus gagata*, Bleeker, *Verh. Bat. Gen.* XXV, p. 58.
1858. *Gagata gagata*, Bleeker, *Ichthyol. Archipel. Indici, Prodromus*, I, *Siluri*, p. 206.
1860. *Gagata gagata*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 151.
1862. *Gagata typus*, Bleeker, *Atl. Ichthyol.* II, p. 7.
1864. *Callomystax gagata*, Günther, *Cat. Fish. Brit. Mus.* V, p. 218.
1869. *Gagata typus*, Day, *Proc. Zool. Soc. London*, p. 309.
1877. *Gagata cenia*, Day (in part), *Fish. India*, p. 492, pl. cxv, fig. 4.
1877. *Callomystax gagata*, Beavan, *Freshw. Fish. India*, p. 149.
1889. *Gagata cenia*, Day (in part), *Faun. Brit. Ind. Fish.* I, p. 208, fig. 75.

D. 1/6; A. 3-4/10-12; P. 1/9; V 1/5; C. 19.

Gagata gagata is a medium-sized, stoutly-built species in which the dorsal profile rises moderately to the commencement of the dorsal fin beyond which it slopes down gradually to the base of the caudal fin. The ventral profile is almost horizontal as far as the commencement of the pelvic fins and thereafter it rises gradually to the base of the caudal fin. The fish is compressed from side to side, more so in the posterior half; the dorsal surface forms a narrow ridge. The ventral surface in front of the pelvic fin is somewhat flattened.

The head is broadly pointed in front; its length is contained from 3·61 to 3·93 times in the standard length. The height of the head at the occiput is contained from 1·05 to 1·45 times and its width from 1·25 to 1·57 times in its length. The snout is prominent and globular; it is produced in front of the mouth for a short distance. The eyes are dorso-lateral in position and are situated nearer to the posterior margin of the operculum than to the tip of the snout. The diameter of the eye is contained from 2·65 to 3·76 times in the length of the head, from 0·89 to 1·58 times in the length of the snout and from 0·65 to 1·20 times in the inter-orbital width. The two nostrils of each side are fairly prominent, close together and situated much nearer to the tip of the snout than to the eye. The dorsal surface of the head is covered with smooth skin but is marked with bony ridges. The median groove on the head commences from in front of the nostrils and is continued with slight variations to the end of the occipital process which misses the basal bone of the dorsal fin by a short distance. The occipital process is long and narrow, almost 4 to 5 times as long as broad at its base. The mouth is small and horizontal; it is bordered by thick and slightly fimbriated lips which are continuous at the angles of the mouth. There are patches of small, villiform teeth in the jaws. There are four pairs of barbels; the nasal barbels are small and thin and are rarely as long as the longitudinal diameter of eye. The maxillary barbels possess

stiff bony bases and membranous flaps along the inner side of the proximal one-third of their lengths. These barbels rarely exceed the length of the head. The two pairs of mandibular barbels have somewhat swollen bases which are arranged in a transverse row behind the lower lip; these barbels are shorter than half the length of the maxillary barbels. The gill-opening is restricted on the ventral surface; the distance between the two openings is contained from 0·55 to 0·92 times in the diameter of the eye.

The depth of the body is contained from 3·34 to 4·37 times in the standard length. The caudal peduncle is well formed; its least height is contained from 1·28 to 2·00 times in its length. Two oval patches of skin above the pectorals indicate the areas where the air-bladder comes directly in contact with the skin. The cubito-humeral processes are fairly well marked. The anal opening is situated nearer to the commencement of the caudal fin than to that of the pectorals. The urino-genital openings[1] are separate; in the female they are situated immediately behind the anus and form a slit-like aperture bordered by fleshy lips which project in the form of a short papilla-like structure distally. In the male the urinary opening is situated on a papilla behind the anus.

The dorsal fin is pointed and situated almost wholly in advance of the pelvic fins; it is longer than the head; its spine is long, pointed and almost as long as, slightly shorter or longer than the head. It is finely serrated along the distal one-third of the anterior border. The adipose fin is short, but well marked; its base is somewhat longer than that of the rayed dorsal. The pectoral fins are also pointed and are placed only slightly above the ventral surface; they do not extend to the base of the pelvic fins. The pectoral spine is strong and denticulated internally; its outer border is provided with a few teeth at the distal end. The pelvic fins extend considerably beyond the anal opening and their outer rays are pointed. The anal fin is of moderate length and the caudal fin is deeply forked with both the lobes pointed, the upper lobe is somewhat better developed than the lower.

The general colour of the body is opaque yellow verging to dull gray. The greater part of the pectorals, the distal halves of the dorsal, pelvic, and anal fins are conspicuously coloured black. The caudal fin is whitish. The colouration of the species is one of its most characteristic features.

Distribution.—Unfortunately a number of specimens of *Gagata gagata* in the collection of the Indian Museum do not bear locality labels, but it seems probable that the species is found in the Ganges, Brahmaputra and Irrawadi River systems. It is represented in the collection from Allahabad, Calcutta, Khulna and Prome. It is said to attain a foot in length.

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[1] Urino-genital structures similar to those described here are erroneously termed by Mookerjee, Mazumdar and Das Gupta as "vagina" and "penis" (*Ind. Journ. Vet. Sci. Animal Husb.* X, p. 295, 1940). The authors seem to have ignored the fact that in teleosts the "urinary opening may be separate or confluent with that of the genital ducts and is frequently placed on a more or less prominent papilla (*papilla urogenitalis*). If separate, the urinary opening is behind the genital; and if a papilla is developed, its extremity is perforated by the urethra, the genital opening being situated near the base" (Günther, *Introduction to the Study of Fishes*, p. 156, 1880).

Measurements in millimetres of the specimens of *Gagata gagata* (Ham.)

——	Allahabad.	Hooghli R., Bengal.				Pusar R., Khulna, Bengal.	Prome, Burma.	Locality unknown.						
Standard length	102·0	77·0	79·0	94·0	97·5	83·5	118·0	81·5	90·0	90·5	92·0	120·0	139·0	143·0
Length of head ..	26·0	20·0	20·5	24·5	26·0	22·0	30·5	21·5	23·5	23·0	23·5	32·0	38·5	38·0
Height of head at occiput ..	20·5	16·0	19·5	21·0	20·5	17·0	21·0	16·5	19·0	19·5	17·0	26·0	27·5	28·5
Width of head ..	18·5	15·5	13·0	19·5	18·5	17·5	19·5	17·0	16·5	17·5	16·0	23·0	25·0	25·0
Length of snout ..	10·0	8·0	8·5	9·5	10·5	8·5	12·5	8·5	10·0	10·0	9·5	13·5	13·0	16·0
Diameter of eye ..	8·5	6·5	5·0	8·0	8·0	7·0	10·5	7·5	7·0	7·5	6·5	8·5	14·5	12·0
Interorbital width	8·0	7·0	6·0	7·5	9·0	8·0	8·0	6·5	8·0	7·0	7·0	9·5	9·5	9·5
Depth of body ..	28·5	23·0	21·0	26·0	26·5	22·5	27·0	21·5	26·5	25·5	24·5	33·0	36·0	33·5
Length of caudal peduncle	17·0	9·0	11·0	14·0	13·0	13·0	18·5	10·5	12·0	13·0	13·5	16·0	21·5	23·0
Least height of caudal peduncle.	8·5	7·0	7·5	7·5	8·5	7·5	11·0	7·0	8·0	8·0	8·5	11·0	13·0	11.5
Longest ray of dorsal	33·5	25·0	23·5	31·5	37·5	27·5	29·0	28·0	30·0	35·0	34·5	40·5	42·0	38·5
Length of dorsal spine	27·5	20·0	19·0	27·0	29·0	23·0	25·0	23·5	24·0	29·0	25·0	33·5	35·5	D.
Length of pectoral	28·5	22·0	21·5	28·0	29·5	22·0	30·5	22·0	14·0	27·0	28·0	32·5	43·5	42·0
Length of pectoral spine	25·5	19·0	19·0	24·5	26·5	21·5	28·0	21·0	22·0	25·0	24·5	30·5	39·0	37·0
Length of ventral	18·0	13·0	13·5	18·0	18·5	15·5	18·0	14·0	14·5	17·5	15·5	21·0	26·5	25·5
Longest ray of anal	21·0	D.	12·0	18·5	19·0	D.	18·5	15·0	17·0	21·0	17·0	D.	30·0	D.
Length of base of anal	16·0	11·0	11·0	13·5	13·5	11·5	17·0	12·0	14·0	15·0	14·5	17·5	19·5	20·0
Length of base of adipose dorsal.	16·5	11·5	10·5	14·5	13·0	8·5	15·0	12·5	10·5	10·0	14·0	14·0	16·5	16·0

Gagata itchkeea (Sykes).

Plate I, figs. 3, 4.

1840. *Phractocephalus itchkeea*, Sykes, *Trans. Zool. Soc. London* II, p. 373, pl. lxvii, fig. 1.
1849. *Pimelodus itchkeea*, Jerdon, *Madras Journ. Litt. Sci.* XV, p. 341.
1854. *Bagrus itchkeea*, Bleeker, *Verh. Bat. Gen.* XXV, p. 56.
1864. *Macrones itchkeea*, *Cat. Fish. Brit. Mus.* V, p. 84.
1876. *Hemipimelodus itchkeea*, Day, *Journ. Linn. Soc. London, Zoology* XII, p. 571.
1877. *Gagata itchkeea*, Day, *Fish. India*, p. 492, pl. cxv, fig. 6.
1889. *Gagata itchkeea*, Day, *Faun. Brit. Ind., Fish* I, p. 209.
1937. *Nangra viridescens*, Hora (*nec* Hamilton), *Rec. Ind. Mus.* XXXIX, p. 19.
1937. *Nangra viridescens*, Hora & Misra (*nec* Hamilton), *Journ. Bombay Nat. Hist. Soc.* XXXIX, p. 511; *ibid.* XL, p. 23, 1938.

D. 2/6; A. 2-3/9-10; P. 1/8; V 1/5; C. 18-19.

Gagata itchkeea is a small, almost cylinderical fish in which both the dorsal and the ventral profiles are slightly arched. The body is only slightly compressed anteriorly, but in the region behind the pelvic fins the compression is more marked. The ventral surface in front of the pelvic fins is only slightly flattened and, in consequence, the pectoral fins are placed at a considerably higher level than the ventral surface.

The head is short, globular and rounded anteriorly; its length is contained from 3·57 to 4·05 times in the standard length. The height of the head at the occiput is contained from 1·25 to 1·50 times and its width from 1·16 to 1·50 times in its length. The snout is so much rounded that one gets the impression of a pug-headed fish and the nostrils are almost directed anteriorly; it projects beyond the mouth for a short distance. The eyes are large and dorso-lateral in position; they are not visible from the ventral surface. The diameter of the eye is contained from 2·20 to 2·75 times in the length of the head, from 0·60 to 1·00 times in the length of the snout and from 0·63 to 0·87 times in the interorbital distance. The nostrils are large and well formed and are situated almost midway between the tip of the snout and the eyes. The median groove on the head extends from between the nostrils to the base of the occipital process, but anteriorly there are lodged in it one large and one small fontanels. After the second fontanel the groove is very shallow and hardly perceptible posteriorly. The edges of the groove are slightly raised to form longitudinal ridges. The occipital process is long and narrow, its length is about 3 times its width at the base; it is separated from the basal bone of the dorsal fin by a short distance. The mouth is small, inferior and horizontal; it is bordered by fleshy lips which are continuous and free at the angles of the mouth. The teeth are small, villiform, and hardly perceptible. There are four pairs of barbels; the nasal barbels are small and considerably shorter than the diameter of the eye; the maxillary barbels are longer than the head and their basal parts stiff; the membrane in

their axils is little developed ; the two pairs of mandibular barbels are almost equal and are as long as the head behind the anterior border of the orbit. The bases of the mandibular barbels are not situated exactly in a transverse line behind the lower lip, but those of the inner pair are slightly in advance of those of the outer. The gill-membranes are attached to the isthmus but the gill-openings are separated by a distance which is generally less than one-fifth of the diameter of the eye.

The depth of the body is contained from 4·00 to 5·41 times in the standard length. The least height of the caudal peduncle is contained from 1·14 to 1·85 times in its length. The portion of the body where the air-bladder comes in close contact with the skin is not well marked externally, but the cubito-humeral processes are fairly distinct. The anus is followed by a small urino-genital papilla.

The dorsal fin is situated in advance of the pelvic fins ; it is generally shorter than the head. The dorsal spine is a strong prickle which is smooth along both the borders. The adipose dorsal is small, but well developed. The pectoral fin is pointed and almost reaches the base of the pelvic fins ; its spine is strong and crenulated along the outer border but serrated for two-thirds of its length internally. The pelvic fins extend beyond the anal opening, but are separated from the anal fin by a short distance. The anal fin is short like the dorsal. The caudal fin is deeply forked ; both the lobes are pointed, the upper being somewhat longer.

Sykes noted that the colour of the fish is " yellowish glossy silver, inclining to greenish on the back, and silvery on the belly ; marked with dark bluish brown broad spots along the back, head, and at the base of the rays of the tail " Day remarked that the colour is " yellowish-bronze, becoming silvery on the sides and abdomen : some dark blotches along the back descending to half way down the sides. A black blotch on either lobe of the caudal, and another on the dorsal fin" In the specimens examined by us the colour varies only slightly from the earlier descriptions, and the saddle-shaped black bands on the body though only faintly marked in some are fairly conspicuous in others.

Distribution.—As stated by Day, *G. itchkeea* is found only in the rivers of the Deccan. In the collection of the Indian Museum, this species is represented from Deolali, Poona, Satara (Bombay Presidency) and from the Cauvery in the Coorg State.

Remarks.—*G. itchkeea* is intermediate between *G. gagata* and *G. nangra* in several respects and on account of its wide gill-openings and the disposition of the bases of the mandibular barbels is liable to be referred to the genus *Nangra.* Its relatively longer barbels also show its affinity to *G. nangra.* Sykes considered it a close ally of Hamilton's *Pimelodus tengana,* which we have referred to the genus *Batasio* Blyth. *G. itchkeea* rarely exceeds three inches in length and seems to be very common in the waterways at Poona.

Measurements in millimetres of the specimens of *Gagata itchkeea* (Sykes).

——	Deolali.	Poona.					Satara.		Coorg.	Bombay market.	Meema.
Standard length	38·0	38·5	40·5	42·5	46·0	46·5	47·0	49·0	50·0	41·0	40·0
Length of head	10·0	10·5	10·0	11·0	12·5	11·5	13·0	13·0	14·0	11·0	10·5
Height of head at occiput	7·0	7·0	8·0	7·5	8·5	9·0	9·0	9·5	10·5	7·5	7·5
Width of head	7·0	7·0	8·0	8·0	8·5	9·5	9·0	10·5	12·0	9·0	7·5
Length of snout	3·5	3·5	3·0	4·0	4·0	3·0	4·5	5·0	4·0	4·0	3·5
Diameter of eye	4·5	4·5	4·5	4·0	5·5	5·0	5·0	5·0	6·0	5·0	4·5
Interorbital width	3·0	3·0	3·0	3·5	3·5	3·5	3·5	4·0	4·0	3·5	3·0
Depth of body	8·0	9·5	9·0	10·0	8·5	11·0	11·5	11·0	12·5	9·0	8·0
Length of caudal peduncle	4·0	5·5	6·5	7·0	5·0	7·0	7·0	7·5	8·5	5·0	4·0
Least height of caudal peduncle ..	3·0	3·5	3·5	4·0	4·0	4·0	4·5	5·0	5·0	4·0	3·5
Longest ray of dorsal ..	8·5	9·0	9·0	11·0	11·0	10·5	11·8	12·0	13·0	10·5	10·5
Length of dorsal spine	6·0	7·5	8·0	9·0	9·0	8·5	9·8	10·4	9·5	8·0	8·0
Length of pectoral ..	11·0	11·0	10·5	12·0	12·0	12·5	14·0	13·5	15·5	13·0	13·0
Length of pectoral spine	9·0	8·0	9·5	10·0	10·5	11·5	12·5	12·0	14·0	11·0	11·5
Length of ventral	7·0	6·0	6·5	8·0	7·5	7·0	8·0	8·5	9·5	7·5	6·5
Longest ray of anal ..	8·0	7·5	8·0	7·0	8·5	9·0	10·0	10·5	11·5	8·0	D.
Length of base of anal..	6·5	5·5	6·5	6·8	5·5	6·0	7·0	8·5	8·0	6·5	6·0
Length of base of adipose dorsal ..	8·0	5·0	5·5	6·5	5·0	6·0	7·0	7·0	7·5	5·5	6·0
Width of isthmus	0·5	0·9	1·0	0·8	1·0	0·95	1·0	1·0	0·3	0·9	1·5

Gagata cenia (Hamilton).

Plate I, figs. 5, 6.

1822. *Pimelodus cenia*, Hamilton, *Fish. Ganges*, pp. 174, 376, pl. xxxi, fig. 57.
1854. *Pimelodus cenia*, Bleeker, *Verh. Bat. Gen.* XXV, p. 58.
1869. *Hemipimelodus cenia*, Day, *Proc. Zool. Soc. London*, p. 308.
1871. *Hemipimelodus cenia*, Day, *Proc. Zool. Soc. London*, p. 288.
1877. *Gagata cenia*, Day (in part), *Fish. India*, p. 492, pl. cxv, fig. 5.
1889. *Gagata cenia*, Day (in part), *Faun. Brit. Ind.* Fish. I, p. 208.
1890. *Gagata cenia*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Geneva* (2) IX, p. 121.
1921. *Gagata cenia*, Hora, *Rec. Ind. Mus.* XXII, p. 182.
1938. *Gagata cenia*, Hora, *Rec. Ind. Mus.* XL, p. 180, fig. 6.
1939. *Gagata cenia*, Das, *Rec. Ind. Mus.* XLI, p. 448.

D. 2/6 ; A. 2-3/10-12 ; P. 1/7-9 ; V 1/5 ; C. 17-19.

Gagata cenia is a comparatively small and slender fish, in which the dorsal and the ventral profiles are slightly arched. The body, however, becomes considerably narrow in the caudal region. The ventral surface in front of the pelvic fins is flattened and horizontal. The dorsal surface is somewhat rounded and the head and the body, except in the tail region, are moderately compressed.

The head is flattened on the ventral surface and more or less rounded anteriorly ; its length is contained from 3·62 to 4·47 times in the standard length. The height of the head at the occiput is contained from 1·29 to 1·87 times, and its width from 1·40 to 2·00 times in its length. The snout is prominent, globular and projects beyond the mouth for a considerable distance. The eyes are large and dorso-lateral in position ; they are not visible from the ventral surface. They are situated either in the middle of the head or slightly nearer to the posterior margin of the operculum than to the tip of the snout. The diameter of the eye is contained from 1·87 to 3·41 times in the length of the head, from 0·62 to 1·33 times in the length of the snout and from 0·50 to 0·85 times in the interorbital width. The nostrils are situated almost midway between the eye and the tip of the snout or slightly nearer to the former than to the latter. The head is covered with smooth skin, but its dorsal surface is marked with two longitudinal bony ridges and the supra-orbital bones are also slightly raised above the surface. The median groove on the head commences from in front of the nostrils and after a slight interruption is continued to a point in front of the base of the occipital process. The occipital process is about three times as long as broad at its base and misses the basal bone of the dorsal fin by a short distance. The mouth is small, horizontal and crescentic ; it is bordered by fleshy lips which are free and continuous at the angles of the mouth. The median portion of the upper lip is swollen and plicated ; it forms a prominent fold in front of the mouth. There are small and villiform teeth in the jaws. There are four pairs of barbels ; the nasal barbels are so minute that they are likely to be overlooked ; the basal portions of the maxillary barbels are stiff and there is a thick membrane in their axils ; they are slightly shorter than the head ; the mandibular barbels are considerably shorter and their bases are situated in a transverse series behind the lower lip. In a very large number of

specimens there are two finger-like processes situated in the mid-ventral line between the bases of the inner mandibular barbels. Sometimes these structures are represented by nodules attached to the posterior lips, while in certain specimens they are entirely absent. These structures, like the barbels, are probably tactile in function. The gill-openings are somewhat restricted on the ventral surface by a narrow isthmus; the distance between the gill-openings is contained from 0·15 to 0·63 times in the diameter of the eye.

The depth of the body is contained from 4·0 to 6·0 times in the standard length. The least height of the caudal peduncle is contained from 1·27 to 2·14 times in its length. The portion of the body where the air-bladder comes in contact with the skin is not well marked externally and the cubito-humeral processes are not so prominent. The urino-genital openings are similar to those described above for *Gagata gagata* (*vide supra*, p. 16).

The dorsal fin is obliquely truncate and its base is situated wholly in advance of the pelvic fins; it is usually shorter than the head, but in rare cases it may be just as long as the head. The dorsal spine is a short, strong prickle which is smooth along the posterior border but is finely serrated along the anterior border, especially along the distal portion. The adipose dorsal is short but well marked. Generally the pectoral fin is shorter than the head, but sometimes it is equal to or even slightly longer than the head; they are separated from the pelvic fins by a considerable distance. The pectoral spine is denticulated in the middle along its inner border and serrated along the distal half of the outer border. The pelvic fins reach as far as or extend slightly beyond the anal opening. The anal fin is short and low. The caudal fin is deeply forked and both the lobes are sharply pointed; the upper lobe is somewhat longer than the lower.

Hamilton noted that "The general *colour* is silver, with some dusky on the back, and the bars descending to the lateral lines. The end of the tail is black; and the first fin of the back, and that of the tail, are stained with the same colour. The eyes are silver-coloured." He had also noted that the back was marked with four transverse bars. Day, who regarded this species as comprising of young individuals only, stated that "The *young* are of a yellowish bronze colour, becoming silvery on the abdomen: they have three dark bands over the head and four more over the back, descending as low as the lateral-line. Caudal with a semi-lunar black band, or a black blotch on each lobe: a dark mark across the dorsal fin." The specimens in the collection of the Indian Museum vary slightly as regards colouration but in general agree closely with Day's description.

Distribution.—Hamilton described this species from the northern parts of Bengal, but as Day had confused *Gagata gagata* with *G. cenia*, it is not possible to accept the range of distribution of this species given by him. In the collection of the Indian Museum, it is represented from the Punjab, Delhi, Nepal, Bihar, Orissa, Bengal, and Assam (including Chindwin Drainage System). It rarely exceeds six inches in length and was originally described by Hamilton from specimens about three inches in length.

Measurements in millimetres of specimens of *Gagata cenia* (Ham.).

	Manipur, Assam.					Chutri Gouri in Terai, Nepal.		Calcutta and Nawabgunge, Bengal.			Barhat and Damodar River, Bihar.			Orissa.	Delhi.		Chenab Canal, Punjab.
Standard length	56·5	59·5	65·0	72·5	84·5	59·0	77·0	63·5	38·0	42·5	59·0	63·0	42·0	55·0	66·0	78·5	52·0
Length of head	14·0	15·0	15·5	18·0	23·0	16·2	20·5	17·5	8·5	11·0	16·0	17·0	11·5	15·0	18·2	21·5	14·0
Height of head at occiput	10·0	10·0	12·0	11·5	13·5	10·0	12·5	10·0	5·5	6·0	8·5	9·5	6·5	8·5	11·0	12·0	7·5
Width of head ..	8·5	9·0	11·0	10·5	13·0	9·0	11·5	9·2	5·5	6·0	8·5	9·0	6·0	7·5	9·2	11·2	8·0
Length of snout ..	5·5	5·0	5·5	7·0	8·0	5·5	8·0	6·0	3·0	3·5	6·0	7·0	4·5	5·0	7·2	8·0	6·0
Diameter of eye ..	6·5	8·0	7·0	7·5	7·0	5·5	6·0	5·5	3·5	4·0	5·5	7·0	4·0	6·0	6·5	7·0	5·0
Interorbital width	4·0	4·0	4·0	5·5	6·0	4·0	5·0	4·0	2·5	2·0	3·5	4·0	2·8	3·5	3·5	5·0	3·0
Depth of body ..	11·0	12·0	14·0	14·0	17·0	10·0	13·0	12·0	6·5	8·5	10·5	10·5	10·5	9·5	11·4	13·5	10·0
Length of caudal peduncle ..	8·0	8·5	9·0	8·5	10·0	8·0	11·0	7·5	5·0	6·0	8·0	7·0	7·0	7·5	9·0	10·0	6·5
Least height of caudal peduncle	5·0	5·0	6·0	6·5	7·0	5·0	5·5	5·0	3·5	4·5	4·5	5·5	4·0	3·5	5·5	6·5	3·5
Longest ray of dorsal ..	12·5	14·0	15·0	14·5	22·5	14·0	17·0	13·0	8·5	11·0	13·0	13·5	10·5	11·5	13·5	16·0	11·0
Length of dorsal spine	11·0	11·0	12·0	D.	15·5	11·0	15·0	12·0	7·5	9·5	11·5	12·0	9·5	9·5	13·0	14·5	10·0
Length of pectoral	15·0	15·0	16·0	D.	20·5	13·0	18·0	13·0	8·5	12·5	12·0	14·5	10·0	11·5	15·5	17·5	11·5
Length of pectoral spine ..	12·0	13·5	14·0	D.	18·0	11·5	17·5	12·5	8·0	10·0	13·0	14·0	9·5	11·0	14·0	17·0	10·5
Length of ventral	8·5	10·0	11·0	12·5	14·0	9·0	11·0	9·5	6·0	7·0	12·5	9·5	6·0	7·5	10·5	12·0	7·5
Longest ray of anal	10·5	10·5	12·0	14·0	14·5	9·5	10·5	9·5	9·0	8·5	10·0	10·0	7·0	7·0	11·0	12·0	8·0
Length of base of anal	9·0	9·0	11·0	11·5	13·0	8·5	11·0	8·5	9·5	9·0	9·0	9·5	6·0	8·5	9·0	9·5	8·5
Length of base of adipose dorsal.	9·0	8·5	8·5	12·0	10·5	8·0	10·0	6·5	4·5	6·0	7·0	8·5	6·5	6·5	8·5	10·5	8·0
Width of isthmus	1·0	1·2	D.	1·0	3·0	3·5	3·5	3·0	0·8	1·0	1·0	2·5	1·5	3·0	2·5	3·0	2·0

Gagata viridescens (Hamilton).

Plate I, figs. 7, 8.

1822. *Pimelodus viridescens*, Hamilton, *Fish. Ganges*, pp. 173, 376, pl. x, fig. 56.
1854. *Pimelodus viridescens*, Bleeker, *Verh. Bat. Gen.* XXV, p. 58.
1877. *Nangra punctata*, Day, *Fish, India*, p. 494, pl. cxv, fig. 8.
1877. *Nangra viridescens*, Day, *Fish. India*, p. 494, pl. cxv, fig. 7.
1889. *Nangra punctata*, Day, *Faun. Brit. Ind. Fish.* I, p. 212. fig. 76.
1889. *Nangra viridescens*, Day, *Faun. Brit. Ind. Fish.* I, p. 212.

D. 1/6; A. 2/9; P. 1/8; V 1/5; C. 21.

In *Gagata virridescens* the head and the body in front of the anal fin is greatly depressed and the ventral surface is flattened. The tail is somewhat compressed and subcylindrical. The dorsal profile is slightly arched, while the ventral profile is straight and horizontal in front of the anal fin.

The head is large and broad, it is covered with minute spine-like structures; its length is contained from 3·00 to 3·18 times in the standard length. The height of the head is contained from 1·63 to 1·78 times and its width from 1·27 to 1·31 times in its length. The snout is broad and rounded in front; it projects beyond the mouth for a considerable distance. The eyes are of moderate size and dorso-lateral in position; they are not visible from the ventral surface. The eyes are relatively larger in young specimens and are situated almost in the middle of the length of the head; their diameter is contained from 3·50 to 4·16 times in the length of the head and from 1·37 to 1·75 times in the length of the snout. The interorbital distance is equal to the diameter of the eye. The nostrils are well-formed, rounded apertures; they are situated much nearer to the tip of the snout than to the eyes. The median groove on the head is pointed both anteriorly and posteriorly, and extends from in front of the nostrils to the base of the occipital process; behind the level of the eyes there is a slight ridge across the groove. The occipital process is long and club-shaped; its width at the base is contained about 4 times in its length; it misses the basal bone of the dorsal fin by a short distance. The mouth is wide, inferior and horizontal; it is provided with fleshy lips which are continuous at the angles of the mouth. The anterior lip is papillated, and both the lips at the angles of the mouth are plicated. The posterior lip is also somewhat roughened along its middle part. The teeth are small and villiform; they are arranged in bands in the jaws. There are four pairs of barbels; the nasals are minute or rudimentary and are liable to be overlooked altogether; the maxillary barbels are considerably shorter than the head, are provided with stiff basal portions which lie in lateral grooves; the mandibular barbels are much shorter and their bases are situated wide apart, those of the inner pair are considerably in advance of those of the outer pair. The gill-openings are wide and extensive; the gill-membranes are confluent with each other and with the isthmus in the mid-ventral line. The width of the isthmus is very narrow.

The depth of the body is contained from 4·45 to 4·54 times in the standard length. The least height of the caudal peduncle is contained

from 1·63 to 1·71 times in its length. The portion of the body where the air-bladder comes directly in contact with the skin is not well marked externally. The cubito-humeral processes are well developed. The external urino-genital organs are similar to those described in *G. gagata* (*vide supra*, p. 16).

The dorsal fin is short and low, and is situated wholly in front of the pelvics; it is considerably shorter than the head and is provided with a small, strong spine, which is smooth along both the borders. The adipose dorsal is short, but well marked; the length of its base is almost equal to that of the rayed dorsal. The paired fins are horizontally placed; the pectorals are shorter than the head and provided with a very strong spine which is smooth along the outer border, but is strongly denticulated internally. The pectorals are separated from the ventrals by a considerable distance. The pelvics are small and pointed and extend beyond the anal opening. The caudal fin is deeply forked, with both the lobes pointed and subequal.

Hamilton stated that in his *Pimelodus viridescens* " The sides are silver *coloured*, the belly livid, and the fins of the back and tail spotted." The back is noted to be " reddish-brown, crossed by three green bars; and with opaque spotless sides " Day described the colouration of his *Nangra punctata* as follows: " coppery, glossed with gold on the sides: a black blotch on occiput, and three or four along the back descending half way down the sides. A black band on dorsal, and some black markings on the caudal." In his *N. viridescens*, which seems to represent young specimens, the colour is " glossy greenish-brown on the back, with two very light green bands passing one from the base of either dorsal fin to the middle of the depth of the body. A dark band on the dorsal fin and spots on either lobe of the caudal " In a young specimen, 44·5 mm. in standard length, besides the two short bands mentioned by Day, there are two other, one obliquely passing through the posterior part of the head and another on the back in front of the base of the caudal fin. The colouration of the larger specimen corresponds fairly closely with that of Day's *N. punctata*.

Distribution.—Hamilton described this species from the rivers of the northern parts of Bengal, but Day noted " Rivers of Northern Bengal, not uncommon in the Jumna at Delhi, and also found at Poona in the Deccan" The two specimens we have referred to *G. viridescens* are from Bengal and Assam respectively and we doubt whether the range of this species extends to the Deccan.

Measurements in millimetres.

	Tezpur, Assam.	Barakar, Santal Parganas.
Standard length	75·0	44·5
Length of head ..	25·0	14·0
Height of head at occiput	14·0	8·5
Width of head ..	19·0	11·0
Length of snout ..	10·5	5·5
Diameter of eye	6·0	4·0
Interorbital width	6·0	4·0
Depth of body	16·5	10·0
Length of caudal peduncle ..	9·0	6·0

Measurements in millimetres.

	Tezpur, Assam.	Barakar, Santal Parganas.
Least height of caudal peduncle ..	5·5	3·5
Longest ray of dorsal ..	15·5	8·0
Length of dorsal spine ..	9·5	6·5
Length of pectoral ..	18·0	12·5
Length of pectoral spine ..	16·0	11·0
Length of ventral	12·0	7·0
Longest ray of anal ..	14·5	8·5
Length of base of anal	9·0	6·5
Length of base of adipose dorsal	9·5	6·5

Gagata nangra (Hamilton).

Plate I, figs. 9, 10.

1822. *Pimelodus nangra*, Hamilton, *Fish. Ganges*, pp. 193, 378, pl. xi, fig. 63.
1854. *Pimelodus nangra*, Bleeker, *Verh. Bat. Gen.* XXV, p. 58.
1871. *Macrones nangra*, Day, *Proc. Zool. Soc. London*, p. 288.
1877. *Nangra buchanani*, Day, *Fish. India*, p. 494, pl. cxiii, fig. 3.
1889. *Nangra buchanani*, Day, *Faun. Brit. Ind. Fish.* I, p. 211.

D. 2/9-10 ; A. 3/10 ; P. 1/9 ; V 1/5 ; C. 16-17.

Gagata nangra is a small and slender species in which the dorsal profile is slightly arched, while the ventral profile is horizontal in front of the pelvic fins and thence rises gradually to the tail. The body is compressed from side to side, more so in the tail region. The ventral surface of the head and the anterior part of the body are flattened.

The head is sharp, long and oval; its length is contained from 3·83 to 4·18 times in the standard length. The height of the head is contained 2·0 times and its width from 1·06 to 1·50 times in its length. The snout is long and pointed, and projects in front of the mouth for a considerable distance. The eyes are relatively small and dorso-lateral in position ; they are not visible from the ventral surface. The diameter of the eye is contained from 5·38 to 6·00 times in the length of the head, 1·20 times in the length of the snout and from 1·20 to 1·33 times in the interorbital width. The two nostrils of each side are well marked and are placed nearer the tip of the snout than the eye. The median groove on the head is broad and extends from between the nostrils to the base of the occipital process ; the lateral edges of the groove are raised into slightly elevated longitudinal ridges. At the sides of the groove in the posterior region of the head there are two pairs of fontanels. The occipital process is broad and long ; it is almost twice as long as broad at the base and almost extends to the basal bone of the dorsal fin. The mouth is inferior, crescentic and horizontal ; its width is almost equal to the length of the snout. The lips are visible as definite structures only near the angles of the mouth. The teeth are minute and in the upper jaw are situated outside the mouth. There are four pairs of barbels ; the nasal barbels are almost as long as the head ; the maxillary barbels are provided with stiff basal parts and extend to the anal fin or beyond ; the outer mandibular barbels are more than one and a half times as long as head while the inner pair is equal to the head behind the nostrils. The bases of the inner pair of mandibular barbels are situated in front of those of the outer pair. The gill-openings are wide

and on the ventral surface extend anteriorly to the median line; the gill-membranes are united with each other.

The depth of the body is contained from 6·90 to 8·37 times in the standard length. The least height of the caudal peduncle is contained from 2·20 to 2·75 times in its length. The portion of the body where the air-bladder comes in contact with the skin is not well marked externally. The cubito-humeral processes are, however, well developed.

The commencement of the dorsal fin is situated well in advance of that of the pelvics, but its base extend over the pelvic fins; its longest ray is greater than the head but the spine is somewhat shorter. The dorsal spine is a strong prickle which is smooth along both the edges. The adipose dorsal is short but well marked. The paired fins are horizontally placed, they are somewhat shorter than the head and are separated from the pelvic fins by a considerable distance. The pectoral spine is strong and broad; it is smooth along the outer border but is strongly denticulated internally. The pelvic fins are long and pointed; they extend beyond the anal opening but do not reach the base of the anal fin. The caudal fin is deeply forked with both the lobes sharply pointed.

Hamilton noted that the colours of *Gagata nangra* " are rather agreeable, being silver, with some green on the back, and a faint brown streak across the foremost back fin, and another across the fin of the tail" According to Day, the colour is " muddy, with three indistinct vertical greenish half bands" In the specimens examined by us, there is a short, faint longitudinal band below the base of the dorsal fin and another along the lateral line. There is a vertical bar at the base of the caudal fin and the dorsal surface of the head is dusky.

Distribution.—Hamilton found this species in the Kosi river, but Day extended its range to the Ganges, Jumna and Indus. The two specimens of *G. nangra* examined by us were collected from the river Hooghly at Nawabgunj.

This species can be readily distinguished by its longer barbels, pointed snout and extensive gill-openings.

Measurements in millimetres.

Standard length	33·5	34·5
Length of head ..	8·0	9·0
Height of head at occiput ..	4·0	4·5
Width of head ..	7·5	6·0
Length of snout ..	1·8	1·8
Diameter of eye	1·5	1·5
Interorbital width	1·8	2·0
Depth of body	4·0	5·0
Length of caudal peduncle	5·5	5·5
Least height of caudal peduncle ..	2·0	2·5
Longest ray of dorsal ..	9·0	10·0
Length of dorsal spine ..	7·0	8·0
Length of pectoral	6·8	8·0
Length of pectoral spine ..	5·2	6·5
Length of ventral	6·0	6·8
Longest ray of anal	7·4	9·5
Length of base of anal ..	5·0	5·0
Length of base of adipose dorsal	5·5	7·0

X. FISHES OF THE GENUS *Batasio* BLYTH.

In the preceding article of this series, attention is directed to the fact that considerable confusion prevails regarding the taxonomic validity and the generic limits of *Batasio* Blyth, and reference has been made to the more salient features by which it can be distinguished from the superficially allied genus *Gagata*. In this article we give a detailed historical and taxonomic account of the genus, and descriptions of the species which we assign to it. A new species of *Batasio* has been discovered from Travancore, S. India, and the range of one of the Indian species, *B. tengana*, has recently been extended by Hora and Gupta[1] to the Malay Peninsula. These new records of the distribution of the genus from such widely separated localities are very significant from a zoogeographical point of view and lend considerable support to the hypothesis advanced by one of us[2] that the similarity in the fish-fauna of the Malay Region and of South India is due to the migration of the southern Chinese fishes to both the regions along mountain ranges at a time when the geographical features of these countries were different from what they are to-day. The migration of *Batasio* from Burma and Assam to Travancore was probably along the old Satpura trend of mountains as far as the Western Ghats and thence along the Ghats to the south of the Peninsula.

Batasio Blyth.

1860. *Batasio*, Blyth, *Journ. As. Soc., Bengal* XXIX, p. 149.
1862. ? *Batasio*, Bleeker, *Atl. Ichthyol.* II, p. 9.
1863. ? *Batasio*, Bleeker, *Ned. Tijds. Dierk.* I, p. 94.
1921. *Macronoides*, Hora, *Rec. Ind. Mus.* XXII, p. 179 (1921).

In 1860, Blyth[3] established the genus *Batasio* to accommodate a group of Bagroid fishes and characterised it as follows :—

> " A Bagroid form well worthy of distinction ; comprising a number of small species with round and prominent muzzle, and the contracted mouth opening from below : with eight, or sometimes (?) six, cirri, which are very short, the maxillary cirri scarcely passing the eye in some. Palatal band of teeth continuous with the mass of maxillary teeth, or separated only by a slight groove. Rest as in *Bagrus* (*verus*).
>
> " Type. *B. Buchanani*, nobis ; *Pimelodus batasio*, H. B."

Blyth did not examine any specimen of Hamilton's[4] *Pimelodus batasio*, but described a new species, *B. affinis*, from Tenasserim. He observed that :—

> " To the same type, but with shorter adipose dorsal, appertain the *tengana*, *chandamara* and *rama* of Buchanan Hamilton. *B. chandamara* is referred to *Silundia* by M. Valenciennes, and is described by Hamilton to have only two cirri ; but his unpublished figure represents six cirri distinctly, and in all this group the minute cirri are discernible with difficulty and are extremely liable to be overlooked. To *Bagrus capenses* of Sir A. Smith's ' Illustrations of S. African Zoology ' would appear also to be referable to this particular division."

Bleeker[5] considered *Batasio* a doubtful genus, but assigned it to the phalanx *Bagrichthyes* and stirps Bagrini. Günther[6] evidently regarded

[1] Hora, S. L. and Gupta, J. C., *Bull. Raffles Mus. Singapore*, No. 17 (1941).
[2] Hora, S. L., *Rec. Ind. Mus.* XXXIX, pp. 255, 256 (1937) ; *Proc. Nat. Inst. Sci. India* IV, p. 405 (1938).
[3] Blyth, E., *Journ. As. Soc. Bengal* XXIX, pp. 149, 150 (1860).
[4] Hamilton, F., *Fish. Ganges*, p. 179 (Edinburgh, 1822).
[5] Bleeker, P., *Ned. Tijds. Dierk.* I, p. 94 (1863).
[6] Günther, A., *Cat. Fish. Brit. Mus.* V, p. 83 (1864).

it as a synonym of *Macrones*, for he described both *Pimelodus batasio* Ham. and *Batasio affinis* Blyth in this genus. Day[1] included it under *Gagata* and remarked in a footnote as follows :—

> " Genus *Batasio*, Blyth, is said to comprise fishes with the barbels shorter than the head and teeth on the palate, examples : *Pimelodus batasio*, H. B. (*the* author merely says of the teeth, that those ' in both jaws are crowded '), *P. tengana*, H. B., *B. affinis*, Blyth, *P. rama*, H. B. The two first probably belong to genus *Gagata*, the third to *Macrones*, and the last two to *Liocassis*."

Vinciguerra[2] discussed the systematic position of *Batasio* in regard to *Macrones* and other allied Bagrid genera, but did not consider it distinct from *Macrones*. He described a new species *M. dayi* from Meetan and Toungoo which is stated to be closely allied to *Batasio affinis* Blyth.

Jordan in his ' Genera of Fishes ' (p. 294) stated that *Batasio* Blyth replaces *Gagata* Bleeker. In view of the confused taxonomic position of *Batasio*, one of us (S. L. H.) did not realize its generic limits when he created the subgenus *Macronoides*[3] for *Macrones affinis* (Blyth), *M. dayi* Vinciguerra and *M. marianiensis* Chaudhuri.[4] *Macronoides* was characterised as follows :—

> " This new subgenus is proposed for species which differ from typical *Macrones* in the possession of a distinct ventral mouth bordered by fringed lips ; in having short barbels not exceeding the length of the head ; in the mandibular pairs of barbels being disposed in a transverse row across the mandible and in the possession of open pores on the ventral surface of the head just behind the mouth. In general facies the fish of this subgenus show a remarkable resemblance to those of the genus *Gagata*, from which, however, they are easily distinguished by the crescentic band of teeth and a free air-bladder in the abdominal cavity."

In examining the collection made by Messrs. G. E. Shaw and E. O. Shebbeare from the Terai and Duars, one of us (S. L. H.) found representatives of Hamilton's little known species—*Pimelodus batasio*—and found it to belong to his genus *Macronoides*. He, therefore, suggested to Shaw & Shebbeare[5] to revive Blyth's genus *Batasio* and to describe this fish as *Batasio batasio* (Hamilton).

Having cleared the systematic position of *Batasio* Blyth from a study of the fresh material of *B. batasio* (Ham.) obtained from its type-locality, we may now consider which other species can be assigned to this genus. We have indicated above (*vide supra*, p. 13) that Hamilton's *Pimelodus tengana*,[6] as surmised by Blyth already (*vide supra*, p. 28), belongs to this genus. In a recent collection made by one of us (S. L. H.) from the Terai and Duars there are several specimens which are referable to this species, though the colouration, which is variable, differs from that described by Hamilton. He observed that :—

> " .....The body is diaphanous, with a silver *coloured membrane* investing the viscera and spine, and with a gloss of gold on the sides. On the back are many black dots, which are collected into a spot above each pectoral fin, and also on the crown of the head. The fins of the back and tail also are dotted, so that the edge of the last is black, and several spots are formed on the first."

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[1] Day, F., *Fish. India*, p. 492 (1877).

[2] Vinciguerra, D., *Ann. Mus. Civ. Stor. Nat. Genova* (2) IX, pp. 211-217, 230-235 (1890).

[3] Hora, S. L., *Rec. Ind. Mus.* XXII, p. 179 (1921).

[4] Chaudhuri, B. L., *Rec. Ind. Mus.* VIII, p. 253, pl. xi, figs. 1, 1*a*, 1*b* (1913).

[5] Shaw, G. E. and Shebbeare, E. O., *Journ. Roy. As. Soc. Bengal, Science* III, pp. 97, 98, text-fig. 98, 1937 (1938).

[6] Hamilton, F., *Fish. Ganges*, p. 176, pl. xxxix, fig. 58 (Edinburgh, 1822).

Hamilton found this species in the Brahmaputra river at Goalpara. In the adult specimens from the Terai and Duars the colouration is more or less similar to that described by Hamilton but in the younger specimens the body is marked with a few oblique bands and spots, and the distal half of the anterior rays of the dorsal fin is black. On the whole the colour seems to vary considerably with age (*vide infra*, p. 38).

In describing *Batasio affinis*, Blyth[1] remarked :—

> " Exceedingly like *B. Buchanani*, as described by Buchanan Hamilton and as figured in one of his unpublished coloured drawings ; whereas his published figure (F. G. pl. xxiii, f. 60) refers to his *Pimelodus carcio*, which is a true *Bagrus* with moderately long maxillary cirri :—but having 12 instead of 16 anal rays, no distinct longitudinal black stripe on each side of the body, but a tendency to show three or four black broad cross-bands, more or less distinct, besides a round black spot near the gill-covers, as in the other. The first dark band proceeds obliquely downwards from the fore-part of the first dorsal, to some distance below the lateral line ; and posterior to this first band are obscure traces of three or four others, the last at base of tail. On the membrane of the dorsal fin is a large blackish spot, consisting of minute dark specks."

The type of Blyth's species is preserved in the collection of the Indian Museum, and though its colouration has faded there can be no doubt of its identity with the specimen of Hamilton's *Pimelodus tengana* from the Tista River System.

In his ' Supplement ' to the ' Fishes of India ' (1888, p. 805), Day described *Leiocassis fluviatilis*, a species of freshwater fish found by Day in Col. Tickell's " volume of beautiful coloured drawings of Burmese Fishes with their descriptions ", of which Col. Tickell is stated to have " obtained four examples, the largest $3\frac{1}{2}$ inches long from the Anin, a steam rising near Weywoon, Wagroo in the Tenasserim Provinces ". The identity of this species is still in doubt, but recently Hora and Gupta examined six specimens from the Chenderoh Lake, Perak, in the collection of the Raffles Museum, Singapore, which they referred to this species. The most characteristic feature of *L. fluviatilis* is its colouration, which, according to Day (*loc. cit.*), is as follows :—

> " Yellowish horny with darker shades of olive brown on the snout and along the back, also some cloudy markings. A large black blotch on the lateral-line above the anal fin, another between the pectoral and first dorsal. Tip of dorsal and ends of both caudal lobes black."

In the examples from Perak the black blotch on the lateral line above the anal fin is very conspicuously marked, while the anterior blotch represents the area against which the air-bladder comes directly in contact with the skin. Another conspicuous feature of these examples is an oblique horseshoe-shaped band lying in front of the first dorsal fin and descending on the sides to below the lateral line. Sometimes this band breaks up into a dorsal blotch and two oblique bars on the sides. There is a submarginal band on the dorsal fin and the tips of the caudal fins are somewhat dusky but not black.

Day observed that with the exception of the maxillary pair of barbels no others were detected. We find that there are two pairs of mandibular barbels, the outer being more or less equal to the diameter of the eye while the inner are very rudimentary. The nasal barbels extend

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[1] Blyth, E., *Journ. As. Soc. Bengal* XXIX, p. 149 (1860).

to the front border of the eye or slightly beyond it. The maxillary barbels, as noted by Day, extend as far as the posterior border of the orbit.

A comparison of the Perak examples with those of *Pimelodus tengana* from the Eastern Himalayas and of *Batasio affinis* from Tenasserim leaves little doubt of their identity. We are, therefore, led to conclude that Day's *Leiocassis fluviatilis* is a synonym of *Batasio tengana* (Ham.).

Vincigeurra's[1] *Macrones dayi* is stated to be closely allied to *Leiocassis fluviatilis* Day and *Batasio affinis* Blyth, only differing in proportions and colouration. From a study of a large number of specimens we have found that such differences have no specific value and we are of opinion, therefore, that *M. dayi* is also a synonym of *Batasio tengana* (Ham.). Chaudhuri's[2] *M. marianiensis*, described from the Brahmaputra River System, Assam, and later recorded from the streams at the base of the Eastern Himalayas, is also a synonym of *B. tengana*. The species described and figured by Shaw and Shebbeare[3] as *Leiocassis rama* is also referable to *B. tengana*. Regarding this species Shaw and Shebbeare noted :—

> " In general appearance resembles those species of *Mystus* which have a shoulder-blotch and longitudinal bands but has much shorter barbels. It therefore somewhat resembles *Batasio batasio* from which it is distinguished by having a shorter adipose fin and a longer anal."

Recently we obtained a number of specimens from Travancore in which the body is of deep gray colour and is devoid of any transverse oblique bands or spots. These specimens are of a somewhat larger size and on morphological characters represent a new species of *Batasio*. In the present-day discontinuous distribution of this genus we have another record of the common origin of the fauna of the Malay Peninsula and that of Peninsular India.

Besides *Batasio batasio* (Ham.) and *B. tengana* (Ham.), there are two other species of Hamilton's *Pimelodus* which have been assigned by Blyth to *Batasio, viz., P. chandramara* and *P. rama*. Hamilton[4] recognised the great similarity between these species and separated them on the following characters :—

P. chandramara.	*P. rama.*
1. Two barbels.	1. Six barbels.
2. Diaphanous with clusters of black dots ; golden stripe along lateral line.	2. Diaphanous, yellowish without dots. Black spot on nape, divided into four lobes.
3. A. 17.	3. A. 15.

As pointed out by Blyth, Hamilton's original figure of *P. chandramara*[5] shows six distinct barbels. The other two points of difference are not of specific value as the colour may vary according to habitats

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[1] Vinciguerra, D., *Ann. Mus. Civ. Stor. Nat. Genova* (2) IX, p. 230 (1890).
[2] Chaudhuri, B. L., *Rec. Ind. Mus.* VIII, p. 253, pl. xi, figs. 1, 1*a*, 1*b* (1913).
[3] Shaw, G. E. and Shebbeare, E. O., *Journ. Roy. As. Soc. Bengal, Science* III, p. 90 text-fig. 88, pl. 3, fig. 4, 1937 (1938).
[4] Hamilton, F., *Fish. Ganges*, pp. 162, 176 (Edinburgh, 1822).
[5] *Vide* Hora, S. L., *Mem. Ind. Mus.* IX, pl. xxi, fig. 6 (1929).

and the difference in the number of anal rays may be due to individual variation. Both the species were described from Northern Bengal.[1]

Hamilton's descriptions of both the species are brief and inadequate for their specific determination, and, as pointed out by Blyth (*loc. cit.*), there are discrepancies between his descriptions and figures. For instance, Hamilton stated in his description that *P. chandramara* possesses only " two tendrils ", whereas in his unpublished figure 6 barbels are distinctly shown. The consideration of the number of barbels alone seems to have led Swainson[2] and Cuvier & Valenciennes[3] to refer *P. chandramara* to the genera *Silonia* and *Silundia* respectively. It may be stated without any fear of contradiction that Hamilton's species does not belong to either of these genera. Blyth placed it in the genus *Batasio* but without examining any specimen of the species; his conclusion seems to have been based on a study of the unpublished drawing of the species. In the two species of *Batasio* referred to above, there is a distinct nasal barbel, which is neither described nor shown in the figure of *Pimelodus chandramara*. Günther[4] referred *P. rama* very doubtfully to the genus *Rita*, but considering the large size of its eyes, general facies and habitat, it is difficult to place it among *Rita*. Day[5] examined a specimen from Assam, which undoubtedly belongs to this species and regarded it as *Leiocassis*.[6] On a careful analysis of Day's description it is found that the species shows affinities with both *Batasio* and *Leiocassis*. For instance, the subcutaneous nature of the eyes is a character of *Leiocassis*, but their relatively large size is a character of *Batasio*. The absence of the nasal barbels, however, precludes it from either of the genera. We have examined Day's specimen from Assam, which is in a poor state of preservation, and have found open pores along the lower jaw and edges of the gill-covers which are characteristic of *Batasio*. In view of what is stated above, and in the absence of good and reliable material it is perhaps desirable to keep *Pimelodus rama* in a separate genus for which Bleeker has already proposed the name *Rama*.

In 1931, H. M. Smith[7] described from Siam a strikingly marked little catfish and referred it to the genus *Mystus*. The colouration and general build of this species, *M. havmolleri*, are very similar to

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[1] Day (*Fish. India*, p. 452, 1877) notes that " In Ham. Buch. MSS. *P. chandramara* is said to be found in the Rangpur district in the Mahánandá and also in the Dinajpur district. In Purniah he records it as termed Thŭnka-pátasĭ of the Kusí and Khămaĭñ at Bholáhát. In the 'Fishes of the Ganges', he remarks that *P. rama* is from the Brahmaputra. The fish I have here described from the same locality, appears to be a link between the two forms, as the Assam one is said to have on nape a large black spot divided into four lobes, and which is not present in my specimens, which it is said to differ from *P. chandramara*. chiefly in the latter being deficient in this mark. I have referred my specimen to *P. rama* as it came from Assam.

[2] Swainson, W., *Nat. Hist. Classification Fish. Amph. Rept.* II, p. 305 (1839).

[3] Cuvier, G. and Valenciennes, A., *Hist. Nat. Poiss.* XV, p. 49 (1840).

[4] Günther, A., *Cat. Fish. Brit. Mus.* V, p. 92 (1864).

[5] Day, F., *Fish. India*, p. 451 (London, 1877).

[6] Regan [*Ann. Mag. Nat. Hist.* (8) II, p. 547, 1913] observed that " *Pimelodus rama* Ham. Buch., from Bengal and Assam, is placed by Day in *Liocassis* (*Fish. India*, p. 451 pl. cxv, fig. 2); it seems improbable that this little fish really belongs to the genus; but if it does, the large eye and minute mandibulary barbels distinguish it from all the other species".

[7] Smith, H. M., *Proc. U. S. Nat. Mus.* LXXIX, Art. 7, p. 24, fig. 24 (1931).

Batasio tengana, though in the size of its eyes, barbels and adipose dorsal it is somewhat different. It is stated to be provided with " a transverse row of 4 large pores behind lower lip ; entire snout thickly beset with minute pores " A more detailed description of the species is necessary to determine its precise specific limits but there can hardly be any doubt of its position in the genus *Batasio*. In fact, its resemblance to *B. tengana* is so close that, in the present state of our knowledge we consider that the differences between the two are not of specific value.

From the above it will be clear that in the present state of our knowledge only three Indian species can definitely be assigned to the genus *Batasio*. These can be distinguished by the following key :—

Key to the Indian species of Batasio *Blyth.*

A. Base of adipose dorsal considerably longer than that of anal.
  I. Body marked with longitudinal bands ; a conspicuous dark spot above pectoral. [Median groove on head continued on occipital process for some distance ; occipital process extending over basal bone of dorsal and meeting first dorsal spine ; no pores on dorsal surface of head.] .. *B. batasio.*
  II. Body without longitudinal bands or spots. [Median groove on head extending to base of occipital process ; occipital process separated from basal bone of dorsal fin by a considerable distance ; pores on dorsal surface of head present] . . *B. travancoria.*

B. Base of adipose dorsal shorter or equal to base of anal. [Median groove on head extending to end of occipital process and in its posterior portion containing basal bone of dorsal fin ; no pores on dorsal surface of head ; body marked with oblique vertical bands or spots.] .. *B. tengana.*

Batasio batasio (Hamilton).

Plate II, figs. 4-6.

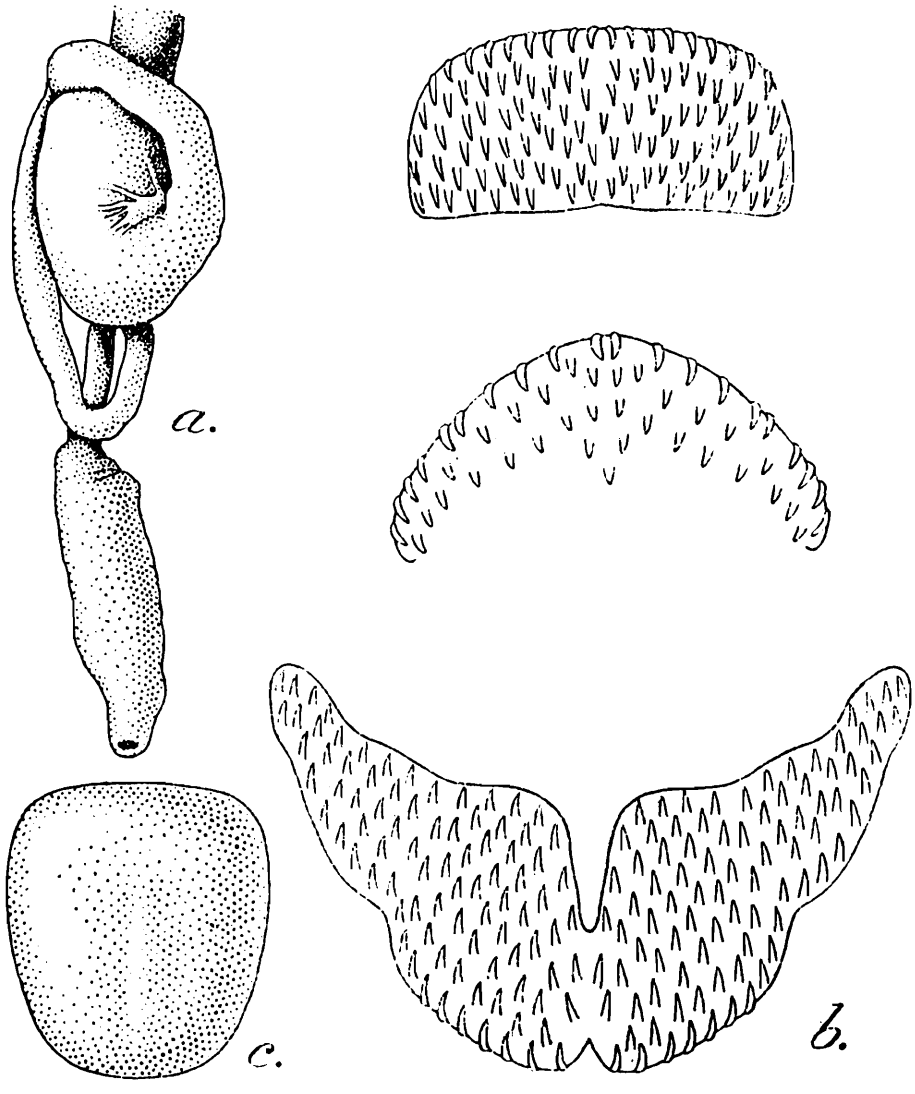
1822. *Pimelodus batasio*, Hamilton, *Fish. Ganges*, pp. 179, 377. (The drawing on pl. xxiii, fig. 60 does not refer to this species, but to *P. carcio* described on p. 181).
1839. *Bagrus batasio*, Cuvier and Valenciennes, *Hist. Nat. Poiss.* XIV, p. 425.
1860. *Batasio Buchanani*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 150.
1862. ? *Batasio Buchanani*, Bleeker, *Atl. Ichthyol.* II, p. 8.
1863. ? *Batasio Buchanani*, Bleeker, *Ned. Tijdschr. Dierkund.* I, p. 94.
1864. *Macrones batasio*, Günther, *Cat. Fish. Brit. Mus.* V, p. 83.
1877. *Gagata batasio*, Day, *Fish. India*, p. 493, pl. xcix, fig. 5 (Hamilton's MS. drawing reproduced).
1889. *Gagata batasio*, Day, *Faun. Brit. Ind. Fish.* I, p. 209.
1929. *Pimelodus batasio*, Hora, *Mem. Ind. Mus.* IX, pl. xxii, fig. 3.
1938. *Batasio batasio*, Shaw and Shebbeare, *Journ. Roy. As. Soc. Bengal, Science* III, p. 97, fig. 98.

D. 2/7 ; A. 3-4/9-10 ; P. 1/5-8 ; V 1/5 ; C. 17.

Batasio batasio is a medium-sized species in which the dorsal and the ventral profiles are moderately arched. The dorsal profile rises gradually from the tip of the snout to the origin of the dorsal fin whence it slopes down gradually to caudal peduncle where it is horizontal. The ventral profile is horizontal and flattish just for a short distance between the head and pelvic fins, thence it rises gradually towards

both ends. The body is compressed from side to side, more so in the tail region.

The head is sharp, bluntly pointed and conical; its length is contained from 3·61 to 3·90 times in the standard length. The height of the head is contained from 1·34 to 1·71 times and its width from 1·43 to 2·38 times in its length. The snout is fairly long and pointed; it projects in front of the mouth for a short distance. The eyes are of a moderate size and dorso-lateral in position; they are not visible from the ventral surface. The orbital margins are free. The diameter of the eye is contained from 2·63 to 3·30 times in the length of the head, from 1·14 to 1·53 times in the length of the snout and from 0·71 to 1·20



Text-fig. 2.—Alimentary canal, dentition and air-bladder of *Batasio batasio* (Hamilton).

a. Alimentary canal: ×2¼. *b*. Dentition: ×12. *c*. Air-bladder: ×2¼.

times in the interorbital width. The two nostrils of each side are wide apart and are not so conspicuous as in the species of *Gagata*. The anterior nostril is placed above the base of the maxillary barbel and much nearer the tip of the snout than the eye; while the second pair is closer to the eye than to the anterior nostril. The median groove on the head is long and narrow; it extends from between the posterior nostrils to one-third of the occipital process; the lateral edges of the groove are slightly raised into longitudinal ridges. In the groove,

there are two fontanels which are separated by a broad bony ridge ; the anterior fontanel extends over the anterior two-thirds of the eye, while the posterior fontanel commences from behind the eye and extends for a short distance over the occipital process. The occipital process is long and broad ; its length is almost $3\frac{1}{2}$ times its width at the base ; it extends over the basal bone of the dorsal fin. The mouth is inferior, crescentic and horizontal ; it is bordered by fleshy lips which are continuous at the angles of the mouth. The labial groove is broadly interrupted in the middle ; both the lips are distinctly fimbriated. Behind the lower lip there are four slit-like openings and four pairs of pores on the ventral surface of head running obliquely from the mandibular barbels to the gill-openings. The teeth are small and villiform ; they are arranged in broad continuous bands in the jaws and in a similar band on the palate. There are four pairs of barbels ; the nasal barbels, which are placed at the anterior end of the posterior nostrils, are small and considerably shorter than the diameter of the eye ; the maxillary barbels do not extend beyond the posterior margin of the orbit and the mandibular barbels are still shorter ; the bases of the latter are not situated exactly in a transverse line behind the lower lip, but those of the inner pair are slightly in advance of those of the outer. The gill-membranes are notched anteriorly and the gill-openings are very extensive.

The depth of the body is contained from 3·72 to 4·40 times in the standard length. The least height of the caudal peduncle is contained from 1·33 to 1·57 in its length. The portion of the body where the air-bladder comes in contact with the skin is well marked externally. The cubito-humeral processes are also well developed. The external features of the urino-genital organs are similar to those as described above in the species of *Gagata* (*vide supra*, p. 16). In ripe males the urinogenital papilla is well marked.

The rayed dorsal fin is situated well in advance of that of the pelvics, but its base extends almost over the pelvic fins ; its longest ray is shorter than the length of the head and the spine is much shorter. The dorsal spine is a strong prickle which is smooth along both the borders. The adipose dorsal is considerably long and well marked ; the length of its base is equal to or greater than the length of its head. The pectoral fins are horizontally placed and are shorter than the head ; they are separated from the pelvic fins by a considerable distance. The pectoral spine is strong and broad ; it is smooth along the outer border but is strongly denticulated internally. The pelvic fins extend beyond the anal opening but do not reach the base of the anal fin. The caudal fin is deeply forked with both the lobes sharply pointed.

Hamilton noted that the fish is provided " with a diaphanous body, having on each side two stripes dotted with black The cavity containing the viscera is lined with a silver *coloured* membrane ; and, besides the two stripes, the fish has on each shoulder a spot composed of black dots. The first dorsal fin is spotted, the second is dotted." Shaw and Shebbeare described the colouration as follows :—

> " Leaden above, yellow beneath. A dark longitudinal band along the lateral line expanding into a shoulder-blotch immediately below the dorsal fin. A second fainter and somewhat curved dark band midway between the lateral line and the

dorsal ridge, commencing at the top of the opercle and ending about the middle of the adipose fin. It is connected with the dark colour of the dorsal ridge at the front part of the rayed dorsal."

Distribution.—Batasio batasio is known so far from the Tista River System. We have examined several specimens from the streams of Terai and Duars.

Measurements in millimetres.

Standard length ..	55·0	65·0	69·0	75·0	84·0	89·5
Length of head ..	14·5	18·0	19·0	20·5	21·5	23·0
Height of head at occiput	9·5	10·5	13·0	14·0	16·0	15·0
Width of head	9·0	10·0	12·5	13·8	9·0	16·0
Length of snout	6·5	7·5	8·0	8·0	10·0	10·0
Diameter of eye ..	5·5	6·0	7·0	7·0	6·5	7·0
Interorbital width ..	4·5	5·0	5·0	5·0	6·0	6·5
Depth of body	12·5	15·0	18·5	17·5	23·5	23·0
Length of caudal peduncle	8·0	9·0	11·0	11·0	12·5	12·0
Least height of caudal peduncle..	5·5	6·5	7·0	8·0	8·5	9·0
Longest ray of dorsal	10·0	11·5	13·0	14·0	D.	14·5
Length of dorsal spine	9·0	12·0	9·5	12·0	D.	D.
Length of pectoral ..	11·0	12·0	14·0	13·0	14·5	14·0
Length of pectoral spine ..	10·0	11·0	12·0	D.	13·0	13·0
Length of ventral ..	8·5	12·0	10·0	11·0	10·5	13·0
Longest ray of anal ..	11·0	9·5	9·5	11·5	15·5	D.
Length of base of anal	10·5	10·0	12·0	11·5	14·5	11·0
Length of base of adipose dorsal	19·0	16·5	19·0	22·0	21·5	23·0

Batasio tengana (Hamilton).

Plate II, figs. 1-3.

1822. *Pimelodus tengana*, Hamilton, *Fish. Ganges*, pp. 176, 377, pl. xxxix, fig. 58.
1839. *Bagrus tengana*, Cuvier & Valenciennes, *Hist. Nat. Poiss.* XIV, p. 433.
1854. *Bagrus tengana*, Bleeker, *Verh. Bat. Gen.* XXV, p. 56.
1860. *Batasio affinis*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 150.
1860. *Batasio tengana*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 150.
1864. *Macrones affinis*, Günther, *Cat. Fish. Brit. Mus.* V, p. 83.
1864. *Macrones tengana*, Günther, *Cat. Fish. Brit. Mus.* V, p. 84.
1873. *Macrones affinis*, Day, *Proc. Zool. Soc. London*, p. 111.
1877. *Macrones Blythii*, Day, *Fish. India*, p. 445.
1877. *Gagata tengana*, Day, *Fish. India*, p. 493.
1888. *Leiocassis fluviatilis*, Day, *Fish. India Suppl.*, p. 805.
1889. *Liocassis fluviatilis*, Day, *Faun. Brit. Ind. Fish.* I, p. 164.
1889. *Macrones blythii*, Day, Faun. *Brit. Ind. Fish.* I, p. 151.
1889. *Gagata tengana*, Day, *Faun. Brit. Ind. Fish.* I, p. 210.
1890. *Macrones Dayi*, Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova* (2) IX, p. 230, pl. vii, fig. 3.
1913. *Macrones marianiensis*, Chaudhuri, *Rec. Ind. Mus.* VIII, p. 253, pl. xi, figs. 1, 1*a*, 1*b*.
1921. *Macrones* (*Macronoides*) *affinis*, Hora, *Rec. Ind. Mus.* XXII, p. 180.
1921. *Macrones* (*Macronoides*) *merianiensis*, Hora, *Rec. Ind. Mus.* XXII, p. 736.
1931. *Mystus havmolleri*, H. M. Smith, *Proc. U. S. Nat. Mus.* LXXIX, art. 7, p. 24, fig. 12.
1937. *Leiocassis rama*, Shaw & Shebbeare (*nec* Hamilton), *Journ. Roy. Asiat. Soc. Bengal, Science* III, p. 90, text-fig. 88, pl. iii, fig. 4.

D. 2/7-8 ; A. 3-4/8-11 ; P. 1/7-9 ; V 1/5 ; C. 16-18.

Batasio tengana is a small, well-built species in which both the dorsal and the ventral profiles are somewhat arched ; the body is deepest about the commencement of the dorsal fin and from that point it tapers both anteriorly and posteriorly. The ventral surface between the pectorals is only slightly flattened, but that of the head is flattish. The fish is compressed from side to side ; this is more marked in the tail region.

The head is broadly pointed anteriorly and the snout is produced beyond the mouth for a short distance. The length of the head is contained from 3·58 to 4·17 times in the standard length ; the height of the head is contained from 1·35 to 1·78 times and its breadth from 1·36 to 1·70 times in its length. The eyes are of a moderate size and are dorso-lateral in position ; they are not visible from the ventral surface, and are situated almost in the middle of the length of the head. The diameter of the eye is contained from 2·50 to 3·40 times in the length of the head and from 0·87 to 1·4 times in the length of the snout. The interorbital distance is considerably less than the diameter of the eye. The nostrils are situated wide apart ; the anterior nostril is tubular and directed forwards ; the posterior nostril is situated almost midway between the eye and the tip of the snout and is provided with a nasal barbel at its anterior end. The median groove on the head is long and narrow ; it extends from behind the posterior nostrils to the end of the occipital process ; its margins form slightly elevated ridges. In the groove, there are two median fontanels which extend to the base of the occipital process and are separated from each other by a narrow ridge situated behind the eyes. The anterior part of the basal bone of the dorsal fin is lodged in the median groove of the occipital process, which is long and narrow. The mouth is small, inferior, horizontal and crescentic ; it is bordered by fleshy lips which are continuous and pendulous at the corners of the mouth. The labial groove is broadly interrupted in the middle ; both the lips are distinctly fimbriated. Behind the lower lip there are five slit-like oval openings and four pairs of small round holes situated obliquely between the bases of the mandibular barbels and the gill-openings. The teeth are small and villiform ; those in the jaws form oval patches while those on the palate form a lunate band. There are four pairs of barbels ; the nasal barbels extend to the anterior border of the orbit or a little farther ; the maxillary barbels are the longest but are just about half the length of the head and the mandibular barbels are considerably shorter. The bases of the mandibular barbels are situated at a considerable distance behind the mouth and are not in a straight line, those of the inner pair being somewhat in advance of those of the outer. The gill-openings are very extensive and the gill-membranes are deeply notched anteriorly.

The depth of the body is contained from 3·69 to 4·65 times in the standard length. The least height of the caudal peduncle is contained from 0·84 to 1·60 times in its length. The portion of the body where the air-bladder comes in contact with the skin is well-marked. The cubito-humeral processes are narrow and can be readily felt through

the skin. The external features of the urinogenital organs are similar to those of *Batasio batasio.*

The rayed dorsal fin is situated considerably in advance of the pelvic fins, but its base extends almost over their commencement. The longest ray of the dorsal fin is considerably shorter than the head and the spine is still shorter. The dorsal spine is a smooth, moderately strong prickle. The adipose dorsal, though well marked, is not so extensive as that of *B. batasio*; it commences considerably behind the rayed dorsal and its base is somewhat shorter than the head. The pectoral fins are situated slightly above the ventral surface of the body; they are much shorter than the head and are separated from the pelvic fins by a considerable distance. The pectoral spine is flattened and strong; it is smooth externally but strongly denticulated internally. The pelvic fins are shorter than the pectorals and extend beyond the anal opening but not as far as the urinogenital openings. The anal fin is situated below the adipose dorsal and its base is slightly longer than that of the rayed dorsal. The caudal fin is deeply forked, with the lower lobe somewhat better developed; both the lobes are bluntly pointed.

As indicated above (*vide supra*, p. 30), the colour varies considerably with the size of the specimens and locality. In fresh specimens collected from the streams of Terai and Duars, Tista River System, the general surface is gray-olivaceous which is deeper above and lighter below. The dorsal surface of the head is dark with an indication of a band in the region of the eyes; this band passes on the sides below the eyes but does not extend to the ventral surface. There is a broad black spot on the nape. Behind the head there is an oblique darkish band dorsally which extends to the sides and joins the black blotches in the region above the pectorals where the air-bladder comes in contact with the skin. The rest of the body is marked with five oblique, saddle-shaped bands of varying depth of colour which do not extend to the ventral surface, the first is at the commencement of the rayed dorsal fin, the second at its termination, the third below the anterior part of the adipose dorsal, the fourth below the posterior part of the adipose dorsal and the last in front of the base of the caudal fin. The distal portions of the anterior rays of the dorsal fin are dark and form a broad patch. The other fins are somewhat dusky. The colour variations consist in the suppression or intensification of some of these markings, but the general colour plan remains more or less similar. For this reason we have attached no significance to colour variations in recognising species established on this character alone.

Distribution.—Batasio tengana was originally described from the Brahmaputra river. We have examined several specimens from below the Darjeeling Himalayas, Assam, Tenasserim, Mergui and Perak. It is also found in Siam (Klong Thalerng, near Ronpibun, Peninsular Siam), from where it was described as *Mystus havmolleri* by H. M. Smith. In the Siamese examples the eyes are considerably smaller and the adipose dorsal relatively longer. As judged from the figure the barbels, especially the maxillary pair, appear to be somewhat longer. In view of these differences it may perhaps be desirable to regard *M. havmolleri* as a variety of *B. tengana.*

Measurements in millimetres.

	Bengal.										Assam.				Tenasserim.	Tasing, Mergui Expedition.	Chenderoh Lake, Perak.	
Standard length	38·5	40·0	43·5	46·0	48·0	49·0	54·5	54·5	56·0	60·0	41·5	57·5	64·5	68·5	63·0	74·0	53·5	61·0
Length of head	10·5	11·0	11·0	12·5	11·5	13·0	15·0	14·5	13·5	15·0	10·0	15·5	16·5	17·5	16·5	20·5	14·0	17·0
Height of head at occiput ..	6·5	6·5	7·0	9·0	7·0	9·0	8·5	9·0	10·0	9·5	6·5	9·5	11·0	11·0	11·0	15·0	10·0	9·5
Width of head	7·0	7·0	7·0	8·0	7·0	9·5	9·5	9·5	9·5	10·0	6·5	9·8	12·0	11·5	11·5	14·5	10·0	10·0
Length of snout	3·5	4·0	4·0	4·5	4·0	5·0	5·5	5·5	5·0	6·0	4·0	5·5	6·0	6·0	5·5	8·5	6·0	7·0
Diameter of eye	4·0	3·5	3·5	4·0	3·5	4·5	4·5	4·5	4·5	4·5	4·0	5·0	5·0	5·5	6·0	7·0	5·0	5·0
Interorbital width	3·0	3·0	3·0	3·0	3·0	3·5	4·0	3·5	4·0	4·0	2·5	3·5	4·0	4·5	5·0	5·0	4·0	4·0
Depth of body .	9·0	9·0	10·5	11·5	10·5	11·5	12·0	13·0	14·5	15·0	9·5	14·5	14·5	18·5	16·0	19·5	12·5	16·5
Length of caudal peduncle	5·0	6·5	8·0	8·0	8·0	6·5	8·0	7·0	11·0	10·5	6·0	9·0	10·0	10·0	7·0	9·0	5·5	7·5
Least height of caudal peduncle	4·5	5·0	5·0	5·7	5·5	5·5	6·5	6·0	7·0	7·0	4·0	6·0	7·5	8·5	7·8	8·0	6·5	6·5
Longest ray of dorsal	8·0	9·0	9·5	10·0	10·0	11·0	12·0	11·5	10·5	13·0	9·0	11·0	13·0	12·0	D.	16·0	10·0	11·5
Length of dorsal spine	6·5	7·0	7·0	8·5	7·5	8·0	9·0	9·0	9·0	10·0	5·5	8·0	10·0	9·5	9·5	9·5	7·0	7·0
Length of pectoral	8·5	9·0	10·5	8·5	10·5	9·0	11·5	11·0	12·0	10·0	9·0	10·5	14·5	14·0	11·0	17·0	12·0	11·5
Length of pectoral spine	7·5	9·5	8·0	8·0	8·5	8·0	9·0	8·5	9·5	D.	6·5	8·0	10·5	10·5	10·0	13·0	9·5	8·0
Length of ventral	6·5	6·5	8·0	7·5	7·0	6·5	8·0	10·0	9·0	9·5	6·0	9·0	10·5	9·5	9·5	12·0	9·0	9·5
Longest ray of anal	8·0	6·0	9·0	8·0	10·0	9·5	8·5	11·0	9·5	12·5	8·5	9·5	13·5	13·5	11·0	D.	10·0	10·5
Length of base of anal	6·0	6·5	6·0	7·0	6·5	8·0	7·0	8·5	7·0	10·5	5·5	8·5	10·0	10·0	9·0	12·0	8·0	6·0
Length of base of adipose dorsal.	8·5	10·0	7·5	10·5	12·5	9·5	13·0	12·0	11·5	14·0	7·0	10·5	14·0	17·5	13·5	22·5	13·5	16·0

Batasio travancoria, sp. nov.

Plate II, figs. 7-9.

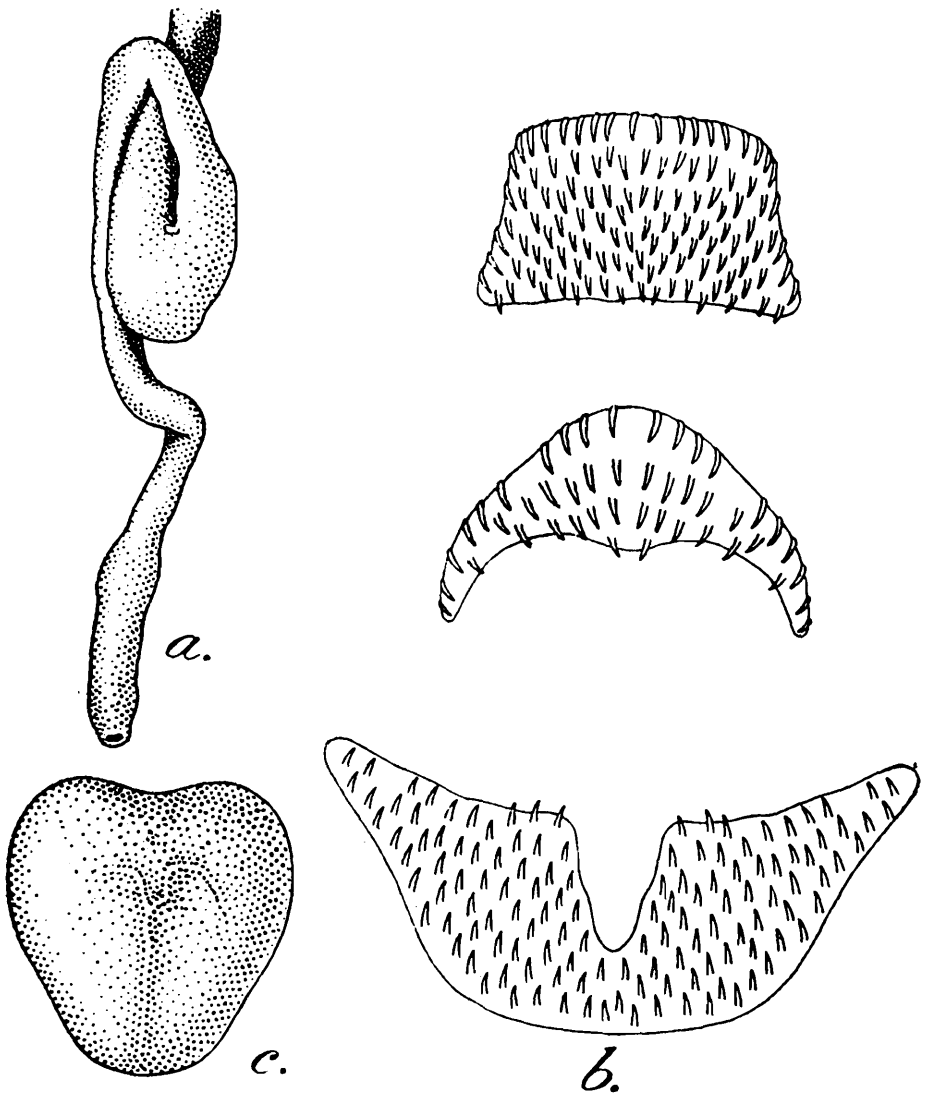
D. 2/7 ; A. 3-4/9-11 ; P. 1/7-9 ; V 1/5 ; C. 16-19.

Batasio travancoria is an elongated, medium-sized fish, in which the dorsal profile is slightly arched while the ventral profile is more or less horizontal in front of the pelvic fins, after which it is slightly arched. The ventral surface of the head and the anterior part of the body are somewhat flattened. The fish is suboylindrical anteriorly and compressed posteriorly.

The head is globular, conical and rounded anteriorly ; its length is contained from 3·87 to 4·35 times in the standard length. The height of the head is contained from 1·44 to 1·81 times and its width from 1·32 to 1·53 times in its length. The snout is rounded and projects beyond the mouth for a short distance ; it is longer than the postorbital part of the head. The eyes are of a moderate size and are dorsolateral in position ; they are not visible from the ventral surface. The diameter of the eye is contained from 2·72 to 3·10 times in the length of the head, from 0·93 to 1·28 times in the length of the snout and from 0·50 to 0·81 times in the interorbital width. The nostrils are situated wide apart ; the anterior nostrils are tubular and are directed forwards while the posterior nostrils are situated much nearer the eye than the anterior nostrils and are provided with nasal barbels. The median groove on the head is long and narrow ; it extends from slightly in front of the posterior nostrils to the base of the occipital process or slightly farther and in it are lodged two fontanels separated by a narrow ridge. At the sides of the median groove there is a series of 3 small fontanels on either side. The occipital process is long and sharply pointed posteriorly ; it is separated from the basal bone of the dorsal fin by a considerable distance. The mouth is small, inferior, lunate and horizontal ; it is bordered by fleshy lips which are pendulous and continuous at the angles of the mouth ; the labial groove is widely interrupted. The lips are slightly crenulate but not fimbriate as in the other two species. There are five large oval pores behind the lower lip and two series of six pores each situated obliquely between the angle of the mouth and the gill-cover. There are pores between the nostrils, below the eyes and along the free borders of the gill-covers. The teeth are small and villiform ; they are arranged in bands in the jaws and on the palate. There are eight barbels ; the nasal barbels are situated at the anterior border of the posterior nostrils and extend to about the middle of the eye ; the maxillary barbels are short and do not extend beyond the eyes ; the outer mandibular barbels are as long as the nasal barbels while those of the inner pair are much shorter. The bases of the mandibular barbels are not situated in a straight line ; those of the inner pair are in advance of those of the outer. The gill-openings are extensive and the gill-membranes are notched anteriorly.

The depth of the body is contained from 4·86 to 5·48 times in the standard length. The least height of the caudal peduncle is contained from 1·01 to 1·29 times in its length. The portion of the body where

the air-bladder comes in contact with the skin is fairly well marked externally, and the cubito-humeral processes can be readily felt through the skin. The external features of the urinogenital organs are similar to those described for the other species. The urinogenital papilla is well marked, especially in the males.



Text-fig. 3.—Alimentary canal, dentition and air-bladder of *Batasio travancoria*, sp. nov.
a. Alimentary canal. ×*ca* 2½. *b*. Dentition: ×15. *c*. Air-bladder. ×2¼.

The rayed dorsal fin is situated almost entirely in advance of the pelvics; its longest ray is considerably shorter than the head. The dorsal spine is comparatively weak and is slightly crenulated along both the borders; it is slightly longer than half the length of the head. The adipose dorsal commences as a slightly raised ridge behind the base of the rayed dorsal, but after the termination of the dorsal when laid flat it becomes a long, prominent ridge; the length of its base is considerably greater than the length of the head. The pectoral fin is considerably shorter than the head and is separated from the pelvics by about half of its length. The pectoral spine is moderately developed; it is smooth externally but denticulated internally. The pelvic fins are horizontal and extend considerably beyond the anal opening to the urinogenital papilla. The anal fin is low and the length of its base is almost equal to the base of the rayed dorsal fin. The caudal fin is

deeply forked with the lobes rounded ; the lower lobe is better developed than the upper.

The colouration in spirit is uniformly gray with the exception of a narrow dark streak along the lateral line. The gray colour is somewhat deeper on the head and the dorsal surface and lighter on the side. The ventral surface is much lighter. All the fins are more or less dusky.

Distribution.—Batasio travancoria is represented in the collection of the Zoological Survey of India by five specimens, which were collected by Dr. C. C. John from the following localities in Travancore :

Locality.	No. of specimens.
Peruntenaruvi, a tributary of the Pamba R., at Edakadathy	1
Kolathupuzha, a tributary of the Kallada R.	2
Chittar R., Palode	1
Kallada R., 4 miles east of Thenmalai..	1

Type-specimen.—F. 13449/1, Zoological Survey of India (*Indian Museum*), Calcutta.

Measurements in millimetres.

Standard length	56·5	59·0	65·0	74·0	79·0
Length of head	14·5	15·0	15·5	17·0	20·5
Height of head at occiput	8·0	10·0	10·0	11·8	14·0
Width of head	10·0	9·8	11·2	12·8	14·5
Length of snout	5·0	5·7	6·4	6·5	7·0
Diameter of eye	5·2	5·5	5·0	5·5	7·5
Interorbital width..	3·8	3·0	4·0	4·5	3·7
Depth of body	11·5	11·5	12·0	15·2	14·5
Length of caudal peduncle ..	7·5	6·6	8·0	10·0	9·5
Least height of caudal peduncle ..	5·8	6·5	6·5	8·0	8·5
Longest ray of dorsal	11·3	12·0	12·4	14·0	15·0
Length of dorsal spine	8·5	9·0	9·5	10·0	10·5
Length of pectoral..	12·0	11·5	12·0	13·4	15·2
Length of pectoral spine	10·0	10·0	10·0	11·0	12·0
Length of ventral	9·0	10·0	11·0	12·0	12·5
Longest ray of anal	11·0	11·5	10·4	10·8	11·8
Length of base of anal	8·5	8·0	9·0	11·0	12·5
Length of base of adipose dorsal ..	21·0	17·8	22·8	24·0	30·5