RECORDS

of the

INDIAN MUSEUM

(A Journal of Indian Zoology)

Vol. 50, Part 2

June, 1952

Edited by the Director, Zoological Survey of India

PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI.
PRINTED BY THE GOVERNMENT OF INDIA PRESS, CALCUTTA, INDIA,
1953.

CATALOGUE OF MAMMALS IN THE ZOOLOGICAL SURVEY OF INDIA. I. PRIMATES : HOMINOIDEA.

By H. KHAJURIA, *M.Sc., Zoological Survey of India, Indian Museum, Calcutta.*

1. GENERAL INTRODUCTION.

The collection in the Zoological Survey of India comes from three sources, namely, Asiatic Society, Indian Museum, and Zoological Survey of India itself. Blyth in 1863 published a catalogue dealing with the collection of the Asiatic Society ; and later, after this collection had been made over to the Indian Museum, Anderson in 1881 and Sclater in 1891 published first and second parts respectively of Catalogue of Mammals in the Indian Museum. Finally the whole collection was transferred to the Zoological Survey of India on its creation in 1916. The desirability of the preparation of a revised catalogue has been keenly felt, as many changes have taken place in the collection since the publication of the last catalogue some sixty years ago. In the first place, there have been notable additions to the collection during this period, the wealth of information on which is not accessible except through occasional short reports published by the departmental staff. Secondly, the collection suffered a considerable loss and damage due to a number of unavoidable causes. In 1942, the headquarters of the Zoological Survey of India was shifted from Calcutta to Banaras under war emergency and as a natural consequence of shifting some damage to the collection occurred. Then came the most unfortunate tragedy, that is, the flood of the Varuna river at Banaras in September, 1943, when a major part of the collection was submerged in water for about three days ! Many specimens were lost ; and many, which were badly damaged, had finally to be rejected. In 1948-49, the headquarters was again shifted from Banaras to Calcutta and again the collection was subjected to the effects of transit. Under the circumstances, there was evidently a great need of assessing our possessions again ; and, consequently, the present work was undertaken.

In view of the rapid progress made by the science of taxonomy since the publication of earlier edition, every specimen had to be thoroughly studied before the work could be brought up-to-date. The numbers on the specimens have all been changed into Zoological Survey of India (Z. S. I.) Register Numbers. Since the collection has passed through many hands, the checking up of the old numbers was a colossal task. All the distinguishing characters of the forms are not enumerated, and only important variations as noted in comparison with typical characters have been recorded.

All the measurements of the skulls are obtained afresh, as those by earlier workers, wherever taken, are not properly defined. The measurements of skins are only given when they have been noted on fresh material by the collectors.

As the particulars of locality and date of collection are wanting in many cases, they have been given, wherever available, in the same column as the collector or donor. The date following a locality is the date of

collection and that following a collector or donor is the date of presentation and is given within brackets.

Wherever possible, the last catalogue numbers have been given along with the corresponding Z. S. I. Reg. Nos. and those of the former which do not appear in this catalogue may be taken as missing. It may, however, be noted that, as the labels of a considerable number of specimens were lost or badly damaged during the flood at Banaras, it has not been possible to ascertain in all cases whether a particular specimen given in the last catalogue is actually missing or present in the collection.

It has to be noted with great regret that earlier collectors seem to have paid little attention to such important particulars as the locality, the date of collection, measurements and colouration of skins in fresh state, field notes, etc. As a consequence, I have failed to base, in several cases, any sound conclusions on the data at my disposal, especially with regard to the geographical significance of the variations.

I am much indebted to Dr. S. L. Hora, Director, Zoological Survey of India and Dr. B. Biswas, Officer-in-Charge, Bird and Mammal Sections for careful perusal of MS. and many useful suggestions.

2. Remarks On The Classification Of Hominoidea.

Simpson's (1945) great work on the classification of mammals has been followed by me with regard to the arrangement of generic and supergeneric groups. Since the two groups Platyrrhini and Catarrhini are too well defined, I propose to retain them in infraordinal ranks under the suborder Anthropoidea (*contra* Simpson, *op. cit.*, p. 184). Gibbons are retained in a separate family (Hylobatidae). For the use of the name *Simia* and consequently Simiidae I need give no explanation (see Chasen, 1940, p. 60); at least, I would like to retain these names till *Pongo* gets more familiarized and there are sufficient grounds to believe that it will not die the way its predecessor did.

For the classification of various genera Elliot (1913), Pocock (1927), Kloss (1929), Schwarz (1934), Allen (1939), and Chasen (1940) have been followed.

3. The Catalogue.

Order PRIMATES

Suborder *ANTHROPOIDEA*

Infraorder CATARRHINI

Superfamily HOMINOIDEA

Family Hylobatidae

Hylobates hoolock (Harlan).

1834. *Simia hoolock* Harlan, *Trans. Amer. Philos. Soc.*, IV, p. 52, pl. II (Garo Hills, Assam).

Material.—

7457	♂	Skin and skull	J. Anderson.
7537	♂	Skin (mounted in the gallery)	W. Rutledge (30-8-1897).
7539	♂	Skin and skull	W. Rutledge.

7540		Skin and skull	. .	W. Rutledge.
7542	♂	Do.	. .	Do.
7544	♀	Do.	. .	Do.
7545	♀	Do.	. .	W. Rutledge (31-8-1897).
7546	♀	Skin	. .	Do.
7547	♀	Do.	. .	Do.
7548	♀	Skin and skull	. .	Do.
7649	♀	Skin	. .	Do.
7650	♂	Do.	. .	Zool. Gardens, Calcutta (7-7-1887).
7679	♀	Do.	. .	....
7754	♀	Skin and skull	. .	Zool. Gardens, Calcutta (5-5-1901).
7831	♀	Do.	. .	Do. (20-4-1903).
7832	♂	Do.	. .	W. Rutledge (16-4-1903).
7833	♀	Do.	. .	Do. (14-7-1903).
7834	♀	Skin	. .	Do.
7878	S.-ad. ♀	Do.	. .	Do. (14-12-1898).
7913	♀	Do.	. .	Do. (7-1-1901).
7923	♂	Skin and skull	. .	Zool. Gardens, Calcutta.
10728	♂	Skin	. .	Do.
10973	Young ♂	Skin (mounted in the gallery)		Kalanaga, Barail range, Manipur, Feb., 1936. Z.S.I. Party.
11426	♂	Skin and skull	. .	5 miles east of Nongpoh (3,500′), Khasi Hills, Assam, 28-5-1949. H. L. Hiteshi (Z. S. I. Party).
11427	♂	Do.	. .	7 miles west of Nongpoh (4,000′), Khasi Hills, Assam, 10-5-1949. H. L. Hiteshi (Z. S. I. Party).
11428	♀	Do.	. .	Manihar Basti, 8 miles north of Nongpoh (2,800′), Khasi Hills, Assam, 5-6-1949. H. L. Hiteshi (Z. S. I. Party).
11429	♀	Do.	. .	Nongpoh, Khasi Hills, Assam, 15-6-1949. H. L. Hiteshi (Z. S. I. Party).
11430	Young	Do.	. .	Manihar Basti, 8 miles north of Nongpoh (2,500′), Khasi Hills, Assam, 5-6-1949. H. L. Hiteshi (Z. S. I. Party).

11518	♂	Skin .	Zool. Gardens, Calcutta (19-1-1910).
11519	..	Do. . .	Teng-yu-chow, Yunnan. J. Anderson.
11520	♀	Damaged skin with skull and bones of limbs	Cachar, Assam (1867). Mus. Collector.
11521	S.-ad. ♀	Skin and skull . .	W. Rutledge (24-6-1850 ?).
11522	S.-ad. ♂	Do. .	Purchased (September, 1866).
11523	♀	Do. .	Zool. Gardens, Calcutta (11-5-1909).
11524	S.-ad. ♀	Damaged skin .	W. Rutledge.
11525 (I.M.6w)	♂	Imperfect skin	Hotha, West Yunnan (Kakh-yen Hills). W. Yunnan Expedition (1868).
11526	Young ♀	Damaged skin . .	....
11527	S.-ad. ♀	Skin . .	..
11528 (I.M.6i)	Young ♂	Skin and skull .	Purchased (29-5-1869).
11529 (I.M. 6r)	♂	Do.	Samaguting, Naga Hills, Assam. J. Butler (Oct., 1872).
11530	♂	Skin . .	Zool. Gardens, Calcutta (7-12-1915).
11577	♀	Skin and skull	Do. (8-11-1950).
11578 (I.M.6p)	♂	Do. (damaged)	W. Rutledge (30-6-1871).
11697	..	Skeleton (mounted in the gallery)	....
11733 (I.M. 6ii)	Young	Skull .	....
11741	Young ♀	In spirit . .	Cachar, Assam. C. Brownlow (5-7-1872).
11742	♀	Skin and skull . .	W. Rutledge (17-3-1877).
11743	♀	Skin .	Zool. Gardens, Calcutta (1877).
11744 (I.M.6y)	♀	Skin and skull	Tripura, East Bengal. W. Rutledge (18-8-1879).
11776 (I.M.6b)	♂	Mounted skeleton .	Barrackpore menagerie (1842).
11784	..	Skeleton (incomplete)	Zool. Gardens, Calcutta (11-3-1909).
11799	♀	Skeleton without skull .	Do. (8-10-1916).
11809 (I.M.6z)	♀	Skin and some bones .	Do. (19-5-1877).
11810 (I.M.6cc)	♀	Skin . .	W. Rutledge (10-4-1880).
11974	Young ♂	Skull .	Purchased (12-6-1869).
11975	Young	Do. . .	....

*Measurements *of skulls.*—4 ♀.-*l*, 108-114·6 (111·3) ; *cb*, 88·6-97·7 (92·1) ; *zw*, 66·2 73·8 (70·6) ; *ow*, 60·8-64·9 (63·4) ; *mw*, 28·6-31·8 (30·1) ; c^1-m^3, 33·7-35·2 (34·4) ; *ml* 76·0-80·2 (77·2).

1 ♂.-*l*, 105 ; *cb*, 87·5 ; *zw*, 64·7 ; *ow*, 54·0 ; *mw*, 28·8 ; *ml*, 73·0.

1 unsexed ad.-*l*, 115 ; *cb*, 92·5 ; *zw*, 7 ; *ow*, 60·5 ; *mw*, 32·6 ; c^1-m^3, 37·9 ; *ml*, 75.

Measurements of skins.—7 ad. H. & B., 475-612 (528·1) ; H. F., 132-160 (148·6) ; Ear, 23-35 (27·5).

Remarks.—The collection consists mostly of young specimens. The white brow-band is, as usual, very prominent ; but in almost all cases, a few white hairs are present around the face at all points, especially at the chin. Only in one adult male, they are entirely absent. In the females that are about to change the colour, the first appearance of the white is noticeable on the chin. In the next stages, it gradually spreads over the whole of the body in patches. All shades ranging from buffy brown to greyish white are present. According to Pocock (1939) there is a narrow line of white between and below the eyes in females. Only is one female from Assam, such a feature is noticeable. Almost all the skins of adult males and young ones are brownish and do not show jet black colour of the pelage, although about certain skins Anderson (1881) definitely stated that they were jet black at the time of collection. The change of colour is apparently due to foxing.

Pocock (1939, p. 22) has remarked that males are slightly larger than the females on the average. The present measurements prove the reverse. It is, therefore, advisable to assume that there is no sexual dimorphism in size.

Distribution.—Assam, Chittagong, Upper Burma to Western Yunnan.

Hylobates lar entelloides Geoffroy.

1842. *Hylobates entelloides* Geoffroy, *C. R. Acad. Sci. Paris*, XV, p. 717 (Malaya Peninsula, lat. 12° N.).

Material.—

4388 (I.M. 7t)	♀	Skin and skull	Mulayit range, Tenasserim 10-12-1880. Limborg and J. Anderson.
7162	Juv. ♀	Skin.	W. Rutledge.

* All measurements are in millimeters, and are the distances between the two points defined in straight lines, that is, the measurements of chords. The average values are given in parentheses.

Explanation of the abbreviations : *cb*, condylobasal length, measured from the hindermost point of the occipital condyle of one side to the anteriormost point of the premaxilla of that side ; c^1-m^3, maximum length between the anterior surface of the root of the upper canine and the posterior surface of the root of last molar of that side ; *l*, maximum length of the skull, measured from the hindermost point of the occipital surface in the middle line to the anteriormost point of the premaxillary symphysis ; *ml*, mandibular length, the distance between the hindermost point of the mandibular condyle to the anteriormost point on the symphysis of the two rami ; *mw*, maxillary width, measured across the outer surfaces of the upper canines ; *ow*, orbital width, maximum distance between the inner surfaces of the outer borders of the two orbits measured at right angles to the axis of the skull ; *zw.*, maximum zygomatic width, measured across the outer surfaces of the zygomatic arches at right angle to the axis of the skull.

11535	..	Skin	. .	....
11536	..	Do.	. .	Zool. Gardens, Calcutta (28-3-1909).
11698	♀	Skin (mounted in the gallery)		....
11747 (I.M.7o)	Young ♂	Skin	. .	W. Rutledge (2-3-1876).
11748 (I.M.7p)	Young ♂	Do.	.	Zool. Gardens, Calcutta (7-5-1877).

Measurements of skin No. 11536.—H. B., 510; H. F., 130; Ear, 25.

Remarks.—The following important variations in the colour pattern have been noted. In No. 11536, there are some white hairs mixed with the black ones here and there, especially around the neck. In No. 11748, the top of the head is darker. In No. 11747, there are two prominent pale patches on the back, the bases of the hairs especially on the legs and the arms are paler and there is a yellowish longitudinal band on the chest and the abdomen. There is also a pale narrow band tending to extend around the ears from the facial band. In Nos. 4388 and 7162, which are in pale phase, the dorsal side is slightly paler than the ventral. A peculiar feature to be noted in No. 4388 is that the hands and the feet are not white but match with the general colour of the body. Since the dorsal surface is also paler than the ventral, a characteristic feature of the pale phase of *H. hoolock*, it would be very difficult to distinguish such specimens from the pale phase of *H. hoolock* on the basis of colour alone. The extension of white over the hands and the feet varies. In No. 11536, the white extends a little beyond the wrists but not beyond the ankles. In Nos. 7162 and 11748, a few dark or brownish hairs are present towards the distal extremities of hands and feet. The facial white band in No. 11748 is expanded on the throat. In No. 11536, it is much reduced and the white hairs of the band are much mixed up with black ones. On the chin, though there is no mixture with the black hairs, the white hairs are very scanty. There is also an extension of the white hairs over the face.

Distribution.—Tenasserrim and lower Siam.

Hylobates lar lar (Linnaeus).

1771. *Homo lar* Linnaeus, *Mantiss, Plant.*, Appendix, p. 521 (Malacca).

Material.—

7404	♂	Skin	. .	W. Rutledge.
10529	♂	Do.	. .	D. Ezra (30-9.19137).
11533 (I.M.7a)	♀	Skin and skull	. .	....
11534	..	Skin	. .	....
11745	♂	Do.	. .	W. Rutledge (13-2-1877).
11746	Young ♂	Do.	.	Do. (18-8-1877).

Remarks.—Several intermediates between the black and the pale phases are present. In the three sexed adults, the colour is dark brown with intermingling of pale hue. In the unsexed adult, there is a broad pale band on the back. The pale ring around the face is more expanded on the cheeks and the throat in the adults than in the young one. The young specimen still has pale colour quite pronounced on the postero-ventral part of the body. The adult male (No. 7404) is somewhat intermediate between *lar* and *entelloides*, as the white extends only beyond the wrists, and not beyond the ankles. There is no preputial tuft in this skin. In No. 11746, there is a mid-ventral white streak. In No. 11745, there are white hairs intermingled with others on the back and the outside of the arms. Extension of the white on the cheeks and the throat is also very variable. In Nos. 11745 and 11746, the white on the cheeks and the throat is much expanded. In No. 11745, the white on the throat is continuous with the grey ventral surface.

In No. 10529, the locality given in Java but, since Mr. Ezra, who presented the specimen, used to purchase specimens from dealers, the sources of his information were not much reliable. Hence no importance can be attached to this locality.

Distribution.—Malaya States.

Hylobates agilis Cuvier.

1821. *Hylobates agilis* Cuvier, in E. Geoffroy St. Hilaire and F. Cuvier's *Hist. Nat. Mammal Le Wouwou*, pls. v & vii (West Sumatra).

Material.—

7405	Young ♂	Skin . . .	Sumatra. W. Rutledge.
11541 (I.M.8i)	♀	Skin, skull and bones of limbs	Purchased (24-12-1878).
11542	Young ♂	Skin, skull, and bones of trunk in extremely damaged condition	W. Rutledge (6-9-1869).
11615 (I.M.8f)	♀	In spirit (damaged) .	Do. (28-7-1877).
11749 (I.M.8g)	♀	Skin, skull, and some bones (damaged)	Do. (3-5-1873).
11750 (I.M.8o)	Young ♂	Skin and skull .	Do. (13-8-1875).
11751 (I.M.8k)	♀	Skin, skull, and bones of trunk	Purchased (25-2-1873).
11752 (I.M.9n)	♀	Skin and skull . .	W. Rutledge (2-3-1880).
11753 (I.M.8m)	♀	Skin (damaged) . .	Do. (9-12-1880).
11754	Young ♂	Skin	W. Rutledge (13-3-1881).
11761 (I.M.10a)	♀	Do. . . .	Do. (13-6-1874).
11762 (I.M.10b)	Adol. ♀	Skin and skull . .	Zool. Gardens, Calcutta.
11777 (I.M.8j)	♀	Skull	W. Rutledge (14-7-1877).
11791 (I.M.8b)	Young ♀	Skin (mounted in the gallery)	Do. (16-1-1870).

Measurements of skulls.—1♀, *l*, 105·2 ; *cb*, 86·5 ; *zw*, 72·1 ; *ow*, 61·6 ; *mw*, 29·7 ; c^1-m^3, 31 ; *ml*, 76·5.

Remarks.—The skins Nos. 11761 and 11762 are found to be very interesting. They are in the black phase but lack the pale rump which, according to the latest authoritative report (Kloss, 1929), is considered to be a characteristic feature of the black phase of this species. In both the skins, the second and the third toes are united at the base, again apparently an unrecorded character in this species as it is understood today. This species is now considered to be confined to Malaya and Sumatra, but Anderson (1881) has stated that these two skins came from Siam. I am, however, unable to trace any record on which Anderson based his statement. Anderson (*op. cit.*) placed them under *H. leucogenys* Ogibly to which they hardly bear any resemblance, except perhaps in the possession of white cheek patches. Under the circumstances, it was thought fit to invite the opinion of the leading museums of the world on the identity of the specimens and accordingly the photographs of the drawings of the face and the foot were sent to Raffles Museum, Singapore ; British Museum (Natural History), London ; Museum National d'Histoire Naturelle, Paris ; Rijksmuseum van Natuurlijke Histoire, Leiden ; Zoologisches Museum, Berlin ; U. S. National Museum, Washington ; and the American Museum of Natural History, New York. All except Leiden and Berlin Museums responded, and I take this opportunity to warmly acknowledge the help so kindly extended to us to elucidate the problem. Except the U. S. National Museum, all authorities replied that they do not have any specimen answering the description of our skins. The information supplied by Mr. Charles O. Handley, Jr. of the U. S. National Museum was, however, very instructive. It was stated that they have one skin, U.S.N.M. No. 143573, more or less agreeing with the description of our skins, five skins with dark rump, and the same number with the second and the third toes united at the base. It was further observed that there were several intermediate stages. These skins are, however, all from Sumatra. This fine piece of information clearly shows that our skins only represent a variation.

The general colour in the pale phase is extremely variable, no two specimens being alike. In No. 11750, the brow-band is incomplete on the temples and between the eye brows. In this specimen there are also white cheek and throat patches. In Nos. 7405, 11749, and 11750, there is a tendency to separate a darker area on the top of the head. In No. 7405, the hands and the feet are white but the white is continued upwards on the inner side of the arms and of the left leg. On the other hand, in Nos. 11749 and 11750 the colour of the hands and the feet is darker. In No. 11749, there are white hairs scattered over the chest. No. 11749 is labelled by Anderson (*op. cit.*) as belonging to this species but, since it is in pale phase, I am not sure of its identity. I, however, include it in this species on the authority of Anderson.

Distribution.—Malaya and Sumatra.

Hylobates moloch funereus Geoffroy.

1850. *Hylobates funereus*, Geoffroy, *C. R. Acad. Sci, Paris*, XXXI, p. 874 (Island of Sulu).

Material.—

11760	♀	Skin and skull	Zool. Gardens, Calcutta.

Measurements of the skull.—*l*, 101·2 ; *cb*, 85·6 ; *zw*, 64·9 ; *mw*, 30·0 ; c^1-m^3, 34·7 ; *ml*, 70.

Remarks.—The neck, the back, the outer parts of the legs (particularly of the thighs) and of the arms are pale brown. The crown, the cheeks, the throat, the shoulders, the ventral surface of the body and the inner parts of the legs are darker. The feet are paler, but the hands more or less match with the general colouration of the body. In the skull the supraorbital ridges are well marked. The left third upper molar is abnormally placed far behind and is just in the course of emerging. The right one is fully developed. The canines are singularly long. From the skull the specimen appears to be very old.

Distribution.—Northern parts of Borneo.

Hylobates moloch abbotti Kloss.

1929. *Hylobates cinereus abbotti* Kloss, *Proc. Zool. Soc. London*, p. 119 (Landak River, Pontianak, South-West Borneo).

Material.—

11755	♀	Skin and some bones	W. Rutledge (10-4-1876).
11756	Young ♂	Do.	Do.
11757 (I.M.9k)	♀	Skin and skull	Zool. Gardens, Calcutta (21-8-1877).
11758	♀	Skin and some bones	W. Rutledge (1878).
11759 (I.M.9m)	Young ♂	Skin and skull	Do. (3-12-1879).

Remarks.—The general colour shows various shades of pale brown. All specimens show to a greater or less degree a paler area around the face with its expansion on the throat. In some cases it is as distinct as in *H. lar lar.* In Nos. 11756 and 11758, the hands are slightly darker than the general colouration. The dark cap which is present in the allied subspecies on the crown is absent, but there is a tendency towards its separation inasmuch as the paleness of the throat tends to extend towards the occiput. All specimens are paler on the ventral side of the body and on the rump and more buffy on the back.

Distribution.—Western Borneo.

Hylobates moloch (subsp.?).

1797. *Simia moloch* Audebert, *Hist. Nat. Singes*, 1st fam., Sect. II, pl. 2 (Java).

Material.—

11595	..	Viscera in spirit	....
11786 (I.M.91)	Young ♂	Skull	W. Rutledge (10-12-1878).
11797 (I.M. 9a)	Young ♀	Do.	Purchased (1834).

Remarks.—The specimens cannot be assigned to any subspecies for want of proper data.

Distribution.—?

Hylobates syndactylus (Raffles).*

1821. *Simia syndactylus* Raffles, *Trans. Linn. Soc.*, XIII, p. 241 (Bencoolen, West Sumatra).

Material.—

7118	♂	Skin, skull, and some bones .	Zool. Gardens, Calcutta (October, 1889).
7241	♀	Skin and some bones . .	W. Rutledge.
7549	♂	Skin and skull . .	Do.
8043	♀	Skin and some bones . .	Zool. Gardens, Calcutta.
10530	♂	Do. . .	L. H. Goldsmith (3-8-1909?).
11579	Young	Do.	....
11580	♂	Do. . .	Zool. Gardens, Calcutta (3-12-1925).
11763 (I.M.5b)	♀	Do. . .	W. Rutledge (24-6-1873).
11764 (I.M.5f)	Young ♂	Skin .	Zool. Gardens, Calcutta (26-6-1880).
11765 (I.M.5g)	♂	Skin and skeleton . .	W. Rutledge (29-11-1880).
11785 (I.M.5c)	Young ♂	Skull . .	Do. (16-8-1873).

Measurements of skulls.—1♂-*l*, 128·7 ; *cb*, 107·7 ; *zw*, 85 ; *ow*, 66·3 ; *mw*, 39 ; c^1-m^3, 41·0 ; *ml*, 92·6.

Remarks.—In the absence of requisite data, I am unable to determine the specimens subspecifically.

Distribution.—Malaya and Sumatra.

Family Simiidae.

Simia satyrus abelli (Lesson).

1827. *Pongo abelli* Lesson, *Man. Mamm.*, p. 32 (Sumatra).

Material.—

11726 (I.M.4a).	♂	Lower jaw . .	Sumatra : C. Cornfoot (1822).
11727 (I.M.4b)	♂	Skull . .	Do. ....

Measurements of the skull.—*l*, 241 ; *zw*, 172 ; *ow*, 92 ; *mw*, 76·5 ; c^1-m^3, 73 ; *ml*, 187.

Remarks.—See p. 142.

Distribution.—Sumatra.

Simia satyrus satyrus Linnaeus.

1766. *Simia satyrus* Linnaeus, *Syst. Nat.*, I, p. 34 (Borneo).

Material.—

11709	♂	Skeleton	Sadong, Borneo. J. Brook (1855).
11710	♀	Skull	Borneo. Do.

*Following Miller (1933), the subgeneric status of the species under the name *Symphalangus* is here accepted, though some competent students like Simpson (1945, p. 67) still continue to give it a generic distinction.

11711 (I.M.3oo)	♂	Skull	Borneo. W. Nicholls (1855).
11713 (I.M.3ww)	♀	Do. . . .	Do. R.W.G. Frith 1836).
11723 (I.M.3nn)	♂	One ramus of lower jaw .	Do. M. Gregory (July, 1838).

Measurements of skulls.—3♂.-*l*, 220-230 (229·7) ; *cb*, 187·1-193 (190·4) ; *zw* (2 specimens), 164-170 (167) ; *ow*, 80-89 (84·3) ; *mw*, 64-70·7 (67·5) ; c^1- m^3, 68-72 (70) ; *ml*, 173-181 (178·2).

1♀.-*l*, 188 ; *cb*, 149 ; *zw*, 131·4 ; *ow*, 72·4 ; *mw*, 53·7 ; c^1-m^3, 59·6 ; *ml*, 146·6.

Remarks.—See p. 142.

Distribution.—Borneo.

Simia satyrus satyrus and Simia satyrus abelli.

The specimens listed below represent a mixture of the two subspecies, and for want of proper data cannot be separated.

Material.—

7220	Young ♂	Skin	W. Rutledge.
7225	♂	Skeleton without skull .	Do.
7325	Young ♀	Skin . . .	..
7326	Young ♂	Skin and skull . .	....
7327	♀	Skull without lower jaw	W. Rutledge (13-3-1893?).
744o	Young ♂	Skin .	B. M. Roy.
7456	Young ♂	Skin and skull .	W. Rutledge.
7492	Young ♀	Do. .	Do. (17-9-1896).
7518	Young ♂	Do. .	Do. (9-7-1897).
7533	Young ♂	Skin . .	Do. (10-2-1897).
7569	Young ♂	Skin and skull .	Do. (1-7-1897).
7571	Young ♂	Do. . . .	Do. (23-6-1897).
7805	Young	Do. . . .	Do. (6-8-1902).
7806	Young ♂	Do. . . .	Do. (13-4-1877).
7867	♀	Incomplete skeleton . .	Do.
7879	Young	Skin and skull . .	Do. (20-8-1902).
7961	♂	Skull . .	Do. (15-12-1894).
7927	♂	Skin and skull	Zool. Gardens, Calcutta.
7964	♂	Skeleton . . .	....
7966	Young ♂	Skeleton without skull .	W. Rutledge.
7967	♀	Skull . . .	Zool. Gardens, Calcutta.
7970	Young ♂	Incomplete skeleton without skull	W. Rutledge (20-2-1897).

7971	♀	Incomplete skeleton without skull	W. Rutledge.
7972	Young ♀	Do.	....
8005	..	Skeleton . . .	Do. (10-12-1903).
8422	♂	Skin and skull . . .	Zool. Gardens, Calcutta.
9026	S.-ad. ♂	Skin	Zool. Gardens, Calcutta.
10039	♂	Do. (mounted in the gallery)	D. Ezra (23-3-1915).
11513	..	Stuffed skin and skull	....
11514	..	Do. . . .	....
11515	..	Do. . .	....
11516	..	Do. . . .	....
11517	..	Do. . . .	....
11692	♂	Skin (mounted in the gallery)	....
11693	♂	Do. . .	....
11694	♀	Do. . .	....
11695	Young	Do. . .	....
11696	..	Skeleton Do. . .	....
11712	Young	Skull . . .	....
11714 (I.M.3ccc)	..	Skull and brain in alcohol .	Purchased (July, 1867).
11715 (I.M.31)	Young ♂	Skull . . .	W. Rutledge (20-3-1879).
11716 (I.M.3g)	S.-ad. ♀	Skin and skull . . .	Do. (10-8-1880).
11717 (I.M.3r)	Young ♂	Part of skin and skull . .	Do. (1-6-1880).
11718 (I.M.3f)	S.-ad. ♂	Skull	Zool. Gardens, Calcutta (13-12-1879).
11719 (I.M.3j)	♀	Do.	W. Rutledge (3-3-1879).
11720 (I.M.3b)	Young ♂	Do. .	Purchased (28-7-1879).
11721 (I.M.3d)	S.-ad. ♂	Skin . . .	Zool. Gardens, Calcutta (1880).
11722 (I.M.3w)	Young ♂	Skin and skull . . .	W. Rutledge (19-5-1877).
11724	Young	Skull . . .	....
11725 (I.M.3n)	Young ♂	Do. . . .	W. Rutledge (1-3-1876).

11729	♂	Skeleton .	W. Nicholls (1853).
11730 (I.M.3hh)	Young ♀	Do. .	Purchased (20-9-1869).
11731	♀	Do. .	W. Rutledge (21-11-1919).
11732	♂	Part of skin and skeleton	Zool. Gardens, Calcutta (25-5-1914).
11737 (I.M.3k)	Young ♀	In spirit	J. Anderson (21-1-1867).
11738	..	Do.	Do.
11739 (I.M.3o)	♀	Uterus in spirit	Zool. Gardens, Calcutta (8-4-1879).
11766	Young ♀	Skull .	W. Rutledge (12-6-1900).
11767	Do.	Skull without lower jaw	....
11768 (I.M.3q)	Young ♂	Skull	W. Rutledge (26-6-1875).
11769 (I.M.3aaa)	Young	Skull without lower jaw	Rajindra Mullick (1863).
11770	..	Do. .	Zool. Gardens, Calcutta.
11771	Young	Do. (damaged) . .	....
11772	..	Do. . .	....
11773	..	Do. . . .	....
11774	Young	Do. . . .	....
11775	..	Skull (damaged) .	....
11778	Young ♀	Skeleton (incomplete and without skull	Purchased (24-11-1883).
11779 (I.M.3i)	Young ♂	Skull	W. Rutledge (7-4-1877).
11780	..	Do.	Purchased (20-10-1875).
11781	♀	Skeleton (incomplete and without skull)	W. Rutledge (15-1-1876).
11782	♀	Do.	Do. (7-1-1876).
11783	♂	Do. .	Do. (19-5-1877).
11794	..	Incomplete skeleton	Zool. Gardens, Calcutta.
11795	..	Skull . .	....
11796	..	Skin and incomplete skeleton	.... (16-8-1904).
11797	Sub-ad. ♂	Skin and skeleton	Zool. Gardens, Calcutta (10-10-1916).
11798	Young ♀	Do. (without skull)	Do. (8-10-1916).
11800	..	Some bones of hand and foot	....
11801	..	Left first to fifth metacarpals	Asiatic Society.

11802	..	Second phalanges of hand and foot	Zool. Gardens, Calcutta. (8-10-1916).
11803 (I.M.3aaa)	Young ♂	Skull . . .	....
11804 (I.M.3eee)	Young ♂	Do. . .	Purchased (17-10-1870).
11805 (I.M.3bb)	Young ♀	Skull . . .	W. Rutledge.
11811	Young	Skin	....
11977	Young ♂	Skull (damaged)' .	..

Measurements of skulls.—

Z.S.I. Reg. Nos.	Sex	*l*	*cb*	*zw*	*ow*	*mw*	c^1-m^3	*ml*
11696	..	210·5	176	172	85·5	69·5	65	167
11719 . .	♀	181	141·5	124	69·5	50·9	57·4	..
11773 .	..	215	171	165·5	84	66·5	62·5	..

Remarks.—The colour of the skins shows various shades of dark and reddish brown. Only two male skins are with cheek expansions. One of them appears to be subadult from its size.

As shown by the measurements (pp. 138, 139) the skull of *abelli* is much larger than that of *satyrus*. The variations in the characters of the cranial ridges have been much discussed by various workers (Anderson, 1881 ; Sonntag, 1924) and I have very little to add to their observations. Sonntag (1924) states that in the pterion the alisphenoid articulates with the parietal separating the squamosal from the frontal. This type of the pterion is considered by him as a distinguishing skull character of *Simia* from the African Simiidae. In conformity with Ashley Montague (1930) and others, my observations show that great variations exist in the composition of pterion in *Simia*. Thus, out of thirty five skulls examined, twelve have the squamosal united with the frontal, four have this arrangement on the left side only, and two on the right side only. Thus, in one and the same skull the two types of pterions may co-exist. The non-union of the orbital ridges across the nose is found to be a constant character throughout. Great variations are present in the number and the arrangement of the cranial foramina. The parietal foramen is observed in only one young skull. The number of infraorbital foramina varies from one to four on each side. The number of the condyloid foramina is one or two. Simognathism or the curvature of the facial line varies from almost a right angle (a very young skull) to nearly a straight line. The outline of the orbits varies from subcircular to elliptical.

Another feature of interest is the separation of small pieces of bones from the larger ones. In No. 11772, a small bone has separated away at the union of the sagittal and the lambdoidal sutures. In No. 11725, in addition to two similar bones there is another small bone separated at the point where the squamosal, the occipital, and the parietal meet. In 11775, there is separation of a piece of bone from the lower border of

the parietal; and in Nos. 7971, 11719, and 11766, similar bones are present on each side of the occipital region.

The cusps of molars vary from four to five. In No. 11773, there is a supernumerary upper molar on the left side. On the right side it has not yet emerged. In No. 11767, there are only two molars on the left side, which of course, is not due to age.

Pan troglodytes troglodytes (Blumenbach).

1799. *Simia troglodytes* Blumenbach, *Handb. d. Naturgesch.*, p. 65 (Mayumba, French Congo).

Material.—

7671	..	Skin (mounted in the gallery)	Purchased (Berlin Mus.).
11736 (I.M.c)	Adol. ♂	In spirit .	British Mus. Exchange.

Remarks.—In the unsexed specimen (No. 7671), the tan spots on the face are prominently present specially on the nose. The forehead is thinly haired or almost bald. The parting of the hairs on the crown is partially noticeable. The fur is long, black, and somewhat soft. The hairs are noticeably scanty on the belly and on certain parts of the legs and the arms. In the other specimen (No. 11736) also the parting of the hairs on the crown is only faintly visible. There is no bald spot on the forehead. The cheeks are hairy and there is a very small beard on the chin. The ears are markedly large.

Distribution.—West coast of Africa (undefined).

Pan troglodytes subsp.?

Material.—

10993	♂	Skin (mounted in the gallery)	Zool. Gardens, Calcutta.

Remarks.—The face has a brownish red tinge. There is a marked parting of the hairs on the crown with a frontal bald spot. The hairs are abundant and fall over the ears and the regions between the eyes and the ears as in the youngs of *P.t. verus* Schwarz. The chin is beardless. The fur is black, long, coarse, and quite abundant, but thin on the belly and certain parts of the legs and the arms. The hands and the feet are black.

Distribution.—?

Pan troglodytes subsp.?

Material.—

11691	..	Skeleton (mounted in the gallery).	....

Remarks.—The superciliary arches are not well developed. The brain case does not steeply descend behind from the parietal region. The face is markedly concave.

Distribution.— ?

Gorilla gorilla gorilla (Savage and Wyman).

1847. *Troglodytes gorilla* Savage and Wyman, *J. Boston Nat. Hist. Soc.*, V., p. 417 (Mpongwe, Gaboon River).

Material.—

11687	♂	Skin (mounted in the gallery)	....
11688	♀	Do.	....
11689	♂	Skeleton (mounted in the gallery)	....
11690	♂ ′	Do.	....

Measurements of skulls.—

	l	*cb*	*zw*	*ow*	*mw*	c^1-m^3	*ml*
♂	306·7 (approx.)	210·4	171	112·5	73·0	..	192
♀	231·4	175	149	111	62·5	84	159

Remarks.—The hairs of the male are black at the tips with alternate black and brownish bands below. On the back the hairs are shorter and paler, and there is a very broad transverse pale band in the middle of the back. The hairs on the legs are also paler. The head, the neck, and the chest are naked. A peculiar character of the male specimen is the union of the third and the fourth fingers. In the female the colour on the whole is paler. In the skulls, the occipital regions are broad with the centres of the lambdoidal crests blunt.

Distribution.—North and North-West of the Congo river, Africa.

Family Hominidae.

Homo sapiens Linnaeus.

Material.—

1758. *Homo sapiens* Linnaeus, *Syst. Nat.*, ed. 10, p. 20.

11788	♂	Skeleton (mounted in the gallery).	India.
11789	Young ♂	Do.	Do.
11790	Young ♀	Do.	Do.
11791	Young ♀	Do.	Do.
11977	Young ♀	Mounted skeleton	Do.
11978	Ad.	Incomplete skeleton	....

References.

Allen, G. M., 1939.—A check list of African mammals. *Bull. Mus. Comp. Zool. Harvard*, LXXXIII, pp. 1-763.

Anderson, J., 1881.—*Catalogue of mammals in the Indian Museum*, Part I. pp. xv+223.—Calcutta : Government Printing Press.

ASHLEY—MONTAGUE, M. F.—1930.—A note on a rare type of pterion in *Gorilla*. *J Anat.*, LXIV, pp. 247-249.

CHASEN, F. N., 1940.—A hand list of malayasian mammals. *Bull. Raffl. Mus. Singapore*, XV, pp. xx+209, 1 map.

ELLIOT, D. G., 1913.—*A review of the Primates*, Vol. III, pp. xiv+262 +clxviii, 35 pls.—New York : *Amer. Mus. Nat. Hist.*

KLOSS. C. B., 1929.—Some remarks on the gibbons with the description of a new subspecies. *Proc. Zool. Soc. London*, pp. 113-127.

MILLER, G. S., 1933.—The classification of gibbons. *J. Mammal.*, XIV, p. 158.

POCOCK, R. I., 1927.—The gibbons of the genus *Hylobates*. *Proc. Zool. Soc. London*, pp. 719-741.

———— 1939.—*Fauna of British India. Mammalia*, vol. I., pp. xxxiii+463, 1 map.— London : Taylor and Francis.

SCHWARZ, E., 1934.—On the local races of the Chimpanzee. *Ann. Mag. Nat. Hist.*, (10) XIII, pp. 576-583.

SIMPSON, G. G., 1945.—The principles of classification and classification of Mammalia. *Bull. Amer. Mus. Nat. Hist.*, LXXXV, pp. xvi+350.

SONNTAG, C. F., 1924.—*The morphology and evolution of apes and man*, pp. xi+364.—London : John Bale and Sons & Danielson Ltd.

ON SOME INTERESTING LARVAL STAGES OF AN ACANTHOCEPHALAN, *CENTRORHYNCHUS BATRACHUS* SP. NOV FROM THE FROG, *RANA TIGRINA* (DAUD) FROM INDIA.

By. E. N. Das, M.Sc., *Department of Zoology, Vidarbha Mahavidyalaya, Amravati, M. P.*

Life histories of very few species of Acanthocephala are known to science. Schneider (1871) described the life history of *Macracanthorhynchus hirudinaceus* (Pall)-(*Echinorhynchus gigas* Bloch 1782). Meyer (1931 *et seq.*) made a detailed study of the developmental stages of the same species. These papers were published before Van Cleave (1935 and 1937) suggested the terms *acanthor* and *acanthella* to denote larval stages in development which are found prior to the formation of definitive proboscis and the differentiation of organs. He restricted the term *juvenile* to young forms in which the development of these organs has taken place and the proboscis has been formed. Therefore, Meyer's terminology of developmental stages was different; he called all later larval stages, actually acanthella stages, as *juveniles*.

In 1946, Moore published accounts of the life histories of *Monoliformis dubius* Meyer 1932, and *Macracanthorhynchus ingens* (von Linstow, 1879). Kates (1943) described the life history of *Macracanthorhynchus hirudinaceus* and, following Van Cleave, described the acanthor and the acanthella stages of this worm. Certain of the acanthella stages, however, could with justificatoin be regarded as actually ' juvenile ' worms because the proboscis was formed and organs were differentiated. Sita (1949) in a note described an egg of *Monoliformis monoliformis* from the faecal matter of Rat and also described a juvenile stage which she called " Infective larvae (acanthella) " in which a proboscis was formed and this according to Van Cleave, should not be called ' *acanthellae* '

The foregoing accounts relate to species of Acanthocephala included in Meyer's order Archiacanthocephala. The development of species belonging to the order Palaeacanthocephala is very insufficiently known. Gupta (1950) described the gross anatomy of some larval stages of a species of Centrorhynchus, and named them as ' inefective ' and ' preinfective ' stages, probably unaware of Van Cleave's (1947) review of terminology for immature stages in Acanthocephalan life histories. Except this paper which describes some developmental stages, the life history of no species belonging to the order Palaeacanthocephala is known.

Material and Method.—The present paper is an attempt to describe the *acanthor* and *acanthella* stages of *Centrorhynchus batrachus* sp. nov. I observed a large number of stages, about 50, embedded in the mesentery of *Rana tigrina* (Daud), some of these were freed from their cysts, and were obsreved in the living condition and fixed. Some were allowed to remain in normal saline solution in which they continued to live for about three weeks and thus developed into *acanthella* and juvenile stages similar to those obtained from the mesentery. I sectionised some acanthellae and made whole mounts of all stages. I am thus able to present in this paper an account of the stages in the development of this worm and describe some facts relating to the formation of skin, proboscis and other organs.

Description of Larval Stages.

(a) *Acanthor* stage in whole mounts.—The youngest larvae appeared a irregularly rounded or oval structures measuring—50μ—60μ×50μ—82μ. (text fig. 1, *a-e*). The larva has an outer dermal layer and an inner nuclear mass. The nuclear mass commences to show a differentiation into a central mass of nuclei, usually taking a deeper colour and a peripheral mass. In the most advanced condition, the nuclear mass appears separated into three areas, one at each pole and one in the central region (text-fig. 1, *e*). The outer dermal layer is also comparatively thicker. This stage seems to lead to the early acanthella stage.

(b) *Acanthella stages in whole mounts.—Stage 1.*—Text-fig. 1, *f*, is the youngest among these stages. There are three definite nuclear areas and the one in the central region stains more deeply. The central nuclear mass consists of larger nuclei with smaller and more numerous granules and the nuclei at the polar regions are smaller but with less numerous and larger granules. One of the two polar masses of nuclei, forms the primordium of the hooks and the proboscis. The central mass probably represents the Anlage of the central nerve ganglion and the proboscis sheath. The group situated at the other pole will form the body of the worm and actually is the region which is seen to elongate in the later stages. The acanthella at this stage measures 0·44 mm.×0·24 mm.

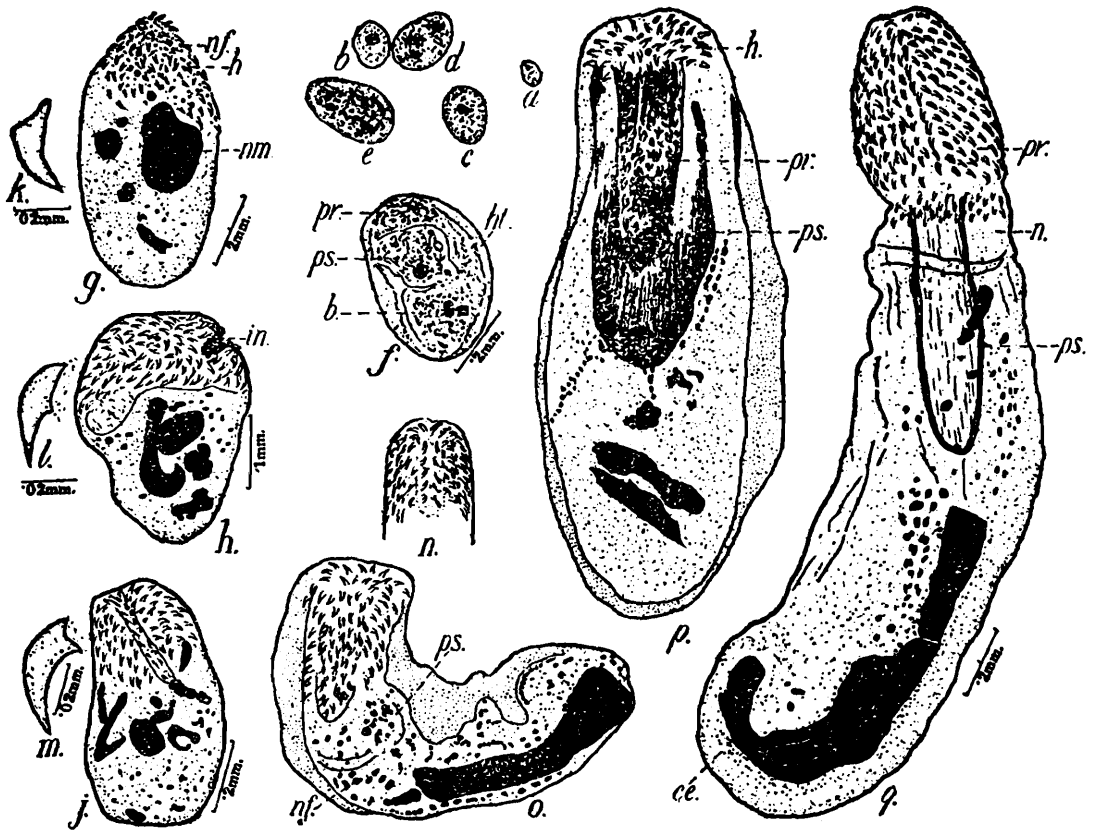
Stage II.—A slightly more advanced acanthella measures 0·71 mm. ×0·37 mm. This second stage acanthella shows distinct hooks and in fact the whole of the anterior region is studded with them (text-fig. 1, *g*). The hooks are not arranged in definite rows and it appears that their shoe-shaped roots have not yet developed. Consequently, the hooks get detached quickly from the surface of the body. An individual hook measures 28μ and is shown in text-fig. 1, *k*.

The nuclei now appear as fused compact masses and occupy positions where the gradient of developmental activity is highest. In addition to one or two such main masses, there are some smaller nuclei scattered throughout the two-thirds of the body behind the region occupied by the hooks. In text fig. 1, *g*, one can see one large mass and other masses of varying sizes behind the spiny region. These nuclear masses represent areas where important organs would develop. It is remarkable that even in the spiny region, small areas of nuclear masses are seen. It is reasonable to conclude that they probably provide material for the growth of root-bases which so far have not developed.

Stage III.—In the next stage (text-fig. 1, *h*) the acanthella is pear-shaped with a broad anterior spine-bearing region and a posterior gradually tapering region. The hook (text-fig. 1, *l*) measures 34μ, but hooks are not arranged in rows. At one end, however, there is a little depression which seems to mark the beginning of a distinct proboscis (text-fig. 1, *h*, *in*). The post-spiny region contains two large nuclear masses, two smaller ones and some still smaller. At the base of the spiny area and lying immediately below the depression there is an area which stains lightly. It consists of faintly staining scattered nuclei.

Stage IV.—The next stage (text-fig. 1, *j*) measures 0·65 mm×0·38 mm. From the relative size of the spine bearing and post-spiny regions, it is

evident that the latter has elongated as compared with previous stage. The most noticeable feature of this stage is the presence among the spines of a clear elongated narrow channel with hooks arranged on each side. The blade of the hook, the part which protrudes out of the cuticle, measures 38μ—40μ, and is of the same size as that of the hook of an adult, an important fact which is discussed later.



Text Fig. 1—Developmental Stages of *Controrhynchus batrachus*, sp. nov.

a-e, Acanthor stages; *f*, acanthella stage I; *g*, acanthella stage II; *h*, acanthella stage III; *j*, acanthella stage IV; *k*, a hook of acanthella stage II; *l*, a hook of acanthella stage III; *m*, external portion of a hook of acanthella stage IV; *n*, proboscis of acanthella stage V; *o*, acanthella stage VI; *p*, acanthella satge VII; *q*, acanthella stage VIII; *r*, *b*, body; *h*, hook; *ht*, host tissue; *in*, invagination; *nf*, nuclear fragments; *pr.*, proboscis; *ps*, proboscis sheath, *ce*, Caudal end.

It is evident that a distinct proboscis has been formed. In the post-spiny region, there are a large number of nuclear masses, but the largest among these is not as large as in the previous stage. The smallest scattered nuclei are present towards the posterior end of the body and this suggests a gradient of developmental activity.

Stage V.—The next stage possesses a well developed proboscis which is shown in text-fig. 1, *n*. Hooks are confined to a definite region and are not found on the entire region. The hooks on the proboscis show a linear arrangement and one can make out that there are 10 hooks in a row. The hooks measure the same as in the previous stage.

Stage VI.—In a more advanced stage (text-fig. 1, *o*), the proboscis takes a definite shape. The arrangement of hooks is suggestive of the adult condition. But the rest of organs have not yet differentiated. The acanthella is elongated in shape with a larger body as compared to the

spine bearing anterior region. The inner extremity of the spine-bearing area is a well marked region. In the post-spiny region, there is one large nuclear mass as long as the body and several small scattered nuclear masses. In the living condition it was found that proboscis reacted to acidulated water and was everted whenever these acanthellae were put into it.

Stage VII.—It seems that there is a slight gap between the previous stage and the next stage (text-fig. 1, *p.*). It possesses a proboscis with proboscis sheath with rudiments of sheath muscles which take a deep stain. The acanthella at this stage measures 1·63 mm and is widest in the middle region where it measures 0·67 mm. The anterior spine-bearing region is a small part of the entire worm and measures 0·62 mm in length and 0·42 mm in maximum width. The portion of the hook protruding out of the cuticle measures 38μ—40μ.

Stage VIII.—The last stage in my collection is shown in text-fig. 1, *q*. It has assumed very nearly the proportions of the juvenile form. The proboscis region measures 0·66 mm. The portion of the hook which protrudes out of the cuticle measures 38μ—40μ. The caudal end is typical of a juvenile form. In this region, large nuclear masses, in close contact with each other are still to be seen and organs other than the proboscis and its sheath have not been fully formed.

Some authors may consider this stage a completely metamorphosed juvenile. However, I have regarded it as the final acanthella stage, because the formation of the body wall is not yet complete.

Development of the body wall and other organs.—I have cut transverse and sagittal sections of the various Acanthella stages (stages IV to VIII) and it is possible to gain from them some information of the changes leading to the formation of the body wall, proboscis sheath, lemnisci and genital organs. In fact, these changes bring out clearly the process of metamorphosis. Van Cleave rightly says "Students who are not familiar with metamorphosis in its varied aspects are inclined to place too much emphasis upon the external transformation in shape of body when in reality cytological and histological changes are much more significant than the gross external evidences of changes"

Body wall.—I have reconstructed the following account of the development of the body wall from five series of sections. In the first series (Acanthella IV) (pl. III, fig. 1) the cuticle is not yet formed. The outermost layer is a syncytium (pl. III, fig. 1, *sy*). Below it are seen giant nuclei arranged along the margin, where the subcuticula will be laid. The occurrence of these small and large nuclei represent developmental activity. The muscles (pl. III, fig. 1, *wmb.*) are wavy bands and have not yet differentiated into circular and longitudinal muscles. In acanthella V the cuticle (pl. III, fig. 2, *c*) is formed though it is not yet a compact sheath. Below it the primordium of the subcuticula (pl. III, fig. 2, *psc*) is being laid. There is no evidence of the formation of either the fibrillae of the subcuticula or the lacunae yet. No change is yet evident in the wavy bands of muscles.

In the next stage, Acanthella VI, the cuticle (pl. III, fig. 3, *c*) becomes compact and takes a deeper stain. Below it the subcuticula (pl. III, fig. 3, *sc*) is better differentiated. The subcuticular nuclei (pl. III, fig. 3, *scn*) are well arranged along the border; the fibrillae of the subcuticul$_a$

(pl. III, fig. 3, *f*) and small lacunae (pl. III, fig. 3, *lsp*) have also just appeared. The muscles are better differentiated and the innermost margin of the body wall inside the muscle layer show cell processes (pl. III, fig. 3, *lm*) which will develop into longitudinal muscles. Large spaces. (pl. III, fig. 3, *bc*) have appeared which will form the body cavity.

In a sagittal section of an Acanthella (stage VIII) the subcuticula is seen to be well formed in which prominent subcuticular nuclei (pl. III, fig. 4, *scn*) and lacunar spaces (pl. III, fig. 4, *lsp*) are present and thus the tissues forming the body wall of Acanthella VIII almost resemble the juvenile form (pl. III, fig. 5) with the only difference that the layer of longitudinal muscles fibres (pl. III, fig. 4, *lm*) is not yet as compact as in the juvenile form. Inside the muscular layer, a well defined body cavity is present.

Lemnisci.—In acanthella VIII, the leminsci appear as fibrous strands (pl. III, fig. 6, *lmn*) in continuation of a very prominent muscle cell (pl. III, fig. 6, *mc*) between the body wall and the wall of the proboscis sheath. The muscle cell will form the compressors of the lemnisci.

Proboscis sheath.—The tissue forming the proboscis sheath are seen in acanthella VI. In a sagittal section of the worm passing through the proboscis sheath (pl. III, fig. 7) below the innermost end of the proboscis, the wall of the proboscis sheath is being formed, the presence of nuclear masses (pl. III, fig. 7, *nm*) in the region of the wall of the proboscis sheath indicates developmental activity. The muscle cells show cell processes (pl. III, fig. 7, *mcp*) which will form the muscle fibres of the proboscis sheath (pl. III, fig. 6, *mf*) of the final stage of acanthella. The retractor muscles of the proboscis (pl. III, fig. 7, *rm*) are defined but are not yet as compact as the retractor muscles in the final stage acanthella VIII. The insertion of the retractor muscles at the base of the proboscis sheath is indicated by a large nuclear mass (pl. III, fig. 7, *ri*), and also a number of cell processes (pl. III, fig. 7, *cp*) situated in the direction of the retractor muscles.

Reproductive organs.—The reproductive organs commence to develop after the formation of the proboscis sheath, in fact, they are the last to develop after all other organs and tissues have metamorphosed. Certain cells (pl. III, fig. 8, *pc*) which invest a portion of the base of the proboscis sheath begin to proliferate and give rise to genital pouch (pl. III, fig. 8, *gp*), which hangs from the base of the proboscis sheath in the body cavity. The wall (pl. III, fig. 8, *gpw*) of the pouch is cellular in structure and in a sagittal section appears as beaded string. Some of the cells of the wall of the genital pouch divide and give rise to ovaries (pl. III, fig. 8, *ov*). In a transverse section (pl. III, fig. 9) of a later stage which has almost attained the juvenile form, a number of clusters of ovaries (pl. III, fig. 9, *ov*) have appeared. In the wall of the genital pouch (pl. III, fig. 9, *gl*), connective tissue is present but it has lost its cellular appearance. In a later stage the wall of the genital pouch elongates and runs right from the base of the proboscis sheath to the posterior end of the worm, and so forms the genital ligament.

In the male worm the testes and the genital ligament develop in the same manner.

The histological nature of the juvenile form differs in no way from that of an adult acanthocephalan found in the final host, except that the body is more elongate and the reproductive organs are mature. A detailed account of the histology of a juvenile centrorhynchus species found in the intermediate host and an adult of the same species from the final host will be described in a subsequent paper.

Discussion :—

(*a*) *Comparison of developmental stages with those of Archiacanthocephala species.*

(i) As *Centrorhynchus batrachus*, sp. nov. is the only representative of the order Palaeacanthocephala in which details of histological changes during the course of its development have been observed, it will be an interesting study to compare these developmental stages with those of the species of Archiacanthocephala.

Van Cleave, 1947, states, " To the present time most of the species on which detailed information is available belong to the Archiacanthocephala. There is no necessary assurance that in representatives of the Eoacanthocephala and Palœacanthocephala the pattern of development is identical " In the present work on a species of the Palaeacanthecephala, though the details of the development are not exactly identical with Archiacanthocephala, the design of development is almost the same as in the species of Archiacanthocephala. The very early developmental stages are distinctly acanthors, though they do not possess rostella hooks or they have probably lost them before they were collected. The nuclei in these stages are equally distributed and are quiescent. The next stage of development which is termed acanthell, is marked by a general increase in the nuclear matter which aggregates to form group of nuclei and later fuse to form nuclear masses which is the most out standing feature of all acanthella stages in the present work. Finally these compact nuclear masses completely transform into minute nuclei of the functional tissue and the acanthella is completely metamorphosed into a juveneile form. Thus the histological observations of the acanthor, acanthella and the juvenile forms recorded in this paper clearly indicate that acanthor and acanthella are the larval stages and the juvenile form their metamorphosed product ; therefore the terminology for the development stages of Acanthocephala, which Van Cleave proposed (1937 and 1947), based on the life histories of Archiacanthocephala species is also valid for this species of Palaeacanthocephala.

(ii) It is evident from the present study of the development of a form belonging to the order Palaeacanthocephala that the hooks and the proboscis start developing much earlier than the other organs of the body ; they attain their full form and shape by the time they reach acanthella stage IV, as is seen in its sagittal section (pl. IV, fig. 1) and also in a higher magnification of a part of the same section (pl. IV, fig. 2). The hook blades at this stage measure 38μ—40μ. The hooks have formed shoe-shaped roots (pl. IV, fig. 2, *hr*) affixed on the muscular layer (pl. IV, fig. 2, *wmb*) which is not yet differentiated and is represented by wavy bands only. Both from the sagittal and the transverse sections (pl. IV

figs. 1 and 3) of the same stages of acanthella, it is evident that no other organ is differentiated yet, but only the hooks are fully developed. In more advanced stages of acanthella (text-fig. 1, *n-p*) I could determine the functional nature of proboscis by treating these acanthella with acidulated water, to which they react by everting the proboscis with fully developed hooks. This makes it clear that if these acanthella were ingested by a vulnerable host and reacted upon by the acidic gastric juice of its stomach, they could evert a proboscis and attach themselves to the lining of the alimentary tract. Hence the proboscis becomes functional in the late acanthella stages of this form of Palaeacanthocephala. In the Archiacanthocephala species, on the other hand Van Cleave (1937, 1947) states that the proboscis remains non-functional in the acanthella stage. However the presence of a functional proboscis in the acanthella stages of this species of Palaeacanthocephala, does not mean that these acanthella stages are no longer larval stages but juvenile forms, because the rudiments of the structures in these acanthella stages have not yet transformed into structures distinctive of the adult worm. Van Cleave (1947) states, " In the light of detailed studies on life histories such as those conducted by Meyer (1933, 1938) by Kates (1943) and by Moore (1946) it is now obvious that the cytological changes accompanying metamorphosis of the acanthella to the juvenile stage are more significant as evidence of metamorphosis (in species that have been investigated) than the attainment of a functional proboscis as originally maintained "

(b) *Comparison with the developmental stages of other species of the genus Centrorhynchus.*

Centrorhynchus ptyasus, Gupta (1950), is the only other species of the *Centrorhynchus* of which few developmental stages have been described. She recorded certain observations which vary from the observation recorded herein and may be mentioned.

(i) The order of the development of the various structures varies. According to Gupta (1950) the wall develops much more in advance of the hooks and proboscis, whereas in the present work the hooks (pl. III, fig. 1, *h*) attain their full shape and form while the wall is still in its rudimentary phase (pl. III, fig. 1). She further states with reference to her text-figure 2. " The body wall has been differentiated into distinct muscle layers " ; but in her text-figure the muscle layer cannot be made out nor is it labelled. As a matter of fact it is next to impossible to trace the development of body wall from *toto* mounts and since Gupta (1950) based her observations on *toto* mounts, I think that the statements by her cannot be considered as final.

(ii) With reference to her text-fig. 3, she states " The lemnisci are also in inverted position and measure 0·28 mm×0·08 mm, " and she has shown them in her text-figure 3, to be enclosed within the proboscis receptacle. It is a well known fact that lemnisci neither get inverted at the time when the proboscis is retracted nor do they lie within the proboscis receptacle. Besides they are not attached to the anterior end of the proboscis so as to be pushed to the middle of the body or even beyond as

shown in Gupta's (1950) text-fig. 3. They maintain their original position both in the retracted and protracted proboscis as they are attached to the body wall at the anterior end of the body and lie free in the body cavity as is shown in a sagittal section of a cyst with a retracted proboscis(pl. IV, fig. 4, *lmn*).

(iii) Gupta (1950) has coined a new terminology for the various stages of development. She states, " The development of the acanthocephalan described in this paper appears to take place in three distinct stages :— (*a*) pre-infective stage, (*b*) Infective stage, (*c*) Juvenile stage " She is probably unaware of Van Cleave's paper (1947), one can use Van Cleave's terminology with profit.

The developmental stages of a *Centrorhynchus sp.* observed in the present work are in agreement with the developmental stages, which Van Cleave proposed (1937 and 1947) and should also be applicable to the developmental stages of all other species of *Centrorhynchus*. There seems to be no necessity of giving new names to various stages. Van Cleave (1947) lays emphasis on cytological changes taking place during the development to determine a developmental stage, which it is not possible to determine from a study of *toto* mounts. However, judging from the external characters in Gupta's description of the developmental stages, it seems that most of the acanthella stages are missing from between what she calls early pre-infective stage and the late pre-infective stage.

(*c*) *Intermediate hosts*.—In the present study and also from the developmental stages of other *Centrorhynchus* species which I have in my collection, it has been found that amphibians, reptiles and small mammals which are supposed to be secondary intermediate hosts, can also be infected directly without the primary invertebrate host intervening because very early larval stages like acanthors and acanthella, which otherwise should develop in the body of the invertebrate host were found in the mesenteries of these vertebrate intermediate hosts. Gupta, 1950, also records acanthors of a *Centrorhynchus* from the mesentery of a snake *Ptyas mucosus*.

Systematic Position :—

The developmental stages described in this paper belong to a new species which has all the characters of the genus *Centrorhynchus*, Luhe, 1911.

(i) Hooks are present both on the proboscis and its basal part.

(ii) Proboscis sheath is double layered.

(iii) The insertion of the proboscis sheath is in the middle of the proboscis like structure dividing it into the true proboscis and its basal part.

(iv) Typical subcuticular nuclei and a well developed lacunar system are present.

Species diagnosis of the juvenile form.—Male and female forms are of the same size, the entire length measures 3·23 mm and the maximum breadth is 0·63 mm.

Proboscis (pl. IV, fig. 5, *pr*).—Anterior part measures 0·51 mm × 0·3 mm ; the basal part (pl. IV, fig. 5, *n*) measures 0·34 mm. long and 0·40 mm broad.

Hooks.—Hooks are present both on the proboscis and its basal part in 32 longitudinal rows. Each row has 12 hooks with 10 on the proboscis and 2 on its basal part. The hooks present on the proboscis vary in size. The largest are located about the middle of the proboscis. That portion of the hook which comes out of the cuticle of the proboscis mesaures 38 μ, the portion which is embedded in the subcuticle is 11 μ, and the root of the hook which is turned towards the posterior end and lies abut against the muscular layer measures 57 μ in length. In the following hooks, the posteriorly turned roots go on decreasing in size till the eighth hook (pl. IV, fig. 6, *eh*) in a row is reached where the root is reduced to a button shaped structure ; the hook next to it has an anteriorly turned root. On the inner surface of the foot-like root, the chitinous part, makes a socket in which the muscles of the wall of the proboscis are inserted. The hooks on the neck are smaller in size than those on the proboscis. The pointed chitinous portion which comes out of the cuticle measures 11 μ and that which is embedded in the subcuticle measures 19 μ. The base is flattened and is encircled with muscle fibres which tag it ending upwards.

Proboscis sheath.—The proboscis sheath (pl. IV, fig. 5, *ps*) is double layered, measures 0·83 mm × 0·34 mm.

Nervous system.—The brain (pl. IV, fig. 5, *br*) lies in the middle of the proboscis sheath.

Lemnisci.—The lemnisci (pl. IV, fig. 5, *lmn*) are long and fibrous.

Comparison with other species.—This form has been carefully compared with all other known species of *Centrorhynchus*, the only species with which it has a near resemblance is *C. cinctus* (Rudolphi, 1819).

	Centrorhynchus cinctus (Rudolphi 1819)	Present form
Length of the entire body	3·25 mm	3·23 mm
Max. breadth of the body	0· 8 mm	0·63 mm
Size of proboscis	0·65 mm × 0·4 mm	0·51 mm × 0·3 mm
Number of long rows	30—32	32—33
Number of hooks in a long row on anterior part of the proboscis.	9	10
Number of hooks in a long row on basal part of the proboscis.	3	2

The above table indicates that the present form differs from *C. cinctus* (Rudolphi 1819) in the arrangement of hooks on the neck and proboscis and also in other respects. Therefore this is a new species for which the name *Centrorhynchus batrachus* is proposed. More detailed anatomy will be described in a later paper.

Acknowledgement.—This work was carried out at Vidarbha Mahavidyalaya under the guidance of Dr. M. A. Moghe, Principal of this College to whom I am greatly indebted for help at every step of my work. I am also grateful to Prof. K. V. Varadapande, Head of the Biology Department for giving me various facilities to collect the material.

References.

Gupta, P. V., 1950.—On some stages in the Development of the Acanthocephhalan Genus Centrorhynchus. *Ind. Journ. Helminth.* **2**, pp. 41-48.

Katyes, K. C., 1943.—Development of the swine thorn-headed worm. *Macracanthorhynchus hirudinaceus*, in its intermediate host. Am. J. Vet. Res. **4** : 173-182.

Meyer, A., 1931.—Infection Entwicklun. und Waschstum des Risenkratzers (*Macracanthorhynchus hirudinaceus* Pall) in Zwischenwirt. Zool. Anz. **93** : 163-172.

————1933.—In H. G. Bronn's Klassen und Ordnungen des Tierreichs : Acantho-ephola **4** (2 ; 2) : 333-582.

————1936.—Cie plasmodiale und Formbilden des Riesenkratzers (Macracanthorhynchus hirudinaceus Pall.) *Zool. Jahrb., Abt. Anat. u. Ontog Teil I*, **62** : 111-172.

————1937.—*Ibid* Teil II, **63** : pp. 1-36.

————1938.—*Ibid* Teil III, **64** : 131-197 ; Aeil IV, LXIV, pp. 198-242.

Moore, D. V., 1946.—Studies on the life history and development of *Moniliformisdubis* Meyer 1933. *J. Parasital* **32** (3) : 257-271.

————1946a.—Studies on the life history and development of *Macracanthorhynchus ingens Meye*, 1933, with a redescription of the adult worm. *Ibid* **32** (4) : 387-399.

Rudolphi, C. A., 1819.—In Meyer A. 1933.

Schneider, Agt, 1871.—On the development of *Echinorhychus gigas*. *Ann. Mag. Nat. Hist.* (4) **7** : 441-443.

Sita, F., 1949.—The life cycle of *Moniliformis moniliformis* (Bremser, 1811), Acanthocephala. *Cur. Sci.* **18**, p. 216.

Van Cleave, H. J., 1935.—The larval stages of Acanthocephala. *J. Parasital*, **21** (6) : 35-36.

———1937.—Developmental stages in Acanthocephalan Life History. *All Union Lenin Acad. Agric. Sci. Moscow*, pp. 739-742.

————1947.—A critical review of terminology for immature stages in Acanthocephalan life histories. *J. Parasital*, **33** (2) : 118-125.

EXPLANATION OF PLATE III.

FIG. 1.—A part of a sagittal section of acanthella IV showing early rudiments of the body wall *h*, hook ; *ht*, host tissue ; *nm*, nuclear masses ; *sg*, syncytium ; *wmb*, wavy muscle bands.

FIG. 2.— A part of a sagittal section of acanthella V, showing the rudiments of cuticle ; *c*, cuticle ; *psc*, primordium of the subcuticula ; other letterings as in fig. 1.

FIG. 3.— A part of a sagittal section of acanthella stage VI, showing the rudiment of the subcuticula and the lacunar spaces ; *bc*, body cavity ; *f*, fibrillae of the subcuticula ; *lm*, longitudinal muscles ; *lsp*, lacunar space ; *sc*, subcuticula ; *scn*, nuclei of the subcuticula ; other letterings as in figures 1 and 2.

FIG. 4.— A part of a sagittal section through the body wall of the acanthella VIII showing the formation of the muscle layers ; *cm*, circular muscles ; *fac*, fibrillae of the subcuticula ; *rfsc*, radial fibrillae of the subcuticula ; other letterings as in figures 1-3.

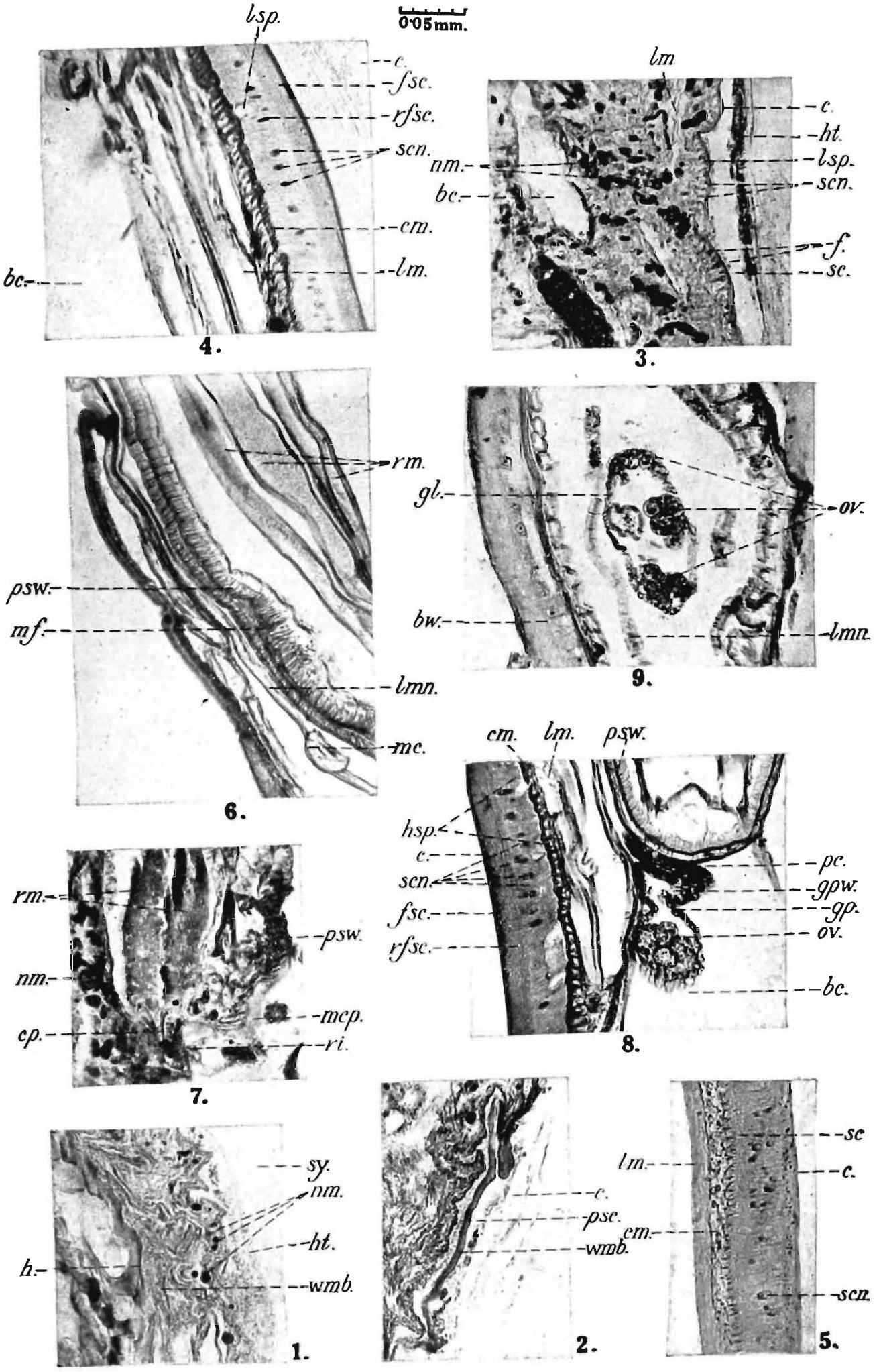
FIG. 5.—A part of a sagittal section through the body wall of juvenile form, showing the structure of the body wall ; letterings as in figures 1-4.

FIG. 6.—A part of a sagittal section of acanthella VIII passing through the region of lemnisci and proboscis ; *lmn*, lemnisci ; *mc*, muscle cell ; *mf*, muscle fibres ; *psw* proboscis sheath wall ; *rm*, retractor muscles.

FIG. 7.—A part of a sagittal section of acanthella VI passing through the region of proboscis sheath, showing rudiments of proboscis sheath ; *cp*, cell processes ; *mcp*, muscle cell processes ; *ri*, insertion of the retractor muscles ; other letterings as in figures 1-6.

FIG. 8.—A part of a sagittal section of acanthella VIII, showing the rudiments o ovaries ; *gpw*, genital pouch wall ; *gp*, genital pouch ; *ov*, ovaries ; *pc*, proliferating cells; other letterings as in figures 1-7.

FIG. 9.— A part of a transverse section of acanthella VIII, *bw*, body wall ; *gl*, genital ligament ; other letterings as in figures 1-8.



LARVAL STAGES OF *CENTRORHYNCHUS*

EXPLANATION OF PLATE IV.

FIG. 1.— A sagittal section of acanthella IV, showing a retracted proboscis and fully developed hooks ; *h*, hooks ; *pr*, proboscis ; other letterings as in figures 1-9 of Pl. I.

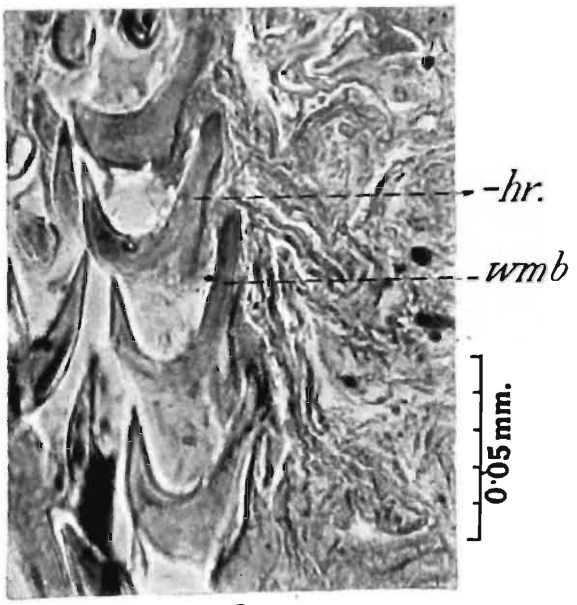
FIG. 2.—Higher magnification of a part of a sagittal section of acanthella IV, through the region of retracted proboscis, showing fully developed hooks and rudimentary muscles ; *hr*, hook roots ; other letterings as in figure 1.

FIG. 3.--A transverse section of acanthella IV through the region of retracted proboscis, showing hooks and rudiments of the body wall ; *rbw*, rudiment of the body wall ; *rrm*, rudiment of retractor muscles ; other letterings as in figures 1-2.

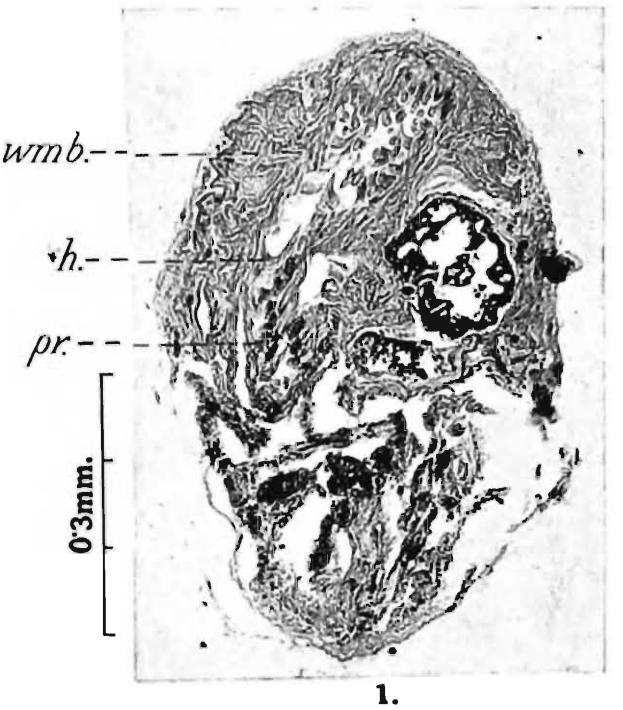
FIG. 4.— A sagittal section of the anterior part of a juvenile form of *Centrorhynchus batrachus* sp. nov., showing retracted proboscis ; *rp*, retracted proboscis ; other letterings as in figures 1-3.

FIG. 5.—A sagittal section of the anterior part of a juvenile form of *Centrorhynchus batrachus* sp. nov., showing protracted proboscis ; *br*, brain ; other letterings as in figures 1-4.

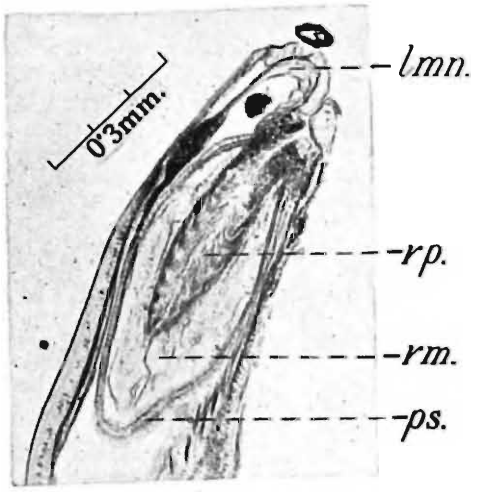
FIG. 6.—A part of sagittal section of proboscis of a juvenile form of *Centrorhynchus batrachus* sp. nov. in higher magnification, showing the structure of hooks and their insertion ; *eh* eighth hook ; other letterings as in figures 1-5.



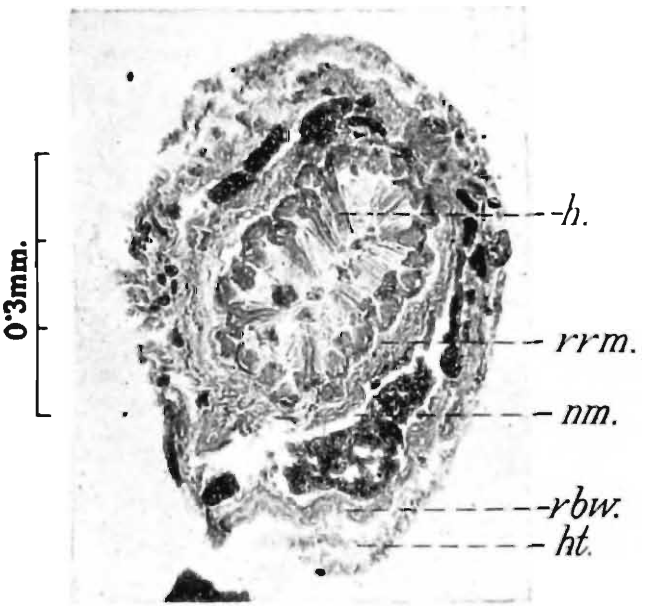
2.



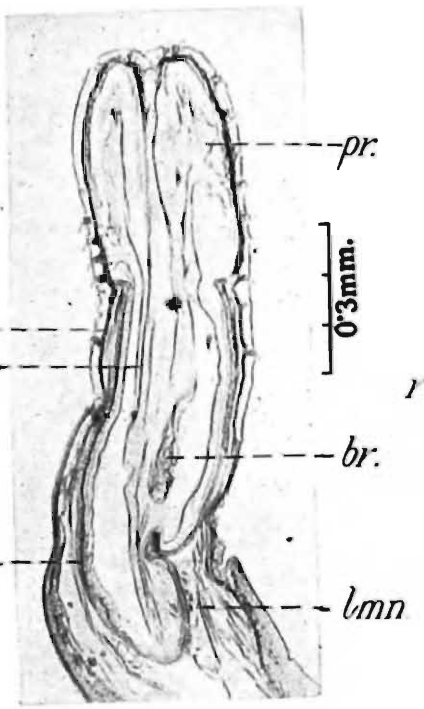
1.



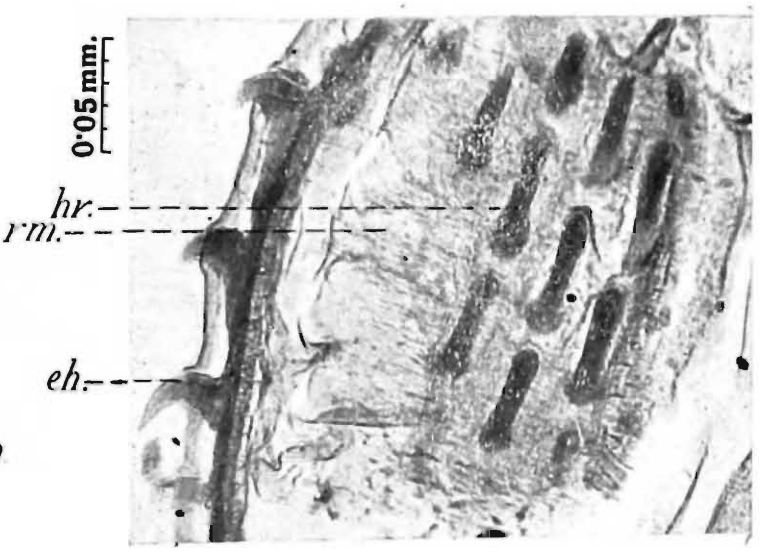
4.



3.



5.



6.

LARVAL STAGES OF *CENTRORHYNCHUS BATRACHUS* SP. NOV.

ON A COLLECTION OF BIRDS FROM THE SIMLIPAL HILLS, MAYURBHANJ DISTRICT, ORISSA.

By AJIT KUMAR MUKHERJEE, *M. Sc., Zoological Survey of India, Indian Museum, Calcutta.*

A short collecting trip made by Dr. B. Biswas and party during February 1951 brought 114 bird specimens from different parts of the Simlipal Hills, Mayurbhanj District, Orissa. The following is the report on the collection with systematic and other notes of interest.

The Mayurbhanj District (Text-fig. 1) lies between 22°34′ and 21°17′ N. and between 85°40′ and 87°10′ E. The Simlipal Hills, where the collection was made, occupy the major central portion of the district. It is a composite group of hills rising from 1,500 feet to 3,824 feet, and occupying about 600 square miles in area. The peaks are densely wooded to the summit, sending countless tributaries to the Baitarani on the south and pouring down the Burabalang river with the feeders of Subarnarekha on the north. The intermediate valleys are cultivated.

The forests mainly composed of *Sal* and a few other fruit bearing trees are distributed over the central group of hill ranges and the plains sloping to the east and west of these hills.

The temperature has been recorded to range between 33°F., minimum in January to a maximum of 112°F., in May and June. The average annual rainfall is about 56·68 inches ; the average main distribution of rain from January to May is 5·64 inches and June to October 48·59 inches.

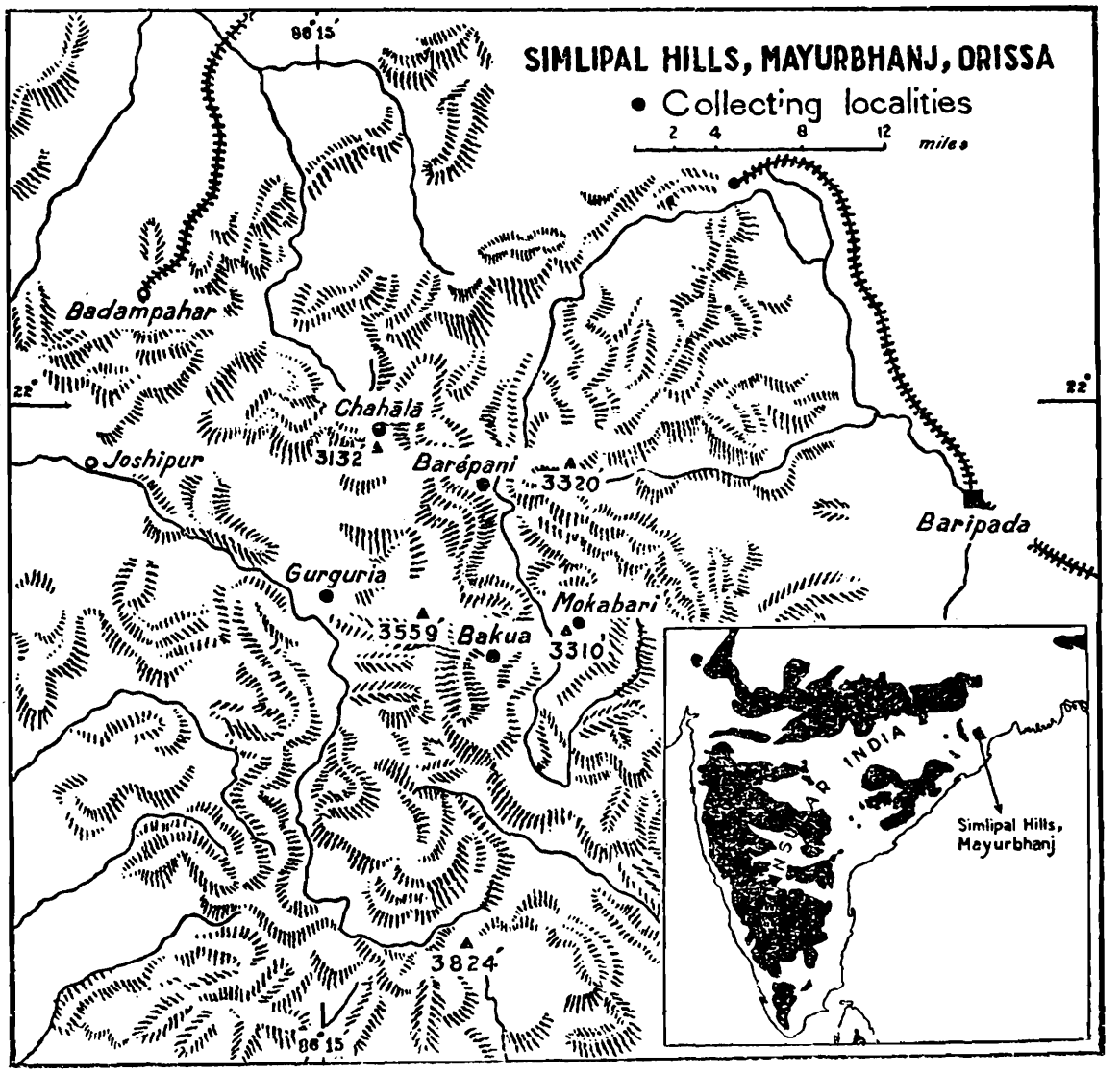
No consolidated account of the avifauna of Mayurbhanj has appeared so far, except for some stray notes. It is a well known fact that many forms of plants and animals occurring in the Himalayas, southern Assam, Burma and Malaya are also found in South India and that the major route of this migration in geological time was the Western Ghats. Abdulali (1949), however, suggested the possibility of an alternate route of migration of many such forms to South India through the Eastern Ghats. The hills of Orissa lie in the extreme north-east of the Indian Peninsula and if Abdulali is correct, should contain examples to support him. The study of the collection of birds from the Simlipal Hills provides an interesting problem of zoogeography by the presence of some species which are only known from the Himalayas and the southern Assamese hills in India and in one or two instances, also from the Nilgiris, and thus Abdulali's hypothesis is borne out. Such species are :—

Cuculus sparverioides.—This species is distributed in the Himalayas from Kashmir to Assam, and from Szechwan and lower Yangtse valley south to the hills of Burma, Siam and Cochin-China. In winter, it is found in the hills of Indian Peninsula, Sumatra, Java, Borneo, the Philippines and Celebes. It is an inhabitant of dense evergreen or semi-evergreen forests.

Nyctyornis athertoni.—This species is distributed in isolated places in the Western Ghats, central Indian hills, and throughout the Himalayas, southern and eastern Assam, Burma, south to Tenasserim and Siam. It is an inhabitant of evergreen and moist deciduous biotope.

Megalaima lineata.—This species is distributed throughout the Himalayas, southern Assam, Burma, Siam, Annam, Cambodia, Cochin-China, south to Malayan Peninsula, Java and Bali. It is an inhabitant of evergreen forests.

Picus flavinucha.—This species has not been collected by us but obtained by Mr. Sálim Ali (see Biswas, 1952) from the Simlipal Hills. It is also known from the Himalayas, southern Assam, Burma, Siam, Indo-China, southern China, Malaya, Sumatra.



Text fig. 1.—Simlipal Hills, Mayurbhanj, Orissa showing the localities where collections were made.

Chloropsis aurifrons.—This species is found throughout the Himalayas, the whole of Burma and Siam. It is an inhabitant of moist deciduous or semi-evergreen hill forests.

Zoothera dauma.—This species is found along the Himalayas to the mountains of Burma, and also in the Nilgiris. It inhabits the hill forests and sholas.

Dicrurus caerulescens.—This species occurs in Ceylon, Western Ghats, central Indian hills and the Himalayas. It is a bird of semi-evergreen or evergreen hill forests.

The tops of the hills of the Simlipal ranges fulfil the ecological conditions required to shelter and to give a permanent footing to the species mentioned above. The heavy rainfall in this area supports an evergreen moist forest almost similar to the foot hills of the eastern Himalayas. These hill tops serve as isolated ecological pockets in which these species, which may be relicts or remnants of secondary invasions, have been preserved when these spots became isolated from the southern Assam hills and the eastern Himalayas due to topographic changes.

The route through which these species migrated is a debatable question, and the writings of Abdulali (1949), Hora (1949), Ripley (1949) and Menon (1951) may be profitably consulted.

The wing (W.) and the tail (Tl.) were measured in the usual way, and the bill (B.) was measured from the skull to the tip unless otherwise stated. The average measurements are given in parentheses.

The sexes in most cases were determined by the examination of gonads by dissecting out the birds in the field ; sexes determined otherwise, *e.g.*, from plumages, are given in parentheses.

The numbers against the specimens refer to the registration numbers in the Zoological Survey of India collection.

Some of the specimens were preserved in spirit for morphological studies. They have been indicated by an asterisk (*) before their registered numbers.

The report on the collection contains 47 species and subspecies. The identification of two Phylloscopi remains pending.

Itinerary.—

Chahālā (*ca.* 3150′).	February 7 to February 14.
Barépani (*ca.* 3320′).	February 11.
Gurguria (*ca.* 2200′).	February 16 to February 23.
Bakua (*ca.* 2800′).	February 18.
Mokabari (*ca.* 3310′).	February 21.

I am grateful to Dr. S. L. Hora, Director, and Dr. B. Biswas, Assistant Superintendent, Zoological Survey of India, for giving me an opportunity to join the party, which has enabled me to study the birds in the field, and for allowing me to work on the collection. I am further indebted to Dr. Biswas for his interest, help and suggestions.

SYSTEMATIC ACCOUNT.

Order CUCULIFORMES

Suborder *CUCULI*

Family CUCULIDAE

Subfamily *CUCULINAE*

Cuculus sparverioïdes sparverioïdes Vigors

(The large hawk-cuckoo)

Specimen collected,—No. 27284 (Juvenal, unsexed), February 23, Gurguria.

Field notes.—Rare, only a single pair was seen in semi-dense wood, flying leisurely. It is a shy bird. Gonads in immature condition.

Remarks.—This is a young specimen in the second stage assuming the grey head, the upper parts are brown faintly barred with rufous. It has been recorded from Raipur in Madhya Pradesh. Coupled with this record the present finding from Mayurbhanj would suggest that the species may possibly be occurring in the hills of Madhya Pradesh, Chotanagpur, Orissa, etc., in suitable places.

Order COLUMBIFORMES

Suborder *COLUMBAE*

Family Columbidae

Subfamily *Columbinae*

Streptopelia chinensis suratensis (Gmelin)

(The Indian spotted dove)

Specimens collected.—Nos. 27279, ♂, 27280, ♂, 27281, ♂ and 27282, ♂, February 16 ; 27283, ♂, February 17, Gurguria.

Measurements.—5 ♂ : W. 135—147 (141·8), Tl. 131—141 (136·8), B. 19—20 (19·6).

Field notes.—Common in open country near about cultivated fields. Testes enlarged.

Order PSITTACIFORMES

Suborder *PSITTACI*

Family Psittacidae

Subfamily *Psittacinae*

Psittaeula eupatria nipalensis (Hodgson)

(The large Indian parakeet)

Specimens collected.—Nos. 27285, ♀, 27286, ♂, February 8 ; 28287, ♂, February 12, Chahālā.

Measurements.—2 ♂ : W. 221—225, Tl. 293—297, B[1]. 36—37. 1 ♀ : W 220, Tl. 254, B[1]. 32.

Field notes.—Fairly common. Gonads in breeding condition.

[1] Measured from the anterior edge of the nostril to the tip.

Order CAPRIMULGIFORMES

Suborder *CAPRIMULGI*

Family CAPRIMULGIDAE

Subfamily *CAPRIMULGINAE*

Caprimulgus macrurus albonotatus Tickell

(Jerdon's long-tailed night jar)

Specimen collected.—No. 27292, ♀, February 10, Chahālā.

Measurements.—1♀: W. 190, Tl. 131.

Field notes.—Common at dusk, flying about silently in two's or three's.

Remarks.—The specimen collected is smaller in size than the average northern Indian specimens. The tips of the tail-feathers are yellowish buff.

Order CORACIIFORMES

Suborder *CORACII*

Family CORACIIDAE

Subfamily *CORACIINAE*

Coracias benghalensis benghalensis (Linné)

(The Indian roller)

Specimens collected.—Nos. 27289, ♀, February 18; 27288, ♂, February 21, Gurguria.

Measurements.—1 ♂: W. 187, Tl. 120, B. 45. 1 ♀: W. 187, Tl. 121, B. 46.

Field notes.—Commonly observed in the open parts of the forests around villages. Ovary near breeding condition, largest ova of the size of chicken pea. Testes enlarged to the size of pea.

Suborder *MEROPES*

Family MEROPIDAE

Merops orientalis orientalis Latham

(The common Indian bee-eater)

Specimen collected.—No. 27290, ♀, February 20, Gurguria.

Measurements.—1♀: W. 95, Tl. 123, B. 33.

Field notes.—Not very common. Ovary in non-breeding cond tion.

Nyctyornis athertoni athertoni Jardine and Selby

(The blue-bearded bee-eater)

Specimen collected.—No. 27291, ♀, February 13, Chahālā.

Measurements.—1♀: W. 135, Tl. 125, B. 50.

Field notes.—Not common. Ovary granular.

Remarks.—This bird is distributed in certain isolated ecological pockets in Travancore and Belgaum in the Western Ghats, Vizagapatam in the Eastern Ghats and certain places in Madhya Pradesh. Ali (in Marian, 1950, p. 164) collected it from Keonjhar and the Simlipal Hills.

Suborder *UPUPAE*

Family Upupidae

Subfamily *Upupinae*

Upupa epops epops (Linné)

(The European hoopoe)

Specimen collected.—No. 27293, ♀, February 20, Gurguria.

Measurements.—1♀: W. 147, Tl. 100, B. 56.

Field notes.—Not common. Ovary granular.

Remarks.—It is said to winter as far east as Bihar and Chotanagpur and upto Deccan in the south (Baker, 1927, p. 309). So far as I believe it has not been reported from Mayurbhanj yet.

Order PICIFORMES

Suborder *GALBULAE*

Family Capitonidae

Megalaima lineata kutru Mukherjee

(The Simlipal lineated barbet)

Specimens collected.—Nos. 27294, ♀, February 8; 27295, ♀, 27296, ♀, 27297, ♂, 27298, ♂, February 13, Chahālā.

Measurements.—2♂: W. 122·5—125, Tl. 77—78, B. 32—33. 3 ♀: W 126—132 (128), Tl. 77—79 (78), B. 31·5—33·5 (32·3).

Field notes.—Common in the deeper parts of the forest where there are *Ficus* trees with ripening fruits. Gonads enlarged.

Megalaima zeylanica caniceps (Franklin)

(The northern Indian green barbet)

Specimen collected.—No. 27299, ♂, February 13, Chahālā.

Measurements.—1 ♂: W. 119, Tl. 77, B. 33.

Field notes.—Found in the company of the lineated barbets feeding on the same tree.

Megalaima haemacephala indica (Latham)

(The Indian crimson-breasted barbet)

Specimen collected.—No. 27300, ♂, February 14, Chahālā.

Measurements.—1 ♂ : W. 80, Tl. 34, B. 18.

Field notes.—The specimen was feeding on *Ficus* tree with ripening fruits. They had just started coming to the jungles of Chahālā. Testes enlarged.

Suborder *PICI*

Family PICIDAE

Subfamily *PICINAE*

Dinopium bengalense bengalense (Linné)

(The northern Indian golden-backed woodpecker)

Specimen collected.—No. 27301, ♂, February 10, Chahālā.

Measurements.—1 ♂ : W. 160, Tl. 87, B. 50.

Field notes.—Common.

Picus chlorolophus chlorigaster Vieillot

(The southern Indian small yellow-naped woodpecker)

Specimens collected.—Nos. 27302, ♂, February 8, Chahālā ; 27303 (♀), February 18, Bakua.

Measurements.—1 ♂ : W. 130, Tl. 80. 1 ♀ : W. 130, Tl. 79, B. 23.

Field notes.—Only a few were noticed in the denser parts of the forest at about 3,000 feet.

Order PASSERIFORMES

Suborder *OSCINES*

Family PYCNONOTIDAE

Pycnonotus dispar flaviventris (Tickell)

(The black-crested yellow bulbul)

Specimens collected.—Nos. 27314, ♀, February 7, Chahālā ; 27315, ♀, February 11, Barépani.

Measurements.—2 ♀ : W. 87, Tl. 84, B. 16.

Field notes.—Common in shady places near hill streams.

Pycnonotus jocosus emaria (Linné)

(The red-whiskered bulbul)

Specimen collected.—No. 27313, ♂, February 13, Chahālā.

Measurements.—1 ♂ : W. 83, Tl. 79, B. 18.

Field notes.—Not common, found in open parts near the borders of the jungles.

Family IRENIDAE

Subfamily *IRENINAE*

Chloropsis aurifrons aurifrons (Temminck)

(The gold-fronted chloropsis)

Specimen collected.—No. 27312,♀, February 13, Chahālā.

Measurements.—1 ♀ : W. 90, Tl. 66, B[1]. 14.

Field notes.—Not common. Ovary granular and in enlarged condition.

Remarks.—As far as I am aware, it has not so far been reported from Orissa. This northern Indian bird has been recorded from Chotanagpur and Rajmahal hills (Baker, 1922, p. 347).

Subfamily *AEGITHININAE*

Aegithina tiphia humei Stuart Baker

(The central Indian iora)

Specimen collected.—No. 27310, ♀, February 19, Gurguria.

Measurements.—1 ♀ : W. 63, Tl. 48, B. 18.

Field notes.—Not uncommon in small flocks.

Family CAMPEPHAGIDAE

Pericrocotus peregrinus peregrinus (Linné)

(The small minivet)

Specimens collected.—Nos. 27327, ♀, 27328, ♀, 27329, ♀, 27330, ♀, 27331, ♂, *27389 (unsexed), *27390 (unsexed), *27391, (unsexed), February 10, Chahālā ; 27332, ♂, February 20, Gurguria.

Measurements.—2 ♂ : W. 70—72, Tl. 74, B. 14. 4 ♀ : W. 68—71 (69·7), Tl. 71—74 (72·3), B. 13—14 (13·6). 3 (unsexed) : W. 70—76 (72), Tl. 75—80 (77·6), B. 14.

Field notes.—Common in parties at about 3,000 feet. Gonads in non-breeding condition.

Pericrocotus flammeus speciosus (Latham)

(The Indian scarlet minivet)

Specimens collected.—Nos. 27325, ♂, February 8, 27326, ♀, February 14, Chahālā.

Measurements.—1 ♂ : W. 102, Tl. 100, B. 21. 1 ♀ : W. 103, Tl. 101, B. 22.

[1] Measured from the anterior edge of the nostril to the tip

Field notes.—Not common, singly or in pairs on the tops of the trees in dense jungle at about 3,000 feet. Gonads in non-breeding condition.

Remarks.—So far this Himalayan minivet has not been recorded anywhere from Orissa. The female specimen has the first two primaries unspotted. The red on the central tail feathers in the male is a very narrow line along the edge of the outer web, and does not extend more than one-third of the total length of the tail.

Family MUSCICAPIDAE

Subfamily *MUSCICAPINAE*

Rhipidura aureola aureola Lesson

(White-browed fantail flycatcher)

Specimens collected.—Nos. 27316 (unsexed), February 8, Chahālā; 27317 (unsexed), February 23, Gurguria.

Measurements.—2 (unsexed): W. 82—85, Tl. 89, B. 15—16.

Field notes.—Common in small flocks in open parts of the forest.

Rhipidura albicollis albicollis (Vieillot)

(The white-throated fantail flycatcher)

Specimens collected.—Nos. 27318, ♀, February 11, Barépani; 27319, ♀, February 13, Chahālā; 27320, ♀, February 18, Bakua; 27321 (unsexed), February 21, Mokabari.

Measurements.—3 ♀: W. 70—73 (72), Tl. 90—100 (95), B. 14—15 (14·8). 1 (unsexed): W. 72, Tl. 96, B. 15.

Field notes.—Common in open parts near the borders of the jungles. Ovary in non-breeding condition.

Hypothymis azurea styani (Hartlaub)

(The black-naped flycatcher)

Specimen collected.—No. 27324, ♀, February 22, Gurguria.

Measurements.—1♀: W. 70, Tl. 69, B. 17.

Field notes.—Not common, found in thick woods. Generally found singly. Ovary in non-breeding condition.

Culicicapa ceylonensis pallidior Ticehurst

(The grey-naped flycatcher)

Specimens collected.—Nos. 27322, ♂, and 27323 (unsexed), February 21, Mokabari.

Measurements.—1♂: W 64, Tl. 56. 1 (unsexed): W. 59, Tl. 52, B. 12.

Field notes.—Not common in dense forest.

Subfamily *Timaliinae*

Tribe Turdoidini

Turdoides somervillei terricolor (Blyth)

(The jungle babbler)

Specimen collected.—No. 27311, ♀, February 19, Gurguria.

Measurements.—1♀ : W. 107, Tl. 110, B. 24.

Field notes.—Common in parties in the open parts of jungle. Ovary granular.

Subfamily *Sylviinae*

Phylloscopus trochiloides viridanus Blyth

(The greenish willow-warbler)

Specimens collected.—Nos. 27369, ♂, February 7, and 27372 (unsexed), February 8, Chahālā.

Measurements.—1♂ : W 63, Tl. 49, B. 12. 1 (unsexed) : W. 59, B. 12.

Field notes.—Not very common, testes in non-breeding condition.

Phylloscopus inornatus humei (Brooks)

(The green willow-warbler)

Specimens collected.—Nos. 27371, ♀, February 7, Chahālā ; 27370, ♂, February 20, Gurguria.

Measurements.—1♂ : W 57, Tl. 43, B. 12·5. 1 ♀ : W. 57, Tl. 43, B. 12·5.

Field notes.—Common in thick woods. Testes in non-breeding condition.

Prinia rufescens rufescens (Blyth)

(Beavan's wren-warbler)

Specimens collected.—Nos. 27374, ♂, February 13, Chahālā ; 27375 (unsexed), February 18, Bakua.

Measurements.—1♂ : W. 45, Tl. 60, B. 14. 1 (unsexed) : W. 48, B. 14.

Field notes.—Very common in bush in small batches. Poor fliers.

Prinia hodgsoni hodgsoni Blyth

(Hodgson's wren-warbler)

Specimens collected.—Nos. 27373 and 27395 (unsexed), February 10, Chahālā ; 27396, ♀, February 18, Bakua.

Measurements.—1♀ : W. 45, Tl. 50, B. 13·5. 2 (unsexed) : W. 44—45, Tl. 50, B. 13—13·5.

Field notes.—Common in bushes.

Subfamily *TURDINAE*

Zoothera dauma dauma Latham

(The small-billed mountain thrush)

Specimen collected.—No. 27358, ♀, February 19, Gurguria.

Measurements.— 1 ♀: W. 136, Tl. 98, B. 29.

Field notes.—This was the only specimen seen. It came out of dense undergrowth of the forest and passed across the jungle path to enter a dense bush on the bank of the river, where it was shot. Ovary enlarged.

Remarks.—The occurrence of this thrush in the Orissa Hills is rather surprising. This specimen could not be separated from the Nepalese examples.

Saxicola leucura (Blyth)

(The white-tailed bush-chat)

Specimen collected.—No. 27376, ♀, February 17, Gurguria.

Measurements.—1 ♀: W. 66, Tl. 49, B. 12.

Field notes.—Very common in flocks in bushes.

Copsychus saularis saularis (Linné)

(The Indian magpie robin)

Specimen collected.—No. 27359, ♂, February 17, Gurguria.

Measurements.—1 ♂: W. 114, Tl. 90, B. 12.

Field notes.—Not common, only a few specimens were seen around villages. Testes in non-breeding condition.

Family MOTACILLIDAE

Motacilla cinerea caspica Gmelin

(The eastern grey wagtail)

Specimens collected.—Nos. 27304, ♀, February 18, Bakua; 27305, ♂, 27306 (unsexed), February 21, *27392 (unsexed), February 23, Gurguria.

Measurements.—1 ♂: W. 82, Tl. 84, B. 17. 1 ♀: W. 79, Tl. 87, B. 18. 2 (unsexed): W. 80—81, Tl. 85, B. 17—17·5.

Field notes.—Common on boulders of river beds. Gonads in non-breeding condition.

Anthus hodgsoni hodgsoni Richmond

(The Indian tree pipit)

Specimens collected.—Nos. 27307, ♀, February 14, Chahālā; 27309, (unsexed), February 19, 27308, ♂, February 20, Gurguria.

Measurements.—1 ♂ : W. 86, Tl. 59, B. 15·5. 1 ♀ : W. 81, Tl. 58, B. 15·5. 1 (unsexed) : W. 83, Tl. 59, B. 15.

Field notes.—Common in small parties searching for food among the undergrowths and fallen leaves. Non-breeding condition of gonads.

Family Laniidae

Subfamily *Laniinae*

Lanius schach Linné (subspecies ?)

(The rufous-backed shrike)

Specimens collected.—Nos. 27356, ♀ (juvenal), February 7, 27357, ♀ (juvenal), February 8, Chahālā.

Field notes.—Not very common, found in the dried-up reed jungles.

Family Sittidae

Subfamily *Sittinae*

Sitta frontalis frontalis Swainson

(The velvet-fronted nuthatch)

Specimens collected.—Nos. 27353, ♀, and 27354, ♀, February 7 ; 27355, ♀, 27403, ♀, February 8, Chahālā.

Measurements.—4 ♀ : W. 69—76 (73·2), Tl. 40—44 (41·3), B. 15—16 (15·2).

Field notes.—Very common in flocks in dense jungle. Ovary developed.

Family Paridae

Subfamily *Parinae*

Parus major stupae Koelz

(The southern grey tit)

Specimen collected.—No. 27344, ♀, February 22, Gurguria.

Measurements.—1 ♀ : W. 63, Tl. 50·5, B. 10.

Filed notes.—Not very common. Ovary just commenced swelling. Observed in open country, singly or in pairs.

Parus xanthogenys aplonotus (Blyth)

(The southern yellow cheeked tit)

Specimens collected.—Nos. 27345, ♀, February 7, 27351 (unsexed), 27352 (unsexed), February 8, 27346, ♂, 27348, ♂, February 10, Chahālā ; 27349, ♀, February 18, Bakua ; 27350, ♀, February 19, 27347, ♀, February 20, Gurguria.

Measurements.—2 ♂ : W. 71, Tl. 59, B. 12·5. 4 ♀ : W. 68—70 (68·5), Tl. 54—59 (55·7), B. 12. 2 (unsexed) ; W. 69—73 ; Tl. 51—57 ; B. 12·5.

Field notes.—Very common. Non-breeding gonads.

Family DICAEIDAE

Dicaeum agile agile (Tickell)

(The thick-billed flowerpecker)

Specimen collected.—No. 27360, ♂, February 22, Gurguria.

Measurements.—1 ♂ : W. 62, Tl. 28, B. 13.

Field notes.—Not common. Testes in breeding condition.

Dicaeum erythrorhynchos erythrorhynchos Latham

(Tickell's flowerpecker)

Specimens collected.—Nos. 27361, ♂, 27362, ♂, February 17 ; 27363, ♀, 27379, ♂, February 18 ; 27398 (unsexed), February 22, Gurguria.

Measurements.—3 ♂ : W. 48—49 (48·3), Tl. 24—25 (24·5), B. 12. 1 ♀ : W. 50, Tl. 25, B. 12. 1 (unsexed) : W. 47·5, Tl. 24, B. 12.

Field notes.—Common. Gonads in breeding condition.

Family STURNIDAE

Subfamily *STURNINAE*

Gracula religiosa peninsularis Whistler and Kinnear

(The central Indian grackle)

Specimens collected.—Nos. 27364, ♂, February 8, 27365, ♂, 27366, ♀, February 10, Chahālā.

Measurements.—2 ♂ : W. 159—163, Tl. 74, B. 18—19. 1 ♀ : W. 154, Tl. 74 , B. 19.

Field notes.—Common in pairs, at about 3,000 feet in dense jungle.

Family ORIOLIDAE

Oriolus xanthornus xanthornus Linné

(The Indian black-headed oriole)

Specimens collected.—Nos. 27367, ♂, February 10, Chahālā ; 27368, ♂, February 21, Mokabari.

Measurements.—2 ♂ : W. 134—144 ; Tl. 87—90 ; B. 28—29.

Field notes.—Not uncommon in the denser parts of the jungle. Testes in non-breeding condition.

Family Dicruridae

Dicrurus caerulescens caerulescens Linné

(The white-bellied drongo)

Specimens collected.—Nos. 27333, ♂, February 8, Chahālā, and 27334, ♀, February 17, Gurguria.

Measurements.—1 ♂: W 124, C. T. F.[1] 87, O. T. F.[1] 124, B.[2] 1 ♀: W 122; C. T. F. 91, O. T. F. 120, B. 25.

Field notes.—Commonly seen in the borders of the jungle. Gonads in enlarged condition.

Remarks.—This is an interesting record of its occurrence in the hills of Orissa. Whistler and Kinnear (1933, p. 349) in revising the species gave the northern limit of this subspecies as Nallamalai Hills in the Eastern Ghats. The present record, however, extends this range further northward.

Dicrurus leucophaeus longicaudatus Jerdon

(The grey drongo)

Specimens collected.—Nos. 27340, ♀, 27341, ♀, February 7, 27342, ♂, February 13, Chahālā, 27343, ♂, February 20, Gurguria.

Measurements.—2 ♂: W. 143—147, C. T. F. 101—107, O. T. F. 158—164, B. 18. 2 ♀: W. 135—139, C. T. F. 94—97, O. T. F. 148, B. 18.

Field notes.—Common in cleared spaces in the jungle between 2,000 and 3,000 feet. Gonads approaching breeding condition.

Remarks.—Whistler and Kinnear (1933, p. 349) gave Jeypore in the Eastern Ghats as the northern limit of this subspecies, but the present record extends its limit further northward.

Dicrurus aeneus aeneus Vieillot

(The bronze drongo)

Specimens collected.—Nos. 27336, ♀, 27337, ♂, February 8; 27338 (unsexed), February 10; 27339, ♂, February 12, Chahālā.

Measurements.—2 ♂: W. 112—118, C. T. F. 84—85, O. T. F. 110, B. 15. 1 ♀: W. 121, C. T. F. 85, O. T. F. 112. 1 (unsexed): W. 122, C. T. F. 87, O. T. F. 112, B. 15.

Field notes.—Common in the borders of the jungles in open parts.

Dicrurus macrocercus macrocercus Vieillot

(The black drongo)

Specimen collected.—27335, ♂, February 17, Gurguria.

Measurements.—1 ♂: W 145, C. T. F. 96, O. T. F. 157, B. 27.

Field notes.—Not common. Testes had commenced swelling.

---

[1] C. T. F. and O. T. F. as given for the species of *Dicrurus*, represent central and outer tail feathers respectively.

[2] In this family measured from the anterior edge of the nostril to the

Family CORVIDAE

Corvus macrorynchus culminatus Sykes

(The Indian jungle crow)

Specimens collected.—27379, ♀, February 12, 27378, ♂, February 13, Chahālā ; 27380, ♀, February 19, Gurguria.

Measurements.—1 ♂ : W 306, Tl. 171, B.[1] 43. 2 ♀ : W. 292—296, Tl. 167—171, B. 43.

Field notes.—Very common in cleared places in jungle. Ovary granular.

Crypsirina vagabunda vagabunda (Latham)

(The Indian tree pie)

Specimen collected.—No. 27377, ♀, February 8, Chahālā.

Measurements.—1 ♀ : W 142, Tl. 197, B.1 21.

Field notes.—Not common, found in open parts of the jungle.

REFERENCES.

ABDULALI, H., 1949.—Some peculiarities of avifaunal distribution in Peninsular India. *Proc. Natl. Inst. Sci. India* XV, pp. 387—393.

BAKER, E. C. S., 1922.—Fauna of British India, Birds (2nd edition) London, I, p. 347.

———1927.—*Ibid.*, IV, p. 309.

BISWAS, B., 1952.—Geographical variations in the woodpecker *Picus flavinucha* Gould. *Ibis*, XCIV, pp. 210—219.

HORA, S. L., 1949.—Satpura hypothesis of the distribution of the Malayan fauna and flora to Peninsular India. *Proc. Natl. Inst. Sci. India* XV, pp. 309—314.

———1949.—Zoogeographical observations on the fauna of Paresnath Hill. *Proc. Natl. Inst. Sci. India* XV, pp. 421—422.

MARIAN, D., 1950.—Notes on some Asiatic Meropidae (Birds). *J. Bombay Nat. Hist. Soc.* XLIX, pp. 151—164.

MENON, A. G. K., 1951.—Further studies regarding Hora's Satpura hypothesis. *Proc. Natl. Inst. Sci. India* XVII, pp. 475—497

WHISTLER, H. AND KINNEAR, N. B., 1933.—The Vernay scientific survey of the Eastern Ghats (Ornithological section), pt. 4, *J Bombay Nat. Hist. Soc.* XXXVI, pp. 348—349.

[1] In this family measured from the anterior edge of the nostril to the tip.

CLASSIFICATION, ZOOGEOGRAPHY AND EVOLUTION OF THE FISHES OF THE CYPRINOID FAMILIES HOMALOPTERIDAE AND GASTROMYZONIDAE.*

By E. G. SILAS, *M.A.*, *M.Sc.*

(From the laboratories of the Zoological Survey of India.)

CONTENTS.

*Part of thesis submitted for the Research Degree of M.Sc., of the Madras University.

CONTENTS—*contd*

I.—INTRODUCTION.

The Homalopteridae and Gastromyzonidae, which are found in the swift currents of the torrential streams in South Eastern Asia, constitute two remarkable families of Cyprinoid fishes. Habitudinal segregation has induced a great variety of adaptive modifications in them. In 1932, Hora gave an account of the " Classification, Bionomics and Evolution of the Homalopterid Fishes " and subdivided the family Homalopteridae (Hora, 1932) into two groups characterised by a number of well defined morphological features. From a study of the material available to him in the various museums of Europe and the Indian Museum at Calcutta, he was led to conclude that the family is polyphyletic in origin, the Homalopterinae having been evolved from the Cyprinidae and the Gastromyzoninae from the Cobitidae. The two subfamilies thus constituted were distinguished from each other by the number of unbranched rays in the paired fins, the nature of the subtemporal fossae and that of the basipterygium. It was also pointed out that the superficial resemblance between the Homalopterinae and Gastromyzoninae was due to similarity of life habits. He had limited material for a morphological study of the aforesaid characters in the seventeen genera to which about 48 species of the family were assigned.

Since then, considerable advance has resulted in our knowledge of these fishes, which has made a critical review of the group desirable once again. Moreover, such a revision is found essential for bringing together the scattered literature and discussing the geographical distribution and evolution of these fishes in the light of recent researches.

In the present work an attempt is also made to clarify the relationships of the various genera and subgenera, which in some cases, has involved a revision of the generic limits of certain genera. For the first time all the known genera and species are treated at length, and synoptic keys to their identification, with short descriptions of genera wherever necessary and notes on species are given. The intra-relationships, zoogeography and evolution of both the families are dealt with in detail. Recent researches tend to show that the Gastromyzonid fishes have evolved independently in South China and in Borneo. Further evidence in favour of this hypothesis is elaborated here.

One genus and one species are described as new and in addition, the correct systematic position of a number of previously known species has been determined. References later than 1932 are given under each genus and species. The bibliography appended at the end contains all recent literature and for the earlier works, Hora (1932. p. 228-230) may be consulted.

My greatest debt of acknowledgment is due to Dr. S. L. Hora, Director, Zoological Survey of India, for suggesting me this problem and for affording me all facilities to work in the Laboratories of the Zoological Survey of India. I am also greatly indebted to him for constant help and guidance in carrying out this work. My heartfelt thanks are also due to Dr. L. S. Ramaswami of Central College, Bangalore, for making available to me his recent works on the cranial osteology of the Homalopteridae and Gastromyzonidae and to Mr. A. G. K. Menon for helping me in various ways.

II.—RECENT ADVANCES IN OUR KNOWLEDGE OF THE HOMALOPTERID AND GASTROMYZONID FISHES.

The considerable amount of work done during the past two decades has helped to give us a more or less clear picture of the systematics of these fishes. In dividing the Homalopteridae into two subfamilies, Hora (1932) pointed out that "The Homalopteridae are probably a polyphyletic family and it is likely that its members are derived from the Cyprinidae and Cobitidae and have come to resemble one another superficially under similar conditions of environment." Recently, he reviewed the systematic position of the family in the light of the opinions expressed in regard to the above view and after an examination of large collections in several American Museums (Hora, 1950) concluded that the assemblage of fishes usually grouped under the family Homalopteridae should be classified into two distinct families, Homalopteridae and Gastromyzonidae, on the same considerations as were advanced for constituting the previous division of the family into two subfamilies. The marked polyphyletism exhibited by the Gastromyzonidae has led to its division into two subfamilies *viz.*, Crossostominae and Gastromyzoninae. In the present revision it has been found that, for a satisfactory classification of these fishes, a still further division of the Gastromyzoninae is necessary, as those genera confined to the mainland of Asia (Southern China, Formosa and Indo-China) can be easily distinguished from those found on the island of Borneo. The two divisions proposed are Pseudogastromyzoni for the genera on the mainland of Asia and Gastromyzoni for those found on Borneo.

Since 1932, a large number of species and genera have been described under the composite family Homalopteridae. From 17 genera and 48 species referred to in Hora's monograph of 1932, their number has increased to 28 genera and about 84 species (Homalopteridae 53 species pertaining to twelve genera and Gastromyzonidae 31 species referrable to sixteen genera).

Three new genera have been described under the Homalopteridae since 1932. The genus *Travancoria* was described by Hora (1941,

from the Hill ranges of Northern Travancore. Chang (1944) described *Metahomaloptera* from Loshan and Omei in China. *Balitoropsis* was described by Smith (1945) from Peninsular Siam. The genus *Bhavania* was merged by Hora with *Homaloptera* in 1932, but he revived it in 1941. In addition to the new genus *Pseudohomaloptera* described here, Herre's subgenus *Neohomaloptera* (Herre, 1945), is raised here to the rank of a genus. A number of new species have been described from time to time under the previously known genera.

Among the Gastromyzonidae, five new genera and a number of species have been added to the previously known list. The new genera are *Liniparhomaloptera* Fang (1935), *Praeformosania* Fang (1935), and *Paraprotomyzon* Pell. & Fang (1935) from China. *Glaniopsis* Boulenger was shown to belong to the Gastromyzonidae by Hora and Jayaram (1951) and they have also described a new genus *Progastromyzon* from Borneo.

Hora and Law (1944) gave an account of the respiratory adaptations of the South Indian Homalopterid fishes. Chang (1946) made a comparative study of the girdles and adjacent structures in the Chinese Homalopterid fishes with special reference to adaptations to torrential streams. I have not seen this paper and I am, therefore, not in a position to say what conclusions Chang has arrived at regarding the phylogeny of these fishes. Law (1950) studied the scale structure in a number of Homalopterid and Gastromyzonid genera and expressed opinions regarding their relationships and phylogeny. He has opined that the genus *Homaloptera* is probably a heterogenous assemblage of forms and that " different forms of *Homaloptera* seem to have given rise to various types of Homalopterine genera."

The recent work of Ramaswami (1948, 1951) on the chondrocranial and cranial osteology of some of the Homalopterid and Gastromyzonid fishes has helped in confirming previous taxonomic findings as well as certain phylogenetic considerations. In 1948 he made a detailed study of two Homalopterids, *Bhavania* Hora and *Balitora* Gray, and a Gastromyzonid, *Gastromyzon* Günther and listed as many as 13 characters distinguishing these two groups of fishes. In one of the two recent contributions (seen in MS), he has made further observations on the skull of two more genera of the Homalopteridae *viz.*, *Homaloptera* van Hass., and *Lepturichthys* Regan and compared them with *Bhavania* Hora and *Balitora* Gray. From a comparative study of the skulls of these four genera he has confirmed that the Homalopteridae have had their origin from the Cyprinod stock, but, later diverged under different environmental conditions. He has also enumerated seven characters on which the Homalopteridae could be said to resemble the Cyprinidae and four important characters on which they differ from them.

III.—LIST OF HOMALOPTERID AND GASTROMYZONID FISHES AND THEIR DISTRIBUTION.

The following table, comprises the known genera and species of the families Homalopteridae and Gastromyzonidae. The species have been arranged under the respective genera in alphabitical sequence. A 'X'

indicates the region from whence the species has been recorded. A somewhat artificial geographical division of their range of distribution has been adopted for convenience. The ten distribution regions here recognised are :—(1) Peninsular India (Western Ghats), (2) North East India, (3) Burma, (4) Siam, (5) Malaya Peninsula, (6) Sumatra, (7) Java, (8) Borneo, (9) Indo-China and (10) China and Formosa.

List of Species	1	2	3	4	5	6	7	8	9	10
Family HOMALOPTERIDAE—										
I. Genus Bhavania Hora—										
*1. *Bhavania australis* (Jerdon).	×	—	—	—	—	—	—	—	—	—
II. Genus Homaloptera van Hasselt—										
*2. *Homaloptera amphisquamata* Weber & Beaufort.	—	—	—	—	—	×	—	—	—	—
*3. *Homaloptera bilineata* Blyth.	—	—	×	—	—	—	—	—	—	—
*4. *Homaloptera gymnogaster* Bleeker	—	—	—	—	—	×	—	—	—	—
*5. *Homaloptera heterolepis* Weber & Beaufort.	—	—	—	—	—	×	—	—	—	—
*6. *Homaloptera indochinensis*, sp. nov.	—	—	—	—	—	—	—	—	×	—
*7. *Homaloptera leonardi* Hora.	—	—	—	—	×	—	—	—	—	—
8. *Homaloptera lineata* Smith.	—	—	—	×	—	—	—	—	—	—
*9. *Homaloptera modesta* (Vincig.).	—	—	×	×	—	—	—	—	—	—
*10. *Homaloptera modiglianii* Perugia.	—	—	—	—	—	×	—	—	—	—
*11. *Homaloptera montana* Herre.	×	—	—	—	—	—	—	—	—	—
*12. *Homaloptera ocellata* Van der Hoeven.	—	—	—	—	—	×	×	—	—	—
13. *Homaloptera ophiolepis* Bleeker.	—	—	—	—	—	×	×	×	—	—
*14. *Homaloptera orthogoniata* Vaillant.	—	—	—	—	×	—	—	×	—	—
15. *Homaloptera ripleyi* (Fowler).	—	—	—	—	—	×	—	—	—	—
*16. *Homaloptera rupicola* (Prashad & Mukerji).	—	—	×	—	—	—	—	—	—	—
17. *Homaloptera salusur* Bleeker.	—	—	—	—	—	×	×	—	—	—
18. *Homaloptera sexmaculata* Fowler.	—	—	—	×	—	—	—	—	—	—
*19. *Homaloptera smithi* Hora.	—	—	—	×	—	—	—	—	—	—
20. *Homaloptera stephensoni* Hora.	—	—	—	—	—	—	—	×	—	—
21. *Homaloptera tweedei* Herre.	—	—	—	—	×	—	—	—	—	—
22. *Homaloptera ulmeri* Fowler.	—	—	—	—	—	×	—	—	—	—
23. *Homaloptera vanderbilti* Fowler.	—	—	—	—	—	×	—	—	—	—

* An asterisk preceding the name of a species indicates that specimens have been actually examined by the author.

List of Species	1	2	3	4	5	6	7	8	9	10
II. Genus Homaloptera van Hasselt—*contd.*										
24. *Homaloptera wassinki* Bleeker.	—	—	—	—	×	×	×	×	—	—
*25. *Homaloptera weberi* Hora.	—	—	—	—	—	—	—	×	—	—
*26. *Homaloptera zollingeri* Bleeker.	—	—	—	×	×	×	×	—	—	—
III. Genus Neohomaloptera Herre—										
*27. *Neohomaloptera johorensis* Herre.	—	—	—	—	×	—	—	—	—	—
IV. Genus Travancoria Hora—										
*28. *Travancoria jonesi* Hora.	×	—	—	—	—	—	—	—	—	—
V. Genus Pseudohomaloptera, gen. nov.—										
29. *Pseudohomaloptera tate-regani* (Popta).	—	—	—	—	—	—	—	×	—	—
VI. Genus *Balitora* Gray—										
*30. *Balitora brucei brucei* Gray.	—	×	—	—	—	—	—	—	—	—
*31. *Balitora brucei burmanicus* Hora.	—	—	×	—	—	—	—	—	—	—
32. *Balitora brucei melanosoma* Hora.	—	—	×	—	—	—	—	—	—	—
*33. *Balitora brucei mysorensis* Hora.	×	—	—	—	—	—	—	—	—	—
*34. *Balitora maculata* Gray.	—	×	—	—	—	—	—	—	—	—
VII. Genus Balitoropsis Smith—										
35. *Balitoropsis bartschi* Smith	—	—	—	×	—	—	—	—	—	—
VIII. Genus Sinohomaloptera Fang—										
36. *Sinohomaloptera hoffmanni* Herre.	—	—	—	—	—	—	—	—	—	×
*37. *Sinohomaloptera kwangsiensis* Fang.	—	—	—	—	—	—	—	—	—	×
IX. Genus Hemimyzon Regan—										
*38. *Hemimyzon abbreviata* (Günther).	—	—	—	—	—	—	—	—	—	×
*39. *Hemimyzon acuticauda* (Fang).	—	—	—	—	—	—	—	—	—	×
*40. *Hemimyzon formosanum* (Boulenger).	—	—	—	—	—	—	—	—	—	×
41. *Hemimyzon sinensis* (Sauvage & Dabry).	—	—	—	—	—	—	—	—	—	×
42. *Hemimyzon yaotanensis* (Fang).	—	—	—	—	—	—	—	—	—	×
X. Genus Lepturichthys Regan—										
*43. *Lepturichthys fimbriata* (Günther).	—	—	—	—	—	—	—	—	—	×
44. *Lepturichthys güntheri* Hora.	—	—	—	—	—	—	—	—	—	×
*45. *Lepturichthys nicholsi* Hora.	—	—	—	—	—	—	—	—	—	×

* An asterisk preceding the name of a species indicates that specimens have been actually examined by the author.

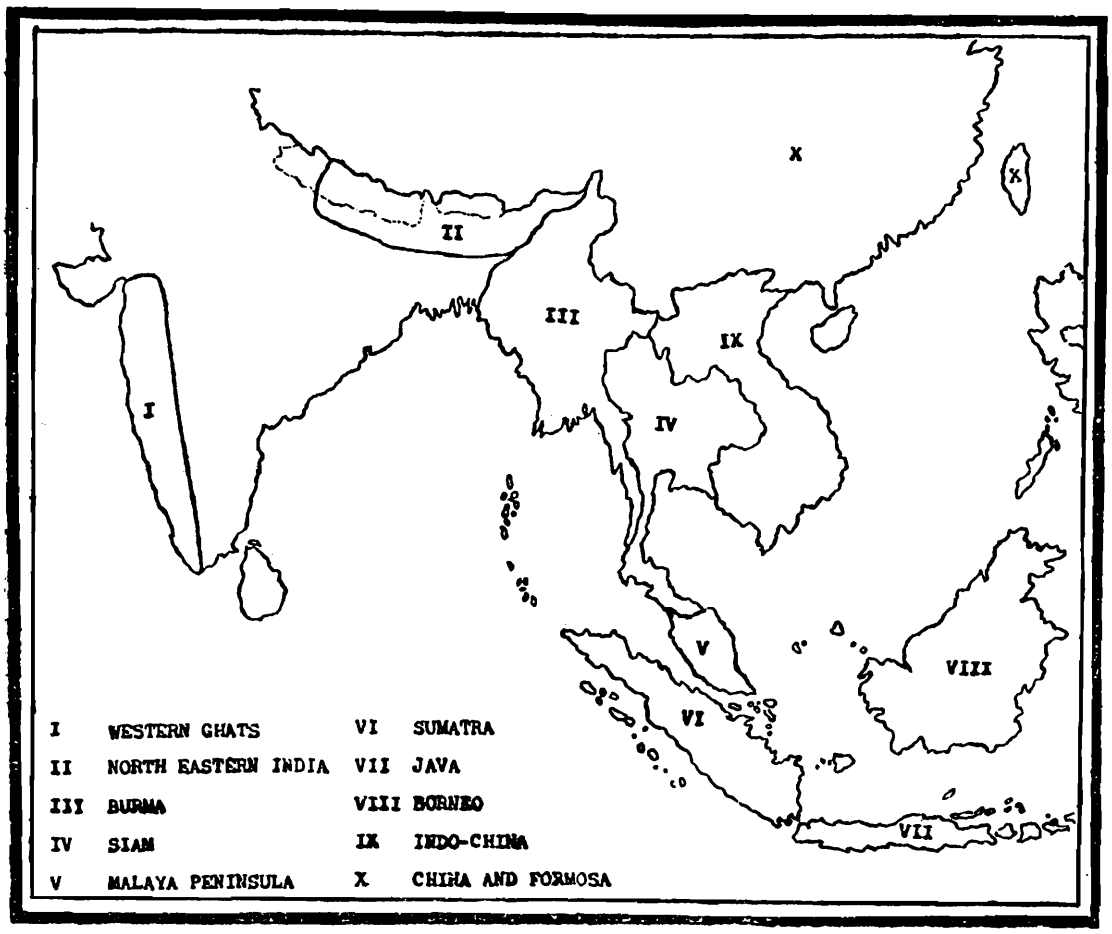
List of Species	1	2	3	4	5	6	7	8	9	10
XI. Genus SINOGASTROMYZON Fang—										
46. *Sinogastromyzon hsiashiensis* Fang.	—	—	—	—	—	—	—	—	—	×
47. *Sinogastromyzon intermedius* Fang.	—	—	—	—	—	—	—	—	—	×
*48. *Sinogastromyzon sanhoensis* Fang.	—	—	—	—	—	—	—	—	—	×
49. *Sinogastromyzon sichangensis* Chang.	—	—	—	—	—	—	—	—	—	×
*50. *Sinogastromyzon szechuanensis* Fang.	—	—	—	—	—	—	—	—	—	×
51. *Sinogastromyzon tonkinensis* Pell. & Fang.	—	—	—	—	—	—	—	—	×	—
52. *Sinogastromyzon wui* Fang.	—	—	—	—	—	—	—	—	—	×
XII. Genus METAHOMALOPTERA Chang—										
53. *Metahomaloptera omeiensis* Chang.	—	—	—	—	—	—	—	—	—	×
Family GASTROMYZONIDAE—										
Subfamily Crossostominae—										
I. Genus GLANIOPSIS Boulenger—										
*1. *Glaniopsis haniischi* Boulenger.	—	—	—	—	—	—	—	×	—	—
II. Genus ANNAMIA Hora—										
2. *Annamia normani* (Hora).	—	—	—	—	—	—	—	—	×	—
III. Genus LINIPARHOMALOPTERA Fang—										
*3. *Liniparhomaloptera disparis* (Lin).	—	—	—	—	—	—	—	—	—	×
IV. Genus PARHOMALOPTERA Vaillant—										
*4. *Parhomaloptera microstoma* (Boulenger).	—	—	—	—	—	—	—	×	—	—
V. Genus VANMANENIA Hora—										
*5. *Vanmanenia caldwelli* (Nichols).	—	—	—	—	—	—	—	—	—	×
*6. *Vanmanenia stenosoma* (Boulenger).	—	—	—	—	—	—	—	—	—	×
VI. Genus PRAEFORMOSANIA Fang—										
7. *Praeformosania intermedia* Fang.	—	—	—	—	—	—	—	—	—	×
8. *Praeformosania lineata* Fang.	—	—	—	—	—	—	—	—	—	×
9. *Praeformosania pinchowensis* Fang.	—	—	—	—	—	—	—	—	—	×
VII. Genus FORMOSANIA Oshima—										
*10. *Formosania lacustre* (Steindachner).	—	—	—	—	—	—	—	—	—	×
VIII. Genus CROSSOSTOMA Sauvage—										
*11. *Crossostoma davidi* Sauvage.	—	—	—	—	—	—	—	—	—	×
*12. *Crossostoma fascicauda* Nichols.	—	—	—	—	—	—	—	—	—	×

* An asterisk preceding the name of a species indicates that specimens have been actually examined by the author.

List of Species	1	2	3	4	5	6	7	8	9	10
Subfamily Gastromyzoninae—										
Division I. Pseudogastromyzoni—										
IX. Genus Paraprotomyzon Pell. & Fang—										
*13. *Paraprotomyzon multifasciatus* Pell. & Fang.	—	—	—	—	—	—	—	—	—	×
X. Genus Pseudogastromyzon Nichols–										
14. *Pseudogastromyzon cheni* Liang.	—	—	—	—	—	—	—	—	—	×
15. *Pseudogastromyzon fangi* (Nichols).	—	—	—	—	—	—	—	—	—	×
16. *Pseudogastromyzon fasciatus* (Sauvage).	—	—	—	—	—	—	—	—	—	×
17. *Pseudogastromyzon fasciatus changtingensis* Liang.	—	—	—	—	—	—	—	—	—	×
18. *Pseudogastromyzon myersi* Herre.	—	—	—	—	—	—	—	—	—	×
19. *Pseudogastromyzon tungpiensis* Chen & Liang.	—	—	—	—	—	—	—	—	—	×
XI. Genus Sewellia Hora—										
*20. *Sewellia lineolata* Valenciennes.	—	—	—	—	—	—	—	—	×	—
XII. Genus Beaufortia Hora—										
21. *Beaufortia kweichowensis* (Fang).	—	—	—	—	—	—	—	—	—	×
*22. *Beaufortia leveretti* (Nichols & Pope).	—	—	—	—	—	—	—	—	—	×
23. *Beaufortia liui* Chaing.	—	—	—	—	—	—	—	—	—	×
*24. *Beaufortia pingi* (Fang).	—	—	—	—	—	—	—	—	—	×
*25. *Beaufortia szechuanensis* (Fang).	—	—	—	—	—	—	—	—	—	×
26. *Beaufortia zebroidus* (Fang).	—	—	—	—	—	—	—	—	—	×
Division II. Gastromyzoni—										
XIII. Genus Protomyzon Hora—										
*27. *Protomyzon borneensis* Hora & Jayaram.	—	—	—	—	—	—	—	×	—	—
*28. *Protomyzon whiteheadi* (Vaillant).	—	—	—	—	—	—	—	×	—	—
XIV. Genus Progastromyzon Hora & Jayaram.										
*29. *Progastromyzon griswoldi* Hora & Jayaram.	—	—	—	—	—	—	—	×	—	—
XV. Genus Neogastromyzon Popta—										
30. *Neogastromyzon nieuwenhuisi* Popta.	—	—	—	—	—	—	—	×	—	—
XVI. Genus Gastromyzon Günther—										
*31. *Gastromyzon borneensis* Günther.	—	—	—	—	—	—	—	×	—	—

* An asterisk preceding the name of a species indicates that specimens have been actually examined by the author.

The above ten divisions are indicated in the following Map.



Text figure 1.—Map showing the areas of Distribution of the Homalopteridae and Gastromyzonidae.

IV.—KEY TO THE FAMILIES HOMALOPTERIDAE AND GASTROMYZONIDAE.

I. Two or more undivided anterior rays in the paired fins. Subtemporal fossae deep. Basipterygium with a lateral foramen and devoid of lateral horns; a ligament connecting distal end of modified rib and lateral foramen of basipteygium .. .. .. *Homalopteridae.*

I. Only one undivided anterior ray in the paired fins. Subtemporal fossae shallow. Basipterygium without a lateral foramen but with a lateral horn; a ligament connecting the medial process of modified rib with the lateral horn of the basipterygium .. *Gastromyzonidae.*

V.—FAMILY HOMALOPTERIDAE.

Fishes of the family Homalopteridae are small loach-like hill-stream fishes in which the body is moderately or greatly depressed and the ventral surface is flattened. The paired fins are horizontally placed and the number of unbranched rays in the paired fins are at least two. The outer rays of the paired fins are provided with adhesive pads on their ventral surface to help in adhering to rocks in the swift waters of the torrential streams. The eyes are small, dorso-lateral, with free orbital margins and are not visible from the ventral surface of the fish. The mouth is subterminal or inferior. The dorsal and anal fins are short. The body is covered with small cycloid scales which are absent on the head and on a part or whole of the

ventral surface. The lateral line is well marked and always extends to the base of the caudal fin. The gill openings are either greatly restricted, in which case they are situated above the bases of the pectorals or they are of moderate size extending to the ventral surface of the body for a short distance. Gill-membranes are united with the isthmus and the pseudobranchiae are absent.

Internal characters.—The subtemporal fossae are deep. The basipterygium is provided with a lateral foramen and there is no lateral horn. There is a ligament connecting the distal end of the modified rib and the region of the lateral foramen of the basipterygium.

In the upper jaw the opercular is elongated in a linear axis of the animal. The preopercular is reduced in size and the posterior process of the quadrate is large. In the lower jaw the sensory canal is on the mesial side of the angular. The tripus is Y-shaped, with one of its anterior limbs short and is connected with the interosseus ligament. The other limb articulates with the centrum of the fused third vertebra and the short posterior portion of the tripus is in contact with the air bladder. The divided air bladder is enclosed in a capsule which is formed by the dorsal ribs of the second and fourth vertebrae.

Distribution.—Peninsular India, North East India, Burma, Siam, Malaya Peninsula, Sumatra, Java, Borneo, Indo-China, China and Formosa.

Key to the identification of the genera of the family Homalopteridae.

I. Two anterior rays of pelvic fin simple—

A. Gill-openings small and situated entirely above base of pectorals .. .. *Bhavania.*

B. Gill-openings of moderate size, extending to the ventral surface for a short distance—

1. Rostral groove in front of mouth absent or very poorly developed. Rostral fold absent or very slightly developed—

a. One barbel at each corner of the mouth, in addition to two pairs of rostral barbels. Pelvics with two simple and 6 to 8 branched rays. Pectorals with 14 to 20 rays, 3 to 8 outer rays being unbranched .. .. .. *Homaloptera.*

b. Two barbels at each corner of the mouth, in addition to two pairs of rostral barbels. Pelvics with 2 simple and 5 branched rays. Pectorals with 10 to 12 rays, 3 to 4 outer rays being unbranched .. .. .. *Neohomaloptera.*

2. Deep rostral groove in front of mouth present, overhung by rostral fold—

a. Rostral barbels 7 or more, arranged in two series. *Travancoria.*

b. Rostral barbels 4, arranged in one row—

i. Lips simple, continuous at angles of mouth; lower lip followed by medially situated papillae. P. 8/12; V. 2/8 .. *Pseudohomaloptera.*

ii. Lips specially the upper strongly papillated. Lower lip not followed by medially situated papillae.

x. One barbel at each corner of the mouth—

y. Body and head greatly depressed; pelvic fin not reaching anal opening which is much nearer anal fin than the base of the pelvics. Pectorals beginning under eye, the rays 19 to 21 with 8 to 10 outer rays unbranched .. *Balitora.*

y'. Body cylindrical; head greatly depressed; pelvic fin extending beyond anal opening which is much nearer to base of pelvic than to anal fin. Pectorals beginning posterior to eye, the rays 14 with 4 outer rays unbranched .. .. .. *Balitoropsis.*

x'. Two barbels at each corner of the mouth. (Pectorals with 20 rays, 7 to 8 outer rays being unbranched) .. .. .. *Sinohomaloptera.*

II. Three or more anterior rays of pelvic fin simple—

A. Pelvics free from each other, not uniting to form a disc like structure—

1. Two barbels at each corner of the mouth; tail stout and deep; least height of caudal peduncle greater than diameter of eye. Lips papillated .. *Hemimyzon.*

2. Three barbels at each corner of the mouth; tail long, slender; least height of caudal peduncle less than diameter of eye. Lips fimbriated .. .. *Lepturichthys.*

B. Pelvics united posteriorly to form a disc-like structure—

1. Gill-openings of moderate size, extending to ventral surface for short distance .. .. *Sinogastromyzon.*

2. Gill-openings small and situated entirely above base of pectorals .. *Metahomaloptera.*

Bhavania Hora.

1920. *Bhavania*, Hora. *Rec. Ind. Mus.*, **19**, p. 202.
1932. *Homaloptera*, Hora (in part), *Mem. Ind. Mus.*, **12**, p. 274.
1937. *Bhavania*, Hora, *Rec. Ind. Mus.*, **39**, p. 11.
1941. *Bhavania*, Hora, *Rec. Ind. Mus.*, **43**, p. 224.
1948. *Bhavania*, Ramaswami, *Proc. Zool. Soc. London*, **118**, p. 513. (Skull characters).

For the diagnostic characters of *Bhavania*, reference may be made to the key on page 182. Hora (1941) has redefined the genus and since then no new species has been described under it.

Genotype.—Bhavania australis (Jerdon).

Distribution.—Peninsular India (Hill ranges of Mysore, Nilgiris and Travancore).

General remarks.—Until recently, great confusion existed regarding the taxonomy of the genus *Bhavania* Hora. First described as *Platycara* by Jerdon (1848), the genus was for some time treated as *Homaloptera* by later ichthyologists. In view of the fact that *Platycara* was preoccupied (McClelland, 1839), and that the forms assigned to *Homaloptera* (*Platycara* of Jerdon) by some workers were quite different from the true *Homaloptera*, Hora (1920) proposed the name *Bhavania* to include two species, *viz.*, *B. australis* (Jerdon) and *B. annandalei* Hora. In 1932 he considered *Bhavania* as a synonym of *Homaloptera*, but in 1937 after examining further material from Peninsular India, the generic status of *Bhavania* was correctly determined. Later, in 1941 he placed *B. annandalei* in the synonymy of *B. australis*. At present the genus *Bhavania* is monotypic, being represented by the type and only species *B. australis* (Jerdon).

Bhavania, like the Chinese genus, *Metahomaloptera* Chang, possesses greatly reduced gill openings. Such a condition is parallelled in several genera of the Gastromyzonidae, such as, *Protomyzon* Hora, *Paraprotomyzon* Pell. & Fang, *Pseudogastromyzon* Nichols, *Sewellia* Hora, *Beaufortia* Hora, *Neogastromyzon* Popta and *Gastromyzon* Günther.

Bhavania australis (Jerdon).

1941. *Bhavania australis* Hora, *Rec. Ind. Mus.*, **43**, p. 225, pl. viii, fig. 1-3.
1941. *Bhavania australis*, Hora and Law, *Ibid*, **43**, p. 248.
1948. *Bhavania australis* Ramaswami, *Proc. Zool. Soc. London*, **118**, p. 515.
1950. *Bhavania australis*, Law, *Rec. Ind. Mus.*, **48**, p. 76, pl. iii, fig. 4.
1951. *Bhavania australis*, Silas, *J. Bombay Nat. Hist. Soc.*, **50**, (2), p. 330.

D. 2/7-9 ; A. 1 ; A. 1/5 ; A. 1/5-6 ; 6 ; P. 6-8/9-11 ; V. 2/7-8 ; C. 17-18 ; L. 1. 70-75.

Head contained 4·3 to 5·4 in standard length and 5·1 to 6·5 in total length. Depth of body 6·45 to 9·3 in standard and 8 to 11 in total length. Head about as long as broad. Diameter of eye contained 3·88 to 5·59 in head ; 1·94 to 3·19 in snout and 1·38 to 2 in inter-orbital space. Least height of caudal peduncle contained 1·5 to 2·2 in its length.

Locality.—Peninsular India (Hill ranges of Msyore, Nilgiris and Travancore).

Specimens examined :—

Reg. No.	*Locality.*	*Donor or collector.*	*No. of Specimens.*
F.9854/1	Stream on Nellimudu Estate, about 1,800 feet, Malabar Dt. Madras.	R. B. S. Sewell . .	1 specimen.
F.9855/1	Cheerambadi, Nilgiris .	Ditto . .	1 specimen.
F.9856/1	Stream at Nadgani, Nilgiris.	Ditto . .	1 specimen.
F.9862/1	Stream on Calicut-Vayitri road at 29 miles. About 500 feet. Malabar Dt.	Ditto . .	3 specimens.

Specimens examined—

Reg. No.	*Locality.*	*Donor or collector.*	*No. of Specimens.*
F.9863/1	Branch of Kabani and adjacent rice fields below Rassellas Estate, Manantoddy, about 2,500 feet, Malabar Dt.	R.B.S. Sewell .	1 specimen.
F.9864/1	Cheerambadi, Nilgiris .	Ditto. .	1 specimen.
F.13600/1	Kallar stream; foot of Ponmudi Hills, Western Ghats, S. Travancore.	S. Jones	1 specimen.
F.649/2	Ditto.	Ditto.	1 specimen.
F.650/2	Ditto.	Nat. Hist. Mus. Stanford.	4 specimens.
F.651/2	Ditto.	A. W. C. T. Herre	3 specimens.

Homaloptera van Hasselt *emend* Van der Hœven.

1932. *Homaloptera*, Hora, *Mem. Ind. Mus.*, **12**, p. 274.
1933. *Homaloptera*, Smith, *J. Nat. Hist. Soc. Siam. Supple.*, **9**, p. 78.
1934. *Homaloptera*, Herre, *Lingnan Sci. Journ. Canton*, **13**, pp. 285-296.
1934. *Homaloptera*, Fowler, *Proc. Acad. Nat. Sci. Philad.*, **86**, p. 98.
1937. *Homaloptera*, Fowler, *Ibid*, **89**, p. 152.
1940. *Homalopterula*, Fowler, *Ibid*, **91**, p. 379.
1941. *Homaloptera*, Hora, *Bull. Raffles Mus., Singapore.* No. 17, p. 61.

As a number of new species have been added under the genus *Homaloptera* since Hora's work on these fishes in 1932, a short redescription of the genus is given below :

Snout either broad and rounded (*Bhavania*-like), or long and pointed (*Helgia*-like). Mouth inferior, slightly arched and of moderate size. Lips continuous at angles of mouth. Three pairs of barbels, of which 4 are rostral and one situated at each angle of mouth. Gill openings oblique, extending to ventral surface for some distance. Body covered with small or moderately large scales, which are absent on head and part of ventral surface of fish. Pectorals may or may not overlap pelvics. Pectorals possess 14 to 20 rays of which 3 to 8 outer rays are simple. Pelvics with 8 to 10 rays of which 2 outer rays are simple. Caudal peduncle usually long and narrow. Caudal fin either emarginate or deeply forked, with the lower lobe longer than the upper. Dorsal commences in advance of pelvics, or opposite or slightly behind it.

Genotype.—Homaloptera ocellata Van der Hoeven.

Distribution.—Peninsular India (Annamalai Hills) ; Burma (Myitkyina District, Upper Burma ; Meetan and Tenasserim, Lower Burma) ; Siam (Mekong at Chiengsen Kao, N. Thiland ; Ronphibun ; Khao Sabap at Banang ; Pran river at Pak Tawan ; Chiengmai ; Tadi stream and Klong Pong at Ban Kiriwing, Nakhon Sritamarat ; Bau Yai, Chantabun ; Metang ; Upper Bangpakong river ; Tachin) ; Indo-China ; Malaya Peninsula (Kula Tahan, Pahang, Mawai District, Johore) ; Sumatra (Lahat ; Si Rambe, Lake Manindjan, Lau Borus, Laut Kawar ;

Atchin, Lake Tawar ; Matur, Pdaangscha Bovenlauden) ; Java (Bautam, Tjampea, Buitenzorg, Kediri, Batavia, Bandung, Parongkalong) ; Borneo (River Kapuas ; River Mahakam ; Sarawak).

General remarks.—Of all the twelve genera of the family Homalopteridae, *Homaloptera* van Hasselt, which is widely distributed and variable, forms more or less the generalised genus. In 1932, Hora assigned a heterogenous assemblage of 19 species to it and indicated the occurrence of another form at Perak in the Federated Malaya States. The same year he also recorded three species of *Homaloptera* from Siam *viz.*, *H. zollingeri* Bleeker, *H. smithi* Hora and *H. modesta* Vinciguerra.

Smith (1933) noted that *H. modesta*, originally described from Lower Burma was taken from three widely separated localities in Siam. *H. smithi* was first described from specimens collected from Peninsular Siam, but Fowler (1933) recorded it from Chieng Mai and Metang in Northern Siam, Bau Yai, north east of Bangkok and Chantaboon in South East Siam. Fowler also described two new species, *H. sexmaculata* and *H. septummaculata*, closely related to *H. smithi* from Chieng Mai, Northern Siam. Following Smith and Hora, *H. septummaculata* is treated here as a synonym of *H. sexmaculata*. In 1937, Fowler added another species of *Homaloptera*, *H. maxinae* to the fauna of Siam. This species was regarded by Smith, and Hora to be a synonym of *H. zollinegri* Bleeker.

In 1932, Tchang described *Homaloptera caldwelli chekianensis*, from Chekiang and next year figured and redescribed it. Fang (1935) has, however, shown it to be a synonym of *Vanamnenia stenostoma* (Boulenger).

Herre (1934) described a new species of *Homaloptera*, *H. hingi*, from Pok Fu Lam, Hong Kong, which Hora (1935) assigned to the genus *Nemachilus* of the Cobitidae.

In the results of the George Vanderbilt Sumatran expedition, Fowler (1940) reported the discovery of a new genus of Homalopterid fish and two new species of *Homaloptera*. The genus *Homalopterula* proposed by him to include the species *H. ripleyi* is provisionally assigned here as a synonym to the genus *Homaloptera*. The two new additions to *Homaloptera* are *H. vanderbilti* and *H. ulmeri*.

H. tweedei was described by Herre (1940) from Malaya Peninsula and Hora (1941) added another new species *H. leonardi* to the fauna of Malaya Peninsula. The year 1945 saw the addition of two other new species to the genus *Homaloptera*. Smith (1945) described *H. linearta* from Siam and Herre (1945) reported the discovery of another species *H. montana*, from the Annamalai Hills in Peninsular India.

Validity of the divisions proposed under the genus Homaloptera.—The great diversity of form and structure seen among the members of the genus *Homaloptera*, has resulted in attempts in the past to split it into several genera. Names such as, *Helgia*, *Homalopteroides*, *Chopraia*, *Homalopterula*, etc., have been proposed, and the validity of these generic names is discussed below.

Vinciguerra (1890) proposed the name *Helgia* for two species of *Homaloptera* from Burma, which he characterised as "Possessing long and pointed snout" An examination of the abundant material of

Homaloptera present in the collections of the Zoological Survey of India, Indian Museum, and a study of the characters of those species not represented here have revealed that among *Homaloptera*, there are all stages between *Helgia*-like forms with long pointed snout and *Bhavania* like forms with broad rounded snouts. It has been pointed out by Law (1951) that the scale of *H. modesta* differs from that of other species and may have generic significance. But the pointed snout, the character on which Vinciguerra based his genus, is not well defined when the genus *Homaloptera* is taken as a whole and as such, it has been thought best to supress the name *Helgia*.

Fowler (1905) created the genus *Homalopteroides* with *Homaloptera wassinki* Bleeker as its type. He characterised his genus as " Dorsal inserted well behind the ventrals ", and thus distinguished it from *Homaloptera* (*sensu stricto*), where the " Dorsal begins in advance of the ventrals " This system of nomenclature has resulted in some confusion which is clarified here. Weber and Beaufort (1916) followed Fowler's classification and divided the genus *Homaloptera* into two subgenera *viz.*, *Homalopteroides* Fowler and *Homaloptera* (*sensu stricto*). They also considered *H. wassinki* as the type of *Homalopteroides*, but at the same time included *H. ocellata* of Cuvier and Valenciennes in the *Homalopteroides*. This would make Fowler's *Homalopteroides* a synonym of *Homaloptera* (*sensu stricto*), since *H. ocellata* is the type of the latter. But, Hora (1932), after examining Cuvier and Valenciennes specimens of *H. ocellata* in the Paris Museum, found that they were really *H. wassinki*. He also pointed out that specimens assigned to *H. erythrorhina* and *H. pavonina* by Weber and Beaufort under *Homaloptera* (*sensu stricto*) were referrable to *H. ocellata* Van der Hoeven, the type of the genus. After examining all diagnostic characters of *Homaloptera*, the position of the dorsal fin in relation to the pelvics, seems to be the most suited character for a division of the genus into two subgenera. As such, in the present revision Fowler's divisions *viz.*, *Homalopteroides* and *Homaloptera* (*sensu stricto*) are recognised.

In 1929, Prashad and Mukerji described the genus *Chopraia*, for a species from Northern Burma. *Chopraia* according to them differed from *Homaloptera* in possessing a broad head which is not greatly depressed, large eyes situated dorso-laterally in the middle of the head and the narrow branchial opening extending as far as the anterior margin of the pectoral fin on the ventral surface. *Chopraia* as defined by them is different from species of *Homaloptera* in Burma, but when the genus is taken as a whole, the above characters loose their diagnostic importance. They are so overlapping in the different species, that, as in the case of *Helgia*, no clear-cut division of the species can be made on the above mentioned characters. *Chopraia* is, therefore, treated as a synonym of the genus *Homaloptera*.

Fang (1930) considered *Sinohomaloptera* as a subgenus of *Homaloptera* and characterised it as " Barbels 2 at each angle of mouth ; a deep groove between snout and upper jaw ; 8 outer rays of pectoral and 3 (actually 2, *vide* Hora, 1932, p. 289) outer rays of the ventral simple " Subsequently from a study of the basipterygium and the modified rib, Fang (1930), raised *Sinohomaloptera* to the rank of a genus.

Homalopterula was proposed by Fowler (1940) for the Sumatran species *H. ripleyi*. *Homalopterula* is known chiefly "by the peculiar shape of the jaw, in combination with its truncated caudal and entirely naked medial under surface of the abdomen. It agrees with *Homalopteroides* with the backward insertion of the dorsal." The species is known from a single specimen which is not in a good state of preservation. Considerable variation exists regarding the nature of the caudal and presence or absence of scales on the ventral surface of the abdomen in species of *Homaloptera*. I have not examined this rare species, but from the figures provided by Fowler (*op. cit.*), it is obvious that the specimen is a *Homaloptera*. Moreover, as the characters are so overlapping, it has been thought best to consider *Homalopterula* for the time being as a synonym of *Homaloptera*.

Neohomaloptera Herre (1945), due to its marked differences from *Homaloptera*, is raised from the rank of a subgenus to that of a genus.

Key to the species of the genus Homaloptera *van Hasselt.*

1. Origin of dorsal behind origin of pelvic fin (*Homalopteroides*).

A. Lateral line scales 39 or less—

1. Pectoral longer than head, extending far on pelvics; P. 4-5/11-12; V. 2/6; scales in transverse series from base of pelvic fin 6-1-4½; back with six saddle shaped bands. All fins with irregular dark bands . *H. smithi.*

2. Pectorals shorter than head, extending to base of pelvic fin; P. 4/11; V. 2/6; scales in transverse series from base of pelvic fin 8½-1-5; a narrow dark stripe from head to base of caudal fin. Fins unmarked. *H. lineata.*

B. Lateral line scales 40 or more.

1. Lateral line scales 40 to 54.

a. Origin of dorsal nearer base of caudal than to tip of snout (L. 1.47; P. 6-7/10; V. 2/6; anal arises somewhat nearer end of pelvics than base of caudal; pelvics not reaching anus; pectorals slightly longer than head, reaching pelvics, caudal deeply emarginate) .. .. *H. wassinki.*

b. Origin of dorsal equidistant from tip of snout and base of caudal or nearer to tip of snout than to base of caudal.

i. Origin of dorsal equidistant from tip of snout and base of caudal.

x. Interorbital width more than diameter of eye; pelvics separated from anal opening by short distance. (L. 1.42-45) .. .. .. *H. rupicola.*

x'. Interorbital width equal or less than diameter of eye. Pelvics reach anal opening.

y. Interorbital width equal diameter of eye; L. 1. 43-44 .. .. *H. indochinensis.*

y'. Interorbital width less than diameter of eye; L. 1. 44-46 .. .. *H. weberi.*

ii. Origin of dorsal nearer tip of snout than base of caudal.

x. Scales on back and sides carinated ; pectorals overlapping the pelvics. (L. 1. 45 ; P. 5/11 ; V. 2/8 ; five round spots along dorsal surface ; the second from front encircling the base of dorsal fin ; fins marked with black bands ; snout marked with two pairs of longitudinal streaks radiating from the eye) .. *H. stephensoni.*

x'. Scales on back and sides not carinated. Pectorals separated from pelvics by considerable distance. L. 1. 40-51.

y. P. 2/12-14 ; V. 2/8-9 ; back with six or seven saddle like spots .. .. .. *H. sexmaculata.*

y'. P. 5-6/8 ; V. 2/6 ; back and sides with numerous irregularly disposed spots of various sizes and shapes. Three black spots on side of head below eye ; all fins barred with black .. .. *H. modesta.*

2. Lateral line scales 55 to 73.—

a. Pectorals with 7 to 8 simple rays—

i. Origin of pelvics equdistant from tip of snout and base of caudal. Height of dorsal $1\frac{1}{4}$ to $1\frac{1}{2}$ in head. Pelvics just reaching vent .. .. *H. vanderbilti.*

ii. Origin of pelvics much closer to tip of snout than to base of caudal. Height of dorsal 1 to $1\frac{1}{10}$ in head. Pelvics falling much short of vent which is situated midway between free margin of pelvics and anal fin .. .. .. *H. ulmeri*

b. Pectorals with 3 to 5 simple rays—

i. L. 1. 60 to 64 ; eyes 7 times in head 3 in interorbital space ; barbels twice as long as eye .. .. *H. modiglianii.*

ii. L. 1. 63 to 73 ; eyes 6 times or less in head ; less than twice in interorbital space. Barbels slightly longer or slightly shorter than eye—

x. Origin of dorsal before middle of length. P. 3-5/9-11.

y. Origin of anal much nearer base of caudal than that of pelvics. Ventral surface scaly between and behind pelvics. A triangular patch of scales before base of pelvices present or absent.

z. Ventral surface upto vent totally scaleless ; 43 scales between dorsal and occiput .. *H. ripleyi.*

z'. Ventral surface upto pelvics scaleless. A triangular patch of scales before base of pelvics present or absent.

Triangular patch of scales before pelvics present. 30 scales between dorsal and occiput. L. 1.63 to 70 ; head much longer than broad .. .. *H. gymnogaster.*

Triangular patch of scales before pelvics absent. 50 scales between dorsal and occiput. L. 1. 70 to 73 ; head about as broad as long .. .. *H. amphisquamata*

y'. Origin of anal equidistant from base of caudal and commencement of pelvics. Ventral surface scaly only behind pelvics .. *H. heterolepis.*

x'. Origin of dorsal behind middle of length P. 4/8. *H. montana.*

II. Origin of dorsal opposite or in front of origin of pelvic fin (*Homaloptera*).—

A. Scales on lateral line 36 to 48.—

1. Scales smooth without keels ; L. 1. 36-37 ; Pectoral extending beyond origin of pelvics .. .. .. *H tweedei.*

1 Scales provided with prominent keels ; L. l. 45-48 ; Pectorals not reaching pelvics.—

a. Height 8 to 8½ in total length ; Scales on upper surface with a single strong keel. Back with 6 obscure dark cross-bands ; upper caudal lobe with 2 to 3 oblique dark bands . . . . *H. zollingeri.*

b. Height 10¼ to 11½ in total length ; scales on upper surface with a keel, the anterior ones with 2 to 4 short ones besides. 7 large brown spots on back, 4 of which are behind the dorsal ; sides with large brown unequal spots . . . *H. ophiolepis.*

B. Scales on lateral line 57 or more.—

1. Ventral surface except between and behind pelvics totally scaleless.—

a. Pelvics separated from anal opening by short distance. (L. l. 64 ; P. 4/9-10 ; V. 2-7 ; anal commences closer to origin of pelvics than to base of caudal . *H. bilineata.*

b. Pelvics reaching or surpassing anal opening.—

i. L. l. 63-67 ; P. 5/10-11 ; V. 2/8 ; large brown irregular blotches dorsally ; a brown streak from tip of snout to eye and continued behind it upto occiput ; another streak downwards across side of head . . . . . *H. orthogoniata.*

ii. L. l. 63-71 ; P. 6/10 ; V. 2/7 ; a series of 6 or 7 large brown yellow edged ocelli along back which may fuse into 3 large patches . . *H. ocellata.*

2. Ventral surface up to base of anal fin totally scaleless.—

a. L. l. 57-60 ; P. 6/10 ; pelvics do not extend upto anal opening ; scales carinate ; eyes large, diameter contained 3·6 to 4·1 in head . . . . *H. leonardi.*

b. L. l. 70-80 ; P. 7/10-11 ; pelvics extend for a short distance beyond anal opening ; scales smooth, without any trace of keels ; eyes small, diameter contained 8 times in head . . . . *H. salusur.*

Homaloptera smithi, Hora.

1932. *Homaloptera smithi,* Hora, *Mem. Ind. Mus.*, **21**, p. 286, pl. xi, fig. 3.

1934. *Homaloptera smithi,* Fowler, *Proc. Acad. Nat. Sci. Philad.*, p. 98.

1939. *Homaloptera smithi,* Fowler, *Ibid.*, p. 58.

1945. *Homaloptera smithi,* Smith, *Bull. U. S. Nat. Mus.*, **188**, p. 276, fig. 54.

D. 2/7 ; A. 1/5 ; P. 6/11-12 ; V. 2/6 ; L. l. 37-39 ; L. tr. 6-1-4½.

Head contained 3·7 to 3·8 in standard length and 4·6 to 4·8 in total length ; depth of body 6·1 to 7·3 and 7·7 to 9 ; greatest width of head contained 1·3 in its length ; height at occiput 2 to 2·3. Snout broad, flat, obtusely pointed. Diameter of eye contained 4·4 to 5·1 in head ; 2·2 to 2·5 in snout and 1·3 to 1·9 in interorbital width. Least height of caudal peduncle contained two times in its length.

Locality.—Peninsular Siam ; Metang in Northern Siam ; Bau Yai north east of Bangkok and Chantaboon in South Eastern Siam.

Type specimen is preserved in the collection of the Zoological Survey of India, Indian Museum.

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11293/1 (Type).	Khong Pong, Ban Kiriwong Nakon-Sritamarat ; Peninsular Siam.	H. M. Smith . .	1 specimen.
F. 11294/1	Do. . .	Do. . . .	3 specimens.
F. 11295/1	Tadi stream, Bau Kiriwong Peninsular Siam.	Do. . . .	2 specimens.
F. 652/2	Do. . .	U. S. Nat. Mus. . .	1 specimen.

Homaloptera lineata, Smith.

1945. *Homaloptera lineata,* Smith, *Bull. U. S. Nat. Mus.,* **188,** p. 277.

D. 2/7 ; A. 1/6 ; P. 4/10 ; V. 2/7 ; L. 1.37 ; L. tr. $8\frac{1}{2}$. -1-5.

Head 4 and depth of body 6·75 in length. Width of head 1·5 in its length and 1·3 in its depth. Diameter of eye 3·5 in head ; 1·3 in snout and equal to interorbital space. Barbels very slender, inner rostral about 0·3 and outer about 0·5 diameter of eye. Least height of caudal peduncle contained 1·5 in its length.

Locality.—Mekong and Chiengsei Kao in Northern Siam.

Remarks.—*H. lineata* can be easily distinguished from other species of *Homaloptera* occurring in Siam in the possession of relatively fewer scales on the lateral line, the fin formulae and the characteristic colouration. Smith (*op. cit.*) observed : " The known specimens are apparently immature, a condition which would affect their body proportions and colourations, but not their squamation and fin formulae. "

Homaloptera wassinki, Bleeker.

1932. *Homaloptera wassinki,* Hora, *Mem. Ind. Mus.,* **12,** p. 279.

1938. *Homaloptera wassinki,* Fowler, *Fisheries Bull, Singapore,* **1.** p. 55.

1941. *Homaloptera wassinki,* Hora, *Bull. Raffles Mus. Singapore,* **17,** p. 5.

D. 3/7 ; A. 2/5 ; P. 6/10-11 ; V. 2/6-7 ; L. 1. 47 ; L. tr. $6\frac{1}{2}$-1-$8\frac{1}{2}$.

Head 4·3 in standard and 5 to 5·5 in total length. Depth of body 5·7 and 7 Diameter of eye 4·5 to 6 in head ; 3 in snout and somewhat less than two times in interorbital width.

The confusion regarding the specific limits of *H. wassinki* Bleeker, in relation to *H. ocellata* Cuvier & Valenciennes (Weber & Beaufort, 1916), has been referred to already (*vide supra,* p.187). A single specimen of *H. wassinki* in the collection of the Zoological Survey of India, Indian Museum, has been lost, most probably in the floods of the Varuna river at Banaras in September 1943.

Locality.—Malaya Peninsula; Sumatra (Lahat) ; Java (Bantam, Tjampea, Buitenzong, Kediri) ; Borneo (Rivers Kapuas and Mahakam, Sarawak).

Homaloptera rupicola (Prashad & Mukerji).

1929. *Chopraia rupicola*, Prashad and Mukerji, *Rec. Ind. Mus.*, **31**, p. 188, pl. viii, fig. 3.

1932. *Homaloptera rupicola*, Hora, *Mem. Ind. Mus.*, **12**, p. 288.

1951. *Homaloptera rupicola*, Silas, *Journ. Zool. Soc. India*, **3**, pp. 10-15.

D. 2/7 ; A. 2/5 ; P. 5/11, V. 2/6 ; L. 1. 42-45 ; L. tr. 12.

Head 4 in standard and 5 in total length ; width of head 1·5 in its length ; diameter of eye 4 in head and 1·8 in snout ; interorbital width slightly more than diameter of eye. Snout blunt, rounded and broad. Mouth with thick fleshy lips devoid of tubercles. Pectorals overlap pelvics. Least height of caudal peduncle contained about two times in its length.

Locality.—Myitkyina, Upper Burma.

Type specimen is preserved in the collection of the Zoological Survey of India, Indian Museum.

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 10879/1 Type	Rocky stream round about Kamaing, Myitkyina Dt., Northern Burma.	Dr. B. N. Chopra . .	1 specimen. Fins slightly damaged.
F. 10880/1	Do. . .	Do. . . .	3 specimens.
F. 10881/1	Sankha, a large hill stream midway between Kamaing and Mongang, Myitkyina Dt.	Do. .	30 specimens.
F. 10882/1	Sattan Chanag stream inside and near Pandawan Cane about 8 miles from Kamaing. Myitkyina Dt.	Do. . .	1 specimen.
F. 10883/1	Small muddy stream along Kamaing, Jade Mines road, Myitkyina Dt.	Do. . .	12 specimens.
F. 10884/1	Rocky stream about half a mile from Namma Rest House. Myitkyina Dt.	Do. .	7 specimens.
F. 10885/1	Small rocky stream round about Kamaing, Myitkyina Dt.	Do. .	7 specimens.

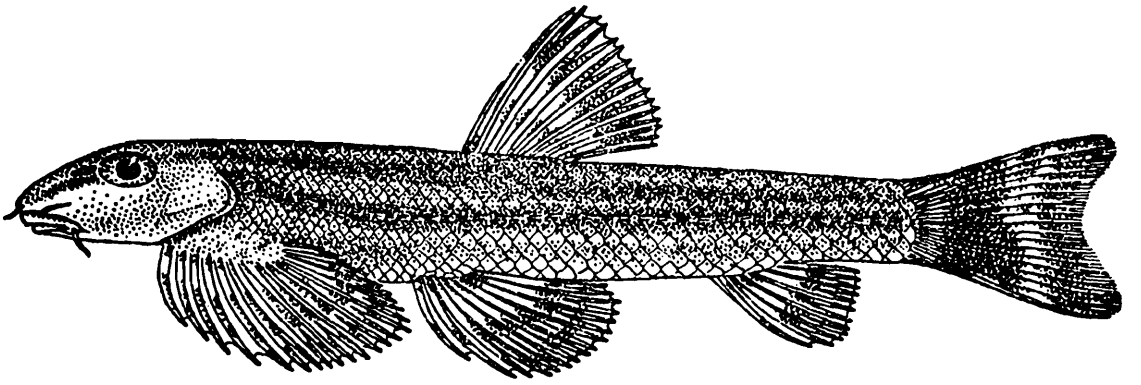
Homaloptera indochinensis, sp. nov.

(Text-figure 2.)

1951. *Homaloptera* sp. Silas, *J. Zool. Soc. India*, **3**, pp. 10-15.

D. 2/7/1 ; A. 1/5/1 ; P. 5/10/2 ; V. 2/7 ; C. 19 ; L. 1. 4[illegible]44.

While describing a specimen of *Homaloptera* from Indo-China (*op. cit.*), it was pointed out that the form showed affinities to *Homaloptera rupicola* of Northern Burma and *H. weberi* of Borneo. Both on geographical grounds as well as on the differences it evinces from other species of *Homaloptera*, in the present revision it has been possible to specifically name it as a new species, *Homaloptera indochinensis* sp. nov. As already a detailed description of the specimen is given elsewhere (Silas, *loc. cit.*), only the diagnostic characters and a figure of the new species are given below :—



Text figure 2. *Homaloptera indochinensis* sp. nov. Lateral view. 1¾.

Head 4·7 in standard and 5·9 in total length. Depth of body 8·5 and 10·6. Width of head contained 0·6 in its length. Diameter of eye contained 4·5 in head and 2·1 in snout. Inter orbital width 1·95 in snout. Least height of caudal peduncle contained 2·1 times in its length. Pectorals overlap base of pelvics.

Type specimen is in the British Museum (1933-8·19·50).

Locality.—Indo-China (? Tonkin).

Homaloptera weberi, Hora.

1932. *Homaloptera weberi,* Hora *Mem. Ind. Mus.,* **12**, p. 284, pl. xi, fig. 2.

1951. *Homaloptera weberi,* Silas, *J. Zool. Soc. India,* **3**, pp. 10-15.

D. 2/7 ; A. 2/5 ; P. 5/11 ; V 2/7-8 ; L. 1. 44-46.

Head contained 4·3 in standard and 5·5 in total length ; width of head 1·3 in its length. Diameter of eye 3·8 in head and 1·8 in snout. Interorbital width slightly less than diameter of eye. Least height of caudal peduncle contained 2·1 in its length.

Locality.—Akar River, Sarawak, Borneo.

Type specimen preserved in the British Museum.

Specimens examined.—

Register. No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11292/1	Akar River, Sarawak, Borneo.	British Museum	1 specimen.

Homaloptera stephensoni, Hora.

1932. *Homaloptera stephensoni,* Hora, *Mem. Ind. Mus.,* **12**, p. 281, pl. xi, fig. 1

D. 2/7 ; A. 2/5 ; P. 5/11 ; V. 2/8 ; L. 1. 45 ; L. tr. 5-1-3.

Head contained 4·6 in standard and 5·7 in total length ; depth of body 7 and 8·7. Width of head in front of pectoral contained 1·2 in its length ; height at occiput 1·7. Diameter of eye contained 4·3 in

length of head, 2·2 in snout and 1·2 in interorbital width. Least height of caudal peduncle contained 2·7 in its length.

Locality.—Upper Mahakam river, Borneo.

Type specimen preserved in Leyden Museum.

Homaloptera sexmaculata, Flower.

1934. *Homaloptera sexmaculata,* Fowler, *Proc. Acad. Nat. Sci. Philad.,* **86,** 98, fig. 47-48.

1934. *Homaloptera septummaculata,* Fowler, *Ibid.,* **86,** p. 99. fig. 49-50.

1945. *Homaloptera sexmaculata,* Smith, *Bull. U. S. Nat. Mus.,* **188,** p. 275.

1945. *Homaloptera septummaculata,* Smith, *Ibid.,* **188,** p. 275.

1950. *Homaloptera sexmaculata,* Hora, *Rec. Ind. Mus.,* **48,** p. 51.

D. 2/8/1; A. 1/5; P. 2/12-14; V. 2/8-9; L. 1. 42-51.

Head 4·33 to 4·75 and depth of body 5·8 to 7 in length. Width of head 1·2 to 1·25 in its length. Snout 2 to 2·75 in head. Diameter of eye 3·75 to 4·12 in head, 1·5 to 1·9 in snout and 1·33 to 1·5 in interorbital space. Width of mouth 4·25 to 4·35 in head.

Locality.—Meping at Chiengmai, Siam.

Remarks.—Speaking of the great similarity between *H. sexmaculata* and *H. septummaculata,* Smith (1945, p. 275) observed " The general pattern of colouration is practically identical in the two forms, and the only difference except in maculation appears to be in the lateral line scales, which number 42 to 46 in *H. sexmaculata* and 49 to 51 in *H. septummaculata.* It is probable that these two forms may represent a single species ". Recently after examining Fowler's material of the two forms in the Philadelphia Academy of Sciences, Museum Hora (1950) also expressed the opinion that they are con-specific. The juvenile condition of the known specimens may be responsible for the slight differences observed in these forms.

Homaloptera modesta (Vinciguerra).

1890. *Helgia modesta,* Vinciguerra, *Ann. Mus. Civ. Stor. Nat. Genova,* (2) **9,** p. 202, pl. ii, fig. 12.

1932. *Homaloptera modesta,* Hora, *Mem. Ind. Mus.,* **12,** p. 288.

1945. *Homaloptera modesta,* Smith, *Bull. U. S. Nat. Mus.,* **188,** p. 275.

D. 2/7; A. 6-7; P. 5-6/8; V. 2/6; L. 1. 47.

Head contained 3·75 to 4·5 in standard and 4·5 to 5 in total length. Head much longer than broad ; snout pointed. Width of head about length of head from tip of snout to posterior border of orbit. Length of snout 0·5 in head. Height at occiput slightly more than two times in length of head. Diameter of eye contained 4·25 in head ; 1·75 in snout and 1·25 in interorbital space. Depth of body contained 9 to 9·5 in total and about 8 in standard length. Least height of caudal peduncle contained 1·5 times in its length.

Locality.—Meetan, Lower Burma.

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens and state of preservation.*
F. 11040/1	Meetan, Lower Burma	Mus. Civ. Stor. Nat. Genova.	2 specimens. One of them is badly desiccated.

Homaloptera vanderbilti, Fowler.

1940. *Homaloptera vanderbilti,* Fowler, *Proc. Acad. Nat. Sci. Philad.,* **91,** p. 375, fig. 1-2.

1950. *Homaloptera vanderbilti,* Hora, *Rec. Ind. Mus.,* **48,** p. 51.

D. 2/7/1; A. 2/5/1; P. 8/9/2; V. 2/8; L. 1. 55-67.

Head contained 4 to 4·8 and depth of body 5·25 to 6 in length. Width of head 1·18 to 1·7 and snout 2 to 2·2 in head. Diameter of eye contained 5 to 7 in head, 2 to 3·75 in snout, and 1·6 to 3 interorbital width. Width of mouth contained 2·4 to 2·5 in head. Predorsal scales 34 to 35. Least depth of caudal peduncle 2·2 to 2·4 in head.

Locality.—Balanganga, in Tirpa river at base camp, 3600 feet elevation, Atjeh Province, Sumatra.

Remarks.—Hora (*op. cit.*) after examining specimens of *H. vanderbilti* and *H. ulmeri* stated: "*H. ulmeri* and *H. vanderbilti* may prove to be con-specific when further material becomes available". I have not examined this species, but from Fowler's original descriptions and figures, I consider it best to treat *H. ulmeri* and *H. vanderbilti* as distinct species.

Homaloptera ulmeri, Fowler.

1940. *Homaloptera ulmeri,* Fowler, *Proc. Acad. Nat. Sci. Philad.,* **91,** p. 377 fig. 3-4.

1950. *Homaloptera ulmeri,* Hora, *Red. Ind. Mus.,* **48,** p. 51.

D. 2/7/1; A. 3/5/1; P. 7/8; V. 2/8; L. 1. 55-65.

Head 4·25 to 4·3 and depth of body 6·33 to 7 in length. Width of head 1 to 1·24 and snout 1·8 to 2 in head. Diameter of eye contained 5·25 to 6·2 in head, 3 in snout, and 2 to 2·25 in interorbital space. Width of mouth 2·75 to 3 in head. Predorsal scales 32 to 33. Least height of caudal peduncle 2·1 to 2·3 in head.

Locality.—Goepang River at Meloewak in Atjeh Province, Sumatra.

Homaloptera modiglianii Perugia.

1893. *Homaloptera modiglianii,* Perugia, *Ann. Mus. Civ. Genova,* **33,** (2) XIII, p. 245.

1916. *Homaloptera modiglianii,* Weber & Beaufort, *Fish. Indo-Austral. Archipel.,* **3,** p. 11.

1932. *Homaloptera modiglianii,* Hora, *Mem. Ind. Mus.,* **12,** p. 288.

D. 3/6; A. 9; V. 2/7; p. 5/9-10; L. 1. 60-64.

Perugia (1893), gave a short description of *H. modiglianii,* which Weber and Beaufort (1916) followed. As I have examined a specimen of this rare species, and since, there exists no detailed description of it, I am redefining it here.

Homaloptera modiglianii is a small slender loach in which the head and body are greatly depressed ; dorsal profile is slightly arched, it rises from tip of snout to hind end of occipital region, from whence it runs straight to the commencement of the dorsal and thence gradually slopes to the base of the caudal fin.

Head contained 5 to 5·5 and depth of body 8·75 to 9·25 in total length. Head longer than broad ; snout broad, flat, obtusely pointed. Snout slightly longer than half length of head and consequently the eyes are situated in posterior half of head. Height of head at occiput about half its length. Eyes dorso-lateral, of moderate size ; diameter contained 7 in head, 3·75 in snout, and 3 in interorbital width. Mouth inferior, cresent-shaped and bordered by thick plain lips which are continuous at angles, but interrupted widely in lower jaw. Barbels slightly longer than diameter of eye.

Caudal peduncle longer than deep, its least height contained 1·5 times in its length. Scales absent on head and anterior half of abdomen ventrally. Scales longer than broad, with a large structureless nuclear area, and a smaller number of circuli. Radii absent in apical and in adjoining lateral areas.

Dorsal commences closer to base of caudal than to tip of snout. Its origin slightly behind that of pelvics. Length of dorsal greater than depth of body beneath it and it is about as long as pelvics. Paired fins are flat and broad. Pectoral slightly pedunculate, with inner 1/3 vertical and outer 2/3 horizontal. Pectorals about as long as head and separated from pelvics by short distance. Pelvics fall much short of vent and their length is contained 0·75 in head. Anal shorter than dorsal. Caudal slightly emarginate, its lobes being equal. Colour in alcohol is yellowish, marmourated with brown. A black transverse band at base of caudal. Fins yellowish and immaculate.

Locality.—Sumatra (Si Rambe).

Specimen examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11296/1	Sumatra .	Mus. Civ. Stor. Nat. Genova.	1 specimen.

Homaloptera ripleyi, (Fowler).

1940. *Homalopterula ripleyi,* Fowler, *Proc. Acad. Nat. Sci. Philad.,* **91,** p. 379, figs. 5-7.

1950. *Homaloptera ripleyi,* Hora, *Rec. Ind. Mus.,* **48,** p. 51.

D. 3/7/1 ; A. 2/5/1 ; P. 3/10 ; V. 2/7 ; L. 1. 73.

Head 4·7 and depth of body 7·75 in length. Width of head 1·2 and snout 1·9 in head. Diameter of eye 6 in head, 3·25 in snout and 2 in interorbital width. Width of mouth 2·75 in head. Interorbital space 3 in head ; predorsal scales 43. Head and entire medial abdominal region scaleless back to vent. Height of dorsal 2 in head and anal 1·75. Least depth of caudal peduncle 2·2 in head.

Locality.—Geompang River, Meloewak in Atjeh Province, Sumatra.

Remarks.—Reference may be made to the discussion (*vide supra*, p. 188) for the relationships of Fowler's genus *Homalopterula*. Hora (*op. cit.*) after an examination of the type and only specimen of *H. ripleyi* stated : " the only specimen of this species is not in a good state of preservation, so the characters could not be made out" Further material when obtained will throw more light on the systematic position of this species.

Homaloptera gymnogaster, Bleeker.

1916. *Homaloptera gymnogaster,* Weber and Beaufort, *Fish. Indo-Austral Archip.* **3,** p. 11.

1916. *Homaloptera lepidogaster,* Weber and Beaufort, *Ibid,* **3,** p. 14.

1932. *Homaloptera gymnogaster,* Hora, *Mem. Ind. Mus.*, **12,** p. 280.

D. 2/7-8 ; A. 2/6 ; P. 5-6/9-10 ; V. 2/7 ; L. 1. 63-70.

Head contained 5·5 and depth of body 7·75 in standard length. Length of snout greater than half length of head. Head longer than broad, its width contained 1·33 in its length. Eyes moderately large, its diameter contained 6·25 in head, and 1·5 in interorbital width. Predorsal scales 30. On ventral surface scales present between pelvics, and in a triangular patch before them.

Locality.—Sumatra (Lake Manindjau, river Anei near Kaju Tanam).

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11297/1	River Anei near Kaju Tanam, Sumatra.	Zool. Mus. Amsterdam	1 specimen. Caudal damaged.

Homaloptera amphisquamata, Weber & Beaufort.

1916. *Homaloptera amphisquamata,* Weber and Beaufort, *Fishes Indo-Austral.* Archip., **3,** p. 12.

1932. *Homaloptera amphisquamata,* Hora, *Mem. Ind. Mus.*, **12,** p. 288.

1951. *Homaloptera amphisquamata,* Ramaswami, *Proc. Nat. Inst. Sci. India.* (in press).

D. 3/7 ; A. 3/4-5 ; P. 6-7/9-10 ; V 2-3/6 ; L. 1. 70-73.

Head 4·7 in standard length and 5·5 in total length. Depth of body 7·2 and 8·5. Diameter of eye less than 5 in head, about 2 in snout and less than 2 times in interorbital space. Origin of dorsal behind that of pelvics, but is closer to tip of snout than to base of caudal. Ventral surface scaly only between and behind pelvics. Predorsal scales 50.

Locality.—Sumatra (Lau Borus, Karo Highlands).

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11045/1	Lau Borus, Karo Highlands, Sumatra.	Zool. Mus. Amsterdam	3 specimens, of which one is slightly damaged.

Homaloptera heterolepis, Weber & Beaufort.

1916. *Homaloptera heterolepis,* Weber & Beaufort, *Fish. Indo-Austral. Archipel.* **3,** p. 12.

D. 2/7 ; A. 2/5 ; P. 4-5/8-10 ; V 2/7-8 ; L. 1. 63-70 ; L. tr. 12-1-10.

Head 4·7 in standard and 5·6 in total length. Depth of body 6·4 and 7·6. Diameter of eye about 5 in head, 2·3 in snout and 2 in interorbital space. Origin of dorsal behind commencement of pelvics, and much nearer tip of snout than base of caudal. Pectorals much shorter than head, not reaching pelvics. Scales on abdomen only behind pelvics.

Locality.—Sumatra (Atchin, Lake Tawar).

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11035/1	Lake Tawar, Sumatra	Zool. Mus. Amsterdam .	2 specimens.

Homaloptera montana, Herre.

(Plate I, figs. 1-2).

1945. *Homaloptera montana,* Herre, Journ. *Washington Sci. Soc.,* **20,** pp. 399.
1950. *Homaloptera montana,* Hora, *Rec. Ind. Mus.,* **48,** p. 54.
1951. *Homaloptera montana,* Silas, *Journ. Bombay Nat. Hist. Soc.* **49,** p. 679.

D. 2/6; A. 1/5; P. 4/8; V. 2-3/6-7; L. 1. 72; L. tr. 16-1-12.

Known from the type and only specimen, *H. montana* was described by Herre (*op. cit.*) from the Anamalai Hills in Peninsular India. I have examined the type specimen received on loan from the Zoological Museum of Stanford University, U. S. A., and am redescribing it here with illustrations.

Head 4·8 and depth of body 9·6 in total length. Length of caudal and pelvic equal to that of head. Diameter of eye 4·3 in head, 2·8 in snout and 1·7 in interorbital width. Snout 2 and postorbital part of head 2·5 in head. Least depth of caudal peduncle twice in its own length.

Body slender, posterior half being laterally compressed; dorsal profile little elevated; eyes dorso-lateral; snout descends steeply with rather flat tip. Mouth small, slightly arched; barbels small and inconspicuous. Dorsal origin well behind that of pelvics and behind middle of length. Pectorals just reaching plevic base. Pelvics fall short of anus which is noticeably in advance of anal origin. Caudal nearly truncate. Head and entire ventral surface back to a little behind pelvic base scaleless.

Herre (*op. cit.*) gives the colour as "in alcohol brown, the under side yellowish; 10 dark short bars across the back, but not extending back to the lateral line; a poorly defined dark longitudinal stripe below the lateral line from the eye to the caudal base; top of head very dark brown; a blackish brown spot on ventral base; caudal with a blackish blotch on its base, and another near its tip; other fins all clear".

Locality.—Puthutotam Estate, Anamalai Hills, South India.

Remarks.—*H. montana* throws some light as to the Malayan affinities of the fish fauna of Peninsular India. Recently Hora (1950) and Silas (1951) have discussed the Zoogeographical significance of the occurrence of this species in Peninsular India.

Homaloptera tweedei, Herre.

1940. *Homaloptera tweedei*, Herre, *Bull. Raffles Mus.*, **16**, pp. 7-8. pl. *i*, fig. 1.

1941. *Homaloptera tweedei*, Hora, *Ibid.*, **17**, p. 61.

1944. *Homaloptera tweedei*, Herre, *Proc. Biol. Soc. Washington*, **57**, p. 51.

D. 1/8; A. 1/4-5; P. 4/10; V. 2/7; L. 1. 36-37; L. tr. 4-5/3-3·5.

Head 3·4 to 3·55 and depth of body 6·6 to 6·8 in total engtth. Diameter of eye 3·8 to 4 in head and about equal to that of interorbital space. Snout 2·6 in head. Interorbital space 1·5 in snout. Least depth of caudal peduncle 2·2 in its length.

Locality.—Mawai District, Johore, Malaya Peninsula.

Remarks.—*H. tweedei* is also characterised by the relatively large size of the scales, fewer rays in the pectoral fins, pectorals overlapping pelvics, larger eyes and the scaleless ventral surface up to the pelvics. For a complete diagnosis of the species reference may be made to Herre (1940, *loc. cit.*).

Homaloptera zollenger, Bleeker.

1916. *Homaloptera zollengeri*, Weber and Beaufort, *Fish. Indo-Austral. Archip.*, **3**, p. 14.

1932. *Homaloptera zollengeri*, Hora, *Mem. Ind. Mus.*, **12**, p. 280.

1937. *Homaloptera maxinae*, Fowler, *Proc. Acad. Nat. Sci. Philad.*, p. 152 figs. 52-53.

1945. *Homaloptera zollengeri*, Smith, *Bull. U. S. Nat. Mus.*, **188**, p. 274.

D. 2/8; A. 2/5-6; P. 4/9-10/1; V. 2/8; L. 1. 45.

Head 6 to 6·3 and depth of body 8 to 8·5 in total length. Diameter of eye 4·5 to 5·5 in head; and about 2 in interorbital width. Origin of dorsal ahead of pelvics. Scales on back and sides with a strong longitudinal keel. Pectorals separated from pelvics by a short distance.

Locality.—Siam (Upper Bangpakong river); Java (Batavia, Ban daung); Sumatra (Lahat); Borneo.

Specimens examined.—

Regeister No.	*Locality.*	*Donor or Collector.*	*No. of sepecimens.*
F. 108/2	King George V National Park, Kualu Tahan, Pahang, F. M. S.	Raffles Museum Singapore	1 specimen.
F. 100/2	Kuala Tahn, Pahang, F. M. S.	Do. . .	1 specimen.
F. 110/2	Plus R. Jalong, Perak F. M. S.	Do. . . .	1 specimen.

Homaloptera ophiolepis, Bleeker.

1916. *Homaloptera ophiolepis*, Weber and Beaufort, *Fish. Indo-Austral. Archipel.*, **3**, p. 15.

1932. *Homaloptera ophiolepis*, Hora, *Mem. Ind. Mus.*, **12**, p. 287.

D. 3/8-9; A. 2/5-6; P. 4-6/9-11; V. 2/8; L. 1. 45-48.

Head 6 to 7 and depth of body 10·25 to 11·5 in total length. Head longer than broad. Diameter of eye 4·5 to 5·5 in head and 2 times in interorbital space. Snout more than half length of head. Barbels subequal and equal to or slightly longer than diameter of eye. Dorsal origin slightly ahead of pelvics. Predorsal scales 15. Abdomen scaly except the space between the pectorals. Scales on each side of the body with median keels.

Locality.—Sumatra (Lahat); Java (Parongkalong, Bundung) Borneo (Mahakam river).

Homaloptera bilineata, Blyth.

1888. *Homaloptera bilineata,* Day, *Fish. India,* **2**, p. 526, pl. cxxi, fig. 8.

1889. *Homaloptera bilineata,* Day, *Faun. Brit. India Fish.*, **1**, p. 244.

1932. *Homaloptera bilineata,* Hora. *Mem. Ind. Mus.*, **12**, p. 288, pl. x, fig. 3.

D.2/8 ; A.2/5 ; P. 4/9-10 ; V. 2/7 ; C. 19 ; L. 1.64 ; L. tr. 12/17.

Head contained 5 and depth of body 7·5 to 8 in standard length. Head much longer than broad, its width contained 1·75 in its length. Tip of snout pointed. Depth of head at occiput equal half its length. Snout more than half length of head. Eyes moderately large, diameter contained 6·5 to 6·75 in head, 3·5 in snout and 2·5 in interorbital width Interorbital space equals about length of post-orbital part of head. Mouth inferior, slightly arched and fringed by thick plain lips which are continuous at angles. Labial groove widely interrupted; barbels short, stout and equal in length. Ventral surface except between pectorals totally scaly. Scales nearly three-fourths as broad as long, with bluntly pointed apical region and broad basal portion. Dorsal commencing ahead of pelvics, and its origin closer to tip of snout than to base of caudal. Pectorals separated from pelvics by considerable distance. Least height of caudal peduncle contained 2 times in its length.

Locality :—Meetan and Tenasserim, Lower Burma.

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens. state of preservation.*
Cat. 955	....	A. S. B.	2 specimens, slightly damaged.
1226	Tenasserim, Lower Burma.	Purchased from F. Day; Original of pl. cxxi, fig. 8.	1 specimen badly desiccated.
F.11041/1	Meetan, Burma	Mus. Civ. Stor. Nat. Genova.	2 specimens.

Homaloptera orthogoniata, Vaillant.

1916. *Homaloptera orthogoniata* , Weber and Beaufort, *Fish. Indo-Aust. Archipel.*, **3**, p. 15.

1932. *Homaloptera orthogoniata,* Hora, *Mem. Ind. Mus.*, **12**, p. 288.

D. 2-3/8-9 ; A. 2-3/5-6 ; P. 5-6/10 ; V. 2/98 ; L. 1.63-67 ; L. tr. 10-1-11

Head 4·5 to 5 in standard length and 5·7 in total length. Depth of body 5 and 6·7. Diameter of eye 10 in head and 4 in interorbital space.

Scales on lateral line 63 to 67. Dorsal originates in advance to commencement of pelvics. Ventral surface except between pectorals totally scaly. Colour in alcohol brown, clouded with large distinct irregular dorsal blotches, or areas of deep brown, a large one between the dorsal and the pelvic. Ventral surface paler. A brown streak runs from side of snout to eye and is continued behind it to occiput. Another streak passes downwards across the sides of the head. All streaks with narrow pale brown margins. Fins brownish white.

This species possesses an incipient rostral groove.

Locality.—Borneo (River Raun and Bougan, System of Upper Kapuas ; Upper Mahakam river ; Baram river), Malaya Peninsula,

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F.11037/1	Howong, Borneo	Rijks Mus. Nat. Hist. Leyden.	1 specimen.
F.11038/1	Baram river, Borneo	Acad. Nat. Sci. Philadelphia.	1 specimen.
F.656/2	Perak, F. Malaya States.	Nat. Hist Mus. Stan. Univ.	1 specimen.

Homaloptera ocellata, Van der Hoeven.

1932. *Homaloptera ocellata,* Hora, *Mem. Ind. Mus.*, **12**, p. 277, pl. x, fig. 5.

D. 3/7-8 ; A. 3/5 ; P. 6-7/10-11 ; V 2/6-7 ; L. 1.63-71.

Head 5·4 to 6 and depth of body 7·1 to 8 in total length. Diameter of eye 6·3 to 7·5 in head, 3 to 4 in snout and 2 in interorbital space. Width of head 1·4 in its length. Barbels subequal and shorter than eye. Origin of dorsal distinctly ahead of pelvics and closer to tip of snout than to base of caudal. Pelvics reach anus. Pectorals shorter than head and separated by considerable distance from pelvics. Caudal deeply forked. Abdomen scaly except a median naked portion beginning before a triangular scaly patch situated in front of pelvics.

Locality.—Jave (Batavia, Buitenzorg, Tjipauas, Tjampea, Bandung, Garut, Ngantang) ; Sumatra (Lahat).

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens and state of preservation.*
H.036/1	Java.	Rijks. Mus. Nat. Hist. Leiden.	1 specimen. Caudal fin broken.
F. 655/2	Tjiwalen Creek, Java	Univ. Mus. Zool. Minchigan, U. S. A.	2 specimens.

Homaloptera leonardi, Hora.

1941. *Homaloptera leonardi,* Hora, *Bull. Raffles Mus. Singapore,* **17**, p. 61.

D. 3/8 ; A. 2/5 ; P. 6/10-11 ; V. 2/8 ; C. 18 ; L. 1.57-60.

Head 4·3 to 4·8 in standard length and 5·3 to 6 in total length. Depth of body 8 to 9·6 and 8·7 to 12. Height of head at occiput 2 times in

its length. Diameter of eye 4·1 in head, 2 to 2·2 in snout and 1 to 1·3 in interorbital space. Least height of caudal peduncle contained 2·6 to 3 in its length.

Locality.—Malaya Peninsula (Kuala Tahang, Pahang).

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 13213/1 (Type).	Kuala Tahan, King George V National Park, Pahang, F. M. States.	Raffles Mus.	1 specimen.
F. 13214/1 (Paratypes).	Do.	Do.	7 specimens.
F. 111/2	Do.	Do.	8 specimens.

Homaloptera salusur, Bleeker.

1916. *Homaloptera erythrorhina,* Weber & Beaufort (in part), *Fish. Indo-Austral. Archip.*, **3**, p. 17.

1932. *Homaloptera salusur,* Hora, *Mem. Ind. Mus.*, **12**, p. 288.

D. 2/9-10 ; A. 2/6 ; P. 7/10-11 ; V. 2/7 ; L. 1.70-80.

Head 4·4 to 4·6 in standard length and 5·5 to over 6 in total length. Depth of body 5·8 and 7·1 to 8. Diameter of eye 6·3 to 7·5 in head, 3 to 4 in snout and more than 2 times in the interorbital width. Snout long and pointed. Pelvics extend beyond anal opening. Scales smooth, without any trace of keels.

Locality.—Java, and Sumatra.

Neohomaloptera, Herre.

1944. *Neohomaloptera,* Herre, *Proc. Biol. Soc., Washington,* **57**, p. 50.

Head and anterior part of body feebly depressed and ventral profile flattened and horizontal. Dorsal profile arched, body being deepest below commencement of dorsal. Snout broadly rounded and provided with trenchent margins. Eyes small and situated dorso-laterally. Mouth small, subterminal and slightly arched. Two pairs of rostral barbels of which inner is as long as diameter of eye. Outer barbel of maxillary angle longer than inner which is about half diameter of eye. Gill openings extend to ventral surface for a short distance. Head and body scaled, except ventral surface which is naked as far back as hind end of pelvics. Paired fins are broad and horizontal. Pectorals scarcely reach pelvics. Pectorals with 12 to 13 rays of which 3 to 4 outer rays are unbranched. Pelvics with 7 rays of which 2 outer rays are unbranched. Dorsal originates behind point of commencement of pelvic. Caudal fin rounded, its length equal or slightly less than length of head.

Genotype.—Neohomaloptera johorensis Herre.

Distribution.—Johore, Malaya Peninsula.

Remarks.—Herre (1944) erected the subgenus *Neohomaloptera* to accommodate a species of *Homaloptera* from Malaya Peninsula. He pointed out that from *Homaloptera* as defined by Hora (1932), *Neohomaloptera* differed in having :

"Two pairs of barbels at each angle of the mouth instead of but one ; the rays of the pectoral and ventral reduced in number, the former with 12 to 13 instead of 14 to 20 ; the latter 7 instead of 8 to 10 ; the pectorals further has but 3 to 4 simple rays instead of 4 to 8. Caudal fin slightly rounded, not forked or emarginate as in typical *Homaloptera*. Caudal peduncle is short and as deep as long."

In view of the above diagnostic characters, *Neohomaloptera* is Considered here as a distinct genus.

Neohomaloptera johorensis, Herre.

(Plate I, figs. 3 and 4.)

1944. *Homaloptera (Neohomaloptera) johorensis*, Herre, *Proc. Biol. Soc. Washington*, **57**, p. 51.

A short description of this species from a specimen I have examined, received on loan from the collection of the Stanford University, U. S. A. is given below :

D. 1/7 ; A. 1-2/5, P. 3-4/8-9 ; V. 2/5 ; L. l. 33-35.

Head contained 3·7 to 4 and depth of body contained 5 to 5·1 in total length. Caudal contained 4 to 4·1 ; pectorals 3·6 to 4 and pelvics about 5·2 in total length. Eyes small, dorsolateral, their diameter contained 4·25 to 4·5 in head and 2 times in interorbital width. Length of snout corresponds to postorbital part of head. 2 pairs of rostral barbels, length of inner equal to diameter of eye ; outer 1½ diameter of eye ; outer maxillary barbels longer than eye ; inner about half diameter of eye.

Body scaled, except ventral surface in front of hind end of base of pelvics. Predorsal scales 14 to 15. Caudal peduncle with 16 scales round it. Dorsal commences slightly behind origin of pelvics. Dorsal slightly shorter than head and its height contained 4·5 to 5 in total length. Pectorals about as long as head, scarcely reaching pelvics. Caudal peduncle about as long as deep.

"Colour in alcohol is more or less brown stippled with minute black specks, interspread with large circular dots. Dorsal with two transverse rows of black spots and caudal with one or two blackish crossbars. Other fins colourless" (Herre, 1944).

Locality.—Simpang Rengam, Johore, Malaya Peninsula.

Travancoria, Hora.

1941. *Travancoria*, Hora, *Rec. Ind. Mus.*, **43**, p. 228.

For the diagnostic characters of this South Indian genus reference may be made to the key for the genera on page 182. In his work on the Homalopterid fishes of Peninsular India, Hora (*loc. cit*) has given a detailed description of the genus.

Genotype.—Travancoria jonesi Hora.

Distribution.—South India (Hill ranges of Northern Travancore ; Anamalai Hills, Western Ghats).

This remarkable monotypic genus was described by Hora (1941, *op. cit.*) from the Hill ranges of Northern Travancore. From *Bhavania* Hora, it is easily distinguished by its more extensive gill openings and the number of rostral barbels. *Travancoria* is also intermediate in certain characters between *Homaloptera* van Hass., and *Balitora* Gray.

Travancoria jonesi, Hora.

1941. *Travancoria jonesi*, Hora, *Rec. Ind. Mus.*, **43**, p. 230, pl. viii, fig. 5-9.
1941. *Travancoria jonesi*, Hora & Law, *Ibid.*, **43**, p. 249.
1942. *Travancoria jonesi*, Hora & Law, *J. Roy, Asiat. Soc. Bengal*, **8**, pp. 39-46.

D. 2/7-8 ; A. 1/4-5 ; P. 6/9-10 ; V 2/6-7 ; C. 17 ; L. 1. 75-77.

Head 5 to 5·8 in standard and 5·9 to 6·8 in total length. Depth of body 8·33 to 8·7 in standard length and 9·87 to 10·15 in total length. Width of head contained 1 to 1·3 and height of head at occiput 1·7 to 1·9 in its length. Diameter of eye contained 4·13 to 5 in head ; 2·5 to 2·6 in snout and 1·4 to 1·5 in interorbital space. Least height of caudal peduncle contained 2·25 to 2·75 in its length.

Type specimen is preserved in the collection of the Zoological Survey of India.

Locality.—South India (High Ranges, Northern Travancore ; Anamalai Hills).

Specimens examined :—

Register No.	*Locality.*	*Donor or Collection.*	*No. of specimens.*
F. 13507/1 (Type)	Pampadampara, N. Travancore	S. Jones.	1 specimen.
F. 13508/1	Do.	Do.	1 specimen.
F. 13598/1	Do.	Do.	2 specimens.
F. 13599/1	Do.	Do.	1 specimen. Badly damaged ; head missing.

Pseudohomaloptera gen. nov.

Small loach-like fish in which head and anterior part of body are depressed and ventral profile is flattened and horizontal. Snout broadly pointed. Eyes placed dorsolaterally, provided with free orbital margins and not visible from below. Mouth inferior, transverse, slightly arched and of moderate size. Lips are full, plain and continuous. Four rostral barbels and a pair of maxillary barbels present. Barbels equal in length and about as long as the eye. Rostral groove well developed and deep at sides of mouth. Jaws strong and provided with strong rasping edges. Gill openings oblique, extending to ventral surface for short distance.

Body covered with moderately small scales which are carinate, slightly increasing in size towards the back. Ventral surface of head and body upto anus totally scaleless. Dorsal origin before middle of length. Paired fins broad, extensive and horizontal. Pelvics not reaching anal. Pectorals reaching pelvics. Pectorals with 20 rays of which 8 outer rays are simple. Caudal fin deeply forked, the lower lobe the longer. Caudal peduncle extremely slender, its height being about three time in its length.

Genotype.—Pseudohomaloptera tate-regani (Popta).

Distribution.—Borneo (River Bo).

Remarks.—The genus *Pseudohomaloptera* has been erected to accommodate a previously known Bornean species described under *Homaloptera* by Popta (1905). The well defined deep rostral groove of *H. tate-regani* is of sufficient importance to give it a generic rank. Hora (1932, p. 327) commented on the peculiar rostral groove of this species, but at that time he did not separate it into a new genus. In view of a thorough revision of the species of *Homaloptera*, it was found difficult to retain it in that genus on account of the presence of a rostral groove and other structures associated with the mouth.

Pseudohomaloptera tate-regani (Popta).

1905. *Homaloptera tate-regani*, Popta, *Notes Leyden Mus.*, **25**, p. 180.
1906. *Homaloptera tate-regani*, Popta, *Ibid.*, **27**, p. 182.
1916. *Homaloptera tate-regani*, Weber & Beaufort, *Fish. Ind. Austral. Archip.*, **3**, p. 19.
1932. *Homaloptera tate-regani*, Hora, *Mem. Ind. Mus.*, **12**, p. 288, pl. xi, fig. **4**.

D. 3/8 ; A. 2/5 ; P. 8/12; V 2/8 ; L. 1. 64 ; L. tr. 6/1/7

Head 4·5 in standard and 6 in total length. Depth of body 7·45 and 10 ; Diameter of eye 7 in head ; 4 in snout and 3 in interorbital width. Origin of dorsal ahead of pelvics. Ventral surface upto vent totally scaleless. Least height of caudal peduncle contained more than three, times in its length.

For detailed diagnosis of this species reference may be made to the description of the genus.

Locality.—Borneo (River Bo).

Balitora Gray.

1941. *Balitora*, Hora, *Rec. Ind. Mus.*, **43**, p. 222.
1945. *Balitora*, Smith, *Bull. U. S. Nat. Mus.*, **188**, p. 278.
1948. *Balitora*, Ramaswami, *Proc. Zool. Soc. London*, **118**, p. 513.

For the diagnostic characters of *Balitora* reference may be made to the key for the genera on page 182. Hora (1941) has redefined the genus.

Genotype.—Balitora brucei Gray.

Distribution.—South India (Mysore) ; Northern India (Bhutan, Northern Bengal ; Sishak river, Chittagong Hills) ; Burma (Meekalan ; Pegu ; Sankha stream, Kamaing, Myitkyina District).

Key to the species of the genus Balitora *Gray.*

I. Pectorals missing or just reaching pelvics ; lower caudal lobe considerably longer than upper . . . *B. brucei.*

II. Pectorals extending beyond commencement of pelvics ; lobes of caudal almost equal in length . *B. maculata.*

Balitora brucei Gray.

1832. *Balitora brucei*, Gray, *Ill. Ind. Zool.*, **1**, pl. lxxxviii, fig. 1.

1920. *Balitora brucei*, Hora, *Rec. Ind. Mus.*, **19**, p. 197.

1932. *Balitora brucei*, Hora, *Mem. Ind. Mus.*, **12**, p. 291, pl. x, fig. 1, pl. xi, fig. 5 ; pl. xii, fig. 2.

D. 3/8 ; A. 2/5 ; P. 10/11-12 ; V. 2/9 ; C. 17 ; Ll. 70 ; L. tr. 10/7.

Head contained 6·5 and depth of body about 11 to 13·5 times in total length. Head slightly longer than broad, its width contained about 0·8 in its length. Diameter of eye contained 6·6 in head, 3·6 in snout and about 2·7 in interorbital space. Snout broad and trenchent. Least depth of caudal peduncle contained about three times in its length.

This type and well known species of the genus *Balitora* is represented in the collection of the Zoological Survey of India, Indian Museum, by a fine series of specimens obtained from Darjeeling and the Khasi Hills in Assam.

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
1509	Darjeeling.	Purchased from F. Day.	1 specimen. Bad state of preservation.
F. 9857-9/1	Cherrapunji, Assam	Bourne.	3 specimens. Partly damaged.
F. 10239/1	Tang-Siang stream Cherrapunji, Assam.	S. L. Hora .	8 specimens.
F. 11092/1	Non-priang stream below Cherrapunji, Assam.	Do.	3 specimens.
F. 685/2	Right bank of Kauala river, N. E. of Jainagur Railway stn., Darbhanga Dt., Bihar.	Do.	2 specimens.

Three geographical races of *Balitora brucei* are recognised at present. They are *B. brucei mysorensis* Hora in Mysore, South India ; *B. brucei burmanicus* Hora in Burma and *B. brucei melanosoma* Hora on the Burma-Siam border. These are dealt with below.

Balitora brucei var. mysorensis Hora.

1941. *Balitora brucei* var. *mysorensis*, Hora, *Rec. Ind. Mus.*, **43**, p. 232, pl. viii, fig. 4.

D. 3/9 ; A. 2/5 ; P. 9/12 ; V. 2/9 ; C. 19 ; L. 1.68.

Head contained 4·3 in standard and 5·64 in total length. Depth of body contained 7·6 and 9·8 width of head contained 1·41 and height of head at occiput 2·23 in its length. Diameter of eye 5·56 in head ; 3·44 in snout and 1·81 in interorbital space. Snout more or less pointed. Least height of caudal peduncle contained 3 times in its length.

Locality.—South India (Sivasamudram, Mysore State).

In addition to the type preserved in the collection of the Zoological Survey of India, I have recently examined a few more specimens of this variety, of which one is deposited in the collection.

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 13512/1	Sivasamudram, alt. 1500—2000 ft., Mysore State, S. India.	B. S. Bhimachar.	1 specimen.
F. 686/2	Mysore.	E. G. Silas	1 specimen.

Balitora brucei var. **burmanicus** Hora.

1932. *Balitora brucei* var. *burmanicus*, Hora, *Mem. Ind. Mus.*, **12**, p. 291.

This variety of *B. brucei* differs from the *forma typica* in having a more narrower body, more elongate head and darker colouration. It is represented in the collection of the Zoological Survey of India by a good series of specimens.

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11034/1 (Type).	Meekalan, Burma	Genova Museum.	3 specimens.
F. 10284/90	Pegu, Burma	N. Theobald	6 specimens.
F. 11042/1	Shishak river, Chittagong Hills.	R. P. Mullon	4 specimens.
F. 10886/1	Sankha stream, Kamaing and Mogaling, Myitkyina District, N. Burma.	B. N. Chopra.	1 specimen.
F. 656/2	Mooleyit, Burma	U. S. Nat. Mus.	1 specimen.

Balitora brucei var. **melanosoma** Hora.

1932. *Balitora brucei* var. *melanosoma*, Hora, *Mem. Ind. Mus.*, 12, p. 291.

For a specimen of *Balitora brucei* (No. 1920., 9. 8. 11) in the collection of the British Museum, Hora (*op. cit.*), gave a subspecific rank and designated it as *melanosoma*. Intermediate between the *forma typica* and the Burmese race, *B. brucei burmanicus*, it is a melanic variety in which the dorsal surface, except the tips of the fins, are dirty white in colour.

Locality.—Lower Burma (Thaungyiu River, (Megla stream) on the Burma-Siam border).

Balitora maculata Gray.

1920. *Balitora maculata*, Hora, *Rec. Ind. Mus.*, **19**, p. 199, fig. 2., pl. xi, fig. 1.
1932. *Balitora maculata*, Hora, *Mem. Ind. Mus.*, **12**, p. 291.

D. 2/9 ; A. 2/5 ; P. 19 ; V. 2/7 ; C. 17 ; L. 1. 70.

Head contained 5·5 and depth of body 9·5 to 10 in standard length. Diameter of eye contained 8 in head, 4 to 4·2 in snout. Head about as long as broad. Snout broadly rounded. Pectorals overlap pelvics.

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 9860-651/1	Darjeeling	N. Wallich	2 specimens (in bad state of preservation).

Balitoropsis Smith.

1945. *Balitoropsis*, Smith *Bull. U. S. Nat. Mus.*, **188**, p. 278.

Body more or less cylindrical ; anteriorly slightly depressed. Head greatly depressed and obtusely pointed ; abdomen and under surface of head flattened. Depth of body and width at origin of dorsal about equal. Mouth small, moderately arched and subterminal. A deep narrow groove extending around the corners of mouth. Well developed rostral barbels in two closely approximated groups, occupying a median rostral lobe ; nostrils large, separated by a flap. Lips finely papillated, upper lip covering upper jaw, lower lip leaving the sharp edged of lower jaw exposed. Scales on back and sides carinated. Head and anterior part of abdomen scaleless. Gill openings oblique, extending to ventral surface for short distance. Vent situated much nearer pelvic base than origin of anal fin. Dorsal arising in advance of pelvics. Pectorals with 14 rays of which 4 rays are simple. Pectorals separated from pelvics by a considerable distance. Pelvics extend far beyond anal opening, but fall short of anal fin. Pelvics with 10 rays of which 2 outer rays are simple. Top and sides of head thickly covered with papillae which are absent on the ventral surface.

Genotype.—Balitoropsis bartschi Smith.

Distribution.—Peninsular Siam (Kao Chang, Trang Province).

Balitoropsis bartschi Smith.

1945. *Balitoropsis bartschi*, Smith, *Bull. U. S. Nat. Mus.*, **188**, p. 279, fig. 56.

D. 2/7 ; A. 2/5 ; P. 4/10 ; V 2/8 ; L. 1. 44 ; L. tr. 7/1/6.

Head 4·4 in standard length ; depth of body equals length of head. Diameter of eye 5 in head, 2·5 in snout and 2 in interorbital space. Eyes situated in posterior half of head. Scales in predorsal region 13. Least depth of caudal peduncle contained 1·8 in its length. For detailed diagnosis reference may be made to the description of the genus.

Locality.—Stream on Kao Chong in Trang Province, Peninsular Siam.

Sinohomaloptera Fang.

1932. *Sinohomaloptera*, Hora, *Mem. Ind. Mus.*, **12**, p. 288.
1938. *Sinohomaloptera*, Herre, *Lingnan Sci., Journ., Canton*, **17**, p. 429.
1943. *Homaloptera*, Nichols, *Nat. Hist. Cent. Asia*, **9**, p. 220.
1949. *Sinohomaloptera*, Chen & Liang, *Quart. Journ., Taiwan Mus.*, **2**, (4). p. 161.

For the diagnostic characters of *Sinohomaloptera* reference may be made to the key for the genera on page 182. For a detailed description of the genus, Hora (*loc. cit.*) may be consulted.

Genotype.—*Sinohomaloptera kwangsiensis* Fang.

Distribution.—Cheng Kon Tsuen, Hainan ; Kwangsi ; China.

Remarks.—Fang (1930, *vide supra*, p. 187) distinguished *Sinohomaloptera* from *Homaloptera* on the nature of the basipterygium and the modified ribs. Herre (1938) described a new species, *S. hoffmanni* from Hainan in China. In the possession of a pair of barbels at each angle of the mouth *Sinohomaloptera* shows affinities to the Malayan genus *Neohomaloptera*. But the rostral fold, papillate lips and larger number of rays in the paired fins distinguishes it from *Neohomaloptera*.

Key to the species of the genus Sinohomaloptera *Fang.*

I. Pectorals 7/11 ; scales on lateral line 61 to 64 ; snout less than two times in head ; pelvics extending beyond anal opening for a short distance — *S. hoffmanni.*

II. Pectorals 8/12 ; scales on lateral line 66 ; snout more than two times in head ; pelvics do not reach anal opening — *S. kwangsiensis.*

Sinohomaloptera hoffamanni Herre.

1938. *Sinohomaloptera hoffmanni*, Herre, *Lingnan Sci, Journ.*, **17**, p. 429, fig. 1.
1943. *Homaloptera* (*Octonema*) *hoffmanni*, Nichols, *Nat. Hist. Cent. Asia*, 9, p. 221.

D. 3/7 ; A. 2/5 ; P. 7/11 ; V 2/8 ; L. 1. 61-64.

Head 4·4 to 4·5 and depth of body 6·9 to 7·1 in total length. Diameter of eye 5·8 in head and 3·2 in snout. Length of snout is 1·8 in head Interorbital space twice diameter of eye. Least depth of caudal peduncle contained 2·25 in its length. Dorsal originates ahead of pelvics and is situated closer to tip of snout than to base of caudal.

Locality.—Cheung Kon Tsuen, Hainan, China.

Sinohomaloptera kwangsiensis Fang.

1930. *Homaloptera* (*Sinohomaloptera*) *kwangsiensis*, Fang, *Sinensia*, **1**, (3), p. 27
1930. *Sinohomaloptera kwangsiensis*, Fang, *Contr. Biol. Lab. Sci. Soc. Canton.* (*Zool, Ser.*), **6**, p. 26.
1932. *Sinohomaloptera kwangsiensis*, Hora, *Mem. Ind. Mus.*, **12**, p. 289.
1943. *Homaloptera* (*Sinohomaloptera*) *Kwangsiensis*, Nichols, *Nat. Hist. Cent Asia*, **9**, p. 222.
1949. *Sinohomaloptera kwangsiensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 161.

D. 2/8 ; A. 2/5 ; P. 8/12, V. 2/8 ; L. 1.66.

Head contained 4·73 and width of body 5·74 in standard length. Head longer than broad, and its width contained 1·41 in its length. Snout slightly less than half length of head. Interorbital width contained 2·83 in head. Eyes moderately large, its diameter contained 5·5 in head. Origin of dorsal slightly ahead of pelvics, and nearer tip of snout than to base of caudal.

Locality.—Kwangsi China.

Specimens examined :—

Register No.	*Locality.*	*Donor or collector.*	*No. of specimens.*
F. 11111/1	Kwangsi, China	Met. Mus. Nat. Hist. Nanking.	1 specimen.

Lepturichthys Regan.

1932. *Lepturichthys*, Hora, *Mem. Ind. Mus.*, **12**, p. 29.
1933. *Lepturichthys*, Fang, *Sinensia*, **4**, (3), p. 48.
1943. *Lepturichthys*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 222.
1949. *Lepturichthys*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 162.

For the diagnostic characters of *Lepturichthys* reference may be made to the key for the genera on page 182. The genus was redefined by Hora in (1932).

Genotype.—*Lepturichthys fimbriata* (Günther).

Distribution.—Upper Yangtse Kiang River ; Min river ; Szechuan, Ichang, Hupeh Province ; Tungtin Lake, Hunan Province ; China.

Remarks.—Regan (1911), created the genus *Lepturichthy* for Günther's species *Homaloptera fimbriata*, and in briefly defining it brought out its differences from that of *Homaloptera*. Later Nichols (1928) assigned several specimens collected from Tungting Lake to *L. fimbriata* (Günther). Hora (1932) differentiated the known specimens of *L. fimbriata* into three species, and defined the genus *Lepturichthys* as : " Tail long and slender, least height of caudal peduncle less than diameter of eye ; fimbriated lips ; three barbels at each angle of the mouth." For the interrelationships of *Lepturichthys* with the other Chinese Homalopteriadae reference may be made to the discussion on page 247.

Key to the species of the genus Lepturichthys *Regan.*

I. Greater part of dorsal surface of head and body smooth ; low keels on scales in tail region and some keels on scales on anterior part of body provided with spinous projections at their ends.

  A. Seven anterior simple rays in the pectoral ; longest ray of dorsal shorter than head . . *L. fimbriata.*

  B. Nine anterior simple rays in pectoral ; longest ray of dorsal much longer than head . . . *L. güntheri.*

II. Entire dorsal surface of head and body covered with wart-like spinous processes ; large scales in front of dorsal with 3 or 4 warts on their distal borders *L. nicholsi.*

Lepturichthys fimbriata (Günther).

1932. *Lepturichthys fimbriata*, Hora, *Mem. Ind. Mus.*, **12**, p. 294.
1933. *Lepturichthys fimbriata*, Fang, *Sinensia*, **4**, (3), p. 49.
1943. *Lepturichthys fimbriata*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 220-233.
1949. *Lepturichthys fimbriata*, Chen & Liang, *Quart. Journ., Taiwan Mus.*, **2**, p. 162.

D. 3/8 ; A. 2/5 ; P. 7/11-12 ; V. 3/8.

Head contained 6·3 in standard and 7·2 in total length. Depth of body contained 12·6 in standard and 14·5 in total length. Height at occiput half width of head, which in turn is contained 1·1 times in length of head. Diameter of eye contained 6·4 in head, 3·7 in snout and 2·5 in interorbital space. Length of caudal peduncle contained 3·8 in standard length. Least depth of caudal peduncle contained 16 times in its length.

Locality.—Ichang ; Hupen Province, China.

Lepturichthys güntheri Hora.

1932. *Lepturichthys güntheri*, Hora, *Mem. Ind. Mus.*, **12**, p. 295.
1933. *Lepturichthys güntheri*, Fang, *Sinensia*, **4**, (3), p. 49.
1943. *Lepturichthys güntheri*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 225.
1949. *Lepturichthys güntheri*, Chen & Liang, *Quart. Journ. Taiwan Mus* ,**2**. p. 162.

D. 3/8 ; A. 2/5 ; P. 9/11-12 ; V 3/9.

Head contained 6·2 to 6·9 and depth of body 11 to 11·5 in standard length. Width of head contained 1·2 times and height at occiput 2 to 2·2 in its length. Diameter of eye contained 6·6 to 7·7 in head, 4 to 4·5 in snout and 2·8 to 3 in interorbital space. Length of caudal peduncle contained 2·9 to 3·2 in standard length. Its least height contained 19 to 23 times in its length.

Locality.—Min River, Szechuan, China.

Lepturichthys nicholsi Hora.

1932. *Lepturichthys nicholsi*, Hora, *Mem. Ind. Mus.*, **12**, p. 297.
1933. *Lepturichthys nicholsi*, Myers, *Copia*, **2**, p. 109.
1933. *Lepturichthys nicholsi*, Fang, *Sinensia*, **4**, (3), p. 50.
1943. *Lepturichthys nicholsi*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 225.
1949. *Lepturichthys nicholsi*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 162.
1950. *Lepthurichthys nicholsi*, Hora, *Rec. Ind. Mus.*, **48**, p. 52.

D. 3/8 ; A. 2/5 ; P. 7-8/11 ; V 3/7.

Head contained 5·9 to 6·1 and depth of body 10 to 11 in standard length. Width of head contained 1·2 and height at occiput 2·1 to 2·2 in its length. Diameter of eye contained 6·1 to 6·3 in head, 3·3 to 3·5 in snout and 2·4 in interorbital space. Length of caudal peduncle contained 3·3 to 3·4 in standard length. Least height of caudal peduncle contained 17 to 18 times in its length.

Locality.—Tungting Lake, Hunan, China.

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11093/1	Tungting Lake, Hunan, China.	Amer. Mus. Nat. Hist.	1 specimen. Caudal and pectoral on one side damaged.
F. 668/2	Do.	Do.	2 specimens.

Remarks.—*L. nicholsi* is readily distinguished from *L. fimbriata* and *L. güntheri*, by the rugose condition of the entire dorsal surface. Myers (1933) threw doubts on the validity of *L. nicholsi* and stated that the wart-like "processes may be nothing more than nuptial tubercles". Hora (1950), after an examination of a number of specimens of *L. nicholsi* in the collection of the American Museum of Natural History has confirmed his earlier findings, *viz.*, that *L. nicholsi* is a distinct species.

The type-specimen of *L. nicholsi* (F. 11098/1), preserved in the collection of the Zoological Survey of India, seems to have been lost, most probably in the floods of the Varuna River at Banaras in September 1943. All the present specimens are, however, paratypes.

Hemimyzon Regan.

1932. *Hemimyzon*, Hora, *Mem. Ind. Mus.*, **12**, p. 298.
1949. *Hemimyzon*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, *2*, (4), p. 162.

For the diagnostic characters of *Hemimyzon* reference may be made to the key for the genera on page 183. The genus was redefined by Hora in 1932.

Genotype.—*Hemimyzon formosanum* (Boulenger).

Distribution.—China (Yao-tan, Luchow; Leang-Chang-Shien in Szechuan; Min river, Szechuan; Taiko river in central Formosa).

Remarks.—The genus was erected by Regan (1911) to accommodate Boulenger's *Homaloptera formosanum* from Formosa. Since then 4 more species from China have been added to this genus. Fang (1930) and Hora (1931) included *Psilorhynchus sinensis* Sauvage & Dabry (1874), under *Hemimyzon*. Hora (1931) assigned *Homaloptera abbreviata* Günther to this genus. Later in 1932 he showed that Fang's species *Sinohomaloptera yaotanensis* and *S. acuticauda*, rightly belonged to *Hemimyzon*. Since then no new additions have been made to the genus.

Key to the species of the genus Hemimyzon *Regan.*

1. Pectorals with 20 to 21 rays and pelvics with 12 rays—

A. Scales spinous; caudal lobes roundish; L.1·71 . . . *H. yaotanensis.*

B. Scales smooth; caudal lobes pointed; L.1·72 . . . *H. acuticauda.*

II. Pectorals with 22 to 26 rays and pelvics with 15 to 18 rays—

A. Scales smooth; anterior nostril in a short tubule; Pectorals extending beyond origin of pelvics.

1. Caudal much longer than head ; D. 3/8 ; A. 2/5 ; L. 1·75. .. .. *H. abbreviata*

2. Caudal as long as head ; D. 2/7 ; A. 1/5 ; L. 1·70 *H. formosanum.*

B. Scales keeled; anterior nostril with two flaps, the secondary minute; pectorals just reaching origin of pelvics. .. .. *H. sinensis.*

Hemimyzon yaotanensis (Fang).

1949. *Hemimyzon yaotanensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, p. 161.

D. 2/8 ; A. 2/5 ; P. 8/12 ; V 4/8 ; L. 1.71.

Head contained 4·81 and depth of body 7·53 in standard length. Width of head in its length 1·41 ; diameter of eye 6·25 in head. Snout 1·79 and interorbital space 2·72 in head. Depth of caudal peduncle 2·4 in head ; its length 1·34. Width of mouth 2·14 in snout.

Locality.—China (Yao-tan, Wachang ; Luchow, Szechuan).

Hemimyzon acuticauda (Fang).

1931. *Sinohmaloptera yaotanensis acuticauda*, Fang, *Sinensia*, **I**, (9), p. 143.

1949. *Hemimyzon acuticauda* Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 161.

D. 2/8 ; A. 2/5 ; P. 8/12 ; V 4/8 ; L.1.72.

Head contained 4·69 and depth of body 7·57 in standard length. Width of head in its length 1·12. Diameter of eye in head 5·65. Snout in head 1·74 and interorbital width 2·82. Depth of caudal peduncle 2·75 and its length 1·57 in head. Width of mouth 2·32 in snout.

Locality.—China (Yao-tan, Wa-chang, Luchow, Szechuan).

Hemimyzon abbreviata (Günther).

1932. *Hemimyzon abbreviata*, Hora, *Mem. Ind. Mus.*, **12**, p. 301.

1949. *Hemimyzon abbreviata*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, p. 161.

D. 3/8 ; A. 2/5 ; P. 12/12 ; V 3/12 ; L. 1.75.

Head contained 5·3 to 5·5 in standard and 6·8 to 7·2 in total length. Depth of body 7·5 in standard length. Head little over twice its height at occiput and 1·4 times its width in front of base of pectoral. Snout considerably more than half length of head. Diameter of eye contained 6·5 in head ; 4 in snout and nearly 3 in interorbital width. Gape of mouth contained slightly over two times in width of head and 3 in its length. Origin of dorsal behind that of pelvics, but much nearer tip of snout than to base of caudal. Pectorals reach base of pelvics. Pelvics separated from anal opening by a short distance. Caudal peduncle long and narrow, its least height contained 4·3 to 4·5 in its length.

Locality.—China (Min river Drainage, Szechuan).

Hemimyzon formosanum (Boulenger).

1919. *Hemimyzon formosanum*, Oshima, *Ann. Carnegie Mus.*, **12**, p. 196.
1932. *Hemimyzon formosanum*, Hora, *Mem. Ind. Mus.*, **12**, p. 299.
1949. *Hemimyzon formosanum*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 162.

D. 2/7 ; A. 1/5 ; P. 22(11/11) ; V. 15-16 ; L. 1.70.

Head contained 5 times and depth of body 7 times in total length. Diameter of eye contained 6 in head and 3 in snout. Interorbital width 2·33 in length of head. A pair of barbels at each angle of the mouth. Scales smooth. Pectorals overlap pelvics.

Locality.—Formosa (Taiko river).

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F.666/2	Karoton, Formosa.	Am. Mus. Nat. Hist.	2 specimens.

Hemimyzon sinensis (Sauvage & Dabry).

1930. *Hemimyzon sinensis*, Fang, *Contr. Biol. Lab. Sci. Soc. China*, **6**, (4), p. 30.
1932. *Hemimyzon sinensis*, Hora, *Mem. Ind. Mus.*, **12**, p. 299.
1949. *Hemimyzon sinensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 161.

D. 3/9 ; A. 1/6 ; P. 12/14 ; V 4/14 ; L. 1.69.

Head contained 5·10 and depth of body 8·3 in standard length. Width of head in its length 1·37. Diameter of eye in head 10. Snout in head 2·66 and interorbital space 2·94. Depth of caudal peduncle 2·55 in head, and its length 0·80. Width of mouth about equal to length of snout.

Locality.—China (Loochow, Szechuan).

Sinogastromyzon Fang.

1931. *Sinogastromyzon*, Fang, *Sinensia*, **2**, (3), p. 48.
1932. *Sinogastromyzon*, Hora, *Mem. Ind. Mus.*, **12**, p. 302.
1935. *Sinogastromyzon*, Pellegrin & Fang, *Bull. Soc. Zool.*, **40**, p. 232.
1944. *Sinogastromyzon*, Chang, *Sinensia*, **15**, p. 53.
1949. *Sinogastromyzon*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 162.

The diagnostic features of *Sinogastromyzon* are given in the key to the genera on page 182. For a detailed description reference may be made to Fang (1931) and Hora 1932.

Genotype.—*Sinogastromyzon wui* (Fang).

Distribution.—China (San-fang, Lo-Ching-shien and Tung-kwei, Lung-chow, Kwangsi ; Hsia-shih, Ma-ha-hsien, Kweichow ; Anning river near Taihoechang ; Sichang ; Szechuan ; San-ho-shien, South Kwei-chow) ; Indo-China (Tonkin).

Remarks.—The genus is at present known from seven species distributed in Central and Southern China and Indo-China. *Sinogastromyzon* superficially resembles *Gastromyzon* of the family *Gastromyzonidae.* Hora (1932) recognised two species of *Sinogastromyzon, viz., S. wui* Fang and *S. szechuanensis* Fang. Fang (1930) described *S. hsiashiensis, S. sanhoensis* and *S. intermedius,* all from China. Pellegrin and Chevey (1935) reported a new species, *S. tonkinensis* from Indo-China. In 1944 Chang described *S. sichangensis* from Sichang Province, China.

Key to the species of the genus Sinogastromyzon *Fang.*

I. Pelvic fin with a well developed muscular base; upper surface of pectoral and pelvic base and part above and below pelvic origin scaleless; scales without dermal ridges; anal with two anterior simple rays or with a spine consisting of two coalacent (spine is separable into two rays) anterior simple rays—

A. Lateral line scales 52 to 64—

1. Anal with two simple rays; sides of body covered by free portion of pectoral partly scaly; scales keeled. L. 1·64. .. .. .. *S. szechuanensis.*

2. Anal with a spine consisting of two coalacent anterior simple rays; sides of body covered by free portion of pectorals entirely scaleless. Scales not keeled.

a. L. l. 52; P. 12/15; V. 8/15; L. tr. 9½/7 *S. tonkinensis.*

b. L. l. 57-61; P. 12/13; V. 7/11/3; L. tr. 10½/2½. .. .. .. *S. hsiashiensis.*

B. Lateral line scales 73-75 .. .. *S. sichangensis.*

II. Pelvic fin without or with only slightly marked muscular base. Pectoral and pelvic base and part above and before pelvic origin scaly; scales more or less with dermal ridges; anal with a strong laterally grooved spine consisting of two coalacent anterior simple rays—

A. Sides of body before pelvic origin partly scaly—

1. Scaleless portion restricted to anterior ½ the length from the pectoral axil to the pelvic origin; anal spine smooth at its posterior edge; L. l. 61-63. .. .. *S. wui.*

2. Scaleless portion restricted to ½ or more the length from the pectoral axil to the pelvic origin. Anal spine finely serrated at its posterior edge. L. l. 53-58. .. .. .. *S. sanhoensis.*

B. Sides of body before pelvic origin scaleless (and below the line drawn from the pelvic origin to posterior insertion of pectoral scaleless entirely. Anal spine finely serrated at its posterior edge. L. l. 61). .. .. *S. intermedius.*

Sinogastromyzon szechuanensis Fang.

1943. *Sinogastromyzon szechuanensis,* Nichols, *Nat. Hist. Central Asia,* ?, p. 233.

1949. *Sinogastromyzon szechuanensis,* Chen & Liang, *Quart. Journ. Taiwan Mus.,* 2, (4), p. 163.

D. 2/8 ; A. 2/5 ; P. 12/13 ; V 21(6-8/13-14) ; L.l· 64 ; Ltr. 11/9½.

Head contained 4·8 and depth of body 7·42 in standard length. Head about as long as broad. Diameter of eye 5·8 in head. Snout 1·8 and interorbital space 2·6 in head. Least depth of caudal peduncle 2·6 and its length 1·7 in length of head. Width of mouth in snout 1·4.

Locality.—China (Szechuan).

I have examined a specimen of this species, recently received on loan from the university of Michigan, Ann Abor, U.S.A.

Sinogastromyzon tonkinensis Pellegrin & Chevey.

1935. *Sinogastromyzon tonkinensis*, Pellegrin & Chevey, *Bull. Soc. Zool.* **40**, p. 232, fig. 1.

D. 2/8 ; A. 1/5 ; P. 12/15 ; V 8/15 ; L. 1·52 ; L. tr. 9½/7.

Head contained 5 in standard and 6 in total length. Depth of body contained 6·2 in standard and 7·5 in total length. Head considerably broader than long. Snout broad, with trenchent margins ; its length about 1·5 in head. Diameter of eye about 5·5 in head ; 3·5 in snout and about 3 in interorbital width. Least depth of caudal peduncle 1·75 in its length. Depth of caudal peduncle in head about 3·2 and its length about 1·5.

Locality.—Indo-China (Lai Ahau ; Tonkin).

Sinogastromyzon hsiashiensis Fang.

1931. *Sinogastromyzon hsiashiensis*, Fang, *Sinensia*, **2**, (3), p. 48, fig. 3-5.

D. 2/8 ; A. 1/5/1 ; P. 12/13 ; V 7/11/3 ; L. 1.57-61 ; L. tr. 10½/2½.

Head contained 4·5 and depth of body 5·9 to 6 in standard length. Head broader than long and its width contained 0·95 in its length. Diameter of eye in head 5·4. Snout 1·52 and interorbital width 2·34 in head. Depth of caudal peduncle 2·9 in head and its length 1·96. Width of mouth 1·44 in snout.

Locality.—China (Hsia-shih, Ma-ha-asien, Kweichow).

Sinogastromyzon sichangensis Chang.

1944. *Sinogastromyzon sichangensis*, Chang, *Sinensia*, **15**, p. 63.

D. 2/8 ; A. 2/5 ; P. 11-12/12-13 ; V 6-7/8-11 ; L. 1·73-75 ; L. tr. 12/9.

Head contained 4·7-4·8 and depth of body 5 to 6·3 in standard length. Head much broader than long and its width equal 0·8 to 0·9 in its length. Snout 1·8 to 1·9 and interorbital space 2 to 2·4 in head. Origin of dorsal much nearer to tip of snout than to base of caudal. Anal with two anterior simple rays. The much larger number of scales in the lateral line distinguishes this species from the other members of the genus.

Locality.—China (Anning River, Tai Hochang, Sichang).

Sinogastromyzon wui Fang.

1930. *Sinogastromyzon wui*, Fang, *Sinensia*, **1**, (3), p. 36.
1931. *Sinogastromyzon wui*, Fang, *Sinensia*, **2**, (3), p. 53.
1932. *Sinogastromyzon wui*, Hora, *Mem. Ind. Mus.*, **12**, p. 303.

D. 2/8 ; A. 1/5 ; P. 12/10-16 ; V 8/15 ; L.l.61-63.

Head contained 4·3 and depth of body 6·1 in standard length. Head about as long as broad. Diameter of eye in head 4·8. Snout in head 2·1 and interorbital width 2·41. Depth of caudal peduncle in head 2·1 and its length 2·3 ; width of mouth 1·5 in snout.

Locality.—China (San-fang, Lo-ching-shien ; and Tung-Kwei, Lung-Chow in Kwangsi).

Sinogatromyzon sanhoensis Fang.

1931. *Sinogastromyzon sanhoensis*, Fang, *Sinensia*, **2**, (3), p. 56, fig. 9.
1943. *Sinogastromyzon sanhoensis*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 233.
1949. *Sinogastromyzon sanhoensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 163.

D. 2/8 ; A. 1/5 ; P. 14/15 ; V. 8/12 ; L. 1.53-58 ; L. tr. $8\frac{1}{2}/8\frac{1}{2}$-9.

Head 4·9 and depth of body 6·4 in standard length. Width of head in its length 1·16. Diameter of eye 5·65. Snout in head 1·68 and interorbital width 3·3. Depth of caudal peduncle in head 2·91 and its length 1·46. Width of mouth in snout 2·1.

Locality.—China (San-ho-shien, South Kweichow).

Specimens examined :—

Register No.	*Locality.*	*Donor or collector.*	*No. of specimens.*
F. 667/2	....	..	1 specimen.

Sinogastromyzon intermedius Fang.

1930. *Sinogastromyzon wui*, Fang (in part), *Sinensia*, **1**, (3), pp. 36-41.
1931. *Sinogastromyzon intermedius*, Fang, *Sinensia*, **2**, (3) pp. 54-56.

D. 2/8 ; A. 1/4/1 ; P. 12-13/12-13 ; V 8/12/1 ; L. 1·61 ; L. tr. $8\frac{1}{2}/8\frac{1}{2}$.

Head contained 3·75 and depth of body 6 in standard length. Head about as long as broad. Diameter of eye 5·92 in head. Snout 2·3 in head and interorbital width 2·96. Depth of caudal peduncle 2·55 in head and its length 1·85. Width of mouth 1·5 in snout.

Locality.—China (Tung-Kwei, Lung-Chow, South Western Kwangsi).

Metahomaloptera Chang.

1944. *Metahomaloptera*, Chang, *Sinensia*, **16**, p. 54.

A short description of the genus *Metahomaloptera* after Chang (*loc. cit.*), is given below :

Head and anterior part of body greatly depressed, while tail region is compressed from side to side. Ventral profile in front of pelvics flattened and horizontal. Snout broadly pointed. Mouth small, inferior, cresent shaped and less than one-third in width of head. Upper lip narrow,

possessing a single row of papillae; lower lip plain and thin. Both jaws provided with sharp horny edges. 8 minute barbels, 4 rostral and 4 maxillary. Gill-openings small, cresent shaped and restricted to considerably above base of pectoral fin. Width of gill opening about twice diameter of eye. Body covered with small cycloid scales. Lateral line straight and complete with 70 to 75 scales along it. Dorsal originates midway between tip of snout and base of caudal or slightly nearer the latter. Pectoral overlaps pelvics and possesses 20 to 23 rays of which 9 to 11 are simple. Pelvics completely united posteriorly to form a suctorial disc; its origin slightly ahead of that of dorsal. Pelvics with 17 to 21 rays of which anterior 5 to 8 are simple, middle 7 to 12 branched and posterior 2 to 4 simple. A muscular band present above pelvic base. Anal reaches caudal which is slightly emarginate and is about as long as head. Vent situated immediately in front of anal fin.

Genotype.—*Metahomaloptera omeiensis* Chang.

Distribution.—China (Loshan and Omei).

Remarks.—This monotypic genus, like *Bhavania* of South India, is remarkable among the Homalopteridae in possessing very small gill-openings, a condition which is also seen in several genera of the family Gastromyzonidae. The United pelvics and the greatly restricted gill-openings give *Metahomaloptera*, a place in the Homalopteridae similar to that of *Gastromyzon* among the Gastromyzonidae.

Metahomaloptera omeiensis Chang.

1944. *Metahomaloptera omeiensis*, Chang, *Sinensia*, **16**, p. 54.

D. 2/7-9 ; A. 2/5 ; P. 20-23(9-10/10-13) ; V 17-21(5-8/7-12/2-4) ; L.l·70-75.

Head 4·6 to 5·1 and depth of body 4·4 to 6·2 in standard length. Depth of head in its length 1·5 to 1·8 ; width of head 0·7 to 0·8. Diameter of eye 4·6 to 5·5. Snout in head 1·6 to 2 and interorbital space 1·7 to 2. Least depth of caudal peduncle 2·7 to 3 in head and its length 1·9 to 2·5. Origin of dorsal equidistant from tip of snout and base of caudal.

Locality.—China (Loshan and Omei).

VI.—DOUBTFUL HOMALOPTERIDAE.

? Juvenile Homalopterid.

? *juvenile Homalopterid*, Silas, *J. Zool. Soc. India*, **3**, (1), p. 14, fig 1.

A peculiar Homalopterid was recently described (Silas, 1951) from Borneo. This form is characterized by the following important features :

D. 3/7 ; A. 1/4 ; P. 7/14 ; V 5/11 ; C. 17.

Snout broadly rounded ; Lips thin, non-papillated, continuous at angles of mouth. Four rostral barbels ; a pair of barbels at each corner of the mouth. Gill-openings extend to opposite base of pectoral fin. Dorsal commences in advance to pelvics and is placed nearer base of

caudal than to tip of snout. Pectoral reaches pelvic base. Pelvics free from each other and not uniting to form a disclike structure.

For detailed diagnosis reference may be made to Silas (*op. cit.*).

Locality.—Borneo (Sarawak).

VII.—FAMILY GASTROMYZONIDAE.

Fishes of the family Gastromyzonidae are small loach-like, hill-stream fishes in which the body is moderately or greatly depressed and the ventral profile is straight and horizontal. Paired fins are horizontally placed and the number of unbranched rays in each is only one. Outer rays of the paired fins are provided with adhesive pads on the ventral surface to help in adhering to rocks in the swift currents. Mouth is subterminal or inferior. Dorsal and anal fins are short. Body is covered with small cycloid scales which are absent on head and on a part or whole of ventral surface. Lateral line is well marked and always extends to base of caudal fin. Gill-openings are either greatly restricted, extending above base of pectorals or of moderate size, extending to opposite base of pectorals dorsally or in some cases to ventral surface for a short distance. Gill-membranes are united with the isthmus and pseudobranchiae are absent.

Internal Characters.—Subtemporal fossae are very shallow and in highly specialized forms, such as *Gastromyzon*, are hardly recognisable. Basipterygium is without a lateral foramen, but is provided with a lateral horn. A ligament connects medial process of modified rib with lateral horn of basipterygium. Some of the other skull characters which are characteristic of the Gastromyzonidae are :

Premaxilla with a long backwardly directed limb ; median limb of premaxilla does not come to lie dorsally to the median rostral bone. Median rostral flattened and cruciform in shape. The preethmoids are lateral to the ethmoid and bear a crescentic suture in the latter. Lateral rostral, flat and articulates with the anterior edge of the preethmoid. Maxilla articulates with the lateral rostral. A backwardly projecting spine from the basioccipital present. Supraethmoid is comparatively small. Parahyoid shows a wing-like process both anteriorly and posteriorly.

Distribution.—Eastern and Southern China, Formosa, Indo-China and Borneo. No member of the family has yet been recorded from Siam, Burma, India, Malaya Peninsula, Sumatra and Java.

Key to the subfamilies of the family Gastromyzonidae.

I. Gill-openings of moderate size, extending to ventral surface of body for a short distance. .. .. *Crossostominae.*

II. Gill-openings small and does not extend to ventral surface of body. .. .. *Gastromyzoninae.*

SUBFAMILY CROSSOSTOMINAE.

Fang (1935) recognised seven genera in this subfamily and expressed views on their relationships. Hora and Jayaram (1950) referred *Glaniopsis* Boulenger from Borneo to the Crossostominae. Besides

these, no new genus referrable to this subfamily has been described. Below is given a key to the identification of the different genera of the subfamily Crossostominae.

Key to the genera of the subfamily Crossostominae.

I. Definite rostral groove and rostral fold absent—

A. Rostral barbels 2 pairs—

1. Snout broad, rounded, mouth slightly arched; 7 to 8 rays in pelvics; P. 1/8-12. .. *Glaniopsis.*

2. Snout narrow, elongated, mouth greatly arched; 11 rays in pelvics; P. 1/16. .. .. .. *Annamia.*

B. Rostral barbels 13 and in several rows, closely applied to rostral fold forming a fringe round the snout. Barbels long. .. .. *Crossostoma.*

II. Definite rostral groove, partly covered by rostral fold, present. Primary rostral barbels partly covered by fold—

A. Mouth opening small, less than ¼ in width of head; strongly curved, nearly horse-shoe shaped. Two pairs of rostral barbels (P. 1/16-18; V. 1/8-10).

1. Ventral surface before and between pectorals devoid of scales. Rostral barbels produced from posterior edge of rostral fold; horse-shoe shaped rostral groove not well differentiated. P. 1/16; V. 1/8. .. .. *Liniparhomaloptera.*

2 Ventral surface before pelvics totally scaleless. Rostral barbels well separated from rostral fold. Horse-shoe shaped rostral groove extending posteriorly being divided at latero-posterior to mouth angle. P. 1/16-18; V. 1/10. .. .. *Parhomaloptera.*

B. Mouth opening of moderate size; more than ¼ in width of head; crescent shaped. Rostral barbels 4 to 13 in one, two or three rows. (P. 1/12-15; V. 1/8).—

1. 4 rostral barbels in one row; rostral fold distinctly trilobate; ventral side of body scaly, except before and between base of pectoral. .. .. *Vanmanenia.*

2. 7 to 13 rostral barbels in two or three rows. Five distinct or more indistinct lobes in the rostral fold. Ventral side of body upto one-third, anterior part of abdomen scaleless.

a. 7 rostral barbels in two indefinite rows *Praeformosania.*

b. 13 rostral barbels in two regular or three indefinite rows. .. .. .. *Formosania.*

Glaniopsis Boulenger.

1932. *Glaniopsis*, Hora, *Mem. Ind. Mus.*, **12**, p. 268.

1950. *Glaniopsis*, Hora & Jayaram, *Rec. Ind. Mus.*, **48**, p. 85.

For the diagnostic features of *Glaniopsis* Boulenger, reference may be made to the key for the genera on page 220. Recently Hora and Jayaram (*loc. cit*) redefined this genus from large series of specimens examined by them.

Distribution.—Borneo (Mount Kina Balu).

Glaniopsis hanitschi Boulenger.

1932. *Glaniopsis hanitschi*, Hora, *Mem. Ind. Mus.*, **12**, p. 268.
1950. *Glaniopsis hanitschi*, Hora & Jayaram, *Rec. Ind. Mus*, **48**, p. 85.

D. 2/6-7 ; A. 1/5 ; P. 1/8-12 ; V 1/7-8 ; C. 16-17.

Head contained 5 to 5·5 and depth of body 7 to 8·5 in total length. Head about as broad as long. Eyes small, diameter contained 5 to 8 in head ; 2 to 4 in snout and 2 to 3 in interorbital space. Least depth of caudal peduncle equals its length.

Locality.—Borneo (Mount Kina Balu).

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 676/2	Mt. Kina Balu, Borneo	Mus. Comp. Zool. Mass. Camb. U.S.A.	9 specimens.
F. 677/2	Do.	Do.	61 specimens.
F. 678/2	Do.	Do.	90 specimens.
F. 679/2	Do.	Do.	9 specimens.
F. 683/2	Do.	Do.	80 specimens.
F. 684/2	Do.	Do.	16 specimens.

Annamia Hora.

1930. *Parhomaloptera*, Hora (in part), *Ann. Mag. Nat. Hist.*, (10), **6**, p. 528-586.
1932. *Annamia*, Hora, *Mem. Ind. Mus.*, **12**, p. 306.

For a detailed description of this genus reference may be made to Hora (1932, p. 306).

Genotype.—Annamia normani (Hora).

Distribution.—Indo-China (Kontum in Annam).

Annamia normani (Hora).

1930. *Parhomaloptera normani*, Hora, *Ann. Mag. Nat. Hist.*, (10), **6**, pp. 582-586, pl. xv. (*Type specimen in British Museum*).
1932. *Annamia normani*, Hora, *Mem. Ind. Mus.*, **12**, p. 307.

D. 2/8 ; A. 1/5 ; P. 1/16 ; V 1/10 ; C. 18.

Head contained 5·1 and depth of body 10·2 in standard length. Greatest width of head about two-thirds and height about two-fifths in its length. Snout more than half length of head. Diameter of eye contained 4·3 in head ; 2·3 in snout and 1·3 in interorbital width. Least depth of caudal peduncle contained 2 to 2·5 in its length.

Locality.—Indo-China (Kontum in Annam).

Crossostoma Sauvage.

1932. *Crossostoma*, Hora, *Mem. Ind. Mus.*, **12**, p. 307.

1932. *Crossostoma*, Tchang, *Bull. Fan. Mem. Inst. Biol. Peiping*, **3**, pp. 121-125.

1934. *Crossostoma*, Herre, *Lingnan Sci. Journ. Canton*, **13**, p. 285.

1935. *Crossostoma*, Fang, *Sinensia*, **6**, pp. 44-97.

1943. *Crossostoma*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 227.

1949. *Crossostoma*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2** (4), p. 164.

For a detailed description of the genus reference may be made to Hora (*op. cit.*)

Genotype.—*Crossostoma davidi* Sauvage.

Distribution.—China (Fukin ; Kwantung).

Remarks.—Hora (1932) redefined *Crossostoma* and recognised three species under it. Fang (1935) opined that *Crossostoma* was monotypic, being known only from *C. davidi* Sauvage. Herre (1934) described *C. tinkhami* from Kwantung in China. Herre's species is identical with *C. fascicauda* Nichols. *C. stigmata* Nichols (1926) was described from juvenile specimens, but recently Hora (1950) after examining specimens of *C. stigmata* has found it to the conspecific with *C. fascicauda*. Fang (1935) assigned *C. fascicauda*, *C. stigmata* and *C. tinkhami* to the genus *Formosania* Oshima. Chen & Liang (1949) followed Fang's classification. After examining the excellent series of specimens of *C. fascicauda* and a few specimens of *C. davidi* in the collection of the Zoological Survey of India, Indian Museum and comparing them with the type species of *Formosania*, *viz.*, *F lacustre* (Steind.), I find that the species *fascicauda* belongs to *Crossostoma* and not to *Formosania*. The absence of a rostral groove, the well developed rostral barbels etc., easily distinguish *Crossostoma* from *Formosania*. Thus at present, *Crossostoma* is known from two species, *viz.*, *C. davidi* Sauvage and *C. fascicauda* Nichols, while the genus *Formosania* is monotypic.

Key to the species of the genus Crossostoma *Sauvage.*

I. Rostral barbels well developed ; Maxillary barbels much longer than diameter of eye .. .. *C. davidi.*

II. Rostral barbels short ; Maxillary barbels as long as or shorter than diameter of eye .. .. *C. fascicauda.*

Crossostoma davidi Sauvage.

1932. *Crossostoma davidi*, Hora, *Mem. Ind. Mus.*, **12**, p. 308, pl. xii, fig. 5.

1932. *Crossostoma davidi*, Tchang, *Zool. Sinica*, (B), **2**, fase 1, pp. 220-221, fig. 115.

1935. *Crossostoma davidi*, Fang, *Sinensia*, **6**, (1), p. 89, fig. 3.

1943. *Crossostoma davidi*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 228.

1949. *Crossostoma davidi*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2** (4), p. 164.

1950. *Crossostoma davidi*, Hora, *Rec. Ind. Mus.*, **48**, p. 48.

D. 3/8 ; A. 3/5 ; P. 1/13-15 ; V 1/8 ; L. 1.95-108 ; L. $tr_{.}$ $17\frac{1}{2}$-$18\frac{1}{2}$/$13\frac{1}{2}$-$14\frac{1}{2}$.

Head 4·1, depth of body 7·3 and width of body 6·5 in standard length. Width of head 1·33 to 1·5 in its length. Snout in head 1·7 to 2·5 ; interorbital space 2·5 to 3·25 ; depth of caudal peduncle 2·13 to 2·9 and its length 1·57 to 1·9. Diameter of eye in head 8·2 ; in snout 4·5 and 3·1 in interorbital space. Width of mouth 1·06 in snout.

Locality.—China (West Fukien, Yenping, Chung-an-hsien, Foochow and South Chekiang).

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens and state of preservation.*
F. 12231/1	Fukein, China.	P. W. Fang.	1 specimen, Caudal fin damage.
F. 660/2	Do.	Amer. Mus. Nat. Hist.	2 specimens.

Crossostoma Fascicauda Nichols.

1926. *Crossostoma* (*Formosania*) *fascicauda*, Nichols, *Amer. Mus. Novit.* No. 224, pp. 2-3, fig. 2.

1926. *Crossostoma* (*Formosania*) *stigmata*, Nichols, *Amer. Mus. Novit.*, No. 224, p. 4, fig. 3.

1928. *Crossostoma fascicauda*, Nichols, *Bull. Amer. Mus. Nat. Hist.*, **43**, p. 45.

1928. *Crossostoma stigmata*, Nichols, *Ibid.*, **43**, p. 45.

1932. *Crossostoma fascicauda*, Hora, *Mem. Ind. Mus.*, **12**, p. 308.

1932. *Crossostoma stigmata*, Hora, *Mem. Ind. Mus.*, **12**, p. 308, pl. x, fig. 12.

1933. *Crossostoma fascicauda*, Tchang, *Zool. Sinica* (B), **2**, fasc. 1, pt. 1, p. 220.

1934. *Crossostoma tinkhami*, Herre, *Lingan Sci. Journ.*, **13**, p. 285.

1934. *Formosania fascicauda*, Fang, *Sinensia*, **6**, (1), pp. 83-83, fig. 12-13.

1934. *Formosania stigmata*, Fang, *Sinensia*, **6**, (1), pp. 85-87, fig. 14.

1943. *Crossostoma fascicauda*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 229, fig. 122.

1949. *Formosania fascicauda*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2** (4), p. 164.

1949. *Formosania stigmata*, Chen & Liang, *Ibid.*, **2** (4), p. 164.

1950. *Crossostoma fascicauda*, Hora, *Rec. Ind. Mus.*, **48**, pt. 1, p. 48.

D. 3/8 ; A. 3/5 ; P. 1/14-15 ; V 1/8 ; L. 1·90-104 ; L. tr. $21\frac{1}{2}/10\frac{1}{2}$-$12\frac{1}{2}$.

Head contained 4·52 ; depth of body 6·28 and width of body 5·73 in standard length. Snout in head 1·81 ; interorbital width 2·71 to 2·8 ; depth of caudal peduncle 2·11 to 2·4 and its length 1·47 to 1·54. Diameter of eye 7 in head. Width of mouth 2·2 in snout.

Locality.—China (Fuching-hsien, Chungan-hsien, Fukien ; Loa-fan shan, Kwantung).

Specimens examined :—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 661/2	Near Yenping, Fukien, China.	Amer. Mus. Nat. Hist.	4 specimens.
F. 663/2	Chungan Hsien, Fukien, China.	Do.	4 specimens.
F. 662/2	Near Yenping, Fukien, China.	Do.	2 specimens

Liniparhomaloptera Fang.

1935. *Liniparhomaloptera*, Fang, *Sinensia*, **6**, (1), p. 93.

1943. *Liniparhomaloptera*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 223.

1949. *Liniparhomaloptera*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4) p. 164.

I am redefining this Chinese monotypic genus from a number of specimens that I have examined recently :—

Snout broadly pointed and covered with a number of sensory pores. Mouth small, inferior and lunate. Upper lip fleshy, partly overhanging jaw and mouth. Lower lip fleshy, but leaves considerable part of jaw uncovered. Middle part of lip raised into tubercles while its posterior part on each side is produced into short barbel-like processes. Lips continuous at angles of mouth. V-shaped groove at each corner of mouth extending forwards as far as base of last rostral barbel. Rostral fold does not cover upper lip, but is produced into 7 barbels, one median and 3 on either side, the last pair being longest. A pair of well developed maxillary barbels present. Gill-openings extend to ventral surface for short distance. Body covered with small scales which are greatly reduced and faintly marked on ventral surface. Dorsal commences ahead of pelvics and its origin is almost equidistant from tip of snout and base of caudal fin. Pectorals 1/16 and Pelvics 1/8. Pectorals separated from pelvics by considerable distance. Pelvics extend beyond anal opening. Caudal slightly emarginate, lower lobe considerably longer than upper.

Genotype.—Liniparhomaloptera disparis (Lin).

Distribution.—China (Lou-fan-shan, Kwantung) and Hong Kong.

Remarks.—First ascribed to *Parhomaloptera* (Lin, 1934), *P. disparis* was redescribed under a new genus, *Liniparhomaloptera* by Fang (1935). *Liniparhomaloptera* is confined to China, whereas, *Parhomaloptera* is found in Borneo. In dealing with the 'Parallel evolution in the cross-ostomoid fishes of the mainland of Asia and the island of Boreno' Hora (1951), enumerates as many as five important differences distinguishing these two genera.

Liniparhomaloptera disparis (Lin,)

1934. *Parhomaloptera disparis*, Lin, *Lingnan Sci. Journ.*, **13**, (2), pp. 225-227, fig. 1-4

1935. *Liniparhomaloptera disparis*, Fang, *Sinensia*, **6**, (1), pp. 94-96.

1949. *Liniparhomaloptera disparis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 164.

D. 3/7/1 ; A. 3/5/1 ; P. 1/16 ; V. 1/8 ; L. 1.69 ; L. tr. $16\frac{1}{2}/11\frac{1}{2}$.

Head 4·56 and depth of body 5·69 in standard length. Width of head 1·28 ; snout 1·8 and interorbital width 2·25 in length of head. Diameter of eye 6·0 in head. Least depth of caudal peduncle 2 and its length 1·5 in length of head. Dorsal commencing slightly ahead of pelvic origin.

Locality :—China (Lou-fan-shan ; Kwantung ; Hong Kong).

A paratype of this type species in the collection of the Zoological Survey of India, has been lost, most probably in the floods of the Varuna River at Banaras in September 1943. I have examined the following specimens of this species.

Specimens examined.—

Register No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 658/2	White cloud mountain, Canton, China.	Nat. Hist. Mus. Stanford univ.	1 specimen.
F. 659/2	Pok Fulam Reservoir, Hongkong.	Nat. Hist. Mus. Stanford univ.	7 Specimens.

Parhomaloptera Vaillant.

1930. *Parhomaloptera*, Hora (in part), *Ann, Mag. Nat. Hist.*, (10) p. 584.

1932. *Parhomaloptera*, Hora , *Mem. Ind. Mus.*, **12**, p. 313.

The genus *Parhomaloptera* is monotypic, being known from the type and only species *P. microstoma*, of Borneo. The diagnostic characters of *Parhomaloptera* are given in the key for the genera on page 220. For a detailed description reference may be made to Hora's monograph (Hora, 1932, *loc. cit.*).

Genotype.—*Parhomaloptera microstoma* (Boulenger).

Distribution.—Borneo (Upper Mahakam river ; Sarawak).

Parhomaloptera microstoma (Boulenger).

1932. *Parhomaloptera microstoma*, Hora, *Mem. Ind. Mus.*, **12**, p. 313, pl. xii fig. 7.

D. 2/7 ; A. 2/5 ; P. 1/16-19 ; V. 1/10 ; L. 1. 100 ; L. tr. 17/1/13.

Head 5·2 in standard and 6·5 in total length. Head much longer than broad. Width 0·75 ; its height 0·5 in its length. Snout more than half length of head. Eyes small, diameter contained 5·6 in head, 3·2 in snout and 2·76 in interorbital width. Dorsal commences in advance of pelvics. Dorsal origin nearer tip of snout than to base of caudal.

Locality.—Borneo (Upper Mahakam River ; River Akar, Sarawak).

Specimens examined.—

Reg. No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11087/1	Upper Mahakam, Borneo.	Rijks Mus. Nat. Hist. Leyden.	1 specimen.

Vanmanenia Hora.

1932. *Vanmanenia*, Hora, *Mem. Ind. Mus.* **12**, pp. 209-311.

1933. *Homaloptera*, Tchang (in part), *Zool. Sinica*, (B), **2**, (1), p. 151.

1935. *Vanmanenia*, Fang, *Sinensia*, **6**, (1), p. 57.

1949. *Vanmanenia*, Chen & Liang, *Qurt. Journ. Taiwan Mus.*, **2**, (4), p. 163.

For a detailed diagnosis of this genus reference may be made to Hora (1932).

Genotype.—*Vanmanenia stenosoma* (Boulenger).

Distribution.—China (Ningpo river ; Fukein).

Remarks.—Hora (op. cit.), erected the genus *Vanmanenia* to accommodate Boulenger's *Homalosoma stenosoma*—(*Homaloptera stonosoma*). He provisionally assigned *Homaloptera caldwelli* Nichols

(1925), to *Vanmanenia*. *Vanmanenia* resembles the genus *Formosania* Oshima, but the latter seems to be more specialised for life in rapid waters and consequently its rostral groove and fold and paired fins show special modifications.

Key to the species of the genus Vanmanenia *Hora.*

I. Scales less than 101 in lateral line; head vermiculate with black; sides of body without longitudinal stripe .. .. *V. stenosoma.*

II. Scales about 150 in lateral line; head uniformly dark; sides of body with a black stripe from behind head to base of caudal fin. *V. caldwelli.*

Vanmanenia stenosoma (Boulenger).

1932. *Vanmanenia stenosma*, Hora, *Mem. Ind. Mus.*, **12**, p. 309, pl. xi, fig. 9.

1932. *Homaloptera (Homalosoma) caldwelli chekianensis*, Tchang, *Bull. Fan. Mem. Inst. Biol.*, **3**, (6), p. 83-84.

1933. *Homaloptera caldwelli chekianensis*, Tchang, *Zool. Sinica*, (B), **2**, fasc I. (1), p. 219, fig. 114.

1935. *Vanmanenia stenosoma*, Fang, *Sinensia*, **6**, pp. 58-68, fig. 7.

1939. *Vanmanenia stenosoma*, Wu, *Sinensia*, **10**, p. 127.

1949. *Vanmanenia stenosoma*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 163.

D. 3/7 ; A. 3/5-6 ; P. 1/13-14 ; V. 1/7 ; L. 1.94-101 ; L. tr. $21\frac{1}{2}/15\frac{1}{2}$.

Head about 5 and depth of body 5·8 to 6·7 in total length. Width of head 1·29 in its length. Snout 1·83 to 1·9 and interorbital space 2·17 to 2·44 in head. Diameter of eye 6·47 to 6·5 in head. Depth of caudal peduncle about equal to its length. Width of mouth 2·2 in length of snout.

Locality.—China (Ningpo ; kikow ; Feughua, Hsia-Chiaokow near West Tien-mu-Shan ; Lau-chie, Chen-hsien, and Tien-tai in Chekian Province).

Vanmanenia caldwelli (Nichols).

1925. *Homaloptera caldwelli*, Nichols, *Amer, Mus. Novit.*, No. 172, p.1.

1935. *Vanmanenia caldwelli*, Fang, *Sinensia*, **6**, (1), p. 68, fig. 8.

1949. *Vanmanenia caldwelli*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 163.

D. 3/8 ; A. 3/5 ; P. 1/13-14 ; V 1/6-7 ; L. 1.150.

Head contained 4·75 to 5 and depth of body 6·75 to 7 in standard length. Snout more than half length of head. Diameter of eye contained 4·25 to 5·25 in head ; 2·25 to 3 in snout and 2·4 in interorbital width Prenasal part of snout about equal to interorbital width. Commencement of dorsal ahead of pelvics, and its origin is nearer to tip of snout than to base of caudal fin. Anal reaches base of caudal. Sides of body with a black stripe from shoulder to base of caudal.

Locality.—China (Yenping, Chungân, Fukein).

I have examined the following specimens in the collection of the Zoological Survey of India, Indian Museum :—

Reg. No.	*Locality.*	*Donor or Collector.*	*No. of Specimens.*
F. 664/2	Yenping, Fukein, China.	Amer. Mus. Nat. Hist.	1 specimen.
F. 665/2	Chungan, Hsien, Fukein, China.	Do.	3 specimens.

Praeformosania FANG.

1935. *Praeformosania*, Fang, *Sinensia*, **6**, (1), p. 71.

1943. *Praeformosania*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 226.

1949. *Praeformosania*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 164.

To facilitate reference in future a short description of this genus is given below :—

Snout broad, rounded and much longer than postorbital part of head Mouth small, inferior and crescent shaped. Lips fleshy, but at angles of mouth are thin and continuous. Rostral groove continuous at angles of mouth. Seven rostral barbels, four primary and three secondary and minute, slightly anteriorly placed thus forming two distinguishable series. Six minute triangular lobes present before secondary rostral barbels. Scales small, covering body except on head and ventral surface of body between and in front of pectorals. Gill-openings extend to ventral surface for a short distance. Dorsal commences slightly in advance to pelvics. Pectorals begin behind eye and are separated from pelvics by a considerable distance. Pelvics reach anal opening but fall much short of anal fin. Pectorals with 15 to 16 rays and pelvics with 9 rays of which the outer one ray is simple. Pelvic provided with a fleshy appendage in its axil. Caudal somewhat emarginate, lower lobe being slightly longer than upper.

Genotype.—Praeformosania pinchowensis Fang.

Distribution.—China (Ping-chow-hsien, Hu-yuan-hsien, South Kweinchow ; Kwang-lau, Lin-yuen-hsien, North Western Kwangsi).

Remarks.—Fang (1935) described three species of *Praeformosania*, *viz.*, *P. pinchowensis*, *P. intermedia* and *P. lineata*. Later Wu, (1939) in describing *Formosania yaoshanensis* from Yao-shan observed : "The new species appears to be in close relation with the species of *Praeformosania*, as noted by Fang and *Formosania stigmata*, but differs from the latter in the colouration." *F stigmata* as shown above (*vide supra*, p.222) is con-specific with *Crossostoma fascicauda* (Nichols). Moreover, *Crossostoma* is easily distinguished from *Formosania* in the absence of a definite rostral groove. The description of *F yaoshanensis* leaves little in doubt about its Praeformosanian characters, and in view of its considerable similarity to *P. lineata*, it is treated here as a synonym of the latter.

Key to the species of the genus Praeformosania *Fang.*

I. Distance from vent to anal ½ that from vent to pelvic axil. (Body marbled with blackish or more or less marked with pale centred rings of same colour on dorsal surface and sides. L. 1. 102.) .. *P. pingchowensis.*

Distance from vent to anal two-third or four-fifth that from vent to pelvic axil.

A. Body and cadual peduncle marked with alternatively arranged dark blotches; L. l. 97 to 102 .. .. .. *P. intermedia.*

B. Body and caudal peduncle with two dark brownish dorso-lateral stripes, extending from head to base of caudal on each side. L. l. 88 to 92. .. .. .. *P. lineata.*

Praeformosania pingchowensis Fang.

1935. *Praeformosania pingchowensis*, Fang, *Sinensia*, **6**, (1), p. 72, fig. 3c and 9.

1943. *Praeformosania pingchowensis*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 226.

1949. *Praeformosania pingchowensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*) **2**, (4), p.164.

D. 3/8; A. 3/5; P. 1/5; V. 1/8; L. l. 102; L. tr. 22/11.

Head contained 4·6 to 4·8 and depth of body 6·7 to 6·9 in standard length. Diameter of eye in head 6·3 to 6·6. Width of head in its length 1.19; snout 1·73 and interorbital 2·64. Depth of caudal peduncle in head 2·73 and its length 1·9 to 2·7. Width of mouth in snout 2·3. For a detailed description of this type species reference may be made to the description of the genus.

Locality.—China (Pingchow-hsien, Southern Kweichow; Mountain streams of Si-kiang or West River).

Praeformosania intermedia Fang.

1935. *Praeformosania intermedia*, Fang, *Sinensia*, **6**, p. 75, fig. 10.

1943. *Praeformosania intermedia*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 226.

1949. *Praeformosania intermedia*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 164.

D. 3/9; A. 3/5/1; P. 1/14; V 1/8; L. 1.97—102; L. tr. $20\frac{1}{2}/12\frac{1}{2}$.

Head contained 4·82 and depth of body 5·5 to 6·62 in standard length. Width of head 1·28; snout 1·83 and interorbital width 2·75 in its length. Diameter of eye 4·4 in head. Depth of caudal peduncle 2·2 in head and its length 1·57. Width of mouth in snout 2·0.

Locality.—China (Tu-yuen-hsien, Southern Kweichow; Mountain streams running into Tungting Lake).

Praeformosania lineata Fang.

1935. *Praeformosania lineata*, Fang, *Sinensia*, **6**, (1), p. 78, fig. 11.

1939. *Formosania yaoshanensis*, Wu, *Sinensia*, **10**, (1-6), p. 128, pl. iii, fig. 7.

1943. *Praeformosania lineata*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 226.

1949. *Praeformosania lineata*, Chen & Liang, *Quart. Journ. Taiwan. Mus.*, **2**, (4), p. 164.

D. 3/8; A. 3/5; P. 1/15; V 1/8; L. l. 88-92; L. tr. $19\frac{1}{2}/12\frac{1}{2}$.

Head contained 4·86 and depth of body 5·67 in standard length. Width of head 1·17; snout 1·57 and interorbital space 2 in its length. Diameter of eye 7 in head. Depth of caudal peduncle 1·75 in head and its length 1·27. Width of mouth in snout 2.

Locality.—China (Kwang-Lau, Ling-yuew-hsien, North Western Kwangsi ; Yao-shan, Likiang).

Formosania OSHIMA.

1932. *Formosania*, Hora, *Mem. Ind. Mus.*, **12**, p. 311.
1935. *Formosania*, Fang, *Sinensia*, **6**, (1), p. 80.
1943. *Crossostoma*, Nichols (in part), *Nat. Hist. Central Asia*, **9**, p. 228.
1949. *Formosania*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (1), p. 164.

For a complete diagnosis of this genus reference may be made to Hora (1932) and Fang (1935). The sailent characters of the genus are given in the key for the genera on page 220.

Genotype.—Formosania lacustre (Steindachner).

Distribution.—Formosa (Tamusi river near Lake Candidius).

Remarks.—The monotypic nature of *Formosania* has been referred to already (*vide supra p.* 222). The genus shows affinities to *Vanmanenia* and *Praeformosania*, but is more specialised than them. The presence of a rostral groove and the shorter barbels and their disposition easily distinguishes *Formosania* from *Crossostoma*, with which genus it was confused by some of the earlier workers.

Formosania lacustre (Steindachner.)

1932. *Formosania lacustre*, Hora, *Mem. Ind. Mus.*, **12**, p. 311, pl. xii, fig. 6.
1934. *Formosania lacustre*, Fang, *Sinensia*, **6**, (1) pp. 82-83.
1949. *Formosania lacustre*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 164.

D. 3/8 ; A. 3/5 ; P. 1/14-15 ; V 1/8 ; L. 1. 113 ; L. tr. $25\frac{1}{2}/15\frac{1}{2}$.

Head contained 4·7 and depth of body 6·3 in standard length. Width of head 1·2 ; snout 1·79 and eye 8·0 in head. Interorbital space 2·5 in length of head. Depth of caudal peduncle 1·75 in head and its length 1·5. Width of mouth 2·25 in snout.

Specimens examined :—

Reg. No.	*Locality.*	*Donor or Collector.*	*No. of Specimens.*
F. 1189/1	Lake Candidius, Formosa.	British Museum.	1 Specimen.

SUBFAMILY GASTROMYZONINAE.

Fishes of the subfamily Gastromyzoninae are confined to Indo-China, China, Formosa and Borneo. On geographical grounds as well as on taxonomical considerations, the subfamily is divided into two divisions. Thus the four genera confined to the mainland of Asia are grouped under *Pseudogastromyzoni* and those found in Borneo under *Gastromyzoni.*

Key to the divisions of the subfamily Gastromyzoninae.

I. Pectorals extending beyond commencement of pelvics. Width of mouth less than $\frac{1}{3}$ in width of head. (Mainland of Asia) .. .. .. *Pseudogastromyzoni.*

II. Pectorals separated from pelvics by a considerable distance. Width of mouth more than $\frac{1}{3}$ width of head. (Borneo) .. .. *Gastromyzoni.*

Division I. *Pseudogastromyzoni.*

Below is given a key to the identification of the different genera of the division Pseudogastromyzoni :

I. Four rostral barbels, plate-like at their bases, provided with fringed edges and terminating in short barbel-like processes ; bases of the two anterior barbels united .. .. *Sewellia.*

II. Four rostral barbels, plain and distinct from each other.

A. Pelvics free from each other and not united to form a disc-like structure.

1. Gill-opening extends to opposite base of pectoral fin .. .. *Paraprotomyzon.*

2. Gill-opening situated entirely above base of pectoral fin .. .. *Pseudogastromyzon.*

B. Pelvics united posteriorly to form a disc-like structure .. .. .. *Beaufortia.*

Sewellia Hora.

1932. *Sewellia*, Hora, *Mem. Ind. Mus.*, **12**, pp. 315-317.

For a detailed description of this remarkable genus reference may be made to Hora's monograph (Hora, 1932, p. 315).

Genotype.—Sewellia lineolata (Val.).

Distribution.—Indo-China.

Remarks.—Since the publication of his Memoir on the Homalopterid fishes (Hora, 1932), no further material has been described under the genus *Sewellia*. Hora (1932), Fang (1933), and Hora (1951) have expressed opinions of the phylogenetic relationships of this remarkable genus. *Sewellia* is a highly specialised form and differs considerably from the Chinese Pseudogastromyzoni. The genus is monotypic.

Sewellia lineolata Valenciennes.

1846. *Balitora lineolata*, Valenciennes, *Hist. Nat. Poiss.*, **18**, p. 99.

1932. *Sewellia lineolata*, Hora, *Mem. Ind. Mus.*, **12**, p. 317. pl. xi, fig. **10**, pl. xii, fig. 10.

D. 9 ; A. 5 ; P. 1/21 ; V. 1/17 ; C. 23 ; L. 1. 46-50.

Head contained 5·6 to 5·9 in total and 4·4 to 4·6 in standard length. Eyes moderately large, diameter contained 3·5 in head, 2 in snout and 1·75 in interorbital width. For a detailed description of this type and only species reference may be made to Hora (*loc. cit.*).

Specimens examined :—

Reg. No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 11291/1	Cochin, China.	Mus. National Hist. Nat. Paris.	1 specimen.

Paraprotomyzon Pellegrin & Fang

1935. *Paraprotomyzon*, Pellegrin & Fang, *Sinensia*, **6**, pp. 99-107.

1936. *Paraprotomyzon*, Pellegrin & Fang, *Absta. Pap. Sci. Conf. Nanking*, p. 665.

1949. *Paraprotomyzon*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 165.

1950. *Paraprotomyzon*, Hora & Jayaram, *Rec. Ind. Mus.*, **48** (2), p. 61.

The genus *Paraprotomyzon* is redefined here as follows :—

Snout broad, rounded and spatulate ; covered with rudimentary warts and sensory pores. Mouth inferior, and cresent shaped. Upper jaw covered by a lip, but anterior sharp rasping edge of lower jaw

exposed. Lips continuous at angles of month. Rostral fold prominent and distinctly trilobate. Six barbels, four rostral and two maxillary. Rostral barbels situated in between lobes of rostral fold. Gill-opening extends to opposite base of pectoral fin. Scales small, cycloid, absent from ventral surface of body before base of pelvic fin. Lateral line complete. Paired fins horizontal, fairly extensive and provided with oblique muscular bases. Pectorals commence behind eye and extend beyond origin of pelvic fin. Pelvics commence slightly in advance to dorsal and extends beyond anal opening. Pectoral with 19 and pelvic with 14 branched rays. Pelvics free from each other, not uniting to form a disc-like structure. Caudal obliquely truncate, with the lower lobe slightly longer.

Genotype.—Paraprotomyzon multifasciatus Pellegrin & Fang.

Distribution.—China (Kwai-Chow, Eastern Szechuan).

Paraprotomyzon multifasciatus Pellegrin & Fang.

1935. *Paraprotomyzon multifasciatus*, Pellegrin & Fang, *Sinensia*, **6**, pp. 103-107, fig. 1-2.

1936. *Paraprotomyzon multifasciatus*, Pellegrin & Fang, *Absts. Pap. Sci. Conf, Nanking*, P. 665.

1949. *Paraprotomyzon multifasciatus*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 165.

1950. *Paraprotomyzon multifasciatus*, Hora & Jayaram, *Rec. Ind. Mus.*, **48** p. 16.

D. 3/7 ; A. 3/5 ; P. 1/19 ; V 1/14 ; L. l. 69-74 ; L. tr. $22\frac{1}{2}/14\text{-}16\frac{1}{2}$.

Head 4·29 to 5 and depth of body 5·3 to 5·72 in standard length. Width of head in its length 0·93. Diameter of eye in head 6 to 7 and 4 in snout. Snout 1·62 to 1·71 and interorbital space 1·62 to 1·78 in head. Least depth of caudal peduncle 1·9 to 2·5 in head and its length 1 to 1·27. Width of mouth 1·8 to 2·3 in snout.

Locality.—China (Kwai-chow, Eastern Szechuan).

Specimens examined :—

Reg. No.	*Locality.*	*Donor or Collector.*	*No. of specimens.*
F. 669/2	Kouri-Tcheon China.	Mus. National Hist. D' Paris.	1 specimen.

Pseudogastromyzon Nichols.

1932. *Pseudogastromyzon*, Hora, *Mem. Ind. Mus.*, **12**, pp. 313-315.

1933. *Pseudogastromyzon*, Fang, *Sinensia*, **4**, (3), p. 39.

1938. *Pseudogastromyzon*, Herre, *Lingnan Sci. Journ.*, **17** (3), p. 428.

1943. *Pseudogastromyzon*, Nichols, *Nat. Hist. Central Asia*, **9** p. 230.

1949. *Pseudogastromyzon*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 165.

For a complete diagnosis of this remarkable genus reference may be made to Hora (1932) and Fang (1933). The salient features of the genus are given in the key on page. 220.

Genotype.—Pseudogastromyzon fasciatus (Sauvage).

Distribution.—China (Chung-hsein, N. Fukien ; Canton ; S. Chekiang ; Changting-hsien, Fukien ; Hong Kong ; Tungpei Shin, Lieuhsien, Kwantung).

Remarks.—Four species and a subspecies have been added to this genus since 1932. Fang (1933) referred *Crossostoma fangi* of Nichols (1931) to *Pseudogastromyzon*. He also gave a redescription of the type species *P. fasciatus* (Sauvage). Herre (1932) described *P. myersi* from Hong Kong. Liang (1942) reported the discovery of a new species and a subspecies of *Pseudogastromyzon, viz., P. cheni*, and *P. fasciatus changtingensis* from Fukien, China. Chen & Liang (1949) described *P. tungpeiensis* from Kwantung, China.

Key to the species of the genus Pseudogastromyzon *Nichols.*

I. Each lobe of trilobed rostral fold provided with 5 papillae along its free border.

A. Scales on lateral line 85; V. 1/10; P. 1/18-19; horizontal portion of pectorals with uniserial warty points arranged from base to the tip .. .. *P. fasciatus.*

B. Scales on lateral line 76-78; V. 1/8; P. 1/19-20; pectorals without warty points on the rays .. .. *P. fasciatus changtingensis.*

II. Each lobe of trilobed rostral fold not provided with 5 papillae along its free border.

A. Pectorals with 16 branched rays.

1. Later line 70; V. 1/8 .. .. *P. myersi.*

2. Lateral line 73-77; V. 1/9 (each lobe of rostral fold provided with 3 papillae along its free border). *P. cheni.*

B. Pectorals with 18 or more branched rays.

1. Lateral line 73; P. 1/18; each lobe of rostral fold provided with 4 papillae along its free border .. *P. tungpeiensis.*

2. Lateral line 96; P. 1/19; each lobe of rostral fold divided into two flat and somewhat barbel shaped lobules a long its free border *P. fangi.*

Pseudogastromyzon fasciatus (Sauvage).

1932. *Pseudogastromyzon fasciatus*, Hora, *Mem. Ind. Mus.*, **12**, p. 314, pl. xii, fig. 8-9.

1933. *Pseudogastromyzon fasciatus*, Fang, *Sinensia*, **4**, (3), pp .41.

1943. *Hemimyzon* (*Pseudogastromyzon*) *zebroides*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 230.

1949. *Pseudogastromyzon fasciatus*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 165.

D. 2/8; A. 1/6; P. 1/18-19; V 1/10; L. l. 85; L. tr. $18\frac{1}{2}/9$—$10\frac{1}{2}$.

Head 4·29 and depth of body 6·25 in standard length. Width of head in its length 1·25. Eyes small, diameter contained 6·29 in head. Snout 1·7 and interorbital width 2·12 in head. Caudal peduncle about as long as deep and its length contained 2·12 in head. Width of mouth 1·43 in snout.

Locality.—China (Chungan-hsien, N. Fukien; Canton; and South Chekiang).

Pseudogastromyzon fasciatus changtingensis Liang

1942. *Pseudogastromyzon fasciatus changtingensis*, Liang, *Contr. Res. Ins. Zool, Bot. Fukien Prov. Acad.*, No. 2, pp. 1-8, fig. 2.

1949. *Pseudogastromyzon fasciatus changtingensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), pp. 165-166.

D. 2/8 ; A. 2/5-6 ; P. 1/19-20 ; V. 1/8 ; L. l. 76-78 ; L. tr. $20\frac{1}{2}$-$21\frac{1}{2}/7\frac{1}{2}$-$9\frac{1}{2}$.

Head 5·16 to 5·35 and depth of body 4·67 to 5·38 in standard length. Width of head equal to its length. Diameter of eye 5·28 to 6 in head. Snout 1·54 to 1·6 and interorbital width 1·7 to 1·85 in head. Least depth of caudal peduncle 2·11 to 2·16 in head and its length 1·57 and 1·81. Width of mouth 2·5 to 3 in snout.

Locality.—China (Changting-hsien, Fukien).

Remarks.—This subspecies is distinguished from the *forma typica* in the pelvics possessing only 8 branched rays instead of 10 ; absence of warty processes on the base of pectoral rays ; lesser number of pores along the lateral line and fewer vertical bands along the sides of the body.

Pseudogastromyzon myersi Herre.

1932. *Pseudogastromyzon myersi*, Herre, *Lingnan Sci. Journ.*, **2**, (3), pp. 430-431.

1938. *Pseudogastromyzon myersi*, Herre, *Ibid.*, **17**, (3), p. 428.

1943. *Hemimyzon myersi*, Nichols, *Nat. Hist. Central Asia*, **9**, *p.* 230.

1949. *Pseudogastromyzon myersi*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, p. 165.

D. 2/7 ; A. 1/5 ; P. 1/16 ; V 1/8 ; L. l. 70.

Head 4·5 and depth of body 8·1 in standard length. Snout 1·6 and interorbital width 2·15 in head. Diameter of eye 4·3 in head. Least depth of caudal peduncle 2·6 in head. Dorsal origin midway between tip of snout and base of caudal. Pectorals overlap pelvics. Pelvics fall considerably short of anal which in turn does not reach caudal fin.

Locality.—Hong Kong and Lantan Islands.

Pseudogastromyzon tungpeiensis Chen & Liang.

1949. *Pseudogastromyzon tungpeiensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 158-161, fig. 1.

D. 2/8 ; A. 2/6 ; P. 1/18 ; V 1/8 ; L. l. 73 ; L. tr. $21\frac{1}{2}/11\frac{1}{2}$.

Head 4·89 and depth of body 6·35 in standard length. Width of head in its length 1·13. Diameter of eye 6·45 in head. Snout 1·59 and interorbital width 2·08 in head. Least depth of caudal peduncle contained 2·0 in head and its length 2·25. Width of mouth in snout 1·89.

Locality.—China (Tungpie-shein, Lienhsien, Kwantung).

Remarks.—From *P. fasciatus* the above species is distinguished by the nature of the rostral fold, the chin adhesive apparatus, the less branched rays of the pelvics and the lesser number of pores along the lateral line. It differs from *P. fangi* in having blackish markings on the dorsal surface of the head and the base of the pectorals. In having larger number of rays in the pectorals (18 *versus* 16) it is distinguished from *P. myersi.*

Pseudogatromyzon cheni Liang.

1942. *Pseudogastromyzon cheni*, Liang, *Contr. Res. Ins. Zool. Bot. Fukien Prov. Acad.*, No. 1, pp. 1-8, fig. 2.

1949. *Pseudogastromyzon cheni*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 166.

D. 2/7 ; A. 2/5 ; P. 1/16 ; V. 1/9 ; L. l. 73-77 ; L. tr. $16\frac{1}{2}$-$20\frac{1}{2}/9\frac{1}{2}$-$11\frac{1}{2}$.

Head 4·64 to 4·89 and depth of body 5·2 to 5·92 in standard length. Width of head in its length 0·9. Diameter of eye 4·3 to 6·74 in head. Snout 1·56 to 1·73 and interorbital space 1·91 to 2·1 in head. Least depth of caudal peduncle 2·21 to 2·6 in head and its length 1·43 to 2·43. Width of mouth 2·6 to 3·4 in head.

Locality.—China (Changting-hsien, Fukien).

Pseudogatromyzon fangi (Nichols).

1931. *Crossostoma fangi*, Nichols, *Lingnan Sci. Journ.*, **10**, p. 263, fig. 1.

1933. *Pseudogastromyzon fangi*, Fang, *Sinensia*, **4**, (3), pp. 46-48, fig. 2.

1943. *Crossostoma fangi*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 299, fig. 123.

1949. *Pseudogastromyzon fangi*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 167.

D. 2/9 ; A. 2/5 ; P. 1/19 ; V. 1/7 ; L. l. 96 ; L. tr. $23\frac{1}{2}/10\frac{1}{2}$.

Head 5 and depth of body 6·8 in standard length. Width of head in its length 1·12. Diameter of eye 5·56 in head. Snout 1·6 and interorbital width 1·99 in head. Least depth of caudal peduncle 2·36 in head and its length 1·4. Width of mouth 2·5 in snout.

Locality.—China (Vicinity of Canton, Kwangtung).

Beaufortia Hora.

1932. *Beaufortia*, Hora, *Mem. Ind. Mus.*, **12**, p. 318.

1943. *Gastromyzon*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 231.

1944. *Beaufortia*, Chang, *Sinensia*, **15**, p. 55.

1949. *Gastromyzon*, Chen & Liang, *Quart, Journ. Taiwan Mus.*, **2**, (2), p. 167.

The diagnositic characters of this genus are given in the key on page 230. For a complete description reference may be made to Hora, 1932, (*loc. cit.*).

Genotype.—Beaufortia leveretti (Nichols & Pope).

Distribution.—China (Omei, Loochow, Szechuan ; Loshan, and Yann ; San-ho-hsien, Kweichow ; Noda, Hainan ; Lin-yueng-hsien, N.W Kwangsi ; Tung-Kwei, Lung-Chow, S.W Kwangsi).

Remarks.—Beaufortia is at present known from six species. Since 1932 only one species, *viz.*, *B. liui* Chang (1944) has been added to the genus.

Key to the species of the genus Beaufortia *Hora.*

I. Pelvics extend upto or beyond anal opening.

A. P. 1/22 ; V. 1/16.

1. Scales on lateral line 98 to 102 *B. liui.*

2. Scales on lateral line 112. .. .. *B. zebroidus.*

B. P. 1/24-27 ; V. 1/19-21.

1. Scales on lateral line 75 ; pelvics extend beyond anal opening ; P. 1/25-27 ; V. 1/20-21 .. .. *B. leveretti.*

2. Scales on lateral line 70-72 ; pelvics extend upto anal opening ; P. 1/24-26 ; V. 1/19-20 .. .. *B. kweichowensis.*

II. Pelvics separated considerably from anal opening.

A. Caudal fin obliquely truncate ; P. 1/22-23 ; V. 1/17 .. .. *B. pingi.*

B. Caudal fin distinctly emarginate ; P. 1/25-26 ; V. 1/17-19 .. .. .. *B. szechuanensis.*

Beaufortia liui chang.

1944. *Beaufortia liui*, Chang, *Sinensia*, **15**, p. 55, fig. 3.

D. 3/7 ; A. 2/5 ; P. 1/22 ; V 1/16 ; L. 1. 98-102.

Head 4·9 and depth of body 4·5 in standard length. Depth of head in its length 1·6 and width 0·9 to 1·0. Diameter of eye 5·3 to 6·6 and interorbital space 2·1 in head. Caudal peduncle 2·1 to 2·2 and its length 2·1 in head.

Locality.—China (Loshan and Yaan, Szechuan).

Beaufortia zebroidus (Fang).

1930. *Gastromyzon pingi zebroidus*, Fang, *Sinensia*, **1**, (3), p. 35, pl. ii, fig. 1-2.

1932. *Beaufortia zebroidus*, Hora, *Mem. Ind. Mus.*, **12**, p. 319.

1943. *Gastromyzon zebroidus*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 231.

1949. *Gastromyzon zebroidus*, Chen & Liang, *Quart. Journ. Taiwan, Mus.*, **2**, (4), p. 167.

D. 2/6 ; A. 2/4-5 ; P. 1/22 ; V. 1/16 ; L. 1. 112.

Head contained 4 times and depth of body 5·4 in standard length. Diameter of eye contained 5·9 to 6 in head.

Locality.—China (Tung-Kwei, Lung-Chown, S.W. Kwangsi).

Beaufortia kweichowensis (Fang).

1931. *Gastromyzon leveretti kweichowensis*, Fang, *Sinensia*, **2**, (3), pp. 41-44, fig. 1.

1943. *Gastromyzon kweichowensis*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 231.

1949. *Gastromyzon kweichowensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 167.

D. 2/8 ; A. 2/4 ; P. 1/24-26 ; V 1/19-20 ; L. 1. 70-72.

Head 4·1 and depth of body 5·4 in standard length. Width of head in its length 1·1. Diameter of eye 6·8 in head. Interorbital width 2·2 and snout 1·48 in head. Depth of caudal peduncle 2·56 in head and its length 2·4. Width of mouth 3·24 in snout.

Locality.—China (San-ho-hsien, Kweichow).

Beaufortia leveretti Nichols and Pope.

1932. *Beaufortia leveretti*, Hora, *Mem. Ind. Mus.*, **12**, p. 319, pl. xii, fig. 11.

1943. *Gastromyzon leveretti*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 231, fig. 125.

1949. *Gastromyzon leveretti*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 167.

D. 2/8 ; A. 2/7 ; P. 1/25-27 ; V 1/20-21 ; L. 1.75.

Head 4·3 and depth of body 5·3 in standard length. Width of head in its length 1·1. Diameter of eye contained 5·5 in head. Snout 1·8 and interorbital width 2·3 in head. Depth of caudal peduncle 2·25 in head, and its length 2·9. Width of mouth 2·4 in snout.

Locality.—China (Nodoa, Hainan).

Specimens examined.—

Reg. No.	*Locality.*	*Donor or collector.*	*No. of specimens.*
F. 11090/1	Hainan, China	Amer. Mus. Nat. Hist.	1 specimen.
F. 670/2	Nodoa, Hainan, China	Do. . .	2 specimens.

Beaufortia pingi (Fang).

1930. *Gastromyzon pingi*, Fang, *Sinensia*, **1**, (3), pp. 31-34, pl. 1, fig. 3-5.
1932. *Beaufortia pingi*, Hora, *Mem. Ind. Mus.*, **12**, p. 319.
1943. *Gastromyzon pingi*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 331.
1949. *Gastromyzon pingi*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 167.

A. 2/4 ; P. 1/22-23 ; V 1/17 ; L. 1.119.

Head 4·5 and depth of body 5·5 in standard length. Width of head in its length 1·2. Diameter of eye in head 6·25 to 6·5. Snout 2·7 and interorbital width 1·5 to 1·6 in head. Least depth of caudal peduncle about its length. Width of mouth 1·67 in snout.

Locality.—China (Lin-yueng-shien, Kwangsi).

I have examined a topotype of this species in the collection of the Zoological Survey of India as under :—

Reg. No.	*Locality.*	*Donor or collector.*	*No. of specimens.*
F. 11112/1	Kwangsi, China .	P. W. Fang .	1 specimen.

Beaufortia szechuanensis (Fang).

1930. *Gastromyzon szechuanensis*, Fang, *Contri. Biol. Sci. Soc. China*, (*Zool. Ser.*), **6**, p. 36, fig. 6-7.
1932. *Beaufortia szechuanensis*, Hora, *Mem. Ind. Mus.*, **12**, p. 319.
1943. *Gastromyzon szechuanensis*, Nichols, *Nat. Hist. Central Asia*, **9**, p. 232.
1949. *Gastromyzon szechuanensis*, Chen & Liang, *Quart. Journ. Taiwan Mus.*, **2**, (4), p. 167.

D. 2/8 ; A. 1/5 ; P. 1/25-26 ; V. 1/17 ; L. 1.137.

Two specimens 78 and 83 mm. in standard length in the collection of the Zoological Survey of India, received recently in exchange from the U. S. National Museum, and labelled *Beaufortia pingi*, on examination have prooved to be *B. szechuanensis*. A short description of this rare species from Szechuan, China, is given below :—

Head contained 5 in standard and 5·7 to 5·9 in total length. Depth of body contained 9·5 in standard and 10·5 to 11 in total length. Snout much more than half length of head. Eyes small diameter, contained

7 in head, 4·75 in snout and 3·3 in interorbital space. Upper lip free from upper jaw. Lower lip notched at its anterior median line where two rounded papillae are present. Four minute rostral barbels present. Maxillary barbels much longer. Dorsal commences behind origin of pelvics. Pectorals begin slightly in front of eyes, and overlap pelvics for a considerable distance. Pelvics united to form a disc-like structure. Pectorals with 26 to 27 rays and pelvics with 18 to 20 rays of which one outer ray in each fin is simple. VENT situated midway between posterior extremity of pelvics and anal fin. A flap of skin adnate to axil of pelvic fin present. Gill-openings restricted to above base of pectoral fin. Colour in alcohol pale brownish on sides and lighter below. Three dark blotches on dorsal surface in front of dorsal fin and 3 to 4 behind it. Caudal with a light brownish marking across.

Locality.—China (Omei, Loochow, Szechuan).

Specimens examined.—

Reg. No.	*Locality.*	*Donor or collector.*	*No. of specimens*
F 671/2	Yachow, Szechuan, China.	U. S. Nat. Mus.	2 specimens.

Division II. GASTROMYZONI.

Pectorals separated from pelvics by some distance. Mouth more than 1/3rd width of head. Below is given a key to the identification of the different genera of the Division Gastromyzoni.

I. Pelvics free from each other, not uniting to form a disc-like structure. Gill-openings restricted to sides, extending to base of pectoral fin dorsally.

A. Gape of mouth considerably less than half width of head; rostral groove and rostral fold absent; rostral barbels fully exposed on ventral surface. *Protomyzon.*

B. Gape of mouth more than half width of head; rostral fold present; rostral fold notched to accommodate four short barbels. .. .. .. *Progastromyzon.*

II. Pelvics united posteriorly to form a disc-like structure. Gill-openings situated entirely above base of pectoral fin.

A. Breadth of body containd five times in total length without caudal; mouth overhung by a fold bearing rostral barbels. .. .. *Neogastromyzon.*

B. Breadth of body contained 3·2 times in total length without caudal; mouth fully exposed; rostral barbels considerably in front of mouth. .. .. *Gastromyzon.*

Protomyzon Hora.

1932. *Protomyzon*, Hora, *Mem. Ind. Mus.*, **12**, p. 306.

1950. *Protomyzon*, Hora & Jayaram, *Rec. Ind. Mus.*, **47** (2), p. 61.

The diagnostic characters of this genus are given in the above key to the genera of the division *Gastromyzoni*. For a complete description Hora (1932, p. 306) may be consulted.

Genotype.—*Protomyzon whiteheadi* (Vaillant).

Distribution.—Borneo (Mout Kina Balu).

Remarks.—Hora (1932) proposed the genus *Protomyzon* to accommodate *Homaloptera whiteheadi* Vaillant (1893) from Borneo. Recently Hora and Jayaram (1950, *op. cit.*), described a species of *Protomyzon*, *viz.*, *P. borneensis* from Mount Kina Balu in Borneo. Hora (1951), has expressed views regarding the relationships of this genus to the other genera of the Gastromyzoni.

Key to the species of the genus Protomyzon *Hora.*

I. Snout broad, rounded ; V. 1/9-10 ; scales absent on ventral surface only between and before base of pectorals ; Lateral line complete. *P. whiteheadi.*

II. Snout conical and more or less pointed. V. 1/8 ; scales absent on ventral surface before anal opening. Lateral line incomplete, extending only up to anal fin. *P. borneensis.*

Protomyzon whiteheadi (Vaillant).

1932. *Protomyzon whiteheadi*, Hora, *Mem. Ind. Mus.*, **12**, p. 306.

1950. *Protomyzon whiteheadi*, Hora & Jayaram, *Rec. Ind. Mus.*, **48**, pt. 2.

D. 1/7 ; A. 1/6-7 ; P. 1/21-22 ; V 1/9-10 ; C. 15-16.

Head contained 5·5 to 6 and depth of body 8 in total length. Height of head slightly less than length of snout. Eyes small, dorsolateral, diameter contained 6 to 7 times in head ; 2·5 to 3 in snout and 2 to 2·5 in inter-orbital width. Least height of caudal peduncle contained 1·5 in its length.

Locality.—Borneo (Mount Kina Balu).

I have examined the following specimens in the collection of the Zoological Survey of India, Indian Museum :

Reg. No.	*Locality.*	*Donor or collector.*	*No. of specimens.*
F 682/2	Mt. Kina Balu, Borneo	Mus. Comp. Zool. Camb. Mass, U. S. A.	2 specimens.
F 681/2	Do. . .	Do. . .	9 specimens.
F 680/2	Do. . .	Do. . .	4 specimens.

Protomyzon borneensis Hora & Jayaram.

1951. *Protomyzon borneensis*, Hora & Jayaram, *Rec. Ind. Mus.*, **48**, pt. 2, p, 193.

D. 1/6 ; A. 2/4 ; P. 1/22 ; V. 1/8 ; C. 18.

Head 4·5 and depth of body 8 in standard length. Diameter of eye contained 2 times in snout and 1·5 in inter-orbital width. Mouth inferior, lips fleshy, upper lip sharp and angular ; lower lip papillated. Rostral fold produced into small clear fleshy prolongations. Two pairs of rostral and a pair of maxillary barbels. A pair of barbel like prolongations at each corner of mouth. Gill-opening extends to ventral surface for a short distance. Origin of dorsal opposite insertion of pelvics, and is nearer to

base of caudal than to tip of snout. Pectoral 1/22 and pelvic 1/8. Pelvic reaches anal opening but falls short of anal fin. In the axil of the pelvic there is a small rudimentary scaly appendage. Anal reaches caudal base. Caudal emarginate. Body covered with small scales except on head and ventral surface as far back as anal opening. Lateral line incomplete, extending up to above anal fin only.

Locality.—Borneo (Mount Kina Balu).

Type specimen preserved in the collection of the Museum of Comparitive Zoology, Harvard College, Cambridge, Mass., U. S. A.

Progastromyzon Hora and Jayaram.

1951. *Pregastromyzon*, Hora & Jayaram, *Rec. Ind. Mus.*, **48**, p. 191.

Described recently by Hora & Jayaram (*op. cit.*), this remarkable Gastromyzonid genus shows great similarity to two other Bornean genera, *viz.*, *Neogastromyzon* and *Gastromyzon* in the form of its mouth. To facilitate future reference, a short description of this genus is given below.

Snout broad, rounded, much longer than post-ocular part and provided with small tubercles on dorsal surface. Mouth opening extensive, its gape being more than half width of head. Anterior lip overhung by rostral fold which is notched to accommodate four rostral barbels. One small barbel at each angle of mouth. Lower lip fimbriated. Gill-opening just reaches base of pectoral fin, but does not extend to the ventral surface. Scales small, absent on head and region between and before pectoral fins ventrally. Dorsal commences opposite origin of pelvics. Paired fins are flattened and horizontal. Pectorals begin just behind eye and are provided with 21 branched rays each. Pectorals separated from pelvics by a short distance. Pelvics free from each other, not uniting to form a disc-like structure. Pelvics extend beyond vent. Anal fin reaches base of caudal. Caudal peduncle much longer than deep.

Genotype.—*Progastromyzon griswoldi* Hora & Jayram.

Distribution.—Borneo (Mount Kina Balu).

Progastromyzon griswoldi Hora & Jayaram.

1951. *Progastromyzon griswoldi*, Hora & Jayaram, *Rec. Ind. Mus.* **48**, p. 192.

D. 3/8 ; A. 2/5 ; P. 1/21 ; V 1/9 ; C. 18 ; L. 1.79 ; L. tr. 9/9.

Head 4·5 and depth of body 6 in standard length. Height of head equal to length of snout. Diameter of eye contained 3 times in snout and 2·5 in inter-orbital space. Origin of dorsal ahead of pelvics, and nearer base of caudal than to tip of snout. Least depth of caudal peduncle about 1·7 in its length.

Locality.—Borneo (Mount Kina Balu).

Neogastromyzon Popta.

1932. *Neogastromyzon*, Hora, *Mem. Ind. Mus.*, **12**, p. 319, pl. xi, fig. 11 ; pl. xii, fig. 12.

For the diagnostic characters of this genus reference may be made to the key on page 237. Hora (*op. cit.*) has given a complete description of this genus.

Genotype.—Neogastromyzon nieuwenhuisi Popta.

Distribution.—Borneo (River Howong).

Remarks.—The genus is monotypic. Weber and Beaufort (1916), considered *Neogastromyzon* to be con-generic with *Gastromyzon.* Hora (1932) clarifiied the generic status of *Neogastromyzon* and discussed its relationships to *Gastromyzon.* Recently (1951), in dealing with the independent evolution of the Gastromyzonid fishes in Borneo he has discussed the phylogenetic relationships of *Neogastromyzon* with the other Gastromyzonid genera of Borneo.

Neogastromyzon nieuwenhuisi Popta.

1932. *Neogastromyzon nieuwenhuisi,* Hora, *Mem. Ind. Mus.,* **12,** p. 320, pl. x, fig. 11 ; pl. xii, fig. 12.

D. 2/7 ; A. 2/5 ; P. 1/24 ; V. 1/17 ; L. 1·90 ; L. tr. 21/1/10.

Head 4·5 and depth of body 5 in standard length. Diameter of eye 6·4 in head, and 3 in inter-orbital space. Origin of dorsal behind middle of length.

Locality.—Borneo (River Howong).

Gastromyzon Günther.

1932. *Gastromyzon,* Hora, *Mem. Ind. Mus.,* **12,** p. 321.

For a complete diagnosis of this well known genus reference may be made to Hora (*op. cit.*).

Genotype.—Gastromyzon borneensis Günther.

Distribution.—Borneo.

Gastromyzon borneensis Günther.

1916. *Gastromyzon borneensis,* Weber & Beaufort, *Fish. Indo-Austral. Archip.,* **2,** p. 3, fig. 1.

1932. *Gastromyzon borneensis,* Hora, *Mem. Ind. Mus.,* **12,** p. 322, pl. xii, fig. 13.

1948. *Gastromyzon borneensis,* Ramaswamy, *Proc. Zool. Soc. London,* **118,** p. 515. (Cranial Osteology).

D. 3/8 ; A. 1/6 ; P. 1/25-27 ; V. 1/19-20 ; L. 1.65 ; L. tr. 19/1/12.

Head 4·25 in standard and 5·25 in total length. Snout more than half length of head. Depth of body below dorsal about length of snout. Diameter of eye contained 7·5 to 8 in head ; 5 in snout and 4 in inter-orbital space. Mouth-opening wide, less than three times in length of head.

Locality.—Borneo.

Gastromyzon borneensis is represented in the collection of the Zoological Survey of India by a fine series of specimens.

Reg. No.	*Locality.*	*Donor of Collector.*	*No. of specimens.*
F 672/2	Mt. Kina Balu, Borneo	Mus. Com. Zool. Camb. Mass.	4 specimens.
F 673/2	Do.	Do.	4 specimens.
F 674/2	Do.	Do.	14 specimens.
F 675/2	Do.	Do.	13 specimens.

VIII.—DISTRIBUTION AND EVOLUTION OF THE FISHES OF THE FAMILY HOMALOPTERIDAE.

1. *Distribution and Intra-relationships of the family Homalopteridae.*

The family Homalopteridae, highly specialised as it is, has a fairly wide range of distribution, extending from Peninsular India in the west to Formosa in the north east and the islands of the Malay Archipelago in the south. The preponderance of endemic genera and species in the different geographical units here recognised, is a remarkable feature met with among these fishes, for it indicates rapid evolutionary radiation after isolation. The table on pages 177 to 179 gives the distribution of the Homalopteridae according to politacal, rather than geographical divisions but all the same they seem to be fairly distinct zoogeographical entities as the following analysis of the species shows :

1. *Peninsular India (Western Ghats).*
   - Genus *Homaloptera* van Hasselt.
     - †*Homaloptera montana* Herre.
   - Genus *Balitora* Gray.
     - †*Balitora brucei mysorensis* Hora.
   - †Genus *Bhavania* Hora.
     - †*Bhavania australis* (Jerdon).
   - †Genus *Travancoria* Hora.
     - †*Travancoria jonesi* Hora.
2. *North Eastern India.*
   - Genus *Balitora* Gray.
     - †*Balitora brucei brucei* Gray.
     - †*Balitora maculata Gray.*
3. *Burma.*
   - Genus *Homaloptera* van Hasselt.
     - *Homaloptera modesta* (Vinciguerra).
     - †*Homaloptera bilineata* Blyth.
     - †*Homaloptera rupicola* (Prashad & Mukerji).
   - Genus *Balitora* Gray.
     - †*Balitora brucei burmanicus* Hora.
     - †*Balitora brucei melanosoma* Hora.
4. *Siam.*
   - Genus *Homaloptera* van Hasselt.
     - *Homaloptera modesta* Vinciguerra.
     - *Homaloptera zollingeri* Bleeker.
     - †*Homaloptera lineata* Smith.
     - †*Homaloptera smithi* Hora.
     - †*Homaloptera sexmaculata* Fowler.
   - *Genus *Balitoropsis* Smith.
     - †*Balitoropsis bartschi* Smith.
5. *Malaya Peninsula.*
   - Genus *Homaloptera* van Hasselt.
     - *Homaloptera zollingeri* Bleeker.
     - *Homaloptera wassinki* Bleeker.
     - *Homaloptera orthogoriata* Bleeker.
     - †*Homaloptera leonardi* Hora.
     - †*Homaloptera tweedei* Herre.
   - *Genus *Neohomaloptera* Herre.
     - †*Neohomaloptera johorensis* Herre.

---

* Indicates endemic genus.
† Indicates endemic species.

6. *Sumatra.*
Genus *Homaloptera* van Hasselt.
Homaloptera zollingeri Bleeker.
Homaloptera wassinki Bleeker.
Homaloptera ophiolepis Bleeker.
Homaloptera ocellata Van der Hoeven.
Homaloptera salusur Bleeker.
†*Homaloptera amphisquamata* Weber & Beaufort.
†*Homaloptera heterolepis* Weber & Beaufort.
†*Homaloptera gymnogaster* Bleeker.
†*Homaloptera modiglianii* Perugia.
†*Homaloptera ripleyi* (Fowler).
†*Homaloptera ulmeri* Fowler.
†*Homaloptera vanderbilti* Fowler.

7. *Java.*
Genus *Homaloptera* van Hasselt.
Homaloptera zollingeri Bleeker.
Homaloptera wassinki Bleeker.
Homaloptera ophiolepis Bleeker.
Homaloptera ocellata Van der Hoeven.
Homaloptera salusur Bleeker.

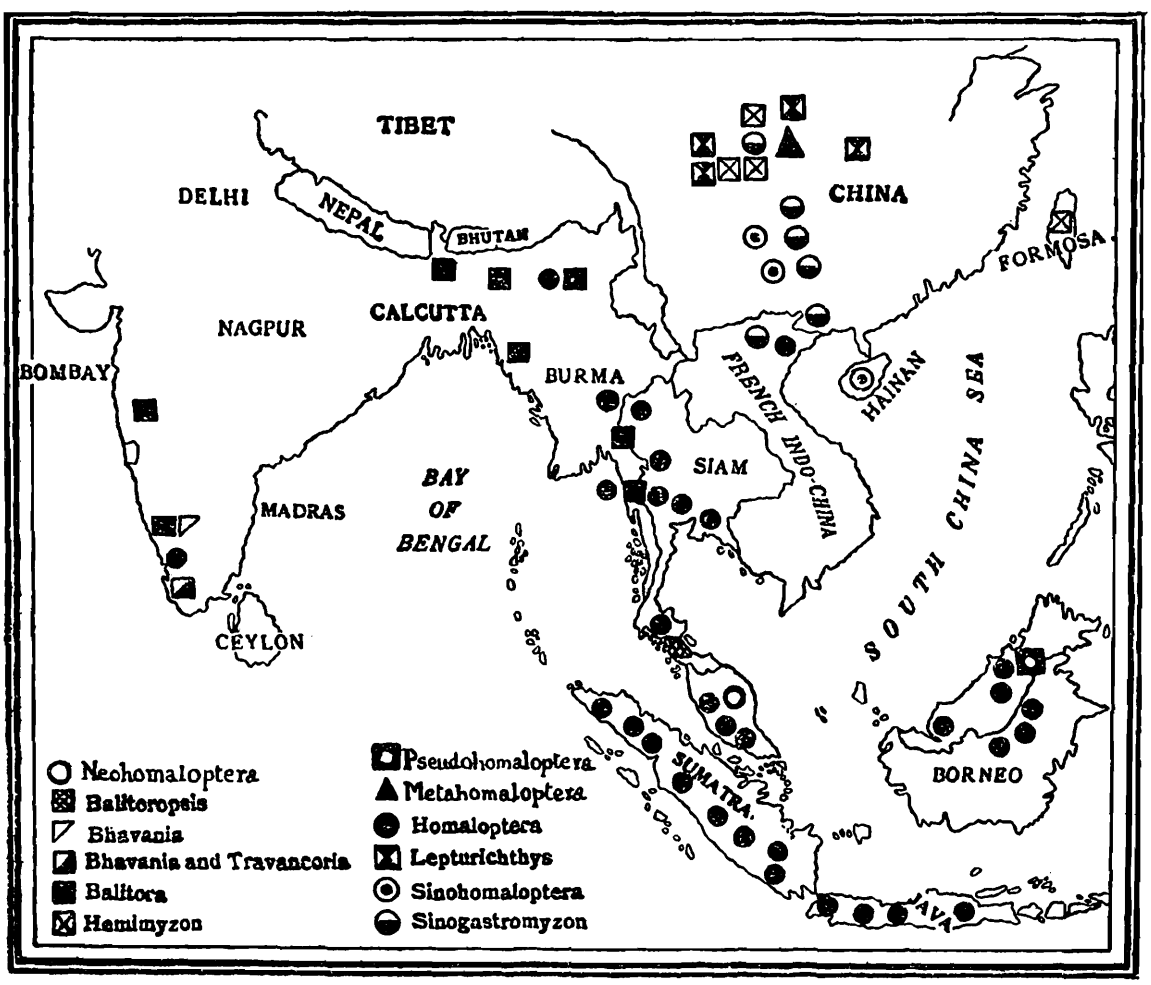
8. *Borneo.*
Genus *Homaloptera* van Hasselt.
Homaloptera wassinki Bleeker.
Homaloptera ophiolepis Bleeker.
Homaloptera orthogoniata Bleeker.
†*Homaloptera stephensoni* Hora.
†*Homaloptera weberi* Hora.
*Genus *Pseudohomaloptera* gen. nov.
†*Pseudohomaloptera tateregani* (Popta).

9. *Indo-China.*
Genus *Homaloptera* van Hasselt.
†*Homaloptera indochinensis* sp. nov.
Genus *Sinogastromyzon* Fang.
†*Sinogastromyzon tonkinensis* Pellegrin & Fang.

10. *China.*
Genus *Sinogastromyzon* Fang.
†*Sinogastromyzon hsiashiensis* Fang.
†*Sinogastromyzon intermedius* Fang.
†*Sinogastromyzon sanhoensis* Fang.
†*Sinogastromyzon sichangensis* Chang.
†*Sinogastromyzon Szechuanensis* Fang.
†*Sinogastromyzon wui* Fang.
*Genus *Sinohomaloptera* Fang.
†*Sinohomaloptera hoffmanii* Herre.
†*Sinohomaloptera kwangeiensis* Fang.
*Genus *Hemimyzon* Regan.
†*Hemimyzon abbreviata* (Günther).
†*Hemimyzon acuticauda* (Fang.).
†*Hemimyzon formosanum* (Boulenger).
†*Hemimyzon sinensis* (Sauvage & Dabry).
†*Hemimyzon yaotancnsis* (Fang.).
*Genus *Lepturichthys* Regan.
†*Lepturichthys fimbriata* (Günther).
†*Lepturichthys güntheri* Hora.
†*Lepturichthys nicholsi* Hora.
*Genus *Metahomaloptera* Chang.
†*Metahomaloptera omeiensis* Chang.

*Indicates endemic genus.
†Indicates endemic species.

From the above analysis of the distribution of species, some very interesting conclusions can be drawn regarding the zoogeography and intra-relationships of the members of the family Homalopteridae. The genus *Homaloptera* has the widest range of distribution, being found in all geographical divisions, except in North Eastern India and in China. Moreover, the species constituting the genus are less specialised than the other Homalopteridae, but at the same time they are highly variable, thus, occupying more or less the central position from which the origin of the other genera could be traced. Both in the Eastern Himalayas and



Text-figure 3 :—Map showing the distribution of the genera of the family Homalopteridae.

in China, the family is represented by highly evolved forms. It is quite likely, that the intense orogenic movements that were prevalent in these places during the later Pliocene and the Pleistocene priods, were directly responsible for the evolution of the highly specialised Homalopterid forms and the elimination of the generalised forms like *Homaloptera* from both these regions. It seems likely, however, that in more secluded positions within these two zoogeographical divisions, *Homaloptera* may have survived and still remains to be discovered. This has happened in the case of the Western Ghats already.

Distributional records and Intra-relationships treated Regionwise.

1. *Peninsular India (Western Ghats).*—Of the four Homalopterid genera in Peninsular India, the genus *Homaloptera* is represented by one species, while *Balitora* is represented by one variety, both of which are

endemic, though the genera *Homaloptera* and *Balitora* are found in the regions to the east also. Two remaining genera, *Bhavania* and *Travancoria*, which are monotypic, are endemic in Peninsular India. Hora (1944), in propounding his Satpura Hypothesis, referred to the probable source from which the Homalopterid element of Peninsular India was derived. Hora (1950) and Silas (1951) have discussed the Zoogeographical significance of the occurrence of the genus *Homaloptera* and allied genera in Peninsular India.

The genus *Bhavania* and *Travancoria* are *Homaloptera*-like, but have undergone certain specialisations. *Bhavania*, which seems to be an earlier off shoot of *Homaloptera* in Peninsular India, resembles the broad headed *Homaloptera*, but has the gill-openings greatly restricted and at the same time has a rostral groove in front of the mouth overhung by a rostral fold. *Travancoria*, with its more pointed snout, resembles the narrow snouted *Homaloptera*, a relict of which has been recently discovered in Peninsular India in *H. montana*. The gill-openings in *Travancoria*, as also in *Homaloptera*, extend to the ventral surface for some distance, but the development of a rostral groove in front of the mouth, overhung by a rostral fold, is an adaptive specialisation of *Travancoria* not met with in *Homaloptera*. Further, the rostral fold in between the rostral barbels is produced into barbel-like prominences, which indicate an increase in the tactile organs. This by itself is a further specialisation over the *Homaloptera*-type. The tilting of the Western Ghats during the Pleistocene (Menon, 1951), and the consequent rejuvination of numerous torrential streams along the Western Ghats, and the climatic fluctuations during the Pleistocene (Silas, 1952), seem to have provided sufficient impetus for the rapid speciation in the early *Homaloptera* which migrated to the Peninsula from the region of the Eastern Himalayas. *Balitora* of Peninsular India would seem to be a later influx from the North-East.

2. *North Eastern India.*—The areas included in this division are the Eastern Himalayas, including Eastern Nepal and Northern Bengal and Assam. In the region of the Eastern Himalayas, *Homaloptera* under the dynamic changes that took place there as a result of the Himalayan tectonic movements became modified into the narrow snouted *Balitora*-like forms. These subsequently would have migrated to the Western Ghats to the West and the Chittagong Hill tracts and the Arakan Yoma to the South-East and are now represented by *Balitora brucei mysorensis*, *B. brucei burmanicus* and *B. brucei melanosoma*. The stock in the centre seems to have become still further modified and given rise to the broad snouted *B. brucei brucei* and *B. maculata*. As indicated already (*vide supra*,) no species of *Homaloptera* has so far been recorded from this region, but the likelihood of its occurrence there cannot be ruled out.

3. *Burma.*—For convenience, along with Burma, the Chittagong Hill tracts are also included. The genus *Homaloptera* is represented in Burma by three species, of which one, *H. modesta* is also found in Siam. The remaining two species, *H. bilineata* and *H. rupicola* are endemic. Similarly, the two varieties of *Balitora brucei*, *viz.*, *burmanicus* and *melanosoma* are endemic. In possessing a pointed snout and a subcylindrical body, *H. modesta* and *H. bilineata* are less specilised than *H. rupicola*,

a form with a more depressed body and a broadly rounded snout. The circumstances which led to the evolution of the broad headed *Balitora* in the Eastern Himalayas seem to have been responsible for the occurrence of the broad headed species of *Homaloptera* in Northern Burma and the narrow headed forms in Lower Burma. In addition, unlike *H. modesta* and *H. bilineata* the paired fins of *H. rupicola* are more extensive, the pectorals overlapping the pelvics. Recently (Silas, 1951), the relationships of *H. rupicola* to two other species, *H. weberi* of Borneo and *Homaloptera* sp. (*H. indochinensis*, sp. nov.), of Indo-China were discussed and it was pointed out that under similar stresses of enviornmental conditions they seem to have evolved along similar lines , *viz.*, broadly rounded head and extensive and overlapping paired fins.

4. *Siam.*—This division includes both Peninsular and Northern Siam. Of the five species of *Homaloptera* in Siam, two species, *H. modesta* and *H. zollingeri* are non-endemic. *H. zollingeri* is a widely distributed species and has a more or less narrowly pointed snout. The scales are keeled and the pectorals are separated from the pelvics by a considerable distance. The body is more or less subcylindrical. The above characters and the wide range of distribution of *H. zollingeri* indicates that it is a more primitive form than some of the other endemic species of *Homaloptera*. *H. lineata* and *H. smithi* are more specialised in possessing a broader snout and overlapping paired fins. In the former character *H. sexmaculata* resembles *H. smithi*. The monotypic genus *Balitoropsis* is endemic in Siam, and as stated elsewhere (Silas, 1951), the genus seems to have evolved from primitive *Homaloptera*-like forms in Siam. *Balitoropsis* is not a very highly specialised genus, for it has a subcylindrical form, with a more or less pointed snout, as is seen in *Travancoria* of Peninsular India. The pectorals fall much short of the pelvics. The genus is specialised in the possession of a deep rostral groove in front of the mouth and in the disposition of the barbels.

5. *Malaya Peninsula.*—The family is represented here by two genera, the genus *Homaloptera* being non-endemic and the monotypic genus *Neohomaloptera* being endemic. Of the five species of *Homaloptera* which occur here, *H. zollingeri*, *H. wassinki* and *H. orthogoniata* are non-endemic, while *H. leonardi* and *H. tweedei* are endemic. *H. wassinki* has a wider range of distribution, being also found in Sumatra, Java and Borneo. I have examined a specimen of *H. orthogoniata* collected by Dr. A. W Herre in Malaya Peninsula, and the species occurs elsewhere in Borneo. *H. leonardi* resembles *H. zollingeri* in certain features. In possessing a broad snout, extensive paired fins (pectorals overlaping the pelvics), and smooth scales, *H. tweedei* seems to be better adapted than the other Malayan species of *Homaloptera*. *Neohomaloptera* resembles the broad headed *Homaloptera*, such as, *H. amphisquamata*, but differs from it in the possession of an additional barbel at the angles of the mouth. Such a condition is seen in *Sinohomaloptera* of China. *Neohomaloptera* would seem to have diverged from the *Homaloptera*-stock in Malaya.

6. *Sumatra.*—Of the twelve species of *Homaloptera* found here, five, *viz.*, *H. zollingeri*, *H. wassinki*, *H. ophiolepis*, *H. ocellata* and *H. salusur* are non-endemic. *H. ophiolepis* like *H. wassinki* is also found in

Java and Borneo, while *H. ocellata* and *H. salusur* are found elsewhere only in Java. The endemic species are *H. amphisquamata, H. heterolepis, H. gymnogaster, H. modiglianii, H. ripleyi, H. ulmeri* and *H. vanderbilti.* Of these, *H. amphisquamata* is a highly specialised species in which the head and body are greatly depressed and the snout is broad and rounded. Ramaswami (1951) enumerated nine important skull characters by which *H. amphisquamata* could be separated from species of *Homaloptera,* like *zollingeri, leonardi* and *rupicola.* According to Fowler (1944), *H. ripleyi* has certain special features, but unfortunately, I have not examined the only known specimen of this species, and so am not in a position to add anything to its known affinities. The relationships of the other species have been discussed already (*vide supra,* p. 245).

7. *Java.*—All five species of *Homaloptera* present here are non-endemic. They are all represented in the fauna of Sumatra, while two species are also found in Borneo.

8. *Borneo.*—The family is represented here by two genera, one of which is endemic. Of the five species of *Homaloptera* in Borneo, *H. wassinki* and *H. ophiolepis* and *H. orthogoniata,* are non-endemic, while *H. stephensoni* and *H. weberi* are endemic. In the last two species the pectorals overlap the pelvics. In addition to a broad snout and an incipient rostral groove, *H. orthogoniata* possesses in each pelvic axil a fleshy appendage, this being another adaptation for life in torrential streams. The last said character is seen well developed in many of the Gastromyzonidae. The genus *Pseudohomaloptera,* is monotypic, and endemic in Borneo. It is characterised by the development of a well defined rostral groove in front of the mouth, extensive paired fins and a narrow elongated caudal peduncle. There is no doubt that *Pseudohomaloptera* has evolved from *Homaloptera*-like forms and has become more specialised than *Homaloptera* along certain lines. The significance of the occurrence of a peculiar Homalopterid in Borneo was discussed recently (Silas, 1951) and it was opined that the form had evolved in Borneo from some primitive Homalopterid stock. Thus Borneo seems to represent a centre of active speciation among torrential fishes. Hora (1951), has also discussed the possibility of the Gastromyzonid fishes in Borneo having evolved there independently under the stresses and strain of environmental factors, from primitive Cobitid stock. The endemic Homalopteridae in Borneo show how rapid divergence could take place from the original stock which should have reached the island before its isolation. The zoogeographical significance of the distribution of the Homalopteridae in the Islands of Malaya Archipelago is dealt with separately.

9. *Indo-China.*—The two non-endemic genera of Homalopteridae *viz.*, *Homaloptera* and *Sinogastromyzon* are represented in Indo-China by one species each. Speaking of the significance of the occurrence of *Homalopteras*p. (*H. indochinensis*) in Indo-China, it was stated that the form has evolved independently from primitive *Homaloptera*-stock (Silas, 1951). It seems probable that, besides the earlier wave of migration that brought *Homaloptera* to Indo-China, there must have been later and relatively speaking more recent waves which brought a highly

specialised from like *Sinogastromyzon* into Indo-China, for this genus is represented in China by several species. The fish fauna of Indo-China is not well known and so it is not possible to discuss its palaeogeograhy here.

10. *China.*—The Chinese Homalopteridae would seem to have been derived from primitive Homaloptera-stock of which no representative has been found there so far. At present the relationships of the different genera are better known. Of the five genera, four, *viz.*, *Sinohomaloptera*, *Hemimyzon*, *Lepturichthys* and *Metahomaloptera* are endemic, while all six species of *Sinogastromyzon* found there are endemic, though the genus is represented elsewhere in Indo-China also.

Sinohomaloptera is nearest to *Homaloptera*-like forms, and this led (Fang, 1930) to include it first as a subgenus of *Homaloptera*. Later, owing to the structure of the basipterygium, the development of the rostral groove and the presence of one more barbel at each angle of the mouth, it was recognised as a distinct genus. *Hemimyzon* has both broad headed as well as narrow headed forms, as has been described among species of *Balitora*. It has also a very variable caudal peduncle. *Hemimyzon* could perhaps be derived from the broad headed *Homaloptera* species. In *Hemimyzon*, the lips are papillated and the paired fins have convergent bases, both being characters of adaptive significance. *Lepturichthys* seems to be an extreme specialisation of the *Homaloptera*-type which gave rise to *Hemimyzon* forms with narrow heads and elongated caudal peduncle. But it does not lie in the direct line of evolution of *Hemimyzon*. In *Lepturichthys*, a whip-like caudal peduncle is developed. The head and anterior part of the body are greatly depressed. The tactile organs in the form of barbels at the angles of the mouth are well developed and greater in number and the rostral groove is well defined. In addition the lips are papillated and the pectorals nearly reach the pelvics.

From the broad headed *Hemimyzon* type, *Sinogastromyzon* can perhaps be derived. In *Sinogastromyzon* the paired fins are very extensive and the pelvics are united to form a disc-like structure. The body itself is greatly depressed and limpet shaped. Though probably not in the direct line of evolution, but closely related to *Sinogastromyzon* and more specialised than it in some respect, is the genus *Metahomaloptera* of Szechuan in China. *Metahomaloptera*, in addition to possessing united pelvics, has also greatly restricted gill-openings which are situated well above the bases of the pectoral fins. In this respect, *Metahomaloptera* among the Homalopteridae stands in par with *Gastromyzon* among the Gastromyzonidae, and shows parallel development in the reduction of the gill-openings to *Bhavania* of Peninsular India.

2. *Zoogeograpical significance of the distribution of Homalopteridae in the Islands of Malaya Archipelago.*

The fresh water as well as land faunas of the Greater Sunda Islands are so similar to that of Malaya Peninsula, that no doubt can exist about a former union of these islands to the mainland. In addition to geological evidences the faunistic data also throw much light on these former land connections. These islands, situated as they are on the continental shelf,

are surrounded by a shallow sea which nowhere exceeds 100 meters in depth. As a matter of fact, the depth is much less in most places. Hence, during the Pleistocene Glacial periods the portions covered by this shallow sea was a dry land, thus uniting the islands together and they in turn were connected to the mainland. It was Molengraaff and Max Weber (1919), who first drew attention to these Pleistocene land connections, and the continuous land mass was known as the Sundaland. The distribution of the Homalopteridae in Malaya Peninsula and the islands of the Archipelago confirm some of the earlier geological and zoogeographical findings. In addition they also bring to light some interesting aspects of distribution. Before considering these, certain facts of the Paleogeography of the Sundaland are dealt with below.

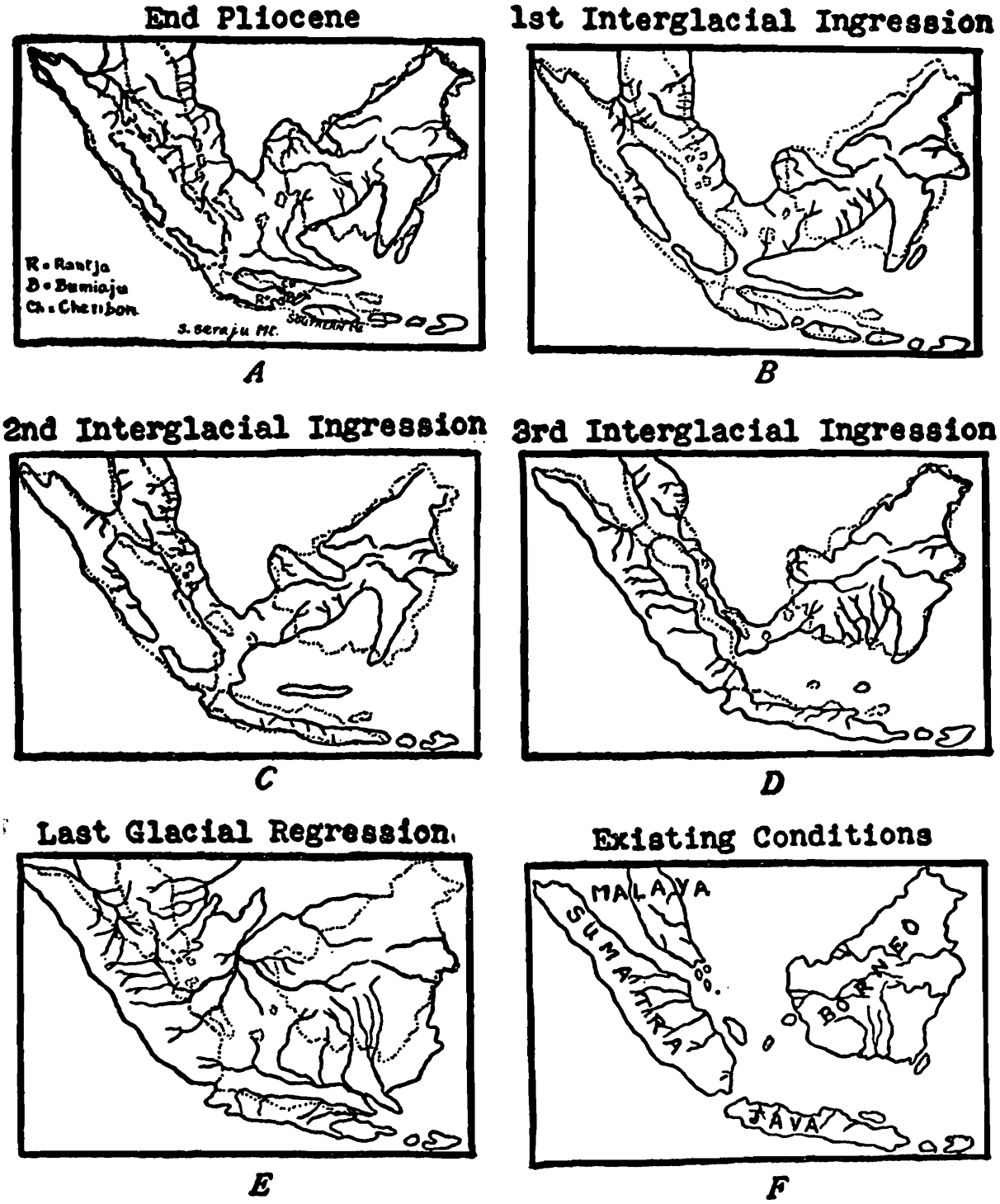
According to Molengraaff (1921), during the glacial times the rivers of Eastern Sumatra and Western Borneo ran through the lowlying plains of the Sundaland which came into existence through the retreat of the sea. These streams ultimately joined into one river which flowed northwards and emptied into the South China Sea. Max Weber, gave zoogeographical support to Molengraaff's view by showing the great similarity of the freshwater fish fauna of the streams of Western Borneo and Eastern Sumatra. The fauna of Eastern Borneo is very peculiar and has very little in common with that of the west.

From former Pleistocene land connections between Java and Borneo relationships in the freshwater fish fauna between Southern Borneo and Northern Java is to be expected. But this is not so, for, their respective faunas are more or less dictinct. Java shows close affinity to Sumatra than to Borneo. Speaking of the Morphological History of the Java Sea, Beaufort (1951), stated :—

> " In the lower Pliocene Western Java formed the end of a Peninsula terminating a land mass which included a great part of Borneo and Sumatra. The rest of Java was mostly below sea, from which only a few smaller islands emerged near its present south coast. During the Pleistocene these islands were joined to Western Java, and only during the third and during the fourth (and last) glaciation was the Java Sea dryland. Then only was direct interchange of faunas between Java and Borneo possible, but even then the watershed running from Sumatra to Borneo and including the islands of Banka and Billiton, prevented the fishes belonging to the ' new invasion ' from spreading to the rivers of Southern Borneo and of Java. The land between Java and Borneo may have been low and covered by swamps which may even have been brackish and hence unsuitable for true freshwater fishes."

Further he observed : " According to Smit Sibinga (1947) the Strait of Sunda now separating Java and Sumatra is of very recent origin. To the ancient Chinese it was unknown as a passage for ships. It must certainly be of post-glacial origin. Sumatra and Malaya were still connected at that time. In the time of Ptolemy there still existed a narrow strip of land between them, at a place which is now known as the ' One fathom bank."

Maps on the Pleistocene history of the Sundaland based on Glacio-estasism, adapted from Beaufort (1951) are given here, as it is thought, they will help in making clear certain facts about the distribution of the Homalopteridae in the islands of the Archipelago.



Tsxt-figure 4 A-E. Palaeogeographical sketch maps of the Indo-Australian Archipelago based on Glacio-eustasisms (after Beaufort, 1951).

From what has already been said the following important data are deduced :—

1. Pleistocene and recent land connections of the Sundaland with the mainland. These connections were mainly with the Malaya region, and this helped in the spread of Homalopteridae and other freshwater forms to the islands of the Malaya Archipelago.
2. Continuity of the watershed between Western Borneo and Eastern Sumatra.

3. Lowlying and swampy land connections between Borneo and Java preventing dispersal of highly specialised torrential fishes from Northern Java to Borneo or *vice versa*.

4. Last severence of Java from Sumatra during the Holocene.

Let us now consider what light the distribution of the Homalopteridae throw on the above deductions. The family, as already indicated, is essentially a northern element which seems to have originated in South Western China, probably in Yunnan (Hora, 1949), some time during the late Pliocene and reached Malaya Peninsula during the Pleistocene. At none of the stages of the Pleistocene was Borneo separated from Sumatra, nor from Malaya Peninsula, and this is ample evidence to show that the western fauna of Borneo came from this direction. It would seem that from Malaya Peninsula the Homalopteridae migrated to Sumatra and thence through the continuous watershed of the Sundaland to Borneo. Two species of *Homaloptera, viz., H. wassinki* and *H. ophiolepis* are common to Sumatra and Borneo. The spread of torrential fishes like *Homaloptera* from Sumatra to Borneo involves a connection between these two places of some altitude, for it is not probable that these fishes could disperse through the lowland rivers. The early homalopterid stock once having reached Borneo would have migrated to their present limits in the island. This west to east influx of Homalopteridae would have been checked as a result of the disappearance of these elevated land connections. These changes did not in any way affect the west to east dispersal of the lowland fishes which are today found common to both these islands.

All through the Pleistocene, Western Java was continuous with Sumatra and species of *Homaloptera*, such as *H. zollingeri, H. wassinki, H. ophiolepis, H. ocellata* and *H. salusur* migrated further south and reached Java. From distributional data, it would seem that *H. zollingeri* and *H. wassinki* were among the earliest to reach Java as they have a wider distribution *H. ophiolepis* would have reached Java prior to *H. ocellata* and *H. salusur*, for it is also found in Borneo. The crustal upheavels of the southern continuation of the direct Himalayan movement in the form of the Malayan Arc passing through Sumatra and Java to further east, would have considerably facilitated the migration of torrential fishes like *Homaloptera* from Sumatra to Java. Later the disruption of land connections between Sumatra and Java during the Holocene, checked further dispersal of the torrential forms from the former to the latter.

Among *Homaloptera*, Java has no species in common with Borneo which does not occur in Sumatra also. This indicates that the Javan and Bornean element of *Homaloptera* were derived from Sumatra. Strangely enough P. and F. Sarasin (1901) also came to a similar conclusion from a study of the land molluscs of these islands. So far as land molluscs go, Java has no species in common with Borneo which does not occur in Sumatra also, and this led them to conclude that Java got its land molluscan fauna from Sumatra and not from Borneo. This molluscan colonization of Java from Sumatra should have taken place during the Pleistocene

glacial epochs, in which case it was also contemporaneous with the dispersal of *Homaloptera* in these islands. The swampy lowlying connections between Northern Java and Southern Borneo were definite barriers to the dispersal of *Homaloptera* from Java to Borneo or *vice versa*. Thus in Java, *Homaloptera* reached a ' blind alley ', in its distribution. From the non-endemicity of *Homaloptera* in Java, it would seem that they are more recent isolates there. It also suggests that, both Borneo and Sumatra were subjected to more intense orogenic movements which indirectly aided rapid divergence of species.

The subsequent severence of land connections of the Sundaland with the mainland and the ingression of the sea resulting in the formation of the large Sunda Islands of Sumatra, Java and Borneo totally isolated the freshwater faunas in these islands. As already indicated, the unsettled orogenic conditions coupled with factors of a torrential environment were of sufficient importance in bringing about rapid divergence in the Homalopteridae in Sumatra and Borneo and also in the other geographical divisions. The great endemicity of these forms indicate that in each geographical division species have evolved within a relatively shorter time.

3.—*Probable lines of evolution of the family Homalopteridae.*

Though it is now known that the Homalopteridae are evolved from Cyprinid ancestors, it has not been possible so far to trace its ancestory to any particular Cyprinid genus or genera. In dealing with the distribution of the family region by region (*vide supra*), remarks were made on the inter-relationships of the species and genera in the different geographical divisions. The recent advances in our knowledge of these fishes has helped to fill in much of the gap that once existed between the different genera. An assessment of their characters reveal that habitudinal variations have brought about repeated divergences and convergences in the family. The following characters may be said to be of functional evolutionary significane in these fishes :—

1. Greatly depressed head and body.
2. Broad snout.
3. Development of a rostral groove.
4. Restriction of the gill-openings to small openings above base of pectoral fin.
5. Extensive paired fins (pectorals overlapping pelvics).
6. Union of pelvics posteriorly to form a disc-like structure.
7 Development of a whip-like caudal peduncle.
8. Tactile organs : greater number of barbels and papillated or fimbriated lips.
9. Development of skin flap in pelvic axil.
10. Smooth scales.

The general depression of the head and anterior part of the body, the compact arrangement of the bones of the skull, the flattened nature of the basipterygium, the reduction of the air bladder, etc., are character

of primary adaptive significance in all the Homalopteridae. Ramaswami (1951) enumerated four important cranial characters on which all Homalopteridae, having taken to life in the torrential streams generally resemble.

To surmise what has already been said regarding the interrelationship of the genera in the different geographical divisions, it may be stated that the earliest step in the specialisation and evolution of these fishes from the *Homaloptera*-type seems to have been a broadening of the snout and the development of a rostral groove in front of the mouth. The snout from the narrow pointed *Helgia*-type tends to become-broad, as is seen in *Bhavania*. Addition of tactile organs such as, increase in the number of barbels and papillations on the lips, more barbels, etc., are seen in some of the genera. Further divergence from the original type is witnessed in the development of more extensive paired fins as seen in many species of *Homaloptera*, *Balitora*, *Hemimyzon*, *Sinogastromyzon*, *Metahomaloptera* etc., the reduction of the gill-openings to small openings well above the base of the pectoral fins as in *Bhavania* and *Metahomaloptera* and the elongation of the caudal peduncle to form a powerful whip-like structure as in *Pseudohomaloptera*, *Lepturichthys* and some species of *Hemimyzon*. In *Sinogastromyzon* and *Metahomaloptera*, the pelvics are united posteriorly to form a disc-like structure. From a study of functional morphological adaptations, *Metahomaloptera* seems to be the most highly evolved from in the family.

IX.—Distribution and Evolution of the Fishes of the Family Gastromyzonidae.

1. *Distribution of the family Gastromyzonidae.*

Unlike the Homalopteridae, the Gastromyzonidae has a somewhat restricted distribution. From the table given on pages 179 to 180 (*vide supra*), it will be seen that they are confined on the mainland of Asia to Indo-China and China (including Formosa) and elsewhere only on the island of Borneo. Their absence in the regions to the west, *viz.*, in India, Burma, Siam, Malaya Peninsula, Sumatra and Java is noteworthy. As will be seen from the following analysis, all gastromyzonid genera are endemic in the three geographical divisions in which they are found at present :—

1. Indo-China.

*Genus *Annamia* Hora.

(motonypic).

*Genus *Sewellia* Hora.

(monotypic).

2. China and Formosa.

*Genus *Liniparhomaloptera* Fang.

(monotypic).

*Genus *Vanmanenia* Hora.

(2 species).

---

* Indicates endemic genus.

*Genus *Praeformosania* Fang.
(3 species).
*Genus *Formosania* Oshima.
(monotypic).
*Genus *Crossostoma* Sauvage.
(2 species).
*Genus *Paraprotomyzon* Pell. & Fang.
(monotypic).
*Genus *Pseudogastromyzon* Nichols.
(6 species).
*Genus *Beaufortia* Hora.
(6 species).

3. Borneo.

*Genus *Glaniopsis* Boulenger.
(monotypic).
*Genus *Parhomaloptera* Vaillant.
(monotypic).
*Genus *Protomyzon* Hora.
(2 species).
*Genus *Progastromyzon* Hora & Jayaram.
(monotypic).
*Genus *Neogastromyzon* Popta.
(monotypic).
*Genus *Gastromyzon* Günther.
(monotypic).

Earlier workers held the view that the Gastromyzonid fishes originated directly in Southern China, from whence they migrated southwards and reached Borneo when former land connections existed. Recently, Beaufort (1951, p. 88), speaking of the inter-relationships and geographical affinities of the Gastromyzoninae of Borneo, observed :—

> "In the mountain torrents of Northern Borneo certain curious fishes are found belonging to the Homalopteridae. Among fishes of this group they have gone farthest in the way of adaptation to life in fast running water, as the whole flat underside, surrounded by much expanded pectoral and pelvic fins, forms a large sucker by which the fish can adhere to stones or rocks. Two genera, *Gastromyzon* and *Negoastromyzon*, are known from Borneo, but closely allied forms are found in the mountain streams of Southern China. They are unknown from Java, Sumatra, Malaya or Siam, and the most probable explanation of their occurrence in Borneo is that they came by a direct route from China. This involved

* Indicates endemic genus.

> a connection between Borneo and China of some altitude, for it is not probable that these fishes could disperse through lowland rivers. Nor is it probable that they used the Pleistocene land bridge through the Philippines and Formosa, for in that case we should expect to find Gastromyzoninae in the mountains of these islands. As the two Bornean genera are endemic, it is also improbable that they reached Borneo so late. They seem to belong to an older invasion, and their occurrence in the upper course of the Mahakam is in favour of this view."

Much can also be said in favour of the view that the Gastromyzonidae did not reach Borneo from China. Hora (1951), in a thought-provoking paper on the Gastromyzonid fishes of the mainland of Asia and the island of Borneo, has brought forward evidence to show that the Gastromyzonid element in Borneo was not derived from the Chinese mainland. Instead in both these places they represent products of independent evolution from primitive Cobitid stock. It is also interesting to find that none of the Bornean Gastromyzonid genera are present on the mainland or *vice versa*. Collateral evidence as seen in the distribution of the Homalopteridae and the Glyptosternoid fishes of the family Sisoridae, order Siluroidea (Hora and Silas, 1951), suggest that, geochronologically speaking, the Gastromyzonidae date back not earlier than the later part of the Pliocene or early Pleistocene. That the Pleistocene land bridge between China and Borneo could have helped in their dispersal from the north to the south does not seem likely, for, there seems to have been no land connections of appreciable elevation between Borneo and Indo-China or China during this period. Lowlying land connections could not have facilitated the dispersal of such highly specialised torrential fishes over such a wide distance. The following section on the polyhyletic origin of the family Gastromyzonidae will help to make clear its zoogeography also.

2. *Polyphyletic origin of the family Gastromyzonidae.*

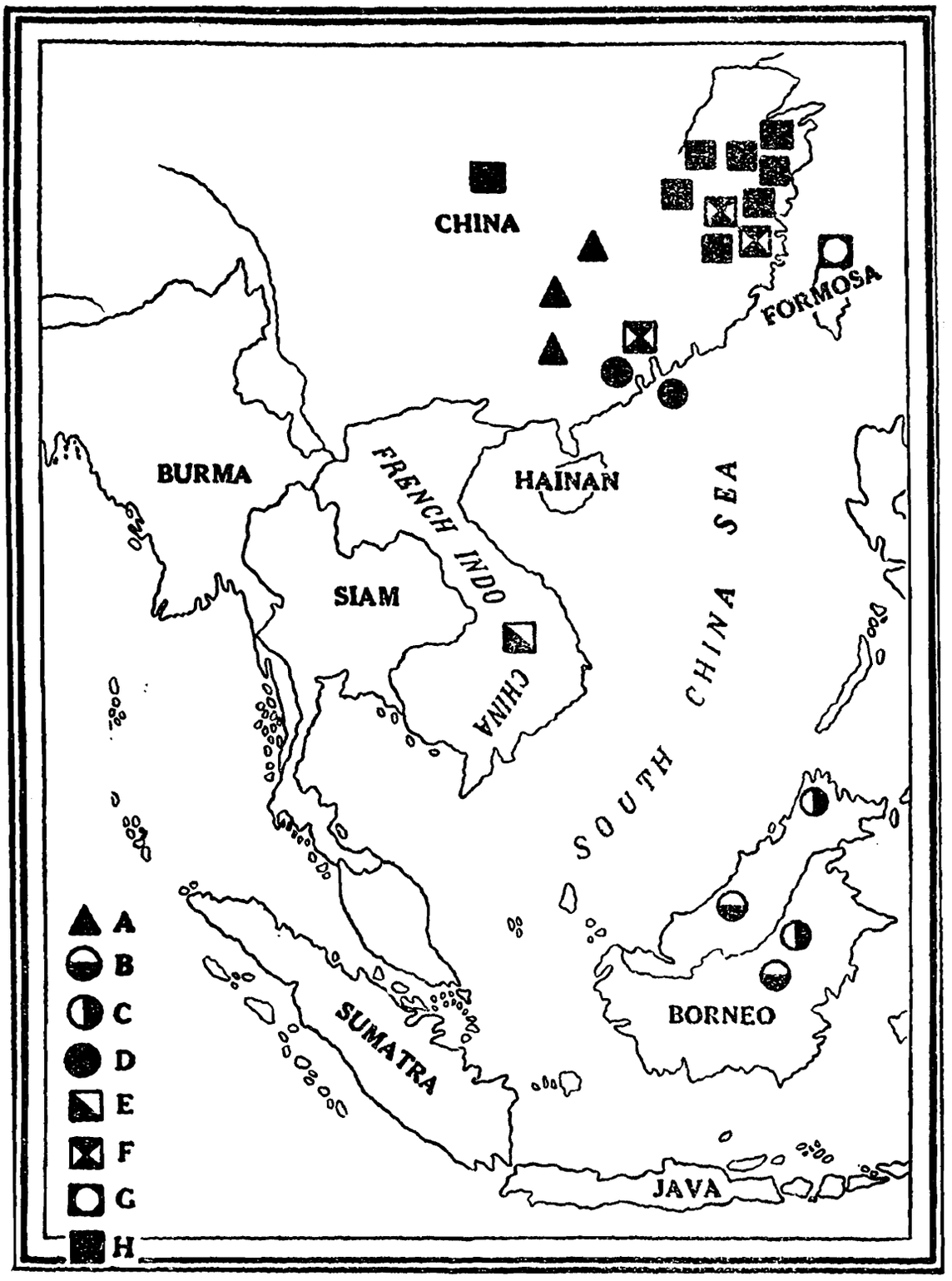
Fang (1935) was the first to draw attention to the fact that the Gastromyzonidae (Gastromyzoninae Hora, 1932) were a polyphyletic assemblage of individuals and divided them into two groups, *viz.*, the Crossostomoid-group and the Gastromyzonid-group. In dealing with the Crossostomoid fishes of China he observed :—

> "Crossostomoid fishes are small forms inhabiting the mountain torrents. They are well separated from the Gastromyzonian fishes in having the gill-openings extending to the ventral side of the body and the pectoral fins set immediately behind them."

The Crossostomoid and the Gastromyzonid groups are now recognised as two distinct subfamilies and as already stated, Hora (1951) has discussed the polyphyletic origin of these fishes in the mainland of Asia and in Borneo. His views are elaborated below.

A. ***Parallel evolution of the Crossostomoid fishes on the mainland of Asia and on Borneo.***

Fang (1935) derived the Crossostomoid fishes from a 'Nemachiloid ancestral stock' and regarded them as having evolved independently along three lines, namely, (1) *Annamia* Hora, (2) *Liniparhomaloptera* Fang and *Parhomaloptera* Vaillant and (3) *Vanmanenia* Hora, *Praeformosania* Fang, *Formosania* Oshima and *Crossostoma* Sauvage. Though



Text-figure 5. Map showing the distribution of the fishes of the subfamily Cross ostominae.

A. *Vanmanenia* Hora. *B.* *Parhomaloptera* Vaillant.
C. *Glaniopsis* Boulenger. *D.* *Liniparhomaloptera* Fang.
E. *Annamia* Hora. *F.* *Crossostoma* Sauvage.
G. *Formosania* Oshima, *H.* *Praeformosania* Fang.

it is not possible to agree with Fang's views on the inter-relationships of the Crossostominae, one thing is certain, *viz.*, that the Crossostominae by itself is a heterogenous assemblage of independently evolved forms, all, derived from primitive Cobitid stocks, both on the mainland and in Borneo. As such, before dealing with the mainland genera, the evolution of the Bornean genera are dealt with first.

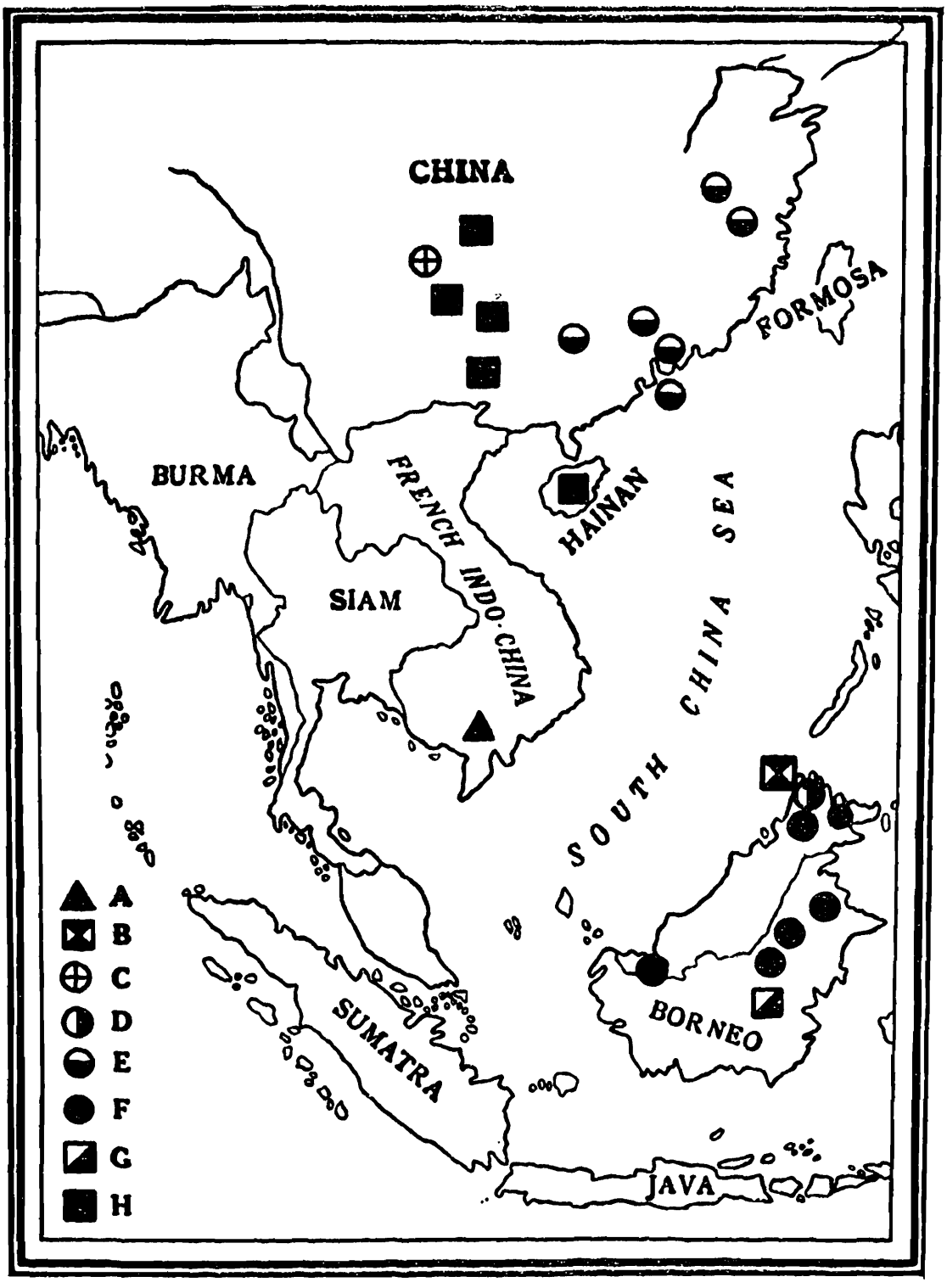
Glaniopsis of Borneo shows a large number of Nemachiline characters, but also exhibits a few important Gastromyzonid features. Ramaswami (1951) has accounted for nine skull characters in which *Glaniopsis* resembles the Nemachiline group, and eight on which it differs from it. According to him, "In possessing independent sensory canal ossicles in the supraorbital, suborbital, temporal and supraoccipital regions and in not having the exoccipital fenestrae, *Glaniopsis* stands apart from the Cobitidae. *Parhomaloptera*, the other Crossostomoid genus found in Borneo, is quite different from *Glaniopsis*, especially in the nature of the mouth and the associated structures. *Parhomaloptera* is more specialised than *Glaniopsis* and it would seem that these two forms have evolved independently in Borneo from primitive *Nemachilus*-like Cobitidae.

On the mainland, the Crossostomoid fishes are represented by six genera, *viz.*, *Vanmanenia*, *Praeformosania*, *Formosania*, *Liniparhomaloptera* and *Crossostoma* in China and *Annamia* in Indo-China. Fang considered *Annamia* and *Liniparhomaloptera* to be independently evolved from 'primitive Crossostomoid fishes'. He was also of the opinion that *Liniparhomaloptera* of China directly gave rise to *Parhomaloptera* of Borneo. But we have already seen that there could have been no interchange of Crossostomoid fishes between Borneo and China or *vice versa*. In the absence of a rostral groove and the disposition of the barbels *Liniparhomaloptera* shows some affinity to *Crossostoma*. It is quite possible that these two forms have been derived from a common ancestral stock, the former being less specialised than the latter, but not in the direct line of evolution of the latter. In addition, *Crossostoma* according to Ramaswami (1951) is characterised by the possession of a pair of prepalatines, a feature which is not found in the other genera studied by him. *Vanmanenia*, *Praeformosania* and *Formosania* represent an evolutionary series of progressive specialisation. Though Fang considered *Crossostoma* as the most specialised of this series, for reasons already indicated, *Crossostoma* is considered to represent an independent line of evolution. *Annamia* of Indo-China, in its slender depressed body, pointed snout, horse-shoe shaped rostral groove, absence of rostral fold, disposition of the rostral barbels and the slender caudal peduncle, is markedly different from the rest of the Crossostomoid fishes, and would seem to represent another independent line of evolution from *Nemachilus*-like primitive Cobitidae.

B. *Parallel evolution of the Gastromyzonid fishes on the mainland of Asia and on Borneo.*

Like the Crossostominae the Gastromyzoninae can be arranged into two geographical units, *viz.*, Pseudogastromyzoni comprising the four genera *Paraprotomyzon* Pellegrin & Fang, *Pseudogastromyzon* Nichols,

Beaufortia Hora and *Sewellia* Hora on the mainland of Asia and the Gastromyzoni including *Protomyzon* Hora, *Progastromyzon* Hora & Jayaram, *Neogastromyzon* Popta and *Gastromyzon* Günther, represented



Text-figure 6. Map showing the distribution of the fishes of the subfamily Gastromyzoninae.

A. *Sewellia* Hora.
B. *Progastromyzon* Hora & Jayaram.
C. *Paraprotomyzon* Pell. & Fang.
D. *Protomyzon* Hora.
E. *Pseudogastromyzon* Nichols.
F. *Gastromyzon* Günther.
G. *Neogastromyzon* Popta.
H. *Beaufortia* Hora.

only in Borneo. These two groups are also separated on definite taxonomical characters, for in the Pseudogastromyzoni (mainland forms) the pectorals overlap the pelvics and the mouths are markedly small being contained less than one-third in the width of the head, while in Gastromyzoni (Bornean forms), the pectorals are separated from the pelvics by a considerable distance, but in *Gastromyzon* and *Neogastromyzon* which are highly specialised genera, lateral flaps of skin are developed to bridge over the space between the paired fins, thus converting the whole ventral surface into an effective suctorial disc. In the extent of the mouth *Progastromyzon*, *Neogastromyzon* and *Gastromyzon* form one group, where it is very extensive and more than half the width of the head. In *Protomyzon* the mouth is about one-third the width of the head. It would thus seem that in Borneo there were two independent lines of evolution among the Gastromyzoni, one giving rise to *Protomyzon* and the other after having evolved to the *Progastromyzon*-stage, diverging along two lines, which are at present represented by *Neogastromyzon* and *Gastromyzon*. Of these *Gastromyzon* seems to be the most specialized genus.

On the mainland *Sewellia* of Indo-China due to its geographical isolation and specialisation appears quite different and independent from the Chinese genera. Likewise *Paraprotomyzon* would also represent another independent line of evolution. The remaining genera, *Pseudogastromyzon* and *Beaufortia*, seem to have evloved from the same stock, but diverged, thus not forming a direct line of progressive specialisation. *Beaufortia* is more highly specialised than *Pseudogastromyzon*, for in it the number of rays in the paired fins are more numerous and the pelvics are united posteriorly to form a disc-like structure.

Summary and Conclusions.

It is proposed to present here very briefly the main conclusions reached in the preceding pages. In the present work, a complete revision of the two Cyprinoid families Homalopteridae and Gastromyzonidae is given, with descriptions of a new genus and a new species. From the distribution of these fishes, certain conclusions of zoogeographical significance have been arrived at. In the west, the distribution of the Homalopteridae throws more light on the migration of torrential fishes from the Eastern Himalayas to the Western Ghats of Peninsular India. In the Malaya Archipelago, the Homalopterid element seems to have spread from Malaya to Sumatra and from Malaya and Sumatra to Borneo on the one hand and from Sumatra to Java on the other. There seems to have been no direct dispersal of the highly specialized torrential fishes between Java and Borneo or *vice versa*. The high percentage of endemic species in Sumatra and Borneo and the absence of endemic species in Java suggest that Java received its Homalopterid element more recently. The overlapping distribution of the 'non-endemic' species of *Homaloptera* in the different geographical divisions is noteworthy, and is a clear indication of the north to south trend of dispersal of these fishes.

The study of the evolution and distribution of the family Gastromyzonidae supports Hora's contention (Hora, 1951) that these fishes

have evolved independently in Borneo and on the mainland of Asia from primitive Cobitidae and that the Bornean element thus does not represent forms that had formerly migrated from China directly to the south as was considered by earlier workers. As such, the Gastromyzonidae by itself is polyphyletic the family being divided into two subfamilies, Crossostominae and Gastromyzoninae, the latter being further divided into two divisions, *viz, Pseudogastromyzoni* (on the mainland of Asia) and *Gastromyzoni* (Borneo). As in the case of Gastromyzoninae, the Crossostominae itself warrants a further division on geographical grounds and if proposed should bear the names *Cross ostomini* (on the mainland of Asia) and *Glaniopsini* (Borneo).

Geographical and ecological isolation have thus played a great role in the evolutionary divergence of these fishes. The isolation being complete or almost complete, the divergences have ranged from subspecific, specific and even to generic levels. As environmental factors are equally important in determining the amount of differentiations that have taken place, the effects of the orogenic movements and resulting physiographic changes that greatly affected the drainage systems in South East Asia during the Pleistocene must not be underestimated. These changes must have had profound influence on the speciation and distribution of these fishes. Such changes in the environmental conditions which may be responsible for inducing totally different modifications are also responsible for the high percentage of endemicity seen among the Homolopteridae and Gastromyzonidae.

The repeated divergences and convergences brought about by habitudinal segregation have made it difficult to discern any straight line of evolution in the Homalopteridae and Gastromyzonidae. But all the same, the directiveness of evolutionary trends in them cannot be doubted for, increased specialization is always associated with more efficiency for life in the rapid waters of the torrential streams. Thus in every case, the adaptation met with, relates to a fine adjustment of the animal to the external conditions of its environment. Divergent and convergent evolution, as evidenced from these fishes, indicate more clearly the causes for adaptive modifications, and the utility of such modifications to the organism concerned.

LITERATURE*.

Beaufort, L. F. de, *Zoogeography of Land and Inland Waters*, London. (1951).

Berg, L. S., *Classification of Fishes both Recent and Fossil.* (1940).

Chang, W. H., Notes on Fishes of Western Szechuan and Eastern Sikang. *Sinensia.* **15,** pp. 27-60.

Chang, H. W., Comparative study of the girdles and their adjacent structures in Chinese Homalopterid with special reference to adaptation to torrential streams. *Sinensia.* **16,** pp. 9-26. (1945).

* For the literature earlier than 1932, reference may be made to Hora, 1932, pp. 328-330.

Chen, J. T. F., and Liang, Y., Description of a new Homalopterid Fish, *Pseudogastromyz ontungpeiensis*, with a synopsis of all known Chinese Homalopteridae. *Quart. Journ. Taiwan Mus.* **2**, (4), pp. 157-172. (1949).

Cockerell, T. D. A., The scales of the Cobitid and Homalopterid Fishes. *Proc. Biol. Soc. Washington*, **22**, pp. 205-207. (1909).

Cockerell, T. D. A., Observation on Fish Scales. *Bull. U.S. Bur. Fisheries*, **32**, p. 140. (1912).

Dammerman, K. W., On the Zoogeography of Java. *Treubia*, **11**, pp. 1-88. (1929).

Fang, P. W., New Homalopterinae Loaches from Kwangsi, China. *Sinensia.* **1**, (3), pp. 25-42. (1930).

Fang, P. W., New and inadequately known Homalopterine Loaches of China. *Contr. Biol. Lab. Sci. Soc. China. (Zool. Ser.)*, **6** (4), pp. 24-43. (1930).

Fang, P. W., *Sinogastromyzon szechuanensis*, A new Homalopterid Fish from Szechuan, China. *Contrib. Biol. Lab. Sci. Soc. China. (Zool. Ser.)*, **6** (9), pp. 99-103. (1930).

Fang, P. W., Notes on new species of Homalopterine Loaches referring to *Sinohomaloptera* from Szechuan, China. *Sinensia.* **1** (9), pp. 137-145. (1931).

Fang, P. W., New and rare species of Homalopterid Loaches. *Sinensia*, **4**, pp. 39-50. (1934).

Fang, P. W., New and rare species of Homalopterid Fishes of China. *Sinensia*, **1**, pp. 41-46. (1931).

Fang, P. W., Study of Crossostomoid Fishes of China. *Sinensia.* **6**, pp. 44-97. (1935).

Fowler, H. W., Some Fishes from Borneo. *Proc. Acad. Nat. Sci. Philad.*, (2), **57**, pp. 475-479. (1905).

Fowler, H. W., Zoological Results of the De Schanensee Siamese Expedition. Part I. Fishes. *Proc. Acad. Nat. Sci. Philad.* **86**, pp. 98-99. (1934).

Fowler, H. W., Zoological Results of the third De Schanensee Siamese Expedition, Part III. Fishes obtained in 1936. *Proc. Acad. Nat. Sci, Philad.*, **89**, p. 152. (1937).

Fowler, H. W., Zoological Results of the George-Vanderbilt Sumatran Expedition. 1936-1937. *Proc. Acad. Nat Sci. Philad.*, **91**, pp. 375-379. (1940).

Herre, A. W., Fishes from Kwantung Province and Hainan Island, China. *Lingnan Sci. Journ. Canton*, **11**, p. 430. (1932).

Herre, A. W., Notes on new or little known Fishes from South Eastern China. *Lingnan Sci. Journ. Canton*, **13**, pp. 285-296. (1934).

Herre, A. W., Notes on a small collection of Fish from Kwantung Province including Hainan, China. *Lingnan Sci. Journ. Canton*, **17**, pp. 425-437. (1938).

Herre, A. W., New species of Fishes from the Malaya Peninsula and Borneo. *Bull. Raffles Mus. Singapore*, **16**, pp. 5-26. (1940).

Herre, A. W., Notes on Fishes in the Zoological Museum of Stanford University. XVII. New Fishes from Johore and India. *Proc. Biol. Soc. Washington.* **57**, pp. 45-51. (1944).

Herre, A. W., Notes on Fishes in the Zoological Museum of Stanford University. XX. New Fishes from China and India, a new genus and a new Indian Record. *Journ. Washington Acad. Sci.* **35**, pp. 399-404. (1945).

Herre, A. W., and Myers, G. S., Fishes from Southern China and Hainan. *Lingnan Sci. Journ. Canton*, **10**, pp. 247-248. (1931).

Hora, S. L., Classification, Bionomics and Evolution of Homalopterid Fishes. *Mem. Ind. Mus.*, **12**, pp. 263-330. (1932).

Hora, S. L., On the Systematic Position of the Loach *Homaloptera hingi* Herre. *Rec. Ind. Mus.*, **32**, pp. 37-38. (1935).

Hora, S. L., Homalopterid Fishes from Peninsular India. *Rec. Ind. Mus.*, **43**, pp. 221-232. (1941).

Hora, S. L., On a small collection of fish from Perak, Federated Malaya States. *Bull. Raffles Mus.*, **17**, pp. 5-11. (1941).

Hora, S. L., Notes on Malayan Fishes in the Collection of the Raffles Museum. Parts 2 and 3. *Bull. Raffles Mus.*, **17**, pp. 44-64. (1941).

Hora, S. L., Notes on Homalopterid Fishes in the Collection of certain American Museums. *Rec. Ind. Mus.*, **48** (1), pp. 45-57. (1950).

Hora, S. L., Parallel Evolution of Gastromyzonid Fishes on the Mainland of Asia and in the Island of Borneo. *Proc. Nat. Inst. Sci. India.* **18** (1952) (in press).

Hora, S. L., Parallel Evolution of the Crossostomoid Fishes on the Mainland of Asia and in the Island of Borneo. *Proc. Nat. Inst. Sci. India* **18** (1952).

Hora, S. L., and Jayaram, K. C., A Note on the Systematic position of two Gastromyzonid genera, *Protomyzon* Hora and *Paraprotomyzon* Pellegrin and Fang. (Fishes : Cyprinoidea). *Rec. Ind. Mus.*, **48**, pp. 61-68. (1950).

Hora, S. L., and Jayaram, K. C., A Note on the Systematic position of *Glaniopsis* Boulenger. (Pisces : Cyprinoidea). *Rec. Ind. Mus.*, **48**, p. 85. (1950).

Hora, S. L., and Jayaram, K. C., On two new Gastromyzonid Fishes from Borneo. *Rec. Ind. Mus.*, **49** (2), pp. 191-196 (1951).

Hora, S. L., and Silas, E. G., Evolution and Distribution of Glyptosternoid Fishes of the Family Sisoridae (Order Siluroidea). *Proc. Nat. Inst. Sci. India.* **18**, (4), pp. 309-322. (1952).

Law, N. C., The Scales of Homalopterid Fishes. *Rec. Ind. Mus.*, **48,** p. 69. (1950).

Liang, Y. S., Notes on some species of Homalopterid Loaches referring to *Pseudogastromyzon* from Fukien, China. *Contr. Res. Ins. Zool. Bot. Fukien Prov. Acad.* No. I, pp. 1-8. (1942).

Lin, S. Y., Three new Freshwater Fishes of Kwantung Province. *Lingnan Sci. Journ. Canton,* **13,** pp. 225-227. (1934).

Martens, E. Van., Uber eine neue Untgaettung Von *Homaloptera, Monatsber. Ak. Wiss. Berlin,* p. 608. (1868).

Molengraaff, G. A. F., and Weber, M., On the relation between the Pleistocene Glacial period and the origin of the Sunda Sea. *Proc. Akad, Wet. Amst.*, **23** (1919).

Menon, A. G. K., Further studies Regarding Hora's Satpura Hypothesis. Role of Eastern Ghats in the Distribution of the Malayan flora and fauna to Peninsular India. *Proc. Nat. Inst. Sci. India,* **17,** p. 475. (1951).

Nichols, J. T., Natural History of Central Asia. Vol. IX. The Fresh Water Fishes of China. *Amer. Mus. Nat. Hist.* (1943).

Oshima, M., Contribution to the study of Freshwater Fishes of the Island of Formosa. *Ann. Carnegie Mus.*, **12,** pp. 193-197. (1919).

Pellegrin, J., and Chevey, P., Poisson nouvean du Tonkin appartenant an genre *Sinogastromyzon. Bull. Soc. Zool.* **60,** pp. 232-234. (1935).

Pellegrin, J., and Fang, P. W., A New Homalopterid, *Paraprotomyzon multifasciatus,* from Eastern Szechuan. *Sinensia,* **3,** pp. 99-107. (1935).

Pellegrin, J., and Fang, P. W., A New Homalopterid, *Paraprotomyzon multifasciatus,* from Szechuan, China. *Absts. Pap. Sci. Conf. Nanking,* p. 665. (1935).

Prashad, B., and Mukerji, D. D., Fishes of the Indawgyi Lake and the streams of the Myitkyina District (Upper Burma). *Rec. Ind. Mus.*, **31,** pp. 186-191. (1929).

Ramaswami, L. S., The Homalopterid Skull. *Proc. Zool. Soc. London.* **118,** pp. 515-538. (1948).

Ramaswami, L. S., Skull of Cyprinoid Fishes in relation to Phylogenetic Studies. III. The skull of Homalopterid Fishes. *Proc. Nat. Inst. Sci. India.* **18,** (6), pp. 495-518. (1952).

Ramaswami, L. S., Skull of Cyprinoid Fishes in relation to Phylogenetic studies. IV. The skull of Gastromyzonid Fishes. *Proc. Nat. Inst. Sci. India,* **18,** (6), 519-538 (1952).

Sagemehal, M., Beitrag Zur Vergleichende Anatomie der Fishe. IV Das Cranium der Cyprinoiden. *Morph. Jb.*, **17,** p. 498. (1891).

Sarasin, P., and F., Uber die geologische Geschiechte der Insel Celebes anf grund der Thierverbritung. *Wiesbaden, C.W. Kreidel's Verlag.* (1901).

Silas, E. G., On a collection of Fish from the Anamalai and Nelliampathi Hill ranges, Western Ghats, with notes on their Zoogeographical Significances. *Journ. Bombay Nat. Hist. Soc.*, **89** (4), pp. 670-681. (1951).

Silas, E. G., Notes on two Homalopterid Fishes. *Journ. Zool. Soc. India.*, **3** (1), pp. 10-15. (1951).

Silas, E. G., Further Studies Regarding Hora's Satpura Hypothesis. 2. Taxonomic Assessment and Levels of Evolutionary Divergences of Fishes with the so-called Malayan Affinities in Peninsular India. *Proc. Nat. Inst. Sci. India*, **18** (5), pp. 423-448. (1952).

Smit Sibienga, G. L., The Morphological History of the Java Sea. *Tijdschr. ned. aard. Gennot.* (e) **64**, pp. 572-576. (1947).

Smith, H. M., Contributions to the Icthyology of Siam. III. A new genus and a new species of Cyprinoid Fishes. VI. Fishes not previously recorded from Siam. *Journ. Nat. Hist. Soc. Siam.* Suppl., **9**, pp. 53-87 (1933).

Smith, H. M., The Freshwater Fishes of Siam or Thailand. *Bull. U. S. Nat. Mus. Washington*, **188**, pp. 278-281. (1945).

Tchang, T. L., Contribution a letude morphologique biologique et taxinomique des Cyprinides du Bassin du Yangtze. *Theses Facul. Sci. Univ. Paris.* (A), No. 209. pp. 149-152. (1930).

Tchang, T. L., A new Loach from Chekiang. *Bull. Fan. Mem. Inst. Biol.*, **3**, pp. 83-84. (1932).

Tchang, T. L., Notes on three new Chinese Fishes. *Bull. Fan. Mem. Inst. Biol.*, **3**, pp. 121-125. (1932).

Tchang, T. L., The Study of Chinese Cyprinoid Fishes. pt. I. *Zool. Sinica* (B), 2 (1), pp. 215-232. (1933).

Weber, M., *Zool. Ergebnisse Reise Bied. Ost-Indien.* **2**, p. 424. (1894).

Weber, M., and de Beaufort, L. F., *The Fishes of the Indo-Australian Archipelago*, **3**, pp. 2-21. (1916).

Wu, H. W., On the Fishes of Li-Kiang. *Sinensia.* **10**, pp. 92-142. (1939).

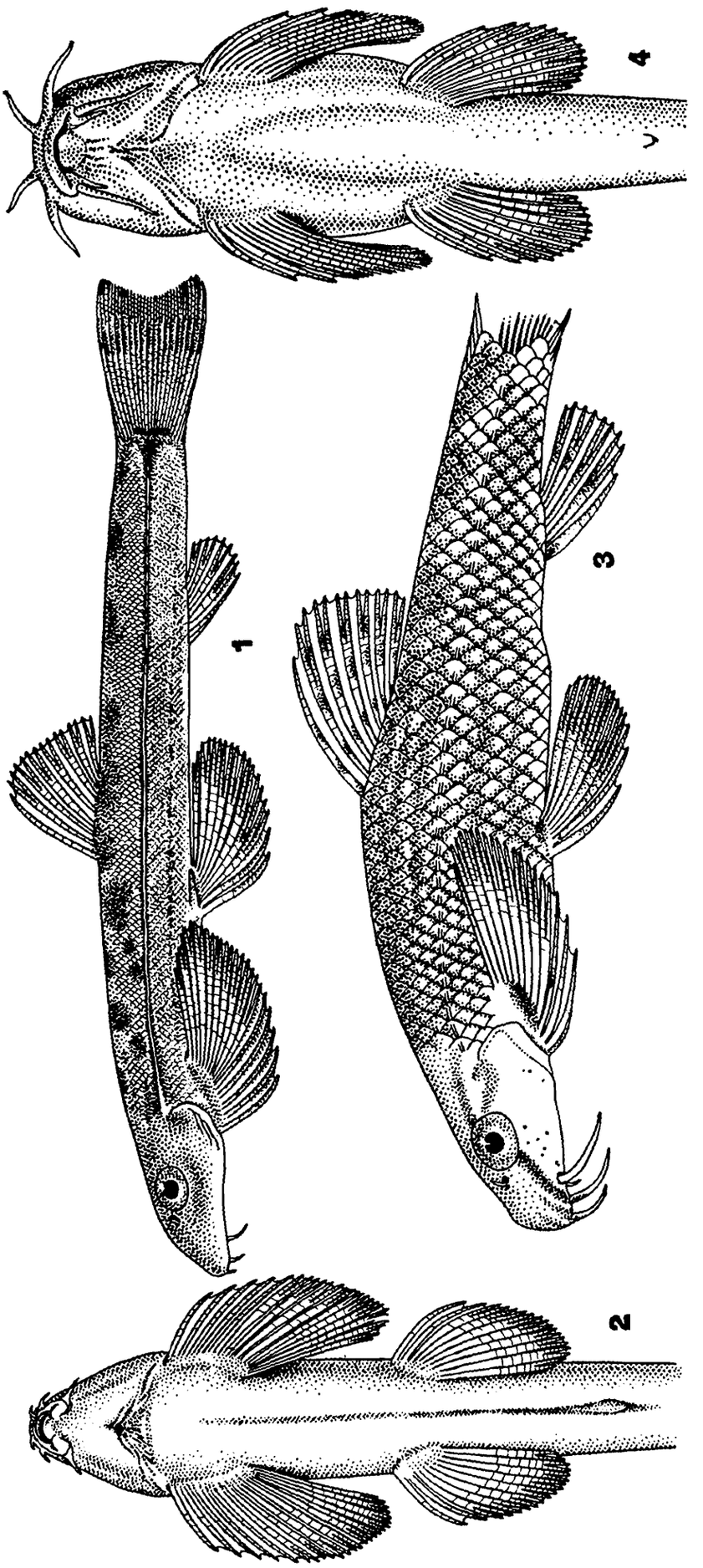
EXPLANATION OF PLATE V.

Homaloptera montana Herre.

1. Lateral View × 3
2. Ventral View × 3

Neohomaloptera johorensis Herre.

3. Lateral view × 5
4. Ventral view × 5



LATERAL AND VENTRAL VIEW OF *H. MONTANA* HERRE AND *H. JOHORENSIS* HERRE.

ON A SMALL COLLECTION OF FISH FROM MANIPUR, ASSAM.

By M. A. S. MENON, *M. Sc., Offg. Scientific Assistant, Zoological Survey of India, Calcutta.*

INTRODUCTION.

Our knowledge about the distribution of the fish fauna of Assam and its bearing on zoogeographical problems is to be drawn mainly from the papers of Hora[1] and Hora and Mukherji[2] who, supporting Annandale[3], have corroborated the view that "the fauna of the extreme eastern part of the Himalayan foothills is not,. .. .Himalayan in the sense in which the term has hitherto been understood, but allied rather to the fauna of Assam south of the Brahmaputra or even to that of Burma".

The collection under report was made by Major Dr. M. L. Roonwal, while serving as Mammalogist to the G.H.Q. (I), Indian Field Typhus Research Team, from central Manipur, about thirty-mile radius of Imphal, during a period of six months (July-December 1945). The following are the collecting localities from which collections were made:

1. Water-pools in field near Kanglatongbi Field Typhus Station (briefly called 'Kanglatongbi Camp'), off milestone 117 in the Dimapur Road about 16 miles north of Imphal: *ca.* 3,500 ft. altitude above sea-level.
2. Kanglatongbi bazar at milestone 121 on Dimapur-Imphal Road, about 12 miles north of Imphal.
3. Imphal market.
4. Water-pools and streams on Imphal-Palel Road south of Imphal at milestones 18-122; *ca.* 2,000 ft. altitude above sea-level.

The area in which the collection was made is washed by the stream of the southern watershed (Chindwin Drainage System) of Assam.

As listed below, altogether 19 species belonging to nine families are represented in the collection: those marked with an asterisk(*) are recorded for the first time from Manipur:

Family FLUTIDAE

1. *Fluta alba* (Zuiew)

Family BAGRIDAE

2. *Mystus bleekeri* (Day)

Family SILURIDAE

3. *Wallago attu* (Bl.)

Family CLARIIDAE

4. *Clarias batrachus* (L.)

Family CYPRINIDAE

5. *Barilius dogarsinghi* Hora
6. *Barilius barila* (Ham.)
7. *Barilius guttatus* Day*
8. *Puntius ticto* (Ham.)
9. *Puntius sarana* (Ham.)
10. *Crossochilus latius burmanicus* Hora
11. *Garra gotyla* (Ham.)

[1]Hora, S. L., *Rec. Ind. Mus.* XXII, pp. 165-224 (1921); *Ibid.* XXXVIII, pp. 317-331 (1936); *Ibid.* XXXIX, pp. 331-338 (1937).

[2]Hora, S. L., & Mukerji, D. D., *Rec. Ind. Mus.* XXXVII, pp. 381-404 (1935).

[3]Annandale, N., *Rec Ind. Mus.* VIII, p. 36 (1921).

Family Cobitidae

12. *Nemachilus manipurensis* Chaudhuri
13. *Lepidocephalichthys berdmorei* (Blyth)
14. *Botia berdmorei* (Blyth)

Family Percidae

15. *Ambassis ranga* (Ham.)

Family Ophicephalidae

16. *Channa gachua* (Ham.)
17. *Channa striatus* (Bl.)*

Family Anabantidae

18. *Anabas testudineus* (Bl.)*
19. *Colisa fasciatus* (Bl.)*

Of these 19 species, twelve are of cosmopolitan distribution in India and Burma. *Nemachilus manipurensis* is restricted to the Brahmaputra and Chindwin drainage systems of Assam while *Barilius dogarsinghi* is found only in the Chindwin drainage. *Lepidocephalichthys berdmorei* is confined to the Chindwin drainage of Assam and Burma. Of *Barilius guttatus* and *Botia berdmorei*, which are endemic in Burma, the latter has been known from Manipur while the former is now recorded for the first time from the Manipur valley. *Garra gotyla*, one of the widely distributed species of the genus all along the base of the Himalayas and which has been recorded from the Upper Chindwin drainage in the Assam-Burma border, is now found to occur in the Manipur valley also. The distribution of *Fluta alba* is known to be limited to southern Asia east of Bay of Bengal.

The present collection, though a small one, is of considerable significance in asmuch as it is the second collection of its kind from Manipur since 1921 and contains five species which are recorded from that area for the first time.

It is a pleasure to thank Dr. K. S. Misra, Assistant Superintendent, Zoological Survey of India, for going through this paper and confirming my indentifications.

Systematic Account.

Fluta alba (Zuiew).

1793. *Muraena alba*, Zuiew, *Nov. Act. Ac. Sc. Petropol.*, p. 299.
1921. *Monopterus albus*, Hora, *Rec. Ind. Mus.* XXII, p. 177.
1929. *Monopterus albus*, Prahad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 171.
1941. *Fluta alba*, Hora & Misra, *Journ. Bombay Nat. Hist. Soc.* XLII, p. 479.

From fields near Kanglatongbi Camp. 24 Oct. 1945. Five young specimens.

Distribution.—Manipur valley, Burma and all over southern Asia east of Bay of Bengal.

Mystus bleekeri (Day).

1853. *Bagrus keletius*, Bleeker, *Verh. Bat. Gen. XXV, Nalez. Ichth. Faun. Beng. en Hind*, p. 115 (*nec.* Cuv. Val.).
1878. *Macrones bleekeri*, Day, *Fish. India*, p. 451, pl. ci, fig. 1.
1921. *Macrones bleekeri*, Hora, *Rec. Ind. Mus.* XXII, p. 179.
1935. *Mystus bleekeri*, Hora, & Mukerji, *Rec. Ind. Mus.* XXXVII, p. 385.
1937. (1938). *Mystus bleekeri*, Shaw & Shebbeare, *Journ. Roy. As. Soc. Bengal, Sci.* III, pp. 7, 91.

From a small muddy stream by the roadside on Imphal-Palel Road at milestone 118. 14 Nov. 1945. Three specimens all measuring about 8·0 cms. in length.

Distribution.—Common in India and Burma.

Wallago attu[1] (Bl.).

1801. *Silurus attu*, Bloch & Schnieder, *Syst. Ichth.* p. 378, t. 75.

1921. *Wallago attu*, Hora, *Rec. Ind. Mus.* XXII, p. 178.

1941. *Wallagonia attu*, Sen, *Journ. Roy. As. Soc. Bengal, Sci.* VII, p. 9.

Purchased from Kanglatongbi bazar. Oct. 1945. One specimen 38·5 cms. long.

Distribution.—Common throughout India and Burma.

Clarias batrachus (L.).

1758. *Silurus batrachus*, Linne, *Syst. Naturae*, p. 305.

1921. *Clarias batrachus*, Hora, *Rec. Ind. Mus.* XXII, p. 178.

1939. *Clarias batrachus*, Das, *Rec. Ind. Mus.* XLI, p. 447.

Purchased from Kanglatongbi bazar. 8 Oct. 1945, four specimens; 13 Oct. 1945, five specimens.

The caudal fin bears a single, arched, faintly dark, vertical band while in the Burmese specimens Prashad and Mukerji[2] noted three such arched bands. The length of the largest specimen is 17 cms.

Distribution.—Common in India and Burma.

Barilius dogarsinghi Hora.

1921. *Barilius dogarsinghi*, Hora, *Rec. Ind. Mus.* XXII, p. 191, text-fig. 3.

1. Purchased from Kanglatongbi bazar. 19 Oct. 1945. Two specimens.

2. From muddy pools in fields near Kanglatongbi Camp. 28 Oct. 1945. Eight specimens.

These specimens agree with Hora's types and descriptions in every respect. The largest specimen is 8·4 cms. in length.

Distribution.—Only in the Chindwin drainage of Assam.

Barilius barila (Ham.).

1822. *Cyprinus barila*, Hamilton, *Fish. Ganges*, p. 267.

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

1935. *Barilius barila*, Hora & Mukherji, *Rec. Ind. Mus.* XXXVII, p. 73.

1937. *Barilius barila*, Hora, *Rec. Ind. Mus.* XXXIX, p. 332.

1. From muddy pools in fields near Kanglatongbi Camp. 28 Oct. 1945. Seven specimens.

2. Purchased from Kanglatongbi bazar. 19 Oct. 1945. One specimen.

In two grown-up specimens the four outer branched rays of the pectorals dorsally bear thickened ridges which are strewn with a linear series of minute, smooth tubercles. Similar tuberculations on the pectoral rays are also noticeable in two grown-up examples collected from Karong, Naga Hills, Assam and registered under No. F 10020/1.

The largest specimen is 15·9 and the smallest 7·8 cms. in length.

Distribution.—Common throughout India and Burma.

---

[1]Myers, G. S., *Proc. Calif. Zool. Club* I, pp. 19-20 (1948).

[2]Prashad, B. & Mukerji, D. D., *Rec. Ind. Mus.* XXXI, p. 171 (1929).

Barilius guttatus Day.

1869. *Opsarius guttatus*, Day, *Proc. Zool. Soc. London*, p. 620.
1878. *Barilius guttatus*, Day, *Fish. India*, p. 593, cxlix, fig. 3.
1889. *Barilius guttatus*, Day, *Faun. Brit. Ind.*, Fish. I, p. 351.
1890. *Barilius guttatus*, Vinciguerra, *Ann. Mus. Stor. Nat. Genova*, (2) IX, p. 310.
1929. *Barilius guttatus*, Prashad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 205.

Purchased from Kanglatongbi bazar. 19 Oct. 1945. One specimen 16·0 cms. long.

There are 47 scales along the lateral line, $2\frac{1}{2}$ between it and the ventral and 23 before the base of the dorsal.

Distribution.—Day gives as 'Irrawaddi from Prome to Mandalay': now recorded from Manipur for the first time.

Puntius ticto (Ham.).

1822. *Cyprinus ticto*, Hamilton, *Fish. Ganges*, p. 314, pl. viii, fig. 87.
1921. *Barbus ticto*, Hora, *Rec. Ind. Mus.* XXII, p. 187.
1939. *Barbus* (*Puntius*) *ticto*, Hora, Misra & Malik, *Rec. Ind. Mus.* XLI, p. 263.

1. From fields near Kanglatongbi, on the banks of Imphal river. 20 Oct. 1945. Two young specimens.
2. Purchased from Imphal market. 7 Oct. 1945. Five specimens.

The specimens resemble the Indian form (Hora *et al*, *op. cit.*).

Distribution.—Throughout India and Burma.

Puntius sarana (Ham.).

1860. *Barbus caudimarginatus*, Blyth, *Journ. As. Soc. Bengal* XXIX, p. 157.
1921. *Barbus sarana caudimarginatus*, Hora, *Rec. Ind. Mus.* XXII, 183.
1934. *Barbus sarana caudimarginatus*, Mukerji, *Journ. Bombay Nat. Hist. Soc.* XXXVII, p. 68.
1951. *Barbus sarana*, Pillai, *Proc. Nat. Inst. Sci. India* XVII, pp. 331-348.

From a small muddy stream by roadside on Imphal-Palel road at milestone 118. 14 Dec. 1945. Three specimens.

Distribution.—India and Burma.

Crossochilus latius burmanicus Hora.

1822. *Cyprinus latius*, Hamilton, *Fish. Ganges*, p. 345.
1921. *Crossochilus latia*, Hora, *Rec. Ind. Mus.* XXII, p. 183.
1935. *Crossochilus latius*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVII, p. 389.
1936. *Crossochilus latius burmanicus*, Hora, *Rec. Ind. Mus.* XXXVIII, p. 324.
1938. *Crossochilus burmanicus*, Hora & Misra, *Journ. Bombay Nat. Hist. Soc.* XL, pl. ii, fig. 1.

1. Purchased from Kanglatongbi bazar. 19 Oct. 1945. Two specimens.
2. Near Palel. 13 Nov. 1945. Nine juveniles.
3. Purchased from Imphal market. 7 Nov. 1945. Nine juveniles.

The specimens range from 5·0 to 10·5 cms. in length. The steel gray line extending from the eye to the base of the caudal just above the lateral line is more prominent in the juveniles.

Distribution.—India and Burma.

Garra gotyla (Gray).

1832. *Cyprinus gotyla*, Gray, *Ill. Ind. Zool.*, pl. lxxxviii, figs. 3, 3*a*.
1921. *Garra gotyla*, Hora, *Rec. Ind. Mus.* XXII, p. 653.
1937. *Garra gotyla*, Hora, *Rec. Ind. Mus.* XXXIX, p. 333.

Purchased from Kanglatongbi bazar. 19 Oct. 1945. Four specimens.

The specimens range from 7·7 to 8·5 cms. in length. The proboscis and the tuberculations on the snout are not so prominent in the smallest as in the three larger examples.

Distribution.—All along the base of the Himalayas ; it has also been recorded by Hora[1] from the Upper Chindwin drainage in the Assam-Burma border.

Nemachilus manipurensis Chaudhuri.

1912. *Nemachilus manipurensis*, Hora, *Rec. Ind. Mus.* VIII, p. 443, pl. xl, figs. 4, 4*a*, 4*b* ; pl. xli, figs. 1, 1*a*, 1*d*.

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

1935. *Nemachilus manipurensis*, Hora & Mukerji, *Rec. Ind. Mus.* XXXVII, p. 398, text-fig. 3.

From fields on the banks of Imphal river, Kanglatongbi Camp. 27 Oct. 1945. Four specimens.

The colour is pale gray, becoming dull white below. The caudal and dorsal are barred with gray. There are about 16–20 faintly marked, bluish gray, transverse stripes on the body, the last one at the base of the caudal being in the form of a bar. Hora and Mukerji[2] have divided this species into two groups banded and mottled or plain, according to colouration and certain other morphological differences. They seem to be correct in their observations. The largest specimen is 5 cms. in length.

Distribution.—Common in the Chindwin and Brahmaputra drainage systems of Assam.

Lepidocephalichthys berdmorei (Blyth).

1860. *Acanthopsis berdmorei*, Blyth, *Proc. As. Soc. Bengal* XXIX, p. 168.

1921. *Lepidocephalichthys berdmorei*, Hora, *Rec. Ind. Mus.* XXII, p. 196.

1937. *Lepidocephalichthys berdmorei*, Hora, *Rec. Ind. Mus.* XXXIX, p. 337.

1941. *Lepidocephalus berdmorei*, Hora & Misra, *Journ. Bombay Nat. Hist. Soc.* XLII, p. 479.

1. From fields near Kanglatongbi Camp. 24 Oct. 1945. Several specimens.

2. From fields on the banks of Imphal river, Kanglatongbi Camp. 27 Oct. 1945. Five specimens.

3. From small muddy stream by roadside on Imphal-Palel road at milestone 118. Five specimens.

Distribution.—The Chindwin drainage in Assam and Burma.

Botia berdmorei (Blyth).

1860. *Syncrossus berdmorei*, Blyth, *Journ. As. Soc. Bengal*, p. 166.

1876. *Botia berdmorei*, Day, *Fish. India*, p. 607, pl. cliv, fig. 3.

1889. *Botia berdmorei*, Day, *Faun. Brit. Ind.*, Fish. I, p. 217.

1890. *Botia berdmorei*, Vinciguerra, *Ann. Mus. Stor. Nat. Geneva*, (2) IX, p. 345.

1921. *Botia berdmorei*, Hora, *Rec. Ind. Mus.* XXII, p. 195.

Purchased from Imphal market. 7 Nov. 1945. Sixteen specimens.

The colour is seen to vary in the preserved specimens. Most of them have gone dull creamy white at the sides, with about 4-6 rows of buff spots, well marked in some on both the sides and rather faint

[1]Hora, S. L., *Rec. Ind. Mus.* XXXIX, p. 33 (1937).
[2]Hora, S. L., & Mukerji, D. D., *Rec. Ind. Mus.* XXXVII, p. 398 (1935).

in others. Some have, however, retained their original colour pattern with about 10-15 bluish gray, transverse stripes which become lighter towards the abdomen. The caudal and the dorsal are also striped. The largest specimen measures 8·6 cms. in length.

Distribution.—Manipur valley, Assam and Burma.

Ambassis ranga (Ham.).

1822. *Chanda ranga*, Hamilton, *Fish. Ganges*, p. 113, pl. xvi, fig. 38.

1921. *Ambassis ranga*, Hora, *Rec. Ind. Mus.* XXII, p. 204.

1947. *Ambassis ranga*, Chauhan, *Rec. Ind. Mus.* XLV, pp. 270, 271, 275-277.

Purchased from Imphal market. 7 Nov. 1945. Twelve specimens.

According to Dr. Roonwal's field notes, the fish is 'almost transparent with silvery gill-cover, silvery eye-ring and black iris'. The preserved specimens have, however, changed to pale, orange yellow in colour with very minute dark spots scattered on the dorsal and upper sides of the body.

Distribution.—Throughout India and Burma.

Channa gachua (Ham.).

1822. *Ophiocephalus gachua*, Hamilton, *Fish. Ganges*, p. 68, pl. xxi, fig. 21.

1937. *Ophicephalus gachua*, Hora, *Rec. Ind. Mus.* XXXIX, p. 338.

1941. *Ophicephalus gachua*, Hora & Misra, *Journ. Bombay Nat. Hist. Soc.* XLII, p. 480.

1949. *Ophicephalus gachua*, Hora, *Journ. Zool. Soc. India* I, p. 2.

1. From fields near Kanglatongbi Camp. 24 Oct. 1945. Seven specimens.

2. Hill streams near Kanglatongbi Camp. 20 Oct. 1945. Several young specimens.

3. From fields on the banks of river Imphal near Kanglatongbi Camp. 27 Oct. 1945. Two young specimens.

Distribution.—Throughout the Oriental region.

Channa striatus (Bl.).

1793. *Ophicephalus striatus*, Bloch, *Nat. Ausl. Fisch.* VII, p. 141, pl. cclix.

1929. *Ophicephalus striatus*, Prashad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 125.

Purchased from Kanglatongbi bazar. 19 Oct. 1945. Two specimens.

The larger one is 42·6 and the smaller one 30·4 cms. long.

Distribution.—Throughout the Oriental region.

Anabas testudineus (Bl.).

1793. *Anthias testudineus*, Bloch, *Nat. Ausl. Fisch.* VII, p. 143, pl. cccxxii.

1929. *Anabas testudineus*, Prashad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 216.

1. Purchased from Kanglatongbi bazar. 1 Sec. 1945. Three specimens.

2. From muddy pools by roadside milestone 122, on Imphal-Palel road. 1 Nov. 1945. Eight young specimens.

Distribution.—Throughout the Oriental region.

Colisa fasciatus (Bl.).

1801. *Trichogaster fasciatus*, Bloch, *Syst. Ichth.*, p. 164. p. xxxvi.

1929. *Trichogaster fasciatus*, Prashad & Mukerji, *Rec. Ind. Mus.* XXXI, p. 216.

Purchased from Kanglatongbi bazar. 19 Dec. 1945. Six specimens.

Distribution.—Throughout the Oriental region.

MGIPC—S1—1 ZSI—27-2-53—450.