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Classification, Zoogeography and Evolution of the Fishes of the Cyprinoid families Homalopteridae and Gastromyzonidae

By

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

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CONTENTS.

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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.

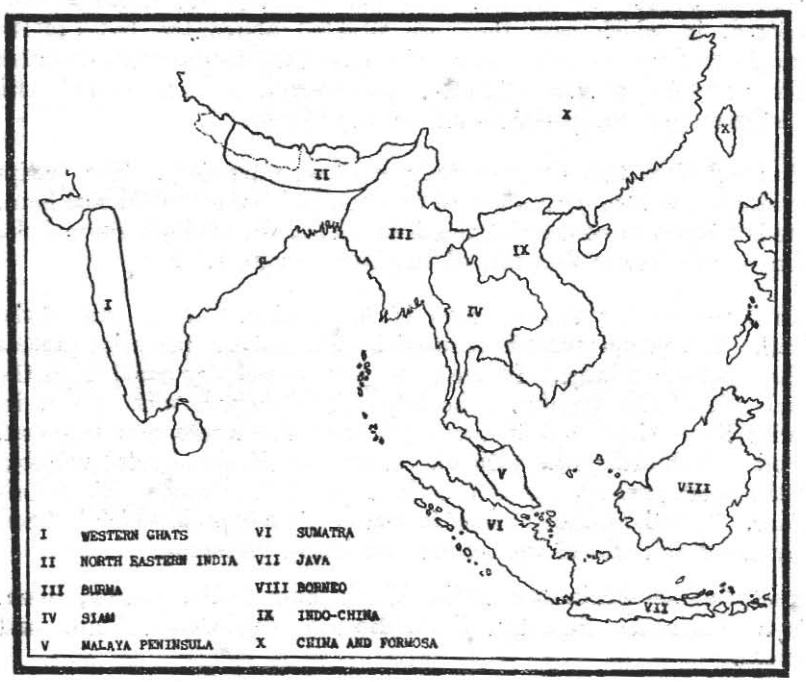
List of Species	1	2	3	4	5	6	7	8	9	10
XI. Genus SINOGASTROMYZON Fang—										
46. *Sinogastromyzon hsiashiensis* Fang.	—	—	—	—	—	—	—	—	—	×
47. *Sinogastromyzon intermedius* Fang.	—	—	—	—	—	—	—	—	—	×
*48. *Sinogastromyzon sanhoensis* Fang.	—	—	—	—	—	—	—	—	—	×
49. *Sinogastromyzon sichangensis* Chang.	—	—	—	—	—	—	—	—	—	×
*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. lineata* 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.

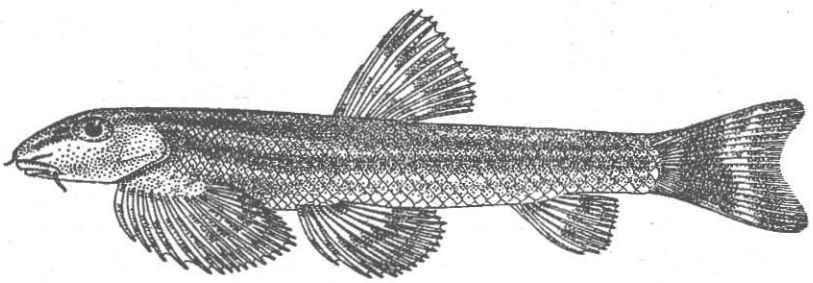
Homaloptera indochinensis, sp. nov.

(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 -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. 1½.

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. l. 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 ength. 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 $1\frac{1}{2}$ 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 os the mouth *Sinohomaloptera* shows affinities to the Malayan genuf *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. 226-233.
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. 1. 52; P. 12/15; V. 8/15; L. tr. $9\frac{1}{2}/7$ *S. tonkinensis.*

b. L. 1. 57-61; P. 12/13; V. 7/11/3; L. tr. $10\frac{1}{2}/2\frac{1}{2}$. .. .. *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 $\frac{1}{3}$ the length from the pectoral axil to the pelvic origin; anal spine smooth at its posterior edge; L. 1. 61-63. .. .. *S. wui.*

2. Scaleless portion restricted to $\frac{1}{2}$ or more the length from the pectoral axil to the pelvic origin. Anal spine finely serrated at its posterior edge. L. 1. 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. 1. 61). .. .. *S. intermedius.*

Sinogastromyzon szechuanensis Fang.

1943. *Sinogastromyzon szechuanensis*, Nichols, *Nat. Hist. Central Asia*, 9, 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.1.61-63.

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. 82-83, 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-fau 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. l. 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, Chungan, 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. l. 102.) .. *P. pingchowensis.*

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

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. l. 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.*

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. 1. 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. 1. 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.* 239.

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. 1. 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. 1. 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. I, 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.

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. *Progastromyzon*, 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) clarified 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.

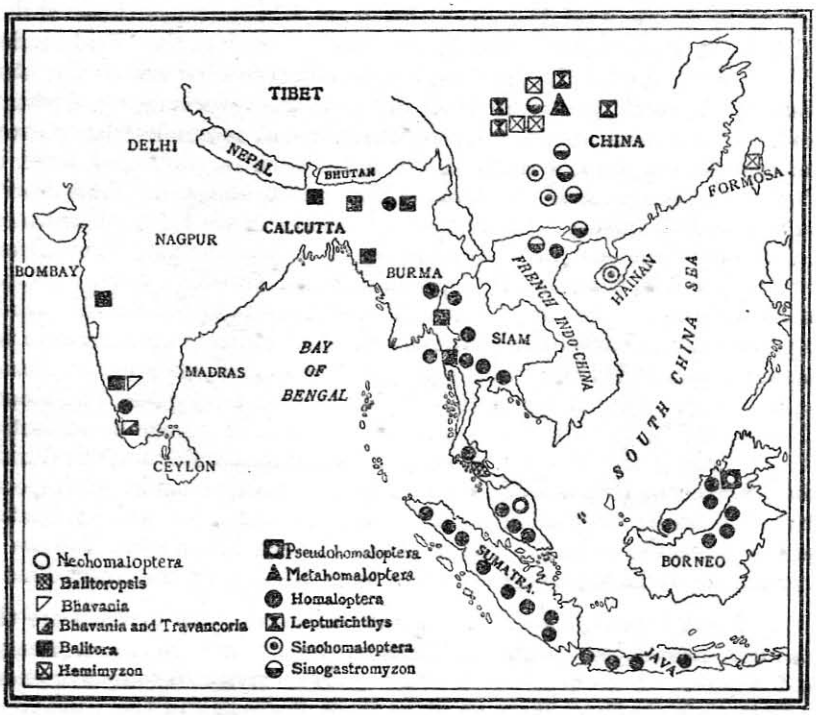
8. *Borneo.*
   Genus *Homaloptera* van Hasselt.
      Homaloptera wassinki Bleeker.
      Homaloptera ophiolepis Bleeker.
      Homaloptera orthogoniata Bleeker
      †*Homaloptera stephensoni* Hora.
      †*Homaloptera weberi* Hora.
   *Genus *Pseudohomaloptera* gen. nov.
      †*Pseudohomaloptera 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 yaotanensis* (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.

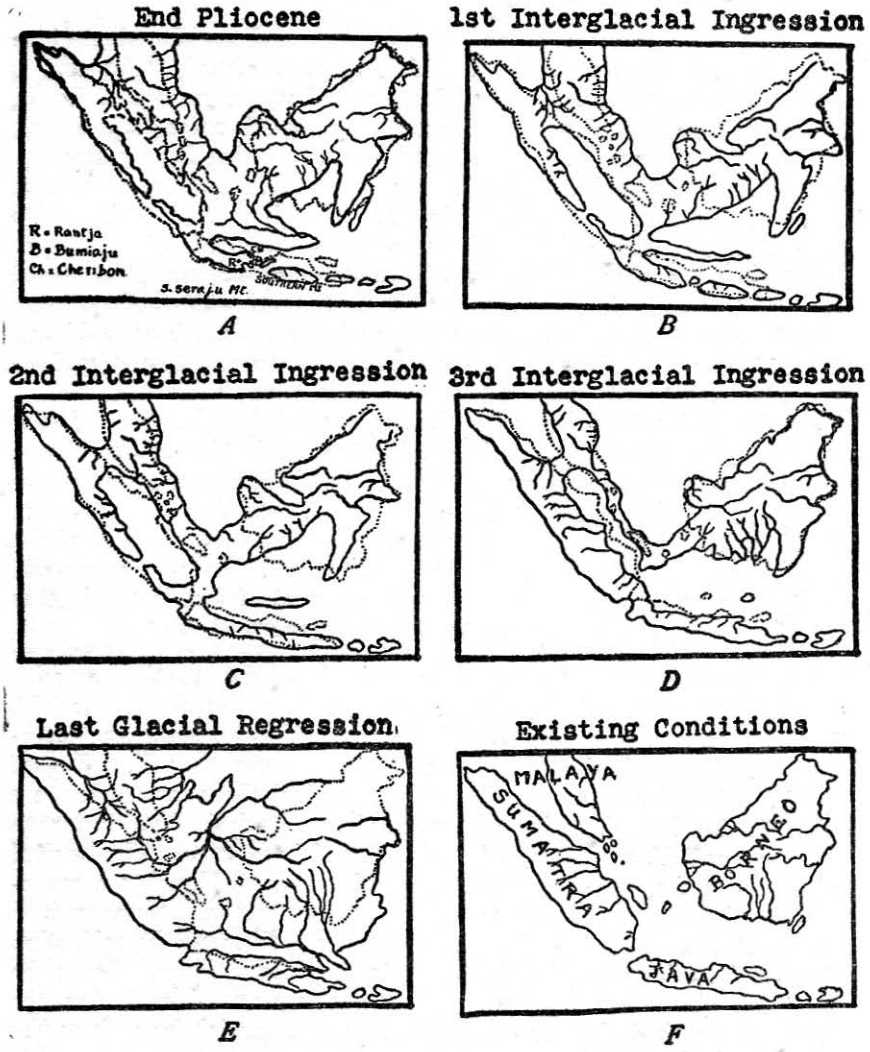
According to Molengraaff (1921), during the glacial times the rivers of Eastern Sumatra and Western Borneo ran through the lowlying plains of the Sundaland which came into existence through the retreat of the sea. These streams ultimately joined into one river which flowed northwards and emptied into 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.



Text-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).

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* 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.*

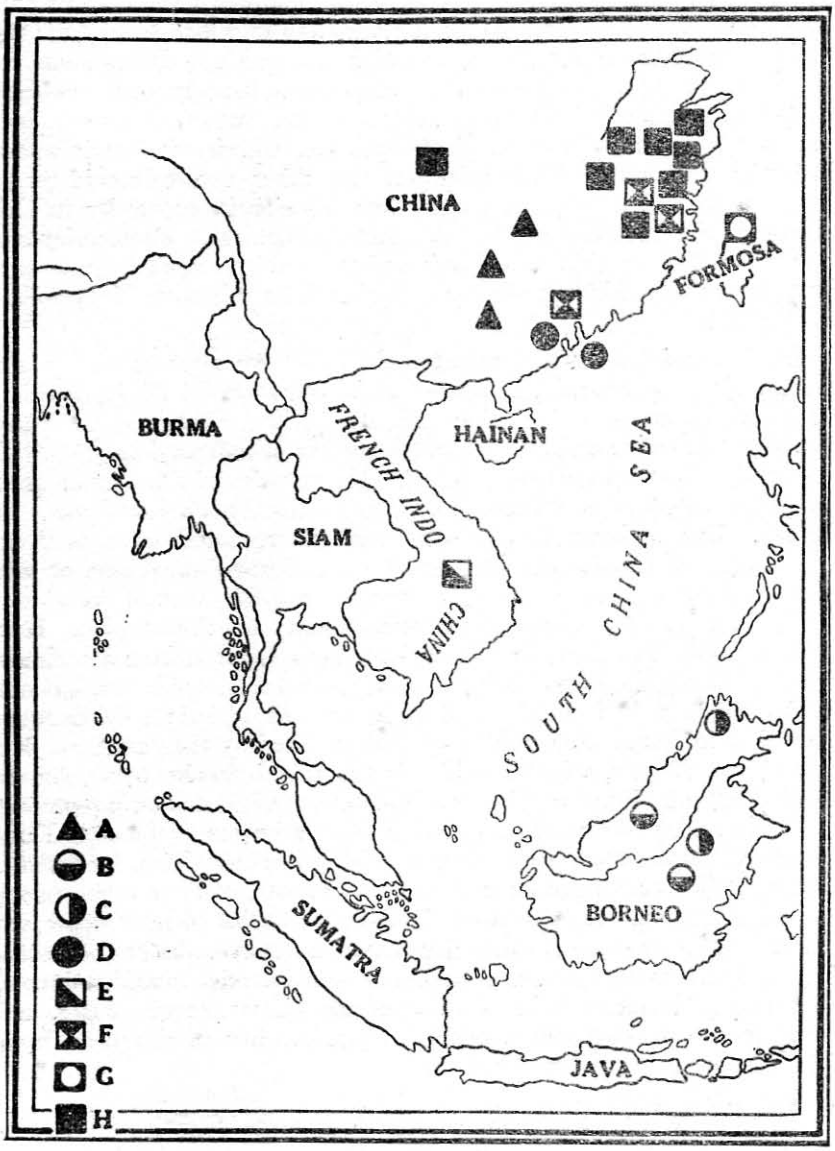
Fang (1935) was the first to draw attention to the fact that the Gastromyzonidae (Gastromyzoninae Hora, 1932) were a polyphyletic assemblage of individuals and divided them into two groups, *viz.*, the Crossostomoid-group and the Gastromyzonid-group. In dealing with the Crossostomoid fishes of China 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.

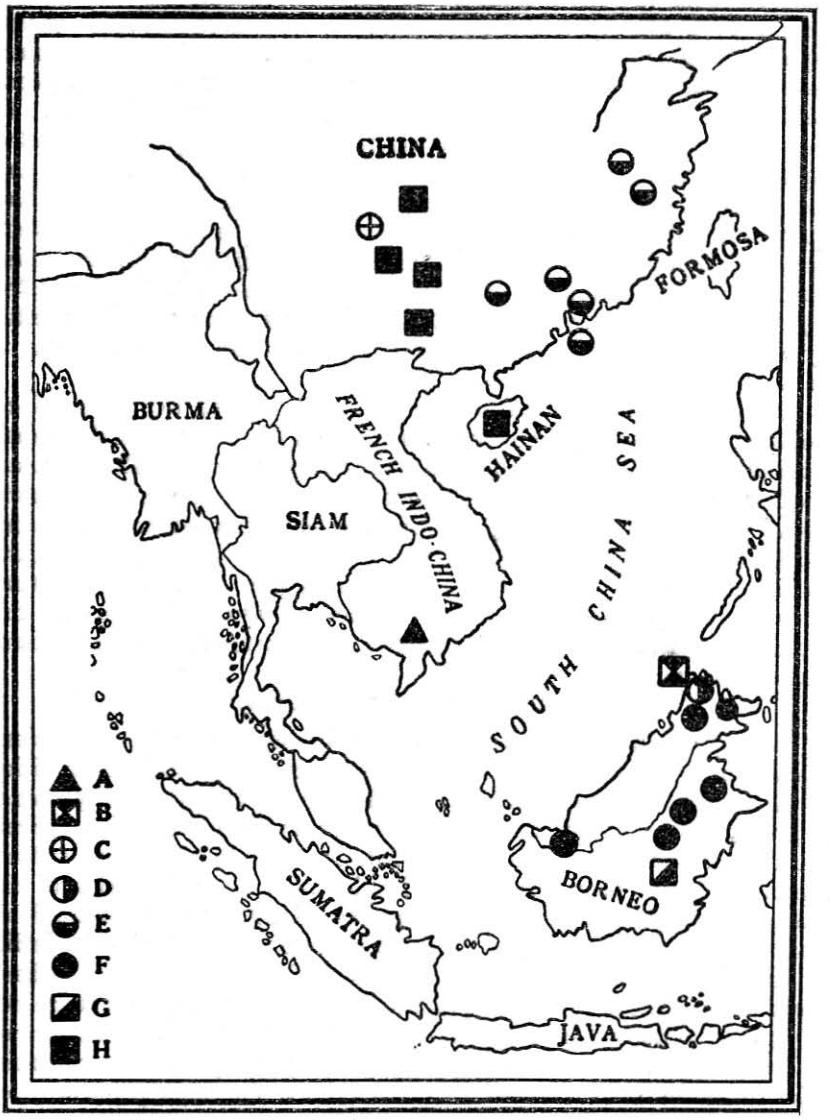
Glaniopsis of Borneo shows a large number of Nemachiline characters, but also exhibits a few important Gastromyzonid features. Ramaswami (1951) has accounted for nine skull characters in which *Glaniopsis* resembles the Nemachiline group, and eight on which it differs from it. According to him, "In possessing 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.

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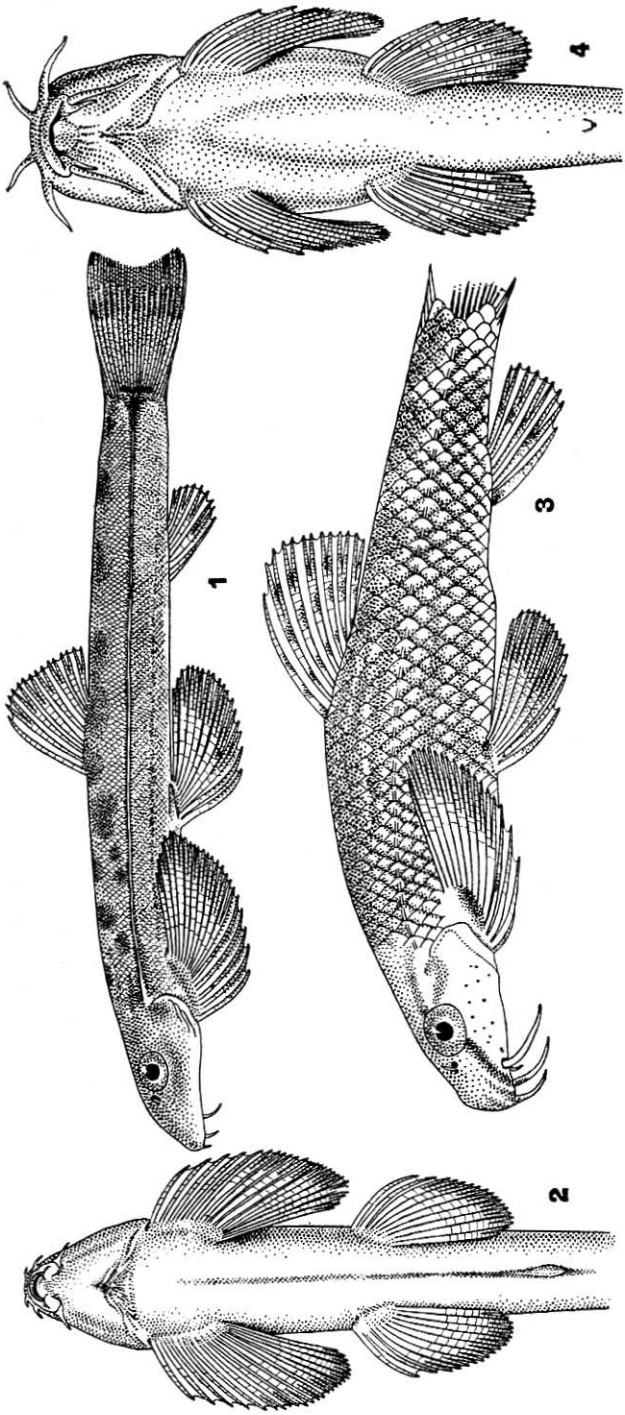
EXPLANATION OF PLATE V.

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.

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53

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ROBERT BERESFORD SEYMOUR SEWELL 1880-1964

AN APPRECIATION

By E. G. SILAS

LIEUT.-COL. R. B. S. SEWELL, C.I.E., M.A., M.R.C.S., L.R.C.P., SC.D. (Cantab.) I.M.S. (Retd.), F.Z.S., F.L.S., F.A.S., F.Z.S.I., F.N.I., F.R.S., died at Cambridge, England on February 11, 1964 at the age of 83. He belonged to a select band of Indian Medical Service Surgeon Naturalists which had on its roll such illustrious men as Lt.-Col. Sir George King, Lt.-Col. Sir David Prain, Lt.-Col. Francis Day, and Lt.-Col. A. Alcock.

Robert Beresford Seymour Sewell, the second son of Rev. Arthur Sewell was born at Leamington on March 5, 1880. He received his schooling at Weymouth where he evinced keen interest in the study of zoology which led him for a short while to the Zoology Department of the University College, London, from whence he moved to Christ College, Cambridge on a scholarship. He obtained his Degree in Zoology at Cambridge in 1902 with first class honours in both parts of natural science Tripos. He then entered St. Bartholomew's Hospital in London to study medicine and took the Conjoint Diploma in 1907. In 1908 he passed into the Indian Medical Service by competition and for the two-year period of compulsory military duty was attached to the 67th and 84th Punjab Regiments. After this, Sewell chose the post of Surgeon-Naturalist to the Marine Survey of India in preference to remaining in 'Military.' He served on the Royal Indian Marine Ship 'INVESTIGATOR II', working off the coast of Burma and in the Andaman Sea until 1914. During this period he was also Honorary Assistant Superintendent, Zoology Section, Indian Museum, Calcutta, and was also seconded for a short time in 1911 to Calcutta Medical College as Professor of Biology. He was recalled to active military duty during the First World War, and between 1914-'18 served in Aden and Palestine, being mentioned in despatches.

After the war, on reversion to civil employment, he was Officiating Superintendent, Zoological Survey of India (1919-'20), and also worked for a third term as Surgeon-Naturalist on board R.I.M.S. 'INVESTIGATOR' until July 1925 when he took over as Director of the Zoological Survey of India. Here, Sewell's task was not an easy one, but he upheld the fine traditions of the Zoological Survey of India set by his predescessor Dr. Nelson Annandale, its Founder-Director. With hardly seven officers, which later swelled to nine (of which one was an Anthropologist), the Zoological Survey of India soon became one of the foremost Institutions of its kind in the world and a centre of active research of a high order. Col. Sewell was a good organizer, and in spite of the 'depression years' he strived for the expansion of the Survey and its activities to cover besides faunistic studies, investigations on fishery and oceanographic problems. However, some of his plans such as the opening of a marine biological station at Karachi as part of the expansion programme of the Survey in 1927 met the same fate—being shelved as Dr. Stanley Kemp's earlier proposal for the establishment of a permanent research station at Port Blair, Andamans. In any case, some of the projects undertaken at the time met with grand success, and one that comes foremost to mind is the shellfish fishery investi-

gations in the Andamans with special reference to *Trochus* and *Turbo*. Attention was drawn to the importance of this resource by extensive poaching by Japanese fishermen. The investigations based on recommendations made by Col. Sewell and carried out by Dr. Srinivasa Rao and his colleagues resulted in an outstanding piece of work not only on the shellfish fishery, but on several biological aspects as well.

At the 14th Indian Science Congress in 1927, Col. Sewell stressed the ' paramount importance in this country of the study of ecology and bionomics ' of animals in their own surroundings. At the same time he also suggested that one or two students from colleges or Universities should accompany Zoological Survey parties on field expeditions to get training in these disciplines. To date, I do not think that this generous offer has been taken advantage of. Col. Sewell was far-sighted in thinking of plans for the expansion of the Survey and its activities. It is gratifying to find that the recommendations that he made from time to time even after his retirement in 1933 are partly being implemented. In this connection, special mention should be made of the starting of the Marine Survey Division in the Zoological Survey of India.

In the early years Col. Sewell's contributions to science covered a wide range of subjects including Physical Anthropology, Ichthyology, Helminthology, Malacology, Copepodology and Physical and Biological Oceanography. Most of his work he did solo and he always had a critical approach to the problems he tackled, being meticulous and taking great pains to achieve accuracy. The resulting publications numbering about 75, thoughtfully written, to some extent accounted for the eminence in which he was held in scientific circles.

The pioneering and vigorous deep-sea biological investigations carried out by Dr. J. Wood-Mason of the Indian Museum, and the Surgeon-Naturalists, notably Lt. Col. A. Alcock, A. R. S. Anderson, and others associated with R.I.M.S. ' INVESTIGATOR I' which operated from 1879-80 to 1908, earned for the Surgeon-Naturalist a honoured place in the field of marine sciences of the day. Col. Sewell, though a junior officer in the Indian Medical Service, having held the appointment of Surgeon-Naturalist for hardly two years, was appointed a Vice-President of Section V, Oceanography, at the Meeting of the International Congress of Zoology held at Monaco in 1913. He was virtually the last to hold the post of Surgeon-Naturalist, his only successor Major R. W. G. Hingston working as Naturalist for hardly a year. A gradual waning in interest in deep-sea biological work, combined with lesser and lesser opportunities and facilities for carrying out deep-sea trawling from ' INVESTIGATOR II ' enabled Col. Sewell from 1913 onwards to take up oceanographic investigations. Thus the first serious attempt was made to study the temperature and salinity in parts of the Indian Seas (Bay of Bengal, Andaman Sea, Gulf of Mannar, and Laccadive Sea up to depths of 1000 metres. His studies embodied in eight parts published in the Memoirs of the Asiatic Society of Bengal between 1925 and 1935 have thrown light on several problems including seasonal and daily variations in air temperature over the open sea in the areas worked ; the time of occurrence of diurnal maximum temperature ; wind force ; atmospheric humidity ; and amount of precipitation. From the very beginning he was highly appreciative of the need of intensive oceanographic investigations of comparatively smaller areas over a long period of time, than undertaking major expeditions spread far apart in space and in time which with each successive expedition added less and less to the sum total of our knowledge. Full credit goes to Col. Sewell for laying the foundations of oceanographic research in this region,

LIEUT.-COL. R. B. S. SEWELL (1880-1964)

(Photo by E. G. Silas—taken in September 1956)

More than once Col. Sewell has stressed the fact that for an elucidation of many of our fishery problems, such as annual fluctuations in the fish populations, annual migrations, etc., the study of oceanographic conditions over a number of years is imperative to enable forecasting the results of our fisheries in any given year. To understand the fishery problems of the west coast of India, he felt that it was essential that we undertook a careful investigation of the waters of the Somali Current and a study of the annual changes in this Current ' as this may enable us to predict what will take place off the Indian Coast a month or two later.' In the formulation of plans for the establishment of the Government of India Research Stations for marine and inland fisheries research in India, his advice was sought and in this connection he visited India for the last time in 1946.

Few would realise that Col. Sewell had contributed a good deal in Physical Anthropological studies as well. His work (with Dr. B. C. Guha) on the prehistoric human remains from Nal, Mekran, and Mohenjo-Daru led them to conclude that the chief racial type of the Chalcolithic times in the Indus Valley was of the ' Mediterranean strain, a large-brained long-headed type of possible Proto-Nordic affinities.' As President of the Anthropological Section of the 16th Indian Science Congress at Madras in 1929, Col. Sewell spoke on the origin of man and the population of India in the past and future. It was here that he propounded the hypothesis that the causative factor for brachycephaly in man was his ' living in high altitudes in the formative period of man's life-history.'

The First World War brought about an awareness as to how the services of professional zoologists could be utilised to tackle some of the medical problems, especially prevention of disease by sanitation and its control by quarantine measures. One major problem was the introduction of diseases, especially *Schistosomiasis*, hitherto unknown in India, by soldiers returning from infected areas in the Middle East. Part of the results of these investigations was Col. Sewell's treatise entitled ' Cercariae Indicae ', and on *Schistosoma*. The project also involved him in the study of the biology of some of the molluscs and a collaborative effort with Dr. Annandale on ' The Banded Pond-Snail of India (*Vivipara bengalensis*). Col. Sewell fully subscribed to Dr. Annadale's views on taxonomy as a dynamic composite subject of which description of pickled specimens was only a part. He was fully aware of the importance of ecology, general variability of species, information on life-history stages, biological details and biogeography in taxonomy. His studies on the pedunculate cirripede *Lithotrya nicobarica* show how critical he was of the use of highly variable characters for species differentiation. He demonstrated on the basis of a good series of material, the considerable range of changes which occurs in this species with size and age increase, indicating that some of the species of *Lithotrya* to which Darwin (1851 : A Monograph of Cirripedia, Vol. 1, Ray Society, London, p. 350) had indicated Class affinity, may in reality only represent different varieties or growth phases of a single species.

In the Pyrosomida he felt that the majority of the different forms may belong to a relatively few species and are mostly based on growth stages. The differences between zooids in the same colony and the similarities of zooids in the different colonies are attributable to changes in the relative growth and development of the different parts of the individual or of the colony caused by corresponding differences in the environment.

Col. Sewell's enduring passion was for the study of Copepoda which he diligently pursued for over half a century, his first contribution on the surface-living

Copepoda of the Bay of Bengal appearing in 1912. He was an authority on Copepoda and his advice and help was freely sought and received by many budding copepodologists in India and abroad. The Copepoda confronts the taxonomist with great complexities—the systematics being still unstable to the morpho-systematist, especially at infra-specific levels. To cite one instance, in the genus *Mesocyclops* Sars (Cyclopoida) with about 39 species (placed under the subgenera *Mesocyclops* s. str., and *Thermocyclops* Kiefer), the main criterion for the separation of the species is the relative length proportion of the two spines of the endopod of the fourth pair of swimming legs, the ranges for most of the species showing considerable overlap. Col. Sewell's work on the subgenus *Thermocyclops* published in 1960 demonstrates how difficult it is to correctly interpret infra-specific variations. In the vast group—Copepoda—Col. Sewell described several species, varieties and forms (forma) new to science in addition to redescribing numerous species and adding information on the life-history stages of several species, with illustrations. A lesser mind may find fault that he has on occasions described a new species or a variety on a single specimen or a few specimens of one sex. In a pioneering work this is inevitable, but to the credit of Col. Sewell it should be mentioned that whenever more material was available, in subsequent publications he made it a point to include additional information on these species. Besides, his familiarity with the Copepoda no doubt enabled him to evaluate the differences and make taxonomic pronouncements which a casual worker on the group would find difficult.

His work on Copepoda led him on to biogeographical studies, best exemplified in two publications, one in the 'Scientific Reports' Series of the John Murray Expedition dealing with the geographical distribution of the free swimming planktonic Copepoda, and the second, his Presidential address to the Linnean Society on 'The Continental Drift Theory and the distribution of Copepoda.' On the basis of the distribution of the present-day Copepoda he favoured the 'Continental Drift Theory' (also referred to as 'the Wegner Drift Theory') over the earlier theory of the 'Permanence of the Ocean Basins.'

His opportunities for conducting field investigations in India, and an early and long association with Dr. Annandale strongly influenced his outlook on the theory of evolution. In 1931 he discussed the problem of evolution from the point of view of experimental modifications of bodily structure and the trend of evolution under natural conditions. In 1958 he more or less summed up his views (as a taxonomer) on evolution, concluding that 'Throughout the whole course of evolution there has been a steady urge towards bodily complexity and simultaneously with this has been a drive towards biochemical complexity ; and the full extent of this is only now beginning to be understood, (but it seems clear that the ultimate character upon which the final decision as to what is a "species" will be based may eventually prove to be bio-chemical.'

Col. Sewell's vast experience was taken advantage of in placing the John Murray Expedition to the Indian Ocean in 1933-34 under his leadership to extend oceanographical and biological investigations earlier carried out from R.I.M.S. 'INVESTIGATOR' westwards to the Laccadive-Maldive Archipelagoes, Persian Gulf, South Arabian Coast, and Somali Coast to Zanzibar. Retirement did not diminish his ardour for research, in fact, it only redoubled his efforts. During the thirty years of his retired life, most of which he lived at Cambridge, he was actively working in spite of ill-health towards the end, organising, getting together for publication and editing the results of the John Murray Expedition in the 'Scientific Reports' Series published by the British Museum (Natural History), at the same

time carrying on his extensive studies on Copepoda at the Department of Zoology, Cambridge University.

Col. Sewell was awarded the Degree of Sc.D by the Cambridge University in 1929 and was elected a Fellow of the Royal Society in 1934. Soon after his retirement from the Indian Medical Service in 1935, he was appointed Companion of the Indian Empire (C.I.E.). During his tenure in India he worked in different capacities on several scientific bodies. He was Sectional President (Zoology) of the Indian Science Congress at its 14th Session held at Lahore in 1927 ; Sectional President (Anthropology) of the 16th Session held at Madras in 1929 ; and the General President of the 18th Indian Science Congress held at Nagpur in 1931. He was also President of the Royal Asiatic Society of Bengal from 1931-1933. As Director of the Zoological Survey of India between 1925 and 1933, he was also Editor of the *Records*, and *Memoirs of the Indian Museum*. From 1933 to 1963 he was Editor of the *Fauna of British India* (presently known as *Fauna of India*) Series.

During his retired life he took an active interest in the affairs of the Linnean Society, as a Member of the Council of the Society from 1935-39, 1944-48, and 1950-56 ; as Vice-President from 1936-37, 1945-46, and 1955-56 ; and as President of the Linnean Society from 1952-1955. He was also President of the Ray Society from 1950 to 1953. Later, for a short while he also worked as Secretary, International Commission on Oceanography.

As a fitting tribute to his preeminence in the field of marine sciences of this region, he was elected the first Honorary Member of the Marine Biological Association of India in 1959.

In September 1956, I had the good fortune to meet him at his home at 18 Barrow Road, Cambridge, and though he was not in the best of health, he was in excellent spirit. He was rather apprehensive and perturbed that the development of marine researches in India was not progressing satisfactorily. In fact, he expressed that things appeared to be in the ' doldrums ' when most countries were ' investing ' in diverse marine research projects near and afar off. Later I heard that he expressed profound satisfaction on hearing about the formation of the Marine Biological Association of India to foster the growth of marine sciences of this region, as a ray of light on a dark horizon. Things have rapidly changed since. It would have been no mean satisfaction to him to see the sudden spurt of intense activity in the Indian Ocean at the International level for an understanding of several of the problems connected with this least known of all oceans. Unfortunately, he did not live long enough to see his *magnum opus* ' The Copepoda ' published in the Fauna of India Series.