

PARALLEL EVOLUTION IN THE CROSSOSTOMID FISHES ON THE  
MAINLAND OF ASIA AND IN BORNEO.

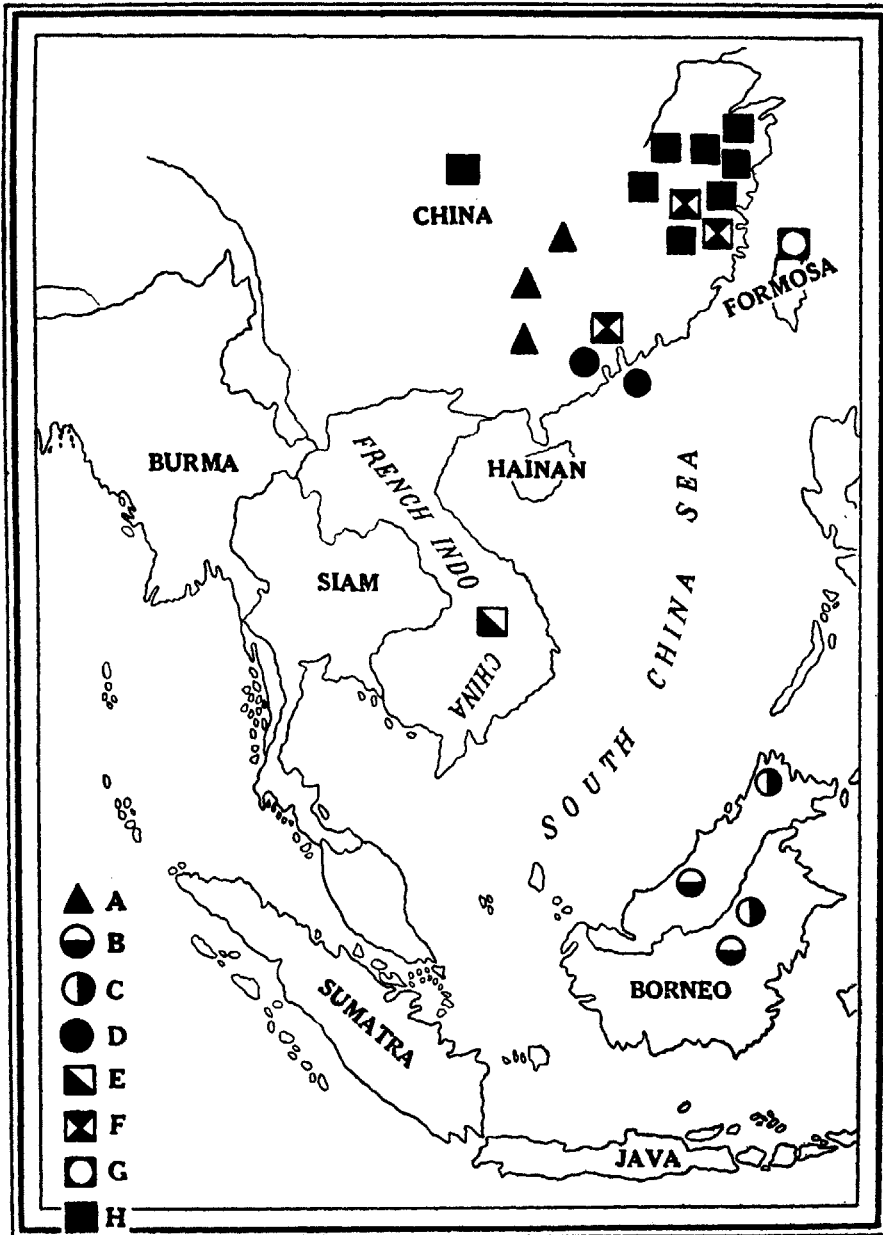
By SUNDER LAL HORA, D.Sc., F.R.S.E., C.M.Z.S., M.I.Biol., F.A.S.,  
F.Z.S.I., F.N.I., Director, Zoological Survey of India,  
Indian Museum, Calcutta.

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In dealing with the parallel evolution among the *Gastromyzonid* fishes on the mainland of Asia and in Borneo (Hora, 1952), reference was made to Fang's (1935) paper on the study of *Crossostomid* fishes of China. Both the *Gastromyzonid* and *Crossostomid* fishes pertain to the subfamily *Gastromyzoninae* (Hora, 1932) which has now been raised to the rank of a distinct family (Hora, 1950). It has also been shown (Hora and Jayaram, 1951, p. 62) that by a simple reduction in the size of the gill-openings and their restriction to the dorsal and lateral surfaces, *Parhomaloptera* Vaillant, a *Crossostomid* fish, may have given rise to *Protomyzon* Hora, a *Gastromyzonid* fish. Recently, in a communication, Dr. L. S. Ramaswami has informed that, on the basis of skull structure, *Glanioptis* Boulenger (see Hora and Jayaram, 1951), and *Protomyzon* Hora are closely related. *Glanioptis*, according to Dr. Ramaswami, has many characters of *Nemachilus* (Cobitidae) but has also developed some special features of the *Gastromyzonidae*. Thus in Borneo, we have a group of three genera, perhaps not genetically related, in which we can trace the origin of the *Gastromyzonidae* from the *Nemachilinae* of the *Cobitidae* through *Crossostominae* to the *Gastromyzoninae*. Though we have similar groups of genera on the mainland of Asia, it is remarkable that no *Crossostomid* genus of Borneo is found on the mainland of Asia and, as in the *Gastromyzoninae*, it seems probable that the *Crossostominae* of Borneo may have evolved independently from the generalised *Cobitid* stock.

No new genera pertaining to the *Crossostominae* have been described since their revision by Fang in 1935. There are six genera from the mainland of Asia, namely *Annamia* Hora, *Liniparhomaloptera* Fang, *Vanmanenia* Hora, *Præformosania* Fang, *Formosania* Oshima and *Crossostoma* Sauvage. According to Fang (p. 55), *Annamia* and *Liniparhomaloptera* are independently evolved from 'Primitive *crossostomoid* Fishes (*Nemachiloid* ancestral stocks)', while the remaining four genera, though evolved from the same stock, form a progressive series of evolutionary changes. There can be no doubt about the unique features of *Annamia*, they are on par with those of *Sewellia* Hora, a *Gastromyzonid* fish of Indo-China. The relationships of the other genera, however, need further comments.

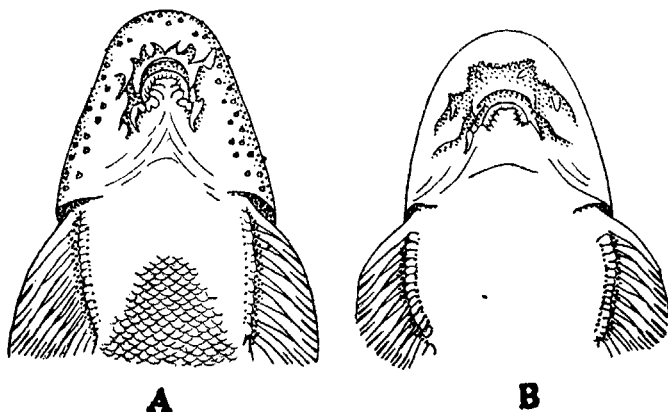
According to Fang, *Liniparhomaloptera* of China directly gave rise to *Parhomaloptera* of Borneo. Unfortunately, sufficient material of these genera is not available to discuss this point from a detailed morphological study of their internal structure. In *Liniparhomaloptera*, the rostral groove is absent (*versus* present in *Parhomaloptera*), the rostral barbels do not arise from the groove but are associated with the rostral fold, the number of rays in the paired fins is P.1/16; V.1/8 (*versus* P.1/16-18, V.1/10 in *Parhomaloptera*) and scales cover a part of the ventral surface between the bases of the pectoral fins. The absence of the rostral groove and disposition of the barbels differentiate *Liniparhomaloptera* from *Parhomaloptera* and show its affinity to a form like *Crossostoma*. I am inclined to regard *Liniparhomaloptera* and *Crossostoma* as having been derived from a common



TEXT-FIG. 1. Map showing the distribution of the Crossostomid genera.

A. *Praeformosania* Fang; B. *Parhomaloptera* Vaillant; C. *Glanipossi* Boulenger; D. *Liniparhomaloptera* Fang; E. *Annamia* Hora; F. *Vanmanenia* Hora; G. *Formosania* Oshima; H. *Crossostoma* Sauvage.

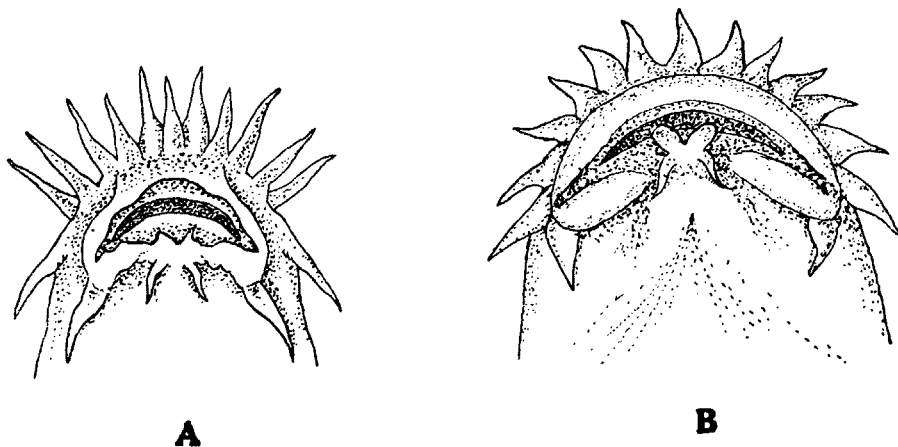
ancestral stock but diverged from each other at a very early stage, the former being now less specialized than the latter. Both the genera are devoid of any rostral groove.



TEXT-FIG. 2. Ventral surface of head and anterior part of body of *Liniparhomaloptera* Fang and *Parhomaloptera* Vaillant. (After Fang.)

A. *Liniparhomaloptera* Fang; B. *Parhomaloptera* Vaillant.

After examining specimens of *Crossostoma* in various Natural History Museums of the U.S.A., I (1950) am now of the opinion that there are only two known species in the genus, *C. davidi* Sauvage and *C. fascicauda* Nichols. *C. stigmata* Nichols and *C. tinkhami* Herre seem to be synonymous with *C. fascicauda*. There is con-



TEXT-FIG. 3. Mouth and associated structures of *Crossostoma* Sauvage.

A. *Crossostoma davidi* Sauvage; B. *Crossostoma fascicauda* Nichols.

siderable confusion between these two species also. After examining a large amount of material in the American Museum of Natural History, I was able to distinguish them by their colouration, relative extent of pelvic fins, size of the eye and position and size of rostral barbels. Tchang (1932) described *C. fascicauda fochowensis*, but Fang (1935, p. 89) considered it a synonym of *C. davidi*.

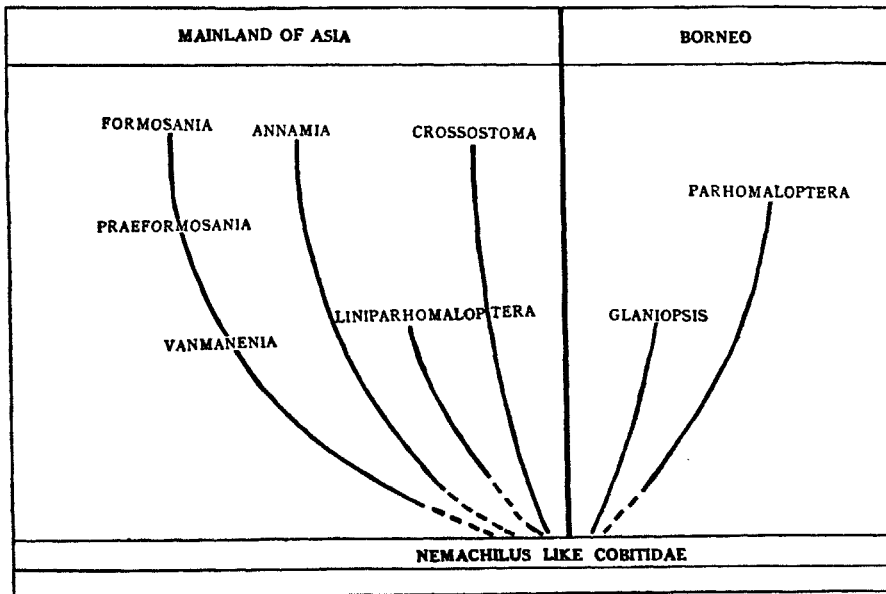
I agree with Fang that *Vanmanenia* Hora, *Praeformosania* Fang and *Formosania* Oshima form an evolutionary series of progressive specialisation. All the genera are provided with a rostral fold and a rostral groove. I do not agree with Fang that *Crossostoma* represents the most specialized member of this series. Probably he has been led to this conclusion by wrongly referring *C. fascicauda* to



TEXT-FIG. 4. Mouth and associated structures of *Formosania* Oshima.

the genus *Formosania*. In the broad rostral groove of *Formosania*, there are three barbels with broad bases which are placed across the groove and join the anterior lip with the rostral fold, reminding one of a similar condition in the *Gastromyzonid* genus *Sewellia* Hora. There is nothing of this nature in *Crossostoma fascicauda*. In describing *Vanmanenia* in 1932, I showed its relationships to *Formosania* and indicated that some intermediate form will be discovered. *Praeformosania* now bridges the gulf between the two genera, though it is much closer to *Formosania* than to *Vanmanenia*.

The relationships of the Crossostomid fishes can be represented as shown below:



TEXT-FIG. 5. Probable lines of evolution of the Crossostomid fishes on the mainland of Asia and in Borneo.

It is presumed from the above discussion that the Crossostomid fishes not only evolved independently in Borneo and on the mainland of Asia, but on the mainland they evolved independently at least along four lines and in Borneo along two lines. The basic stock in all cases seems to have been provided by the Cobitid loaches of the *Nemachilus*-type.

#### SUMMARY.

Morphological and Palaeogeographical evidences all point to the conclusion that the Crossostomid fishes, like the Gastromyzonid fishes, evolved independently both in Borneo and on the mainland of Asia from primitive cobitid loaches of the *Nemachilus*-type. Further, in the mainland they seem to have evolved independently along four lines and in Borneo along two lines.

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